

Foundations in Accountancy/ACCA

Management Accounting (FMA/MA)

Workbook

**For exams from 1st
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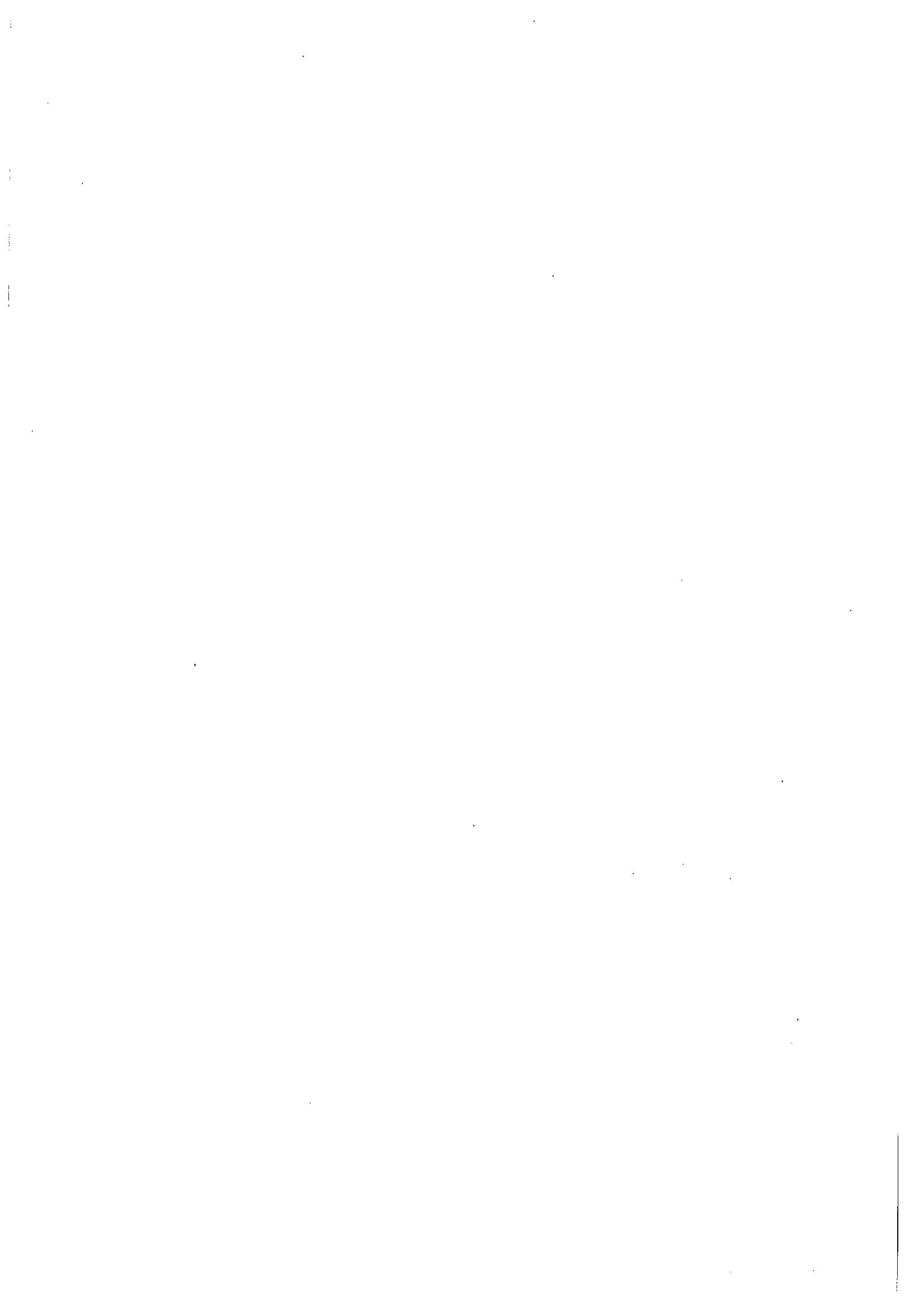
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Helping you to pass

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The PER alert

Before you can qualify as an ACCA member, you not only have to pass all your exams but also fulfil a three-year practical experience requirement (PER). To help you to recognise areas of the syllabus that you might be able to apply in the workplace to achieve different performance objectives, we have introduced the 'PER alert' feature (see the next section). You will find this feature throughout the Workbook to remind you that what you are learning to pass your ACCA exams is equally useful to the fulfilment of the PER requirement. Your achievement of the PER should be recorded in your online My Experience record.

Key to icons



Key term

Central concepts are highlighted and clearly defined in the Key terms feature. Key terms are also listed in bold in the Index, for quick and easy reference.



Formula to learn

This boxed feature will highlight important formula which you need to learn for your exam.



PER alert

This feature identifies when something you are reading will also be useful for your PER requirement (see 'The PER alert' section above for more details).



Real world examples

These will give real examples to help demonstrate the concepts you are reading about.



Illustration

Illustrations walk through how to apply key knowledge and techniques step by step.



Activity

Activities give you essential practice of techniques covered in the chapter.



Essential reading

Links to the Essential reading are given throughout the chapter. The Essential reading is included in the free eBook, accessed via the Exam Success Site (see inside cover for details on how to access this).

At the end of each chapter you will find a Knowledge diagnostic, which is a summary of the main learning points from the chapter to allow you to check you have understood the key concepts. You will also find a Further study guidance which contains suggestions for ways in which you can continue your learning and enhance your understanding. This can include: recommendations for question practice from the Further question practice and solutions, to test your understanding of the topics in the Chapter; suggestions for further reading which can be done, such as technical articles; and ideas for your own research.

Introduction to the Essential reading

The electronic version of the Workbook contains additional content, selected to enhance your studies. Consisting of revision materials and further explanations of complex areas (including illustrations and activities), it is designed to aid your understanding of key topics which are covered in the main printed chapters of the Workbook. The Essential reading section of the eBook also includes further illustrations of complex areas..

A summary of the content of the Essential reading is given below.

Chapter	Summary of Essential reading content
1 Accounting for management	<ul style="list-style-type: none">Detail on strategic, tactical and operational information.
2 Data and presenting information	<ul style="list-style-type: none">Sampling examples: random sampling, stratified sampling, systematic sampling, multistage sampling
3 Cost classification and behaviour	<ul style="list-style-type: none">Different types of cost behaviour, eg non-linear, curvilinear variable costsLinear equationsDifferent types of coding system
4 Forecasting	<ul style="list-style-type: none">Moving averages with an even number of resultsAdjusting seasonal variations using a multiplicative model
5 Summarising and analysing data	<ul style="list-style-type: none">Advantages and disadvantages of different types of averageCalculating probabilities using z scores
6 Accounting for materials	<ul style="list-style-type: none">Detail on the different types of inventory cost
7 Accounting for labour	<ul style="list-style-type: none">Labour records, eg time sheets
8 Accounting for overheads	There is no essential reading for this chapter
9 Process costing	<ul style="list-style-type: none">How to deal with losses with a disposal costDealing with different rates of input
10 Costing methods	<ul style="list-style-type: none">Illustration of job accountsIllustration of cost per unit calculation in service businessesAccounting for by-productsHow joint products are incorporated into process accounts
11 Setting budgets	<ul style="list-style-type: none">Administration of the budgetDetail on controllable costsPreparing the capital budget
12 Implementing budgets	<ul style="list-style-type: none">Attitudes to budgetingCost reduction programmesDetail on value analysis
13 Project appraisal	<ul style="list-style-type: none">Calculating discounted payback
14 Standard costing	<ul style="list-style-type: none">Standard cost card activities using absorption and marginal costingIllustration of variance calculations using flexed budget

Chapter		Summary of Essential reading content
		<ul style="list-style-type: none"> Detail on when fixed and flexed budgets are appropriate
15	Variance analysis	<ul style="list-style-type: none"> Material variances when there is closing inventory Reasons for fixed overhead variances Causes of sales variances Information on possible control action
16	Target setting	<ul style="list-style-type: none"> Government influence on businesses
17	Financial performance measurement	<ul style="list-style-type: none"> Management performance measures
18	Assessing non-financial performance	<ul style="list-style-type: none"> Performance measures for service industries, manufacturing, contract and process costing environments

Introduction to Management Accounting (FMA/MA)

Overall aim of the syllabus

To develop knowledge and understanding of management accounting techniques to support management in planning, controlling and monitoring performance in a variety of business contexts.

The syllabus

The broad syllabus headings are:

A	The nature, source and purpose of management information
B	Data analysis and statistical techniques
C	Cost accounting techniques
D	Budgeting
E	Standard costing
F	Performance measurement

Main capabilities

On successful completion of this exam, you should be able to:

A	Explain the nature, source and purpose of management information
B	Explain and analyse data analysis and statistical techniques
C	Explain and apply cost accounting techniques
D	Prepare budgets for planning and control
E	Compare actual costs with standard costs and analyse any variances
F	Explain and apply performance measurements and monitor business performance

Links with other exams

The Performance Management (PM) syllabus assumes knowledge acquired in Management Accounting (MA/FMA) and develops and applies this further and in greater depth.

Achieving ACCA's Study Guide Learning Outcomes

This BPP Workbook covers all the Management Accounting (FMA/MA) syllabus learning outcomes. The tables below show in which chapter(s) each area of the syllabus is covered.

A The nature, source and purpose of management information		
A1	Accounting for management	Chapter 1
A2	Sources of data	Chapter 2
A3	Cost classification	Chapters 3, 17
A4	Presenting information	Chapter 2

B	Data analysis and statistical techniques	
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B1	Sampling methods	Chapter 2
B2	Forecasting techniques	Chapters 3, 4
B3	Summarising and analysing data	Chapter 5
B4	Spreadsheets	Chapter 2 (and Checkpoint 2)

C	Cost accounting techniques	
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C1	Accounting for material, labour and overheads	Chapters 6, 7, 8
C2	Absorption and marginal costing	Chapter 8
C3	Cost accounting methods	Chapters 9, 10
C4	Alternative cost accounting principles	Chapter 10

D	Budgeting	
----------	------------------	--

D1	Nature and purpose of budgeting	Chapter 11
D2	Budget preparation	Chapters 11, 14
D3	Flexible budgets	Chapter 14
D4	Capital budgeting and discounted cash flow	Chapters 11, 13
D5	Budgetary control and reporting	Chapters 12, 14, 15, 17
D6	Behavioural aspects of budgeting	Chapter 12

E	Standard costing	
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E1	Standard costing system	Chapters 14, 15
E2	Variance calculations and analysis	Chapter 15
E3	Reconciliation of budgeted and actual profit	Chapter 15

F	Performance measurement	
----------	--------------------------------	--

F1	Performance measurement - overview	Chapter 16
F2	Performance measurement - application	Chapters 16, 17, 18
F3	Cost reductions and value enhancement	Chapter 12
F4	Monitoring performance and reporting	Chapters 16, 17, 18

The complete syllabus and study guide can be found by visiting the exam resource finder on the ACCA website: www.accaglobal.com/gb/en.html.

The exam

Computer-based exams

Computer-based examinations (CBEs) are available for all of the Foundations in Accountancy exams. The CBE exams for the first seven modules can be taken at any time; these are referred to as 'exams on demand'. The Option exams can be sat in June and December of each year; these are referred to as 'exams on sitting'. For more information on CBE exams and to access Specimen exams in the CBE software, please visit the ACCA website.

How do CBEs work?

- Questions are displayed on a monitor.
- Candidates enter their answer directly onto the computer.
- Candidates have two hours to complete the examination.
- Candidates sitting exams on demand are provided with a Provisional Result Notification showing their results before leaving the examination room.
- The CBE Licensed Centre uploads the results to the ACCA (as proof of the candidate's performance) within 72 hours.
- Candidates sitting the Option exams will receive their results approximately five weeks after the exam sitting once they have been expert marked.
- Candidates can check their exam status on the ACCA website by logging into myACCA.

Benefits

- **Flexibility** – the first seven modules, exams on demand can be sat at any time.
- **Results** for the first seven modules can also be taken at any time and there is no restriction on the number of times a candidate can sit a CBE.
- **Instant feedback** for the exams on demand as the computer displays the results at the end of the CBE.

For more information on computer-based exams, visit the ACCA website.

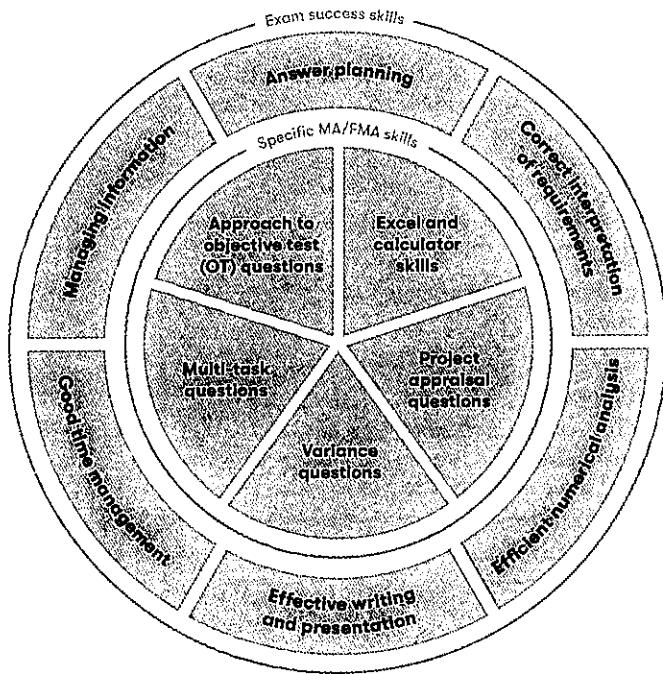
www.accaglobal.com/gb/en/student/exam-entry-and-administration/computer-based-exams.html

Essential skills areas to be successful in Management Accounting (FMA/MA)

We think there are three areas you should develop in order to achieve exam success in FMA/MA:

- (a) Knowledge application
- (b) Specific Management Accounting skills
- (c) Exam success skills

These are shown in the diagram below.



Specific FMA/MA skills

These are the skills specific to FMA/MA that we think you need to develop in order to pass the exam.

In this Workbook, there are five **Skills Checkpoints** which define each skill and show how it is applied in answering a question. A brief summary of each skill is given below.

Skill 1: Approach to objective test (OT) questions

The FMA/MA exam contains two sections. Section A consists of 35 objective test (OT) questions worth 2 marks each and Section B contains 3 multi-task questions worth 10 marks each. The multi-task questions are made up of OT questions and therefore being able to answer OT questions effectively, is extremely important.

A step by step technique is outlined below.

General guidance for approaching OT questions

STEP 1: Answer the questions you know first.

If you're having difficulty answering a question, move on and come back to tackle it once you've answered all the questions you know.

It is often quicker to answer discursive style OT questions first, leaving more time for calculations.



General guidance for approaching OT questions

STEP 2: Answer all questions.

There is no penalty for an incorrect answer in ACCA exams; there is nothing to be gained by leaving an OT question unanswered. If you are stuck on a question, as a last resort, it is worth selecting the option you consider most likely to be correct and moving on. Flag the question, so if you have time after you've answered the rest of the questions, you can revisit it.



Guidance for answering specific OT questions

STEP 3: Read the requirement first!

The requirement will be stated in bold text in the exam. Identify what you are being asked to do, any technical knowledge required and what type of OT question you are dealing with. Look for key words in the requirement such as "which TWO of the following," or " which of the following is NOT".



Guidance for answering specific OT questions

STEP 4: Apply your technical knowledge to the data presented in the question.

Take your time working through calculations, making sure to read through each answer option with care. OT questions are designed so that each answer option is plausible. Work through each response option and eliminate those you know are incorrect.

Skills Checkpoint 1 covers this technique in detail and highlights the different types of OT question that you are likely to see in your exam.

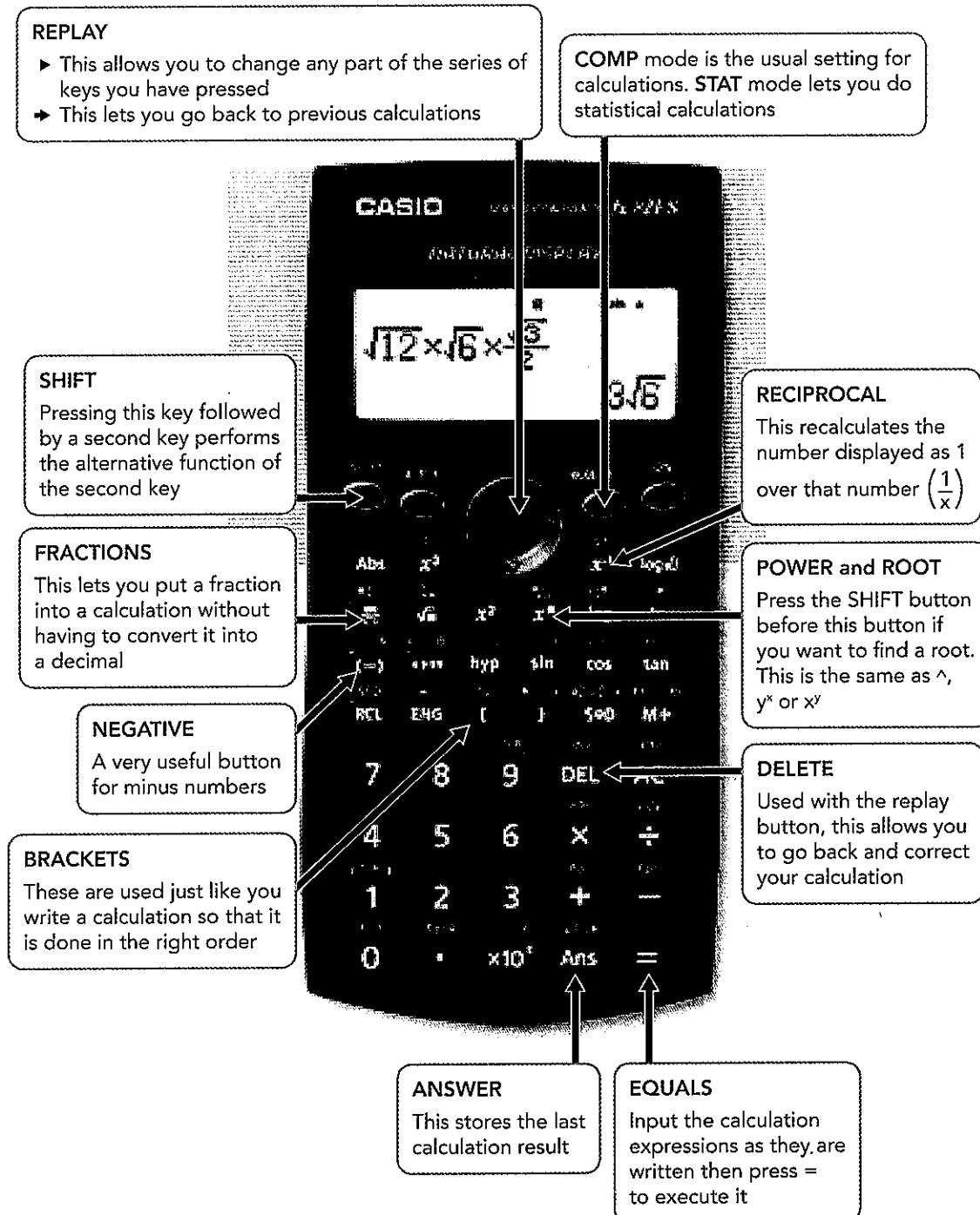
Skill 2: Excel and calculator skills

This checkpoint covers two areas – using spreadsheets and using your scientific calculator.

Spreadsheets are specifically mentioned on the FMA/MA syllabus and you can expect to see questions that require you to apply your knowledge of spreadsheets to management accounting questions. For example, questions may show you an extract of a budget spreadsheet and ask you to select the correct spreadsheet formula to calculate a particular figure.

You must be able to use your calculator quickly and correctly in the exam. The ability to calculate the correct answer efficiently is a fundamental skill in management accounting. You will have more time for thinking in the exam if you can make best use of your calculator to get the right answer. For example, you must be able to use your calculator to calculate the correlation coefficient, EOQ formula and standard deviation.

Here is an example of a typical scientific calculator:



Skills Checkpoint 2 covers the use of your calculator in detail using an exam-standard question.

Skill 3: Project appraisal questions

The syllabus states that you should be able to 'calculate NPV, IRR and payback (discounted and non-discounted)'. However, the MA/FMA examining team report repeatedly says that a common problem for students, particularly in Section B questions, is the **calculation of payback, NPV and IRR**. This checkpoint looks at these calculations in detail using exam standard questions.

Skill 4: Variance questions

Variance questions are very likely to appear in your exam in some form.

In order to answer variance questions well, you need to ensure that you:

- Have learnt the variance formulae
- Understand the differences between marginal costing system variances and absorption costing system variances
- Understand the format of an operating statement
- Understand that variances can be calculated using a flexed budget to compare like with like

Skills Checkpoint 4 covers variance analysis in detail using an exam-standard question.

Skill 5: Multi-task questions

Multi-task questions (MTQs) in Section B comprise 30% of your exam (via three 10-mark questions, broken down into sub-questions of varying mark allocations). It is therefore important that you give adequate revision time to practising these questions.

The biggest difference between Section A OTQs and Section B MTQs is the way they are presented. For example, an OTQ is always worth two marks and any fill in the blank OTQs are likely to only need a single answer. MTQs are made up of several 'tasks' and some tasks may be worth more than others. For example, an MTQ could contain a task showing a table with several fill in the blank boxes, for say, six marks, followed by two OTQs worth two marks each (total MTQ score = 10 marks). Even if you get one of the answers in one of the boxes incorrect, this will not affect your ability to score on the other answer boxes. Fill in the blank questions require accurate calculation and careful number entry, so it's worth taking your time over these types of question

Skills Checkpoint 5 covers this technique using an exam-standard question.

Exam success skills

Passing the FMA/MA exam requires more than applying syllabus knowledge and demonstrating the specific skills; it also requires the development of good exam technique through question practice.

We consider the following skills to be vital for exam success. The Skills Checkpoints show how each of these skills can be applied in the exam.

1 Exam success skill 1

Managing information

It is easy for the amount of information contained in a particular question to feel a little overwhelming.

Advice on developing Managing information

Approach

The exam is 2 hours long. There is no designated 'reading' time at the start of the exam, however, one approach that can work well is to start the exam by spending a few minutes carefully reading through all of the questions to familiarise yourself with the exam and the topics in Section B.

Next consider the order in which you will attempt the questions; always attempt them in your order of preference. For example, you may want to leave to last the question you consider to be the most difficult.

If you find that this approach doesn't work for you, don't worry – you can develop your own technique.

Active reading

Active reading is a useful technique. It involves focusing on the requirements first on the basis that, until you have done this, the detail in the question will have little meaning and will seem more intimidating.

2 Exam success skill 2

Correct interpretation of the requirements

Identify from the requirement the type of OT question. This is especially important with multiple response options (MRO) to ensure you select the correct number of response options. It is also important for fill in the blank questions as they may tell you to give your answer to a certain number of decimal places or to the nearest thousand dollars.

Advice on developing correct interpretation of the requirements

This skill can be developed by analysing question requirements and applying this process:

Step 1	Read the requirement Firstly, read the requirement a couple of times slowly and carefully.
Step 2	Read the rest of the question By reading the requirement first, you will have an idea of what you are looking out for as you read through the scenario. This is a great time saver and means you don't end up having to read the whole question in full twice. You should do this in an active way – see Exam success skill 1: Managing Information.
Step 3	Read the requirement again Read the requirement again to remind yourself of the exact requirement before selecting your answer. This will capture any misinterpretation of the requirements and should become a habit in your approach.

3 Exam success skill 3

Answer planning: Priorities, structure and logic

Answer planning is a skill that you will need when you study higher level exams such as PM or APM. It is not quite as relevant for the style of question in FMA/MA.

4 Exam success skill 4

Efficient numerical analysis

This skill aims to maximise the marks awarded by being careful in arriving at your answer. You must be careful with calculations because distractors (incorrect answers in MCQs) are based on commonly made errors. For fill in the blank questions, you must enter your answer carefully. If you have calculated the answer to be 25 and you accidentally enter 52, you will lose the two marks for the question.

Advice on developing Efficient numerical analysis

You should make sure you can use your calculator efficiently (as explained in Checkpoint 2) and practise taking care when entering fill in the blank answers.

5 Exam success skill 5

Effective writing and presentation

As with answer planning, this skill is more relevant for higher level exams such as PM and APM.

6 Exam success skill 6

Good time management

This skill means planning your time across all the requirements so that all tasks have been attempted at the end of the 2 hours available and actively checking on time during your exam. This is so that you can flex your approach and prioritise requirements which, in your judgement, will generate the maximum marks in the available time remaining.

Advice on developing good time management

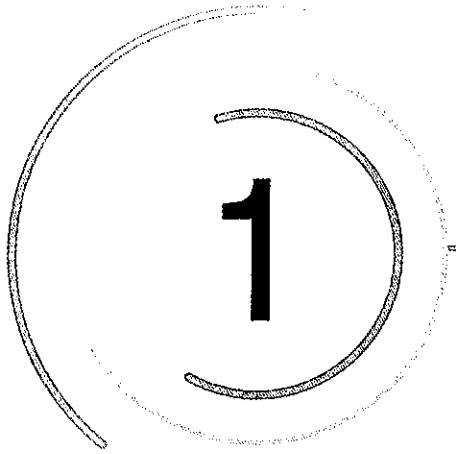
The exam is 2 hours long, which translates to 1.2 minutes per mark. Therefore a 10-mark requirement should be allocated about 12 minutes to complete your answer before you move on to the next task.

Keep an eye on the clock

Aim to attempt all requirements, but be ready to be ruthless and move on if your answer is not going as planned. The challenge for many is sticking to planned timings. Be aware this is difficult to achieve in the early stages of your studies and be ready to let this skill develop over time.

Question practice

Question practice is a core part of learning new topic areas. When you practise questions, you should focus on improving the Exam success skills – personal to your needs – by obtaining feedback or through a process of self-assessment.



Accounting for management

Learning objectives

On completion of this chapter, you should be able to:

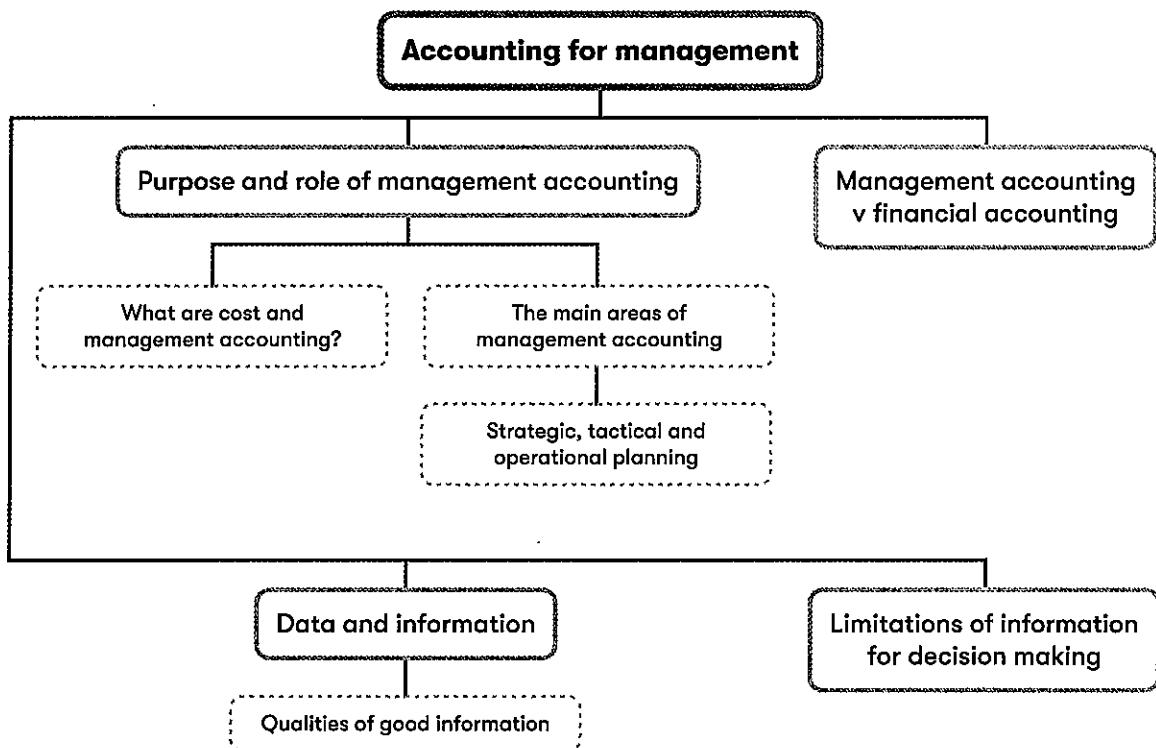
	Syllabus reference no.
Describe the purpose and role of cost and management accounting within an organisation.	A1(a)
Compare and contrast financial accounting with cost and management accounting.	A1(b)
Outline the managerial processes of planning, decision making and control.	A1(c)
Explain the difference between strategic, tactical and operational planning.	A1(d)
Distinguish between 'data' and 'information'.	A1(e)
Identify and explain the attributes of good information.	A1(f)
Explain the limitations of management information in providing guidance for managerial decision making.	A1(g)

Exam context

The contents of this chapter are mainly to serve as an introduction to the Management Accounting exam.

Although this chapter is an introductory chapter, it is still highly examinable. You should expect questions on every chapter, including this one.

Chapter overview



1 Purpose and role of cost and management accounting

1.1 What are cost and management accounting?

Cost accounting and management accounting are terms that are often used interchangeably. It is not correct to do so. Cost accounting is part of management accounting. Cost accounting provides a bank of data for the management accountant to use and is concerned with:

- Preparing statements
- Cost data collection
- Applying costs to inventory, products and services.

Management accounting is concerned with the provision and the use of accounting information. This information is used by managers of the business to assist them when making decisions to achieve the organisation's overall objective. The assumption that will usually be made in your studies is that companies wish to maximise the wealth of their shareholders. Usually, this will be achieved by maximising profit.



Cost accounting: Cost accounting is the 'gathering of cost information and its attachment to cost objects, the establishment of budgets, standard costs and actual costs of operations, processes, activities or products; and the analysis of variances, profitability or the social use of funds'. (CIMA Official Terminology)

Management accounting: Management accounting is the 'application of the principles of accounting and financial management to create, protect, preserve and increase value for the shareholders of for-profit and not-for-profit enterprises in the public and private sectors'. (CIMA Official Terminology)

1.2 The main areas of management accounting

Management accounting can be broken down into five main areas:

- (a) Costing

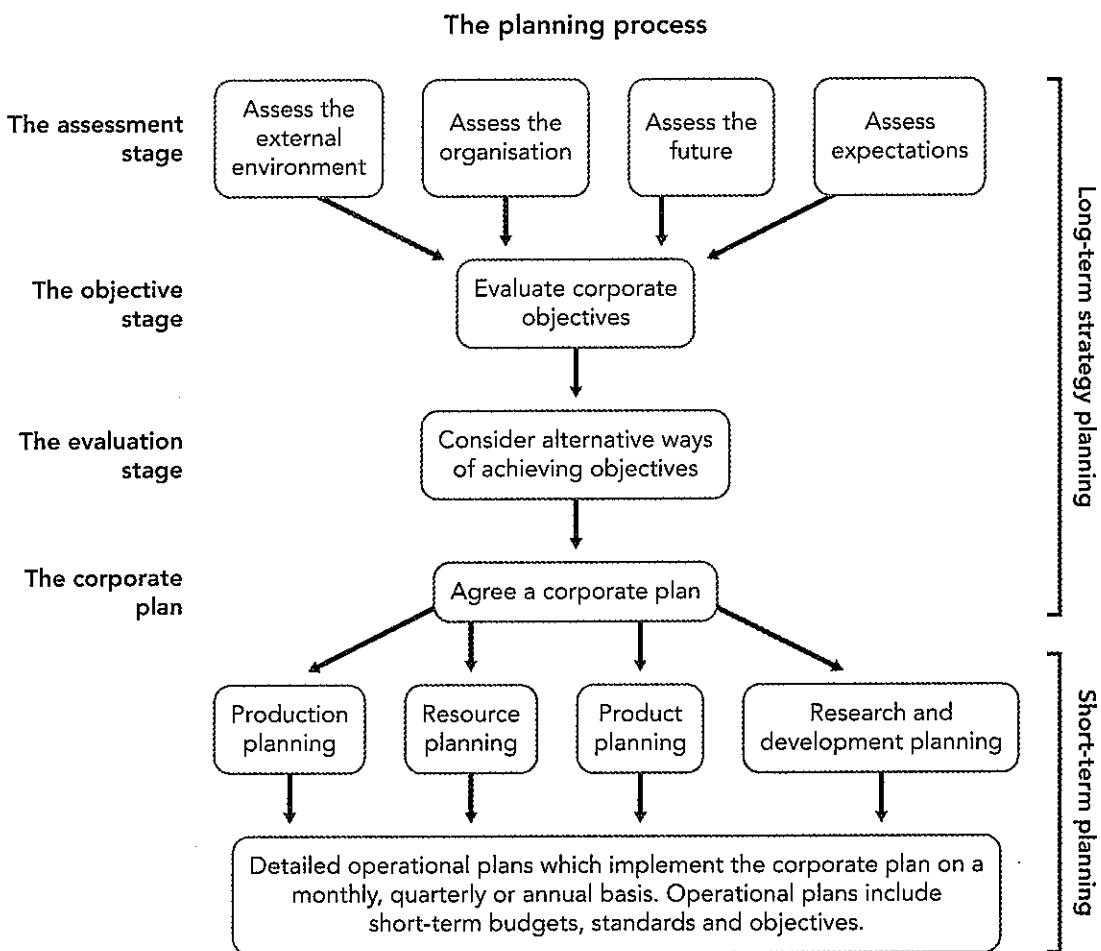
What is the cost of goods or services provided?

We need to know this to assess the profitability of products or services, to help set prices and to value inventory in the statement of financial position.

- (b) Planning

Planning involves defining objectives and assessing future costs and revenues to set up a budget.

Planning is essential in assessing the purchasing/production requirements of the business. It forces management to think ahead.



(c) Control

Once plans have been made, the business must ensure they are being followed and address any inefficiencies. There are two stages in the **control process**.

- The **performance of the organisation** as set out in the detailed operational plans is compared with the actual performance of the organisation on a regular and continuous basis. Any deviations from the plans can then be identified and corrective action taken.
- The **corporate plan** is reviewed in the light of comparisons made and any changes in the parameters on which the plan was based (such as new competitors and government instructions) to assess whether the objectives of the plan can be achieved. The plan is modified as necessary before any serious damage to the organisation's future success occurs.

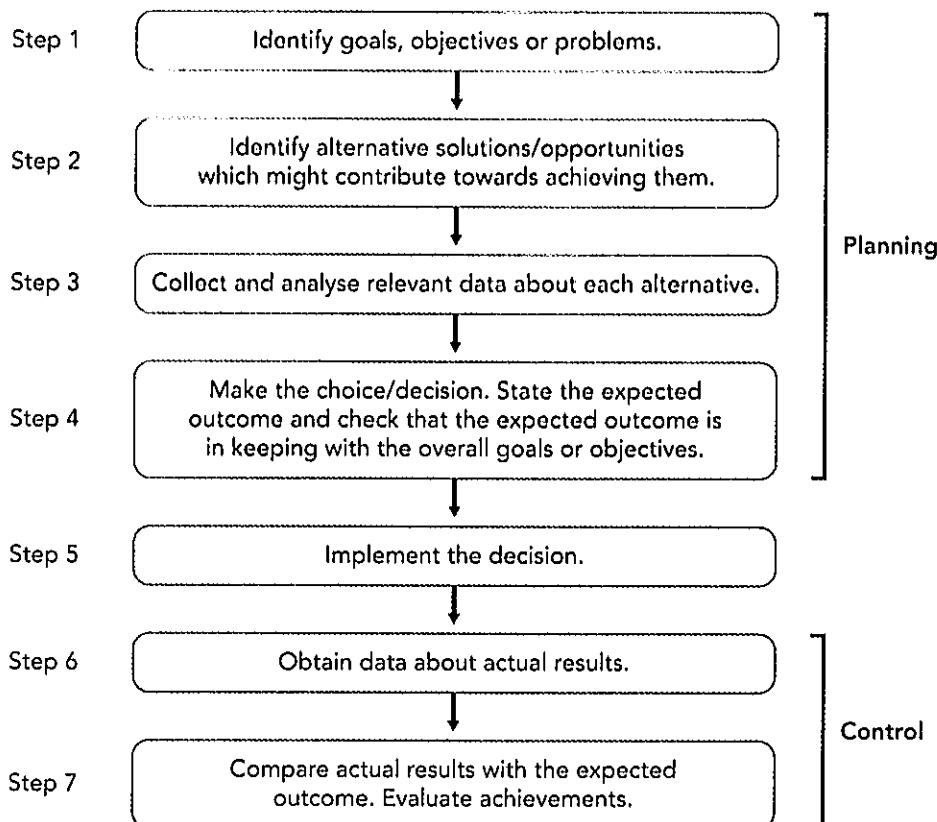
Effective control is therefore not practical without planning, and planning without control is pointless.

(d) Decision making

There are many decisions managers may have to make, such as:

- What should we produce?
- How should we finance the business?
- Is a project worthwhile?

Decision making process



(e) Performance evaluation

The performance of divisions and employees can be assessed by comparing their performance against budgets or divisional or individual targets. Sometimes performance evaluation is classed as part of control (see (c) above).



Exam focus point

The MA/FMA syllabus specifically mentions the managerial processes of planning, control and decision making. Make sure that you understand the meaning of each of these processes.

1.3 Strategic, tactical and operational planning

R N Anthony, a leading writer on organisational control, has suggested that the activities of **planning, control and decision making should not be separated** (Anthony, 1965) since all managers make planning and control decisions. He has identified three types of management activity.

- (a) **Strategic planning:** 'the process of deciding on objectives of the organisation, on changes in these objectives, on the resources used to attain these objectives, and on the policies that are to govern the acquisition, use and disposition of these resources'.

Long-term strategic planning, also known as corporate planning, involves selecting appropriate strategies so as to prepare a long term plan to attain objectives. Examples of strategic planning include the selection of products and markets, the required levels of company profitability and the purchase and disposal of subsidiary companies or major non-current assets.

- (b) **Tactical control (also known as management control):** 'the process by which managers assure that resources are obtained and used effectively and efficiently in the accomplishment of the organisation's objectives'.

Resources are often referred to as the '**4 Ms**' (manpower, materials, machines and money).

Efficiency in the use of resources means that optimum output is achieved from the input resources used. It relates to the combinations of labour, land and capital (for example, how much production work should be automated) and to the productivity of labour, or material usage.

Effectiveness in the use of resources means that the **outputs** obtained are in line with the intended **objectives** or targets.

Tactical planning therefore refers to the conversion of the long-term corporate plan into a series of short-term plans, usually covering one year, which relate to sections, functions or departments. The annual process of short-term planning should be seen as stages in the progressive fulfilment of the corporate plan as each short-term plan steers the organisation towards its long-term objectives.

- (c) Operational control: 'the process of assuring that specific tasks are carried out effectively and efficiently'.

It is important to remember that operational planning occurs in all aspects of an organisation's activities, even when the activities cannot be scheduled nor properly estimated because they are non-standard activities (such as repair work and answering customer complaints). The scheduling of unexpected or 'ad hoc' work must be done at short notice, which is a feature of much operational planning. In the repairs department, for example, routine preventive maintenance can be scheduled, but breakdowns occur unexpectedly and repair work must be scheduled and controlled 'on the spot' by a repairs department supervisor.



Illustration 1: Planning

Plan 1

Senior management decide that the company should increase sales by 5% per annum for at least five years.

Plan 2

The sales director and senior sales managers make plans to increase sales by 5% in the next year, with some provisional planning for future years. This involves planning direct sales resources, advertising, sales promotion and so on. Sales quotas are assigned to each sales territory.

Plan 3

The manager of a sales territory specifies the weekly sales targets for each sales representative.

Required

State whether each plan is strategic, tactical or operational.

Solution

Plan 1: This is a strategic plan. Increasing sales by 5% per annum for at least five years is an overall objective of the organisation and is therefore a strategic plan.

Plan 2: This is a tactical plan. The sales director and senior sales managers are ensuring that resources are obtained and used effectively and efficiently in the accomplishment of the organisation's overall objectives. This is therefore a tactical plan.

Plan 3: This is operational planning. Individual sales managers are given tasks which they are expected to achieve and this is therefore an operational plan.

2 Management accounting v financial accounting

Management accounting will use the same source data as financial accounting but there are some important differences to understand.

Management accounting systems provide information specifically for the use of managers within an organisation.

Financial accounting systems ensure that the assets and liabilities of a business are properly accounted for and provide information about profits and so on for shareholders and for other interested parties.

Financial accounts	Management accounts
Financial accounts detail the performance of an organisation over a defined period and the state of affairs at the end of that period.	Management accounts are used to aid management record, plan and control the organisation's activities and to help the decision-making process.
Limited liability companies must, by law, prepare financial accounts.	There is no legal requirement to prepare management accounts.
The format of published financial accounts is determined by local law, by International Accounting Standards and International Financial Reporting Standards. In principle the accounts of different organisations can therefore be easily compared.	The format of management accounts is entirely at management discretion: no strict rules govern the way they are prepared or presented. Each organisation can devise its own management accounting system and format of reports.
Financial accounts concentrate on the business as a whole, aggregating revenues and costs from different operations, and are an end in themselves.	Management accounts can focus on specific areas of an organisation's activities. Information may be produced to aid a decision rather than to be an end product of a decision.
Most financial accounting information is of a monetary nature.	Management accounts incorporate non-monetary measures. Management may need to know, for example, tons of aluminium produced, monthly machine hours, or miles travelled by salespeople.
Financial accounts present an essentially historic picture of past operations.	Management accounts are both an historical record and a future planning tool.



Activity 1: Financial v management accounting

Which of the following statements about management accounts are true?

- (1) There is a legal requirement to prepare management accounts.
 - (2) The format of financial accounts is largely determined by law.
 - (3) Management accounts serve as a future planning tool and are not used as a historical record.
- (1) and (2)
 (2) and (3)
 (1) and (3)
 (2) only

3 Data and information



Data: Data is the raw material for data processing. Data relates to facts, events and transactions and so forth.

Information: Information is data that has been processed in some way to make it meaningful to the person who receives it. Information is anything that is communicated.

Information is sometimes referred to as processed data. The terms 'information' and 'data' are often used interchangeably. It is important to understand the difference between these two terms.

Researchers who conduct market research surveys might ask members of the public to complete questionnaires about a product or a service. These completed questionnaires are data; they are processed and analysed in order to prepare a report on the survey. This resulting report is information and may be used by management for decision-making purposes.



Activity 2: External information

What external information may the managers of a business need?

Source	Information needed
Competitors	
Customers	
Suppliers	
Government	

3.1 Qualities of good information

Good information should be **relevant, complete, accurate and clear**. It should **inspire confidence**, be **appropriately communicated**, be of manageable volume, **timely**, and its **cost** should be less than the benefits it provides.



Illustration 2: Qualities of good information

A bank statement provides a company with information.

Required

What are the qualities of a bank statement which make it a good source of information?

Solution

Accurate	Inaccurate figures would mislead the company as to its current bank balance. This may result in the company exceeding its overdraft facility.
Complete	The information in the bank statement will be used to reconcile and identify transactions not included in the accounts. It is therefore essential that all transactions are recorded that have occurred within the period of the bank statement.
Cost beneficial	A company will not be willing to pay an excessive amount to view the transactions that have occurred through its account. The costs of collecting

	and presenting the information should therefore be evaluated.
User targeted	The volume of information is kept to the minimum needed for the customer. Details that are meaningful only to the bank are largely excluded.
Relevant	The customer is not interested in all of the transactions that occurred for the entire bank. Therefore, only information relating to the user is included.
Authoritative	The information within the bank statement can be used for control purposes as the bank is considered a reliable and authoritative source.
Timely	In order to be useful, the information needs to be provided within a sensible time period. Many companies have now switched to online bank statements as they don't want to wait until the end of the month to receive information.
Easy to use	It is always in the same format.

The qualities of good information can be remembered using the mnemonic ACCURATE.



Activity 3: Good information

Which TWO of the following are good information?

- Monthly sales figures for August received in November
- A summary provided at the front of a report to save senior manager's from having to read the whole document
- A dashboard report summarising all the key results for the last period for use at the next management meeting
- A monthly report showing that the chocolate mixing machine was adding 1% too much cocoa in the last period



Essential reading

See Chapter 1 Section 1 of the Essential reading, for detail on how information can be analysed using Anthony's hierarchy.

The Essential reading is available as an Appendix of the digital edition of the Workbook.

4 Limitations of information for decision making

All decision making is concerned with the future and so there will **always be some degree of uncertainty** surrounding the possible outcomes of a decision. **Information for decision making should therefore incorporate uncertainty** in some way. The methods of incorporating uncertainty are outside the scope of this syllabus, but you should realise that if cost accounting information does not take account of uncertainty, it is unsuitable for decision making. If an attempt to incorporate uncertainty is made, the information should be more suitable for decision making but can **never be risk free**.

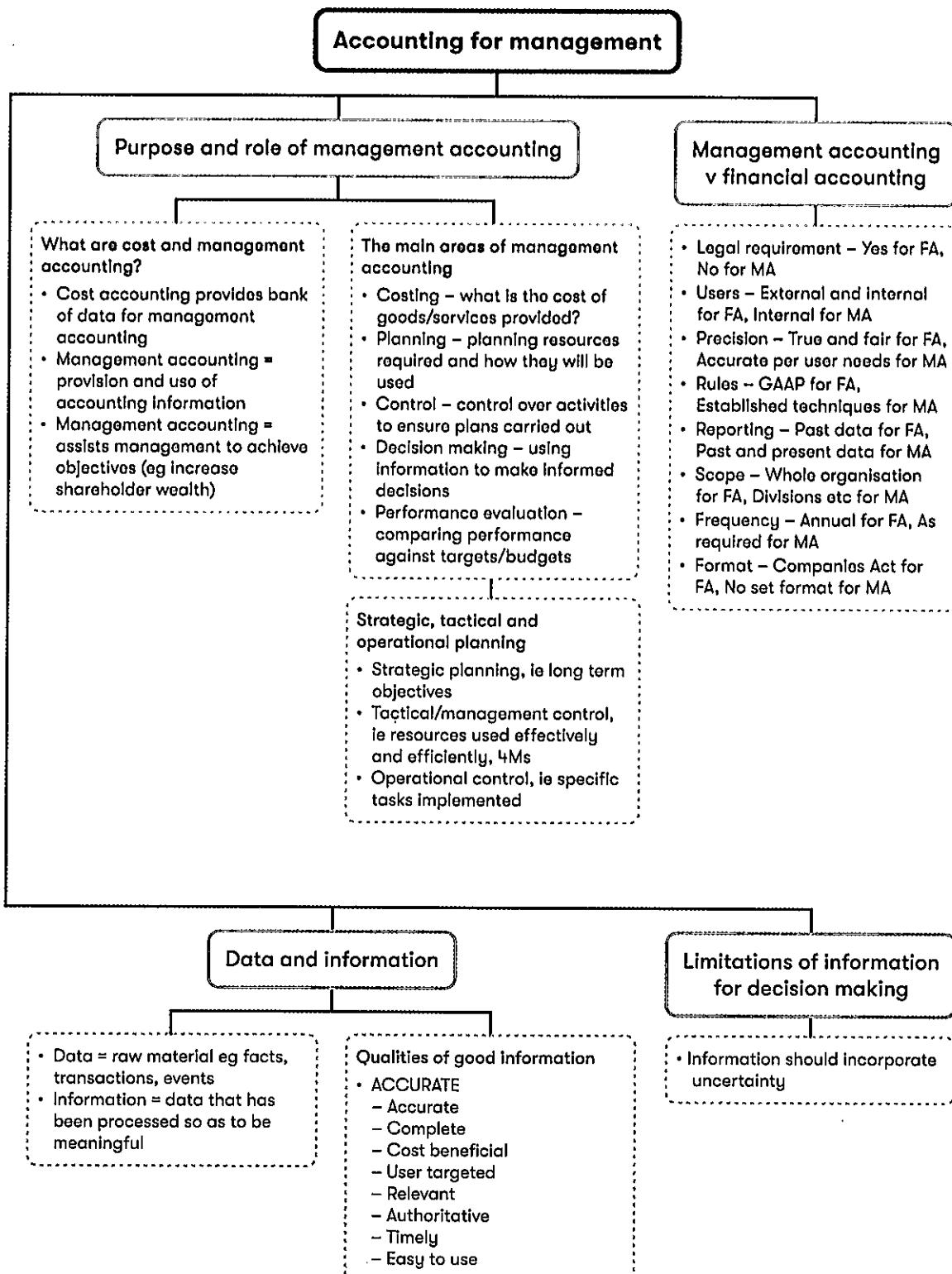


Activity 4: Uncertainty

Can you think of any factors which contribute to the uncertainty an organisation might face?

Solution

Chapter summary



Knowledge diagnostic

1. Introduction to management accounting

Purpose is to assist management in running their business to achieve an overall objective.

2. Role of management accountant

Includes costing, planning, control, decision making and performance evaluation.

3. Management accounting and financial accounting

Financial accounting systems ensure that the assets and liabilities of a business are properly accounted for. Management accounting systems provide information specifically for managers.

4. Data and information

Information is data that has been processed to be meaningful to the person who receives it.

Qualities of good information: ACCURATE

5. Limitations of information for decision making

Information may not be appropriate for future decision making because of uncertainty.

Further study guidance

Question practice

Now try the following from the Further question practice bank (available in the digital edition of the Workbook):

Section A questions: Q1 - Q4

Activity answers

Activity 1: Financial v management accounting

The correct answer is: (2) only

Statement (1) is incorrect. Limited liability companies must, by law, prepare **financial** accounts.

The format of published financial accounts is determined by law. Statement (2) is therefore correct.

Management accounts do serve as a future planning tool but they are also useful as a historical record of performance. Therefore, statement (3) is incorrect.

Activity 2: External information

Source	Information needed
Competitors	Prices, product specifications, markets
Customers	Needs and wants of product, price prepared to pay
Suppliers	Products, prices, quality of supplies, financial position, delivery time
Government	Tax rates, minimum wage and other legislation

Activity 3: Good information

The correct answers are:

- A summary provided at the front of a report to save senior manager's from having to read the whole document
- A dashboard report summarising all the key results for the last period for use at the next management meeting

Monthly sales figures for August, received in November, are too late and therefore not timely. A monthly report showing that the mixing machine was adding 1% too much cocoa in the last period is not complete. Management would need to know how this compared to other months and whether there was a tolerance level.

Activity 4: Uncertainty

Here are a few suggestions. You probably thought of others.

- The actions of competitors
- Inflation
- Interest rate changes
- New government legislation
- Possible shortages of material or labour
- Possible industrial disputes

2

Data and presenting information

Learning objectives

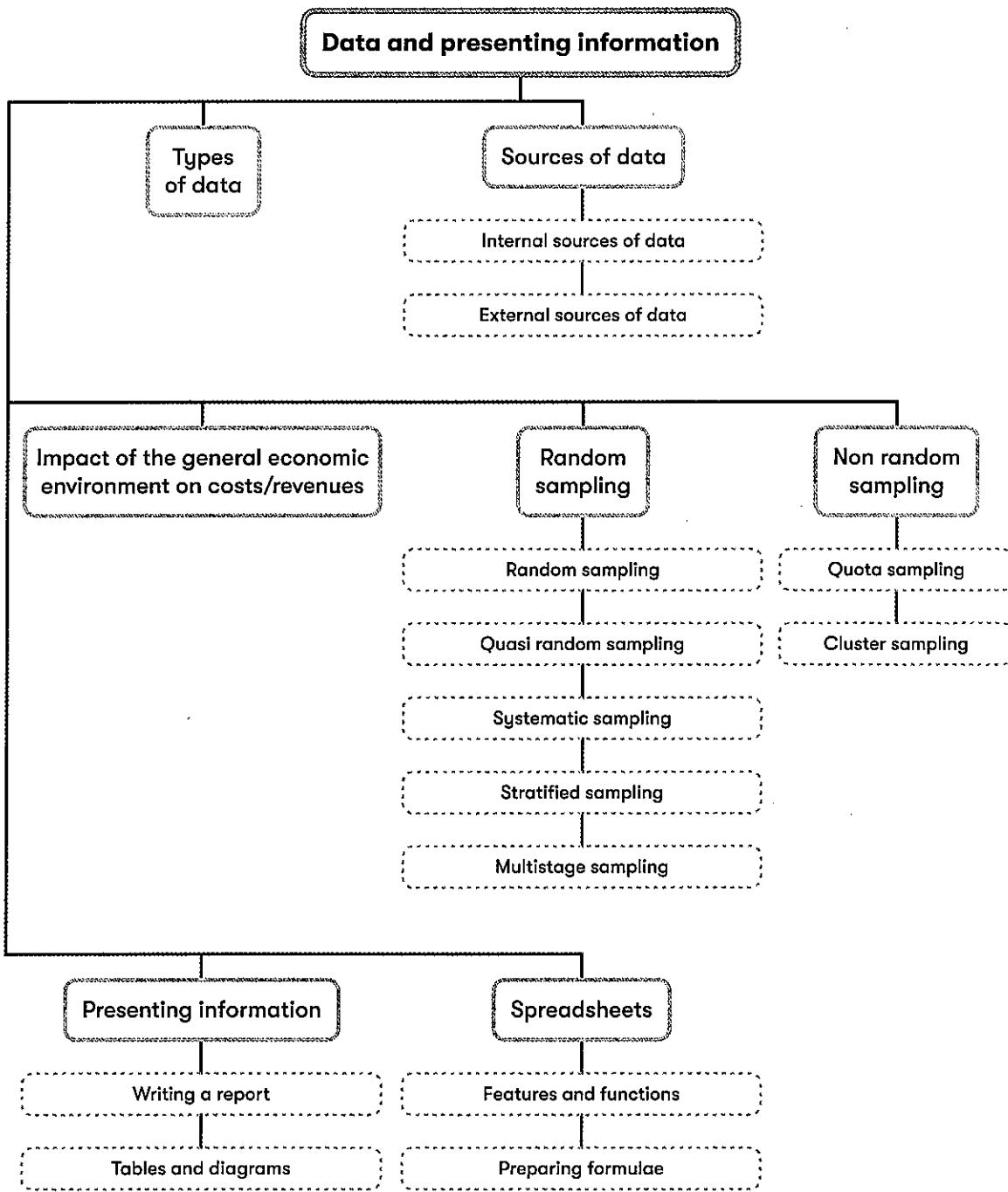
On completion of this chapter, you should be able to:

	Syllabus reference no.
Describe the three main data sources: machine/sensor, transactional and human/social.	A2 (a)
Describe sources of information from within and outside the organisation (including government statistics, financial press, professional or trade associations, quotations and price lists).	A2 (b)
Explain the uses and limitations of published information/data (including information from the internet).	A2 (c)
Describe the impact of general economic environment on costs/revenues.	A2 (d)
Prepare written reports representing management information in suitable formats according to purpose.	A4 (a)
Present information using tables, charts and graphs (bar charts, line graphs, pie charts and scatter graphs).	A4 (b)
Interpret information (including the above tables, charts and graphs) presented in management reports.	A4 (c)
Produce reports highlighting key areas for management attention and recommendations for improvement.	F4 (g)
Explain sampling techniques (random, systematic, stratified, multistage, cluster and quota).	B1 (a)
Choose an appropriate sampling method in a specific situation.	B1 (b)
Describe the two types of data: categorical (nominal and ordinal) and numerical (continuous and discrete).	B3 (d)
Explain the role and features of a computer spreadsheet system.	B4 (a)
Identify applications for computer spreadsheets and their use in cost and management accounting.	B4 (b)
Produce reports highlighting key areas for management attention and recommendations for improvement.	F4 (g)

Exam context

As well as collecting information we also need to consider how best to present that information to users. You should expect questions in Section A of the exam on these topics.

Chapter overview



1 Types of data

In Chapter 1 we defined data as the raw material for data processing. Data relates to facts, events and transactions and so forth and can be classified in the following ways:



Primary data: Primary data is data collected specifically for a particular purpose.

Secondary data: Secondary data is data which has already been collected elsewhere, for some other purpose, but can still be used or adapted for the survey being conducted.

Numerical data: As the name suggests, numerical data is data that is expressed in numbers. It can be discrete or continuous.

Discrete data: Discrete data is data which can only take on a finite or countable number of values within a given range (eg month of birth).

Continuous data: Continuous data is data that can take on any value. It is measured rather than counted (eg weight).

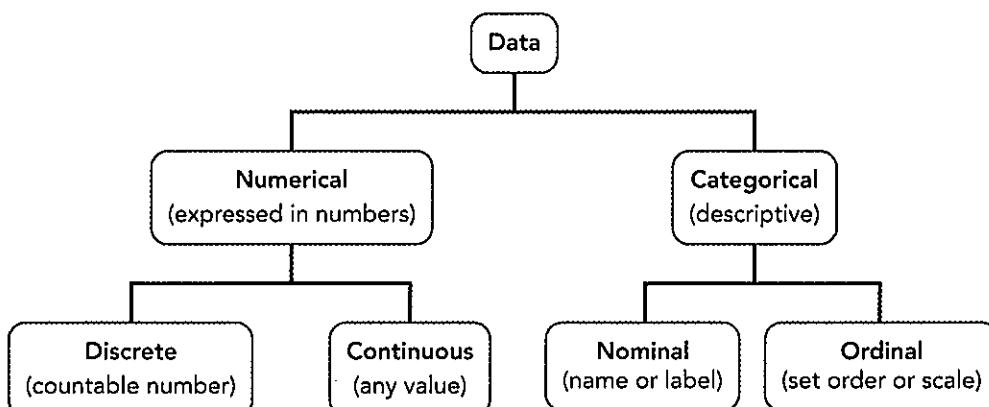
Categorical data: Categorical data is data that is descriptive rather than numeric. For example, age, educational level, eye colour, satisfaction levels, quality ratings. It can be nominal or ordinal.

Nominal data: Nominal data can be thought of as a name or a label and has no set order. You can count nominal data but you can't order or measure it. For example, eye colour.

Ordinal data: Ordinal data has a set order or scale. For example, levels of satisfaction data, collected on a scale of one to ten.

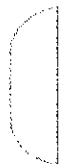
Sample data: Sample data is data arising as a result of investigating a sample. A sample is a selection from the population.

Population data: Population data is data arising as a result of investigating the population. A population is the group of people or objects of interest to the data collector.



Activity 1: Primary data

What are the key advantages and disadvantages of using primary data?



2 Sources of data



Machine/sensor data: This is data that comes from the output of devices that detect input from their surroundings.

Transactional data: This is data that comes from the transactions of an organisation.

Human/social data: This is data from humans and is often non-numerical. Social data sometimes includes data about the social media user such as their location. Human/social data can be more difficult for data analysis software to handle.

Examples include the following:

Source	Examples
Machine/sensor	<ul style="list-style-type: none">• Wearables such as fitness trackers• Smart phones• Temperature sensors• Distance eg parking sensors• Touch sensors in electronic devices• Location tracking sensors• Gas exposure detectors
Transactional	<ul style="list-style-type: none">• Sales orders• Purchase orders• Returns
Human/social	<ul style="list-style-type: none">• Customer queries• Hand written letters• Focus group feedback• Social media posts



Real life example

Supermarkets that offer a delivery service often have location tracking sensors in the lorries. They can be used to track delivery status and check whether shopping has been delivered on time.

Information may be obtained from either an internal source or from an external source.

2.1 Internal sources of information

These include: financial accounting records, payroll and human resources information, production information, time sheets, published accounts and historical records.

2.2 External sources of information

These include: market research, interviews, postal questionnaires (primary external data), data from governments such as statistics and indices, banks, newspapers, trade journals, reference manuals, consultancies, the internet, libraries, advice and information bureaux (secondary external data).

Source	Detail
Governments	Official statistics are supplied by many governments. In Britain, official statistics are supplied by the Office for National Statistics (ONS). Statistics published by government departments may include retail prices, employment figures, population data.
Banks	Data on banks, the money supply, government borrowing.
Trade journals	Data on industry averages, competitors' products, developments in the industry.
Financial newspapers	Detailed business data. Eg Financial Times, Wall Street Journal, Singapore Business Times, Nikkei Weekly.

2.2.1 The internet as a source of information

- The internet is a global network connecting millions of computers, allowing a computer with a telecommunications link to send and receive information to and from any other suitably equipped computer.
- A website is a collection of images and text that provide information which may be viewed on the World Wide Web. Most organisations now have a website and many are able to process transactions (known as electronic commerce or e-commerce).
- Information on the internet it is not necessarily good information, just because it is 'published'. Anybody can put information on the internet. The reliability and reputation of the provider is important, eg the Financial Times site, FT.com, is a respected source of financial information.

3 Impact of the general economic environment on costs/revenues

The general economic environment will affect the costs and revenues of a business.



Illustration 1: The economic environment

Consider an accountancy training business and state how it might be affected by a recession (ie the general economic environment).

Solution

Change	Impact
Decline in gross domestic product (GDP) (GDP is the total annual value of goods produced/services provided in a country)	Less money in the economy meaning less disposable income may create fall in demand for courses.
The firm operates in a city which has a high proportion of financial service firms which seem to be bucking the overall recession well (eg of a local economic trend)	A higher proportion of students coming from an area less affected by the recession may stave off the expected fall in demand due to the national recession.
Increased inflation	High inflation in prices of utilities and food costs mean that students will have less disposable income and therefore may not be able to afford fees. Staff and facility costs may also increase.
Low interest rates	Will make it easier for the business to raise debt finance to finance its business. From the point of view of the students low interest rates should keep down mortgage repayments and thus combat the high price inflation to help maintain disposable income levels, or make it cheaper to borrow the course fees.
Increases in tax rates	Will reduce the post-tax profits made by the business which could cause a reduction in either the dividends paid to investors or a reduction in reinvestment within the business.
Reductions in government spending	Any contracts with government agencies could be at risk due to local cutbacks.

4 Random sampling

Data is often collected from a **sample** rather than from a population. If the whole population is examined, the survey is called a **census**.

Due to the high costs and time consuming nature of a census, a sample is often used. It is therefore important that the sample chosen covers all areas of the population and is non-biased.

There are many different techniques for selecting a sample:

4.1 Random sampling



Simple random sample: A simple random sample is a sample selected in such a way that every member in the population has an equal chance of being included, and should therefore be free from bias.

If random sampling is used, then it is necessary to construct a **sampling frame**.



Sampling frame: A sampling frame is a numbered list of all items in a population.

Random numbers can be generated from a computer programme or a book of random numbers. The items, which correspond to the chosen random numbers then form the sample.

4.1.1 Drawbacks of random sampling

- The selected items are subject to the full range of variations inherent in the population
- Sample may be unrepresentative
- Sample may be scattered over a large geographical area
- An adequate sampling frame may not exist
- The numbering of the population may be laborious
- Expensive

4.2 Quasi-random sampling

The three main methods of quasi-random sampling are as follows:

- Systematic sampling
- Stratified sampling
- Multistage sampling

4.3 Systematic sampling



Systematic sampling: Systematic sampling is a sampling method which works by selecting every nth item after a random start.

- Designed to give a good approximation to random sampling.
- The gap between every nth item is known as the sampling interval.

4.3.1 Advantages of systematic sampling

- It is easy to select the sample items given a sampling frame.
- It is reasonably random, providing that there is no pattern to the distribution of items.

4.3.2 Disadvantages of systematic sampling

- It requires a sampling frame.
- It requires access to the whole population.
- If there is a regular pattern to the distribution of items, the sample may be biased.
- It may be expensive to select the required sample (every nth item).

4.4 Stratified sampling



Stratified sampling: Stratified sampling is a method of sampling which involves dividing the population into strata or categories. Random samples are then taken from each stratum or category.

4.4.1 Advantages of stratified sampling

- Samples are representative as all important groups will have elements in the final sample.
- The sample structure reflects the population as the same proportion of individuals should be chosen from each strata.
- Each stratum is represented by a randomly chosen sample.
- Increased precision.

4.4.2 Disadvantages of stratified sampling

- Prior knowledge required of each item in the population (to determine strata).
- Time consuming to divide population into strata.

4.5 Multistage sampling



Multistage sampling: Multistage sampling is a probability sampling method which involves dividing the population into a number of sub-populations and then selecting a small sample of these sub-populations at random.

Each sub-population is then divided further, and then a small sample is again selected at random. This process is repeated as many times as is necessary.

4.5.1 Advantages of multistage sampling

- Approximates to a random sample.
- It does not require a sampling frame.
- Suits very large populations.
- Relatively cheap as samples may be collected quickly.

4.5.2 Disadvantages of multistage sampling

- It is not truly random.
- The sample may be biased if only a small number of regions are selected.



Essential reading

See Chapter 2, Section 1 of the Essential reading for some examples of random sampling.

The Essential reading is available as an Appendix of the digital edition of the Workbook.

5 Non-random sampling

There are two main methods of non-random sampling. They are used when a sampling frame cannot be established and random sampling can therefore not be used.

- Quota sampling
- Cluster sampling

5.1 Quota sampling



Quota sampling: Quota sampling is a method of sampling in which randomness is forfeited in the interests of cheapness and administrative simplicity. Investigators are told to interview all the people they meet up to a certain quota.

This method is most commonly used by market researchers and involves stratifying the population and restricting the sample to a fixed number in each stratum on a 'first come first served' basis.

5.1.1 Advantages of quota sampling

- Cheap and administratively easy
- Large samples can be studied
- No sampling frame required
- May be the only approach to use
- Yields sufficiently accurate information for market research

5.1.2 Disadvantages of quota sampling

- Bias may exist (first come first serve basis could attract keenest members of the population)
- Not ultimately satisfactory if theoretically valid results required
- Cannot estimate sampling error

5.2 Cluster sampling



Cluster sampling: Cluster sampling is a non-random sampling method that involves selecting one definable subsection of the population as the sample, that subsection taken to be representative of the population in question.

5.2.1 Advantages of cluster sampling

- No sampling frame required
- Good alternative to multistage sampling
- Quick and cheap to administer

5.2.2 Disadvantage of cluster sampling

- Potential for considerable bias



Illustration 2: Stratified sampling

Using stratified sampling, calculate the number of customers to be interviewed from each area of the country to obtain a representative response from 5,000 questionnaires. Do not show decimals. Round to the nearest whole number.

Region	North	East	South	West	Total
Number of customers	75,000	36,500	90,000	98,500	300,000
Sample					

Solution

Region	North	East	South	West	Total
Number of customers	75,000	36,500	90,000	98,500	300,000
Sample	1,250	608	1,500	1,642	5,000

Working

$$\text{Eg North} = (75,000/300,000) \times 5,000 = 1,250$$



Activity 2: Sampling

Which TWO of the following statements are true?

- If a sample is selected using random sampling, it will be free from bias
- A sampling frame is a numbered list of all items in a sample
- Multistage sampling is a non-random sampling method
- In quota sampling, investigators are told to interview all the people they meet up to a certain quota

6 Presenting information

6.1 Reports

The purpose of a report is usually to initiate a decision or action by the reader(s) of the report. The decisions or actions might be the following types:

- Control actions
- Planning decisions

Reports can be routine (such as budgetary control reports, sales reports or progress reports) or non-routine (market research report, report on a proposed project).

The likely contents will be:

- Information
- Narrative or description
- Analysis
- Evaluation

The format of the report will depend on who the report is for. When a **formal request is made by a superior for a report** to be prepared, such as in a formally worded memorandum or letter, it is likely that the **format and style of the report** is expected to be **formal as well**.

An **informal request** for a report – ‘Can you jot down a few ideas for me about ...’ or ‘Let me know what happens, will you?’ – **will result in an informal report**, in which the structure will be less rigid, and the style slightly more personal (depending on the relationship perceived to exist between the writer and user).

A short formal report might be structured like this:

SHORT FORMAL REPORT	
TITLE	At the top of every report (or on a title page, for lengthy ones) appears the title of the report (its subject) and, as appropriate, who has prepared it, for whom it is intended, the date of completion, and the status of the report ('Confidential' or 'Urgent').
I	TERMS OF REFERENCE or INTRODUCTION Here is laid out the scope and purpose of the report: what is to be investigated, what kind of information is required, whether recommendations are to be made etc.
II	PROCEDURE or METHOD This outlines the steps taken to make an investigation, collect data etc. Telephone calls or visits made, documents consulted, computations made etc should be briefly described, with the names of other people involved.
III	FINDINGS In this section, the information itself is set out. The content should be clearly structured in chronological order, order of importance, or any other logical relationship.
IV	CONCLUSIONS This section allows for a summary of main findings.
V	RECOMMENDATIONS Here, if asked to do so in the terms of reference, the writer of the report may suggest the solution to the problem investigated so that the recipient will be able to make a decision if necessary.

A report should be presented in an unbiased way as possible and be tailored to the users' needs.

6.2 Tables and diagrams

Ways of presenting data:

- Tables
- Charts
- Graphs

Before these methods are used, the data may have to be summarised in some way.

Ways of doing this include:

- Calculation of averages
- Construction of time series
- Calculation of ratios

6.2.1 Tables



Table: A table is a matrix of data in rows and columns with the rows and columns being titled. It is two dimensional, so shows two variables.

6.2.2 Charts

Charts are a more visual display than tables. Using them depends on:

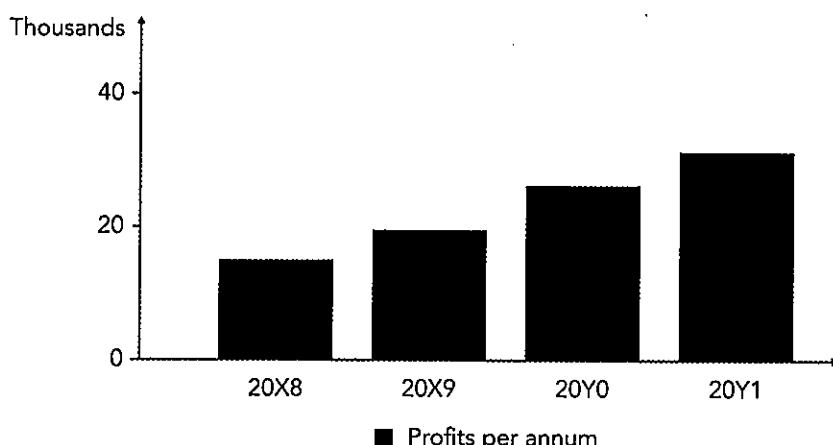
- What the data is intended to show.
- Who is going to use the data.

6.2.3 Bar charts

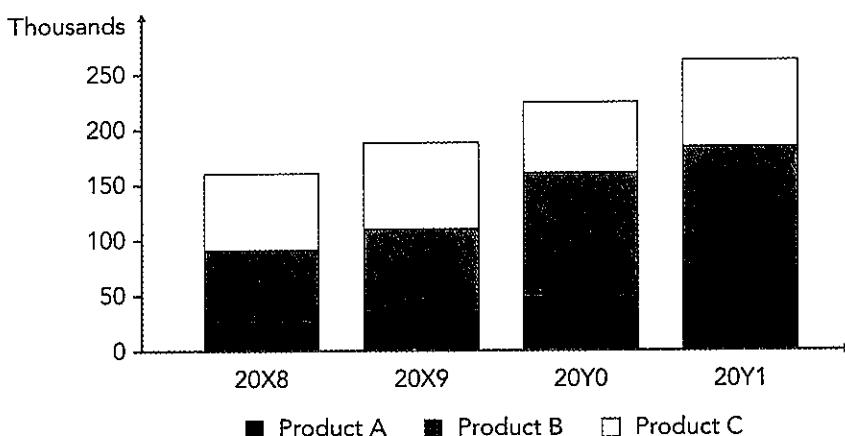


Bar chart: A bar chart is a method of presenting information in which quantities are shown in the form of bars on a chart, the length of the bars being proportional to the quantities.

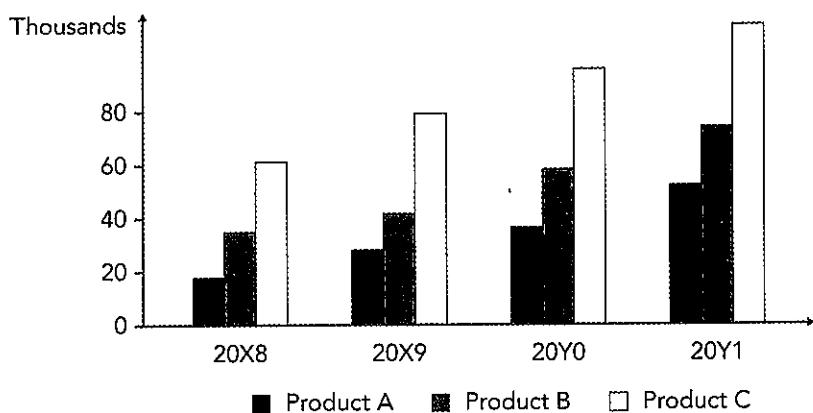
Simple bar charts – are charts consisting of a set of non-joining bars. A separate bar is drawn for each class with a height proportional to the class frequency. The widths of the bars drawn for each class are always the same. For example:



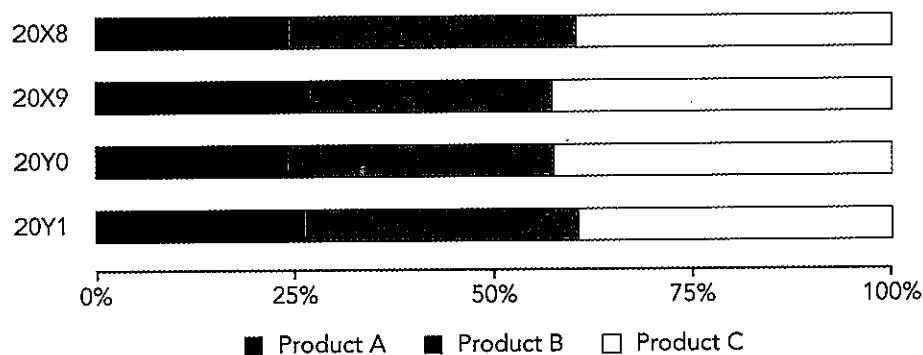
Component bar charts – have each bar representing a class and split up into constituent parts (components). Within each bar, components are always stacked in the same order. For example:



Multiple bar charts – have a set of bars for each class, each bar representing a single constituent part of the total. Within each set, the bars are physically joined and always arranged in the same sequence. Sets of bars should be separated. For example:



Percentage component bar charts – have each bar representing a class but all drawn to the same height, representing 100% (of the total). The constituent parts of each class are then calculated as percentages of the total and shown within the bar accordingly. Within each bar, components are stacked in the same order. For example:

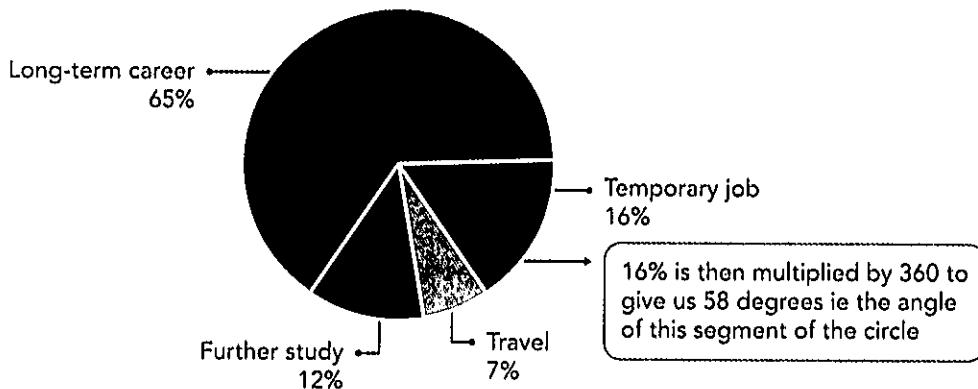


6.2.4 Pie charts



Pie chart: A pie chart is a chart which is used to show pictorially the relative size of component elements of a total.

Example - Employment: Destination of graduates in 20X9



6.2.5 Scatter graphs

Scatter graphs (or scatter diagrams) are graphs which are used to exhibit data, (rather than equations) in order to compare the way in which two variables vary with another.



Illustration 3: Scatter graphs

The output at a factory each week for the last ten weeks, and the cost of that output, were as follows.

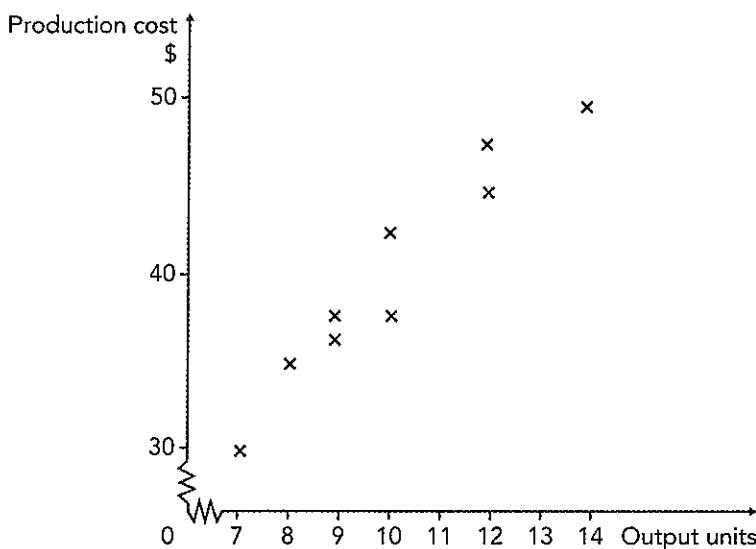
Week	1	2	3	4	5	6	7	8	9	10
Output (units)	10	12	10	8	9	11	7	12	9	14
Cost (\$)	42	44	38	34	38	43	30	47	37	50

Required

Plot the data given on a scatter diagram.

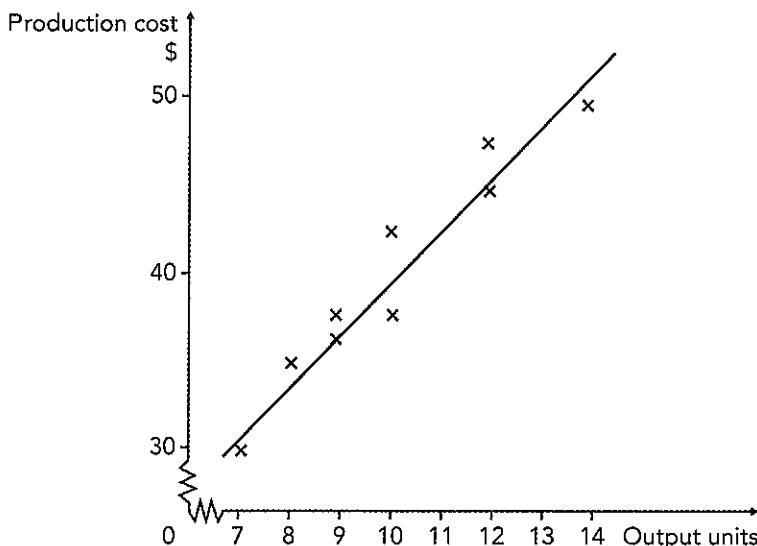
Solution

The data could be shown on a scatter diagram as follows.



- (1) The cost depends on the volume of output: volume is the independent variable and is shown on the x axis.
- (2) You will notice from the graph that the plotted data, although scattered, lies approximately on a rising trend line, with higher total costs at higher output volumes. (The lower part of the axes have been omitted, so as not to waste space. The break in the axes is indicated by the jagged lines.)

For the most part, scatter diagrams are used to try to identify **trend lines** which can be used to make predictions. For example:



We will return to the subject of trends later in this Workbook when we cover forecasting.

6.2.6 Line graphs



Line graphs: A line graph is a type of chart used to visualise relationships between variables. It consists of a horizontal x-axis and a vertical y-axis.

One of the clearest ways of presenting the relationship between two variables is by plotting a line on a graph. The relationship is often between time and something else. For example, the marketing costs over the last ten years.

A graph has a horizontal axis, the x-axis and a vertical axis, the y-axis. The x-axis is used to represent the independent variable and the y-axis is used to represent the dependent variable. If time is one variable, it is always treated as the independent variable.



Illustration 4: Line graphs

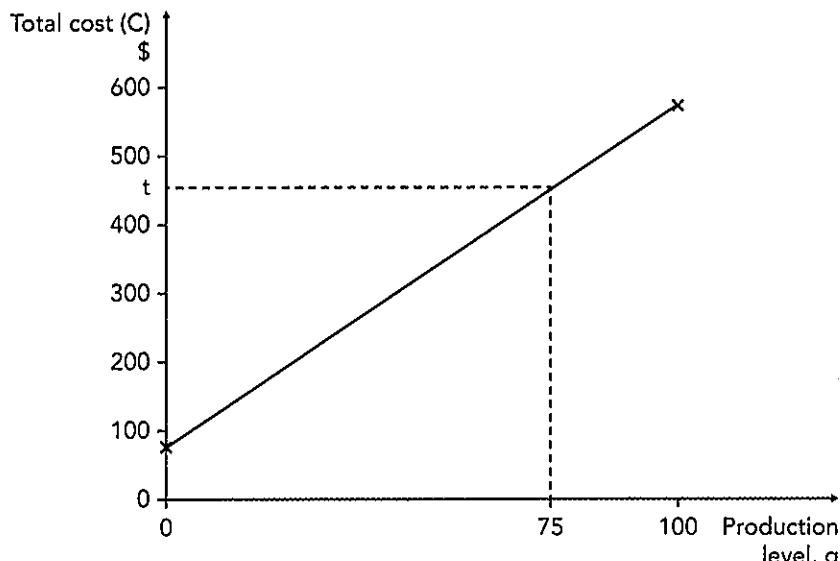
A company manufactures a product. The total fixed costs are \$75 and the variable cost per unit is \$5.

Required

- (1) Find an expression for total costs (C) in terms of q , the quantity produced.
- (2) Use your answer to (a) to determine the total costs if 100 units are produced.
- (3) Use the graph to determine the total cost if 75 units are produced.

Solution

- (1) Let C = total costs
 C = total variable costs + total fixed costs
 $C = 5q + 75$
- (2) If $q = 100$, $C = (5 \times 100) + 75 = \575



- (3) From the graph above, if $q = 75$, $C = \$450$



Exam focus point

A computer-based exam cannot require you to draw charts so questions will focus on labelling, calculating values, choosing an appropriate chart and coming to conclusions using charts.



Activity 3: Pie chart

A company has four regional divisions whose sales for the last quarter are as follows:

	Sales \$m
North	320
South	120
East	180
West	100

Required

If the figures were displayed in a pie chart, what would be the angle of the section representing the South division?

- 90 degrees
- 60 degrees
- 120 degrees
- 75 degrees



PER alert

PER performance objective 14b requires you to 'Analyse and provide appropriate information to measure performance'. How information is presented, including appropriate use of graphs and charts, is an important aspect of communication.

7 Spreadsheets

Spreadsheets are the basic tool of accountants to record and manipulate management information.

This section is intended only as a summary and we will return to spreadsheets when we cover budgeting in Chapter 11.

A spreadsheet is an electronic piece of paper divided into **rows** and **columns**. The intersection of a row and a column is known as a **cell**. Cells can be used to hold numerical data. Data can be processed by defining a relationship between cells, to derive output.

Some common applications of spreadsheets by management accountants are:

- Preparation of management accounts
- Cash flow analysis, budgeting and forecasting
- Account reconciliation
- Revenue and cost analysis
- Comparison and variance analysis
- Sorting, filtering, categorising large volumes of data

7.1 Features and functions

Cell contents can include:

Text	Eg words, abbreviations, descriptions, references, key words, decision summary
Values	A number which can be used as part of a calculation
Formulae	A definition of a mathematical relationship between cells. For example, if we multiply the contents of two cells A1 and B1 the formula required is =A1*B1

The **formula bar** allows you to see and edit contents of the active cells. It also shows the '**cell address**', which is the location of the current highlighted cell.

7.2 Preparing formulae

Note that questions in the exam on formulae will expect you to know exactly how the formulae would be written in Excel. For example, with an equals sign at the beginning.



Activity 4: Spreadsheet formulae

	A	B
1		Sales value
2	January	150
3	February	120
4	March	100
5	Total	
6	Sales tax	
7	Gross sales	

Required

What is the formula in cell B5 to calculate total sales value?

What is the formula in cell B6 to calculate the sales tax payable at a rate of 20% on the sum calculated in cell B5?

What is the formula in cell B7 to calculate the gross sales value?

Formula for total sales value

Formula for sales tax value

Formula for gross sales value

7.2.1 Absolute cell referencing

When copying a formula, we sometimes want one of the cell references to remain the same. By using \$ (absolute cell referencing) we can do this.

The following sales tax calculation uses absolute cell referencing. A \$ sign either side of the column letter anchors the formula to this cell. The formula can now be copied.



Illustration 5: Absolute cell referencing

	A	B	C
1			
2	Sales tax	20%	
3			
4	Price (excl sales tax)	Sales tax	Price (incl sales tax)
5	12		=A5+B5
6	15.5		=A6+B6
7	35		=A7+B7

Required

What formula will be typed into B5 to calculate the sales tax (using absolute cell referencing)?

Solution

=A5*\$B\$2

7.2.2 Rounding

Simple rounding uses the following formula:

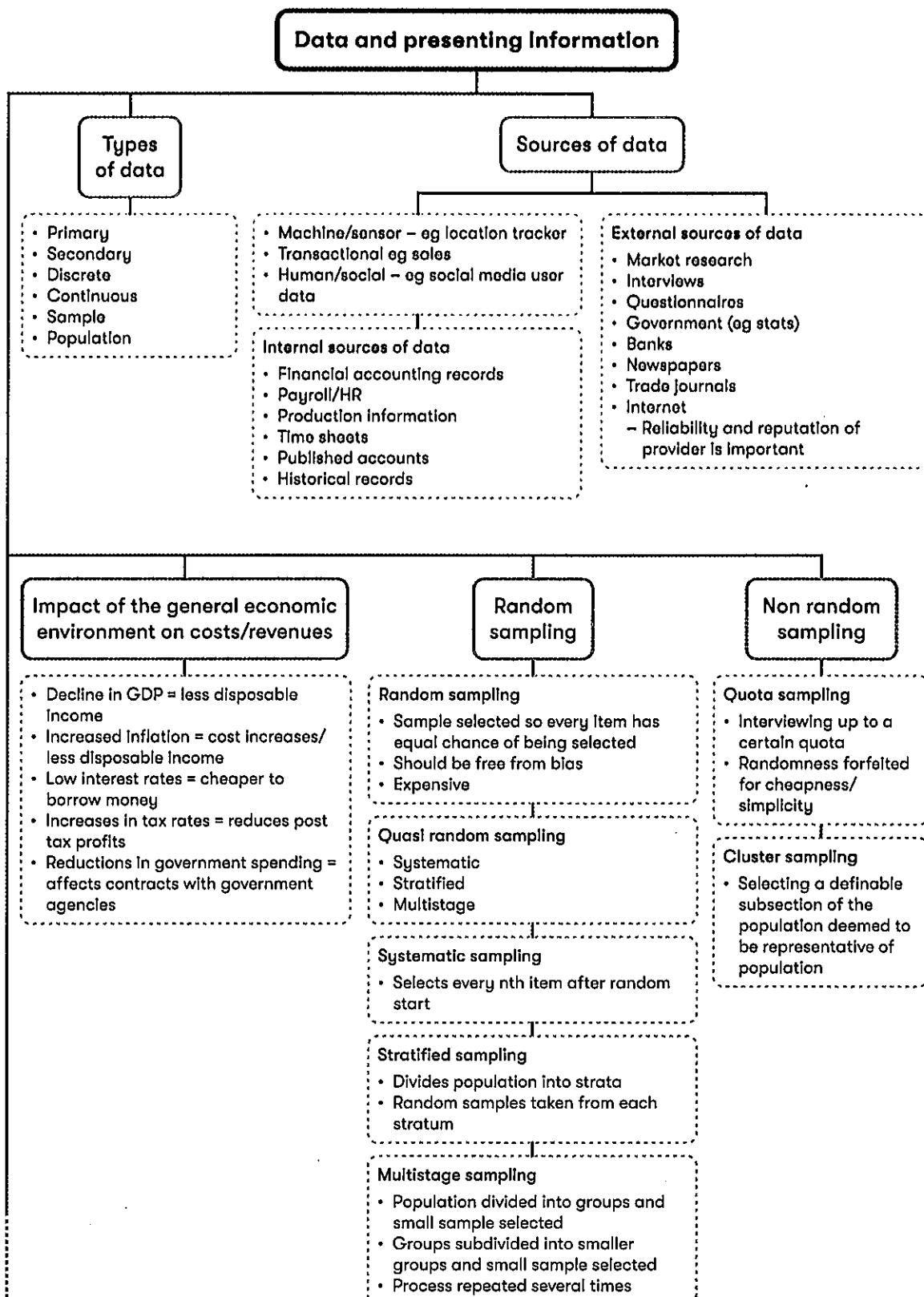
=ROUND(cell ref, decimal places required)

eg =ROUND(C5,2) will round everything in cell C5 to 2 decimal places

7.2.3 Spreadsheets and What if? analysis

Spreadsheets can be very helpful for 'what if' analysis. Once a forecast cash flow has been prepared the formulae used in assumptions to create the spreadsheet can easily be tweaked to see the results of different scenarios. For example, once a cash flow forecast has been prepared, the assumption that cost of sales is 60% of revenue could be altered to see the impact of it rising to 64% or the impact of receivables taking two months to pay, rather than one month, could be seen quickly.

Chapter summary



Presenting information

Writing a report

- Can be formal or informal
- Should be tailored to the users' needs

Tables and diagrams

- Tables
- Charts
- Bar charts
 - Simple bar charts
 - Component bar charts
 - Multiple bar charts
 - Percentage component bar charts
- Pie charts
- Scattergraphs
- Line graphs

Spreadsheets

Features and functions

- Text, values, formulae

Preparing formulae

- Always use an equals sign
- Use \$ for absolute cell referencing
- =ROUND(cell ref, decimal places required)

Knowledge diagnostic

1. Data

Data is a term for facts, figures, information and measurements. If collected for a specific purpose, it is known as primary data and if collected for another purpose it is known as secondary.

2. Sources of data

Data can be internal (accounting records, payroll information, product information, published accounts or historic records) or external (market research, interviews, questionnaires, data from government, banks, newspapers or the internet).

3. Impact of the economic environment on costs/revenues

The economic environment will impact the costs and revenues of a business. Think about how businesses suffer during a recession.

4. Sampling

A sample is where data is only collected from a sample of the population whereas a census collects information from the whole population.

5. Random sampling

The sample is selected in such a way that each item has an equal chance of being selected. Often done using random numbers. Quasi-random sampling can also be used.

6. Non-random sampling

Where a random sample cannot be used non-random sampling can be a solution. Both quota and cluster sampling can be used.

7. Reports

Should be presented in an unbiased way as possible and be tailored to the users' needs.

8. Tables and diagrams

A table is a matrix of data in rows and columns.

Charts are a more visual display than tables.

Bar charts are charts consisting of a set of non-joining bars with the height proportional to the class frequency.

A pie chart shows the relative size of the components of a total.

9. Spreadsheets

A spreadsheet is an electronic piece of paper divided into rows and columns.

A wide range of formulae and functions are available in Excel.

Further study guidance

Question practice

Now try the following from the Further question practice bank (available in the digital edition of the Workbook):

Section A: Q5-11

Further reading

There is a technical article available on ACCA's website, called *Effective presentation and communication of information using charts*, which the various types of chart.

You are strongly advised to read this article in full as part of your preparation for the MA/FMA exam.

Activity answers

Activity 1: Primary data

Advantages of primary data

- Known source
- Known collection method
- Awareness of limitations
- Tailor-made to requirements
- Up-to-date

Disadvantages of primary data

- Expensive to collect
- Time consuming

Activity 2: Sampling

The correct answers are:

- If a sample is selected using random sampling, it will be free from bias
- In quota sampling, investigators are told to interview all the people they meet up to a certain quota

A sampling frame is a numbered list of all items in a population, not a sample.

At each stage in multistage sampling, a sample is picked at random.

Activity 3: Pie chart

The correct answer is: 60 degrees

$$120/720 \times 360 \text{ degrees} = 60 \text{ degrees}$$

Activity 4: Spreadsheet formulae

Formula for total sales value =B2+B3+B4 or =SUM(B2:B4)

Formula for sales tax value =B5*20%

Formula for gross sales value =B5+B6 or =B5*1.20

3

Cost classification and behaviour

Learning objectives

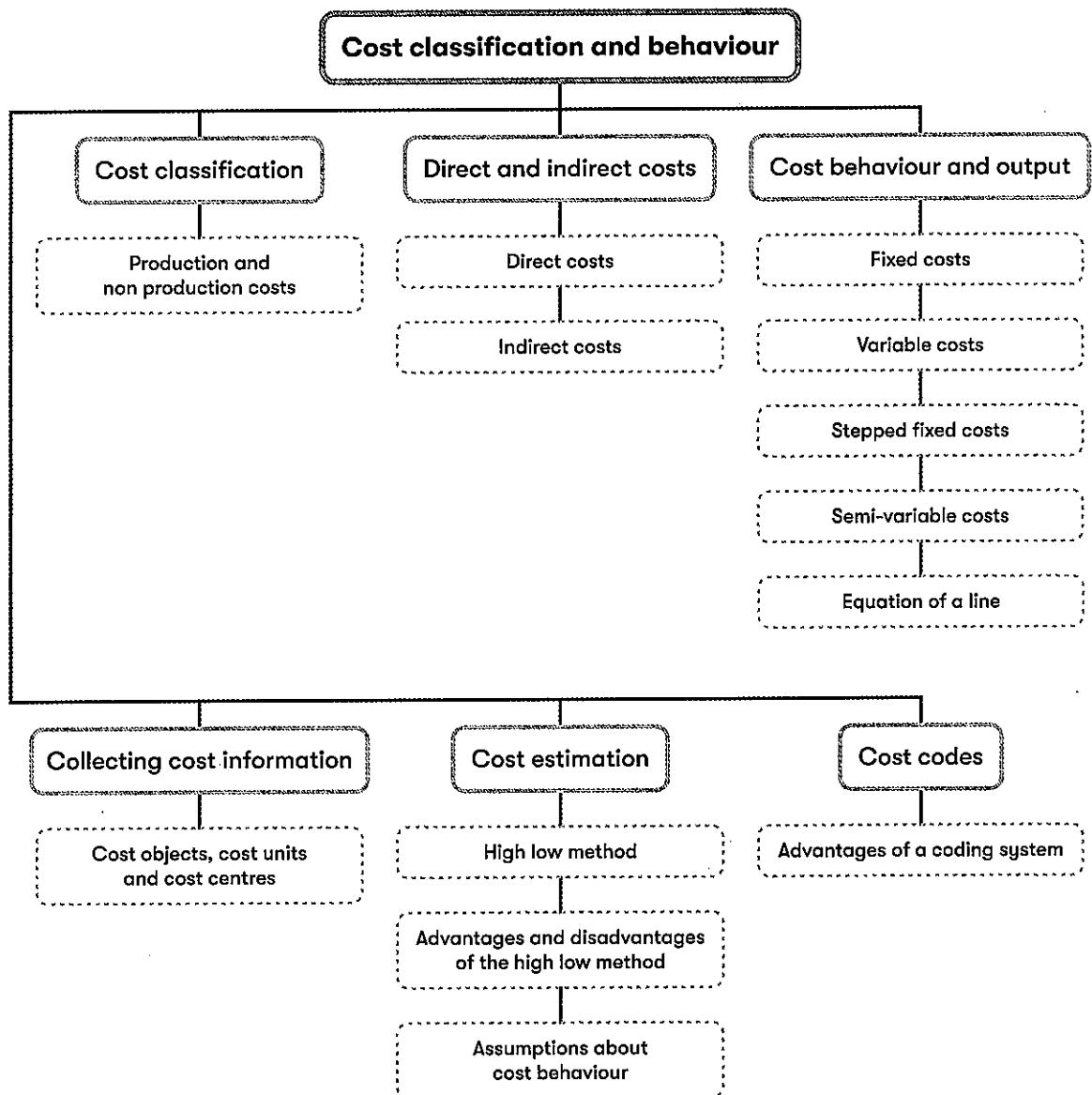
On completion of this chapter, you should be able to:

	Syllabus reference no
Explain and illustrate production and non-production costs.	A3 (a)
Describe the different elements of non-production costs – administrative, selling, distribution and finance.	A3 (b)
Describe the different elements of production cost – materials, labour and overheads.	A3 (c)
Explain the importance of the distinction between production and non-production costs when valuing output and inventories.	A3 (d)
Explain and illustrate with examples classifications used in the analysis of the product/service costs, including by function, direct and indirect, fixed and variable, stepped fixed and semi variable costs.	A3 (e)
Explain and illustrate the use of codes in categorising transactions.	A3 (f)
Describe and illustrate, graphically, different types of cost behaviour.	A3 (g)
Explain and illustrate the concepts of cost objects, cost units and cost centres.	A3 (h)
Explain the structure of linear functions and equations.	B2 (a)
Use high-low analysis to separate the fixed and variable elements of total cost, including situations involving semi variable and stepped fixed costs and changes in the variable cost per unit.	B2 (b)
Explain the advantages and disadvantages of using the high-low method to estimate the fixed and variable element of costing.	B2 (c)

Exam context

Cost classification is one of the key areas of the syllabus. As well as providing you with key terminology for many of the following chapters, it is also very examinable in Section A of the exam.

Chapter overview



1 Cost classification

The classification of costs (for example into direct or indirect costs) is an essential process for an organisation in the determination of the cost of a unit of product or service.

The fixed and variable cost classifications, on the other hand, are important in absorption and marginal costing, and behaviour. You will meet all these topics as we progress through the Workbook.

This chapter therefore acts as a foundation stone for a number of other chapters and so, an understanding of the concepts covered in it is vital before you move on.

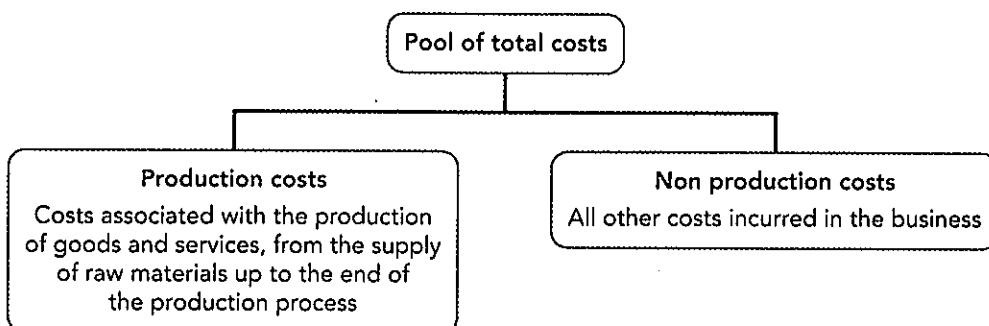


Cost classification: The arrangement of cost items into logical groups, for example by their function (administration, production etc) or by their nature (materials, wages etc). The eventual aim of costing is to determine the cost of producing a product or service.

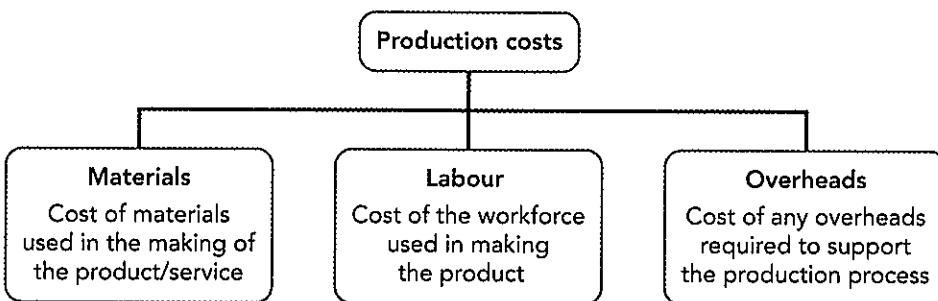
1.1 Production and non-production costs

Classification by function involves classifying costs as production/manufacturing costs, administration costs or marketing/selling and distribution costs.

At the highest level there could be groups of production costs and groups of non-production costs.



Production costs can be broken down further into material, labour and overheads elements.

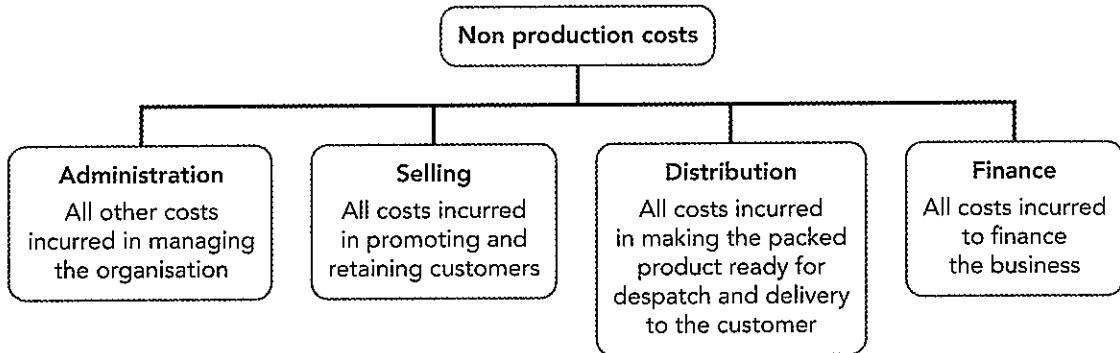


Activity 1: Production costs

Give an example of production costs under each of the three headings below.

Materials	
Labour	
Overheads	

Non-production costs can also be broken down further by function to aid analysis.



Activity 2: Non-production costs



Give an example of non-production costs under each of the four headings below.

Administration	
Selling	
Distribution	
Finance	

Remember the eventual aim of costing is to determine the cost of producing a product or service.

This information is important to management for many reasons, the three most important being:

- Profitability analysis
- Selling price determination
- Inventory valuation purposes



Illustration 1: Inventory valuation

A business has the following costs for a period.

	\$
Materials	600
Labour	1,000
Production overheads	500
Administration overheads	<u>700</u>
	<u>2,800</u>

Required

If 100 units are produced, what would each unit be valued at?

Solution

If all these costs were allocated to the 100 production units, each unit would be valued at \$28.

This would be incorrect. Only **production** costs are allocated to units of inventory. Administrative overheads are **non-production** costs.

So, each unit of inventory should be valued at $\$21((600 + 1,000 + 500)/100)$.

This affects both gross profit and the valuation of closing inventory. If during the period, 80 units are sold at \$40 each, the gross profit will be:

	\$
Sales (80×40)	3,200
Cost of sales (80×21)	<u>(1,680)</u>
Gross profit	<u>1,520</u>

The value of closing (unsold) inventory will be \$420 (20×21).

2 Direct and indirect costs

Production costs can be split into direct costs and indirect costs of production.



Direct cost: A direct cost is a cost that can be traced in full to the product, service or department that is being costed.

Direct materials	Materials that are incorporated into the finished product (eg wood used in the construction of a table) or used in providing a service (eg hair dye used by a hairdresser)
Direct labour	Wages paid to those workers who make products in a manufacturing business (eg machine operators) or perform the service in a service business (eg hairdressers in a hair salon).
Direct expenses	Expenses that have been incurred as a direct consequence of making a product, or providing a service (such as patent royalties payable to the inventor of a new product or process).



Prime cost: Prime cost = Direct materials + Direct labour + Direct expenses

2.1 Indirect costs



Indirect costs: Indirect production costs are those costs which are incurred in the course of making a product/service but which cannot be identified with a particular cost unit.

Indirect production costs are often referred to as production overheads.

Indirect materials	Materials that are used in the production process but not incorporated into the product (eg machine lubricants and spare parts). Insignificant costs that are attributable to each unit are sometimes included in indirect materials for convenience (eg nails and glue).
Indirect labour	Wages and salaries of the other staff, such as supervisors, storekeepers and maintenance workers.
Indirect expenses	Expenses that are not spent on individual units of production (eg rent and rates, electricity and telephone).

Analysis of total cost

Materials	=	Direct materials	+	Indirect materials
+		+		+
Labour	=	Direct labour	+	Indirect labour
+		+		+
Expenses	=	<u>Direct expenses</u>	+	<u>Indirect expenses</u>
Total cost	=	<u>Direct cost</u>	+	<u>Overhead</u>



Activity 3: DVD costs

Identify direct and indirect materials, labour and expenses involved in the production of a DVD.

Solution

The cost of producing a DVD can be broken down on a cost card as follows:

Cost card

Production costs	
Direct production costs	X
Prime cost	X
Indirect production costs (production overheads)	X
Non production cost	
Administration cost	X
Selling and distribution cost	X
Total product cost	X =

Materials
Labour
Expenses

Materials
Labour
Expenses

3 Cost behaviour and output

Cost behaviour is the way in which costs are affected by changes in the volume of output.

A business needs to know how costs behave as production volumes either increase or decrease, so that predictions of costs can be made.

It is expected that costs will increase as production increases but, the exact way costs behave as output changes, will depend on the nature of the cost.

We first classify costs according to how they behave as output changes. Note that the volume of output is sometimes referred to as the level of activity.

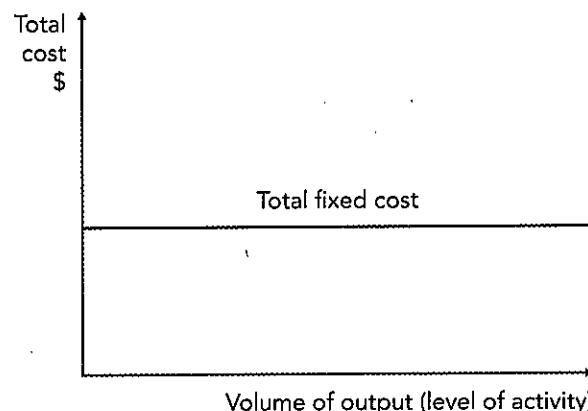
3.1 Fixed costs



Fixed cost: A fixed cost is a cost which tends to be unaffected by increases or decreases in the volume of output.

Fixed costs are a period charge, in that they relate to a span of time; as the time span increases, so too will the fixed costs (which are sometimes referred to as period costs for this reason).

A sketch graph of a fixed cost would look like this:



Examples of a fixed cost would be as follows:

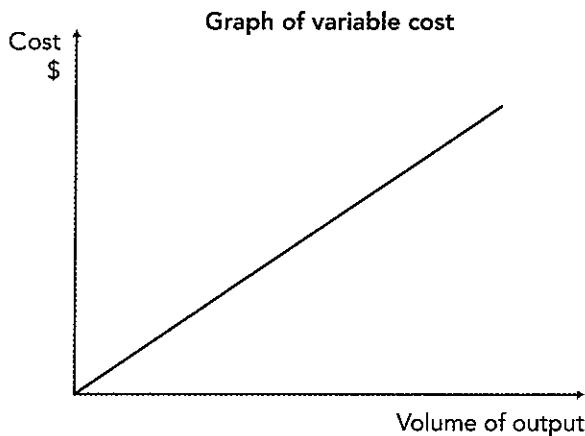
- The salary of the managing director (per month or per year)
- The rent of a single factory building (per month or per year)
- Straight line depreciation of a single machine (per month or per year)

3.2 Variable costs



Variable cost: A variable cost is a cost which tends to vary with the volume of output.

The variable cost per unit is the amount for each unit produced. The graph of variable costs would look like this:



A constant variable cost per unit implies that the price per unit of, say, material purchased is constant, and that the rate of material usage is also constant.

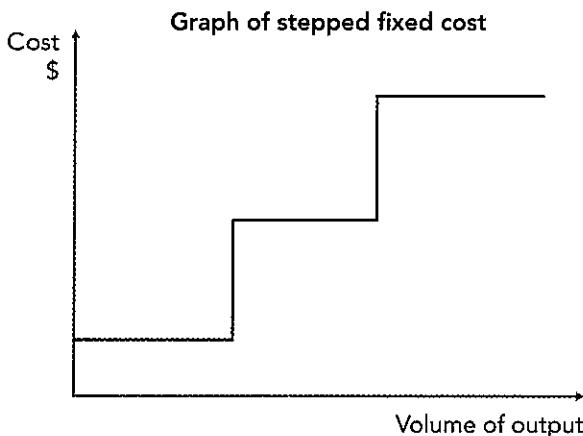
- The most important variable cost is the **cost of raw materials**.
- **Direct labour costs** are, for very important reasons, classed as a variable cost even though basic wages are usually fixed.
- **Sales commission** is variable in relation to the volume or value of sales.

3.3 Stepped fixed costs



Stepped fixed cost: A stepped fixed cost is a cost which is fixed in nature but only within certain levels of activity.

A sketch graph of a stepped fixed cost would look like this.



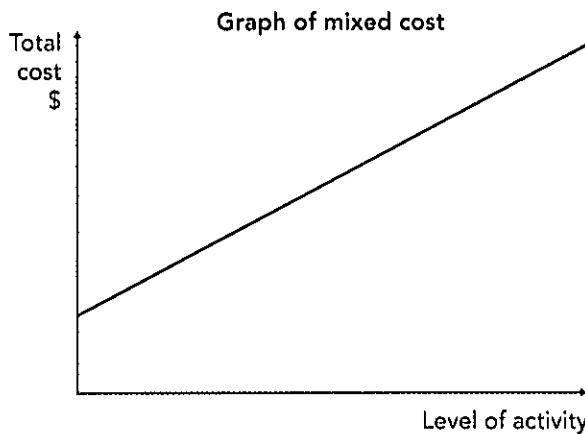
Rent is a step cost in situations where accommodation requirements increase as output levels get higher.

3.4 Semi-variable costs



Semi-variable cost: A semi-variable/semi-fixed/mixed cost is a cost which contains both fixed and variable components and so is partly affected by changes in the level of activity.

A sketch graph of a semi-variable cost would look like this:



Examples of these costs include the following.

Electricity and gas bills

- Fixed cost = standing charge
- Variable cost = charge per unit of electricity used

Salesman's salary

- Fixed cost = basic salary
- Variable cost = commission on sales made



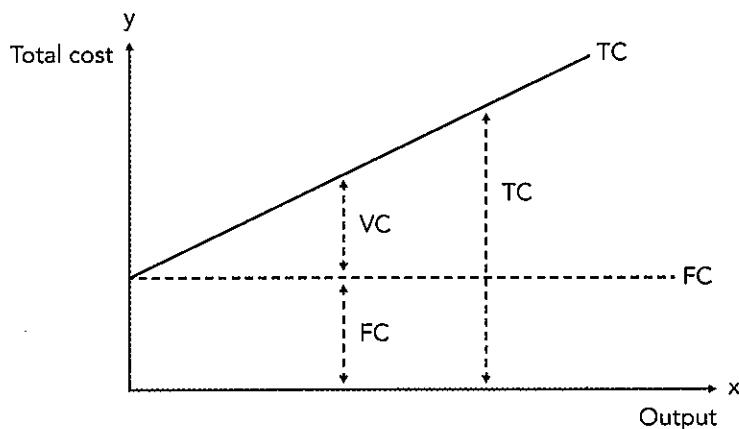
Essential reading

See Chapter 3, Section 1 of the Essential reading for detail on different types of cost behaviour.

The Essential reading is available as an Appendix of the digital edition of the Workbook.

3.5 Equation of a line

The total costs of a business are likely to have a variable cost and a fixed cost element.



If there is a linear relationship (ie a straight line relationship) between output and total cost then the relationship can be within this form:



Formula to learn

$$y = a + bx$$

Where

y is the dependent variable (eg total cost)

x is the independent variable (eg output)

a is the intercept on the y axis (eg fixed cost)

b is the gradient on the line (eg variable costs per unit).

Therefore, total cost = fixed cost + (variable cost x output)

$$TC = FC + VC \text{ per unit} \times \text{output}$$



Essential reading

See Chapter 3 Section 2 of the Essential reading, for detail on linear equations.

The Essential reading is available as an Appendix of the digital edition of the Workbook.

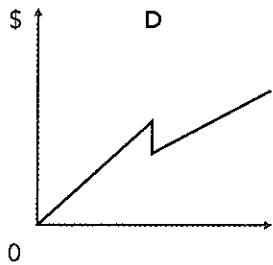
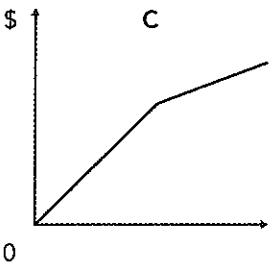
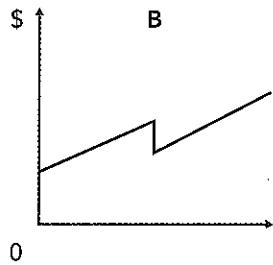
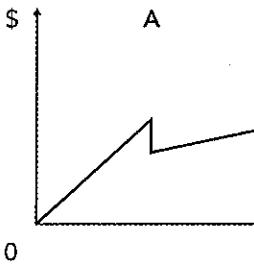


Activity 4: Cost behaviour graphs

Up to a given level of activity in each period one purchase price of a unit of raw material is constant. After that point a lower price per unit applies both to further units purchased and also retrospectively to all units already purchased.

Required

Which of the following graphs depicts the total cost of the raw materials for a period?



4 Collecting cost information

4.1 Cost objects, cost units and cost centres



Cost object: A cost object is anything for which cost data is desired eg products, product lines, jobs, customers or departments and divisions of a company.

Examples of cost objects include:

- The cost of a product
- The cost of a service
- The cost of operating a department



Cost unit: A cost unit is a unit of product or service in relation to which costs may be ascertained.

The cost unit should be appropriate to the type of business. For example:

Business	Appropriate cost unit
Car manufacturer	Car
Builder	Job / Contract
Management consultant	Project



Cost centre: A cost centre is a location, function or item of equipment in respect of which costs may be ascertained and related to cost units for control purposes.

Each cost centre acts as a 'collecting place' for certain costs before they are analysed further.
Note:

- Cost centres may be set up in any way the business thinks appropriate.
- Usually, only manufacturing costs are considered and hence, we will focus on factory cost centres.

We need to distinguish between **factory cost centres** that are:

- **Production cost centres**, through which cost units actually flow.
- **Service cost centres**, which support/service the production cost centres.



Activity 5: Cost centres

Suggest three examples of production cost centres and service cost centres within a clothes manufacturing factory.

Solution

5 Cost estimation

To help with analysis and planning for the future, it is necessary to determine the fixed and variable elements of the total costs.

5.1 High low method

A method known as **high low** can be used to estimate the fixed and variable elements of a given cost.

The high low method is a four-step process.



Illustration 2: High low method

The total costs of a business for differing levels of output are as follows:

Output (units)	Total costs (\$'000)
500	70
200	30
300	50
800	90
1,000	110

Required

Calculate the fixed and variable elements of the total cost using the high-low method and select the correct formula for total costs, where y = total costs and x = output in units.

- $y = \$30,000 + \$100x$
- $y = \$30,000 + \$110x$
- $y = \$10,000 + \$110x$
- $y = \$10,000 + \$100x$

Solution

The correct answer is: $y = \$10,000 + \$100x$

Calculations as follows.

Step 1 Select highest and lowest activity level and associated cost.

Units produced (output)		Total costs \$
Highest level of output	1,000	110,000
Lowest level of output	200	30,000

Step 2 Find the change in cost resulting from the change in output.

	Units	Total costs \$
Highest	1,000	110,000
Lowest	<u>200</u>	<u>30,000</u>
Difference	<u>800</u>	<u>80,000</u>

Step 3 Calculate the VC/unit.

$$\$80,000/800 = \$100 \text{ per unit}$$

Step 4 Substitute back into formula of line.

$$\text{Total cost} = \text{fixed cost} + (\text{variable cost} \times \text{output})$$

$$\$110,000 = \text{FC} + (\$100 \times 1,000)$$

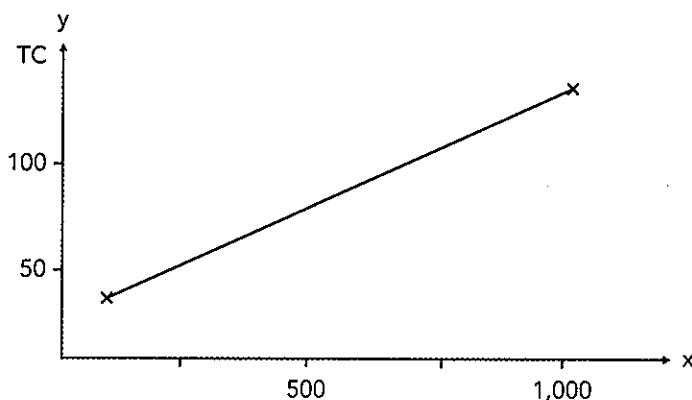
$$\text{Therefore FC} = \$110,000 - \$100,000 = \$10,000$$

$$\text{Equation for total costs} = \$10,000 + \$100X$$



Exam focus point

Remember that the high low method refers to the highest and lowest volume and not the highest and lowest cost.



In using the high low method we have:

- Plotted a line between the highest and lowest points.
- Calculated equation of that line.

We can now use that equation for planning.



Activity 6: Cost estimation

The equation for total costs: $y = \$10,000 + \$100x$ where y = total costs and x = output in units.

Required

If production next year is expected to be 780 units, what is the estimated total cost?

\$



Illustration 3: The high low method with stepped fixed costs

The following data relate to the overhead expenditure of industrial cleaners at two activity levels.

Square metres cleaned	12,750	15,100
Overheads	\$73,950	\$83,585

When more than 14,000 square metres are industrially cleaned, there will be a step up in fixed costs of \$4,700.

Required

Calculate the estimated total cost if 14,500 square metres are to be industrially cleaned.

Solution

Before we can compare high output costs with low output costs in the normal way, we must eliminate the part of the high output costs that are due to the step up in fixed costs.

Total cost for 15,100 without step up in fixed costs = $\$83,585 - \$4,700 = \$78,885$

We can now proceed in the normal way using the revised cost above.

	Units		\$
High output	15,100	Total cost	78,885
Low output	12,750	Total cost	<u>73,950</u>
	<u>2,350</u>		<u>4,935</u>

Variable cost = $\$4,935 / 2,350 = \2.10 per square metre

Before we can calculate the total cost for 14,500 square metres, we need to find the fixed costs. As the fixed costs for 14,500 square metres will include the step up of \$4,700, we can use the activity level of 15,100 square metres for the fixed cost calculation.

	\$
Total cost (15,100 square metres) (this includes the step up in fixed costs)	83,585
Total variable costs ($15,100 \times \$2.10$)	<u>31,710</u>
Total fixed costs	<u>51,875</u>

Estimated overhead expenditure if 14,500 square metres are to be industrially cleaned:

	\$
Fixed costs	51,875
Variable costs ($14,500 \times \$2.10$)	<u>30,450</u>
	<u>82,325</u>



Exam focus point

The examining team has regularly commented that many of the poorly attempted questions are calculation-based. A past question on the high-low method with stepped fixed costs saw less than 30% of students selecting the correct answer. Make sure you know how to do this type of question.

5.2 Advantages and disadvantages of the high low method

Advantages

- It is easy to use and understand
- It needs just two activity levels

Disadvantages

- It uses two extreme data points which may not be representative of normal conditions
- Using only two points to determine a formula may mean that the formula is not very accurate

5.3 Assumptions about cost behaviour

Assumptions include the following:

- Within the normal range of output (known as the relevant range), costs are assumed to be either fixed, variable or semi-variable.
- Variable costs per unit are constant.



Activity 7: Forecasting using the high low method

LMN Co has a manufacturing capacity of 100,000 units. The production cost of the company is as follows:

Capacity	65%	100%
Total production costs	\$290,500	\$378,000

Required

What is the budgeted total production cost if it operates at 80% capacity?

Solution



Activity 8: Stepped fixed costs

The following data has been collected from Steps Co:

Units produced	5,000	7,500	10,000
Total costs	54,500	76,500	90,000

Total costs are made up of two elements, a stepped fixed cost that changes when the units exceed 7,000 and some variable costs, which remain constant.

Required

What are the total fixed cost at production levels below and above 7,000 units?

What is the variable cost per unit (to two decimal places)?

Total fixed costs below 7,000 units = \$

Total fixed costs above 7,000 units = \$

Variable cost per unit = \$

Solution

The same methodology could be applied if fixed costs were constant and variable costs changed above a certain level of output.

6 Cost codes

Once the costs have been classified, a coding system could be put in place to make it easier to manage the cost data.

Each individual cost should be identifiable by its code. This is done by building up the individual characteristics of the code. The characteristics are normally identified as follows:

- The nature of the cost (eg material/labour/overhead) which is known as a subjective classification
- The type of cost (eg indirect/direct)
- The cost centre to which the cost should be allocated which is known as an objective classification; and
- The department which the particular cost centre is in.

An example of a coding system might be a composite code. For example, let's consider a composite code number of 413.375. The first three digits might indicate the nature of the expenditure (subjective classification) and the last three digits might indicate the cost centre to be charged (objective classification).

So the digits 413 might refer to:

4 Materials

1 Raw materials

3 Plastic sheeting

Therefore, anyone familiar with the coding system would know that 413 indicates expenditure on plastic sheeting.

The digits 375 might refer to:

3 Direct cost

7 Factory Beta

5 Finishing department

This would indicate the expenditure was to be charged as a direct material cost to the finishing department in factory beta.

6.1 Advantages of a coding system

- A code is usually briefer than a description, thus saving time and storage space
- A code is more precise and reduces ambiguity
- Coding facilitates data processing

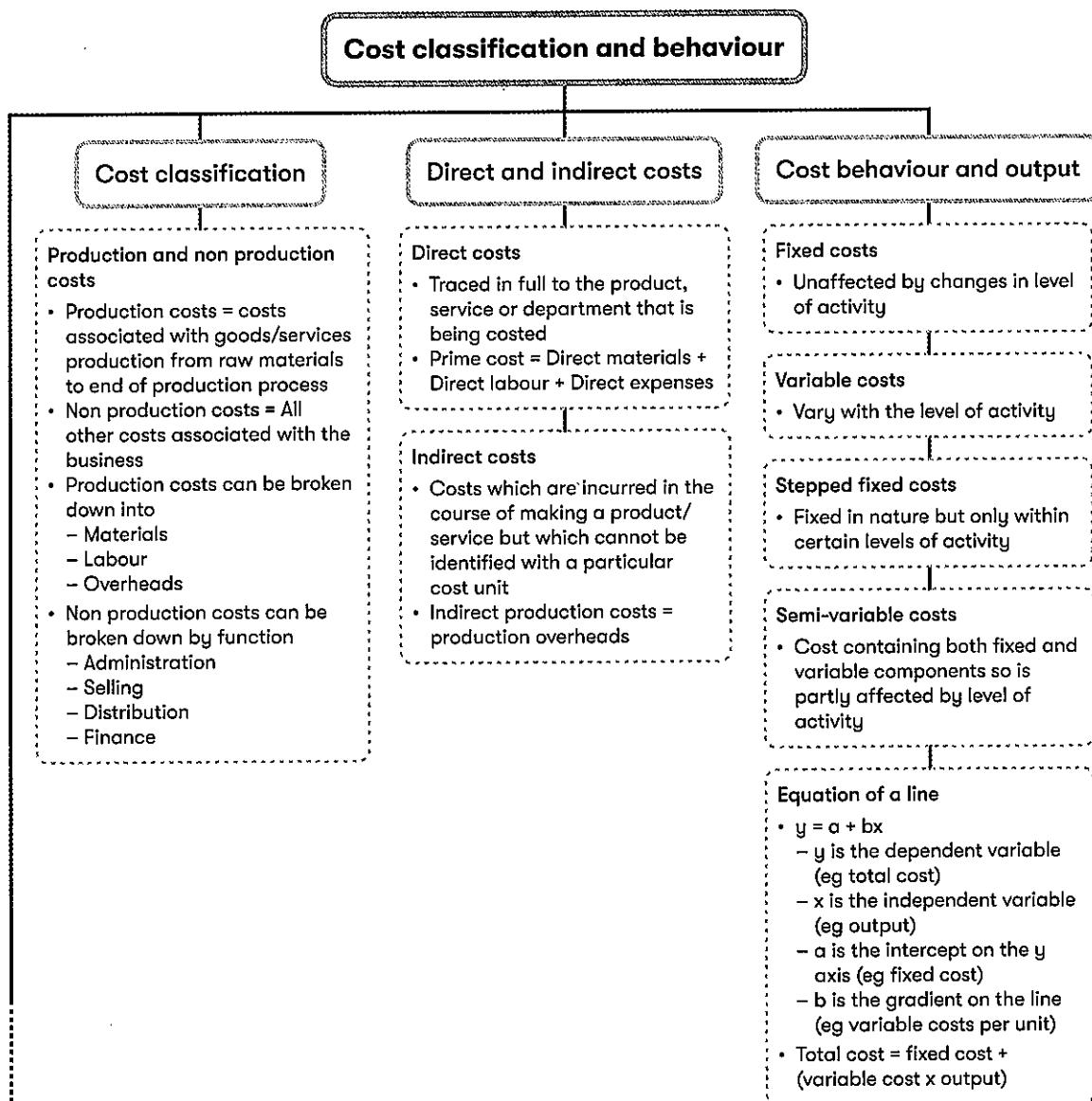


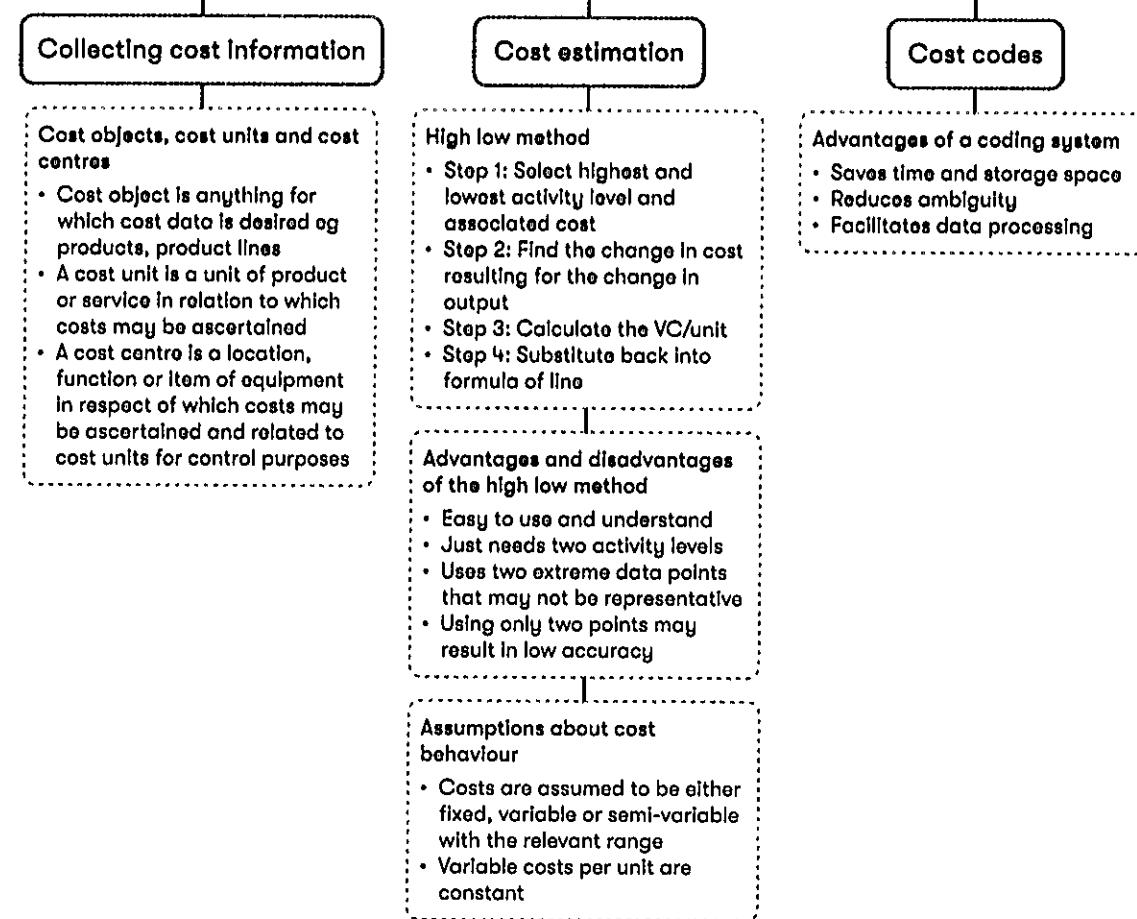
Essential reading

See Chapter 3, Section 3 of the Essential reading for detail on different types of coding system.

The Essential reading is available as an Appendix of the digital edition of the Workbook.

Chapter summary





Knowledge diagnostic

1. Classification

Cost classification is the arrangement of cost items into logical groups by their function or by their nature.

The eventual aim of costing is to determine the cost of producing a product/service.

2. Production and non-production costs

Costs can be split by their function into production and non-production costs.

Production costs can be split further into material, labour and overhead costs.

3. Direct and indirect costs

Direct costs are costs that can be directly traced to a cost unit.

Indirect costs are costs incurred in production but cannot be directly linked to a cost unit.

A cost card can be built up for an individual cost unit.

4. Cost behaviour and output

Cost behaviour is the way in which costs are affected by changes in volume of output.

A fixed cost will be unaffected by an increase or decrease in volume of output.

A variable cost is a cost that will vary with output. The variable cost per unit is the same amount for each unit produced.

A stepped fixed cost is a cost which is fixed in nature within certain volumes of output.

A semi-variable cost contains both fixed and variable components and so is partially affected by changes in volumes of output.

5. Cost objects, cost units and cost centres

Costs can be calculated and analysed at different levels within an organisation's structure.

6. Cost estimation

The fixed and variable element of a mixed cost can be determined by the high-low method.

7. Codes

A coding system can save time and reduce ambiguity when recording items of expenditure.

Further study guidance

Question practice

Now try the following from the Further question practice bank (available in the digital edition of the Workbook):

Section A: Q12-17

Activity answers

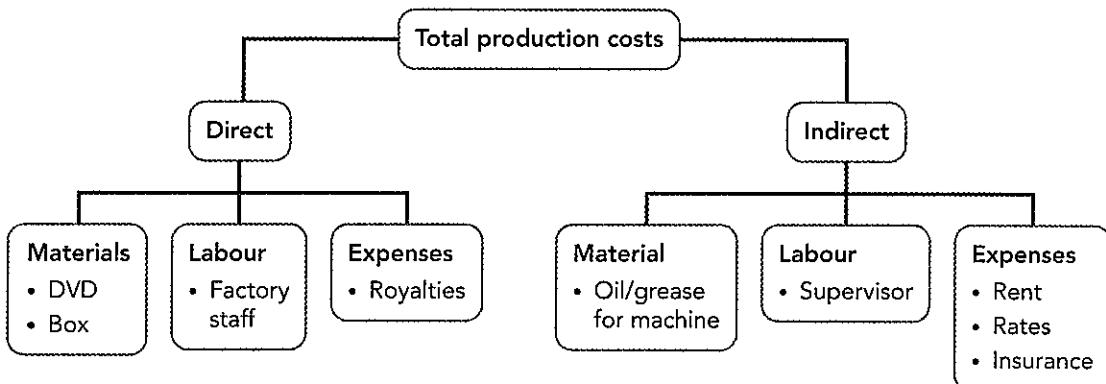
Activity 1: Production costs

Materials	Wood, metal
Labour	Factory workers, supervisors
Overheads	Rent, rates, insurance of machinery

Activity 2: Non-production costs

Administration	Office staff salaries, depreciation of office equipment
Selling	Sales staff salaries, advertising
Distribution	Packing, driver salaries, van insurance
Finance	Overdraft interest, loan interest

Activity 3: DVD costs



Activity 4: Cost behaviour graphs

Graph D

Activity 5: Cost centres

Production cost centres

- Machining
- Finishing
- Pressing
- Packing

Service cost centre

- Canteen
- Maintenance
- Stores

Activity 6: Cost estimation

\$ [88,000]

$$y = 10,000 + 100x$$

$$y = 10,000 + 100 \times 780$$

$$TC = \$88,000$$

Activity 7: Forecasting using the high low method

Units	\$
100,000	378,000
65,000	290,500
35,000	87,500

$$\text{Variable cost} = \$87,500/35,000 = \$2.50$$

$$\begin{aligned}\text{Fixed cost} &= 378,000 - (100,000 \times 2.50) \\ &= 128,000\end{aligned}$$

$$80\% \text{ capacity} = 80,000 \text{ units}$$

$$\text{Flexible budget allowance for 80,000 units} = \$128,000 + (80,000 \times \$2.50) = \$328,000.$$

Activity 8: Stepped fixed costs

Total fixed costs below 7,000 units = \$ [27,500]

Total fixed costs above 7,000 units = \$ [36,000]

Variable cost per unit = \$ [5.40]

$$VC/\text{unit} = \$13,500/2,500 = \$5.40/\text{unit}$$

Note. This is constant at all volumes of output

TC = FC + VC/unit × output

Substitute at lowest (or highest) level:

$$\$76,500 = FC + \$5.40 \times 7,500$$

FC = \$36,000 above output of 7,000 units

So at 5,000 units:

TC = FC + VC/unit × output

$$\$54,500 = FC + \$5.40 \times 5,000$$

FC = \$27,500 below output of 7,000 units

4

Forecasting

Learning objectives

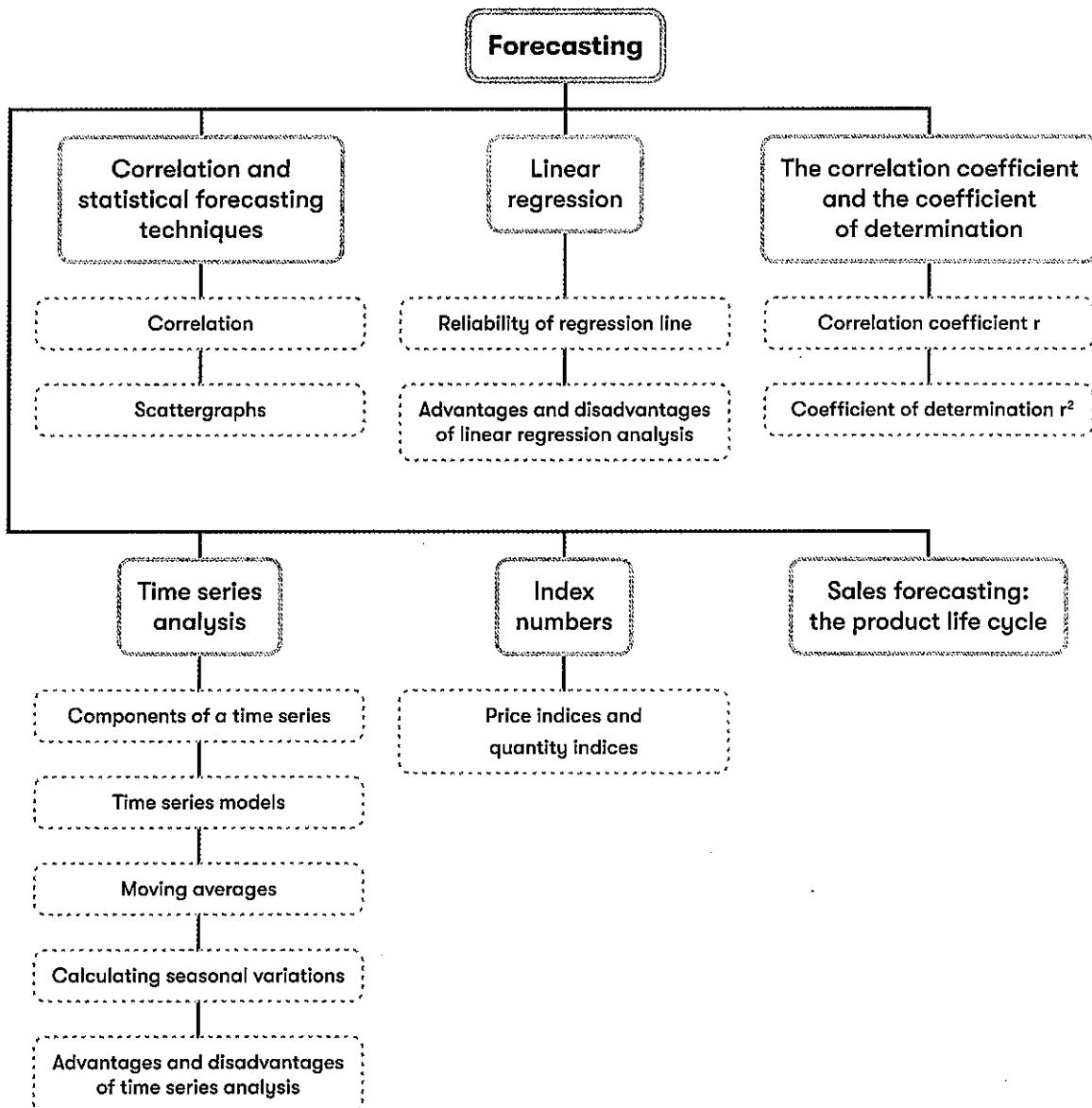
On completion of this chapter, you should be able to:

	Syllabus reference no.
Construct scatter diagrams and lines of best fit.	B2 (d)
Explain the concept of correlation coefficient and coefficient of determination.	B2 (e)(i)
Calculate and interpret correlation coefficient and coefficient of determination.	B2 (e)(ii)
Establish a linear function using regression analysis and interpret the results.	B2 (e)(iii)
Use linear regression coefficients to make forecasts of costs and revenues.	B2 (f)
Adjust historical and forecast data for price movements.	B2 (g)
Explain the advantages and disadvantages of linear regression.	B2 (h)
Explain the principles of time series analysis (cyclical, trend, seasonal variation and random elements).	B2 (i)
Calculate moving averages.	B2 (j)
Calculation of trend, including the use of regression coefficients.	B2 (k)
Use the trend and seasonal variation (additive and multiplicative) to make budget forecasts.	B2 (l)
Explain the advantages and disadvantages of time series analysis.	B2 (m)
Explain the purpose of index numbers.	B2 (n)
Calculate simple and multi-item (weighted) index numbers for one or more variables, including Laspeyres and Paasche indices.	B2 (o)
Describe the product life cycle and explain its importance in forecasting.	B2 (p)

Exam context

It is vital that you understand forecasting techniques and can apply the numerical techniques within this chapter as they could be tested in section A of the examination.

Chapter overview



1 Correlation and statistical forecasting techniques

1.1 Correlation

In order for a business to be able to plan and make decisions, it needs to be able to accurately predict costs at differing output levels.

If we can identify the relationship between the output level and the cost at that level from observation then it is possible to construct a model to predict costs at all future output levels.

If this relationship exists, there is said to be a **correlation** between output levels and total costs.



Correlation: Two variables are said to be correlated if a change in the value of one variable is accompanied by a change in the value of another variable.

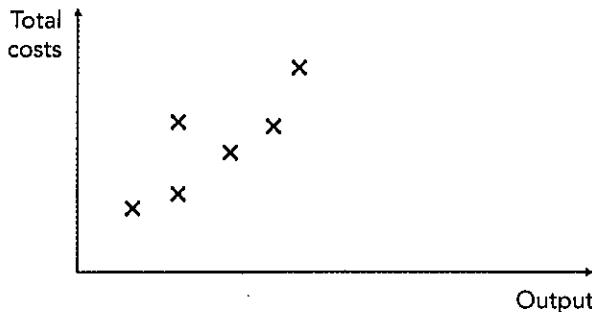
Examples of variables that may be correlated are:

- A person's height and weight
- The distance of a journey and the time it takes to make it

1.2 Scattergraphs

Plotting a scattergraph is the best way of ascertaining a correlation between two variables, (computer packages make this easy even for large amounts of data).

For example, total costs at different levels of output could be plotted as:



The 'independent variable' is plotted on the x axis and is output in this case.

Total cost is the 'dependent variable' and is plotted on the y axis.

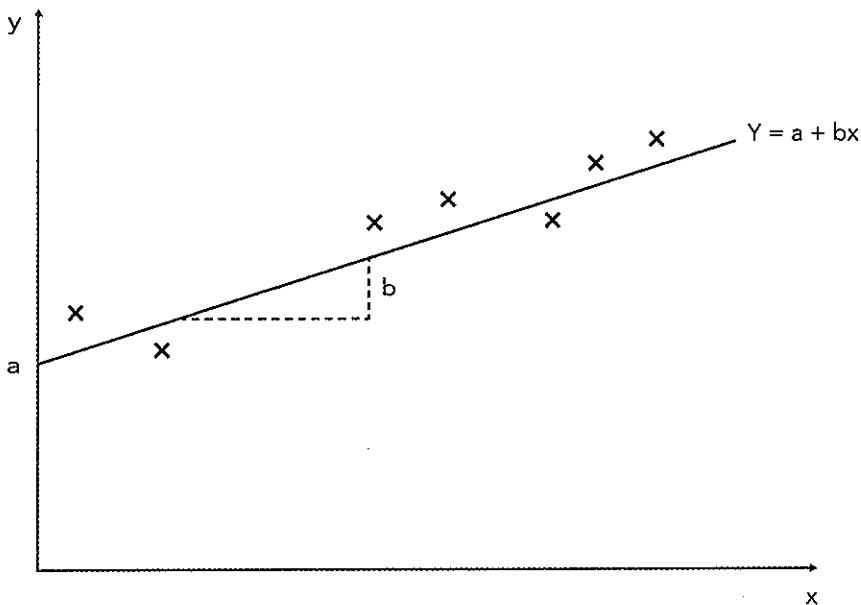
The scatter graph seems to show a linear relationship, ie a correlation between the two variables.

We can estimate the line of best fit for this data and use this information to help predict the total cost at future levels of output.

Two main techniques for estimating this information are:

- (a) **High low** (covered in Chapter 3). This method forms a linear relationship between the highest and lowest point plotted.
- (b) **Linear regression**. This method finds the line of best fit mathematically.

Example



The formula for a basic linear relationship as seen in Chapter 3 is:



Formula to learn

$$y = a + bx$$

where:

y is the dependent variable (eg costs)

x is the independent variable (eg output)

a is the intercept on the vertical axis (y axis) (eg fixed costs)

b is the slope (gradient) of the line (eg variable cost per unit).

For example, if the information is related to costs then:

Total cost = Fixed cost + Variable cost per unit × output.

2 Linear regression

Linear regression finds an equation for the line of best fit mathematically. Once an equation for a line of best fit has been determined, forecasts can be made. The equation represents the trend of the data.



Formula provided

$$y = a + bX$$

$$b = \frac{n\sum xy - \sum x \sum y}{n\sum x^2 - (\sum x)^2}$$

$$a = \bar{y} - b\bar{x} = \frac{\sum y}{n} - b \frac{\sum x}{n}$$

where n is the number of pairs of data

Σ means the 'sum of' (see illustration below)

\bar{y} bar means the average of y (ie $\sum y / n$ as shown in the formula)

\bar{x} means the average of x (ie $\Sigma x / n$ as shown in the formula)

Note. This technique can be applied to any pairs of data not just cost and output.



Illustration 1: The least squares method/linear regression

Time period	1	2	3	4	5
Output ('000 units)	20	16	24	22	18
Total cost (\$'000)	82	70	90	85	73

Required

Using the data above for variables X (output) and Y (total cost), calculate an equation to determine the expected level of costs, for any given volume of output, using the least squares method. Prepare a forecast for total costs if output is 22,000 units.

Solution

We need the following values:

ΣX	Add up the five values of X to get a total. $(\Sigma X)^2$ will be the square of this total.
ΣY	Add up the five values of Y to get a total. $(\Sigma Y)^2$ will be the square of this total.
ΣXY	Multiply each value of X by its corresponding Y value, so that there are five values for XY. Add up the five values to get the total.
ΣX^2	Find the square of each value of X, so that there are five values for X^2 . Add up these values to get a total.
ΣY^2	Find the square of each value of Y, so that there are five values for Y^2 . Add up these values to get a total.

X	Y	XY	X^2	Y^2
20	82	1,640	400	6,724
16	70	1,120	256	4,900
24	90	2,160	576	8,100
22	85	1,870	484	7,225
18	73	1,314	324	5,329
$\Sigma X = 100$	$\Sigma Y = 400$	$\Sigma XY = 8,104$	$\Sigma X^2 = 2,040$	$\Sigma Y^2 = 32,278$

n = 5 (There are five pairs of data for x and y values)

$$b = \frac{n\sum XY - \sum X \sum Y}{n\sum X^2 - (\sum X)^2} = \frac{(5 \times 8,104) - (100 \times 400)}{(5 \times 2,040) - 100^2}$$

$$= \frac{40,520 - 40,000}{10,200 - 10,000} = \frac{520}{200} = 2.6$$

$$a = \frac{\sum Y}{n} - b \frac{\sum X}{n} = \frac{400}{5} - 2.6 \times \left(\frac{100}{5}\right) = 28$$

$$Y = 28 + 2.6X$$

where Y = total cost, in thousands of dollars and X = output, in thousands of units

Note that the fixed costs are \$28,000 (when $X = 0$ costs are \$28,000) and the variable cost per unit is \$2.60.

If the output is 22,000 units, we would expect costs to be:

$$28 + 2.6 \times 22 = 85.2 = \$85,200.$$

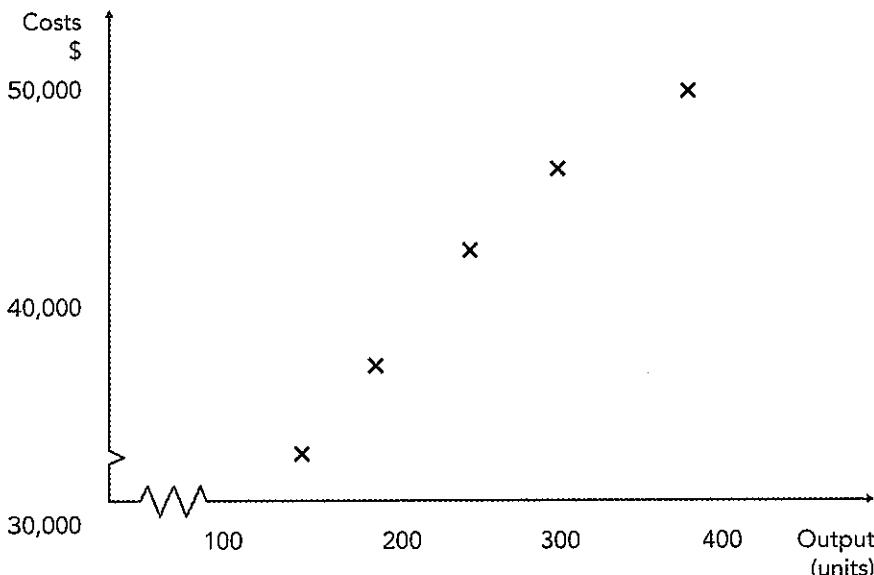


Activity 1: Regression line

Wigwam Co makes high quality tents for outdoor festivals. The company accountant has observed costs at different production levels as follows:

Output (units)	Total costs (\$)
280	46,500
350	49,100
200	36,700
160	32,000
240	44,500

These costs could be plotted on a scattergraph as follows:



The costs appear to follow an approximately linear pattern.

Required

Calculate the regression line and use the line to estimate costs for output of 240 units and 700 units.

Note. The answers will be expressed in \$'000 as the values for Y are given in \$'000.

2.1 Reliability of regression line

The formula applied will find a value for a and b and hence a formula for the line.

The usefulness of this formula for predicting results in the future depends on how strong the correlation between the two variables is.



Interpolation: Interpolation means using a line of best fit to predict a value within two extreme points of the observed range.

Extrapolation: Extrapolation means using a line of best fit to predict a value outside the two extreme points of the observed range.

The further you extrapolate from the observed data, the less accurate the predictions are going to be.

2.2 Advantages and disadvantages of linear regression analysis

Advantages

- Gives a definitive line of best fit
- Makes efficient use of data and good results can be obtained with relatively small amounts of data
- Many processes are linear and so are well described by regression analysis

Disadvantages

- Assumes linearity between x and y
- The observations used may be atypical
- Historic data is used and patterns may change in future
- Each observation should be independent from the others
- Forecasting usually involves extrapolation outside the given range of observations where working conditions and therefore cost patterns may change

3 The correlation coefficient and the coefficient of determination

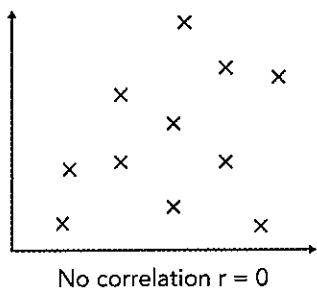
3.1 Correlation coefficient r



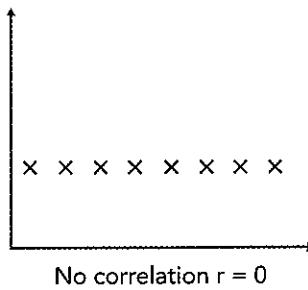
Correlation coefficient (r): The correlation coefficient (r) measures the degree of linear correlation between two variables. The nearer r is to +1 or -1, the stronger the relationship.

Correlation coefficient (r) indicates the strength of the linear relationship between x and y.

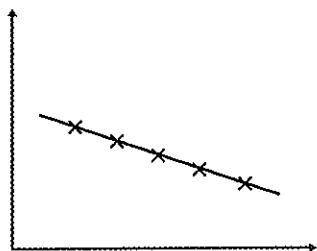
Examples of correlation coefficients:



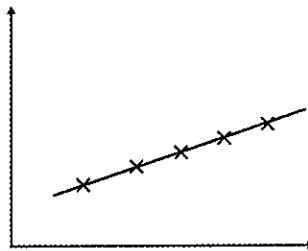
No correlation $r = 0$



No correlation $r = 0$



Perfect negative correlation $r = -1$



Perfect positive correlation $r = +1$



Formula provided

$$r = \frac{(n\sum xy) - (\sum x)(\sum y)}{\sqrt{[n\sum x^2 - (\sum x)^2][n\sum y^2 - (\sum y)^2]}}$$

Where r = correlation coefficient.

The value of the correlation coefficient must be between -1 and 1.



Illustration 2: The correlation coefficient formula

The cost of output at a factory is thought to depend on the number of units produced.

Data has been collected for the number of units produced each month in the last six months, and the associated costs, as follows.

Month	Output ‘000s of units		Cost \$’000
	X	y	
1	2	9	
2	3	11	
3	1	7	
4	4	13	
5	3	11	
6	5	15	

Required

Assess whether there is any correlation between output and cost.

Solution

$$r = \frac{n\sum XY - \sum X \sum Y}{\sqrt{[n\sum X^2 - (\sum X)^2][n\sum Y^2 - (\sum Y)^2]}}$$

We need to find the values for the following.

ΣXY	Multiply each value of X by its corresponding Y value, so that there are six values for XY. Add up the six values to get the total.
ΣX	Add up the six values of X to get a total. $\Sigma(X)^2$ will be the square of this total.
ΣY	Add up the six values of Y to get a total. $\Sigma(Y)^2$ will be the square of this total.
ΣX^2	Find the square of each value of X, so that there are six values for X^2 . Add up these values to get a total.
ΣY^2	Find the square of each value of Y, so that there are six values for Y^2 . Add up these values to get a total.

X	Y	XY	X^2	Y^2
2	9	18	4	81
3	11	33	9	121
1	7	7	1	49
4	13	52	16	169
3	11	33	9	121
5	15	75	25	225
$\Sigma X = 18$	$\Sigma Y = 66$	$\Sigma XY = 218$	$\Sigma X^2 = 64$	$\Sigma Y^2 = 766$

$$(\sum X)^2 = 18^2 = 324 \quad (\sum Y)^2 = 66^2 = 4,356$$

$$n = 6$$

$$r = \frac{(6 \times 218) - (18 \times 66)}{\sqrt{(6 \times 64 - 324) \times (6 \times 766 - 4,356)}}$$

$$r = \frac{1,308 - 1,188}{\sqrt{(384 - 324) \times (4,596 - 4,356)}}$$

$$r = \frac{120}{\sqrt{60 \times 240}} = \frac{120}{\sqrt{14,400}} = \frac{120}{120} = 1$$

There is **perfect positive correlation** between the volume of output at the factory and costs, which means that there is a perfect linear relationship between output and costs.



Activity 2: Correlation coefficient

What is the correlation coefficient for the data in the previous activity Wigwam Co?

Solution



3.2 Coefficient of determination r^2



Coefficient of determination (r^2): The coefficient of determination r^2 measures the proportion of the total variation in the value of one variable that can be explained by variations in the other variable. It denotes the strength of the linear association between two variables.

The **coefficient of determination (r^2)** does not prove a cause and effect relationship. It merely suggests a possible link.

The value must be between 0 and 1.



Activity 3: Coefficient of determination

What is the coefficient of determination for the data in the activity Wigwam Co?



Activity 4: b, a and the correlation coefficient

The following data regarding Holly Co's costs has been collected:

$\Sigma x = 440$, $\Sigma y = 330$, $\Sigma x^2 = 17,986$, $\Sigma y^2 = 10,366$, $\Sigma xy = 13,467$ and $n= 11$.

Required

- 1 What is the value for 'b', the gradient of the line?
 1.45
 2.40
 -0.69
 0.69
- 2 What is the value for 'a', the point of intersection with the y axis?
 57.6
 19.3
 2.4
 26.4
- 3 What is the value for the correlation coefficient, to two decimal places?
 0.98
 0.63
 0.96
 0.59



4 Time series analysis



Time series: A time series is a series of figures or values recorded over time.

The analysis of time series allows historical data to be monitored so that observations can be made about how a variable has performed over a period of time.

Examples:

- Output at a factory each day for the last month
- Total costs per annum for last ten years
- Monthly sales over the last five years

4.1 Components of a time series (TS)



Trend (T): The trend is the underlying long-term movement over time in the values of the data recorded (eg growth, inflation).

The trend is generally expected to be a smooth line/curve. It can be found using moving averages (see later).



Seasonal variations (SV): Seasonal variations are short-term fluctuations in recorded values, due to different circumstances that affect results at different times of the day or week or year or any regularly repeating pattern.

Cyclical variations (CV): Recurring patterns over a longer period of time, not generally of a fixed nature (ie recession/depression/economic growth).

Random variations (RV): Irregular/unpredictable variations, due to rare/chance occurrences (hurricanes, floods, nuclear war).

4.2 Time series models

The four components of variation are assumed to combine together in two ways. Thus we have two mathematical models of the variable, TS.

4.2.1 The additive model

In the additive model, the components are assumed to add together to give TS.

$$TS = T + SV + CV + RV.$$

This is valid only if the components are independent. In the exam, you will only be required to do calculations involving the trend (T) and seasonal variations (SV) therefore:

$$TS = T + SV$$

4.2.2 The multiplicative model

In the multiplicative model, the components are assumed to multiply together to give TS.

$$TS = T \times SV \times CV \times RV.$$

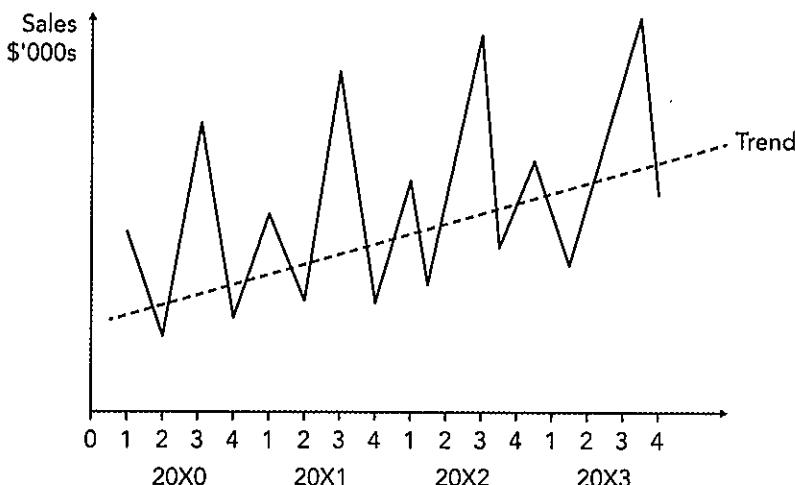
In the exam, you will only be required to do calculations involving the trend (T) and seasonal variations (SV) therefore:

$$TS = T \times SV$$

4.3 Moving averages

Regression analysis can be used to find an equation for the trend. However, the use of moving averages is the main method for calculating a trend from a time series. The technique averages all of the results of a fixed number of periods and relates to the mid-point of the overall period.

The most appropriate number of periods for a moving average will depend on the circumstances and the nature of the time series. For example, a time series of output over a five day week should use a five period moving average, whereas a time series of sales per quarter would use a four period moving average.



In the above example, there would appear to be a large seasonal variation in demand, but there is also a basic upward trend.



Illustration 3: Moving averages

Year	Sales (units)
20X0	390
20X1	380
20X2	460
20X3	450
20X4	470

Year	Sales (units)
20X5	440
20X6	500

Required

Take a moving average of the annual sales over a period of three years.

Solution

Average sales in the three-year period 20X0–20X2 were:

$$(390 + 380 + 460) / 3 = 1,230 / 3 = 410$$

This average relates to the middle year of the period, 20X1.

Similarly, average sales in the three-year period 20X1–20X3 were:

$$(380 + 460 + 450) / 3 = 1,290 / 3 = 430$$

This average relates to the middle year of the period, 20X2.

The average sales can also be found for the periods 20X2–20X4, 20X3–20X5 and 20X4–20X6, to give the following:

Year	Sales	Moving total of 3 years' sales	Moving average of 3 years' sales ($\div 3$)
20X0	390		
20X1	380	1,230	410
20X2	460	1,290	430
20X3	450	1,380	460
20X4	470	1,360	453
20X5	440	1,410	470
20X6	500		

Note the following points.

- (1) The moving average series has five figures relating to the years from 20X1 to 20X5. The original series had seven figures for the years from 20X0 to 20X6.
- (2) There is an upward trend in sales, which is more noticeable from the series of moving averages than from the original series of actual sales each year.



Essential reading

See Chapter 4, Section 1 of the Essential reading for detail on moving averages with an even number of results.

The Essential reading is available as an Appendix of the digital edition of the Workbook.

4.4 Calculating seasonal variations

Once the trend has been established, the seasonal variation can be determined using the models above.

Additive model: $SV = TS - T$

Multiplicative model: $SV = TS / T$

(Ignoring CV and RV as this will not be in calculations in the exam.)

Note. When predicting values, an average of all seasonal variations for a particular period is used.



Activity 5: Seasonal variation

Using moving averages, determine the trend given a three-period recurring seasonal variation. Rearranging the equation for TS, determine the SV by subtracting the trend from the time series, ie using the additive model.

Time series (TS)	3 Period moving average	Seasonal variation $SV = TS - Trend$
2		
5		
5		
5		
8		
8		
8		
11		

Under the additive time series model, the sum of seasonal variations must equal zero. Adjustments need to be made where this is not the case. For example, if the seasonal variations sum to 2, then we spread 2 across the quarters so that the final total of the variations sum to zero.

Under the multiplicative time series model, the sum of the seasonal variations must equal the number of periods over which seasonality occurs prior to repeat ie the sum of a quarterly seasonal variation should equal 4. If, for example, the sum of a quarterly seasonal variation was 4.7, then we would deduct 0.7 by spreading it across the quarters, ie by deducting $0.7/4 = 0.175$ from each one.



Activity 6: Additive model - adjusted SV

Adjust the following seasonal variation where necessary.

	Adjustment	Adjusted SV
Q1 SV = +6		
Q2 SV = -3		
Q3 SV = +5		
Q4 SV = -6		



Essential reading

See Chapter 4, Section 2 of the Essential reading for an example, adjusting the seasonal variations using a multiplicative model.

The Essential reading is available as an Appendix of the digital edition of the Workbook.



Activity 7: Forecasting sales

You are given the regression equation of how the sales trend varies with time:

$$y = 400 + 20x$$

where:

x = quarter (x increases by one for each new quarter)

y = unit sales.

Required

Forecast sales for year 6 for each quarter using the seasonal variations below.

Trend sales	SV	Forecast sales
Q1		-5%
Q2		+10%
Q3		+20%
Q4		-25%



Activity 8: Forecasting overhead costs

If budgeted fixed overheads = \$120,000 per year and the following seasonal variations have been observed:

Q1	Q2	Q3	Q4
+10%	-20%	+15%	-5%

Required

What would be the budgeted fixed overheads per quarter for the coming year?

Q1	
Q2	
Q3	
Q4	

4.5 Advantages and disadvantages of time series analysis

Advantages

- Trend lines can be reviewed and assessed after each period for reliability, possibly leading to improved forecasts with experience.
- Time series components and theory is relatively easy for non-financial managers to understand.

Disadvantages

- The further into the future the forecast the more unreliable it's likely to be.
- The less data available on which to base the forecast the less reliable the forecast.
- The pattern of trend and seasonal variation cannot be guaranteed to continue.
- There is always the danger of random variations upsetting the pattern of trend and seasonal variation.

5 Index numbers

Index numbers are often used by economists to provide a standardised way of comparing values over time.

An index measures the average changes in the values, prices or quantities of a group of items. We can get a feel for how a time series is changing over time by plotting a trend line or we can convert the actual figures into a series of index numbers.

An index starts with the base year, at an index number of 100. Single item index numbers can be calculated by comparing the price (or quantity levels) over two periods and multiplying by 100.

For example, each period's figure is converted to the equivalent index using the following formula:



Formula to learn

$$\text{Index} = \frac{\text{Current period's figure}}{\text{Base period figure}} \times 100$$



Illustration 4: Price index

The price of a cup of coffee was 40c in 20X0 and 50c in 20X1.

Required

Using 20X0 as a base year (value = 100) what is the price index number for 20X1 and what does it mean?

Solution

Price index for 20X1 = $50/40 \times 100 = 125$

This means that the price has risen by 25%.

If there is a group of items, the formula becomes:



Formula to learn

$$\text{Price index} = \frac{\sum P_n}{\sum P_0} \times 100$$

Where $\sum P_n$ = the sum of the current period figures and $\sum P_0$ is the sum of the base period figures.

5.1 Price indices and quantity indices

When index numbers are used to measure the change in the monetary value of a group of items over time, they are called price indices.

For example, the Consumer Prices Index (CPI) is used in the UK, and internationally, to measure changes in the rate of inflation.

When index numbers are used to **measure the change in the non-monetary values** of a group of items over time, they are called are quantity indices (or volume indices).

An example is an index number for production volume showing the production achieved by a factory over time.



Activity 9: Cost of living index

Suppose a cost of living index is to be calculated from the following three items: beer, pizza and chocolate and that prices for 20X1 and 20X2 were as follows:

	X1	X2
Beer	\$2.00	\$2.10
Pizza	\$3.50	\$3.55
Chocolate	\$0.55	\$0.60

Required

What is the cost of living index for X2, assuming X1 as a base year? (Give your answer to one decimal place.)

Solution

5.2 Base weighted price indices (Laspeyres index)

The consumer prices index (CPI) measures the change in the average basket of goods and services. It is published every month, and its principal use is as a **measure of monthly and annual inflation**. The CPI measures the percentage change, month by month, in the **average level of**

prices of 'a representative basket of goods'. The composition of the basket of goods is reviewed every year to ensure that CPI calculations reflect up-to-date shopping patterns. The data is presented as a fixed index with reference to a base year.

One way of working out the change in price of a basket of goods is to weight the price rises by the quantities purchased at the start of the period (ie in the base year). This type of index is called a **base weighted price index** (or **Laspeyres Index**). The base weighted price index uses quantities consumed in the base period as weights. The formula is:

Formula to learn

$$\text{Laspeyres price index} = \frac{\sum P_n Q_0}{\sum P_0 Q_0} \times 100$$

where P_n represents the prices in the current year, P_0 represents prices in the base year and Q_0 represents quantities using base-year values.

Illustration 5: Laspeyres price index

Imagine that only three products are being purchased, bread, tea and caviar, in the quantities and at the prices shown below.

Item	Quantity in 20X1 (millions)		Price in 20X1 P_0
	Q_0		
Bread	6		\$20
Tea	2		\$25
Caviar	0.067		\$450

During 20X2 the price of bread has risen to \$40, the price of tea has risen to \$30, and the price of caviar has fallen to \$405.

Required

What is the overall price index for this 'basket' of goods, using a **base weighted approach**?

Solution

The 20X2 price index value could be calculated by weighting the price changes using the quantities purchased as the weights.

Item	Quantity millions Q_0	Price in 20X1 P_0	Base-year value		Price in 20X2 P_n	$P_0 \times Q_0$ $P_n Q_0$
				$P_0 \times Q_0$		
Bread	6	20		120	40	240
Tea	2	25		50	30	60
Caviar	0.067	450		30	405	27
				200		327

$$\text{Index in 20X2} = (327 / 200) \times 100 = 163.5$$

In other words, the weighted average price rise is 63.5%.

5.3 Current weighted indices (Paasche index)

Another way of working out the change in price of a basket of goods is to weight the price rises by the quantities **currently** being purchased. This type of index is sometimes called a **current weighted price index** (or the Paasche index).

With this approach, the weights are changed every time period. This is time consuming, but it does mean that the price rises reflect the change in the current cost of living; CPI is calculated using current weights for this reason.

The calculations for the current weighted index are similar to those demonstrated for the base weighted index but use the **up-to-date purchasing behaviour** of consumers.



Formula to learn

$$\text{Paasche price index} = \frac{\sum P_n Q_n}{\sum P_0 Q_n} \times 100$$

where P_n represents the prices in the current year, P_0 represents prices in the base year and Q_n represents quantities using current-year values.



Illustration 6: Paasche price index

Imagine that only three products are being purchased, bread, tea and caviar, in the quantities and at the prices shown below.

Item	Quantity in 20X1 (millions)		Price in 20X1		Quantity in 20X2 (millions)		Price in 20X2	
	Q_0	P_0	P_0	Q_n	P_n	P_n	P_n	
Bread	6	\$20		5	\$40			
Tea	2	\$25		1.5	\$30			
Caviar	0.067	\$450		0.12	\$405			

Required

What is the overall price index for this 'basket' of goods, using a current weightings approach?

Solution

The 20X2 price index value can be calculated by weighting the price changes, using the quantities currently purchased as the weights.

Item	Quantity millions	Price in 20X1	Value	Price in 20X2	
	Q_n	P_0	$P_0 \times Q_n$	P_n	$P_n Q_n$
Bread	5	20	100	40	200
Tea	1.5	25	37.5	30	45
Caviar	0.12	450	54	405	48.6
			191.5		293.6

Index in 20X2 = $(293.6 / 191.5) \times 100 = 153.3$

In other words, the average price rise is 53.3%

5.4 Calculating quantity indices

We have seen that price indices are usually weighted by quantities. We will now look at quantity indices, which measure changes in quantities and use prices as weights. One application of this is to measure changes in national income.

Formula to learn

$$\text{Laspeyres quantity index} = \frac{\sum P_0 Q_n}{\sum P_0 Q_0} \times 100$$

where P_0 represents the prices in the base year, Q_0 represents quantities in the base year and Q_n represents quantities using current-year values.

Illustration 7: Laspeyres quantity index

Country F produces four types of goods and services.

In 20X0, the quantities of good produced and their average price were as follows.

	Quantity (billions) Units	Price per unit \$
Good A	20	2
Good B	5	10
Good C	40	3
Good D	15	6

The total value of output (national income) is $(20\text{bn} \times \$2) + (5\text{bn} \times \$10) + (40\text{bn} \times \$3) + (15\text{bn} \times \$6)$ = \$300 billion.

In 20X2, the quantities of good produced were as follows:

	Quantity (billions) Units
Good A	15
Good B	6
Good C	36
Good D	25

Required

Using 20X0 as a base year, calculate the quantity index value in 20X2 for national income of Country F.

Solution

	Price \$	Quantity produced in 20X0	P_0	Q_0	$P_0 Q_0$	Q_n	$P_0 Q_n$
Good A	2			20	40	15	30
Good B	10			5	50	6	60

	Price \$	Quantity produced in 20X0	P_0	Q_0	$P_0 Q_0$	Q_n	$P_0 Q_n$
Good C	3			40	120	36	108
Good D	6			15	90	25	150
					300		348

$$\text{Quantity index} = (348 / 300) \times 100 = 116$$

This would suggest that the level of national income has grown by 16% since 20X2.

Formula to learn

$$\text{Paasche quantity index} = \frac{\sum P_n Q_n}{\sum P_0 Q_0} \times 100$$

where P_n represents the prices in the current year, Q_0 represents quantities in the base year and Q_n represents quantities using current-year values.

Activity 10: Quantity indices

The following data relates to production in Country D in 20X3 and 20X4.

	Quantity produced	Price per unit		Quantity produced	Price per unit	
		20X3	20X3		20X4	20X4
		'000	\$		'000	\$
Good A	3	1.20		4		1.50
Good B	6	0.95		5		0.98
Good C	1	1.40		2		1.30
Good D	4	1.10		3		1.14

Required

Calculate the following quantity indices for 20X4 (with 20X3 as the base year).

- A quantity index using base year weightings
- A quantity index using current year weightings

Solution

5.5 Which to use - Paasche or Laspeyre?

- Paasche index may be more costly as the index requires quantities to be ascertained each year
- Paasche index denominator must be recalculated each year
- Because Laspeyres denominator is fixed, index numbers for several different years can be compared
- The weights for Laspeyres index become out of date
- A Laspeyres price index implicitly assumes that, whatever the price changes, the quantities purchased will remain the same. In terms of economic theory, no substitution of cheaper alternative goods and services is allowed to take place. Even if goods become relatively more expensive, it assumes that the same quantities are bought. As a result, the index tends to overstate inflation.
- The effect of current year weighting when using the Paasche price index means that greater importance is placed on goods that are relatively cheaper now than they were in the base year. As a consequence, the Paasche price index tends to understate inflation.

5.6 Fisher's ideal index

As we said, Laspeyres price index tends to overstate inflation and Paasche price index tends to understate inflation. To overcome these difficulties, some statisticians prefer to use Fisher's ideal index. This index is found by taking the geometric mean of the Laspeyre index and the Paasche index.

Fisher's ideal index = $\sqrt{(\text{Laspeyres} \times \text{Paasche})}$



Activity 11: Fisher's ideal index

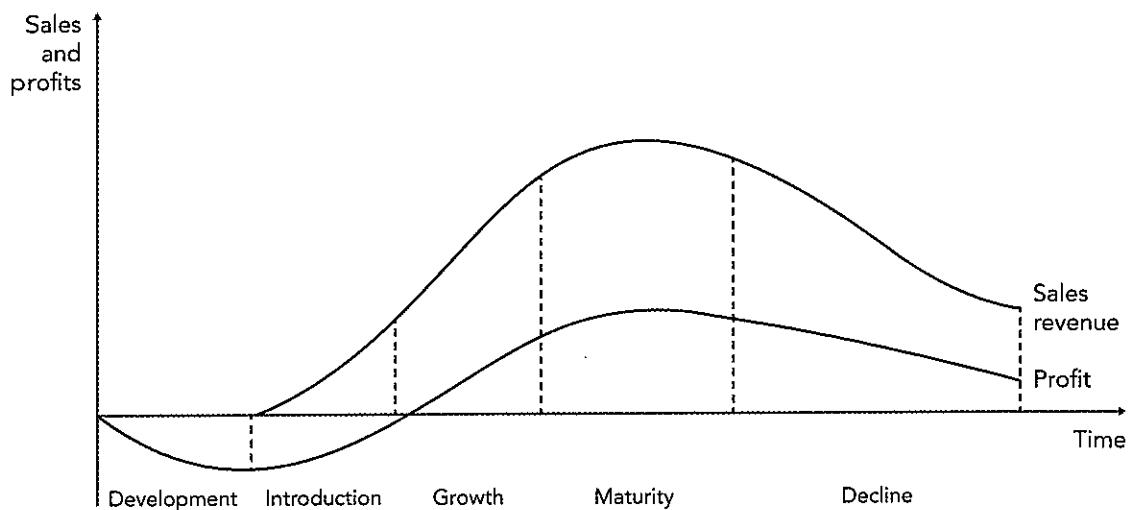
The Laspeyres index of retail prices for 20X7 (with a base year of 20X1) is 137.2. The corresponding Paasche index is 134.9.

Required

Calculate Fisher's ideal index to one decimal place.

6 Sales forecasting: the product life cycle

The product life cycle (PLC) model shows how sales of a product can be expected to vary with the passage of time. It can be divided into five stages.

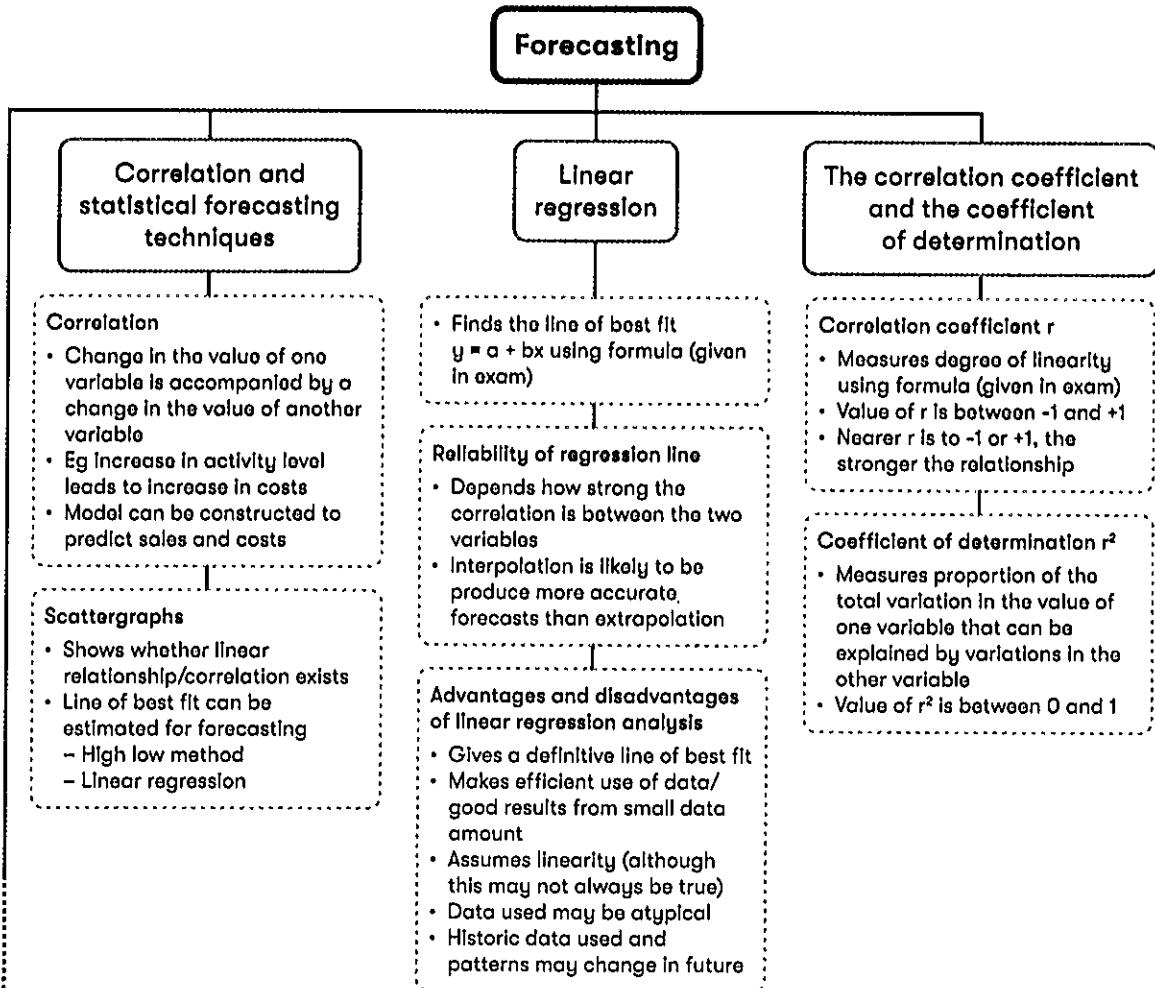


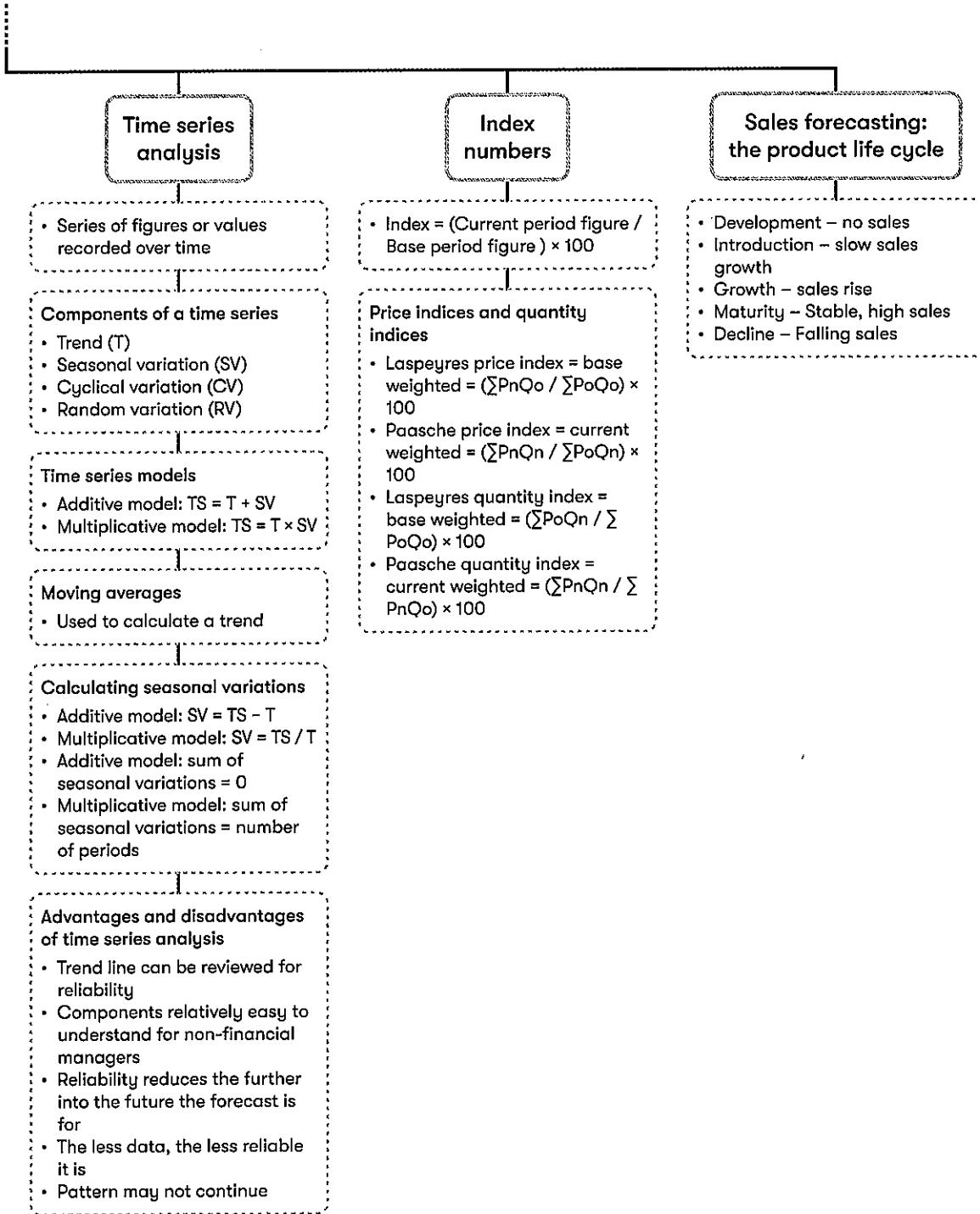
6.1 Characteristics of the PLC

The product life cycle is useful for forecasting because the stage within the life cycle usually dictates the main type of cost (eg variable, fixed) and whether the costs are increasing or decreasing. Understanding the stage of the life cycle (and therefore the likely behaviour of costs) leads to more accurate forecasting.

Stage	Sales volume	Costs
Development	None	Research & development
Introduction	Very low levels	Very high fixed costs (eg non-current assets, advertising)
Growth	Rapid increase	Increase in variable costs Some fixed costs increase (eg Increase number of non-current assets)
Maturity	Stable High volume	Primarily variable costs
Decline	Falling demand	Primarily variable costs (now decreasing) Some fixed costs (eg decommissioning costs)

Chapter summary





Knowledge diagnostic

1. Correlation

Two variables are correlated if a change in the value of one variable is accompanied by a change in the value of another variable.

2. Scattergraphs

Observations of the behaviour of two variables can be plotted on a scattergraph.

3. Linear regression

Linear regression is a mathematical technique that finds the line of best fit that defines the relationship between two variables.

4. Correlation coefficient

The degree of correlation is measured by the correlation coefficient 'r'.

5. Time series

There are four components of a time series: trend, seasonal variations, cyclical variations and random variations.

Additive model

$$TS = T + SV + RV + CV$$

Multiplicative model

$$TS = T \times SV \times RV \times CV$$

Moving averages

One method of finding a trend is to use moving averages.

6. Forecasting problems

All forecasts are subject to error and this impacts on their use.

7. Index numbers

An index is a measure, over time, of the average changes in value (price or quantity) of a group of items relative to the situation at some point in the past.

8. Product life cycle

The product life cycle model shows how sales of a product can be expected to vary with the passage of time.

Further study guidance

Question practice

Now try the following from the Further question practice bank (available in the digital edition of the Workbook):

Section A: Q18 - Q22

Activity answers

Activity 1: Regression line

x (units)	y (\$'000)	xy (\$'000)	x ²	y ² (\$'000)
280	46.5	13,020	78,400	2,162.25
350	49.1	17,185	122,500	2,410.81
200	36.7	7,340	40,000	1,346.89
160	32.0	5,120	25,600	1,024.00
<u>240</u>	<u>44.5</u>	<u>10,680</u>	<u>57,600</u>	<u>1,980.25</u>
<u>1,230</u>	<u>208.8</u>	<u>53,345</u>	<u>324,100</u>	<u>8,924.20</u>

Remember b represents the gradient of the line ie \$92.02 per unit.

$$b = \frac{(5 \times 53,345) - (1,230 \times 208.8)}{(5 \times 324,100) - 1,230^2} = \frac{9,901}{107,600} = 0.092 \text{ (in 000's)}$$

$$a = \frac{208.8}{5} - 0.092 \times \frac{1,230}{5} = 19.128 \text{ (in 000's)}$$

Remember a represents the fixed costs ie \$19,128 in total

$$y = \$19,128 + \$92x$$

Interpolation, when output is 240 units:

$$\text{Cost predicted} = \$19,128 + \$92 \times 240 = \$41,208$$

Extrapolation, when output is 700 units:

$$\text{Cost predicted} = \$19,128 + \$92 \times 700 = \$83,528$$

Activity 2: Correlation coefficient

$$r = \frac{9,901}{\sqrt{107,600 \times ((5 \times 8,924.2) - 208.8^2)}}$$

$$r = \frac{9,901}{\sqrt{107,600 \times 1,023.56}} = 0.94$$

Activity 3: Coefficient of determination

$$r^2 = 0.94^2 = 0.8836$$

This suggests that 88.36% of the changes in total costs can be explained by the changes in output.

Activity 4: b, a and the correlation coefficient

1 The correct answer is: 0.69

$$b = (n\sum xy - \sum x \sum y) / (n\sum x^2 - (\sum x)^2)$$

$$\therefore b = 2,937/4,246 = 0.69$$

2 The correct answer is: 2.4

$$a = \sum y/n - b\sum x/n = (330/11) - (0.69 \times 440/11) = 2.4$$

3 The correct answer is: 0.63

$$r = \frac{(n\sum xy) - (\sum x)(\sum y)}{\sqrt{[n\sum x^2 - (\sum x)^2][n\sum y^2 - (\sum y)^2]}}$$

$$r = \frac{(11 \times 13,467) - (440 \times 330)}{\sqrt{((11 \times 17,986) - 440^2)((11 \times 10,366) - 330^2)}}$$

$$r = \frac{2,937}{\sqrt{(4,246 \times 5,126)}} = 0.63$$

Activity 5: Seasonal variation

Time series (TS)	3 Period moving average	Seasonal variation SV = TS - Trend
2		
5	4	1
5	5	0
5	6	-1
8	7	1
8	8	0
8	9	-1
11		

Working

TS	T	TS-T
2		
5	$2 + 5 + 5 = 12$	$12 / 3 = 4$
5	$5 + 5 + 5 = 15$	$15 / 3 = 5$
5	$5 + 5 + 8 = 18$	$18 / 3 = 6$
8	$5 + 8 + 8 = 21$	$21 / 3 = 7$
8	$8 + 8 + 8 = 24$	$24 / 3 = 8$
8	$8 + 8 + 11 = 27$	$27 / 3 = 9$
11		

Activity 6: Additive model - adjusted SV

	Adjustment	Adjusted SV
Q1 SV = +6	-0.5	+5.5
Q2 SV = -3	-0.5	-3.5
Q3 SV = +5	-0.5	+4.5

	Adjustment	Adjusted SV
Q4 SV = -6	-0.5	-6.5

$\Sigma SV = +2$ therefore the SVs need to be adjusted by a total of -2. Each SV needs to be adjusted by $-2/4 = -0.5$.

Activity 7: Forecasting sales

	Trend sales	SV	Forecast sales
Q1	820	-5%	779
Q2	840	+10%	924
Q3	860	+20%	1,032
Q4	880	-25%	660

We are looking at year 6, therefore, we are looking at quarters 21, 22, 23 and 24.

The trend for Q1 is calculated as $y = 400 + (20 \times 21) = 820$. Forecast = $820 \times 95\% = 779$

The trend for Q2 is calculated as $y = 400 + (20 \times 22) = 840$. Forecast = $840 \times 110\% = 924$

The trend for Q3 is calculated as $y = 400 + (20 \times 23) = 860$. Forecast = $860 \times 120\% = 1,032$

The trend for Q4 is calculated as $y = 400 + (20 \times 24) = 880$. Forecast = $880 \times 75\% = 660$

Activity 8: Forecasting overhead costs

Q1	33,000
Q2	24,000
Q3	34,500
Q4	28,500

\$120,000 / 4 = \$30,000 per quarter

	SV	Budgeted overhead
Q1	30,000	+10%
Q2	30,000	-20%
Q3	30,000	+15%
Q4	30,000	-5%

Activity 9: Cost of living index

103.3

$$\text{Price index} = \frac{\sum P_n}{\sum P_0} \times 100$$

	X1	X2
Beer	\$2.00	\$2.10
Pizza	\$3.50	\$3.55
Chocolate	<u>\$0.55</u>	<u>\$0.60</u>
	$\sum P_o 6.05$	$\sum P_n 6.25$

$$\text{Price index} = \frac{6.25}{6.05} \times 100$$

$$= 103.3$$

Prices have therefore inflated by 3.3% in a year.

Activity 10: Quantity indices

	Q_o	P_o	Q_n	P_n	$P_o Q_o$	$P_o Q_n$	$P_n Q_o$	$P_n Q_n$
Good A	3	1.20	4	1.50	3.60	4.80	4.50	6.00
Good B	6	0.95	5	0.98	5.70	4.75	5.88	4.90
Good C	1	1.40	2	1.30	1.40	2.80	1.30	2.60
Good D	4	1.10	3	1.14	<u>4.40</u>	<u>3.30</u>	<u>4.56</u>	<u>3.42</u>
					<u>15.10</u>	<u>15.65</u>	<u>16.24</u>	<u>16.92</u>

Quantity index numbers for 20X4 are as follows:

- Laspeyres quantity index: $(15.65 / 15.10) \times 100 = 103.64$
- Paasche quantity index: $(16.92 / 16.24) \times 100 = 104.19$

Activity 11: Fishers ideal index

136.0

$$\sqrt{(137.2 \times 134.9)} = 136.0$$

5

Summarising and analysing data

Learning objectives

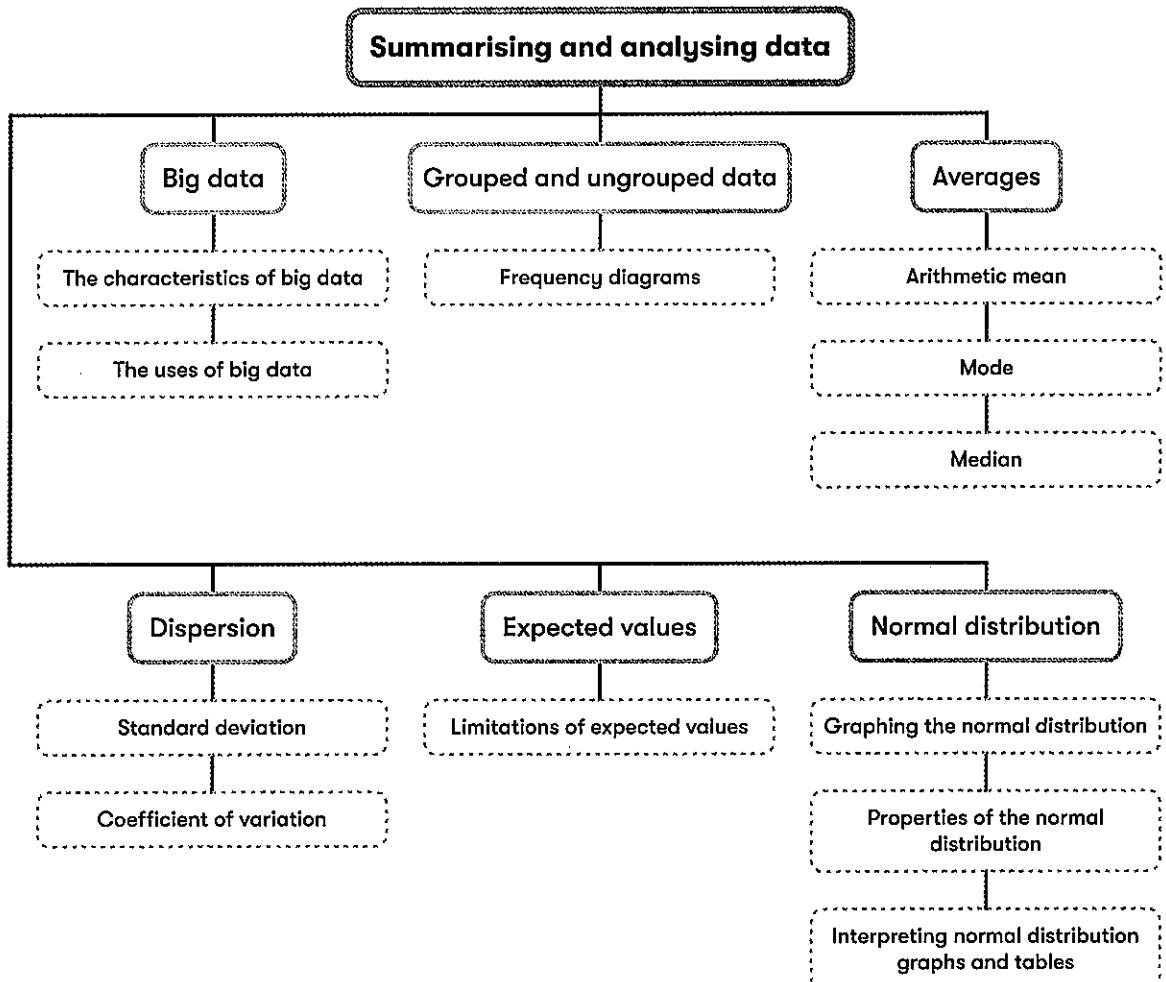
On completion of this chapter, you should be able to:

	Syllabus reference no.
Describe the five characteristics of big data (volume, variety, velocity, value and veracity).	B3 (a)
Explain the three types of big data: structured, semi-structured and unstructured.	B3 (b)
Describe the main uses of big data and analytics for organisations.	B3 (c)
Explain the terms descriptive analysis and inferential analysis.	B3 (e)
Calculate the mean, mode and median for ungrouped data and the mean for grouped data.	B3 (f)
Calculate measures of dispersion including the variance, standard deviation and coefficient of variation for both grouped and ungrouped data.	B3 (g)
Calculate expected values for use in decision making.	B3 (h)
Explain the properties of a normal distribution.	B3 (i)
Interpret normal distribution graphs and tables.	B3 (j)

Exam context

This important topic forms part of the data analysis and statistical techniques section of the syllabus and it is important that you are able to understand data analysis and apply the statistical techniques within this chapter as they could be tested in Section A of the examination.

Chapter overview



1 Big data



Big data: Big data refers to the mass of data that society creates each year, extending far beyond the traditional financial and enterprise data created by companies. Sources of big data include social networking sites, internet search engines, and mobile devices.

1.1 The characteristics of big data

The main characteristics of big data are volume, velocity, variety, value and veracity.

Volume	The scale of information which can now be created and stored is staggering. Advancing technology has allowed embedded sensors to be placed in everyday items such as cars, video games and refrigerators. Mobile devices have led to an increasingly networked world where people's consumer preferences, spending habits, and even their movements can be recorded.
Velocity	Advances in data storage technology as well as a fall in price of this storage has allowed for the captured data to be stored for further analysis.
Variety	The speed at which 'real time' data is being streamed into the organisation. Timeliness is a key factor in the usefulness of financial information to decision makers, and it is no different for the users of big data. One source of high-velocity data is Twitter.
Value	Modern data takes many different forms. Structured data may take the form of numerical data whereas unstructured data may be in the format of images, video, location information, call centre recordings, email, and social media posts. Processing these sources may require significant investment in people and IT.
Veracity	Value refers to its usefulness to the business. Collecting big data alone is of no use but the insights gained can inform decisions and add 'value' to a business.

Big data can be structured, semi-structured or unstructured.



Structured data: Structured data is data that is contained within a field or a data record, making it easy to analyse. It is in a standardised format (such as rows and columns in a spreadsheet) and/or resides in a specified location in a document (such as the expiry date on a credit card). Structured data is easy to analyse, store and search.

Semi-structured data: Semi-structured data is data that doesn't reside in a fixed field but does contain some properties that allow it to be analysed and organised to some extent. For example, emails contain structured data such as the date, sender name and email address but the actual content of the email is unstructured.

Unstructured data: Unstructured data is data that is not easily contained within structured data fields (such as video, audio and images). It is difficult to analyse, manage and search.

1.2 The uses of big data



Data analytics: Data analytics is the process of collecting and examining data in order to extract meaningful business insights, which can be used to inform decision making and improve performance.

Data analytics can be categorised into descriptive analytics (explaining what's happening), diagnostic analytics (explaining why it's happening), predictive analytics (forecasting what's likely to happen) and prescriptive analytics (recommendations on what to do). Descriptive analysis is specifically mentioned on the FMA/MA syllabus.



Descriptive analysis/analytics: Descriptive analysis summarises or describes what the data shows.

Another form of analysis is inferential analysis. Inferential analysis uses characteristics about a population to infer results. It is specifically mentioned on the FMA/MA syllabus.



Inferential analysis: Inferential analysis makes predictions about a population based on a sample.

There are numerous uses of big data in the business context. At this stage, we shall consider how it is relevant to businesses' **decision making**.

A business makes all kinds of decisions every day; for example, should it enter a new market, redesign its packaging, reorganise the sales team or launch a new product. Such decisions are often more **complicated** than they first appear because many factors will come into play to determine whether or not the decision will be successful. In very complex decisions, some factors are beyond the knowledge of those taking them.

The key role of big data is to **analyse all relevant information** and to generate a **predictive model** of what the outcome of the decision will be.

1.2.1 Big data and business value

Business value is measured in many ways, such as profit, shareholder value, brand value and intellectual value. Big data can be used to **analyse opportunities** to increase revenue and reduce costs, thereby increasing profit. For example, a holiday company can use big data to analyse trends such as where tourists are visiting in order to improve the range of holiday locations that it offers. It can reduce its offering in unpopular areas and increase its offering of popular areas and increase its revenue.

1.2.2 Big data and corporate strategy

To be successful, big data must fit into the organisation's overall aims and objectives. After identifying how business value can be improved, and the requirements of the customer, business priorities can be determined – for example, which markets or customers are the most important in terms of increasing business value.

Big data is a key source of innovation, helping to create new products and services. Volume and velocity of data helps speed up decision making. This means that big data can help create new sources of income for a business and contribute to an improvement in the organisation's competitive advantage.

1.2.3 Effect of big data on decisions

The key effects of big data on decisions can be summarised as follows:

- Decisions can be made quickly.
- Businesses can respond earlier to environmental changes and be more flexible in their response.
- Decisions can be based on current situations, but also have an element of taking potential future situations into account.

- Decisions are made on hard data evidence that can be quantified.
- Decisions can be made on a collaborative basis because data is easily shared and converted from one form into another.
- 'Outside the box' decisions are more likely because all factors are taken into account, not just the ones managers think of.

2 Grouped and ungrouped data

If there is a large set of data or if every (or nearly every) data item is different, it is often convenient to group **frequencies** (how often data occurs) together into bands or classes.



Grouped data: Grouped data is where the frequency is shown in terms of a range (for example 0 - 100 units, 101 to 200 units and so on).

Ungrouped data: Ungrouped data is where the frequency is shown in terms of a specific measure/value.

2.1 Frequency diagrams

Frequency diagrams are used if values of particular variables occur more than once.

Frequently, the data collected from a statistical survey or investigation is simply a mass of numbers. For example:

65	69	70	71	70	68	69	67	70	68
72	71	69	74	70	73	71	67	69	70

Many sets of data, however, contain a limited number of data values, even though there may be many occurrences of each value. It can therefore be useful to organise the data into what is known as a **frequency distribution** (or **frequency table**) which records the number of times each value occurs (the **frequency**).

A frequency distribution for the data above (the output in units of 20 employees during one week) is as follows.

Production output of employees in week

Output (units)	Number of employees (frequency)
65	1
66	0
67	2
68	2
69	4
70	5
71	3
72	1
73	1
74	1
	<u>20</u>

When the data is arranged in this way, it is immediately obvious that 69 and 70 units are the most common volumes of output per employee per week.

2.1.1 Grouped frequency distributions

If there is a large set of data or if every (or nearly every) data item is different, it is often convenient to group frequencies together into **bands** or **classes**. For example, suppose that the output produced by another group of 20 employees during one week was as follows, in units.

1,087	850	1,084	792
924	1,226	1,012	1,205
1,265	1,028	1,230	1,182
1,086	1,130	989	1,155
1,134	1,166	1,129	1,160

The range of output from the lowest to the highest producer is 792 to 1,265, a **range** of 473 units. This range could be divided into classes of say, 100 units (the **class width** or **class interval**), and the number of employees producing output within each class could then be grouped into a single frequency, as follows.

Output (units)	Number of employees (frequency)
700 – 799	1
800 – 899	1
900 – 999	2
1,000 – 1,099	5
1,100 – 1,199	7
1,200 – 1,299	4
	20

Note, however, that once items have been 'grouped' in this way, their individual values are lost.

A cumulative frequency distribution (or cumulative frequency table) can be used to show the total number of times that a value above or below a certain amount occurs.

There are two possible cumulative frequency distributions for the grouped frequency distribution in the paragraph above.

Cumulative frequency		Cumulative frequency	
≥ 700	20	< 800	1
≥ 800	19	< 900	2
≥ 900	18	< 1,000	4
≥ 1,000	16	< 1,100	9
≥ 1,100	11	< 1,200	16
≥ 1,200	4	< 1,300	20

- (a) The first cumulative frequency distribution shows that of the total of 20 employees, 19 produced 800 units or more, 18 produced 900 units or more, 16 produced 1,000 units or more and so on.

- (b) The second cumulative frequency distribution shows that, of the total of 20 employees, one produced under 800 units, two produced under 900 units, four produced under 1,000 units and so on.

3 Averages

The example below will be used throughout the chapter in order to calculate the three averages; the mean, median and mode. The following data will be used to illustrate each.

In the small town of Brum Brum, a survey of 1,600 out of 100,000 car owners was performed to find out about annual mileage travelled. The results were as follows:

Annual miles travelled		< 2,000	Midpoint mileage	Number of cars	Mileage
			x		fx
		< 2,000	1,000 *	10	10,000
2,000	-	< 4,000	3,000	14	42,000
4,000	-	< 6,000	5,000	154	770,000
6,000	-	< 8,000	7,000	292	2,044,000
8,000	-	< 10,000	9,000	493	4,437,000
10,000	-	< 12,000	11,000	404	4,444,000
12,000	-	< 14,000	13,000	164	2,132,000
14,000	-	< 16,000	15,000	48	720,000
		≥ 16,000	17,000 *	21	357,000
				1,600	14,956,000

* assume same size as adjacent intervals.

3.1 Arithmetic mean



Arithmetic mean: The arithmetic mean is calculated by adding all the observations and dividing by the number of observations. The arithmetic mean of a variable x is shown as \bar{x} ("x bar").

The arithmetic mean is the best known type of average and is widely understood.

Formula provided

Ungrouped data:

$$\bar{x} = \frac{\sum x}{n}$$

Grouped data:

$$\bar{x} = \frac{\sum fx}{f}$$

Where x = value and f = frequency

Where the frequency is a grouped distribution ie a range of values, we use the 'midpoint' for x to calculate the mean.



Illustration 1: Arithmetic mean of ungrouped data

The demand for a product on each of 20 days was as follows (in units).

3	12	7	17	3	14	9	6	11	10	1	4	19	7	15	6	9	12	12	8
---	----	---	----	---	----	---	---	----	----	---	---	----	---	----	---	---	----	----	---

Required

What is the mean level of demand (to two decimal places)?

 units

Solution

9.25 units

$$\bar{x} = \frac{\sum x}{n}$$

Mean = Sum of demand (x) / Number of days (n) = 185 / 20 = 9.25 units

In this example, demand on any one day is never actually 9.25 units. The arithmetic mean is merely an **average representation** of demand on each of the 20 days.



Illustration 2: Arithmetic mean of data in a frequency distribution

In our previous example about daily demand, the demand figures can be listed next to their frequency (how often they occur). The 'frequency distribution' would be shown as follows:

Daily demand	Frequency	Demand x frequency
x	f	fx
1	1	1
3	2	6
4	1	4
6	2	12
7	2	14
8	1	8
9	2	18
10	1	10
11	1	11
12	3	36
14	1	14
15	1	15
17	1	17

Daily demand	Frequency	Demand x frequency
x	f	fx
19	1	19
	20	185

Required

Calculate the mean demand to two decimal places.

Solution

$$\bar{x} = \frac{\sum fx}{f} = \frac{185}{20} = 9.25$$



Activity 1: Mean

Using the information in Section 3, calculate the mean annual mileage for the 1,600 cars to one decimal place.

[] miles

Solution

3.2 Mode



Mode: The mode or modal value is the most frequently occurring value.



Activity 2: Mode

A group of shoppers were interviewed and asked how many loaves of bread they would need to buy from the bakers over a one-week period. The results are as follows:

Number of loaves	Number of shoppers
0	2
1	22
2	32
3	2
4	34
5	6
6	12

Required

What is the mode of the number of loaves needed per shopper in a one-week period?

 loaves

3.3 Median



Median: The median is the value of the middle member of an array. The middle item of an odd number of items is calculated as the

$$\frac{(n + 1)\text{th}}{2} \text{ item.}$$

(a) **Ungrouped data (odd number)**

- Arrange data in order
- Calculate middle (median) rank - $(n+1)/2 = \text{nth item in the list}$
- Median value = the entry corresponding to the median rank

(b) **Ungrouped data (even number)**

- Arrange the data in order
- Calculate the MEAN of the two median ranks.



Illustration 3: Median (odd number of items)

What is the median of the following nine values?

8 6 9 12 15 6 3 20 11

Solution

We take the middle item (the fifth one) in the array:

3 6 6 8 9 11 12 15 20

Therefore the median is 9.



Illustration 4: Median - even number of items

What is the median of the following ten values?

1 2 2 2 3 5 6 7 8 11

Solution

We have to take the mean of the two middle items.

Median = $(3 + 5) / 2 = 4$



Activity 3: Median

The following times taken to produce a batch of 100 units of Product X have been recorded:

21 mins	17 mins	24 mins	11 mins	37 mins	27 mins
20 mins	15 mins	17 mins	23 mins	29 mins	30 mins
24 mins	18 mins	17 mins	21 mins	24 mins	20 mins

Required

What is the median time?

mins



Essential reading

See Chapter 5, Section 1 of the Essential reading for the advantages and disadvantages of the different types of average.

The Essential reading is available as an Appendix of the digital edition of the Workbook.

4 Dispersion

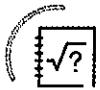
Averages are a method of determining the 'location' or central point of a set of data, but they give no information about the dispersion of values. Measures of **dispersion** give some indication of the spread of data about the central point (mean).

4.1 Standard deviation



Standard deviation σ : Standard deviation σ is one of the most important measures of dispersion (spread of data). The standard deviation measures the spread of data around the mean.

Variance σ^2 : The variance is the square of the standard deviation (variance = σ^2).



Formula to learn

Standard deviation for ungrouped data:

$$\sigma = \sqrt{\frac{\sum(x-\bar{x})^2}{n}} = \sqrt{\frac{\sum x^2}{n} - \bar{x}^2}$$

(Note that the first formula is given on the FMA/MA formula sheet.)

Standard deviation for grouped data (frequency distribution):

$$\sigma = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f}\right)^2} = \sqrt{\frac{\sum fx^2}{\sum f} - \bar{x}^2}$$

(Note that the first formula is given on the FMA/MA formula sheet.)

Where:

σ = standard deviation

x = value

\bar{x} = mean

f = frequency

$n = \sum f$

In general, the larger the standard deviation value in relation to the mean, the more dispersed the data. For example, look at these two sets of data:

Set 1	1	8	13	16	21	23	30
Set 2	1	16	16	16	16	17	30

Note how both data sets range from 1 to 30 but many of the values in Set 2 are 16.

Both of these sets have a mean of 16 but you can see that there is more spread about the mean (ie more total distance from the mean) in Set 1, so the standard deviation will be larger than the standard deviation of Set 2.

Advantages of standard deviation:

- Uses all data
- Gives 'weight' to values that lie far away from the mean



Illustration 5: Mean, variance and standard deviation

The hours of overtime worked in a particular quarter by the 60 employees of ABC Co are as follows:

	Hours	Frequency
More than	Not more than	
0	10	3
10	20	6
20	30	11
30	40	15
40	50	12
50	60	7
60	70	<u>6</u>
		<u>60</u>

Required

Calculate the mean, variance and standard deviation.

Solution

Midpoint		Σf	Σfx	Σx^2	Σfx^2
5	3	15	25	75	
15	6	90	225	1,350	
25	11	275	625	6,875	
35	15	525	1,225	18,375	
45	12	540	2,025	24,300	
55	7	385	3,025	21,175	
65	<u>6</u>	<u>390</u>	4,225	<u>25,350</u>	
	$\Sigma f = 60$	$\Sigma fx = 2,220$			$\Sigma fx^2 = 97,500$

$$\text{Mean} = \Sigma fx / \Sigma f = 2,220 / 60 = 37 \text{ hours}$$

$$\text{Variance} = \frac{\Sigma fx^2}{\Sigma f} - \left(\frac{\Sigma fx}{\Sigma f} \right)^2 = \frac{97,500}{60} - 37^2 = 256 \text{ hours}$$

$$\text{Standard deviation} = \sqrt{\frac{\Sigma fx^2}{\Sigma f} - \left(\frac{\Sigma fx}{\Sigma f} \right)^2} = \sqrt{\frac{97,500}{60} - 37^2}$$

$$= \sqrt{256} = 16 \text{ hours}$$



Activity 4: Standard deviation

Complete the following table to calculate the standard deviation.

Mileage (‘000s)	x	f	fx	x^2	fx^2
< 2	1	10			
2 –< 4	3	14			
4 –< 6	5	154			
6 –< 8	7	292			
8 –< 10	9	493			
10 –< 12	11	404			
12 –< 14	13	164			
14 –< 16	15	48			
≥ 16	17	21			
		1,600			

Mean = miles (calculation to one decimal place)

Standard deviation = (to nearest mile)



Exam focus point

Watch out for questions where you are given a variance but need a standard deviation (for example, you need the standard deviation for the calculation of the coefficient of variation).

$$\text{Variance} = \sigma^2$$

$$\text{Standard deviation } \sigma = \sqrt{\text{variance}}$$

4.2 Coefficient of variation

The spreads of two distributions can be compared using the **coefficient of variation**.

It measures the standard deviation as a proportion of the mean.



Formula provided

$$\text{Coefficient of variation} = \frac{\text{Standard deviation}}{\text{Mean}} = \frac{\sigma}{\bar{x}}$$

The bigger the coefficient of variation, the wider the spread.



Activity 5: Coefficient of variation

Using the data in the previous activity, calculate the coefficient of variation as a percentage, to one decimal place.

 %

5 Expected values



Expected value: An expected value is a weighted average value of the different possible outcomes from a decision, where weightings are based on the probability of each possible outcome.

Expected values indicate what an outcome is likely to be in the long term, if the decision can be repeated many times over. Fortunately, many business transactions do occur over and over again.



Formula provided

$$\text{Expected value (EV)} = \sum p x$$

Where

Σ = sum of

p = probability of outcome occurring

x = outcome/results



Illustration 6: Expected profit

Suppose a manager has to choose between mutually exclusive options A and B, and the probable outcomes of each option are as follows.

Option A		Option B	
Probability	Profit	Probability	Profit
	\$		\$
0.8	5,000	0.1	(2,000)
0.2	6,000	0.2	5,000

		0.6	7,000
		0.1	8,000

Required

What is the expected profit for each option and which option should be selected?

Solution

The expected value (EV) of profit of each option would be measured as follows:

Option A					Option B				
Prob		Profit		EV of profit	Prob		Profit		EV of profit
p		x		px	p		x		px
		\$		\$			\$		\$
0.8	\times	5,000	=	4,000	0.1	\times	(2,000)	=	(200)
0.2	\times	6,000	=	<u>1,200</u>	0.2	\times	5,000	=	1,000
		EV	=	<u>5,200</u>	0.6	\times	7,000	=	4,200
					0.1	\times	8,000	=	<u>800</u>
							EV	=	<u>5,800</u>

In this example, since it offers a higher EV of profit, option B would be selected in preference to A, unless further risk analysis is carried out.



Activity 6: Expected value

A wildlife photographer has entered a photography competition. From past competitions, the probability distribution relating to the photographer's chances in the competition is as follows:

Place	Winnings	Probability
1st	\$100	5%
2nd	\$50	15%
3rd	\$25	10%
No place	Nil	70%

Required

What is the expected value of the photographer's winnings?

5.1 Limitations of expected values

There are limitations with using expected values:

- Expected value is a long-run average result, therefore it is inappropriate for one-off decisions.
- It is heavily dependent on probability distribution.
- EV ignores risk where risk is the spread or variability of outcomes.

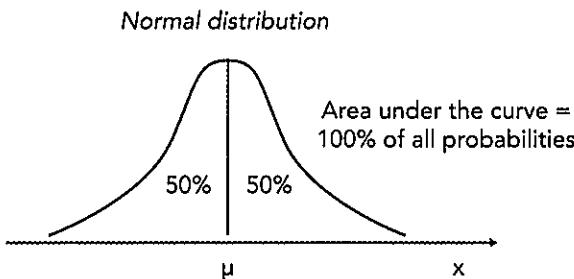
6 Normal distribution

The normal distribution (or probability distribution) is a frequency distribution and it is important because it arises frequently in 'real life'.

For example, if we take the population of a country and look at the distribution of the height of all adults, it would almost certainly follow a normal distribution. In fact, most data distributions follow a normal distribution because the majority of items lie near to the average.

6.1 Graphing the normal distribution

The normal distribution can be drawn as a graph, known as a **bell-shaped curve**.



This graph could represent people's heights. As the majority of people's heights lie on or near to the average height (the mean), there is a higher concentration of occurrences, the closer we get to the mean.

As you get further away from the mean, the number of people with these heights gets smaller and smaller, hence the curve gets lower and lower.

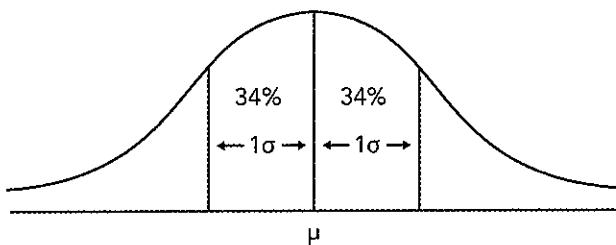
6.2 Properties of the normal distribution

- It has a mean, μ
- The graph is symmetrical around the mean and bell-shaped
- The area under the curve totals exactly 1 (ie 100%)
- The area to the left of μ = area to the right of μ = 0.5 (ie 50%)
- At a point a certain number of standard deviations from the mean, the area under the curve will always represent the same % of the population (no matter what normal curve is being considered).

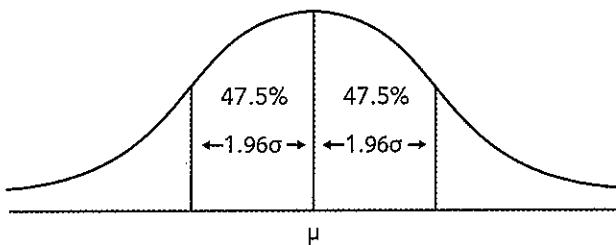
6.3 Interpreting normal distribution graphs and tables

For any normal distribution, the **dispersion** around the mean (μ) of the frequency of occurrences can be measured exactly in terms of the **standard deviation** (σ). As we said, at some point, a certain number of standard deviations from the mean, the area under the curve will always represent the same % of the population (no matter what normal curve is being considered).

For example, about 68% of frequencies have a value within one standard deviation either side of the mean.



95% of the frequencies in a normal distribution occur in the range ± 1.96 standard deviations from the mean.



You will not need to remember these precise figures, as a normal distribution table can be used to find the relevant proportions and this will be available to you in the exam.



Essential reading

See Chapter 5, Section 2 of the Essential reading for detail on how the relative dispersion around the mean is the same for every normal distribution and how this allows us to calculate probabilities using z scores.

The Essential reading is available as an Appendix of the digital edition of the Workbook.

6.3.1 Using the normal distribution to calculate probabilities

The relative dispersion around the mean is the same for every normal distribution.

Distances from the mean in the normal distribution are always measured by the **number of standard deviations** they represent. This is known as a **z-score**.



Formula provided

This formula is on the formula sheet above the normal distribution tables.

$$Z = \frac{x - \mu}{\sigma}$$

Where:

z = the number of standard deviations above or below the mean (z score)

x = the value of the variable under consideration

μ = the mean

σ = the standard deviation



Illustration 7: z scores

Calculate the z scores and identify the corresponding proportions using normal distribution tables.

- (1) $x = 100, \mu = 200, \sigma = 5$
- (2) $x = 1,000, \mu = 1,200, \sigma = 200$
- (3) $x = 25, \mu = 30, \sigma = 6$

Solution

$$\begin{aligned}z &= (x - \mu) / \sigma \\&= (100 - 200) / 50 \\&= 2\end{aligned}$$

A z score of 2 corresponds to a proportion of 0.4772 or 47.72%.

$$\begin{aligned}z &= (x - \mu) / \sigma \\&= (1,000 - 1,200) / 200 \\&= 1\end{aligned}$$

A z score of 1 corresponds to a proportion of 0.3413 or 34.13%.

$$\begin{aligned}z &= (x - \mu) / \sigma \\&= (25 - 30) / 6 \\&= 0.833\end{aligned}$$

A z score of 0.833 corresponds to a proportion of 0.2967 or 29.67%.



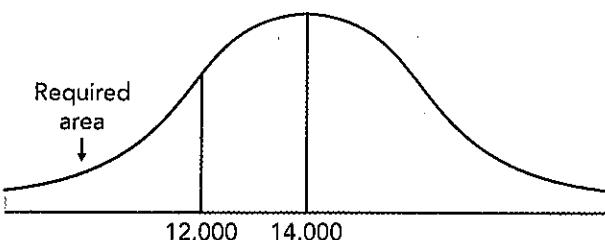
Illustration 8: Normal distribution and proportions

The salaries of employees in an industry are normally distributed, with a mean of \$14,000 and a standard deviation of \$2,700.

Required

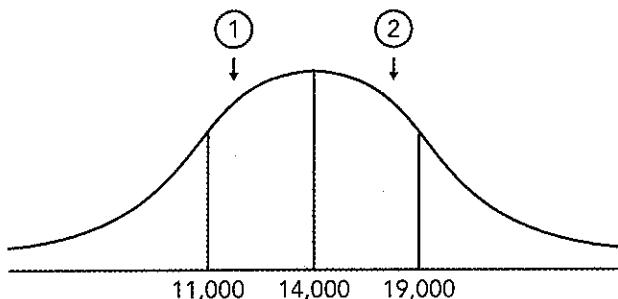
- (1) Calculate the proportion of employees who earn less than \$12,000.
- (2) Calculate the proportion of employees who earn between \$11,000 and \$19,000.

Solution



$$(1) z = (12,000 - 14,000) / 2,700 = -0.74$$

From normal distribution tables, the proportion of salaries between \$12,000 and \$14,000 is 0.2704 (from tables). The proportion of salaries less than \$12,000 is therefore $0.5 - 0.2704 = 0.2296$.



$$z = (11,000 - 14,000) / 2,700 = 1.11$$

$$z = (19,000 - 14,000) / 2,700 = 1.85$$

The proportion with earnings between \$11,000 and \$14,000 is 0.3665 (from tables where $z = 1.11$).

The proportion with earnings between \$14,000 and \$19,000 is 0.4678 (from tables where $z = 1.85$).

The required proportion is therefore $0.3665 + 0.4678 = 0.8343$.

Note that the normal distribution is, in fact, a way of calculating probabilities. In this question, for example, the probability that an employee earns less than \$12,000 (part (a)) is 0.2296 (or 22.96%) and the probability that an employee earns between \$11,000 and \$19,000 is 0.8343 (or 83.43%).



Essential reading

See Chapter 5, Section 3 for more illustrations of calculating probabilities.

The Essential reading is available as an Appendix of the digital edition of the Workbook.



Activity 7: Probabilities

The average number of bottles of beer consumed in three months by accountancy students is 251. The standard deviation is 15 bottles.

Assume a normal distribution.

Required

What is the likelihood that a student will drink:

- (1) More than 285 bottles?
- (2) Between 220 – 255 bottles?

Solution

It is important to recognise that you may need to manipulate the z-score calculation to answer questions.



Activity 8: Normal distribution

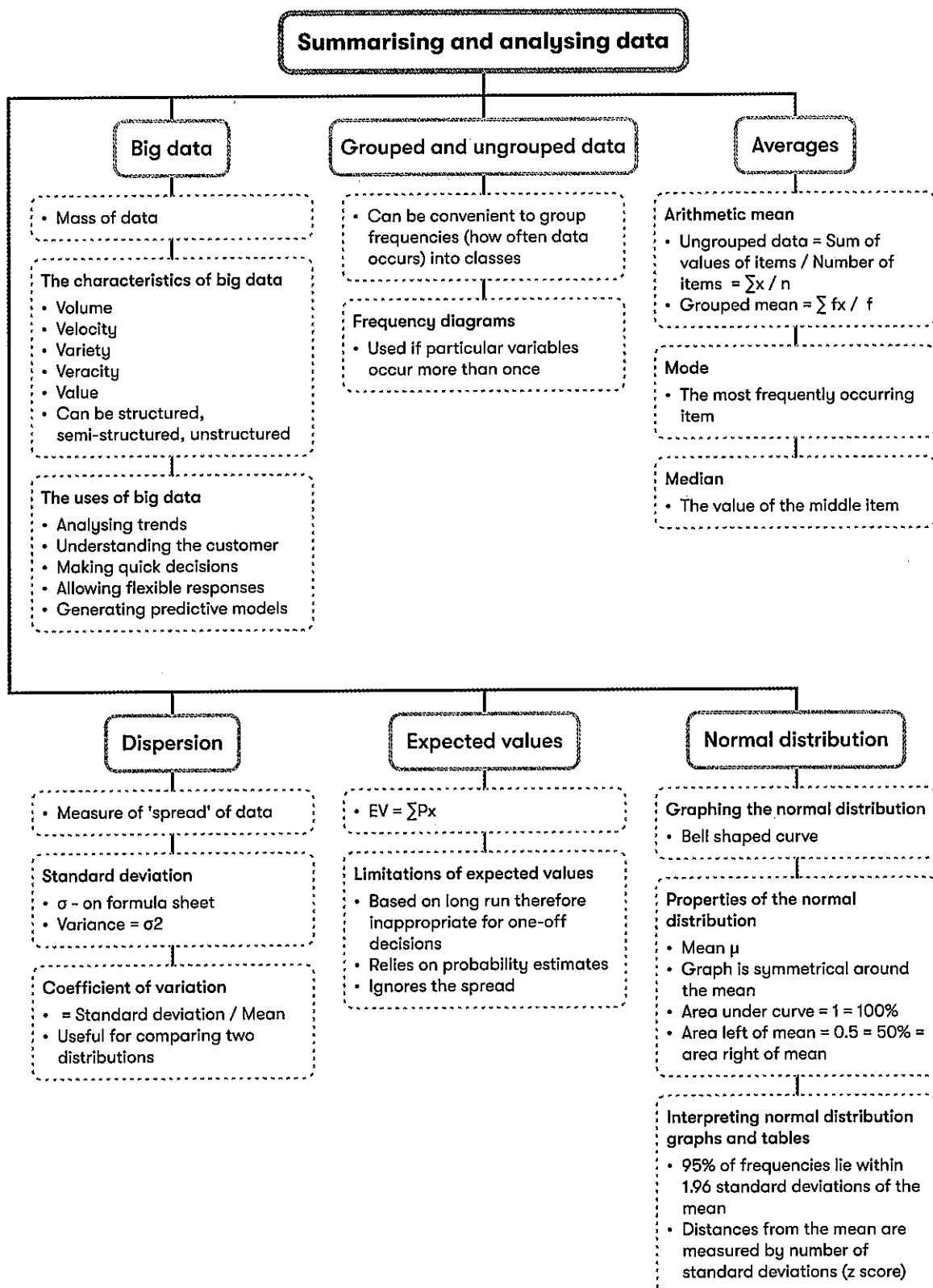
A normal distribution has a mean of 150 and a standard deviation of 20.

Required

80% of the population is therefore below what?

Solution

Chapter summary



Knowledge diagnostic

1. Big data

Volume, velocity, variety, value, veracity

Structured, semi-structured, unstructured

2. Grouped and ungrouped data

Grouped Data: Where the frequency is shown in terms of a range.

Ungrouped Data: Discrete data, where the frequency is shown in terms of a specific measure/value

3. Averages

Mean = Sum of values of items / Number of items

Mode = most frequently occurring item

Median = the value of the middle item

4. Dispersion

The **standard deviation**, which is the square root of the **variance**, is the most important measure of spread used in statistics. The spreads of two distributions can be compared using the **coefficient of variation**.

5. Expected values

An **expected value** (EV) is a weighted average, based on probabilities.

6. Normal distribution

The **normal distribution** is a probability distribution which applies to continuous variables.

Further study guidance

Question practice

Now try the following from the Further question practice bank (available in the digital edition of the Workbook):

Section A: Q23 - 27

Activity answers

Activity 1: Mean

9,347.5 miles

Annual miles travelled	<	2,000	1,000	10	Mid point		No of cars	Mileage
					xf	f		
2,000	- <	4,000	3,000	14			42,000	
4,000	- <	6,000	5,000	154			770,000	
6,000	- <	8,000	7,000	292			2,044,000	
8,000	- <	10,000	9,000	493			4,437,000	
10,000	- <	12,000	11,000	404			4,444,000	
12,000	- <	14,000	13,000	164			2,132,000	
14,000	- <	16,000	15,000	48			720,000	
	≥	16,000	17,000	21			357,000	
					1,600			14,956,000

$$\bar{X} = \frac{\sum fx}{f} = \frac{14,956,000}{1,600} = 9,347.5$$

Activity 2: Mode

4 loaves

The mode is the most frequently occurring number of loaves required by a shopper, ie 4 loaves.

Activity 3: Median

21 mins

Firstly, we need to arrange the times in order.

11, 15, 17, 17, 17, 18, 20, 20, 21, 21, 23, 24, 24, 24, 24, 27, 29, 30, 37

There are eighteen items which is an even number, therefore the median is the arithmetic mean of the two middle items (ie ninth and tenth items) = 21 mins.

Activity 4: Standard deviation

Mileage (‘000s)	x	f	fx	x^2	fx^2
< 2	1	10	10	1	10
2 -< 4	3	14	42	9	126
4 -< 6	5	154	770	25	3,850
6 -< 8	7	292	2,044	49	14,308
8 -< 10	9	493	4,437	81	39,933
10 -< 12	11	404	4,444	121	48,884
12 -< 14	13	164	2,132	169	27,716
14 -< 16	15	48	720	225	10,800
≥ 16	17	<u>21</u>	<u>357</u>	289	<u>6,069</u>
		<u>1,600</u>	<u>14,956</u>		<u>151,696</u>

Mean = 9,347.5 miles (calculation to one decimal place)

Standard deviation = 2,727 (to nearest mile)

Standard deviation =

$$\sqrt{\frac{151,696}{1,600} - 9.3475^2} = 2.72658 \text{ (000s of miles)}$$

= 2,727 to the nearest mile.

Activity 5: Coefficient of variation

29.2 %

$$\text{Coefficient of variation} = \frac{\sigma}{\bar{x}} = \frac{2,727}{9,347.5} = 0.292$$

= 29.2%

Activity 6: Expected value

Winnings \$		Probability		EV
100	x	0.05	=	5
50	x	0.15	=	7.5
25	x	0.10	=	2.50
Nil	x	0.70	=	<u>Nil</u>
				<u>15</u>

Activity 7: Probabilities

$$(1) z = (285 - 251) / 15 = 2.27$$

$$0.5 - 0.4884 = 0.0116$$

Therefore, the probability of a student drinking more than 285 bottles is 0.0116 or 1.16%.

$$(2) z = (220 - 251) / 15 = -2.07$$

$$0.4808$$

$$z = (225 - 251) / 15 = 0.27$$

$$0.1064$$

Therefore, the probability that a student will drink between 220 and 255 bottles in three months = $0.4808 + 0.1064 = 0.5872$ or 58.72%.

Activity 8: Normal distribution

50% are below 150

Need to find 30% (30% from the tables gives a z of 0.84)

$$(x - 150) / 20 = 0.84$$

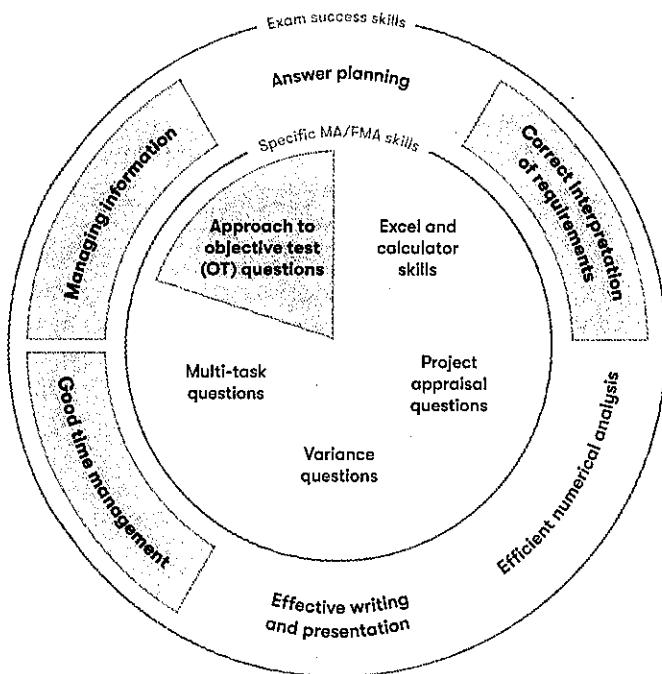
$$x = 166.8$$

80% of the population is under 166.8

Skills checkpoint 1

Approach to objective test (OT) questions

Chapter overview



Introduction

The exam contains two sections. Section A consists of 35 objective test (OT) questions worth 2 marks each and Section B contains 3 multi-task questions worth 10 marks each. The multi-task questions are made up of OT questions and therefore being able to answer OT questions effectively, is extremely important.

OT questions

OT questions in Section A are single, short questions that are auto-marked and worth two marks each. You must answer the whole question correctly to earn the two marks. There are no partial marks.

The OT questions in Section A aim for a broad coverage of the syllabus, and so all areas of the syllabus need to be carefully studied. You need to work through as many practice objective test questions as possible, reviewing carefully to see how correct answers are derived.

The following types of OT questions commonly appear in the MA/FMA exam:

Question type	Explanation
Multiple choice (MCQ)	You need to choose one correct answer from four given response Options.

Question type	Explanation
Multiple response options (MRO)	Eg Q1 of the specimen exam These are a type of multiple-choice question where you need to select more than one answer from a number of given options. The question will specify how many answers need to be selected. It is important to read the requirement carefully. Eg Q9 of the specimen exam
Fill in the blank (FIB)	This question type requires you to type a numerical answer into a box. The unit of measurement (eg \$ or months) will sit outside the box and if there are specific rounding requirements, these will be stated in the question. Eg Q4 of the specimen exam
Drop down list	This question type requires you to select one answer from a dropdown list. Some of these questions may contain more than one drop down list and an answer has to be selected from each one. This requires the same skills as a multiple-choice question as only one correct answer should be selected. Eg Q36 Task 1 of the specimen exam

Section B questions will include three multi-task questions on Budgeting, Standard costing and Performance measurement. Note that budgeting MTQs in Section B can also include tasks from B2 Forecasting techniques. B4 Spreadsheets could be included in any of the MTQs, as either the basis for presenting information in the question scenario or as a task within the MTQ.

The OT skills required for Section A, are also needed for Section B questions.

Approach to OT questions

MA/FMA Skill: Approach to OT questions

A step-by-step technique for approaching OT questions is outlined below. Each step will be explained in more detail in the following sections as a 'mini exam' is answered in stages.

General guidance for approaching OT questions

STEP 1: Answer the questions you know first.

If you're having difficulty answering a question, move on and come back to tackle it once you've answered all the questions you know.

It is often quicker to answer discursive style OT questions first, leaving more time for calculations.



General guidance for approaching OT questions

STEP 2: Answer all questions.

There is no penalty for an incorrect answer in ACCA exams; there is nothing to be gained by leaving an OT question unanswered. If you are stuck on a question, as a last resort, it is worth selecting the option you consider most likely to be correct and moving on. Make a note of the question, so if you have time after you have answered the rest of the questions, you can revisit it.



Guidance for answering specific OT questions

STEP 3: Read the requirement first!

The requirement will be stated in bold text in the exam. Identify what you are being asked to do, any technical knowledge required and **what type of OT question** you are dealing with. Look for key words in the requirement such as "which TWO of the following," "which of the following is NOT"



Guidance for answering specific OT questions

STEP 4: Apply your technical knowledge to the data presented in the question.

Take your time working through questions, and make sure to read through each answer option with care. OT questions are designed so that each answer option is plausible. Work through each response option and eliminate those you know are incorrect.

Exam success skills

The following questions are examples of the sorts of questions you could see in your exam.

For these questions, we will also focus on the following **exam success skills**:

- **Managing information.** It is easy for the amount of information contained in a particular question to feel a little overwhelming. Active reading is a useful technique to avoid this. This involves focusing on the requirements first on the basis that, until you have done this, the detail in the question will have little meaning and will seem more intimidating.
- **Correct interpretation of requirements.** Identify from the requirement the type of OT question. This is especially important with multiple response options (MRO) to ensure you select the correct number of response options. It is also important for fill in the blank questions as they may tell you to give your answer to a certain number of decimal places or to the nearest thousand dollars.
- **Good time management.** Complete all questions in the time available. Each OT in Section A is worth two marks and should be allocated 2.4 minutes. However, some questions may take longer than others so just make sure that you complete all of the Section A questions within 84 minutes (35 x 2.4 minutes). This will leave you with 36 minutes to complete Section B where you should allocate 12 minutes (10 marks x 1.2 minutes) to each of the three questions.

Skill activity

- (a) A company which makes rechargeable batteries selects some of the batteries for examination. The procedure used chooses two random numbers, say n and m . Starting at the n th battery, every battery at an interval of m is then chosen for examination.

What is this type of sampling known as? (2 marks)

- Stratified
- Systematic
- Random
- Multistage

Note. This is an MCQ requiring one correct answer to be selected. The question does not require any calculations and so can be answered relatively quickly, leaving extra time for calculation questions.

- (b) In a time series analysis, the multiplicative model is used to forecast sales and the following seasonal variations apply. Remember, instead of summing to zero, as with the additive approach, the averages should sum (in this case) to 4.0, 1.0 for each of the four quarters.

Quarter	1	2	3	4
Seasonal variation	0.45	1.22	1.31	?

What is the seasonal variation for quarter 4? (2 marks)

- 0.02
- 1.02
- 1.98
- 2.98

Note. This is also an MCQ. A calculation of the seasonal variation is required. Remember that the distractors (incorrect answers) are numbers that you will obtain if you make a particular mistake. Do not look at the options until you have finished the calculation as it is possible that a 'part finished calculation' is one of the incorrect distractors.

- (c) Brady Co is a painting and decorating company. The following information is available for two periods.

	Period 1	Period 2
Square metres decorated	10,000	14,000
Total cost	\$44,000	\$56,000

When more than 12,000 square metres are decorated, the fixed costs increase by \$6,000.

What is the total cost for period 3 if 15,500 square metres are decorated? (2 marks)

\$ _____

Note. This is a fill in the blank (FIB) question and so you need to enter your answer carefully.

- (d) Table Co manufactures tables.

Which TWO of the following items would be treated as an indirect cost? (2 marks)

- Wood used to make the table top
- Metal used to make the table legs
- Sales director's salary
- Staple to attach the label to the tables

Note. This is an MRO asking for two answers to be selected. You must get them both right to obtain the 2 marks.

- (e) A normal distribution has a mean of 60 and a standard deviation of 3.8.

What is the probability of a score of 56 or less? (2 marks)

Select...

85%

50%

35%

15%

Note. This is a drop down list question. Like an MCQ, you need to select one correct answer.

STEP 1 Answer the questions you know first.

If you are having difficulty answering a question, move on and come back to tackle it once you have answered all the questions you know. It is often quicker to answer discursive style OT questions first, leaving more time for calculations.

Questions (a) and (d) are discursive style questions. It would make sense to answer these two questions first as it is likely that you will be able to complete them comfortably within the 2.4 minutes allocated to each one. Any time saved could then be spent on the more complex calculations required to answer the remaining questions.

STEP 2 Answer all questions.

There is no penalty for an incorrect answer in FIA/ACCA exams so there is nothing to be gained by leaving an OT question unanswered. If you are stuck on a question, as a last resort, it is worth selecting the option you consider most likely to be correct, and moving on. Make a note of the question, so if you have time after you have answered the rest of the questions, you can revisit it.

For the MCQs and drop down lists, you have a 25% chance of getting the answer correct, so do not leave any unanswered. MROs can also be guessed. It is obviously more difficult to get a fill in the blank question correct by guessing.

STEP 3 Read the requirement first!

The requirement will be stated in bold text in the exam. Identify what you are being asked to do, any technical knowledge required and what type of OT question you are dealing with. Look for key words in the requirement such as 'Which TWO of the following...', 'Which of the following is NOT...'

Question (c) is a FIB requiring the **total cost**. Be sure you complete your calculations to produce the total cost, rather than just the cost per unit or the fixed costs.

STEP 4 Apply your technical knowledge to the data presented in the question.

Take your time working through calculations, and be sure to read through each answer option with care. OT questions are designed so that each answer option is plausible.

Let's have a look at a few of the questions in detail.

Question (a)

This is the sort of question that you either know or you don't know. The correct answer is Systematic. **Systematic sampling** is a sampling method which works by selecting every nth item (or mth in this case) after a random start.

Question (b)

The correct answer is: 1.02

As this is a multiplicative model, the seasonal variations should sum (in this case) to 4 (an average of 1) as there are four quarters.

Let x = seasonal variation for quarter 4.

$$0.45 + 1.22 + 1.31 + x = 4$$

$$2.98 + x = 4$$

$$x = 4 - 2.98$$

$$x = 1.02$$

Question (c)

Note. This is a fairly long calculation, therefore any time saved in the discursive style OTs would be beneficial.

The first step is to eliminate the extra fixed costs from period 2 total costs so that we are comparing 'like with like'.

Total costs with no extra fixed costs = \$56,000 - \$6,000 = \$50,000

We can now use the high-low method in the usual way to calculate variable cost per unit.

Square metres		\$
High output	14,000	Total cost 50,000
Low output	<u>10,000</u>	Total cost <u>44,000</u>
	<u>4,000</u>	<u>6,000</u>

Variable cost per square metre = \$6,000/4,000 = \$1.50

Using the high level to calculate fixed costs:

\$		
Total costs	56,000	(includes the step up in fixed costs)
Total variable costs	<u>21,000</u>	(14,000 square metres × \$1.50 per sq m)
Total fixed costs	<u>35,000</u>	

Total cost for 15,500 square metres:

\$		
Total variable costs	23,250	(15,500 sq m × \$1.50)
Total fixed costs	<u>35,000</u>	(see above)
Total costs	<u>58,250</u>	

Therefore, the total cost for period 3, if 15,500 square metres are decorated is \$58,250.

Question (d)

The correct answers are:

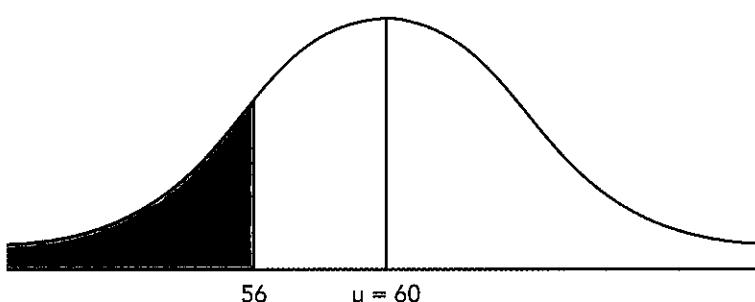
- Wood used to make the table top
- Metal used to make the table legs

Rather than each staple being allocated to a particular product, a box of staples would be treated as a general production overhead. The salary of the sales director is a selling overhead.

The other costs can be directly traced to each chair manufactured.

Question (e)

The correct answer is 15%.



We are interested in the shaded area of the graph above, which we can calculate using normal distribution tables.

$$z = \frac{x-\mu}{\sigma}$$

$$= \frac{56-60}{3.8}$$

$$= 1.05$$

A z value of 1.05 corresponds to a probability of 0.3531.

The shaded area has a corresponding probability of $0.5 - 0.3531 = 0.1469$ or 0.15 or 15%.

Note. The answer options in this question highlight the fact that OT questions are designed so that each answer is plausible.

85% is incorrect because it represents the probability of getting a score of 56 or more.

50% represents the probability of getting a score of 60 or less, ie 50% (the mean represents the point below which 50% of the population lie and above which 50% of the population lie).

If you selected 35%, you forgot to deduct your answer from 0.5.

Exam success skills diagnostic

Every time you complete a few questions, use the diagnostic below to assess how effectively you demonstrated the exam success skills in answering the questions. The table has been completed below for the 'mini exam' activity to give you an idea of how to complete the diagnostic.

Exam success skills	Your reflections/observations
Managing information	Did you read each of the five requirements first? Did you actively read the scenario for each question making a note of relevant points? Eg In question (c), the fact that when more than 12,000 square metres are decorated, the fixed costs increase by \$6,000.
Correct interpretation of requirements	Did you identify the correct technical knowledge needed to answer each requirement? Did you identify what type of OT question you were dealing with? For example, knowing that only one correct answer is required for a multiple-choice question.
Good time management	Did you manage to answer all five questions within 12 mins? Did you manage your time well by answering Questions (a) and (d) first?
Most important action points to apply to your next question	

Summary

Being able to answer OTs is very important for the MA/FMA exam. Key skills to focus on throughout your studies will therefore include:

- Always reading the requirements first to identify what you are being asked to do and what type of OT question you are dealing with.

- Actively reading the scenario, making a note of key data needed to answer each requirement.
- Answering OT questions in a sensible order, dealing with any easier discursive style questions first.

6

Accounting for materials

Learning objectives

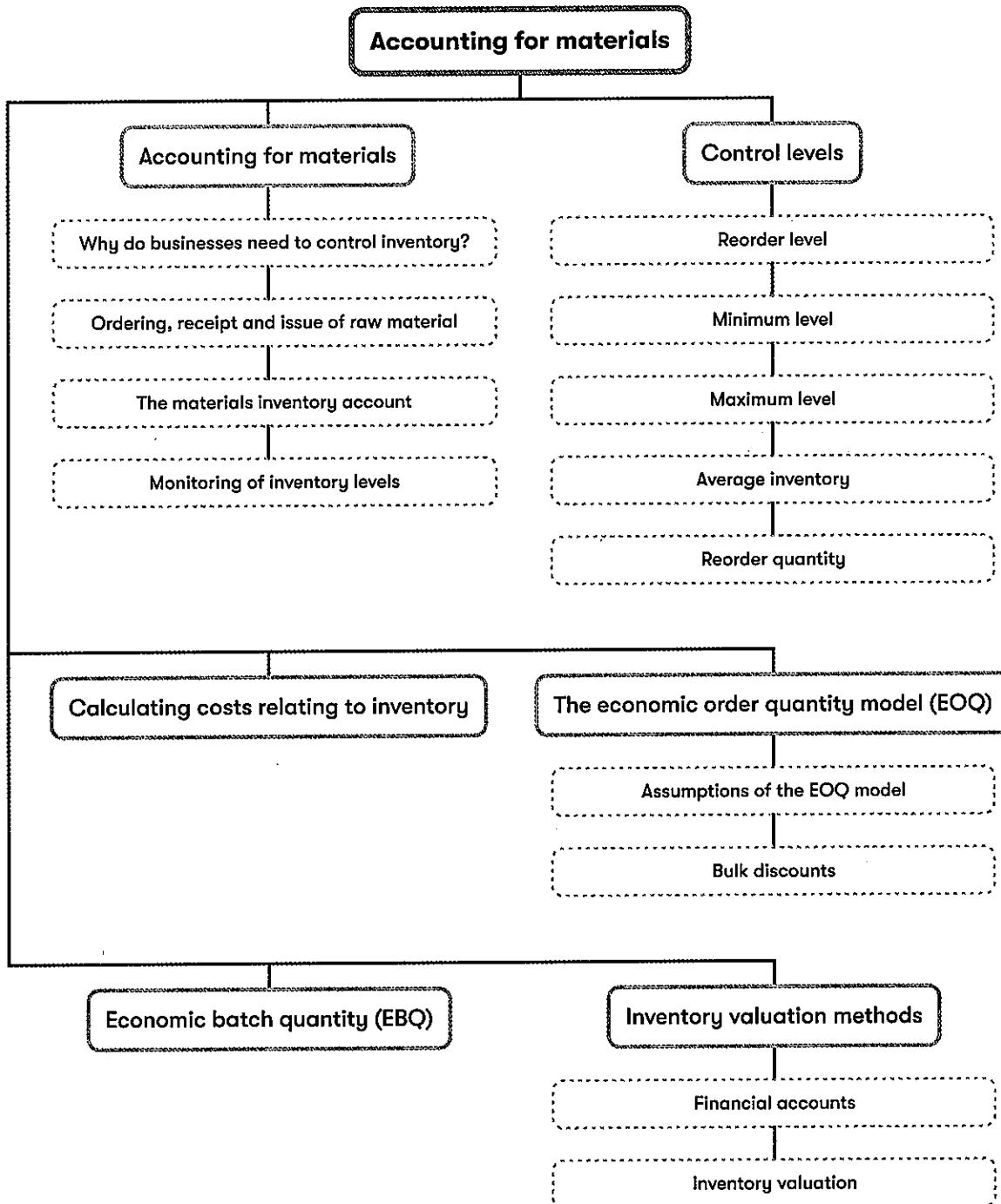
On completion of this chapter, you should be able to:

	Syllabus reference no.
Describe the different procedures and documents necessary for the ordering, receiving and issuing of materials from inventory.	C1 (a)(i)
Describe the control procedures used to monitor physical and 'book' inventory and to minimise discrepancies and losses.	C1 (a)(ii)
Interpret the entries and balances in the material inventory account.	C1 (a)(iii)
Identify, explain and calculate the costs of ordering and holding inventory (including buffer inventory).	C1 (a)(iv)
Calculate and interpret optimal reorder quantities.	C1 (a)(v)
Calculate and interpret optimal reorder quantities when discounts apply.	C1 (a)(vi)
Produce calculations to minimise inventory costs when inventory is gradually replenished.	C1 (a)(vii)
Describe and apply appropriate methods for establishing reorder levels where demand in the lead time is constant.	C1 (a)(viii)
Calculate the value of closing inventory and material issues using LIFO, FIFO and average methods.	C1 (a)(ix)

Exam context

Materials cost is a key cost within a manufacturing environment. This is an important part of the syllabus and you need to be happy with all relevant calculations and formulae for Section A of the examination, particularly the EOQ formula. The EOQ formula will be given to you in the exam but you will need to learn the other formulae.

Chapter overview



1 Accounting for materials

1.1 Why do businesses need to control inventory?

Inventory can be:

- Raw materials
- Spare parts/consumables
- Work in progress
- Finished goods

This chapter will concentrate on an **inventory control system** for raw materials, but similar problems and considerations apply to all forms of inventory.

Businesses control inventory for the following reasons:

- Holding costs of inventory may be expensive.
- Production will be disrupted if it runs out of raw materials.
- Unused inventory with a short shelf life may incur unnecessary expenses.

If manufactured goods are made out of low quality materials, the end product will also be of low quality. It may therefore be necessary to control the quality of inventory in order to maintain a good reputation with consumers.

Inventory control includes the processes of:

- (a) Ordering
- (b) Purchasing
- (c) Receiving goods into store
- (d) Storing
- (e) Issuing inventory
- (f) Controlling levels of inventory

We will begin with processes (a)-(e) before considering how and why levels of inventory are controlled.

1.2 Ordering, receipt and issue of raw material



PER alert

PER performance objective 12a requires you to 'Evaluate management accounting techniques and approaches'. This could include systems containing information relating to raw materials.

Every movement of material should be documented in order to keep a proper physical record and so that the correct entries can be entered in the 'books' of the company. The documents explained below are likely to be computerised but the images are shown to help your understanding of the process and records. Even when inventory records are computerised, the same type of information is stored.

1.2.1 Purchase requisition

When the stores department (or warehouse) needs materials, it issues a purchase requisition which is sent to the purchasing department.

PURCHASE REQUISITION Req. No.			
Department/job number:	Date:		
Suggested supplier:	Requested by:		
	Latest date required:		
Quantity	Code number	Description	Estimated cost
			Unit \$
Authorised signature:			

1.2.2 Purchase order (PO)

The purchasing department raise a PO which is sent to:

- The supplier
- The accounts department
- Stores (warehouse)

Purchase order/Confirmation				
Our order ref:	Date:			
To				
<input type="checkbox"/> (Address)		<input checked="" type="checkbox"/> Please deliver to the above address Ordered by: Passed and checked by: Total order value \$		
			Subtotal	
			VAT	
			Total	



1.2.3 Delivery note

When the supplier delivers the consignment of materials, the storekeeper signs a **delivery note** for the carrier. The packages must then be checked against the copy of the purchase order to ensure that the supplier has delivered the types and quantities of materials which were ordered. (Discrepancies would be referred to the purchasing department.) The delivery note looks very much like a goods received note (GRN). The delivery note is for the supplier and the GRN is for the business receiving the goods.

1.2.4 Goods received note (GRN)

If the delivery is acceptable, the storekeeper prepares a GRN which is sent to:

- The purchasing department
- The accounts department

GOODS RECEIVED NOTE			WAREHOUSE COPY NO 5565
DATE:	TIME:	OUR ORDER NO.: WAREHOUSE A	
SUPPLIER AND SUPPLIERS ADVICE NOTE NO.:			
QUANTITY	CAT NO	DESCRIPTION	
RECEIVED IN GOOD CONDITION:			(INITIALS)

The accounts department should match the PO to the GRN and the invoice when it arrives from the supplier.

1.2.5 Materials requisition note

When materials are required from the stores (or warehouse) for a particular job, a materials requisition/stores requisition is raised by the job manager.

Materials requisition note			
Date required	Cost centre no. / Job no.		
Quantity	Item code	Description	\$
Signature of requisitioning Manager		Date	

1.2.6 Materials transfers and returns

Where materials, having been issued to one job or cost centre, are later transferred to a different job or cost centre, without first being returned to stores, a material transfer note should be raised.

Material returns must also be documented on a material returned note. This document is the 'reverse' of a requisition note, and must contain similar information.

1.3 The material inventory account

Materials purchased will be recorded in the **accounting books of a company** as follows.

- (a) When a purchase is made or an invoice received

Dr Materials inventory

Cr Cash/payables account

(b) When an issue is made to a production process

Dr Production process/work-in-process (WIP)

Cr Materials inventory

MATERIALS INVENTORY ACCOUNT

(a) Materials purchased	X	(b) Materials issued production	X
		C/f closing inventory	X
	X =		X =
B/f opening inventory	X		



Exam focus point

Any increases in materials inventory will result in a debit entry in the material control account, while any reductions in materials inventory will be shown as a credit in the material control account.



Illustration 1: Accounting for materials

Doodaa Co issued \$100,000 of material from stores, 25% of which did not relate directly to production.

Required

How would the transaction be recorded in Doodaa's ledger accounts?

- Debit: Work in Progress \$100,000 Credit: Material Control Account \$100,000
- Debit: Material Control Account \$100,000 Credit: Work in Progress \$100,000
- Debit: Work in Progress \$75,000 Debit: Factory Overheads \$25,000 Credit: Material Control Account \$100,000
- Debit: Material Control Account \$100,000 Credit: Work in Progress \$75,000 Credit: Factory Overheads \$25,000

Solution

The correct answer is: Debit: Work in Progress \$75,000 Debit: Factory Overheads \$25,000 Credit: Material Control Account \$100,000

Materials inventory is being reduced as materials are being issued; therefore, the Material Control Account is credited with \$100,000. Twenty-five per cent of the total (\$25,000) did not relate to production and should therefore be debited to Factory Overheads. The remaining \$75,000 which relates directly to production, should be debited to Work in Progress. The total debit entries equal the total credit entries, which should always be the case.

1.4 Monitoring of inventory levels

One of the objectives of storekeeping is to maintain accurate records of inventory levels.

This involves accurately monitoring inventory movements in order that the physical inventory is reflected in the company's books.

A company will carry out inventory counts (stocktakes) to check that the physical inventory matches that shown in the inventory records.

This count can be carried out on a periodic or continuing basis.



Periodic stocktaking: Periodic stocktaking is a process whereby all inventory items are physically counted and valued at a set point in time, usually at the end of an accounting period.

Continuous stocktaking: Continuous stocktaking is counting and valuing selected items at different times on a rotating basis. This involves a specialist team counting and checking a number of inventory items each day, so that each item is checked at least once a year. Valuable items or items with a high turnover could be checked more frequently.

Any discrepancies between the physical amount and the amount shown in the records should be investigated, and appropriate action taken to ensure that it does not happen again.

Obsolete items (items which have become out of date and are no longer required) should be written off and disposed of.

1.4.1 Free inventory

Managers need to know the free inventory balance in order to obtain a full picture of the current inventory position of an item. Free inventory represents what is really available for future use and is calculated as follows:

Materials in inventory	X
Add: Materials on order from suppliers	X
Less: Materials requisitioned but not yet issued	(X)
Free inventory balance	X



Essential reading

See Chapter 6, Section 1 of the Essential reading, for detail on inventory costs.

The Essential reading is available as an Appendix of the digital edition of the Workbook.



Activity 1: Inventory holding and ordering costs

- (1) What are the reasons for holding inventory?
- (2) What are the costs of holding inventory?
- (3) What are the costs of ordering inventory?

Solution

2 Control levels

The costs of purchasing and holding inventory are usually some of the largest costs faced by a manufacturing organisation. Having the optimum levels of inventory means keeping costs as low as possible while also maintaining sufficient goods to meet demand, future shortages, seasonal variations and so on.

Three control levels (reorder level, minimum level and maximum level) can be calculated from historic records:

2.1 Reorder level

When the inventory level reaches the reorder level, a new order should be made.

It is set so that in theory, it is not possible to run out of inventory and it is based on the maximum usage of inventory and the maximum delivery days or lead time.

Formula to learn

$$\text{Reorder level} = \text{Maximum usage per day} \times \text{Maximum lead time}$$

2.2 Minimum level

This is an inventory level below which inventory should not normally fall.

It acts as a warning sign to management that inventory is very low and that there is an increased risk of stockouts. It is sometimes called buffer inventory or safety inventory.

Formula to learn

$$\text{Minimum level} = \text{Reorder level} - (\text{Average usage per day} \times \text{Average lead time})$$

2.3 Maximum level

This is an inventory level above which inventory should not normally rise.

It acts as a warning sign to management that too much inventory is held which may be uneconomical.

Formula to learn

$$\text{Maximum level} = \text{Reorder level} + \text{Reorder quantity} - (\text{Minimum usage per day} \times \text{Minimum lead time})$$

2.4 Average inventory

The average inventory formula assumes that inventory levels fluctuate evenly between the minimum (or safety or buffer) inventory level and the highest possible inventory level (the amount of inventory immediately after an order is received).



Formula to learn

Average inventory = Minimum inventory + 1/2 Reorder quantity

2.5 Reorder quantity

This is the quantity of inventory which is ordered when inventory reaches the reorder level. If it is set to minimise the total costs associated with holding and ordering inventory, then it is known as the economic order quantity.



Activity 2: Inventory levels

Data for a component part with inventory number B1422 is as follows:

Minimum usage	1,000 units
Maximum usage	2,250 units
Lead time (delivery time)	8-16 days
Reorder quantity	14,500 units

Required

(a) What is the reorder level?

- 8,000 units
- 36,000 units
- 18,000 units
- 27,000 units

(b) What is the minimum inventory holding below which inventory should not fall?

units

(c) What is the maximum inventory holding above which inventory should not rise?

- 32,500 units
- 34,500 units
- 42,500 units
- 58,500 units

Solution

3 Calculating costs relating to inventory

Purchase cost: Unaffected by inventory policy unless bulk discounts are available.

Formula to learn

Purchase costs = purchase price × annual demand = $P \times D$

Ordering cost: If a fixed amount per order is charged, total ordering cost will be affected by inventory policy (ie the number of orders placed). If an amount per unit is charged, the cost will be fixed per annum since it only depends on purchases level (assumed constant).

Formula to learn

Ordering costs = cost per order × number of orders pa = $C_o \times D/Q$

Where D = annual demand and Q = order quantity per order

Holding cost: Will consist of some costs which are fixed per annum (ie warehouse rental) and therefore irrelevant to inventory policy and those which vary with the number of units held in inventory and are thus relevant to any decision (ie per unit insurance costs).

Formula to learn

Holding costs = cost of holding one unit for one year × average inventory throughout the year, ie:

$$\text{Total holding costs} = C_H \times \left(\frac{Q}{2} + \text{minimum inventory}\right)$$

4 The economic order quantity model

The economic order quantity (EOQ) is a mathematical tool to calculate the order quantity that minimises the holding costs, ordering costs and purchase costs.

Formula to learn

Total inventory costs = ordering costs + purchase costs + holding costs

$$\text{Total inventory cost (TC)} = \frac{C_o D}{Q} + P D + \frac{C_H Q}{2}$$

P = purchase price

D = annual demand in units

C_o = fixed cost per order

C_H = cost of holding one unit for one year

Q = number of units ordered



Formula provided

The total cost is minimised when:

$$Q = EOQ = \sqrt{\frac{2C_0D}{C_H}}$$



Illustration 2: EOQ

A company purchases material with a cost of placing an ordering of \$32. Annual demand for the material is 25,000 units and the annual holding cost per unit is \$6.40.

Required

What is the EOQ?

units

Solution

500 units

$$EOQ = \sqrt{\frac{2 \times \$32 \times 25,000}{\$6.40}} = \sqrt{250,000} = 500$$

4.1 Assumptions of the EOQ model

- Demand is constant
- Delivery is instantaneous or lead time is constant
- Purchase costs are constant (no discounts)



Activity 3: Basic EOQ

Demand 150 units per month

Cost per unit \$25

Order cost \$32

Holding cost 18% per year of inventory value

Required

- (1) What is the economic order quantity (in units)?
- (2) What is the total cost associated with this order quantity?
- (3) What are the holding and order costs for order quantities of 200, 600 and 1,000 units?

Solution

4.2 Bulk discounts

Discounts may be available if the order quantity is above a certain size. This needs to be considered when determining the best order quantity.

The economic order quantity will give us the optimal order quantity to minimise holding, ordering and purchase costs but it does not take into account any bulk discounts available.

We therefore need to calculate total costs at each discount level to find the lowest total cost.

- Step 1** Calculate EOQ in normal way
- Step 2** Recalculate EOQ if it falls within a discount band; Ch will have changed as it is a % of purchase price.
- Step 3** Calculate the total annual costs using the formula at the EOQ.
- Step 4** Calculate annual costs at the lower boundary of each discount band above the EOQ.
- Step 5** Select order quantity that minimises costs.



Illustration 3: Discounts

The annual demand for an item of inventory is 45 units. The item costs \$200 a unit to purchase, the holding cost for one unit for one year is 15% of the unit cost and ordering costs are \$300 an order.

The supplier offers a 3% discount for orders of 60 units or more, and a discount of 5% for orders of 90 units or more.

Required

Calculate the cost-minimising order size.

Solution

(1) EOQ (ignoring discounts):

$$\text{EOQ} = \sqrt{\frac{2 \times 300 \times 45}{15\% \times 200}} = \sqrt{900} = 30$$

	\$
Purchases (no discount) $45 \times \$200$	9,000
Holding costs (W1)	450
Ordering costs (W2)	450
Total annual costs	<u>9,900</u>

Workings

1 Holding costs

Holding costs = Average inventory × holding cost for one unit of inventory per annum

Average inventory = Order quantity ÷ 2 = 30 ÷ 2 = 15 units

Holding cost for one unit of inventory per annum = $15\% \times 200 = \$30$

∴ Holding costs = $15 \text{ units} \times \$30 = \$450$

2 Ordering costs

Ordering costs = Number of orders × ordering costs per order (\$300)

Number of orders = Annual demand ÷ order quantity

$$= 45 \div 30$$

$$= 1.5 \text{ orders}$$

∴ Ordering costs = $1.5 \text{ orders} \times \$300 = \$450$

(2) With a discount of 3% and an order quantity of 60, unit costs are as follows:

	\$
Purchases $\$9,000 \times 97\%$	8,730
Holding costs (W3)	873
Ordering costs (W4)	225
Total annual costs	<u>9,828</u>

3 Holding costs

Holding costs = Average inventory × holding cost for one unit of inventory per annum

Average inventory = Order quantity ÷ 2

$$= 60 \div 2 = 30 \text{ units}$$

Holding cost for one unit of inventory per annum = $15\% \times 97\% \times \$200 = \$29.10$

Note. 97% = $100\% - 3\% \text{ discount}$

∴ Holding costs = $30 \text{ units} \times \29.10

$$= \$873$$

4 Ordering costs

Ordering costs = Number of orders × ordering costs per order (\$300)

Number of orders = Annual demand ÷ order quantity

$$= 45 \div 60$$

$$= 0.75 \text{ orders}$$

∴ Ordering costs = $0.75 \text{ orders} \times \300

$$= \$225$$

(3) With a discount of 5% and an order quantity of 90, unit costs are as follows:

	\$
Purchases $\$9,000 \times 95\%$	8,550
Holding costs (W5)	1,282.5
Ordering costs (W6)	150
Total annual costs	<u>9982.5</u>

5 Holding costs

Holding costs = Average inventory × holding cost for one unit of inventory per annum

Average inventory = order quantity ÷ 2

$$= 90 \div 2$$

= 45 units

$$\text{Holding cost for one unit of inventory per annum} = 15\% \times 95\% \times \$200 \\ = \$28.50$$

(95% = 100% – 5% discount)

$$\therefore \text{Holding costs} = 45 \text{ units} \times \$28.50 \\ = \$1,282.50$$

6 Ordering costs

Ordering costs = Number of orders × ordering costs per order (\$300).

Number of orders = Annual demand ÷ order quantity

$$= 45 \div 90 \\ = 0.5 \text{ orders}$$

$$\therefore \text{Ordering costs} = 0.5 \text{ orders} \times \$300 \\ = \$150$$

The cheapest option is to order 60 units at a time.

Note that the value of CH varied according to the size of the discount, because CH was a percentage of the purchase cost. This means that **holding costs are reduced because of a discount**. This could easily happen if, for example, most of CH was the cost of insurance, based on the cost of inventory held.



Activity 4: Minimum total costs

Using the same information as used in Basic EOQ, calculate the minimum total cost, assuming the following discounts apply:

Discount of 1% given on orders of 150 and over

Discount of 2% given on orders of 300 and over

Discount of 4% given on orders of 800 and over

Required

How many units should be ordered at a time?

- 150
- 300
- 800

Solution



5 Economic batch quantity (EBQ)

The EBQ is a modification of the EOQ and is used when inventory is replenished gradually to match production rates, rather than instantaneously.

This approach is used in order to minimise administration, reduce inventory holding costs and to guarantee future inventory supplies where a company is manufacturing inventory for its own use, rather than ordering from an external supplier. Alternatively, EBQ is used if the external supplier is willing to deliver gradually.

For example, a company may wish to order a batch of 500,000 (Q) components to secure supply, whilst receiving delivery to match the weekly production demand for the components of 50,000 (R) due to the limited availability of warehouse space.

The EOQ formula is amended to reflect that Q units are never all held in inventory.

Formula to learn

$$EBQ = \sqrt{\frac{2C_0D}{C_H(1-\frac{D}{R})}}$$

$$\text{Total holding costs} = \frac{Q}{2}(1-\frac{D}{R})C_H$$

Q = The amount ordered per batch

D = Demand in the time period

C_0 = Set up cost of one batch/cost of making one order

C_H = Holding cost per unit per time period

R = Production rate/delivery rate per time period

Illustration 4: Economic production run

A company is able to manufacture its own components for inventory at the rate of 4,000 units a week. Demand for the component is at the rate of 2,000 units a week. Set-up costs for each production run are \$50. The cost of holding one unit of inventory is \$0.001 a week.

Required

Calculate the economic production run.

Solution

$$Q = \sqrt{\frac{2 \times 50 \times 2,000}{0.001(1-2,000/4,000)}} = 20,000 \text{ units}$$

Activity 5: EBQ

Berry Co has capacity to manufacture 800 cakes in a week. The cakes are demanded at a rate of 600 per week.

Set-up costs for each production run are \$5.40 and the holding cost of each unit is 5 cents per week.

Required

What is the EBQ in units and what are the total weekly holding and set up costs associated with inventory if Berry Co's aim is to minimise costs?

EBQ = units

Holding costs (to two decimal places) = \$

Set up costs (to two decimal places) = \$

Solution**Activity 6: EOQ and annual holding cost**

Dixon always determines its order quantity for raw material R by using the Economic Order Quantity (EOQ) model.

Required

What would be the effects on the EOQ and the total annual holding cost of an increase in the cost of ordering a batch of raw material R?

- EOQ Higher. Annual holding costs Lower.
- EOQ Higher. Annual holding costs Higher.
- EOQ Lower. Annual holding costs Higher.
- EOQ Lower. Annual holding costs Lower.

6 Inventory valuation methods

6.1 Financial accounts

You may be aware from your studies for the Foundations of Financial Accounting exam that, for financial accounting purposes, inventories are valued at the **lower of cost and net realisable value**. In practice, inventories will probably be valued at cost in the stores records throughout the course of an accounting period. Only when the period ends, will the value of the inventory in hand

be reconsidered so that items with a net realisable value below their original cost will be revalued downwards, and the inventory records altered accordingly.

6.2 Inventory valuation

The correct pricing of issues and valuation of inventory are of the utmost importance because they have a direct effect on the calculation of profit. Several different methods can be used in practice.

- (a) FIFO (First in first out) assumes that unit purchased first are issued/sold before those purchased later.
- (b) LIFO (Last in first out) assumes the most recently purchased items are issued/sold before those already in stock.
- (c) AVCO (Average cost) calculates a cumulative weighted average of all the units in inventory to value those issued/sold.

6.2.1 First in first out (FIFO)

FIFO assumes that materials are issued out of inventory in the order in which they were delivered into inventory: issues are priced at the cost of the earliest delivery remaining in inventory.



Illustration 5: FIFO

	Quantity Units	Unit cost \$	Total cost \$	Market value per unit on date of transaction \$
Opening balance, 1 May	100	2.00	200	
Receipts, 3 May	400	2.10	840	2.11
Issues, 4 May	200			2.11
Receipts, 9 May	300	2.12	636	2.15
Issues, 11 May	400			2.20
Receipts, 18 May	100	2.40	240	2.35
Issues, 20 May	100			2.35
Closing balance, 31 May	200			2.38
			<u>1,916</u>	

Required

Using FIFO, what are the values of the issues and the value of the closing inventory for May?

Solution

Cost of issues = \$1,464

Value of closing inventory = \$452

Date of issue	Quantity issued Units	Value \$
4 May	200	100 o/s at \$2 100 at \$2.10
		<u>200</u> <u>210</u>
		410
11 May	400	300 at \$2.10
		630

		100 at \$2.12	<u>212</u>
			842
20 May	100	100 at \$2.12	<u>212</u>
Cost of issues			1,464
Closing inventory value	200	100 at \$2.12	212
		100 at \$2.40	<u>240</u>
			452
			<u>1,916</u>

Tutorial note. The cost of materials issued, plus the value of closing inventory, equals the cost of purchases, plus the value of opening inventory (\$1,916).

The market price of purchased materials is rising dramatically. In a period of inflation, there is a tendency with FIFO for materials to be issued at a cost lower than the current market value, although closing inventories tend to be valued at a cost approximating to current market value. FIFO is therefore essentially a **historical cost method**, materials included in cost of production being valued at historical cost.

6.2.2 Advantages and disadvantages of FIFO

Advantages	Disadvantages
It is a logical pricing method which probably represents what is physically happening; in practice the oldest inventory is likely to be used first.	FIFO can be cumbersome to operate because of the need to identify each batch of material separately.
It is easy to understand and explain to managers.	Managers may find it difficult to compare costs and make decisions when they are charged with varying prices for the same materials.
The inventory valuation can be near to a valuation based on replacement cost.	In a period of high inflation, inventory issue prices will lag behind current market value.

6.2.3 Last in first out (LIFO)

LIFO assumes that materials are issued out of inventory in the reverse order to which they were delivered: the most recent deliveries are issued before earlier ones, and issues are priced accordingly.



Illustration 6: LIFO

	Quantity Units	Unit cost \$	Total cost \$	Market value per unit on date of transaction \$
Opening balance, 1 May	100	2.00	200	
Receipts, 3 May	400	2.10	840	2.11
Issues, 4 May	200			2.11

	Quantity Units	Unit cost \$	Total cost \$	Market value per unit on date of transaction \$
Receipts, 9 May	300	2.12	636	2.15
Issues, 11 May	400			2.20
Receipts, 18 May	100	2.40	240	2.35
Issues, 20 May	100			2.35
Closing balance, 31 May	200			2.38
			<u>1,916</u>	

Required

Using LIFO, what are the values of the issues and the value of the closing inventory for May?

Solution

Date of issue	Quantity issued Units	Valuation	
		\$	\$
4 May	200	200 at \$2.10	420
11 May	400	300 at \$2.12	636
		100 at \$2.10	<u>210</u>
			846
20 May	100	100 at \$2.40	<u>240</u>
Cost of issues			1,506
Closing inventory value	200	100 at \$2.10	210
		100 at \$2.00	<u>200</u>
			410
			<u>1,916</u>

Tutorial note. The cost of materials issued plus the value of closing inventory equals the cost of purchases plus the value of opening inventory (\$1,916).

In a period of inflation, there is a tendency with LIFO for the following to occur:

- Materials are issued at a price which approximates to current market value (or **economic cost**).
- Closing inventories become undervalued when compared to market value.

6.2.4 Advantages and disadvantages of LIFO

Advantages	Disadvantages
Inventories are issued at a price which is close to current market value.	The method can be cumbersome to operate because it sometimes results in several batches being only part-used in the inventory records

Advantages	Disadvantages
	before another batch is received.
Managers are continually aware of recent costs when making decisions, because the costs being charged to their department or products will be current costs.	LIFO is often the opposite to what is physically happening and can therefore be difficult to explain to managers.
	As with FIFO, decision making can be difficult because of the variations in prices.

6.2.5 Cumulative weighted average pricing (AVCO)

The cumulative weighted average pricing method (or AVCO) calculates a **weighted average price** for all units in inventory. Issues are priced at this average cost, and the balance of inventory remaining would have the same unit valuation. The average price is determined by dividing the total cost by the total number of units.

A new weighted average price is calculated whenever a new delivery of materials is received into store. This is the key feature of cumulative weighted average pricing.



Illustration 7: AVCO

	Quantity	Unit cost	Total cost	Market value per unit on date of transaction
	Units	\$	\$	\$
Opening balance, 1 May	100	2.00	200	
Receipts, 3 May	400	2.10	840	2.11
Issues, 4 May	200			2.11
Receipts, 9 May	300	2.12	636	2.15
Issues, 11 May	400			2.20
Receipts, 18 May	100	2.40	240	2.35
Issues, 20 May	100			2.35
Closing balance, 31 May	200			2.38
			<u>1,916</u>	

Required

Using AVCO, what are the values of the issues and the value of the closing inventory for May?

Solution

Date	Received	Issued	Balance	Total inventory value	Unit cost
	Units	Units	Units	\$	\$
Opening inventory			100	200	2.00
3 May	400			<u>840</u>	2.10
			* 500	1,040	2.08

4 May	200	(416)	2.08	416
	300	624	2.08	
9 May		636	2.12	
	* 600	1,260	2.10	
11 May	400	(840)	2.10	840
	200	420	2.10	
18 May	100	240	2.40	
	* 300	660	2.20	
20 May	100	(220)	2.20	220
				1,476
Closing inventory value	200	440	2.20	440
				1,916

* A new inventory value per unit is calculated whenever a new receipt of materials occurs.

Tutorial note. The cost of materials issued plus the value of closing inventory equals the cost of purchases plus the value of opening inventory (\$1,916).

In a period of inflation, using the cumulative weighted average pricing system, the value of material issues will rise gradually, but will tend to lag a little behind the current market value at the date of issue. Closing inventory values will also be a little below current market value.

6.2.6 Advantages and disadvantages of AVCO

Advantages	Disadvantages
Fluctuations in prices are smoothed out, making it easier to use the data for decision making.	The resulting issue price is rarely an actual price that has been paid, and can run to several decimal places.
It is easier to administer than FIFO and LIFO because there is no need to identify each batch separately.	Prices tend to lag a little behind current market values when there is gradual inflation.



Activity 7: Inventory valuation methods

Shown below is an extract from records for inventory code no 988988.

Date	Receipts			Issues			Balance		
	Qty	Value	Total	Qty	Value	Total	Qty	Value	Total
		\$	\$		\$	\$		\$	\$
5 June							30	2.50	75
8 June	20	3.00	60						
10 June				10		A			

14 June				20		B			
18 June	40	2.40	96						
20 June				6		C			D

Required

- (a) The values that would be entered on the stores ledger card for A, B, C and D in a cumulative weighted average pricing system would be:

A = \$

B = \$

C = \$

D = \$

- (b) The values that would be entered on the stores ledger card for A, B, C and D in a LIFO system would be:

A = \$

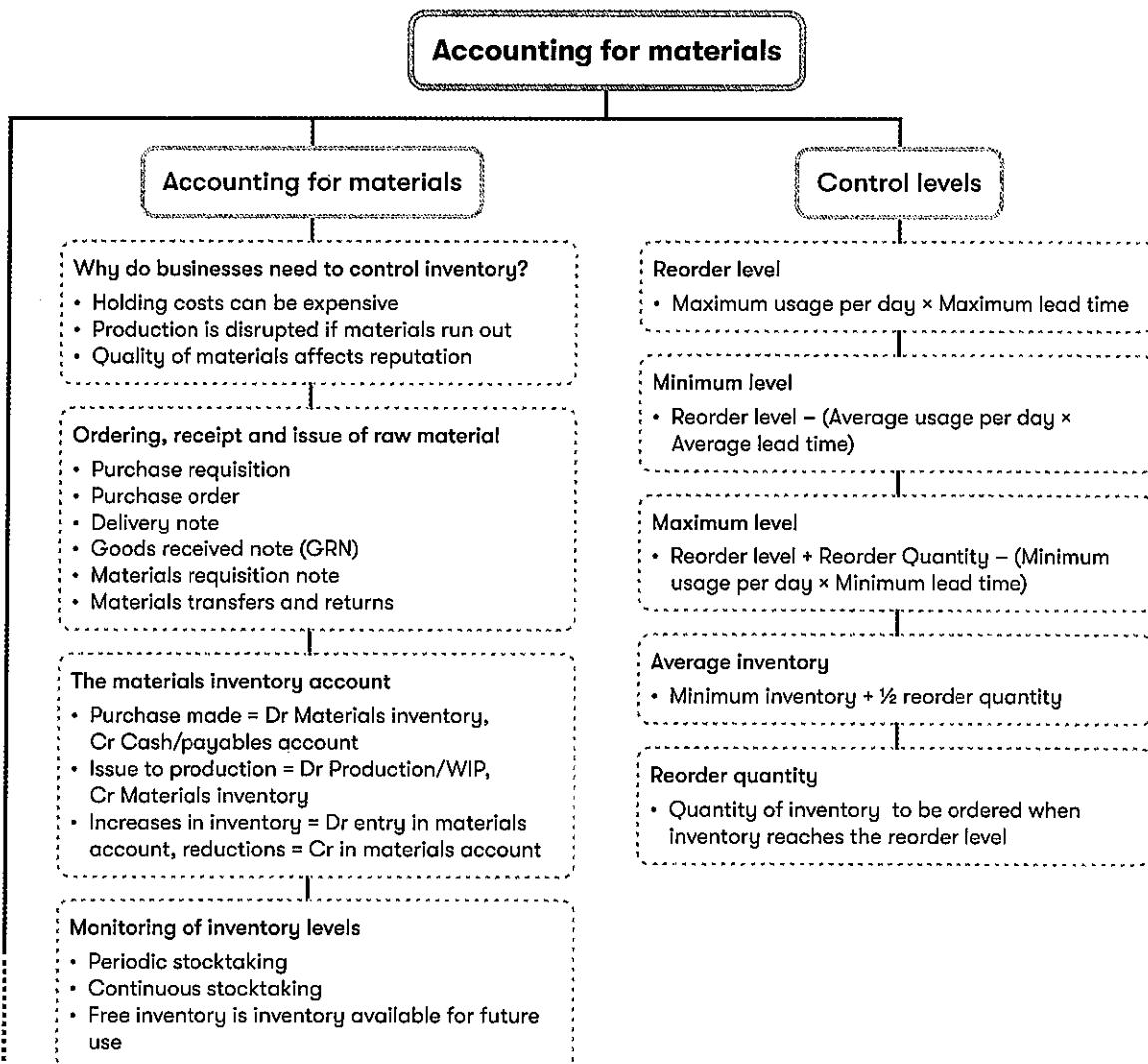
B = \$

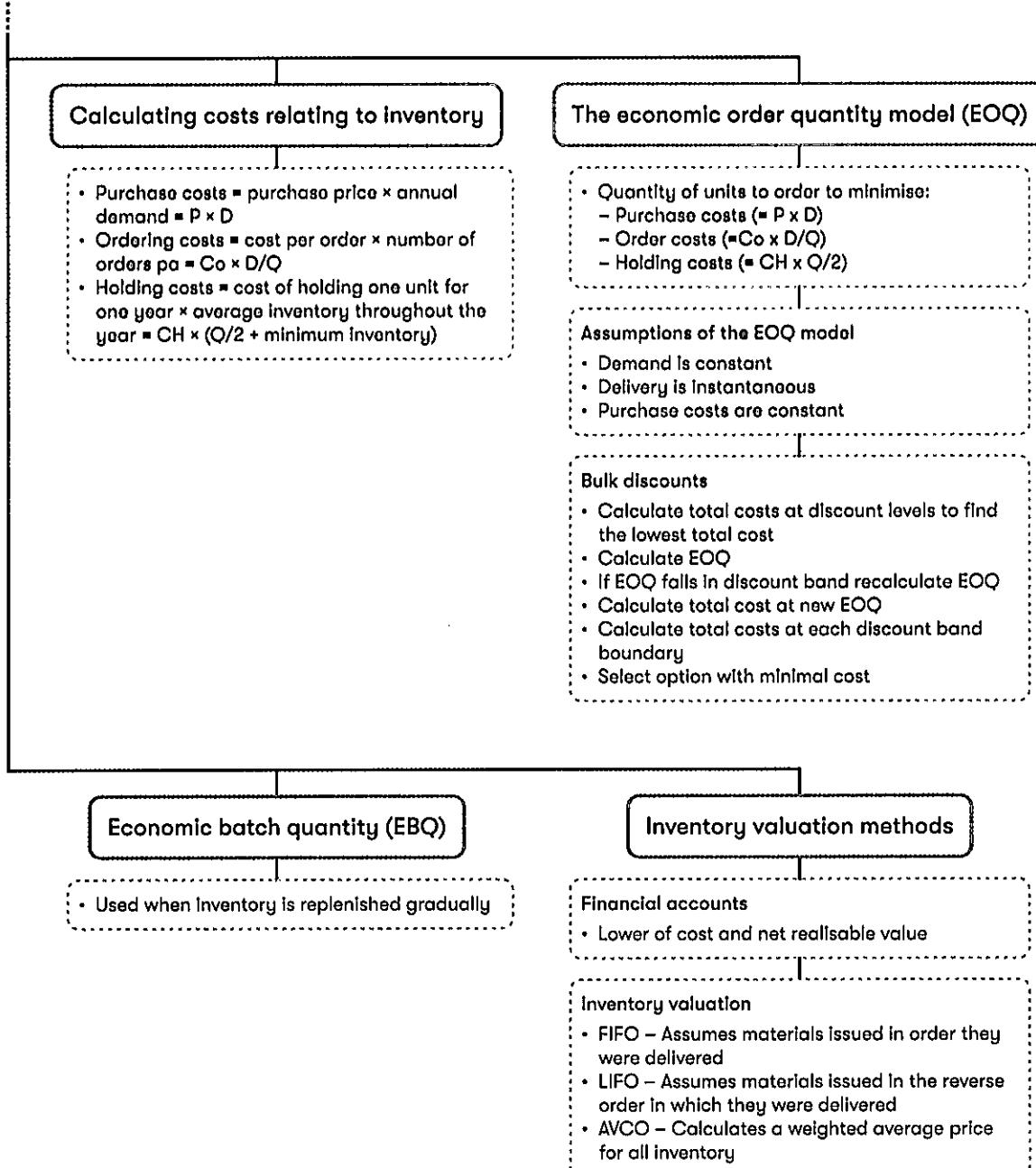
C = \$

D = \$

Solution

Chapter summary





Knowledge diagnostic

1. Inventory control

Inventory control includes the functions of inventory ordering and purchasing, receiving goods into store, storing and issuing inventory and controlling the level of inventories.

2. Ordering, receipt and issue of raw material

Documents record the movements of raw materials.

3. Monitoring of inventory levels

Inventory should be counted on a periodic or perpetual basis in order to match physical and book quantities.

4. Inventory control levels

Inventory control levels can be calculated in order to maintain inventories at the optimum level.

The three critical control levels are:

- Recorder level
- Minimum level
- Maximum level

5. Costs involved with inventory

Inventory costs include purchase costs, holding costs, ordering costs and stock-out costs.

6. The economic order quantity model

EOQ is the order quantity that minimises inventory costs.

7. Discounts

Discounts may be available if the order quantity is above a certain size. This needs to be considered in determining the best order quantity.

8. Economic batch quantity (EBQ)

EBQ is a modification of the EOQ and is used when re-supply is gradual instead of instantaneous.

9. Inventory valuation

Three methods: FIFO, LIFO, AVCO.

Further study guidance

Question practice

Now try the following from the Further question practice bank (available in the digital edition of the Workbook):

Section A questions: Q28 - Q32

Further reading

There is a technical article available on ACCA's website called *Inventory control*.

You are strongly advised to read this article in full as part of your preparation for the FMA/MA exam.

Activity answers

Activity 1: Inventory holding and ordering costs

Reasons:

- Ensure goods are available to meet demand ie no stockout
- Provide a buffer between processes
- Meet future shortages
- Take advantage of bulk discount
- Absorb seasonable fluctuations in usage and demand
- Investment if expecting shortages/inflation

Costs of holding inventory:

- Cost of storage
- Interest charges
- Insurance
- Risk of obsolescence
- Deterioration

Costs of ordering inventory:

- Clerical and administration
- Transport

Activity 2: Inventory levels

(a) The correct answer is: 36,000 units

Reorder level = max usage per day × max lead time.

$$2,250 \times 16 = 36,000 \text{ units}$$

(b) 16,500 units

Minimum level = Re-order level – (Average usage × Average lead time)

$$36,000 - ((2,250 + 1,000)/2 \times (8 + 16)/2) = 16,500 \text{ units}$$

(c) The correct answer is: 42,500 units

Maximum level = Re-order level + Re-order quantity – (Min usage × Min lead time)

$$36,000 + 16,500 - (1,000 \times 8) = 42,500 \text{ units}$$

Activity 3: Basic EOQ

(1)

$$\text{EOQ} = \sqrt{\frac{2 \times 32 \times 150 \times 12}{25 \times 0.18}} = 160 \text{ units}$$

(2)

$$\text{Total cost} = \frac{C_0 D}{Q} + PD + \frac{C_H Q}{2}$$

$$\text{Total cost} = \frac{32 \times 150 \times 12}{160} + (25 \times 150 \times 12) + \frac{25 \times 0.18 \times 160}{2} = 360 + 45,000 + 360 = \$45,720$$

(3)

	$C_H \times Q/2$	$C_0 \times D/Q$
--	------------------	------------------

Order quantities	Holding costs	Order costs
Units	\$	\$
200	$18\% \times 25 \times 200/2 = 450$	$32 \times (150 \times 12)/200 = 288$
600	1,350	96
1,000	2,250	57.6

Activity 4: Minimum total costs

The correct answer is: 300

$$EOQ = \sqrt{\frac{2C_0D}{C_h}} = \sqrt{\frac{2 \times 32 \times 150 \times 12}{25 \times 18\%}} = 160$$

Recalculate =

$$EOQ = \sqrt{\frac{2 \times 32 \times 150 \times 12}{25 \times 99\% \times 18\%}} = 160.8 \text{ units ie } 161 \text{ units}$$

Discount	Number of units ordered	Purchase cost	Ordering cost	Holding cost	Total cost
		\$	\$	\$	\$
1%	161	44,550 $\$25 \times 0.99 \times 1800$	357.76 $(32 \times 150 \times 12) / 161$	358.63 $(25 \times 0.99 \times 0.18 \times 161)/2$	45,266.39
2%	300	44,100 $\$25 \times 0.98 \times 1800$	192 $(32 \times 150 \times 12)/300$	661.5 $(25 \times 0.98 \times 0.18 \times 300)/2$	44,953.50
4%	800	43,200 $\$25 \times 0.96 \times 1800$	72 $(32 \times 150 \times 12)/800$	1,728 $(25 \times 0.96 \times 0.18 \times 800)/2$	45,000

Order 300 units at a time as total cost is minimised.

Activity 5: EBQ

$$EBQ = \boxed{720} \text{ units}$$

$$\text{Holding costs (to two decimal places)} = \$ \boxed{4.50}$$

$$\text{Set up costs (to two decimal places)} = \$ \boxed{4.50}$$

$$EBQ = \sqrt{\frac{2 \times 5.40 \times 600}{0.05(1 - \frac{600}{800})}} = 720 \text{ units}$$

Holding costs =

$$\frac{720}{2} \times 0.05 \times \left(1 - \frac{600}{800}\right) = \$4.50$$

Set up costs = $(600 / 720) \times \$5.40 = \4.50

Activity 6: EOQ and annual holding cost

The correct answer is: EOQ Higher. Annual holding costs Higher.

The cost of ordering is C_o . If C_o increases, then the EOQ and the annual holding costs will increase because it becomes more cost effective to order more units at a time.

Activity 7: Inventory valuation methods

(a) A = \$

B = \$

C = \$

D = \$

				\$
8 June	Inventory balance	30	units @ \$2.50	75
		20	units @ \$3.00	60
		50		135

Weighted average price = $\$135/50 = \2.70

10 June	Issues	10	units @ \$2.70	\$27
14 June	Issues	20	units @ \$2.70	\$54
18 June	Inventory balance	20	units @ \$2.70	54
	Remaining receipts	40	units @ \$2.40	96
		60		150

Weighted average price = $\$150/60 = \2.50

20 June	Issues	6	units × \$2.50	\$15
	Inventory balance	54	units × \$2.50	\$135

(b) A = \$

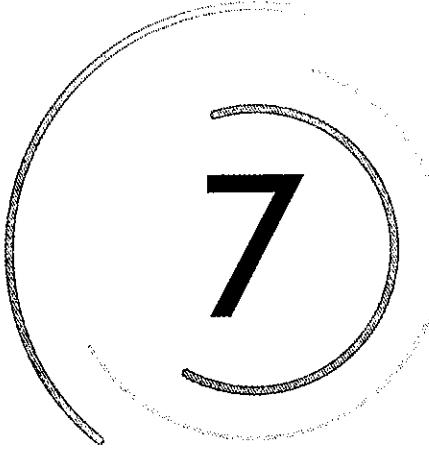
B = \$

C = \$

D = \$

10 June		10	units × \$3.00	\$30
14 June	Remaining	10	units × \$3.00	\$30

		10	units × \$2.50	\$25
20 June	Issues:	6	units × \$2.40	\$55
	Balance:	34	units × \$2.40	\$14.40
		20	units × \$2.50	81.60
		54		50.00
				131.60



7

Accounting for labour

Learning objectives

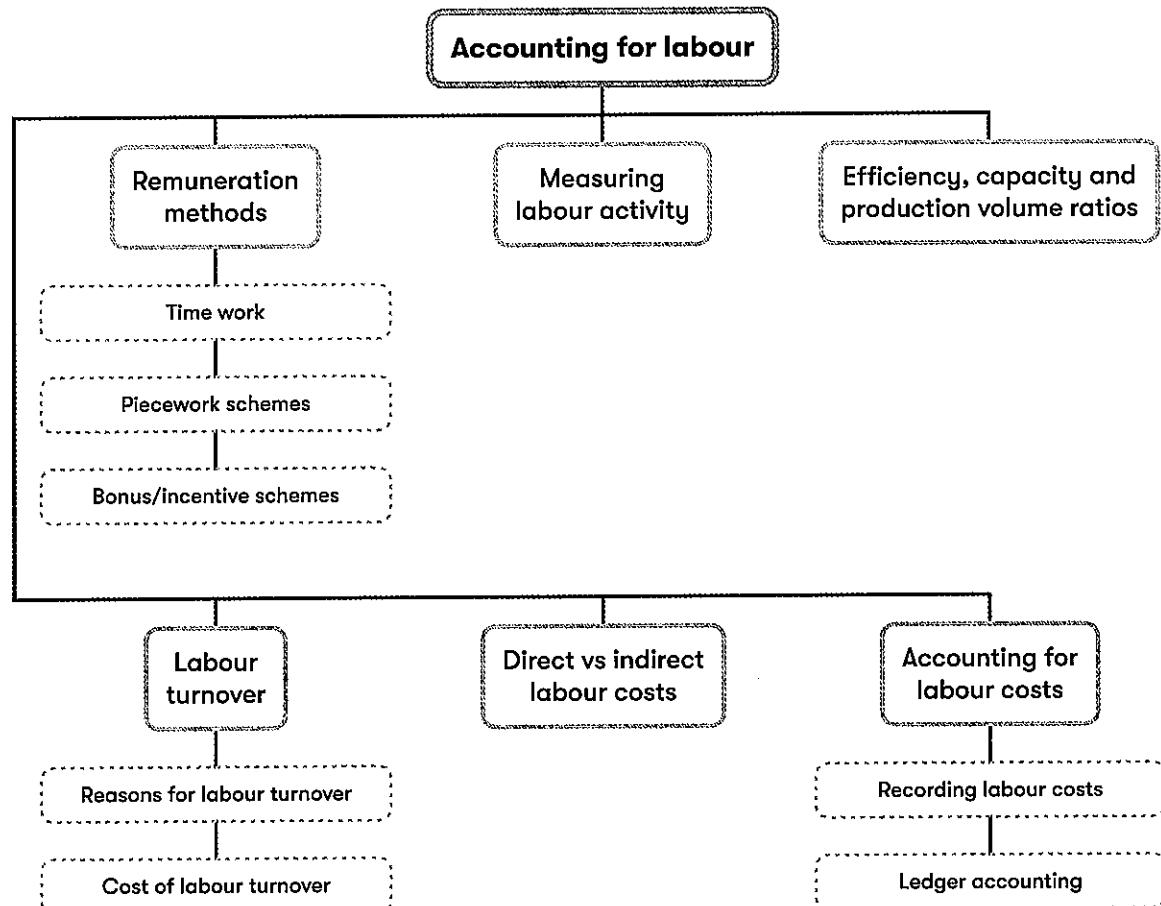
On completion of this chapter, you should be able to:

	Syllabus reference no.
Calculate direct and indirect costs of labour.	C1(b)(i)
Explain the methods used to relate input labour costs to work done.	C1(b)(ii)
Prepare the journal and ledger entries to record labour cost inputs and outputs.	C1(b)(iii)
Describe different remuneration methods: time-based systems, piecework systems and individual and group incentive schemes.	C1(b)(iv)
Calculate the level, and analyse the costs and causes of labour turnover.	C1(b)(v)
Explain and calculate labour efficiency, capacity and production volume ratios.	C1(b)(vi)
Interpret the entries in the labour account.	C1(b)(vii)

Exam context

As with materials costs in Chapter 6, the labour cost within a manufacturing or a service environment is a key area of the syllabus. You can expect to see questions on this topic in Section A of your examination.

Chapter overview



1 Remuneration methods

In the same way management need to control inventories and operate an appropriate valuation policy in an attempt to control material costs, so too must they be aware of the most suitable remuneration policy for their organisation. There are three basic groups of remuneration method:

- Time work
- Piecework schemes
- Bonus/incentive schemes.

Labour remuneration methods have an effect on the following:

- The cost of finished products and services
- The morale and efficiency of employees

1.1 Time work

Wages are determined by the number of hours worked. If an employee works more than their basic hours, then an overtime payment might be made. The most common form of time work is a day-rate system in which wages are calculated as:

$$\text{Wages} = \text{Hours worked} \times \text{Rate of pay per hour}$$

1.1.1 Overtime premium

If an employee works for more hours than the basic requirement, they may be entitled to an overtime payment. Hours of overtime are usually paid at a premium rate. For instance, if the basic day rate is \$4 per hour and overtime is paid at time and a quarter, eight hours of overtime for the week would be paid the following amount:

	\$
Basic pay ($8 \times \$4$)	32
Overtime premium ($8 \times \$1$)	8
Total overtime payment ($8 \times \$5$)	<u>40</u>

The overtime premium is the extra rate per hour which is paid and not the whole of the payment for the overtime hours. This is an important point that we will return to in Section 'Direct vs indirect labour costs'.

1.1.2 Summary of day-rate systems

- Easy to understand.
- Do not lead to complex negotiations when being revised
- Most appropriate when quality of output is more important than quantity, or where there is no basis for payment by performance
- No incentive for employees who are paid on a day rate basis to improve their performance

1.2 Piecework schemes

In this case, wages are calculated on the number of units/items produced. It is usual for pieceworkers to be guaranteed a minimum wage.



Illustration 1: Piecework

An employee is paid \$5 per piecework hour produced. In a 35 hour, week they produce the following output:

Piecework time allowed per unit	
3 units of product A	2.5 hours
5 units of product B	8.0 hours

Required

What is the employee's pay for the week?

Solution

Piecework hours produced are:

	Hours
Product A 3×2.5 hours	7.5
Product B 5×8 hours	<u>40.0</u>
	47.5
Total piecework hours	

Therefore, the employee's pay = $47.5 \times \$5 = \237.50 for the week.

1.2.1 Summary of piecework schemes

- They are occasionally used by employers as a means of increasing pay levels.
- They are often seen to drive employees to work too hard to earn a satisfactory wage.
- Careful inspection of output is necessary to ensure that quality doesn't fall as production increases.

1.3 Bonus/incentive schemes

These schemes were introduced to compensate workers paid under a time-based system, who unlike pieceworkers, could not increase their pay by being more efficient. The main aim of all these schemes is to increase productivity.

Scheme	Characteristics
High day rate	<ul style="list-style-type: none">Employees are paid a high hourly wage rate in the expectation that they will work more efficiently.Simple and guarantees consistently high wage.Doesn't guarantee employees will be more efficient.
Individual bonus	<ul style="list-style-type: none">Individual employees qualify for a bonus on top of their basic wage, with each person's bonus being calculated separately.Each person's output must be measured separately.Individual earns bigger bonus the greater their efficiency.
Group bonus	<ul style="list-style-type: none">Incentive plan which is related to the output performance of an entire group of workers, a department, or even the whole factory.Less effort to measure team output (rather than individual).Can increase cooperation between workers.Can cause friction between workers.



Activity 1: Labour costs

Normal working day	8 hours
Basic rate of pay	\$6 per hour
Standard time allowed to produce 1 unit	2 minutes
Premium bonuses	75% of time saved at basic rate

Required

What is the cost of producing 340 units in one day?

\$

Solution



Activity 2: Piecework

A company pays its employees using a piecework scheme. The rates are as follows:

0-100 units per week	\$4 per unit
101-150 units per week	\$4.50 per unit
151-200 units per week	\$5 per unit
201 + units per week	\$5.50 per unit

Required

If an employee produces 163 units in week 48, what would their pay be for that week?

\$

2 Measuring labour activity

Production and productivity are common methods of measuring labour activity.

Production is the quantity or volume of output produced. **Productivity** is a measure of the efficiency with which output has been produced. An increase in production without an increase in productivity will not reduce unit costs.



Standard hour of production: Standard hour of production is a concept used in standard costing, and refers to the number of units that can be produced by one worker, working in the standard way, at the standard rate for one hour.

In other words, a standard hour is a 'quantity of work', not a period of time.

Standard labour hours = actual units of output × standard time per unit.



Activity 3: Standard hours produced

An employee makes 200 units of product A, 350 units of product B and 300 units of product C.

- (1) 4 minutes
- (2) 2 minutes
- (3) 3 minutes

Required

What are the standard hours produced by the employee (in hours)?

3 Efficiency, capacity and production volume ratios

Measures of labour activity include the following:

$$\text{Efficiency ratio} \times \text{Capacity ratio} = \text{Production volume ratio}$$



Formula to learn

$$\text{Efficiency ratio} = \frac{\text{Expected hours to make output}}{\text{Actual hours taken}}$$

$$\text{Capacity ratio} = \frac{\text{Actual hours worked}}{\text{Hours budgeted}}$$

$$\text{Production volume ratio} = \frac{\text{Expected hours to make output}}{\text{Hours budgeted}}$$

These ratios are normally expressed as percentages.



Illustration 2: Labour activity ratios

Rush and Fluster Co budgets to make 25,000 standard units of output (in 4 hours each) during a budget period of 100,000 hours.

Actual output during the period was 27,000 units which took 120,000 hours to make.

Required

Calculate the efficiency, capacity and production volume ratios.

Solution

$$\text{Efficiency ratio} = \frac{27,000 \times 4}{120,000} \times 100\% = 90\%$$

$$\text{Capacity ratio} = \frac{120,000 \text{ hours}}{100,000 \text{ hours}} \times 100\% = 120\%$$

$$\text{Production volume ratio} = \frac{27,000 \times 4}{100,000} \times 100\% = 108\%$$



Activity 4: Labour ratios

Barnes Co budgeted to make 13,000 standard units of output during a budgeted period of 26,000 hours. Each unit should take two hours. During the period, the company made 14,000 units which took 35,000 hours.

Required

What are the efficiency, capacity and production volume ratios to one decimal place?

Efficiency ratio = %

Capacity ratio = %

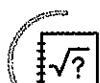
Production volume ratio = %

4 Labour turnover



Labour turnover: Labour turnover measures the number of employees leaving/being recruited in a period of time expressed as a percentage of the total labour force.

Labour turnover should ideally be kept as low as possible.



Formula to learn

Labour turnover rate = $\frac{\text{Replacements}}{\text{Average number of employees in period}} \times 100\%$



Illustration 3: Labour turnover rate

Revolving Doors Co had a staff of 2,000 at the beginning of 20X1 and, owing to a series of redundancies caused by the recession, 1,000 at the end of the year. Voluntary redundancy was taken by 1,500 staff at the end of June, 500 more than the company had anticipated, and these excess redundancies were immediately replaced by new joiners.

Required

What is the labour turnover rate to one decimal place?

%

Solution

33.3 %

Rate = $\frac{500}{(2,000 + 1,000)/2} \times 100\% = 33.3\%$



Activity 5: Labour turnover

A company has 1,000 staff at the start of 20X3 and at the end this had reduced to 920 due to redundancies being made.

100 staff took voluntary redundancy which was 20 more than the company had anticipated and these 20 employees were replaced.

Required

What is the labour turnover rate per year to one decimal place?

 %

4.1 Reasons for labour turnover

Controllable causes	Uncontrollable causes
<ul style="list-style-type: none">Demotivated staffWork not interesting / challengingStaff not appropriately rewardedStaff leave to work for a competitor	<ul style="list-style-type: none">Company recruit staff as trainees, therefore once qualified they have more options open to themRetirementIllnessStaff moving away

4.2 Costs of labour turnover

Costs associated with labour turnover can be split into two categories:

Replacement costs	Preventative costs
<ul style="list-style-type: none">Cost of selection and placementInefficiency of new labour (learning curve)TrainingTiming problems	<ul style="list-style-type: none">Costs to maintain good relationshipsCosts of welfare, eg sports facilities; canteens; social eventsEmployee benefits

5 Direct vs indirect labour costs

Labour costs can be broken down into both direct and indirect costs according to the type of worker and the work done as follows:

	Direct workers	Indirect workers
Normal basic pay	Direct cost	Indirect cost
General production: Overtime – Basic pay element	Direct cost	Indirect cost
General production: Overtime – O/T premium	Indirect cost	Indirect cost
General non-production: Overtime – Basic pay element	Indirect cost	Indirect cost

	Direct workers	Indirect workers
General non-production: Overtime – O/T Premium	Indirect cost	Indirect cost
Specific overtime – Basic pay element	Direct cost	Direct cost
Specific overtime – O/T premium	Direct cost	Direct cost

When we talk about production pay, we mean the costs of the workforce used to make a business's product or provide a service. General production means the everyday work on normal production. Non-production pay means the costs of the workforce who do not work directly on the product or service (eg administrative staff). When we talk about general overtime, we mean overtime worked to produce normal production. Specific overtime refers to overtime for a specific job.



Illustration 4: Direct and indirect labour

A direct labour employee's wage in week 5 consists of the following:

	\$
(1) Basic pay for normal hours worked, 36 hours at \$4 per hour =	144
(2) Pay at the basic rate for overtime, 6 hours at \$4 per hour =	24
(3) Overtime shift premium, with overtime paid at time and a quarter, $\frac{1}{4} \times 6$ hours $\times \$4$ per hour =	6
(4) A bonus payment under a group bonus (or "incentive") scheme – bonus for the month =	30
Total gross wages in week 5 for 42 hours of work	<u>204</u>

Required

Establish which costs are direct costs and which are indirect costs.

Solution

Items (1) and (2) are direct labour costs of the items produced in the 42 hours worked in week 5. Overtime premium, item (3), is usually classed as an overhead expense (indirect cost) rather than a direct cost. This is because it is regarded as arbitrary to charge payments in excess of the normal wage rate against a particular order, simply because work on the order happened at the end of the production schedule and fell into overtime hours. It was no 'fault' of the customer and should not be reflected in its cost (and possibly therefore, its price).

Overtime premiums are generally regarded as indirect costs, unless that overtime is worked at the specific request of a customer to get their order completed, in which case the overtime premium paid is classed as a direct cost of fulfilling the order.

Group bonus scheme payments, item (4), are usually overhead costs, because they cannot normally be traced directly to individual products or jobs.

In this example, the direct labour employee costs were \$168 in direct costs and \$36 in indirect costs.



Activity 6: Labour cost classification

Busy bees employs two types of labour: skilled workers, considered to be direct workers and semi-skilled workers, considered to be indirect workers. Skilled workers are paid \$10 per hour and semi-skilled, \$7.50 per hour. All employees work a standard 35 hour week. There are seven skilled workers and four semi-skilled workers.

The skilled workers have worked 50 hours of overtime this week, 20 hours on a specific order and 30 hours on general production.

The semi-skilled workers have worked 20 hours of overtime, 10 hours on a specific order at a customer's request and the remaining 10 hours to meet general production requirements.

All overtime is paid at time and a half.

Required

What are the total direct and indirect labour costs for the week (to two decimal places)?

Direct costs = \$

Indirect costs = \$

6 Accounting for labour costs

6.1 Recording labour costs

Records can include:

- Attendance time records
- Job time records (to record the amount of labour time spent on individual jobs)
- Time sheets (to record the amount of labour time spent on individual clients, eg accounting and law)



Essential reading

See Chapter 7, Section 1 of the Essential reading, for detail on the records.

The Essential reading is available as an Appendix of the digital edition of the Workbook.

6.2 Ledger accounting

When gross wages are paid to employees, they are accounted for as:

Dr: Wages control account

Cr: Bank/Income tax control account/Social security control account

When labour is used within a particular production process, the direct labour costs are transferred from the wages control account using:

Dr: Work in progress account

Cr: Wages control account

Indirect labour costs are transferred from the wages control account to be grouped with other indirect costs using:

Dr: Production overhead account

Cr: Wages control account

WAGES CONTROL ACCOUNT

	\$		\$
Bank etc (actual wages)	X	WIP (direct labour)	X
		Production overheads (indirect labour)	X
		Statement of profit or loss (balancing figure)	X
	X		X

 **Illustration 5: The wages control account**

The following details were extracted from a weekly payroll for 750 employees at a factory:

Analysis of gross pay

	Direct workers	Indirect workers	Total
	\$	\$	\$
Ordinary time	36,000	22,000	58,000
Overtime: basic wage	8,700	5,430	14,130
premium	4,350	2,715	7,065
Shift allowance	3,465	1,830	5,295
Sick pay	950	500	1,450
Idle time	<u>3,200</u>	<u>—</u>	<u>3,200</u>
	<u>56,665</u>	<u>32,475</u>	<u>89,140</u>
Net wages paid to employees	\$45,605	\$24,220	\$69,825

Required

Prepare the wages control account for the week.

Solution

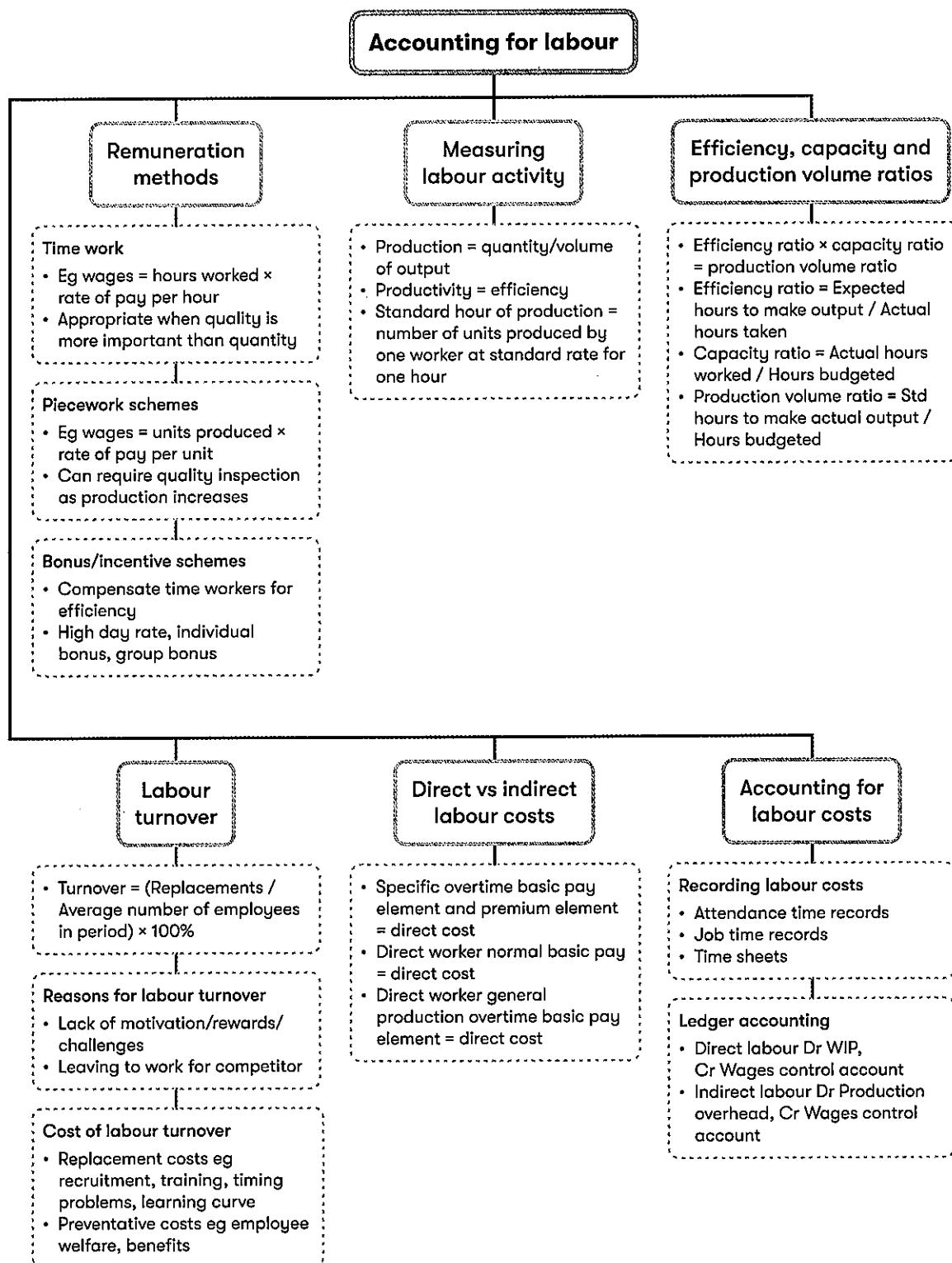
- (1) The wages control account acts as a sort of 'collecting place' for net wages paid and deductions made from gross pay. The gross pay is then analysed between direct and indirect wages.
- (2) The first step is to determine which wage costs are **direct** and which are **indirect**. The direct wages will be debited to the work in progress account and the indirect wages will be debited to the production overhead account.
- (3) There are, in fact only two items of direct wages cost in this example, the ordinary time (\$36,000) and the basic overtime wage (\$8,700) paid to direct workers. All other payments (including the overtime premium) are indirect wages.
- (4) The net wages paid are debited to the control account, and the balance then represents the deductions which have been made for tax, social insurance, and so on.

WAGES CONTROL ACCOUNT

	\$		\$
Bank: net wages paid	69,825	Work in progress – direct labour	44,700
Deductions control accounts*		Production overhead control:	
(\$89,140 - \$69,825)	<u>19,315</u>	Indirect labour	27,430
		Overtime premium	7,065
		Shift allowance	5,295
		Sick pay	1,450
		Idle time	<u>3,200</u>
	<u>89,140</u>		<u>89,140</u>

*In practice, there would be a separate deductions control account for each type of deduction made (for example, tax and social insurance).

Chapter summary



Knowledge diagnostic

1. Remuneration methods

Methods of remuneration for production staff include:

- Time based systems
- Piecework systems
- Bonus/incentive systems

2. Measuring labour activity

Labour productivity is a measure of the efficiency with which output has been produced.

Businesses will monitor productivity as part of their cost control procedures. You need to be able to calculate:

- Efficiency ratios
- Capacity ratios
- Production volume ratios

3. Labour turnover

High labour turnover will cause increased cost to a business.

4. Accounting for labour costs

Labour costs will be split between direct and indirect costs and double entry will be used to record these costs.

Further study guidance

Question practice

Now try the following from the Further question practice bank (available in the digital edition of the Workbook):

Section A questions: Q33 - Q37

Activity answers

Activity 1: Labour costs

\$ [63]

Standard time	340×2 mins	680 mins
Actual time	$8 \text{ hrs} \times 60 \text{ mins}$	480 mins
Time saved		200 mins
Bonus	$75\% \times (200 \text{ mins}/60) \times \$6/\text{hr}$	\$15
Basic	$8 \text{ hr} \times \$6$	\$48
		<u>\$63</u>

Activity 2: Piecework

\$ [690]

		\$
1 st 100 units	$(100 \times \$4)$	400
Next 50 units	$(50 \times \$4.50)$	225
Remaining 13 units	$(13 \times \$5)$	65
Week 48 pay		<u>690</u>

Activity 3: Standard hours produced

Standard hours produced:

A	$200 \times 4 =$	800
B	$350 \times 2 =$	700
C	$300 \times 3 =$	900
		<u>2,400 mins</u>
		$\div 60 = 40 \text{ hours}$

Activity 4: Labour ratios

Efficiency ratio = [80.0] %

Capacity ratio = [134.6] %

Production volume ratio = [107.7] %

Efficiency ratio = $((14,000 \times 2)/35,000) \times 100 = 80.0\%$

Capacity ratio = $(35,000/26,000) \times 100 = 134.6\%$

Production volume ratio = $((14,000 \times 2)/26,000) \times 100 = 107.7\%$

Activity 5: Labour turnover

[2.1] %

$$\text{Rate} = \frac{20}{(1,000 + 920)/2} \times 100\% = 2.1\%$$

Activity 6: Labour cost classification

Direct costs = \$ 3,162.50

Indirect costs = \$ 1,312.50

	Direct cost \$	Indirect cost \$
Skilled workers:		
Basic pay for normal hours worked		
(7 × 35 × \$10)	2,450	
Basic pay for general overtime		
(30 × \$10)	300	
Specific overtime		
(20 × \$10 × 1.5)	300	
Overtime premium for general overtime		
(30 × \$10 × 0.5)	150	
Semi-skilled workers:		
Basic pay for normal hours		
(4 × 35 × \$7.50)	1,050	
Specific overtime		
(10 × \$7.50 × 1.5)	112.50	
General overtime		
(10 × \$7.50 × 1.5)	112.50	
	<u>3,162.50</u>	<u>1,312.50</u>

8

Accounting for overheads

Learning objectives

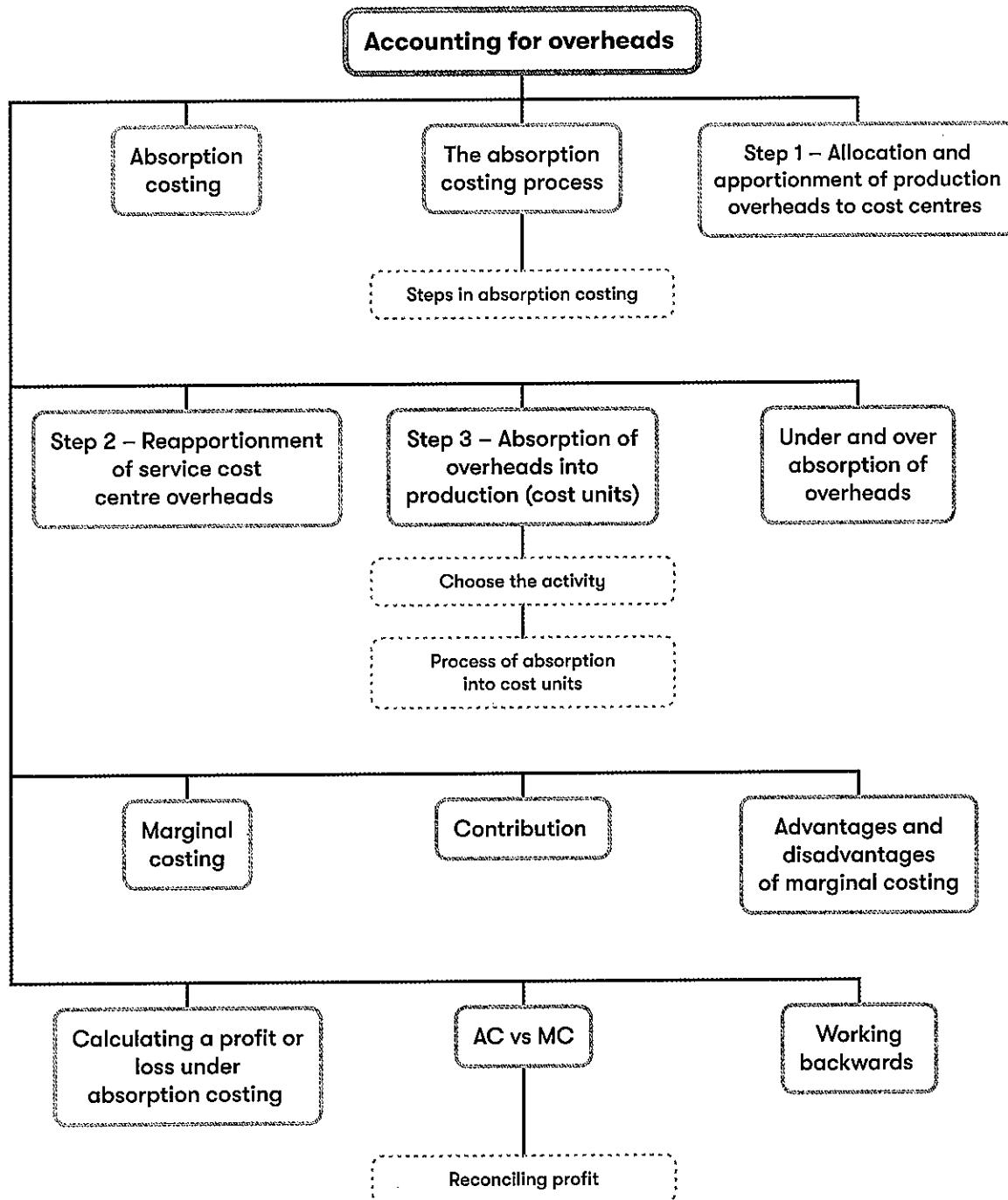
On completion of this chapter, you should be able to:

	Syllabus reference no.
Explain the different treatment of direct and indirect expenses.	C1 (c) (i)
Describe the procedures involved in determining production overhead absorption rates.	C1 (c) (ii)
Allocate and apportion production overheads to cost centres using an appropriate basis.	C1 (c) (iii)
Reapportion service cost centre costs to production cost centres (including using the reciprocal method where service cost centres work for each other).	C1 (c) (iv)
Select, apply and discuss appropriate bases for absorption rates.	C1 (c) (v)
Prepare journal and ledger entries for manufacturing overheads incurred and absorbed.	C1 (c) (vi)
Calculate and explain the under- and over-absorption of overheads.	C1 (c) (vii)
Explain the importance of, and apply, the concept of contribution.	C2 (a)
Demonstrate and discuss the effect of absorption and marginal costing on inventory valuation and profit determination.	C2 (b)
Calculate profit or loss under absorption and marginal costing.	C2 (c)
Reconcile the profits or losses calculated under absorption and marginal costing.	C2 (d)
Describe the advantages and disadvantages of absorption and marginal costing.	C2 (e)

Exam context

Overhead apportionment and absorption is one of the most important topics in your Management Accounting studies and is almost certain to appear in Section A of the examination you will be facing.

Chapter overview



1 Absorption costing

1.1 Overview

Absorption costing is a method for accounting for overheads that allows a business to determine the cost of making its product or providing a service.

Businesses need to be able to ascertain the full cost of making their product or service for three main reasons:

- Profitability analysis – a business can judge how profitable each individual product is if overheads are shared on a fair basis to each product.
- Determining the selling price – many companies attempt to fix selling prices by calculating the full cost of production or sales of each product, and then adding a margin for profit. Without using absorption costing, a full cost is difficult to ascertain.
- Inventory valuation purposes – absorption costing is recommended in financial accounting by IAS 2 Inventories. Closing inventories should be valued at full factory cost.

1.2 Cost card

A cost card can be built up for an individual unit.

For example:

	Cost/unit
Direct materials	\$ 8
Direct labour	3 hours @ \$7/hr
Direct expenses	4
Prime costs	33
Indirect costs (overheads)	10
Total cost	<u>43</u>

1.3 Production overheads

An overhead is a cost incurred in the course of production that can't be traced directly to the product or service, hence overheads are often referred to as indirect costs.



Example

Indirect materials	Oil, grease, paper towels
Indirect labour	Supervisors salary
Indirect expenses	Rent, rates, insurance, depreciation

Ascertaining the direct costs of a cost unit to get the prime cost is usually quite straightforward.

However, since overheads are not identified with specific cost units, we need a method to charge a share of the total production overhead to each cost unit.

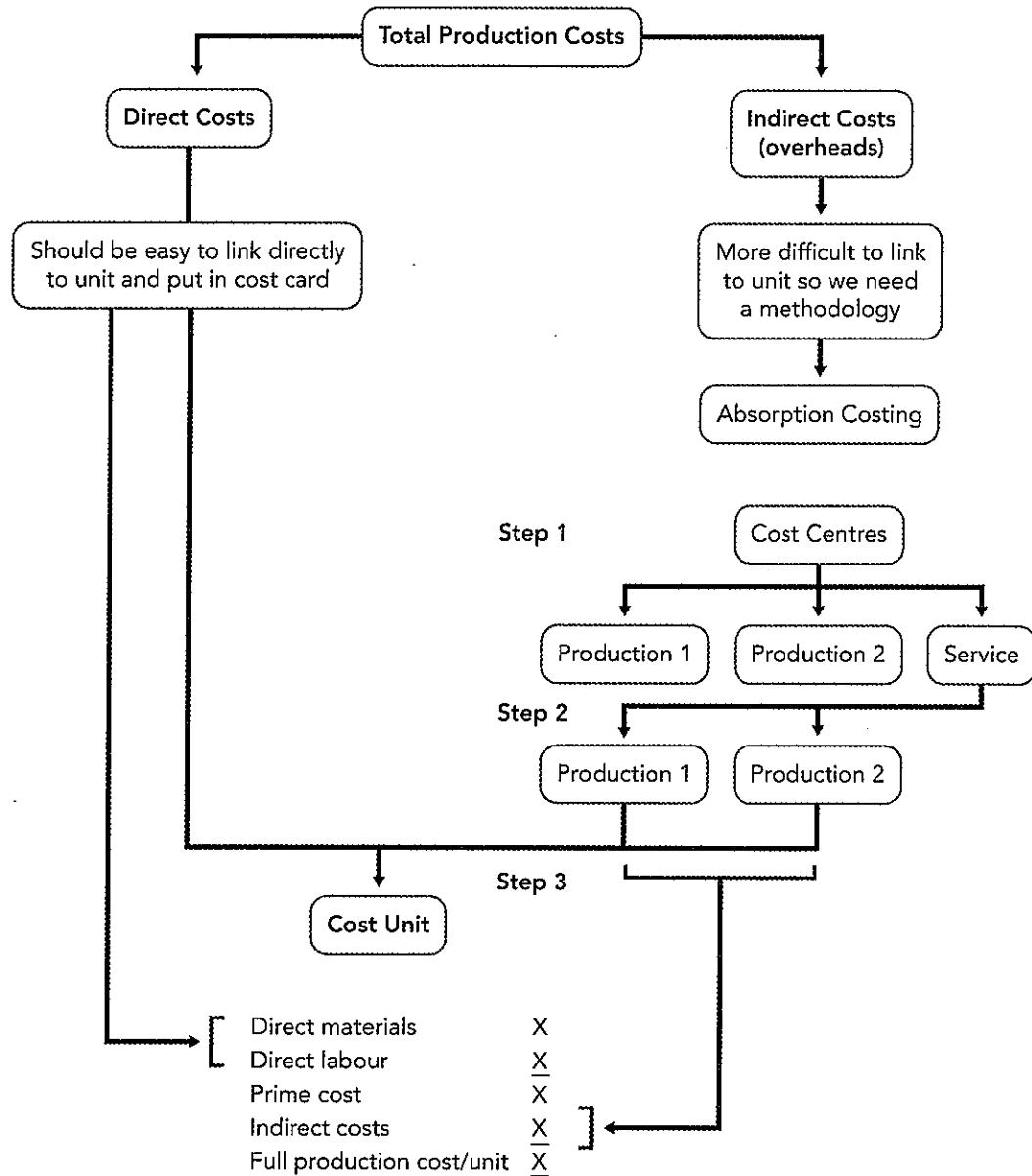
2 The absorption costing process

The objective of absorption costing (AC) is to calculate the **full production cost** for a unit of output. It does this by including an appropriate share of the organisation's overheads in the total cost of each product.



Absorption costing: A method for sharing overheads between different products on a fair basis using an overhead absorption rate.

2.1 Absorption costing overview



2.2 Steps in absorption costing

- Step 1 Allocate and apportion production overheads to cost centres.
- Step 2 Reapportion overheads in service cost centres to production cost centres.
- Step 3 Absorb overheads into cost units.

3 Step 1 – Allocation and apportionment of production overheads to cost centres

The first stage in valuing the overhead cost of a cost unit is to allocate and apportion overheads between the cost centres.

Allocation is the process by which whole cost items are charged direct to a cost unit or a cost centre.

Apportionment is a procedure whereby indirect costs are spread fairly between cost centres.



Illustration 1: Overhead allocation

Consider the following costs of a company.

Wages of the foreman of department A	\$200
Wages of the foreman of department B	\$150
Indirect materials consumed in department A	\$50
Rent of the premises shared by departments A and B	\$300

The cost accounting system might include three overhead cost centres.

Cost centre:

- 101 Department A
- 102 Department B
- 201 Rent

Required

How would the overhead costs be allocated?

Solution

Remember that allocation is the process by which **whole cost items** are charged direct to the cost unit or cost centre.

These overhead costs would be allocated **directly to each cost centre**, ie \$200 + \$50 to cost centre 101, \$150 to cost centre 102 and \$300 to cost centre 201. The rent of the factory will subsequently be shared between the two production departments but, for the purpose of day to day cost recording, the rent will first of all be charged in full to a separate cost centre

Apportioned costs are apportioned to cost centre on '**some fair basis**'. You will need to identify relevant information from the question and think about why the cost is being generated, to decide on the most appropriate basis. The bases of apportionment for the most usual cases are given below.

Overhead to which the basis applies	Basis
Rent, rates, heating and light, repairs and depreciation of buildings	Floor area occupied by each cost centre

Overhead to which the basis applies	Basis
Depreciation, insurance of equipment	Cost or book value of equipment
Personnel office, canteen, welfare, wages and cost offices, first aid	Number of employees, or labour hours worked in each cost centre



Illustration 2: Overhead apportionment

Swotathon Inc has two production departments (A and B) and two service departments (maintenance and stores). Details of next year's budgeted overheads are shown below.

	Total (\$)			Total (\$)
Heat and light	19,200	Rent and rates		38,400
Repair costs	9,600	Canteen		9,000
Machinery depreciation	54,000	Machinery insurance		25,000

Details of each department are as follows:

	A	B	Maint'nce	Stores	Total
Floor area (m ²)	6,000	4,000	3,000	2,000	15,000
Machinery book value (\$)	48,000	20,000	8,000	4,000	80,000
Number of employees	50	40	20	10	120
Allocated overheads (\$)	15,000	20,000	12,000	5,000	50,000

Service departments' services were used as follows:

	A	B	Maint'nce	Stores	Total
Maintenance hours worked	5,000	4,000		1,000	10,000
Number of stores requisitions	3,000	1,000			4,000

Required

How should the overheads be apportioned between the four departments?

Solution

Item of cost	Basis of apportionment	Department					
		A	B	Maint'nce	Stores	Total	
						\$	\$
Heat and light	Floor area (W1)	7,680	5,120	3,840	2,560	19,200	
Repair costs	Floor area (W1)	3,840	2,560	1,920	1,280	9,600	
Machine dep	Machinery value (W2)	32,400	13,500	5,400	2,700	54,000	
Rent and rates	Floor area (W1)	15,360	10,240	7,680	5,120	38,400	

Item of cost	Basis of apportionment	Department				
		A	B	Maint'nce	Stores	Total
		\$	\$	\$	\$	\$
Canteen	No of employees (W3)	3,750	3,000	1,500	750	9,000
Machine insurance	Machinery value (W2)	<u>15,000</u>	<u>6,250</u>	<u>2,500</u>	<u>1,250</u>	25,000
Total		<u>78,030</u>	<u>40,670</u>	<u>22,840</u>	<u>13,660</u>	

Workings

1 Overhead apportioned by floor area

Overhead apportioned to department = (Floor area occupied by department/Total floor area) × total overhead

For example:

Heat and light apportioned to Dept A = (6,000 / 15,000) × 19,200 = \$7,680

2 Overheads apportioned by machinery value

Overheads apportioned to department = (Value of department's machinery/Total value of machinery) × total overhead

3 Overheads apportioned by number of employees

Overheads apportioned to department = (Number of employees/Total number of employees) × total overhead



Activity 1: Overhead allocation and apportionment

Marz Co has the following overheads in the year ended 31 December 20X5:

Overhead	\$
Rent and rates	90,000
Insurance of machinery and equipment	40,000
Stores costs (wages and salaries)	75,000
Heating costs	<u>57,000</u>
	<u>262,000</u>

Additional information includes:

	Mixing	Stirring	Stores	Canteen	Total
Floor space (square metres)	9,000	3,000	1,000	2,000	15,000
NBV of machinery and equipment (\$'000)	2,000	1,000	600	400	4,000

Required

After allocating and apportioning overhead costs, calculate the total cost in the mixing dept, stirring dept, stores and canteen:

Mixing department \$

Stirring department \$

Store department \$

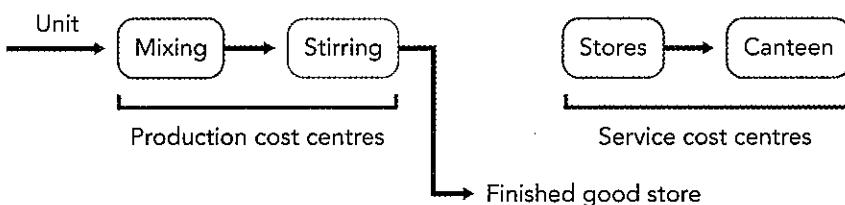
Canteen department \$

Solution

4 Step 2 – Reapportionment of service cost centre overheads

Factory cost centres can be broken down into two types:

- (a) **Production cost centres** – through which cost units actually flow – these make the cost units.
- (b) **Service cost centres** – which support/service the production cost centres and each other

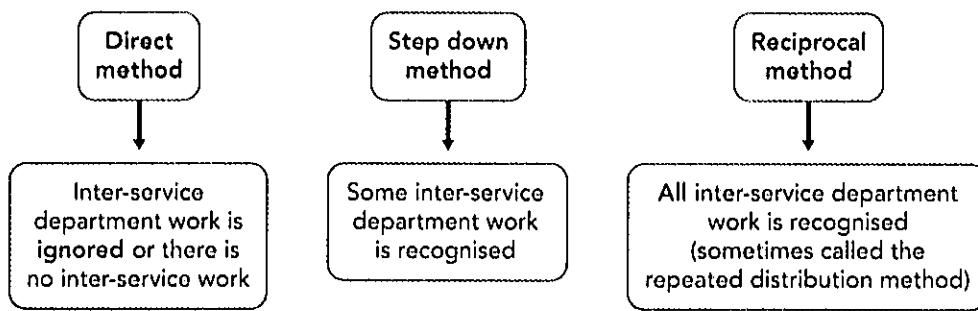


We therefore need to transfer all service cost centre overheads to the production centres so that all production overheads for the period are shared between the production cost centres alone – as it is through these cost centres that cost units flow.

The reapportionment becomes a little more complicated where there is:

- More than one service cost-centre; and
- The service centres do work for one another (inter-service department work), for example, the canteen feeds employees in stores and stores holds materials for canteen.

To reapportion service cost centre overheads to production cost centre, there are three methods.



(a) **The direct method**

All the inter-service department work is ignored and service centre overheads are reapportioned directly to production cost centres.

Mainly used when there is only one service centre or the service centres do not work for each other.

A simple but inaccurate method.

(b) **The step-down method**

A method best used when some service cost centres provide services to other service cost centres, but these services are not reciprocated. For example, when maintenance employees eat in the canteen, but kitchen equipment is not serviced by the maintenance department.

The service department that serves most other service centres should be reapportioned first. We then 'step down' to the service centre that provides the second most service, and so on.

This method provides a simple approximation.

(c) **The reciprocal method (repeated distribution)**

This method recognises all inter-service department work and is therefore more accurate. This accuracy is more time consuming to calculate. If the examiner wants this method used, it will ask for a method that 'fully reflects the reciprocal services involved'.

The reciprocal method can be carried out in one of two ways:

- (i) Repeated distribution/continuous apportionment
- (ii) Algebraic method. (Most efficient use of time in the exam.)



Illustration 3: Service cost reapportionment

	Production depts		Service centres	
	Mixing	Stirring	Stores	Canteen
			\$	\$
Allocated and apportioned overheads from Marz Co	108,200	39,400	90,800	23,600
Estimated work done by the service centres for other departments:				
Stores	50%	30%	—	20%
Canteen	45%	40%	15%	—

After the apportionment of the service departments to the production department, the total overhead costs for the production departments using the different methods will be:

Required

- 1 Direct method

Mixing \$

Stirring \$

- 2 Step down method

Mixing \$

Stirring \$

- 3 Repeated distribution method

Mixing \$

Stirring \$

- 4 Algebraic method

Mixing \$

Stirring \$

Solution

1 Mixing \$

Stirring \$

Direct method

	Production depts		Service centres	
	Mixing	Stirring	Stores	Canteen
			\$	\$
Overheads	108,200	39,400	90,800	23,600
Reapportion Stores (50:30)	56,750	34,050	(90,800)	-
Reapportion Canteen (45:40)	<u>12,494</u>	<u>11,106</u>	-	<u>(23,600)</u>
	<u>177,444</u>	<u>84,556</u>	=	=

2 Mixing \$

Stirring \$

Step down method

	Production depts		Service centres	
	Mixing	Stirring	Stores	Canteen
			\$	\$
Overheads	108,200	39,400	90,800	23,600

	Production depts		Service centres	
	Mixing	Stirring	Stores	Canteen
	\$	\$	\$	\$
Reapportion Stores (50:30:20)	45,400	27,240	(90,800)	18,160
Reapportion Canteen (45:40)	<u>22,108</u>	<u>19,652</u>	—	<u>(41,760)</u>
	<u><u>175,708</u></u>	<u><u>86,292</u></u>	—	—

3 Mixing \$ 176,203

Stirring \$ 85,797

Repeated distribution method

	Production depts		Service centres	
	Mixing	Stirring	Stores	Canteen
	\$	\$	\$	\$
Overheads	108,200	39,400	90,800	23,600
Reapportion Stores (50:30:20)	45,400	27,240	<u>(90,800)</u>	<u>18,160</u>
			—	<u>41,760</u>
Reapportion Canteen (45:40:15)	18,792	16,704	<u>6,264</u>	<u>(41,760)</u>
			<u>6,264</u>	—
Reapportion Stores (50:30:20)	3,132	1,879	<u>(6,264)</u>	<u>1,253</u>
			—	<u>1,253</u>
Reapportion Canteen (45:40:15)	564	501	<u>188</u>	<u>(1,253)</u>
			<u>188</u>	—
Reapportion Stores (50:30:20)	94	56	<u>(188)</u>	<u>38</u>
			—	<u>38</u>
Reapportion Canteen (45:40:15)	17	15	<u>6</u>	<u>(38)</u>
			<u>6</u>	—
Reapportion Stores (50:30:20)	3	2	<u>(6)</u>	<u>1</u>
			—	<u>1</u>
Reapportion Canteen (45:40:15)	1	—	—	<u>(1)</u>
	<u><u>176,203</u></u>	<u><u>85,797</u></u>	—	—

4 Mixing \$ 176,203

Stirring \$ 85,797

Let:

S be the total amount reapportioned out of stores

C be the total amount reapportioned out of maintenance

Then:

$$S = 90,800 + 0.15C$$

$$C = 23,600 + 0.2S$$

Solve for S and C:

$$S = 90,800 + 0.15(23,600 + 0.2S)$$

$$S = 90,800 + 3,540 + 0.03S$$

$$0.97S = 94,340$$

$$S = 97,258$$

Substitute:

$$97,258 = 90,800 + 0.15C$$

$$C = 43,053$$

	Production depts		Service centres	
	Mixing	Stirring	Stores	Canteen
	\$	\$	\$	\$
Overheads	108,200	39,400	90,800	23,600
Reapportion Stores (50:30:20)	48,629	29,177	(97,258)	19,452
Reapportion Canteen (45:40:15)	<u>19,374</u>	<u>17,221</u>	<u>6,458</u>	<u>(43,053)</u>
	<u><u>176,203</u></u>	<u><u>85,797</u></u>	<u><u>—</u></u>	<u><u>—</u></u>

Activity 2: Step-down method

Acorn Co has two production cost centres (A and B) and two service cost centres (C and D). The following overheads have been apportioned and allocated to the cost centres.

Cost centre	A	B	C	D
Allocated and apportioned overhead (\$)	12,000	16,000	8,000	10,000

The company has calculated the following usage of C and D's services.

	A	B	C	D
Use of C's services	60%	30%	Nil	10%
Use of D's services	80%	20%	Nil	Nil

Required

How much would cost centre A's total overhead cost be if the company used the step-down method to reapportion service cost centre overheads?

- \$16,800
- \$20,000
- \$24,800
- \$25,440

5 Step 3 – Absorption of overheads into production (cost units)

All of the production overhead costs have now been apportioned to the production cost centres. We now need to charge these to the cost units passing through the production cost centres. This is termed **absorption**. We are going to absorb an element of total production overhead into each cost unit.



Overhead absorption: The process whereby overhead costs allocated and apportioned to production cost centres are added to unit, job or batch costs.

Overheads are usually added to cost units using a predetermined **overhead absorption rate**, which is calculated using figures from the budget.



Formula to learn

Overhead absorption rate (OAR) = Budgeted production overhead/Budgeted activity level

5.1 Choosing the activity

Ideally, the basis chosen for the activity should be the one which most accurately reflects the way in which the overheads are in fact being incurred:

For example:

- Per unit*
- Per labour hour*
- Per machine hour*
- % of direct labour cost
- % of direct materials cost
- % of prime cost

*Main methods used in exam

5.2 Process of absorption into cost units

Where the OAR has been calculated using an activity other than units, some extra calculation will be required to get the cost for the cost card.

- (a) Calculate the overhead absorption rate using an appropriate activity level (eg number of machine hours).

OAR = Production overhead/Activity level

- (b) Find the activity level per unit (eg machine hours per unit) and then apply the OAR calculated to the specific unit.

OAR per unit = OAR per machine hour × machine hours per unit

- (c) Repeat for all production cost centres.

Remember each production cost centre may absorb overhead on a different basis.



Illustration 4: Separate absorption rates

The Old Grammar School has two production departments, for which the following budgeted information is available.

	Department A	Department B	Total
Budgeted overheads	\$360,000	\$200,000	\$560,000
Budgeted direct labour hours	200,000 hrs	40,000 hrs	240,000 hrs

If a single factory overhead absorption rate is applied, the rate of overhead recovery would be:

$$\$560,000 / 240,000 \text{ hrs} = \$2.33 \text{ per direct labour hour}$$

If separate departmental rates are applied, these would be:

$$\text{Department A} = \$360,000 / 200,000 \text{ hrs} = \$1.80 \text{ per direct labour hour}$$

$$\text{Department B} = \$200,000 / 40,000 \text{ hrs} = \$5 \text{ per direct labour hour}$$

Department B has a higher overhead rate of cost per hour worked than department A.

Now let us consider two separate jobs.

Job X has a prime cost of \$100, takes 30 hours in department B and does not involve any work in department A.

Job Y has a prime cost of \$100, takes 28 hours in department A and 2 hours in department B.

What would be the factory cost of each job, using the following rates of overhead recovery?

Required

- 1 A single factory rate of overhead recovery
- 2 Separate departmental rates of overhead recovery

Solution

Using a single factory overhead absorption rate, both jobs would cost the same. However, since job X is done entirely within department B, where overhead costs are relatively higher, whereas job Y is done mostly within department A, where overhead costs are relatively lower, it is arguable that job X should cost more than job Y. This will occur if separate departmental overhead recovery rates are used to reflect the work done on each job in each department separately.

If all jobs do not spend approximately the same time in each department then, to ensure that all jobs are charged with their fair share of overheads, it is necessary to establish **separate overhead rates for each department**.

1

	Job X	Job Y
Single factory rate	\$	\$
Prime cost	100	100
Factory overhead ($30 \times \$2.33$)	<u>70</u>	<u>70</u>
Factory cost	<u><u>170</u></u>	<u><u>170</u></u>

	Job X	Job Y
Single factory rate	\$	\$
Prime cost	100	100.00
Factory overhead:		
Department A	0	(28 × \$1.80)
Department B (30 × \$5)	<u>150</u>	(2 × \$5)
Factory cost	<u>250</u>	<u>160.40</u>



Activity 3: Overhead absorption rate

Marz Co has decided to use the direct method to re-apportion service centre costs to its two production departments, mixing and stirring.

As calculated previously, this resulted in allocated overheads of \$177,444 and \$84,556 to the mixing and stirring departments respectively.

During the year, the following data has been collected:

	Mixing	Stirring
Direct labour hours	12,500	4,000
Direct machine hours	2,000	10,000
Number of batches of Marz cakes (each batch consists of 1,000 cakes)	2,500	2,500
Direct materials cost	\$75,000	\$30,000
Direct labour cost	\$62,500	\$20,000

Note that Marz cakes are just one of many products produced by Marz Co in this factory.

Required

- Decide which basis you think is most appropriate for the absorption of overheads in each department and state why.
- Using the bases chosen in 1, calculate the overhead absorption rate per batch.

(a) In the mixing department \$

(b) In the stirring department \$

Solution

6 Under- and over absorption of overheads

Under- and over-absorption of overheads occurs because the predetermined overhead absorption rates are based on estimates.

Over-absorption means that the overheads charged to the cost of sales are greater than the overheads actually incurred.

Under-absorption means that insufficient overheads have been included in the cost of sales.

It is almost inevitable that at the end of the accounting year, there will have been an over-absorption or under absorption of the overhead actually incurred.

The under-over-absorption of overheads can be calculated as follows:

	\$
Actual overhead incurred	X
Overhead absorbed ($OAR \times$ actual units)	<u>(X)</u>
Under/over-absorption of overheads	<u>X/(X)</u>

If the actual overhead incurred is greater than the absorbed overhead, then overheads are under absorbed.

If the actual overhead incurred is less than the absorbed overhead, then overheads are over absorbed.



Example: Over- and under-absorption

Suppose that the budgeted overhead in a production department is \$80,000 and the budgeted activity is 40,000 direct labour hours. The overhead recovery rate (using a direct labour hour basis) would be \$2 per direct labour hour.

Actual overheads in the period are, say, \$84,000 and 45,000 direct labour hours are worked.

	\$
Overhead incurred (actual)	84,000
Overhead absorbed ($45,000 \times \$2$)	<u>90,000</u>
Over-absorption of overhead	<u>6,000</u>

In this example, the cost of production includes \$6,000 more of overhead than was actually incurred. An adjustment to reconcile the overheads charged to the actual overhead is necessary and the over-absorbed overhead will be credited to the statement of profit or loss account at the end of the accounting period.



Activity 4: Over- and under-absorption

A company uses an overhead absorption rate of \$2.50 per machine hour, based on 32,000 budgeted machine hours for the period. During the same period, the actual total overhead expenditure amounted to \$78,875 and 30,000 machine hours were recorded on actual production.

Required

By how much was the total overhead under or over absorbed for the period?

- Over absorbed by \$3,875
- Under absorbed by \$5,000
- Over absorbed by \$5,000
- Under absorbed by \$3,875

Solution

6.1 Ledger entries relating to overheads

When an absorption costing system is in use, we now know that the amount of overhead included in the cost of an item is absorbed at a predetermined rate. The entries made in the cash book and the nominal ledger, however, are the actual amounts.

You will remember that it is highly unlikely that the actual amount and the predetermined amount will be the same. The difference is called **under- or over-absorbed overhead**. To deal with this in the cost accounting books, therefore, we need to have an account to collect under- or over-absorbed amounts for each type of overhead.



Illustration 5: The under-/over-absorbed overhead account

Mariott's Motorcycles absorbs production overheads at the rate of \$0.50 per operating hour and administration overheads at 20% of the production cost of sales. Actual data for one month was as follows:

Administration overheads	\$32,000
Production overheads	\$46,500
Operating hours	90,000
Production cost of sales	\$180,000

Required

What entries need to be made for overheads in the ledgers?

Solution

PRODUCTION OVERHEADS

	Dr	Cr
	\$	\$
Cash	46,500	Absorbed into WIP ($90,000 \times \$0.50$)
	<hr/>	<hr/>
	46,500	Under-absorbed overhead
	<hr/>	<hr/>
	46,500	46,500

ADMINISTRATION OVERHEADS

	Dr	Cr
	\$	\$
Cash	32,000	To cost of sales ($180,000 \times 0.2$)
Over-absorbed overhead	<hr/> 4,000	<hr/>
	36,000	36,000

UNDER-/OVER-ABSORBED OVERHEADS

	Dr	Cr
	\$	\$
Production overhead	1,500	Administration overhead
Balance to SOPL account	<hr/> 2,500	<hr/>
	4,000	4,000

Less production overhead has been absorbed than has been spent, so there is **under-absorbed overhead** of \$1,500. More administration overhead has been absorbed (into cost of sales, note, not into WIP) and so there is **over-absorbed overhead** of \$4,000. The net over-absorbed overhead of \$2,500 is a credit in the statement of profit or loss.

7 Marginal costing

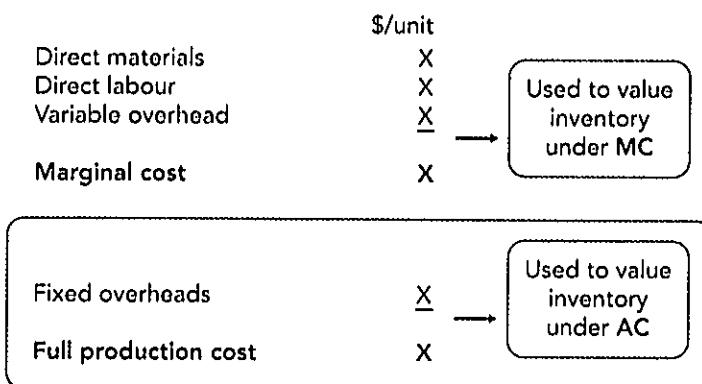
Some businesses only want to know the variable costs of the units they make, regarding **fixed costs as period costs**.



Marginal costing: Marginal costing is an alternative method of costing to absorption costing. In marginal costing, only variable costs are charged as a cost of sale and a contribution is calculated (sales revenue minus variable cost of sales). Closing inventories of work in progress or finished goods are valued at marginal (variable) production cost. Fixed costs are treated as a period cost, and are charged in full to the statement of profit or loss account of the accounting period in which they are incurred.

Marginal costing (MC) includes only the variable cost of a product or a service. That is a cost which would be avoided if the unit was not produced or provided.

Cost card – marginal costing



7.1 Calculating a profit or loss under marginal costing

	\$	\$
Sales	X	
Less variable cost of sales:		
Opening inventory	X	
Production costs:		
– Variable	<u>X</u>	
	<u>X</u>	
Less closing inventory	<u>(X)</u>	
	<u>(X)</u>	
Less variable selling, distribution and administration costs		<u>(X)</u>
CONTRIBUTION		X
Less fixed costs:		
Production	X	
Selling and distribution	X	
Administration	<u>X</u>	
	<u>(X)</u>	
NET PROFIT		X

Note. Inventories are valued at variable production costs only.



Illustration 6: Marginal costing

Goodtime Co manufactures cheap watches which it sells to wholesalers for \$25.

The cost card for each watch is as follows:

	\$
Direct materials	7
Direct wages	8
Variable production overheads	5
	<u>20</u>

There is a variable selling cost per unit of \$0.50.

Additional information:

	Year 1	Year 2
	Units	Units
Normal/budgeted production	12,000	12,000
Actual production	14,000	11,500
Actual sales	13,000	12,500
Actual fixed production overheads	\$11,000	\$11,000
Actual fixed selling costs	\$5,000	\$5,000

There is no opening inventory. All variable costs were as per budget for the two years.

Required

Set out a statement of profit or loss under marginal costing for both years 1 and 2.

Solution

	Year 1	Year 1	Year 2	Year 2
	\$	\$	\$	\$
Sales @ \$25		325,000		312,500
Less: COS				
Opening inventory (1,000 × \$20)	–		20,000	
Production costs – variable				
(14,000 × \$20)	280,000			
(11,500 × \$20)	—		<u>230,000</u>	
	280,000		250,000	
Less: Closing inventory (1,000 × \$20)	<u>20,000</u>		—	
	(260,000)		<u>(250,000)</u>	
		65,000		62,500
Less: Variable selling costs (13,000 × \$0.50)		(6,500)		

	Year 1	Year 1	Year 2	Year 2
	\$	\$	\$	\$
(12,500 × \$0.50)		—		<u>(6,250)</u>
Contribution		58,500		56,250
Less: Fixed costs				
– Production	11,000			
– Selling	5,000		5,000	
		(16,000)		(16,000)
Net profit		<u>42,500</u>		<u>40,250</u>

8 Contribution

Contribution is a fundamental concept in marginal costing. Contribution is an abbreviation of '**contribution towards fixed costs and profit**'.

It is the difference between selling price and *all* variable costs (including non-production variable costs), usually expressed on a per unit basis.

	\$	\$
Selling price		X
Less: Variable production costs	X	
Variable non-production costs	X	
		(X)
Contribution	X	=

Note. Contribution takes account of all variable costs. Marginal costing takes account of variable production costs only and inventory is valued at marginal cost.



Activity 5: Marginal costing profit

Parsons has budgeted to produce 5,000 units of Product E per month. The opening and closing inventories of Product E for next month are budgeted to be 400 units and 900 units respectively. The budgeted selling price and variable production costs per unit for Product E are as follows:

	\$ per unit
Selling price	20.00
Direct costs	6.00
Variable production overheads	3.50

Total budgeted fixed production overheads are \$29,500 per month.

Required

What is the budgeted profit for Product E next month under marginal costing?

\$

9 Advantages and disadvantages of marginal costing

9.1 Advantages

- Appropriate for decision making as it highlights contribution. (It is useful for short-term pricing decisions or decisions on on-off or ad hoc contracts.)
- Fixed costs are treated in accordance with their nature, ie as period costs.
- Profit depends on sales and efficiency, not on production levels.

9.2 Disadvantages

- There is a danger that products will be sold on an ongoing basis at a marginal contribution which fails to cover fixed costs.
- Does not comply with IAS 2, thus necessitating year-end adjustments for the preparation of published accounts.
- Mixed costs must be split into fixed and variable elements.

10 Calculating a profit or loss under absorption costing

In **marginal costing**, fixed production costs are treated as **period costs** and are written off as they are incurred. In **absorption costing**, fixed production costs are absorbed into the cost of units and are carried forward in inventory to be charged against sales for the next period. Inventory values using absorption costing are therefore greater than those calculated using marginal costing.

The following proforma can be used to calculate a profit or loss under absorption costing:

	\$	\$
Sales		X
Less: Cost of sales		
Opening inventory		X
Production costs:		
Variable overheads		X

	\$	\$
Fixed overhead absorbed	X	
Adjustment Fixed overhead under-/over-absorbed	<u>X/(X)</u>	
Less: Closing inventory	<u>(X)</u>	
	(X)	
Gross profit	X	
Less: Non-production costs (selling, administration etc)	<u>(X)</u>	
Net profit	X	
	<u>=</u>	

Note. Inventory is valued at full production cost.



Illustration 7: Absorption costing

Goodtime Co decides that it wishes to implement absorption costing.

Selling price \$25.

Cost card per unit:

	\$	
Direct materials	7	
Direct wages	8	
Variable production overheads	5	
Fixed production overheads	<u>0.90</u>	
	<u>20.90</u>	

There is also a variable selling cost per unit of \$0.50.

	Year 1	Year 2
	Units	Units
Normal/budgeted production	12,000	12,000
Actual production	14,000	11,500
Actual sales	13,000	12,500
Actual fixed production overheads	\$11,000	\$11,000
Actual fixed selling costs	\$5,000	\$5,000

There is no opening inventory. All variable costs were as per budget for the two years.

Required

- Calculate the total budgeted fixed production overhead.
- Calculate the profit/(loss) under absorption costing for years 1 and 2.

Solution

- OAR = \$0.90

OAR = Budgeted fixed production overheads/Normal activity

∴ \$0.90 = Budgeted fixed production overheads/12,000

Budgeted fixed production overhead = $12,000 \times \$0.90$

= \$10,800

2 Absorption statement of profit or loss

	Year 1	Year 1	Year 2	Year 2
	\$	\$	\$	\$
Sales @ \$25		325,000		312,500
Less: CoS				
Opening inventory (1,000 × \$20.90)		-		20,900
Production costs				
– Variable				
(14,000 × \$20)		280,000		230,000
(11,500 × \$20)				
– Fixed (absorbed)				
(14,000 × \$0.90)		12,600		
(11,500 × \$0.90)				10,350
Adjustment for (Over)/under-absorption*		<u>(1,600)</u>		<u>650</u>
	291,000		261,900	
Less: Closing inventory (1,000 × \$20.90)	<u>(20,900)</u>			-
	271,700		261,900	
		<u>(270,100)</u>		<u>(261,900)</u>
Gross profit		54,900		50,600
Less: Selling costs				
– Variable				
(13,000 × \$0.50)		(6,500)		
(12,500 × \$0.50)				(6,250)
– Fixed		<u>(5,000)</u>		<u>(5,000)</u>
Net profit	<u>43,400</u>		<u>39,350</u>	

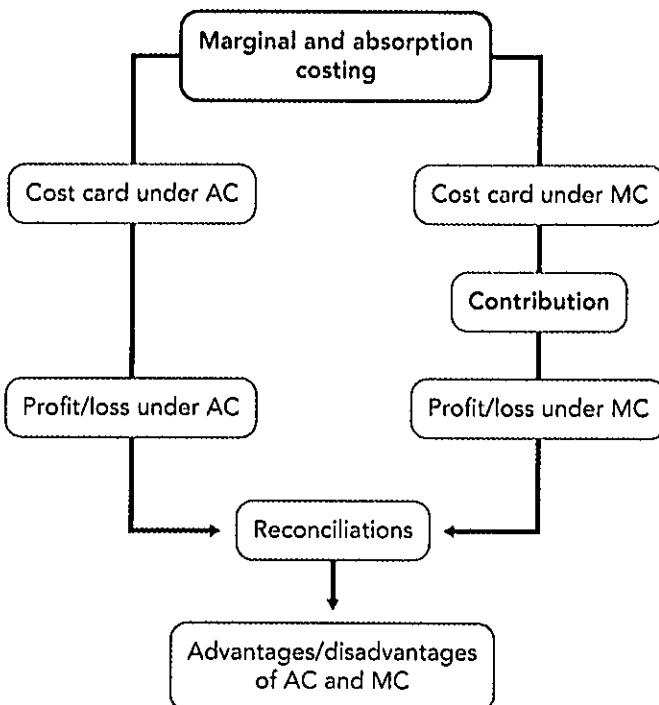
*(See Ch 14 for more detail on over/under-absorption.)



11 Absorption vs marginal costing

Marginal costing	Absorption costing
Closing inventories are valued at marginal production cost.	Closing inventories are valued at full production cost.
Fixed costs are period costs.	Fixed costs are absorbed into unit costs.
Cost of sales does not include a share of fixed overheads.	Cost of sales does include a share of fixed overheads (see note below).

Note. The share of fixed overheads included in cost of sales are from the previous period (in opening inventory values). Some of the fixed overheads from the current period will be excluded by being carried forward in closing inventory values.



Example

	Year 1	Year 2	Total
	\$	\$	\$
Absorption costing	43,400	39,350	82,750
Marginal costing	<u>42,500</u>	<u>40,250</u>	<u>82,750</u>
	<u>900</u>	<u>(900)</u>	=

- Overall the same profit is recognised.
- The difference arises from different inventory valuations. (Absorption costing inventory valued at \$20.90 per unit and marginal costing inventory valued at \$20 per unit.)

11.1 Reconciling profits

Important Note

Reported profit figures using marginal costing or absorption costing will differ if there is any change in the level of inventories in the period. If production is equal to sales, there will be no difference in calculated profits using the costing methods.

The difference in profits reported under the two costing systems is due to the different inventory valuation methods used.

If inventory levels increase between the beginning and end of a period, absorption costing will report the higher profit. This is because some of the fixed production overhead incurred during the period will be carried forward in closing inventory (which reduces cost of sales) to be set against sales revenue in the following period instead of being written off in full against profit in the period concerned.

If inventory levels decrease, absorption costing will report the lower profit because as well as the fixed overhead incurred, fixed production overhead, which had been carried forward in opening inventory, is released and is also included in cost of sales.

Profits generated using AC and MC can also be reconciled as follows

Formula to learn

Difference in the profit = Change in inventory in units × OAR per unit

To work out which profit figure is greatest remember when:

Production > Sales

Closing inventory > Opening inventory

AC profit > MC profit

Illustration 8: Reconciling profits

When opening inventories were 8,500 litres and closing inventories were 6,750 litres, a firm had a profit of \$62,100 using marginal costing.

Required

Assuming that the fixed overhead absorption rate was \$3 per litre, what would be the profit using absorption costing?

Solution

Difference in profit = $(8,500 - 6,750) \times \$3 = \$5,250$

Absorption costing profit = \$62,100 - \$5,250 = \$56,850

Since inventory levels reduced, the absorption costing profit will be lower than the marginal costing profit.

Activity 6: Reconciling profits

The following budgeted information relates to a manufacturing company, Perry, for the next period:

	Units	\$
Production	35,000	Fixed production costs
Sales	30,000	Fixed selling costs

The normal level of activity is 35,000 units per period.

Using absorption costing the profit for next period has been calculated as \$90,000.

Required

What would be Perry's profit for the next period using marginal costing?

\$

11.2 Advantages and disadvantages of absorption costing and marginal costing

Absorption costing is most often used for routine profit reporting and must be used for financial accounting purposes. Marginal costing provides better management information for planning and decision making. There are a number of arguments both for and against each of the costing systems.

Absorption costing	Marginal costing
Advantages	
Recognises that selling price must cover all costs.	Highlights contribution so appropriate for decision making.
Complies with IAS 2.	Fixed costs treated in accordance with their nature.
	Profit depends on sales and efficiency- not production levels.
Drawbacks	
Profits can be manipulated by changing production levels.	Danger that contribution fails to cover fixed costs.
Based on the assumption that overheads are volume related.	Does not comply with IAS 2.
	Necessitates analysis of mixed costs between fixed and variable.

12 Working backwards

Exam questions may give you the movement in inventory and the difference in profits and then ask you to work backwards in order to calculate the OAR.



Example: Working backwards

In a period, opening inventories were 12,600 units and closing inventories 14,100 units. The profit, based on marginal costing, was \$50,400 and profit using absorption costing was \$60,150.

What is the fixed overhead absorption rate per unit?

	Units
Opening inventory	12,600
Closing inventory	14,100
Increase in inventory level	1,500
	\$
Absorption costing profit	60,150
Marginal costing profit	50,400
Difference in profit	9,750

Difference in the profit = Change in inventory in units × OAR per unit

Therefore OAR = Difference in the profit / Change in inventory in units

OAR = \$9,750 / 1,500 = \$6.50 per unit



Activity 7: Working backwards

In a period, opening inventories were 10,000 units and closing inventories 11,000 units. Profits, based on marginal costing, were \$100,000 and profit under absorption costing was \$105,000.

Required

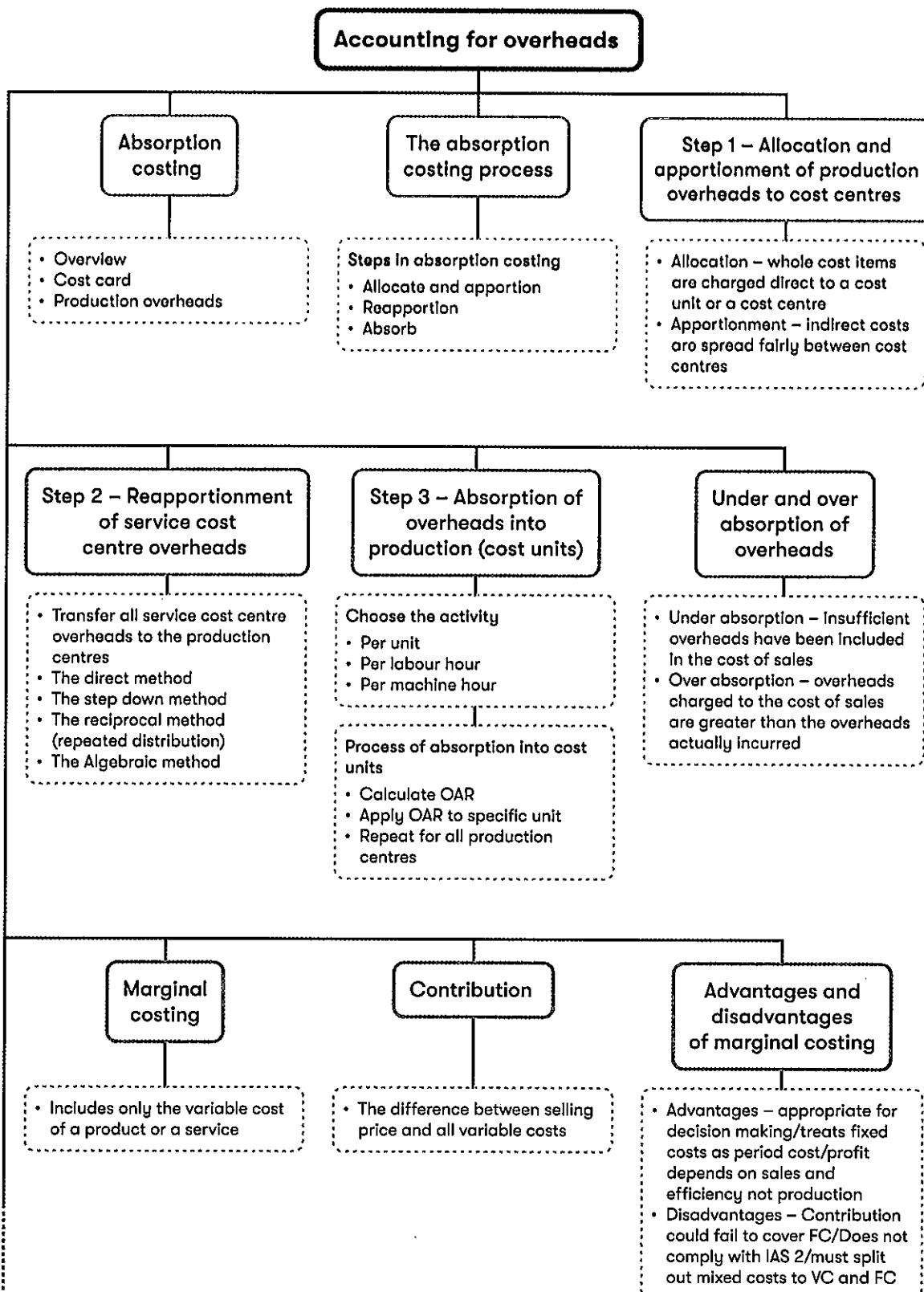
What is the fixed overhead absorption rate per unit?

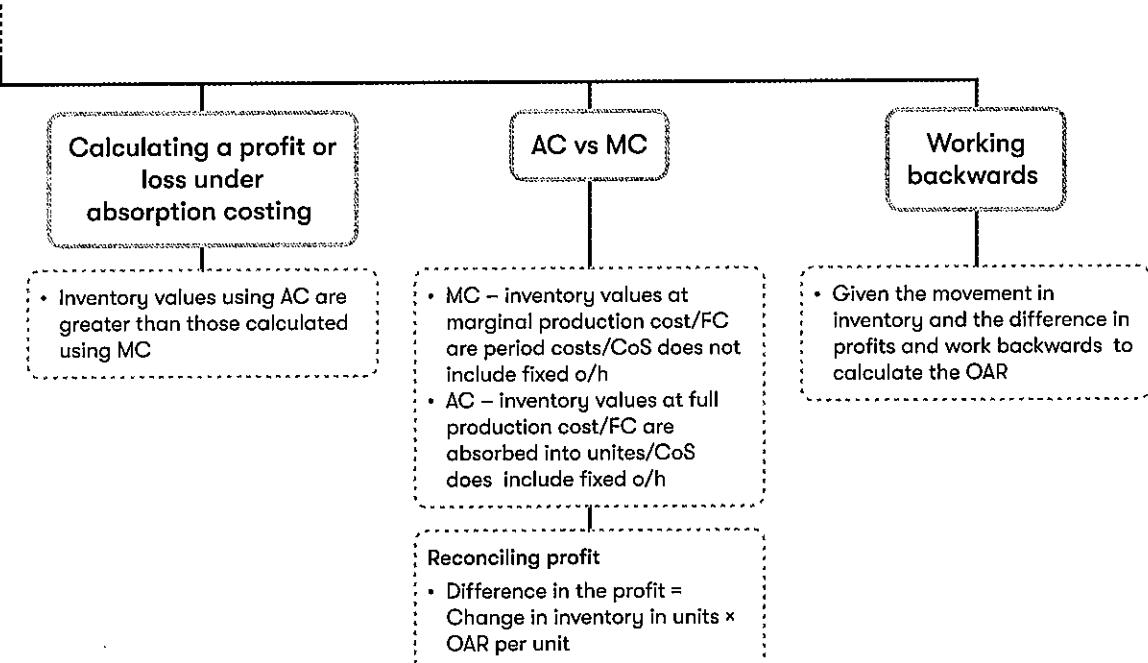
- \$0.50
- \$5.00
- \$4.50
- \$5,000

Solution



Chapter summary





Knowledge diagnostic

1. Overheads

Overheads are costs incurred in the course of making a product that can't be directly linked to a unit.

2. Absorption costing (AC)

The objective of absorption costing is to include a share of the overheads in the total cost of the product.

3. Step 1 – Allocation and apportionment

The first stage in valuing the overhead cost of a cost unit is to allocate and apportion overheads between the cost centres.

4. Step 2 – Reapportionment

The second stage is to transfer all service cost centre overheads to the production centres – as it is through these cost centres that cost units flow.

5. Step 3 – Absorption

The final stage is to charge the overheads to the cost units passing through the production cost centres using an overhead absorption rate (OAR).

6. Under-and over-absorption of overheads

If actual overhead incurred less absorbed overhead = NEGATIVE, then overheads are over absorbed.

If actual overhead incurred less absorbed overhead = POSITIVE, then overheads are under absorbed.

7. Marginal costing

The marginal cost is the variable production cost of one unit.

8. Contribution

Contribution is the amount that a unit contributes towards fixed costs when it is sold. It is calculated as selling price less all variable costs.

9. Calculating a profit or loss under marginal costing

In marginal costing, fixed costs are treated as period costs and are deducted from total contribution.

10. Calculating a profit or loss under absorption costing

In absorption costing, fixed costs are absorbed into the units of production and carried forward in closing inventory. (Which is valued at the full production cost.)

11. Absorption costing vs marginal costing

AC recognises that all costs must be covered in the long run, whilst MC is better for short-term decision making.

12. Reconciliation of absorption and marginal costing profits

The different inventory valuations in AC and MC can lead to different profits being reported.

The difference can be reconciled by multiplying the change in the inventory by the OAR.

Further study guidance

Question practice

Now try the following from the Further question practice bank (available in the digital edition of the Workbook):

Section A: Q38 - Q45

Further reading

There are two technical articles available on ACCA's website, called *Fixed overhead absorption* and *Re-apportionment of service cost centre costs*.

You are strongly advised to read these articles in full as part of your preparation for the MA/FMA exam.

Activity answers

Activity 1: Overhead allocation and apportionment

Mixing department \$ [108,200]

Stirring department \$ [39,400]

Store department \$ [90,800]

Canteen department \$ [23,600]

Working

	Mixing	Stirring	Stores	Canteen	Total
	\$	\$	\$	\$	\$
Stores cost	-	-	75,000	-	75,000
Rent and rates (9:3:1:2)	54,000	18,000	6,000	12,000	90,000
Insurance (2:1:0.6:0.4)	20,000	10,000	6,000	4,000	40,000
Heat and light (9:3:1:2)	34,200	11,400	3,800	7,600	57,000
	108,200	39,400	90,800	23,600	262,000

Activity 2: Step-down method

The correct answer is: \$25,440

	Production depts		Service centres	
	A	B	C	D
	\$	\$	\$	\$
Allocated and apportioned overheads	12,000	16,000	8,000	10,000
Reapportion C (60:30:10)	4,800	2,400	(8,000)	800
Reapportion D (80:20)	<u>8,640</u>	<u>2,160</u>	<u>—</u>	<u>(10,800)</u>
	<u><u>25,440</u></u>	<u><u>20,560</u></u>	<u><u>—</u></u>	<u><u>—</u></u>

Activity 3: Overhead absorption rate

- 1 The most appropriate activity for the mixing department is labour hours as it is a labour-intensive department.

The most appropriate activity for the stirring department is machine hours as it is a machine-intensive department.

- 2 Total overheads = \$70.98 (mixing) + \$33.82 (stirring) = \$104.80 per batch of marz cakes.

- (a) In the mixing department \$ [70.98]

$$\$177,444/12,500 \text{ labour hours} = \$14.20 \text{ per labour hour}$$

$$\times 5 \text{ labour hours per batch} = \$70.98$$

- (b) \$84,556/10,000 machine hours = \$8.46 per machine hour

$$\times 4 \text{ machine hours per batch} = \$33.82$$

Activity 4: Over- and under-absorption

The correct answer is: Under absorbed by \$3,875

Actual overhead expenditure	\$78,875
Overhead absorbed ($30,000 \text{ hours} \times \2.50)	\$75,000
Under-absorption	\$3,875

Activity 5: Marginal costing profit

\$ 17,750	\$
Sales price	20
Less: Direct costs	(6)
Variable production overheads	(3.50)
Contribution per unit	10.50
× units sold	4,500
Total contribution	47,250
Less: Fixed production overheads	(29,500)
MC profit	17,750

Activity 6: Reconciling profits

\$ 67,500

Budgeted OAR = $\$157,500 / 35,000 = \4.50 per unit

$\$4.50 \times 5,000$ units = $\$22,500$ difference in profits.

Since inventory levels are increasing, absorption costing profit will be higher than marginal.

MC profit = $\$90,000 - \$22,500 = \$67,500$

Activity 7: Working backwards

The correct answer is: \$5.00

The difference in profits is due to fixed overheads in opening/closing inventory. 1,000 extra units of inventory led to a \$5,000 difference in profits. Therefore, each unit of inventory has \$5 of fixed overheads.

9

Process costing

Learning objectives

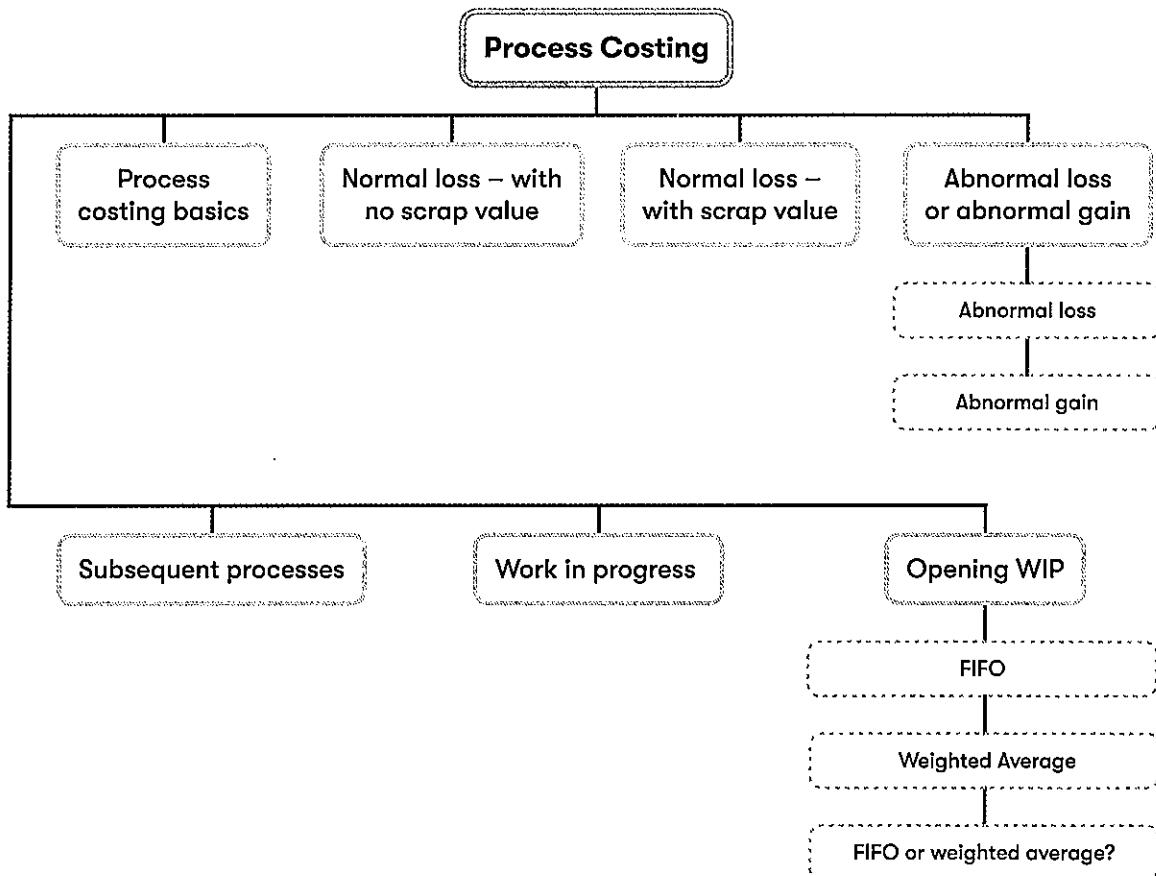
On completion of this chapter, you should be able to:

	Syllabus reference no.
Describe the characteristics of process costing.	C3 (b)(i)
Describe the situations where the use of process costing would be appropriate.	C3 (b)(ii)
Explain the concepts of normal and abnormal losses and abnormal gains.	C3 (b)(iii)
Calculate the cost per units of process outputs.	C3 (b)(iv)
Prepare process accounts involving normal and abnormal losses and abnormal gains.	C3 (b)(v)
Calculate and explain the concept of equivalent units.	C3 (b)(vi)
Apportion process costs between work remaining in process and transfers out of a process using the weighted average and FIFO methods.	C3 (b)(vii)
Prepare process accounts in situations where work remains incomplete.	C3 (b)(viii)
Prepare process accounts where losses and gains are identified at different stages of the process.	C3 (b)(ix)
(Situations involving work-in-progress and losses in the same process are excluded.)	

Exam context

In Section A, you might be required to do calculations for completion of a process account. Make sure that you can deal with losses, gains, scrap and WIP. However, losses and WIP will not be examined in the same question.

Chapter overview



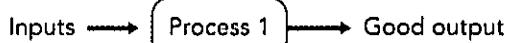
1 Process costing basics



Process costing is a costing method used where it is not possible to identify separate units of production, or jobs, usually because of the continuous nature of the production process involved. Process costing involves the averaging of the total costs of each process over the total output of that process.

Examples of processes where process costing may be used are:

- Oil refining
- Paper production
- Food and drink production
- Chemical production



Formula to learn

$$\text{Cost per unit} = \frac{\text{Costs Incurred}}{\text{Expected output}}$$

(Note that expected output is calculated as Input units - normal loss units.)

Steps for process costing calculations

Process costing is centred around three key steps. The exact work done at each step will depend on whether there are normal losses, scrap, opening and closing work in progress.

Step 1 Determine output and losses.

Step 2 Calculate cost per unit of output, losses and WIP.

Step 3 Complete accounts.



Illustration 1: Process 1

Input to Process 1 during a period was 1,000 units of raw materials, which cost \$40,000.

Other costs were: labour \$50,000 and overheads \$20,000.

There were no losses and all of the output was transferred to Process 2.

Required

Complete the process account and calculate the cost per unit.

Solution

Step 1: Unit calculation

Input units = 1,000 units. Output units = 1,000 units.

Step 2: Cost per unit

Cost per unit = \$110,000/1,000 units = \$110 per unit

Step 3: Complete process account

PROCESS 1					
	Units	\$		Unit	\$
Raw materials	1,000	40,000	To Process 2	1,000	110,000
Labour		50,000			
Overheads		20,000			
	1,000	110,000		1,000	110,000

2 Normal loss - with no scrap value



Normal loss: Normal loss is the loss that is expected from a business's experience of the process eg wastage or evaporation. It is not given a cost.



Illustration 2: Process 1 Normal loss

Input to Process 1 during a period was 1,000 units of raw materials, which cost \$40,000.

Other costs were: labour \$50,000 and overheads \$20,000.

All of the output was transferred to Process 2.

We have discovered that losses normally account for 10% of input.

Actual output was 900 units.

Required

Calculate the cost per unit and prepare the Process 1 ledger account.

Solution

Step 1: Unit calculation

Input units	=	Good output	+	Normal loss
1,000	=	900		100

Step 2: Calculate cost per unit

Cost per unit = Costs incurred / Expected output = \$110,000 / 900 = \$122.22 per unit

Step 3: Complete the process account

PROCESS 1					
	Units	\$		Unit	\$
Raw materials	1,000	40,000	To Process 2	1,000	110,000
Labour		50,000			
Overheads		20,000			
	1,000	110,000		1,000	110,000

3 Normal loss – with a scrap value

Any proceeds we receive for the normal loss can be used to reduce the processing costs.



Formula to learn

$$\text{Cost per unit} = \frac{\text{Input cost} - \text{scrap value of normal loss}}{\text{Expected output}}$$

Normal loss can be calculated in several ways, depending on the normal expectation of the process:

- % of input (most common) – this means materials input only not opening WIP;
- % of throughput = opening WIP + materials input – closing WIP;
- % of good output
- % of total output = good output + losses.



Illustration 3: Process 1 – scrap

Input to Process 1 during a period was 1,000 units of raw materials, which cost \$40,000.

Other costs were: labour \$50,000 and overheads \$20,000.

All of the output was transferred to Process 2.

We have discovered that losses normally account for 10% of input.

Actual output was 900 units.

Scrapped units (losses) have a scrap value of \$20 each.

Required

Calculate the cost per unit of good output and prepare the process and scrap ledger accounts.

Solution

Step 1: Unit calculation

Input units	=	Good output	+	Normal loss
1,000	=	900		100

Step 2: Calculate the cost per unit

Total scrap value = 100 units × \$20 = \$2,000

Cost per unit

$$= \frac{\text{Cost} - \text{scrap value of normal loss}}{\text{Expected output}} = \frac{110,000 - 2,000}{1,000 - 100} = \$120 \text{ per unit}$$

Step 3: Complete the process account and scrap account

Process 1

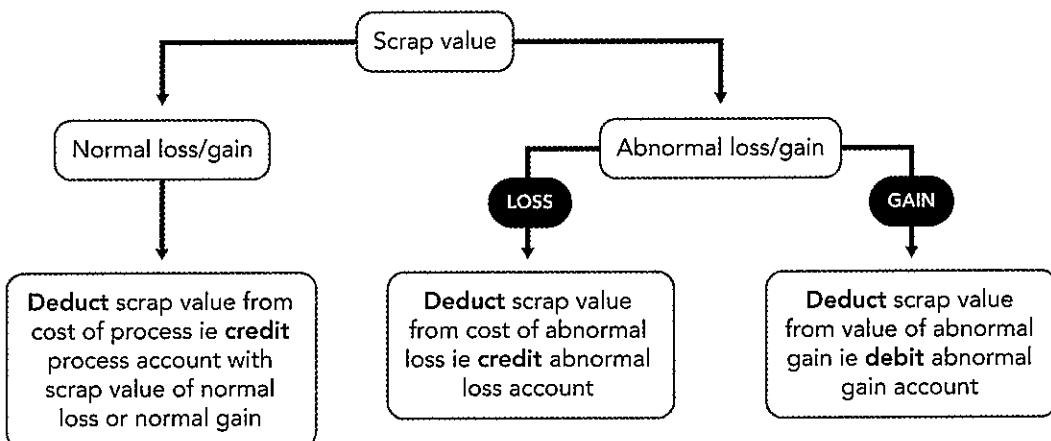
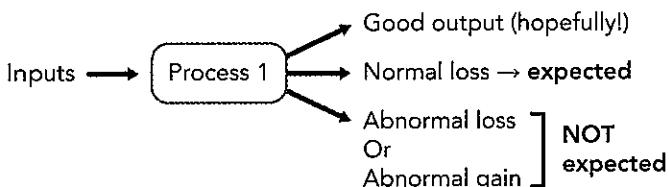
	Units	\$		Units	\$
Raw materials	1,000	40,000	Normal loss	100	2,000
Labour		50,000	To Process 2	900	108,000
Overheads		20,000			
	1,000	110,000		1,000	110,000

Scrap account

	Units	\$		Units	\$
Normal loss	100	2,000	Cash	100	2,000

4 Abnormal loss or abnormal gain

An abnormal loss or abnormal gain occurs when the actual loss is different from the expected loss.



Abnormal loss: This is the excess of actual spoilage over normal spoilage. The abnormal loss should be valued at the same cost per unit as a good unit and any losses or gains taken to the statement of profit or loss (SOP/L) for the period.



Illustration 4: Process 1 Abnormal loss

Input to Process 1 during a period was 1,000 units of raw materials, which cost \$40,000.

Other costs were: labour \$50,000 and overheads \$20,000.

All of the output was transferred to Process 2.

We have discovered that losses normally account for 10% of input.

All scrapped units have a scrap value of \$20 each.

However, this time output to Process 2 is 880 units not 900 units as expected.

Required

Calculate the cost per unit and prepare the process cost account, the scrap account, the abnormal gains and losses account.

Solution

Step 1: Unit calculation: Input units = Good output + Normal loss / Abnormal loss/(gain).

Unit calculation

Input units	=	Good output	+	Normal loss	+/-	Abnormal loss/(gain)
1,000	=	880	+	100	+	20

Step 2: Calculate the cost per unit

$$= \frac{\text{Cost} - \text{scrap value of normal loss}}{\text{Expected output}} = \frac{110,000 - 2,000}{1,000 - 100} = \$120 \text{ per unit}$$

Step 3: Complete the process account, scrap account and abnormal losses account

Process 1

	Units	\$		Units	\$
Raw materials	1,000	40,000	Normal loss	100	2,000
Labour		50,000	To Process 2	880	105,600
Overheads		20,000	Abnormal loss	20	2,400
	<u>1,000</u>	<u>110,000</u>		<u>1,000</u>	<u>110,000</u>

Scrap account

	Units	\$		Units	\$
Normal loss	100	2,000	Cash	120	2,400
Abnormal loss	<u>20</u>	<u>400</u>			
	<u>120</u>	<u>2,400</u>		<u>120</u>	<u>2,400</u>

Abnormal losses account

	Units	\$		Units	\$
Abnormal loss	20	2,400	Scrap	20	400
	<u>—</u>	<u>—</u>	SOP/L a/c	<u>—</u>	<u>2,000</u>
	<u>20</u>	<u>2,400</u>		<u>20</u>	<u>2,400</u>



Abnormal gain: This is the shortfall of actual spoilage from normal spoilage. It is given a negative cost.



Illustration 5: Process 1 Abnormal gain

Input to Process 1 during a period was 1,000 units of raw materials, which cost \$40,000.

Other costs were: labour \$50,000 and overheads \$20,000.

All of the output was transferred to Process 2.

We have discovered that losses normally account for 10% of input.

All scrapped units have a scrap value of \$20 each.

However, this time output to Process 2 is 920 units not 900 units as expected.

Required

Calculate the cost per unit and prepare the process cost account, the scrap account, the abnormal gains and losses account.

Solution

Step 1: Unit calculation

Input units	=	Good output	+	Normal loss	+/-	Abnormal loss/(gain)
1,000	=	920	+	100	-	20
						Abnormal gain

Step 2: Calculate the cost per unit

$$\text{Cost per unit} = \frac{\text{Input costs} - \text{scrap value of normal loss}}{\text{Expected output}}$$

$$= \frac{\$110,000 - \$2,000}{1,000 - 100}$$

$$= \$120/\text{unit}$$

Step 3: Complete the Process 1 account, scrap account and abnormal gains account.

Process 1

	Units	\$		Units	\$
Raw materials	1,000	40,000	Normal loss	100	2,000
Labour		50,000	To Process 2	920	110,400
Overheads		20,000			
Abnormal gain	<u>20</u>	<u>2,400</u>			
	<u>1,020</u>	<u>112,400</u>		<u>1,020</u>	<u>112,400</u>

Scrap account

	Units	\$		Units	\$
Normal loss	100	2,000	Abnormal gain	20	400
	<u>—</u>	<u>—</u>	Cash	<u>80</u>	<u>1,600</u>
	<u>100</u>	<u>2,000</u>		<u>100</u>	<u>2,000</u>

Abnormal gains account

	Units	\$		Units	\$
Scrap	20	400	Abnormal gain	20	2,400
SOP/L account	<u>—</u>	<u>2,000</u>		<u>—</u>	<u>—</u>
	<u>20</u>	<u>2,400</u>		<u>20</u>	<u>2,400</u>



Exam focus point

Abnormal losses and gains never affect the cost of good units of production. The scrap value of abnormal losses is not credited to the process account, and abnormal loss and gain units carry the same full cost as a good unit of production.



Activity 1: Abnormal loss or gain?

Information relating to two processes (J and K) is follows:

Process	Normal loss as % of input	Input (kg)	Output (kg)
J	3	85,000	82,400
K	7	47,000	44,000

Required

For each process was there an abnormal loss or an abnormal gain?

	Abnormal gain	Abnormal loss
Process J		
Process K		

Solution

Direct labour and production overhead may be treated together in an exam question and called **conversion cost**.



Activity 2: Abnormal loss/gain calculation

HB Co uses 3,000 units of material, which are input to process 1.

Process costs are as follows:

Material \$11,700

Conversion costs \$6,300

Output is 2,000 units. Normal loss is 20% of input.

Required

Calculate the value of the abnormal gain/loss.

Solution



Activity 3: Charlton

Charlton Co manufactures a product in a single process operation. Normal loss is 10% of input. Loss occurs at the end of the process. Data for June is as follows:

Opening and closing inventories of work in progress Nil

Cost of input materials (3,300 units) \$59,100

Direct labour and production overhead \$30,000

Output to finished goods 2,750 units

Required

What is the cost of finished output in June?

- \$74,250
- \$81,000
- \$82,500
- \$89,100

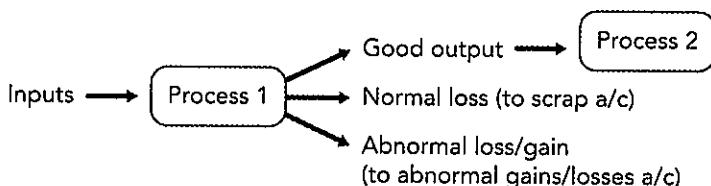


Exam focus point

When abnormal losses can be sold for scrap, their net cost is the cost per unit of making them, less the revenue derived from their sale.

5 Subsequent processes

Costs in each process include the full cost of material inputs from previous processes.



Conversion cost: Labour and overhead costs together are called **conversion costs**.



Illustration 6: Process 1 subsequent processes

The output from Process 1 (920 units with a value of \$110,400) forms the input to Process 2.

Normal loss in Process 2 is 10% of good output (from Process 2) and has no scrap value. Output from Process 2 is 900 units.

Other inputs to Process 2 are:

Added materials	\$20,600
Conversion costs	\$35,000

Required

Prepare the Process 2 cost account, scrap account, abnormal gains and losses account and calculate the cost per unit.

Solution

Step 1: Unit calculation

Input units	=	Good output	+	Normal loss	+/-	Abnormal loss/(gain)
920	=	900	+	90	-	70
						Abnormal gain

Step 2: Calculate the cost per unit

$$\text{Cost/unit} = \frac{\text{Input costs} - \text{scrap value of normal loss}}{\text{Expected output}}$$

$$= \frac{\$110,400 + \$20,600 + \$35,000}{920 - (900 \times 10\%)} = \frac{\$166,000}{830}$$

$$= \$200/\text{unit}$$

Step 3: Complete the Process 2 account, scrap account and abnormal gains account

Process 2

	Units	\$		Units	\$
Input from process	920	110,400	Output to finished goods	900	180,000
Added materials		20,600	Normal loss	90	
Conversion		35,000			
Abnormal gain	70	14,000		—	—
	990	180,000		990	180,000

Scrap account

	Units	\$		Units	\$
Normal loss	90	—	Abnormal gain	70	—
	—	—	Scrap	20	—
	90	—		90	—

Abnormal gain account

	Units	\$		Units	\$
Scrap	70	—	Abnormal gain	70	14,000
SOP/L a/c	—	14,000		—	—
	70	14,000		70	14,000



Essential reading

See Chapter 9, Section 1 of the Essential reading to read about how to deal with losses which have a disposal cost.

The Essential reading is available as an Appendix of the digital edition of the Workbook.

6 Work in progress

At the end of the accounting period we may have two types of output from the process:

- (a) Fully completed good output
- (b) Output that has not yet been finished

This partially completed output is known as **work in progress (WIP)**.

If we compare the value of one unit of WIP with the value of one unit of good output, the value of the unit of WIP will be less than the value of one unit of good output. This is because WIP is only partially completed. To make comparison easier, we restate partially completed units in terms of equivalent whole units.



Equivalent units: Equivalent units are notional whole units which represent incomplete work, and which are used to apportion costs between work in process (WIP) and completed output.

It is necessary to establish the degree of completion for WIP.



Illustration 7: WIP

Suppose that we have the following account for Process 2 for period 9.

PROCESS ACCOUNT

	Units	\$		Units	\$
Materials	1,000	6,200	Finished goods	800	?
Labour and overhead	_____	<u>2,850</u>	Closing WIP	<u>200</u>	_____?
	<u>1,000</u>	<u>9,050</u>		<u>1,000</u>	<u>9,050</u>

Assume that closing WIP is 100% complete in respect of materials and 25% complete for labour and overhead.

Required

Calculate the value of finished goods and closing WIP.

Solution

Step 1: Statement of equivalent units

	Total units	Degree of completion	Materials	Labour and overheads
Finished output	800	100%	800	100%
Closing WIP	<u>200</u>	100%	<u>200</u>	25%
	<u>1,000</u>		<u>1,000</u>	<u>850</u>

Step 2: Statement of cost per equivalent unit

	Materials	Labour and overhead
Costs incurred in the period	\$6,200	\$2,850
Equivalent units of work done	1,000	850
Cost per equivalent unit (approx)	\$6.20	\$3.3529

Step 3: Statement of evaluation

Item	Materials			Labour and overheads			Total cost
	Equiv units*	Cost per EU	Cost	Equiv units	Cost per EU	Cost	
	\$	\$	\$	\$	\$	\$	
Finished output	800	6.20	4,960	800	3.3529	2,682	7,642
Closing WIP	200	6.20	1,240	50	3.3529	168	1,408
	<u>1,000</u>	<u>6,200</u>	<u>850</u>			<u>2,850</u>	<u>9,050</u>

* equivalent units = (EU)

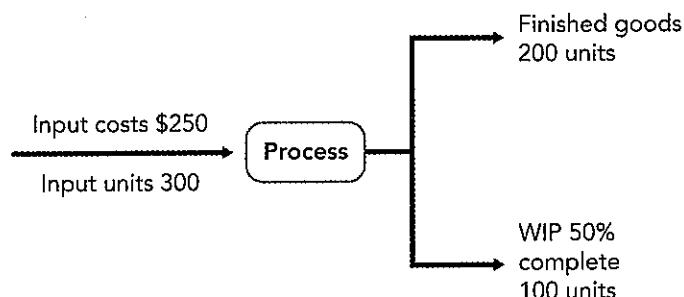
Step 4: Complete the process account

PROCESS ACCOUNT

	Units	\$		Units	\$
Materials	1,000	6,200	Finished goods	800	7,642
Labour overhead	____	2,850	Closing WIP	200	1,408
	<u>1,000</u>	<u>9,050</u>		<u>1,000</u>	<u>9,050</u>



Activity 4: WIP



Required

Using the usual cost per unit calculation the cost per unit is \$

The value of WIP is \$

The value of finished goods is \$

Using equivalent units, the cost per equivalent is \$

The value of WIP is \$

The value of finished goods is \$



Activity 5: Equivalent units

Ally Co has the following information available on Process 9:

PROCESS 9 ACCOUNT

	\$			\$	
Input	10,000 kg	59,150		Finished goods	8,000 kg
				Closing WIP	2,000 kg
		59,150			7,150
					59,150

Required

How many equivalent units (kg) were there for closing WIP?

- 1,000
- 1,100
- 2,000
- 8,000

Solution



Activity 6: Degree of completion

Henleaze Co operates a process in which no losses are incurred. The process account for last month, when there was no opening work-in-progress, was as follows:

Process account

	Units	S		Units	S
Costs arising	12,000	385,000	Finished output	7,000	245,000
			Closing WIP	5,000	140,000
	_____	_____		_____	_____
	<u>12,000</u>	<u>385,000</u>		<u>12,000</u>	<u>385,000</u>

The closing work-in-progress was complete to the same degree for all elements of cost.

Required

What was the percentage degree of completion of the closing work-in-progress?

- 20%
 - 42%
 - 70%
 - 80%
-

Essential reading

See Chapter 9, Section 2 of the Essential reading for detail on dealing with different rates of input.

The Essential reading is available as an Appendix of the digital edition of the Workbook.

7 Opening WIP

The closing WIP from one accounting period will become the opening WIP in the next. There are two methods that we can use when there is opening WIP, the first in first out (FIFO) method or the weighted average cost method.

7.1 First in, first out (FIFO)

- Assumes that opening WIP is completed first;
- Spreads costs incurred in the period over work done in that period;
ie spreads costs over
 - (a) Work done on finished goods/output (**started and finished**)
 - (b) Work done on **finishing opening WIP**
 - (c) Work done on **starting closing WIP**

We add on the opening WIP costs to the sum of (a) and (b) to give the total costs of finished output.



7.2 Weighted average

- Assumes all items are equally likely to be completed;
- Spreads all costs (including those brought forward in opening WIP) over all units

7.2.1 Unit calculation

Formula to learn

Opening WIP + input units = Good output + Normal loss + / - Abnormal loss/(gain) + Closing WIP



Illustration 8: Opening WIP

If there was closing WIP at the end of the previous period, this becomes opening WIP for the following period:

Raw materials	2,050 units	\$22,550
Labour		\$16,304
Overheads		\$8,212

Opening WIP: 50 units

Output from Process 1: 2,020 units

Closing WIP: 80 units complete as below

Raw materials	100%	complete
Labour	60%	complete
Overheads	60%	complete

There were no losses.

Required

Prepare a Process 1 ledger account using:

- (1) FIFO and
- (2) Weighted average methods.

Solution

(1) FIFO

Op WIP	+	Input units	=	Good output	+	Normal loss	+/-	Ab loss/gain	+	Cl WIP
50	+	2,050	=	2,020	+	0	+	0	+	80

Process 1

	Units	\$		Units	\$
Opening WIP	50	610	To Process 2	2,020	46,220
Raw materials	2,050	22,550			
Labour		16,304			
Overheads		8,212	Closing WIP	80	1,456
	2,100	47,676		2,100	47,676

Statement of equivalent units

	Actual units	Materials	Labour	Overheads	Equivalent units
Opening WIP (completed)	50	-	20	35	
Started & finished	<u>1,970</u>	<u>1,970</u>	<u>1,970</u>	<u>1,970</u>	
Output	2,020	1,970	1,990	2,005	
Closing WIP (started)	<u>80</u>	<u>80</u>	<u>48</u>	<u>48</u>	
	<u>2,100</u>	<u>2,050</u>	<u>2,038</u>	<u>2,053</u>	

Costs per equivalent unit

	Materials	Labour	Overheads
	\$	\$	\$
Costs	<u>22,550</u>	<u>16,304</u>	<u>8,212</u>
Cost/EU	\$11.00	\$8.00	\$4.00
Total cost/EU		\$23.00	

Valuations

	\$
Good output	
Costs b/f in opening WIP	610
Materials	(1,970 × \$11.00) 21,670
Labour	(1,990 × \$8.00) 15,920
Overheads	(2,005 × \$4.00) 8,020
	<u>46,220</u>

	\$
Closing WIP	
Materials	(80 × \$11.00) 880
Labour	(48 × \$8.00) 384
Overheads	(48 × \$4.00) 192
	<u>1,456</u>

(2) Weighted average

Process 1

	Units	\$		Units	\$
Opening WIP	50	610	To Process 2	2,020	46,238
Raw materials	2,050	22,550	Closing WIP	80	1,448
Labour		16,304			
Overheads		8,212	Rounding		(10)
	<u>2,100</u>	<u>47,676</u>		<u>2,100</u>	<u>47,676</u>

Statement of equivalent units

	Actual units	Materials	Labour	Overhead	Equivalent units
Good output	2,020	2,020	2,020	2,020	2,020
Closing WIP	<u>80</u>	<u>80</u>	<u>48</u>	<u>48</u>	
	<u>2,100</u>	<u>2,100</u>	<u>2,068</u>	<u>2,068</u>	
Cost per equivalent unit					
		Materials	Labour	Overhead	
		\$	\$	\$	
Costs – b/f		400	180	30	
– incurred		<u>22,550</u>	<u>16,304</u>	<u>8,212</u>	
		<u>22,950</u>	<u>16,484</u>	<u>8,242</u>	
Cost/EU		\$10.93	\$7.97	\$3.99	
Total Cost/EU					\$22.89
Valuations					
					\$
Good output					<u>46,238</u>
(2,020 × \$22.89)					
Closing WIP					\$
– materials		(80 × \$10.93)			874.40
– labour			(48 × \$7.97)		382.56
– overheads			(48 × \$3.99)		<u>191.52</u>
					<u>1,448.48</u>

7.3 FIFO or weighted average?

FIFO inventory valuation is more common than the weighted average method, and should be used unless an indication is given to the contrary. You may find that you are presented with limited information about the opening inventory, which forces you to use either the FIFO or the weighted average method. The rules are as follows:

- (a) If you are told the degree of completion of each element in opening inventory, but not the value of each cost element, then you must use the **FIFO method**.
- (b) If you are not given the degree of completion of each cost element in opening inventory, but you are given the value of each cost element, then you must use the **weighted average method**.



Activity 7: Units started and completed

Walter Co uses the FIFO method of process costing. At the end of a four-week period, the following information was available for Process P.

Opening WIP	2,000 units (60% complete) costing \$3,000 to date
Closing WIP	1,500 units (40% complete)

Transferred to next process 7,000 units

Required

How many units were started and completed during the period?

- 5,000
 - 7,000
 - 8,400
 - 9,000
-



Activity 8: Finished goods

Warehouse Co. which operates a process costing system, had work-in-progress at the start of last month of 750 units (valued at \$6,375) which were 60% complete in respect of all costs. Last month, a total of 5,000 units were completed and transferred into the finished goods warehouse. The cost per equivalent unit for costs arising last month was \$15. The company uses the FIFO method of cost allocation.

Required

What was the total value of the 5,000 units transferred to the finished goods warehouse last month?

- \$68,250
- \$74,625
- \$75,000
- \$6,375

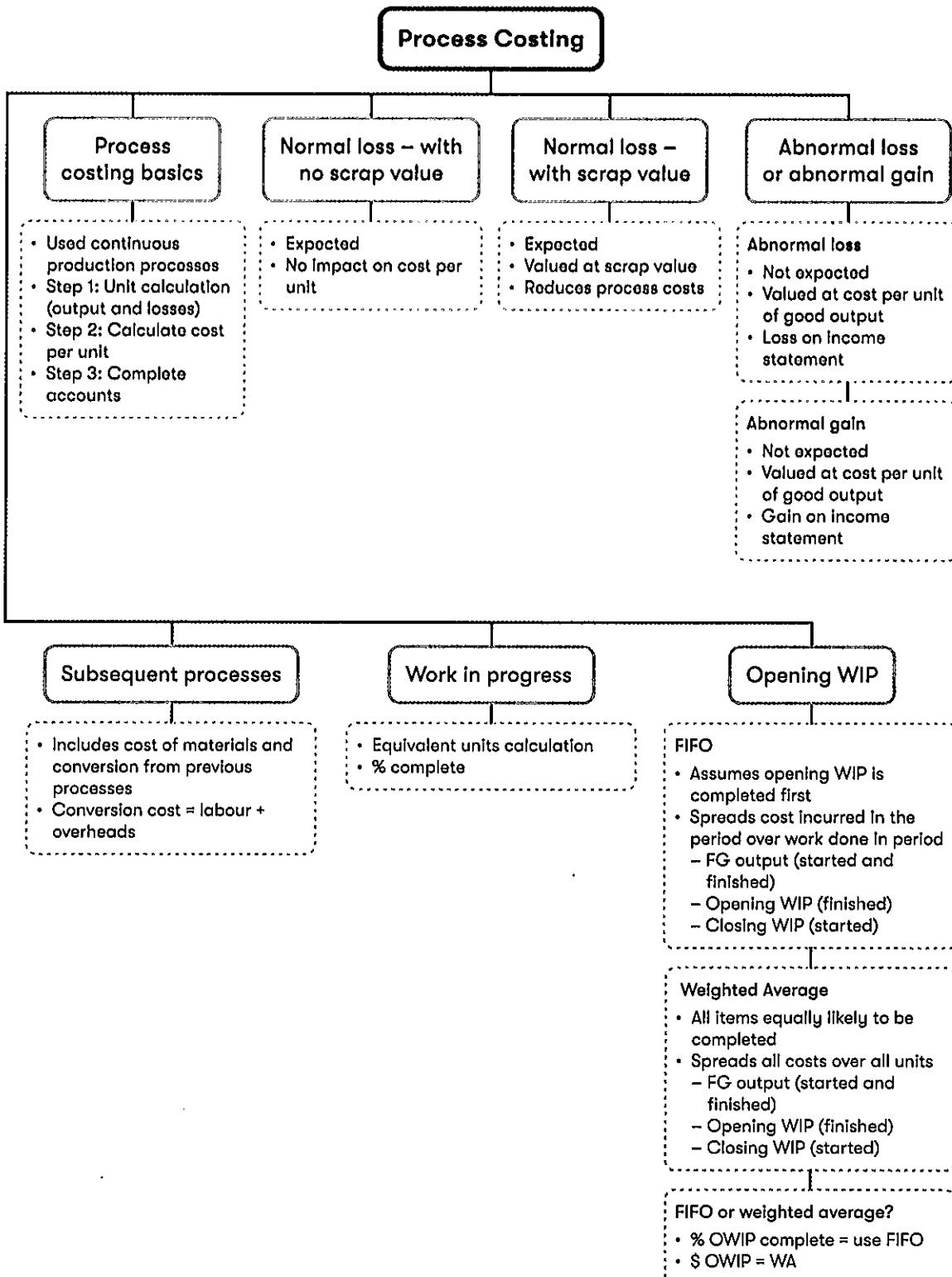
Solution



PER alert

PER performance objective 12b requires you to 'apply appropriate costing techniques to products and services'. This could include reporting on process costing information.

Chapter summary



Knowledge diagnostic

1. Process costing

Process costing can be used in a situation where it is not possible to identify separate units of production.

2. Normal loss

Expected losses are called normal losses. They may or may not have a value.

3. Abnormal loss

During the process abnormal gains or losses may occur, when the actual loss differs from the expected loss.

4. Subsequent processes

Costs in each process include the full cost of material inputs from previous processes.

5. Work in progress

Opening and closing WIP can be accounted for using either the FIFO or weighted average method.

Question approach:

- Determine output/losses and WIP units.
- Set up account and fill out easy parts. ie units and value of normal loss
- Calculate the cost per equivalent unit
- Complete the account

6. Which method to use

Use FIFO if opening WIP given in %

Use weighted average if opening WIP given in \$

Further study guidance

Question practice

Now try the following from the Further question practice bank (available in the digital edition of the workbook):

Section A: Q46 - Q50

Further reading

There is a technical article available on ACCA's website, called *Process costing*.

You are strongly advised to read this article in full as part of your preparation for the MA/FMA exam.

Activity answers

Activity 1: Abnormal loss or gain?

	Abnormal gain	Abnormal loss
Process J		✓
Process K	✓	

	Normal loss	Actual loss	Abnormal loss	Abnormal gain
Process J	$85,000 \times 3\% = 2,550$	$85,000 - 82,400 = 2,600$	50	-
Process K	$47,000 \times 7\% = 3,290$	$47,000 - 44,000 = 3,000$		290

Activity 2: Abnormal loss/gain calculation

Step 1: Unit calculation

Input units	=	Good output	+	Normal loss	+/-	Abnormal loss/(gain)
3,000	=	2,000	+	600	+	400
						Abnormal loss

Step 2: Calculate cost per unit of output and losses

$$\text{Cost per unit} = \frac{\$11,700 + \$6,300}{2,400} = \$7.50$$

Value of abnormal loss: $\$7.50 \times 400 \text{ units} = \$3,000$

Step 3: Complete accounts

Process 1 account

	Units	\$		Units	\$
Material	3,000	11,700	Output	2,000	15,000
Conversion costs		6,300	Normal loss	600	
	_____	_____	Abnormal loss	400	3,000
	3,000	18,000		3,000	18,000

Note. The question asked for the value of the abnormal gain or loss. You do not need to complete the process account but this is shown for completeness.

Activity 3: Charlton

The correct answer is: \$82,500

Step 1: Unit calculation

Input units	=	Good output	+	Normal loss	+/-	Abnormal loss/(gain)
3,300	=	2,750	+	330	+	220

Step 2: Calculate cost per unit

$$\frac{\text{Input costs}}{\text{Expected output}} = \frac{\$89,100}{3,300 - 330} = \$30 \text{ per unit}$$

Cost of good output:

$$\$30 \times 2,750 \text{ units} = \$82,500$$

Activity 4: WIP

$$\text{Cost per unit} = \text{Total cost} / \text{Total units} = \$250 / 300 \text{ units} = \$0.83 \text{ per unit}$$

Hence valuations:

$$\text{WIP: } 100 \text{ units @ } \$0.83 \text{ each} = \underline{\underline{\$83}}$$

$$\text{Finished goods: } 200 \text{ units @ } \$0.83 \text{ each} = \underline{\underline{\$166}}$$

$$\text{WIP } 100 \text{ units } 50\% \text{ complete} = 50 \text{ equivalent units}$$

$$\text{Cost per equivalent unit: } \$250 / 250 \text{ units} = \$1 \text{ per equivalent unit}$$

Hence valuations:

$$\text{WIP: } 50 \text{ equivalent units @ } \$1 \text{ each} = \underline{\underline{\$50}}$$

$$\text{Finished goods: } 200 \text{ equivalent units @ } \$1 \text{ each} = \underline{\underline{\$200}}$$

Activity 5: Equivalent units

The correct answer is: 1,100

You are required to work backwards.

You can calculate the cost per unit using the finished goods figures.

$$\text{Cost per unit} = \text{Cost of finished goods} / \text{Number of kg} = \$52,000 / 8,000 = \$6.50$$

If 2,000 kg (closing WIP figure) were fully complete total cost would be:

$$2,000 \times \$6.50 = \$13,000$$

$$\text{Actual cost of closing WIP} = \$7,150$$

$$\text{Degree of completion} = 7,150 / 13,000 = 55\%$$

$$\text{Therefore, equivalent units} = 55\% \times 2,000 = 1,100 \text{ kg}$$

Activity 6: Degree of completion

The correct answer is: 80%

$$\text{Cost per equivalent unit} = \$245,000 / 7,000 \text{ units} = \$35$$

$$\text{Degree of completion} = (\$140,000 / \$35) / 5,000 = 80\%$$

Activity 7: Units started and completed

The correct answer is: 5,000

As we are dealing with the FIFO method, opening WIP must be completed first.

Total output	7,000 units
Less opening WIP (completed first)	<u>2,000</u> units
Units started and completed during the period	<u>5,000</u> units

Activity 8: Finished goods

The correct answer is: \$74,625

	\$
4,250 units × \$15	63,750
750 units × 0.4 × \$15	4,500
Opening WIP value	<u>6,375</u>
Total value	<u>74,625</u>

10

Costing methods

Learning objectives

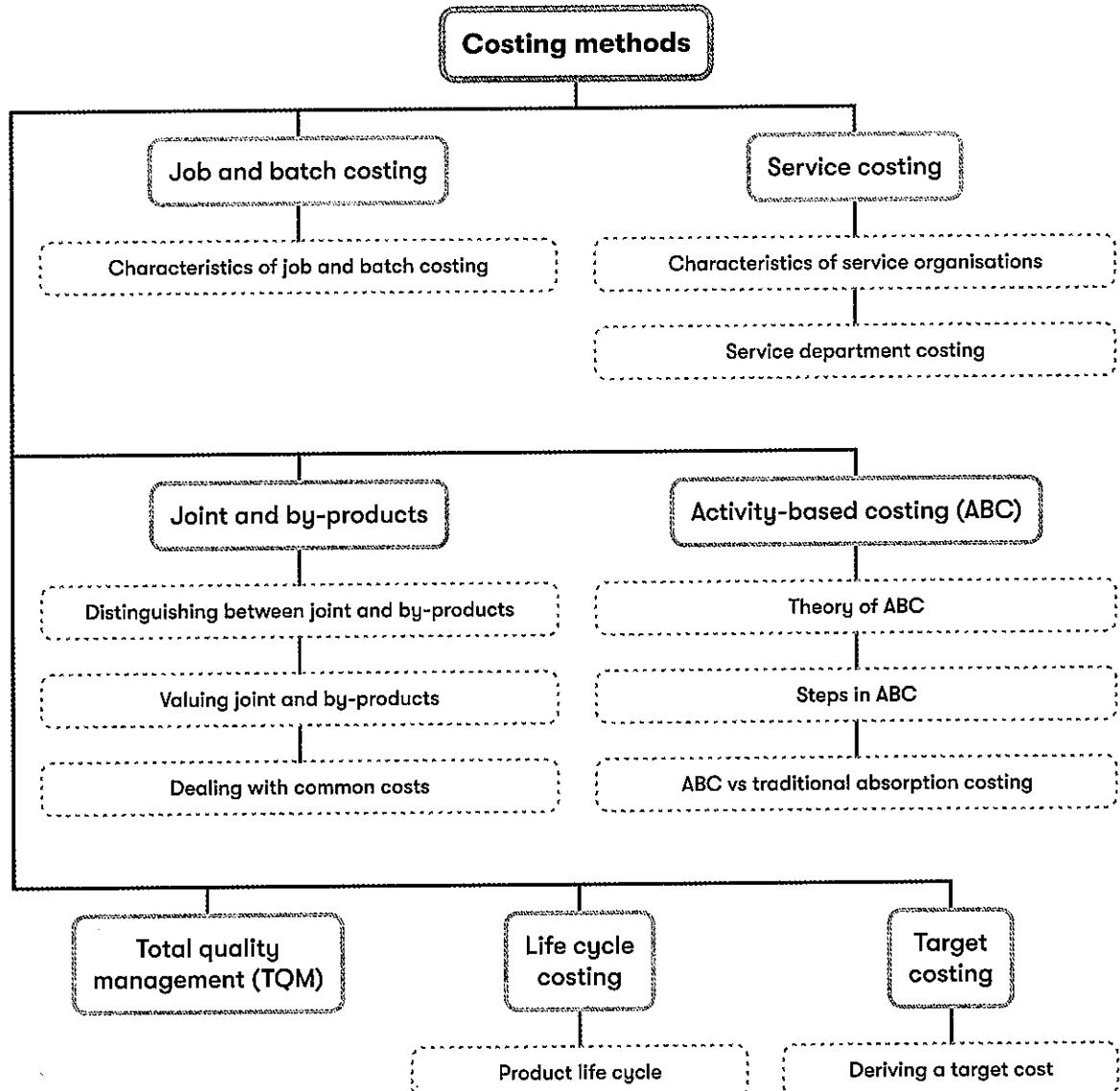
On completion of this chapter, you should be able to:

	Syllabus reference no.
Describe the characteristics of job and batch costing.	C3 (a)(i)
Describe the situations where the use of job or batch costing would be appropriate.	C3 (a)(ii)
Prepare cost records and accounts in job and batch costing situations.	C3 (a)(iii)
Establish job and batch costs from given information.	C3 (a)(iv)
Identify situations where the use of service/operation costing is appropriate.	C3 (c)(i)
Illustrate suitable unit cost measures that may be used in different service/operation situations.	C3 (c)(ii)
Carry out service cost analysis in simple service industry situations.	C3 (c)(iii)
Distinguish between by-products and joint products.	C3 (b)(x)
Value by-products and joint products at the point of separation.	C3 (b)(xi)
Prepare process accounts in situations where by-products and/or joint products occur.	C3 (b)(xii)
Explain activity-based costing (ABC), target costing, life cycle costing and total quality management (TQM) as alternative management techniques.	C4 (a)
Differentiate ABC, target costing and life cycle costing from the traditional costing techniques (note calculations are not required).	C4 (b)

Exam context

This chapter is a popular topic for questions. Make sure that you are able to deal with job, batch, service costing and joint product calculations for Section A of the examination. Notice that there will be no calculation questions for activity-based costing, target costing, life-cycle costing and TQM, so you only need to be able to answer discursive questions on these topics.

Chapter overview



1 Job and batch costing



Job: A job is a cost unit that consists of a single order or contract. Each job is separately identifiable and costs can be attributed to each job eg construction of a rail link.

Batch: A batch is a cost unit that consists of a separate, readily identifiable group of units, eg production of 10,000 disposable razors. Here the cost of a single unit is too small to be measured in \$'s.

The **cost per unit** manufactured in a batch is the total batch cost, divided by the number of units in the batch.



Activity 1: Job costing

Suggest three examples of businesses that use job costing.

Solution

1.1 Characteristics of job and batch costing

The work relating to a job moves through processes and operations as a **continuously identifiable unit**. Job costing is most commonly applied within a factory or workshop, but may also be applied to property repairs and internal capital expenditure. Customers tend to approach a supplier to indicate requirements of a job and then an estimate (or quote) for the job is prepared.

In general, the procedures for costing batches are very similar to those for costing jobs, as the batch is treated as a job during production. Once the batch has been completed, the cost per unit can be calculated as the total batch cost divided into the number of units in the batch.

1.1.1 Cost cards

A separate record must be maintained to show the details of individual jobs or batches. Such records are often known as **job cost sheets** or **cost cards** and are drawn up using absorption or marginal costing techniques in the same way as for individual products.

A job cost card would look like this:

Job XYZ	
	S
Direct materials	X
Direct labour (hrs × \$/hr)	X
Direct Expenses	<u>X</u>
PRIME COST	X
Variable overheads (hrs × \$/hr)	<u>X</u>
Fixed overheads	<u>X</u>
TOTAL COST	X

The organisation may also absorb **non-production overheads** and include these in the estimate of the total jobs cost.



Essential reading

See Chapter 10, Section 1 of the Essential reading for an illustration of job accounts.

The Essential reading is available as an Appendix of the digital edition of the Workbook.



Illustration 1: Batch costing

Rio manufactures Brazils to order and has the following budgeted overheads for the year, based on normal activity levels.

Production departments	Budgeted overheads	Budgeted activity
Welding	\$12,000	3,000 labour hours
Assembly	\$20,000	2,000 labour hours

Selling and administrative overheads are 25% of factory cost. An order for 500 Brazils, made as Batch 38, incurred the following costs.

Materials: \$24,000

Labour:

- 200 hours in the welding department at \$5 per hour
- 400 hours in the assembly department at \$10 per hour

\$1,000 was paid for the hire of X-ray equipment for testing the accuracy of the welds.

Required

Calculate the cost per unit for Batch 38.

Solution

The first step is to calculate the overhead absorption rate for the production departments.

Welding = $\$12,000 / 3,000 = \4 per labour hour

Assembly = $\$20,000 / 2,000 = \10 per labour hour

Total cost - Batch 38

	\$	\$
Direct material		24,000
Direct expense		1,000
Direct labour $200 \times \$5 =$	1,000	
$400 \times \$10 =$	<u>4,000</u>	<u>5,000</u>
Prime cost		30,000
Overheads $200 \times \$4 =$	800	
$400 \times \$10 =$	<u>4,000</u>	<u>4,800</u>
Factory cost		34,800
Selling and administrative cost (25% of factory cost)		<u>8,700</u>
Total cost		<u>43,500</u>

Cost per unit = \$43,500 / 500 = \$87



Activity 2: Job cost

A company is preparing for job X112. The job requires materials worth \$1,350 and 150 hours of labour.

Labour is paid at \$6 per hour, variable overheads are absorbed at a rate of \$2 per labour hour and fixed overheads at a rate of \$3 per labour hour.

Required

What is the total cost of job X112?

\$

Solution

1.1.2 Pricing a job



Exam focus point

An exam question about job costing may ask you to accumulate costs to arrive at a job cost, and then to determine a job price by adding a certain amount of profit. The selling price can be expressed as a percentage **margin** or a percentage **mark-up**.

For example, a selling price based on a 20% **margin** means that profit is 20% of **selling price**.

	%
Cost of job	80
+ Profit	20
= Selling price	100

A selling price based on a 20% **mark-up** means that profit is 20% of **cost**.

	%
Cost of job	100
+ Profit	20
= Selling price	120



Illustration 2: Margin and mark-up

Product CT's unit cost is \$150. A selling price is set based on a margin of 20%.

Product HM's unit cost is \$650. The mark-up is 20%.

Product JT's selling price is \$935. The mark-up is 10%.

Required

What are the selling prices for CT and HM and the unit cost for JT (to two decimal places)?

CT selling price \$

HM selling price \$

JT unit cost \$

Solution

CT selling price \$

HM selling price \$

JT unit cost \$

CT selling price

	\$	%
Cost	150	80
Profit	?	20
Selling price	?	100

Therefore selling price = \$150 + 80% = \$187.50

HM selling price

	\$	%
Cost	650	100
Profit	?	20
Selling price	?	120

Therefore, selling price = $\$650 \times 120\% = \780

JT unit cost

	\$	%
Cost	?	100
Profit	?	10
Selling price	935	110

Therefore, unit cost = $\$935 + 110\% = \850

2 Service costing

Service costing can be used by companies operating in a service industry or by companies wishing to establish the cost of services carried out by some of their departments. Service organisations do not make or sell tangible goods.



Service costing: Service costing (or function costing) is a costing method concerned with establishing the costs, not of items of production, but of services rendered.



Formula to learn

$$\text{Cost per service unit} = \frac{\text{Total costs for period}}{\text{Number of service units in the period}}$$

Service costing may be used in the following circumstances:

- Business operating in the service industry
 - Electricians
 - Car hire services
 - Road, rail or air transport services
 - Hotels
- Businesses wishing to establish the cost of services carried out by some of its departments
 - Costs of the vans or lorries used in distribution
 - The costs of the computer department
 - The staff canteen



Activity 3: Service costing

Suggest three examples of service organisations and consider how service organisations differ from manufacturing organisation.

	Service	Manufacturing
Product	<input type="text"/>	<input type="text"/>
Types of cost	<input type="text"/>	<input type="text"/>
Cost unit	<input type="text"/> <input type="text"/>	<input type="text"/> <input type="text"/> <input type="text"/>
Heterogeneous/ homogenous	<input type="text"/> <input type="text"/>	<input type="text"/>

Solution

2.1 Characteristics of service organisations

Simultaneous

The production and consumption of a service are simultaneous, and therefore it cannot be inspected for quality in advance.

Heterogeneous

A service is heterogeneous. The service received will vary each time. Services are more reliant on people. People are not robots, so how the service is delivered will not be identical each time.

Intangible

A service is intangible. The actual benefit being bought cannot be touched.

Perishable

Services are perishable, that is, they cannot be stored. For example, a hairdresser cannot do haircuts in advance and keep them stocked away for when demand increases.

This can be remembered using **SHIP**.

2.1.1 Composite cost units

The main problem with service costing is the difficulty in defining a realistic cost unit that represents a suitable measure of the service provided. Frequently, a composite cost unit may be deemed more appropriate.

For example, the charge for excess baggage on an airline might be based on:

- How far in km baggage has to be transported.
- How heavy the baggage is.

Both of these will impact on the airline's fuel cost, so it would be inappropriate to base the charge on either distance or weight alone. Clearly taking 10 kg 100 km will cost less than taking 10 kg 10,000 km.

To take account of this, a composite cost unit is derived ie cost per kg per km. This will provide a method of comparing costs for any weight travelling any journey.



Activity 4: Cost units

Suggest cost units that might be used by the service industry companies listed:

Service	Cost unit
Hotels	
Education	
Hospitals	
Catering establishments	
Rail, road and air transport	



Illustration 3: Service cost calculation

In the last year, the following information was collected:

Total kg of excess baggage carried	32,000 kg
Total miles excess baggage carried	25,000 km
Total cost incurred (eg extra fuel)	\$6m

Required

What is the cost of carrying an extra 2 kg an extra 5,000 km?

Solution

First work out the cost per kg per km:

$$\frac{6,000,000}{(32,000 \times 25,000)} = \$0.0075$$

Then work out the cost for the extra 2kg transported an extra 5,000km:

$$\$0.0075 \times 2 \times 5,000 = \$75.00$$



Essential reading

See Chapter 10, Section 2 for an illustration of a cost per unit calculation in a service business.

The Essential reading is available as an Appendix of the digital edition of the Workbook.

2.1.2 Charging customers for services

The procedure for charging customers for services is similar to that which applies in job costing. A mark-up will be added to the cost per unit to give a selling price which will provide the required level of profit.

The choice of the cost unit by the organisation is important to ensure that an equitable charge is made to the users of the service.

2.2 Service department costing

Service department costing is used to establish a specific cost for an ‘internal service’ that is, a service provided by one department for another, rather than one sold externally to customers. Service departments therefore include canteens and data processing departments.

Service department costing has two basic purposes:

- To control the costs and efficiency in the service department.
- To control the costs of the user departments, and prevent the unnecessary use of services.

2.2.1 The bases for charging service costs to user departments

- No charge at all
- Total actual cost
- Standard absorption cost
- Variable cost
- Opportunity cost
- Cost plus a margin for profit



PER alert

PER performance objective 12b requires you to ‘apply appropriate costing techniques to products and services’. This could include internal reporting on job, batch and service costing information.

3 Joint and by-products



Joint products: Joint products are two or more products which are output from the same processing operation, but which are indistinguishable from each other up to their point of separation.

By-products: A by-product is a supplementary or secondary product (arising as the result of a process) whose value is small relative to that of the principal product.

3.1 Distinguishing between joint and by-products

- (a) A **joint product** is regarded as an important saleable item, and so it should be **separately costed**. The profitability of each joint product should be assessed in the cost accounts.
- (b) A **by-product** is not important as a saleable item, and whatever revenue it earns is a ‘bonus’ for the organisation. Because of their relative insignificance, by-products are **not separately costed**.



Activity 5: Joint and by-products

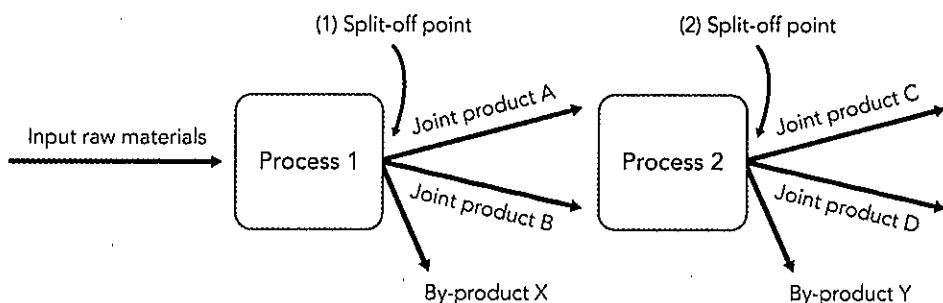
Give three examples of joint or by-products.

Solution

3.2 Valuing joint and by-products

The point at which joint products and by-products become separately identifiable is known as the **split-off point** or **separation point**. Costs incurred up to this point are called **common costs** or **joint costs**.

Common costs need to be allocated (apportioned) in some manner to each of the joint products. In the following sketched example, there are two different split-off points:



By-products:

- Do not allocate joint costs to them.
- If usual occurrence then calculate net proceeds of by-products and reduce process costs by this amount.
- If one-off then calculate net proceeds and treat as miscellaneous income.

3.3 Dealing with common costs

The main methods of apportioning joint costs, each of which can produce significantly different results, are as follows:

- Physical measurement
- Relative sales value apportionment method; sales value at split-off point

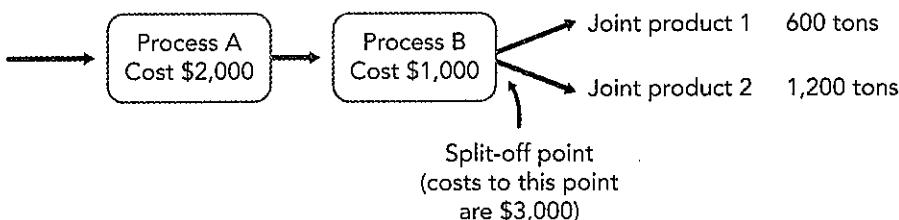
3.3.1 Physical measurement

With **physical measurement**, the common cost is apportioned to the joint products on the basis of the proportion that the output of each product bears by weight or volume to the total output.



Illustration 4: Physical measurement

Two products, Product 1 and Product 2, incur common costs to the point of separation of \$3,000 and the output of each product is 600 tons and 1,200 tons respectively.



Product 1 sells for \$4 per ton and product 2 for \$2 per ton.

Required

Calculate the profit for each product using physical measurement to apportion the common costs.

Solution

The division of the common costs (\$3,000) between Product 1 and Product 2 could be based on the tonnage of output.

	Product 1	Product 2	Total
Output	600 tons	+ 1,200 tons	1,800 tons
Proportion of common cost	$600 / 1,800 = 1/3$	$1,200 / 1,800 = 2/3$	
	\$ 1,000	\$ 2,000	\$ 3,000
Apportioned cost ($\$3,000 \times 1/3$ and $2/3$)	<u>2,400</u>	<u>2,400</u>	<u>4,800</u>
Sales			
Profit	<u>1,400</u>	<u>400</u>	<u>1,800</u>



Activity 6: Common costs and physical measurement

A process involves incorporating 2,000 units input of material costing \$2,000 with labour costs of \$2,000 and overheads of \$1,000.

The output of the process is two joint products: 600 units P1, 1,200 units P2; and 200 units of by-product. The by-product will be able to be sold for \$50 in total.

Required

- (1) Allocate the joint costs on a physical units basis.
- (2) Assuming P1 sells at \$2/unit and P2 sells at \$5/unit, what is the profit for each product?

Solution

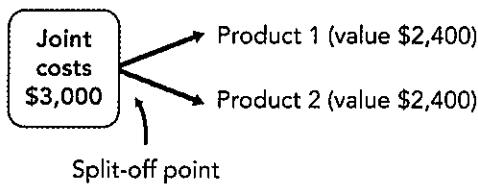
3.3.2 Sales value at split-off point

With relative sales value apportionment of common costs, the cost is allocated according to the product's ability to produce income. This method is most widely used because the assumption that some profit margin should be attained for all products under normal marketing conditions is satisfied.



Illustration 5: Sales value at split-off

Two products, Product 1 and Product 2, incur common costs to the point of separation of \$3,000 and the sales value of each product is \$2,400 (@ \$4 per ton) and \$2,400 (@ \$2 per ton) respectively.



Required

Calculate the profit for each product using sales value at split-off to apportion the common costs.

Solution

	Product 1	Product 2	Total
Sales	\$2,400	\$2,400	\$4,800
	2,400 / 4,800 = 0.5	2,400 / 4,800 = 0.5	
Proportion of common cost apportioned			

	\$	\$	\$
Apportioned cost ($\$3,000 \times 0.5$)	1,500	1,500	3,000
Sales	<u>2,400</u>	<u>2,400</u>	<u>4,800</u>
Profit	<u>900</u>	<u>900</u>	<u>1,800</u>



Activity 7: Relative sales value

A process involves incorporating 2,000 units input of material costing \$2,000 with labour costs of \$2,000 and overheads of \$1,000.

The output of the process is two joint products: 600 units P1, 1,200 units P2; and 200 units of by-product. The by-product will be able to be sold for \$50 in total.

Required

- (1) Allocate the joint costs based on sales value at split-off.
- (2) Assuming P1 sells at \$2/unit and P2 sells at \$5/unit, what is the profit for each product?

Solution



Exam focus point

Make sure you split the joint costs according to **sales value of production** rather than individual selling prices or the sales value of products sold.

3.3.3 Physical measurement vs sales value

Physical units basis is useful where:

- The joint products are in the same form eg both solids or both liquids
- The joint products are components in another product and therefore have no relevant sales value.

Relative sales value basis is useful where:

- Products are to be sold immediately with no further costs being incurred (such as selling costs);
- Joint products are not in the same form of output



Activity 8: Physical measurement

Two products, S and T, are created from a joint process. S can be sold immediately after split-off. T requires further processing into product TT before it is in a saleable condition. There are no opening inventories and no closing work-in-progress of products S, T or TT. The following data is available for the last period:

	\$	
Total joint processing costs	262,500	
Further processing costs of product T	49,500	
Product	Production units	Closing inventory
S	315,000	15,000
TT	247,500	22,500

Required

Using the physical unit method for apportioning joint production costs, what was the total value of the closing inventory of product TT for the last period?

- \$12,480
- \$13,969
- \$15,000
- \$16,200

Solution

3.3.4 By-products



Essential reading

See Chapter 10, Section 3 of the Essential reading for illustrations of accounting for by-products. The Essential reading is available as an Appendix of the digital edition of the Workbook.

3.4 Joint products in process accounts



Essential reading

See Chapter 14, Section 4 of the Essential reading for an illustration of how joint products are incorporated into process accounts.

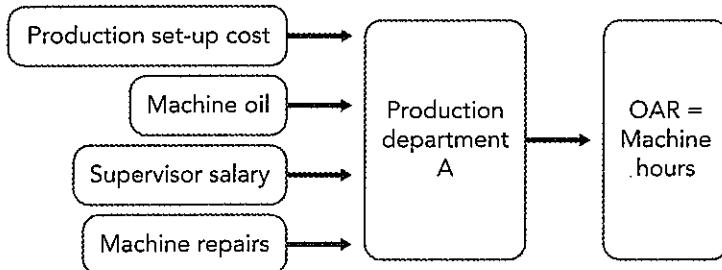
The Essential reading is available as an Appendix of the digital edition of the Workbook.

4 Activity-based costing (ABC)

ABC is a modern alternative to absorption costing which attempts to overcome the problems of costing in a modern manufacturing environment.

Traditional absorption costing uses a **single basis** for absorbing all overheads into cost units for a particular production department cost centre.

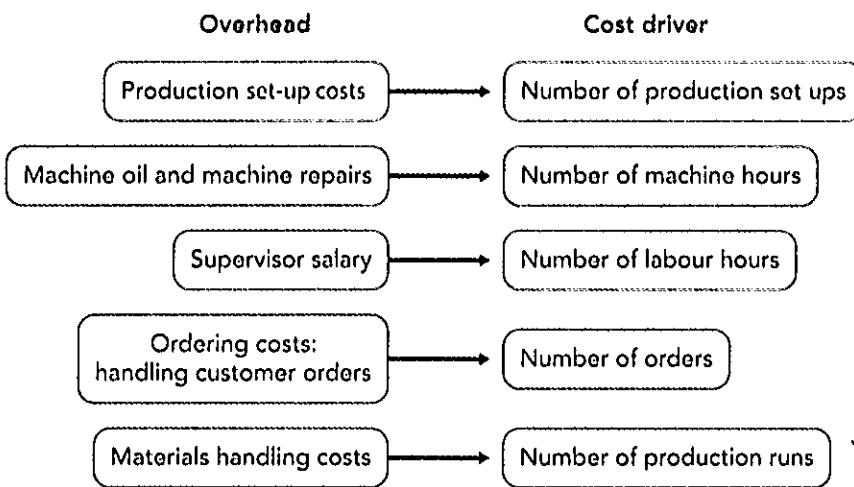
A business will choose the basis that best reflects the way in which the overheads are being incurred, eg in an automated business, much of the overhead cost will be related to maintenance and repair of the machinery. It is likely that this will vary to some extent with machine hours worked, so we would have used a machine hour absorption rate.



4.1 Theory of ABC

Production overheads are by no means all volume-related and hence, a single basis for absorption, eg labour hours, would not adequately reflect the **complexity** of producing certain products/cost units as opposed to others.

ABC is an extension of absorption costing specifically considering what causes each type of overhead category to occur, ie what the cost drivers are. Each type of overhead (often referred to as 'activity' in ABC) is absorbed using a **different basis** depending on the cost driver.



4.2 Steps in ABC

- Group overheads into activities, according to how they are driven. These groups are known as **cost pools**.
- Identify the **cost drivers** for each activity, ie what causes the activity cost to be incurred.
- Calculate a **cost per unit of cost driver**.
- Absorb** activity costs into production based on usage of cost drivers.

4.3 ABC vs traditional absorption costing

- ABC avoids reapportionment of service department costs.
- As ABC uses many cost drivers as absorption bases (rather than just one, such as labour hours) ABC absorption rates should be linked more closely to the causes of the overheads.
- ABC absorption rates should lead to more accurate product costing and therefore better decision making (eg setting product prices).
- ABC recognises that overhead costs arise out of diversity and complexity of operations.

5 Total quality management (TQM)



Total quality management (TQM): Total quality management (TQM) is the process of applying a zero defect philosophy to the management of all resources and relationships within the firm as a means of developing and sustaining a culture of continuous improvement that focuses on meeting customers' expectations.

Total quality management (TQM) is a business philosophy aimed at improving quality.

The process of the management of quality involves:

- Establishing standards of quality for a product/ service
- Establishing procedures or production methods to ensure these standards are met in a suitably high proportion of cases
- Monitoring actual quality; and
- Taking control action when actual quality is below standard.

TQM has two key philosophies:

- Get it right, first time**
 - The cost of preventing mistakes is less than the cost of correcting them if they occur.
- Continuous improvement**
 - Never be satisfied with current achievement. It is always possible to improve performance.

Performance measures for TQM should not simply be confined to the production process, as quality should be embraced in every activity of the organisation. Measures should also cover the work of the sales, distribution and administration departments and often non-financial performance measures are most useful.

Type of non-financial measure	Example
Measuring incoming supplies	<ul style="list-style-type: none"> Percentage of defective items per delivery Number of returns per supplier
Monitoring work done as it proceeds	<ul style="list-style-type: none"> Number of rejects per production run Ratio of waste material to used material
Measuring customer satisfaction	<ul style="list-style-type: none"> Complaints per 10,000 units sold Number of claims under warranty

6 Life cycle costing

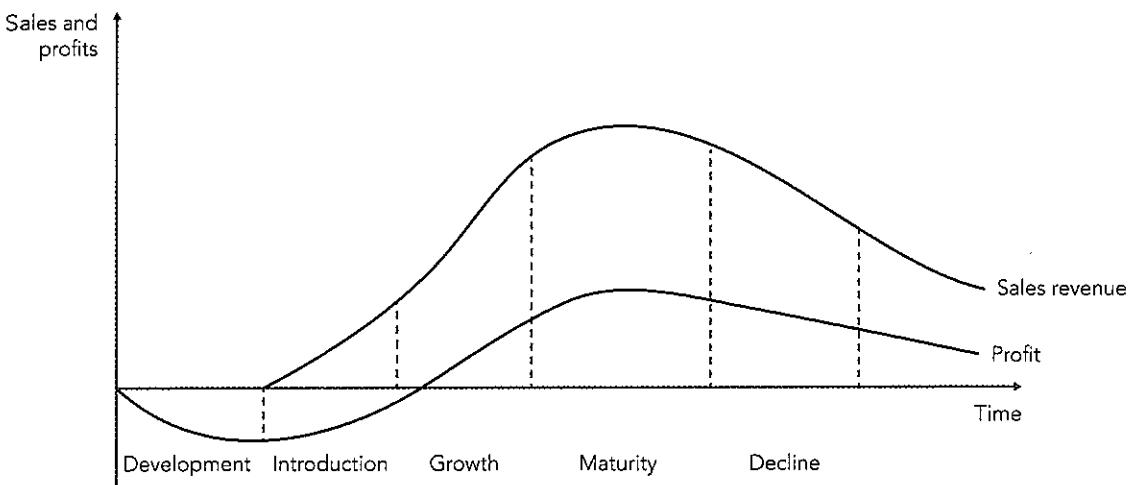
Life cycle costing aims to cost a product, service, customer or project over its entire lifecycle with the aim of maximising the return over the total life while minimising costs.

Traditionally, the costs and revenues of a product are assessed on a financial year or period-by-period basis.

Product life cycle costing considers all the costs that will be incurred from design to abandonment of a new product and compares these to the revenues that can be generated from selling this product at different target prices throughout the product's life.

6.1 Product life cycle

The product life cycle (PLC) can be divided into five stages:



Stage	Sales volume	Costs
Development	None	<ul style="list-style-type: none"> Research & development
Introduction	Very low levels	<ul style="list-style-type: none"> Very high fixed costs (eg non-current assets, advertising)
Growth	Rapid increase	<ul style="list-style-type: none"> Increase in variable costs Some fixed costs increase (eg Increase number of non-current assets)

Stage	Sales volume	Costs
Maturity	Stable High volume	<ul style="list-style-type: none"> Primarily variable costs
Decline	Falling demand	<ul style="list-style-type: none"> Primarily variable costs (now decreasing) Some fixed costs (eg decommissioning costs)

7 Target costing



Target costing: Target costing involves setting a target cost by subtracting a desired profit margin from a competitive market price.

Target cost: Target cost is an estimate of a product cost which is determined by subtracting a desired profit margin from a competitive market price. This target cost may be less than the planned initial product cost but it is expected to be achieved by the time the product reaches the maturity stage of the product life cycle.

In a modern environment with shortening product lifecycles, organisations must continually redesign their products. It is essential that they try to achieve a target cost during the product's development.

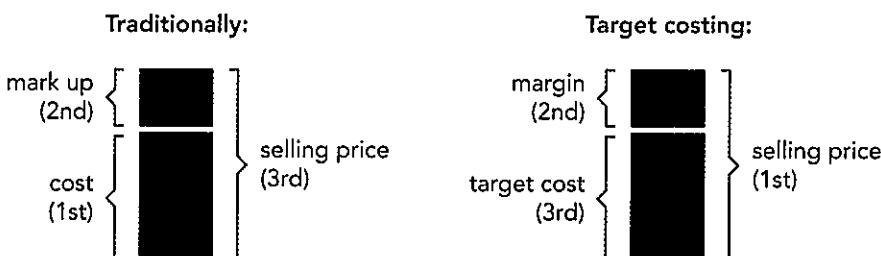
Under traditional approaches to pricing, businesses calculate the cost of manufacturing and selling a product, and then add mark up, to give the profit element. These methods are known as 'cost plus pricing'.

A major criticism of cost plus pricing techniques is that they do not consider any external factors (eg demand for product; number of competitors, etc). They are therefore unlikely to maximise the profits that a business will generate.

As product life cycles have become much shorter, the planning, development and design stage of a product is critical to an organisation's cost management process. Cost reduction must be considered at this stage of a product's life cycle, rather than during the production process.

Target costing involves setting a selling price for your product by reference to the market. From this, your desired profit margin is deducted, leaving you with a **target cost**.

7.1 Deriving a target cost



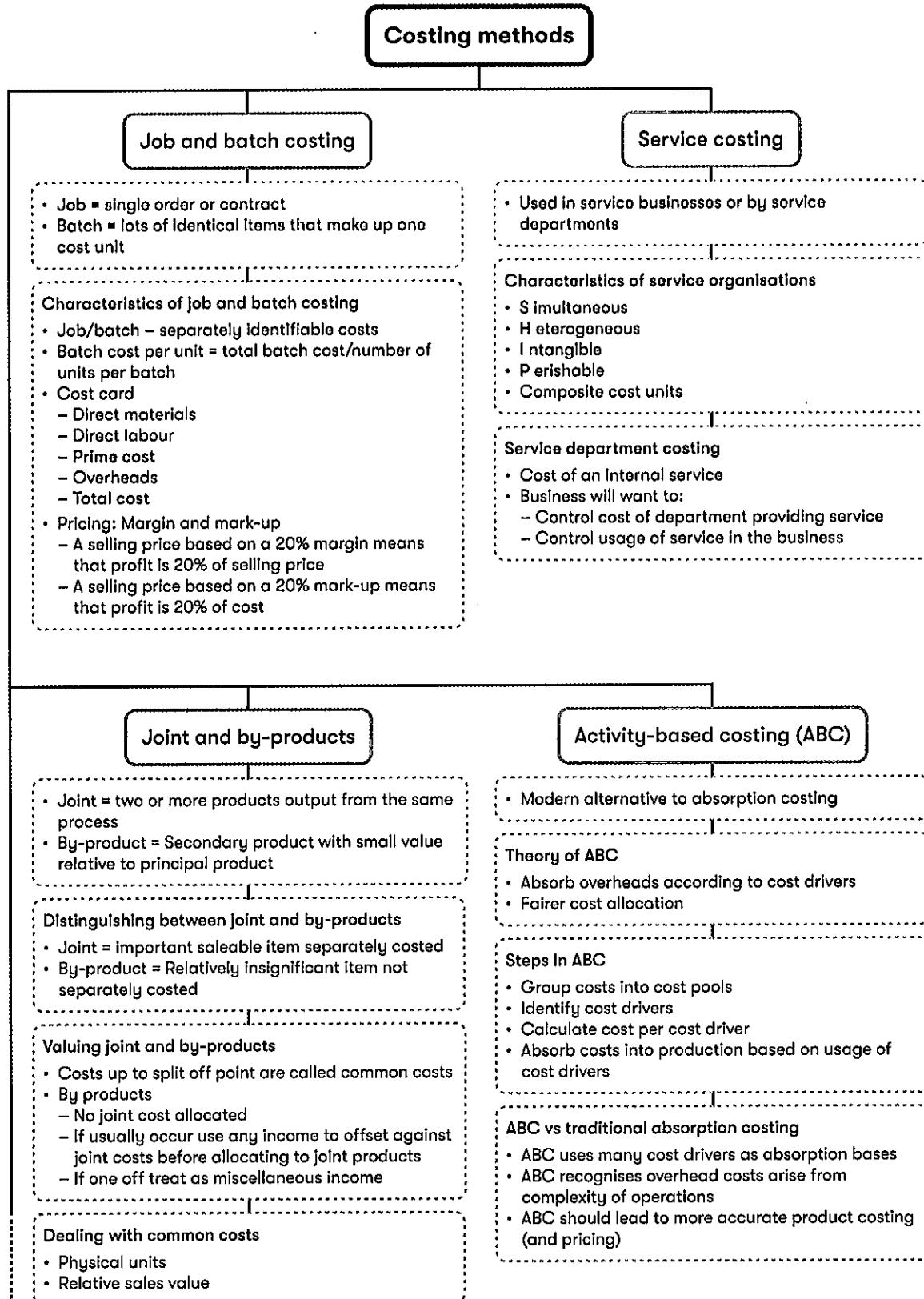
- Define product specification and estimate anticipated sales volume.
- Set a target selling price at which the company will be able to achieve the desired market share.
- Required profit is estimated based on profit margins or return on investment.

(d) Target cost is calculated as:

	\$
Target selling price	X
Less: target profit	<u>(X)</u>
Target cost	<u>X</u>

- (e) The estimated cost of the product is calculated based on the product specification and current cost levels.
- (f) Estimated Product Cost – Target Cost = Cost Gap
- (g) Efforts are made to close the cost gap. Aim to 'design out' costs before production starts.

Chapter summary



Total quality management (TQM)

- Focus on quality
- Get it right first time
- Continuous improvement

Life cycle costing

- Consider all costs and revenues of product throughout its life not just on a periodic basis

Product life cycle

- Development
- Introduction
- Growth
- Maturity
- Decline

Target costing

- Cost designed out and close cost gap

Deriving a target cost

- Target cost derived by deducting required margin

Knowledge diagnostic

1. Job and batch costing

Job costing is a costing method applied where work is undertaken to customers' special requirements and each order is of comparatively short duration.

Batch costing is similar to job costing in that a separately identifiable group of units are produced (often to order) and are treated as a single cost unit (like a job).

2. Service costing

Service costing is used by companies operating in a service industry. The main difficulty is defining an appropriate cost unit.

Service companies often use composite cost units to work out cost per unit on which to base their prices.

Service department costing is used to determine costs for 'internal services' such as canteens or IT support.

3. Joint products and by-products

Joint products are two or more products separated after a process, each of which has a significant value.

A by-product is an incidental product from a process which has an insignificant value compared to the main product.

By-products are not allocated any of the joint costs.

Joint products need to be apportioned a fair share of the joint costs at the split-off point.

The main methods of apportioning joint costs are by physical measurement and by relative sales value.

4. TQM

TQM is a business philosophy aimed at improving quality with two main ideas.

- Get it right, first time
- Continuous improvement

5. Life cycle costing

Life cycle costing considers all costs and revenues of a product throughout its life, rather than on a periodic basis.

6. Target costing

A target cost is derived by setting a selling price for a product and deducting a desired profit margin to arrive at the target cost.

Costs are then designed out of the product to ensure the target cost is achieved.

Further study guidance

Question practice

Now try the following from the Further question practice bank (available in the digital edition of the workbook):

Section A: Q51 - Q55

Activity answers

Activity 1: Job costing

Job costing may be used by:

- Plumbers
- Builders
- Engineering company

Activity 2: Job cost

\$ [3,000]

	Job X112 \$
Direct materials	1,350
Direct labour ($150 \times \$6$)	900
Variable overheads ($150 \times \$2$)	<u>300</u>
Prime cost	2,550
Fixed overheads ($150 \times \$3$)	<u>450</u>
Total cost	3,000

Activity 3: Service costing

Service		Manufacturing
Product	Intangible	Tangible
Types of cost	High proportion indirect	High proportion direct
Cost unit	Difficult to identify Can't be stored	Easy to identify Can build up inventory (not always - perishable)
Heterogeneous/ homogenous	Composite Heterogeneous	Homogenous

Examples of service businesses:

- Accountancy firm
- Advertising agency
- Law firm
- Government agency
- Charity

Activity 4: Cost units

Service	Cost unit
Hotels	Occupied bed per night
Education	Full-time students per tutor (Student/tutor)
Hospitals	Patient per day (Patient/day)
Catering establishments	Meals served
Rail, road and air transport	Passenger/mile or kilometre, ton/mile, tonne/kilometre

You may have thought of alternative suitable cost units.

Activity 5: Joint and by-products

Joint products

- Oil refinery (diesel, petrol, paraffin)
- Chicken farm (legs, wings)
- Forestry (timber, paper)

By products

- Forestry (saw dust)
- Fruit processing (fruit oils)
- Chicken farm (feathers)

Activity 6: Common costs and physical measurement

$$(1) P1: (600 / 1,800) \times (5,000 - 50) = \$1,650$$

$$P2: (1,200 / 1,800) \times (5,000 - 50) = \$3,300$$

(2) Profit

	Sales	Costs*	Profit
	\$	\$	\$
P1	1,200	1,650	(450)
P2	<u>6,000</u>	<u>3,300</u>	<u>2,700</u>
	<u>7,200</u>	<u>4,950</u>	<u>2,250</u>

*from 1

Activity 7: Relative sales value

$$(1) P1: (1,200 / 7,200) \times (5,000 - 50) = \$825$$

$$P2: (6,000 / 7,200) \times (5,000 - 50) = \$4,125$$

(2) Profit

	Sales	Costs	Profit
	\$	\$	\$
P1	1,200	825	375
P2	<u>6,000</u>	<u>4,125</u>	<u>1,875</u>

7,200 4,950 2,250

Activity 8: Physical measurement

The correct answer is: \$15,000

Joint costs apportioned to TT $((247,500/(315,000 + 247,500)) \times 262,500 = \$115,500)$

Closing inventory valuation $(22,500/247,500) \times (115,500 + 49,500) = \$15,000$

11

Setting budgets

Learning objectives

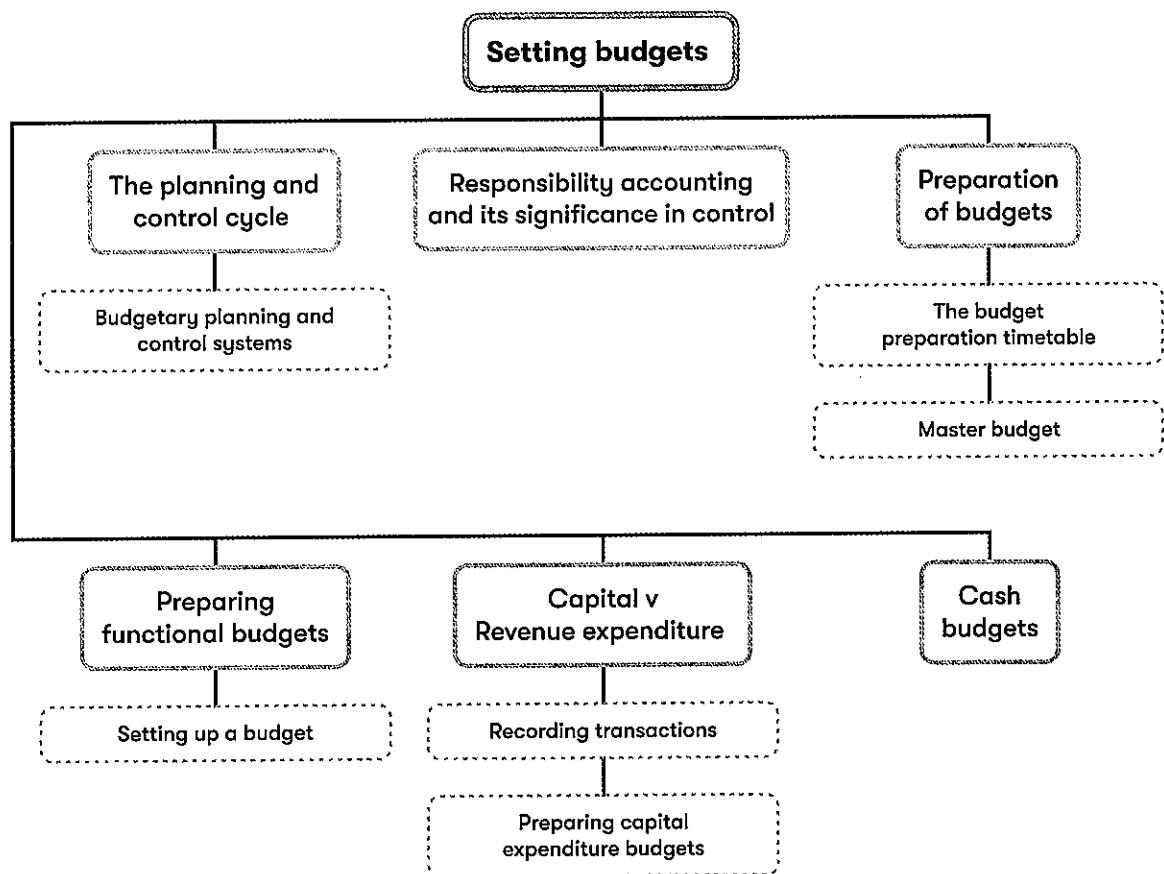
On completion of this chapter, you should be able to:

	Syllabus reference no.
Explain why organisations use budgeting.	D1 (a)
Describe the planning and control cycle in an organisation.	D1 (b)
Explain the administrative procedures used in the budgeting process.	D1 (c)
Describe the stages in the budgeting process (including sources of relevant data, planning and agreeing draft budgets and the purpose of forecasts and how they link to budgeting).	D1 (d)
Define and distinguish between capital and revenue expenditure.	D4 (b)
Discuss the importance of capital investment planning and control.	D4 (a)
Outline the issues to consider and the steps involved in the preparation of a capital expenditure budget.	D4 (c)
Explain the importance of the principal budget factor in constructing the budget.	D2 (a)
Prepare sales budgets.	D2 (b)
Prepare functional budgets (production, raw materials usage and purchases, labour, variable and fixed overheads).	D2 (c)
Prepare cash budgets.	D2 (d)
Prepare master budgets (statement of profit or loss and statement of financial position).	D2 (e)

Exam context

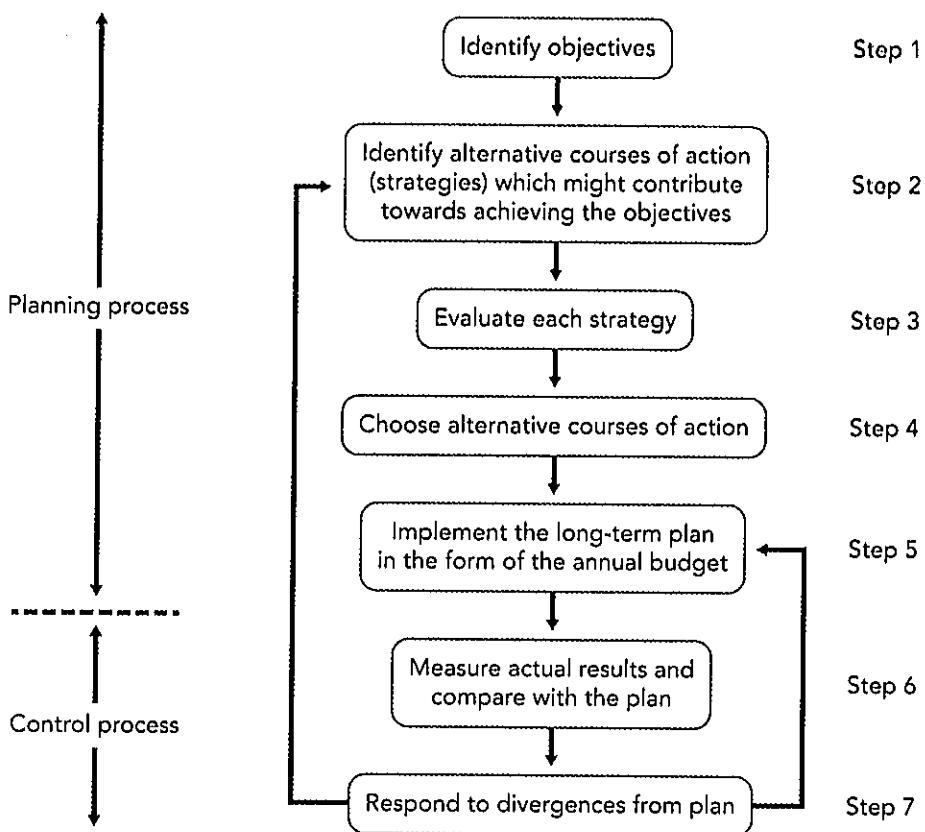
Budgeting is one of the key roles that a management accountant may perform and essential for planning and control within a business. You should expect to see questions on this topic in Section A and/or B of your examination.

Chapter overview



1 The planning and control cycle

The diagram below represents the planning and control cycle. Planning involves making choices between alternatives and is primarily a decision-making activity. The control process involves measuring and correcting actual performance to ensure that the strategies that are chosen and the plans for implementing them are carried out.



Step 1 Identify objectives

Objectives establish the direction in which the management of the organisation wish it to be heading. Typical objectives include the following:

- To maximise profits
- To increase market share
- To produce a better quality product than anyone else

Objectives answer the question: 'where do we want to be?'

Step 2 Identify potential strategies

Once an organisation has decided 'where it wants to be', the next step is to identify a range of possible courses of action or strategies that might enable the organisation to get there.

The organisation must therefore carry out an information-gathering exercise to ensure that it has a full understanding of where it is now. This is known as a 'position audit' or 'strategic analysis' and involves looking both inwards and outwards.

Step 3 Evaluate strategies

The strategies must then be evaluated in terms of suitability, feasibility and acceptability in the context of the strategic analysis. Management should select those strategies that have the greatest potential for achieving the organisation's objectives. One strategy may be chosen, or several.

Step 4 Choose alternative courses of action

The next step in the process is to collect the chosen strategies together and co-ordinate them into a long-term plan, commonly expressed in financial terms.

Step 5 Implement the long-term plan

The long-term plan should then be broken down into smaller parts. It is unlikely that the different parts will fall conveniently into successive time periods. Strategy A may take two and a half years, while Strategy B may take five months, but not start until year three of the plan. It is usual, however, to break down the plan as a whole into equal time periods (usually one year). The resulting short-term plan is called a budget.

Step 6 Measure actual results and compare with plan.

At the end of the year actual results should be compared with those expected under the long-term plan. The long-term plan should be reviewed in the light of this comparison and the progress that has been made towards achieving the organisation's objectives should be assessed.

Step 7 Respond to divergences from plan

Management can also consider the feasibility of achieving the objectives in the light of unforeseen circumstances which have arisen during the year. If the plans are now no longer attainable, then alternative strategies must be considered for achieving the organisation's objectives, as indicated by the feedback loop (the arrowed line) linking Step 7 to Step 2. This aspect of control is carried out by senior management, normally on an annual basis.

1.1 Budgetary planning and control systems

A budget is a quantified plan of action for a forthcoming accounting period. A budget is a plan of what the organisation is aiming to achieve and what it has set as a target, whereas a forecast is an estimate of what is likely to occur in the future.



Budget: A quantitative statement for a defined period of time, which may include planned revenues, expenses, assets, liabilities and cash flows. A budget facilitates planning.

The **objectives** of a budgetary planning and control system are as follows:

- P – Planning** – forces management to plan ahead in detail
- R – Responsibility** – clarifies what the budget holder can control
- I – Integration and co-ordination** – between departments / divisions
- M – Motivation** – employee behaviour will be affected by the budget
- E – Evaluation and control** – compare actual performance to budget targets



Activity 1: Purpose of a budget

Which of the following is NOT a purpose of a budget?

- To establish a basis of control of operations
- To communicate targets to managers
- To formulate strategic plans
- To coordinate the organisation's activities



Essential reading

See Chapter 11, Section 1 of the Essential reading, for detail on the administration of the budget.

The Essential reading is available as an Appendix of the digital edition of the Workbook.

2 Responsibility accounting and its significance in control

If a manager is to bear responsibility for the performance of a division, he will need information about its performance. To this end, different areas of the business are divided into responsibility centres.

Responsibility centres can be divided into three types:

Centre	Responsible for
Cost	Costs only
Profit	Costs and revenues
Investment	Costs, revenues and investment



Responsibility centre: A function or department of an organisation that is headed by a manager who has direct responsibility for its performance.

Responsibility accounting: A system of accounting that segregates revenue and costs into areas of personal responsibility in order to monitor and assess the performance of each part of an organisation.

Managers of responsibility centres should only be held accountable for costs over which they have some influence. From a motivation point of view, this is important because it can be very demoralising for managers who feel that their performance is being judged on the basis of something over which they have no influence. It is also important from a control point of view in that control reports should ensure that information on costs is reported to the manager who is able to take action to control them.



Controllable cost: 'A cost that can be controlled, typically by a cost, profit or investment centre manager'.

(CIMA Official Terminology)



Essential reading

See Chapter 11, Section 2 of the Essential reading, for detail on controllable costs.

The Essential reading is available as an Appendix of the digital edition of the Workbook.

3 Preparation of budgets

The budget period is commonly the accounting year and is usually split up into 12 or 13 control periods. (ie 13 four-week periods).

The budget manual is a collection of instructions governing the budgetary process. It is likely to contain:

- An explanation of the objectives of the budget
- Organisational structures
- Principal budgets
- Administrative detail
- Procedural matters

The budget committee is the co-ordinating body in the preparation and administration of budgets.



3.1 The budget preparation timetable

Step 1 Communicating details of the budget policy and budget guidelines

- Start point for budget is the long-term plan
- Managers also require guidelines on wage rate increases, changes in productivity etc

Step 2 Determining the factor that restricts output (the limiting factor)

The principal budget factor (or key budget factor or limiting budget factor) is the factor that limits an organisation's performance for a given period and is often the starting point in budget preparation. In most organisations, the principal budget factor is sales demand: a company is usually restricted from making and selling more of its products because there would be no sales demand for the increased output at a price which would be acceptable/profitable to the company. The principal budget factor may also be machine capacity, distribution and selling resources, the availability of key raw materials or the availability of cash. Once this factor is defined, the rest of the budget can be prepared. For example, if sales are the principal budget factor, then the production manager can only prepare their budget after the sales budget is complete.

Step 3 Preparation of the sales budget (assuming this is the limiting factor)

For many organisations, the principal budget factor is sales volume. The sales budget is therefore often the primary budget from which the majority of the other budgets are derived.

Before the sales budget can be prepared, a sales forecast has to be made.

On the basis of the sales forecast and the production capacity of the organisation, a sales budget will be prepared. This may be subdivided, possible subdivisions being by product, by sales area or by management responsibility.

Step 4 Initial preparation of budgets

(see section below on initial preparation of budgets)

Step 5 Negotiation of budgets with superiors

- Each budget is submitted to the relevant superior for approval.
- Budgets are then incorporated into others and passed on to the next superior and so on, until the final budget is presented to budget committee for approval.
- Each step involves negotiation until agreement is reached between parties

Step 6 Co-ordination of budgets

- Budget officer reviews all budgets to identify inconsistencies and ensure revisions of any budgets which require attention.
- Budgeted statement of profit or loss, statement of financial position and cash budgets is then prepared

Step 7 Final acceptance of the budgets.

It is at this point that the budgets are pulled together into a master budget (see below).

Step 8 Budget review

- Actual results compared to budget
- Variance analysis performed
- Budget committee meet periodically to review performance and revise budget
- Budget process should be seen as a continuous and dynamic process

3.2 Master budget

Once the functional budgets have all been prepared and reviewed to ensure they are all consistent, they are pulled together into a master budget. This comprises of a budgeted statement of profit or loss, statement of financial position and cash budget, which provide an overall picture of the planned performance for the budget period.

You should be aware of the format of a statement of profit or loss and statement of financial position and understand that they are produced on an accruals basis. A cash budget, by contrast, is simply a budget of both cash inflows and outflows, incorporating both capital and revenue items.

Given the nature of the MA exam, you would never be asked to complete the full statements in the exam. You could, however, be asked about one particular number.



Master budget : The master budget consists of a budgeted statement of profit or loss, a budgeted statement of financial position and a cash budget.

4 Preparing functional budgets

A functional budget is a budget that is associated with the various functions of an organisation. For example, sales budget, production budget, labour budget and cash budget.



Functional budget: Functional (or departmental) budgets are the budgets for the various functions and departments of an organisation. They therefore include production budgets, marketing budgets, sales budgets, personnel budgets, purchasing budgets and research and development budgets.

4.1 Principal budget factor (or limiting budget factor)

This is the factor that prevents an organisation from expanding at present beyond a certain point. The principal budget factor is usually sales demand.

Other factors could include:

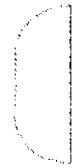
- Availability of raw material
- Availability of labour supply
- Machine capacity
- Availability of cash
- Distribution and selling resources



The principal budget factor : The principal budget factor (or key budget factor or limiting budget factor) is the factor that limits an organisation's performance for a given period and is often the starting point in budget preparation.



Activity 2: Limiting budget factor



Magic Co's production process requires 3.5 kg of material per unit of production. For the first three months of next year, only 54,600 kg of material will be available each month. Assume, production is spread evenly over the three months.

Required

What will be the maximum monthly production level?

 units

Solution

4.2 Setting up a budget

- Step 1** Identify the principal budget factor.
- Step 2** Work the budgets around it.

4.3 Initial preparation of budgets

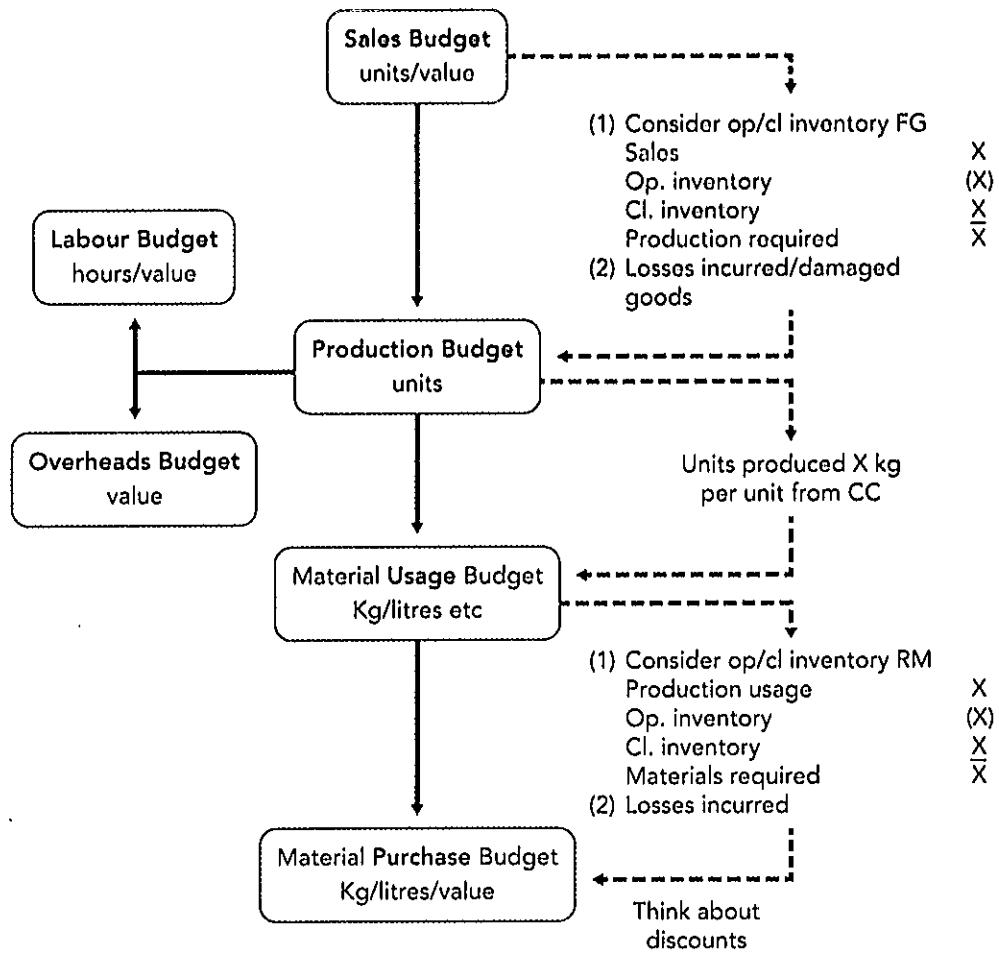


Illustration 1: Functional budgets

Bun Co makes a range of cakes. When producing the budget for 20X1, the company realises that its principal budget factor is sales, and forecasts the following sales:

Product name:	Sponge cake	Jam cake	Cream cake
Sales (number of batches)	2,400	4,800	1,200
Selling price per batch	\$150	\$175	\$200

The unit direct costs of producing a batch of each type of cake are:

Materials/Labour	Sponge cake	Jam cake	Cream cake
Flour (@ 50c/kg)	5kg	6kg	7kg
Milk (@ 70c/litre)	4 litres	5 litres	6 litres
Labour Mixers (@\$2/hr)	1/2 hour	3/4 hour	1 hour
Labour Cooks (@\$3/hr)	1/2 hour	1/2 hour	1 hour

The company has inventory levels of completed batches of cakes as follows: 480 Sponges, 480 Jams and 240 Creams and raw materials inventory of 1,000 kg of flour and 500 litres of milk. Management feel that 20X1's sales figures could well be repeated in 20X2 and wishes to have sufficient inventory of finished batches to cope with 10% of this demand and raw materials to cope with 20% of the demand for the finished product.

Required

Complete the functional budgets for Bun Co.

Solution

Sales budget

	Sponge cake	Jam cake	Cream cake	Total
Sales (number of batches)	2,400	4,800	1,200	8,400
Selling price per batch	\$150	\$175	\$200	
Revenue	\$360,000	\$840,00	\$240,000	\$1,440,000

Production budget

	Sponge cake	Jam cake	Cream cake
Sales	2,400	4,800	1,200
Closing inventory	<u>240</u>	<u>480</u>	<u>120</u>
	2,640	5,280	1,320
Opening inventory	(480)	(480)	(240)
Production	<u>2,160</u>	<u>4,800</u>	<u>1,080</u>

Material usage

	Sponge cake	Jam cake	Cream cake	Total
Flour – (kg)	10,800	28,800	7,560	47,160
Milk – (litres)	8,640	24,000	6,480	39,120

Material purchases

	Flour Kg	Flour \$	Milk Litres	Milk \$	Total
Usage	47,160	23,580	39,120	27,384	50,964
Closing inventory (W)	<u>9,840</u>	<u>4,920</u>	<u>8,160</u>	<u>5,712</u>	<u>10,632</u>
	57,000	28,500	47,280	33,096	61,596
Opening inventory	(1,000)	(500)	(500)	(350)	(850)
Purchases	<u>56,000</u>	<u>28,000</u>	<u>46,780</u>	<u>32,746</u>	<u>60,746</u>

W: Closing inventory

Flour: $(20\% \times 2,400 \text{ sales} \times 5 \text{ kg}) + (20\% \times 4,800 \text{ sales} \times 6 \text{ kg}) + (20\% \times 1,200 \times 7 \text{ kg}) = 9,840 \text{ kg}$

Milk: $(20\% \times 2,400 \text{ sales} \times 4\text{l}) + (20\% \times 4,800 \text{ sales} \times 5\text{l}) + (20\% \times 1,200 \times 6\text{l}) = 8,160 \text{ litres}$

Labour utilisation budget

	Mixers (hours)	Cooks (hours)	Total (hours)
Sponge (2,160 units)	1,080	1,080	2,160
Jam (4,800 units)	3,600	2,400	6,000
Cream (1,080 units)	<u>1,080</u>	<u>1,080</u>	<u>2,160</u>
	<u>5,760</u>	<u>4,560</u>	<u>10,320</u>
Hourly rate	\$2	\$3	
Total cost	<u><u>\$11,520</u></u>	<u><u>\$13,680</u></u>	<u><u>\$25,200</u></u>



Activity 3: Material purchases budget

Suppose a company currently holds 100 units of inventory but it wishes to increase its inventory holding to 150 units during the next month. Sales are expected to be 850 units. Each unit requires 5 kg of material. Of units produced, 10% have to be discarded because they are defective. No inventories of raw materials are held.

Required

What should the raw materials purchases for next month be? (Give your answer to the nearest whole kg.)

[] kg

Solution

5 Capital v revenue expenditure

Capital expenditure is the acquisition of non-current assets or an improvement in their earning capacity. Non-current assets will be acquired and retained by the business with a view to earning profits and not merely turning them into cash.



Revenue expenditure is usually incurred for the purpose of the trade of the business or to maintain the existing earning capacity of non-current assets.

Capital expenditure: Capital expenditure is expenditure which results in the acquisition of non-current assets, or an improvement in their earning capacity.

Non-current asset: A non-current asset is an asset which is acquired and retained in the business with a view to earning profits and not merely turning into cash. It is normally used over more than one accounting period.

Revenue expenditure: Revenue expenditure is expenditure which is incurred for either of the following reasons:

- For the purpose of the trade of the business; this includes expenditure classified as selling and distribution expenses, administration expenses and finance charges
- To maintain the existing earning capacity of non-current assets



Activity 4: Capital v revenue expenditure

Brum Brum Co is a second hand car dealer. The bookkeeper has a list of items of expenditure for the last month, but cannot decide if they are capital or revenue, and has asked for your help.

	Capital expenditure	Revenue expenditure
Purchase of envelopes for the office		
Extension to the sales office		
Purchase of new delivery van		
Road tax & insurance for new delivery van		
Purchase of 10 new cars for resale		
Repair of broken window in the workshop		
Purchase of 5 new laptops for the sales men (previously they recorded sales leads in a notebook)		

Required

Select the correct box for each item of expenditure.

5.1 Recording transactions

Capital expenditure is not charged as an expense in the statement of profit or loss for the business, although a depreciation charge will usually be made to write off the capital expenditure over the assets' useful economic life. This depreciation charge will be debited to the statement of profit or loss.

There will be a debit to the statement of financial position to show the purchase of a non-current asset.

Revenue expenditure will be charged to the statement of profit or loss for the period, provided that it relates to trading activity and sales of that particular period.

It is essential that the type of transactions is correctly identified and treated, as incorrect classification will result in incorrect levels of profit being reported.



Activity 5: Recording transactions

An error has been identified in the accounts of Hawk Co.

The purchase of new machinery has been treated as revenue expenditure.

Required

What would be the impact on the financial statements of this error?

- Profit reported - too high, Machinery asset value - too high
- Profit reported - too high, Machinery asset value - too low
- Profit reported - too low, Machinery asset value - too high
- Profit reported - too low, Machinery asset value - too low

5.2 Capital income v revenue income

Capital income is the proceeds from the sale of non-trading assets (ie proceeds from the sale of non-current assets, including investments). The profits (or losses) from the sale are included in the statement of profit or loss for the accounting period in which the sale takes place.

Revenue income is derived from the following sources:

- The sale of trading assets
- Interest and dividends received from investments held by the business

5.3 Other capital transactions

The categorisation of capital and revenue items above does not mention raising additional capital from the owner(s) of the business, or raising and repaying loans. These are entirely reflected on the statement of financial position and would not be shown in the statement of profit or loss.

5.4 Preparing capital expenditure budgets

Capital expenditure often involves spending large sums of money. Companies therefore need to appraise decisions to invest in new capital expenditure carefully and make sure that they have the funds available at the correct time.

We will see how to appraise projects in Chapter 13.

Planning for capital expenditure should form part of the business' longer term plans, and so should be drawn up for the short, medium and long term.



Essential reading

See Chapter 11, Section 3 of the Essential reading, for more detail on preparing the capital expenditure budget.

The Essential reading is available as an Appendix of the digital edition of the Workbook.



PER alert

PER performance objective 13b requires you to 'Coordinate, prepare and use budgets'. The knowledge covered in this chapter will help you demonstrate your competence in this area.

6 Cash budgets

The level of cash held by a business is important. A cash budget shows how the cash balance will change over several months.



Cash budget: A cash budget is a detailed budget of cash inflows and outflows incorporating both revenue and capital items.

A cash budget is a statement in which estimated future cash receipts and payments are tabulated in such a way as to show the forecast cash balance of a business at defined intervals.

6.1 Presentation

XYZ Co: Cash budget for the three months ended 31 March 20X3

	Jan	Feb	March
Cash receipts			
Sales receipts (W1)	X	X	X
Loan	-	X	X
	X	X	X
Cash payments			
Purchase payments (W2)	(X)	(X)	(X)
Wages	(X)	(X)	(X)
Overheads	(X)	(X)	(X)
Non-current assets	(X)	-	-
	X	X	X
Net cash flow	X	(X)	X
Opening balance	X	X	X
Closing balance	X	(X)	X

6.2 Approach to preparing a cash budget

Fill in the easy figures first.

- Sundry receipts and payments: for example, the purchase of non-current assets.
- Wages and salaries: usually paid when due.
- Sales receipts. Check the timing of the cash receipt – some sales may be for cash, others for credit.
- (Payments to payables. Again the timing of the payment needs to be considered carefully.)

Cash budgets consider the cash element of business transactions, whereas the statement of profit or loss records all transactions on an accruals basis regardless of when cash is received or paid.



Activity 6: Cash budget transactions

Select the correct boxes to show which of the following should be included in a cash budget.

	Include	Do not include
Purchase of new machinery		

	Include	Do not include
Payment of tax		
Bad debts written off		
Depreciation of delivery van		
Road tax for delivery van		
Payment to supplier		

6.3 Cash effect

You may need to work out the cash effect of a transaction from Income statement and statement of financial performance information as follows.

Receivables receipts – sales recorded in January will not usually be cash receipts for January.

	\$
Receivables b/fwd	X
Sales (on credit)	X
Receivables c/fwd	(X)
∴ Cash received	(X) =

Purchase payments

	\$
Payables b/fwd	X
Purchases (on credit)	X
Payableless c/fwd	(X)
∴ Cash paid	(X) =

6.4 Potential cash surpluses or shortages

Cash budgets can give management an indication of any cash surpluses or shortages expected.

Management can then make decisions on financing any expected cash shortage or investing any cash surpluses.



Illustration 2: Preparation of a cash budget

Kookaburra have prepared the following budgeted data.

	March	April	May	June	July
Sales	4,250	4,600	5,000	5,350	5,400
Purchases	1,200	1,300	1,500	1,600	1,750
Wages	800	800	850	850	850
Other overheads	650	650	675	675	675
Capital expenditure			3,000	1,000	

Additional information:

- (1) 30% sales are for cash. The remaining sales are on credit and customers pay 1 month later
- (2) Purchases are paid for after one month
- (3) Wages and other overheads are paid in the current month. Other overheads include \$400 of depreciation each month.

Required

Prepare a monthly cash flow forecast for quarter 2.

Solution

	April	May	June	Total qtr 2
Receipts				
Cash sales	1,380	1,500	1,605	4,485
Credit sales	<u>2,975</u>	<u>3,220</u>	<u>3,500</u>	<u>9,695</u>
	4,355	4,720	5,105	14,180
Payments				
Purchases	1,200	1,300	1,500	4,000
Wages	800	850	850	2,500
Overheads	250	275	275	800
Non-current assets	<u>0</u>	<u>3,000</u>	<u>1,000</u>	<u>4,000</u>
Total payments	2,250	5,425	3,625	11,300
Net cash flow	2,105	(705)	1,480	2,880
Opening balance	<u>750</u>	<u>2,855</u>	<u>2,150</u>	<u>750</u>
Closing balance	2,855	2,150	3,630	3,630



Activity 7: Cash budget

Kaz Co currently sells its product for \$50 but it is anticipated that there will be a price increase of 4% from 1 February. The sales quantities are expected to be as follows:

January	20,000 units
February	21,500 units
March	22,800 units

All sales are on credit and 40% of cash is received in the month following the sale and the remainder, two months after the sale.

Required

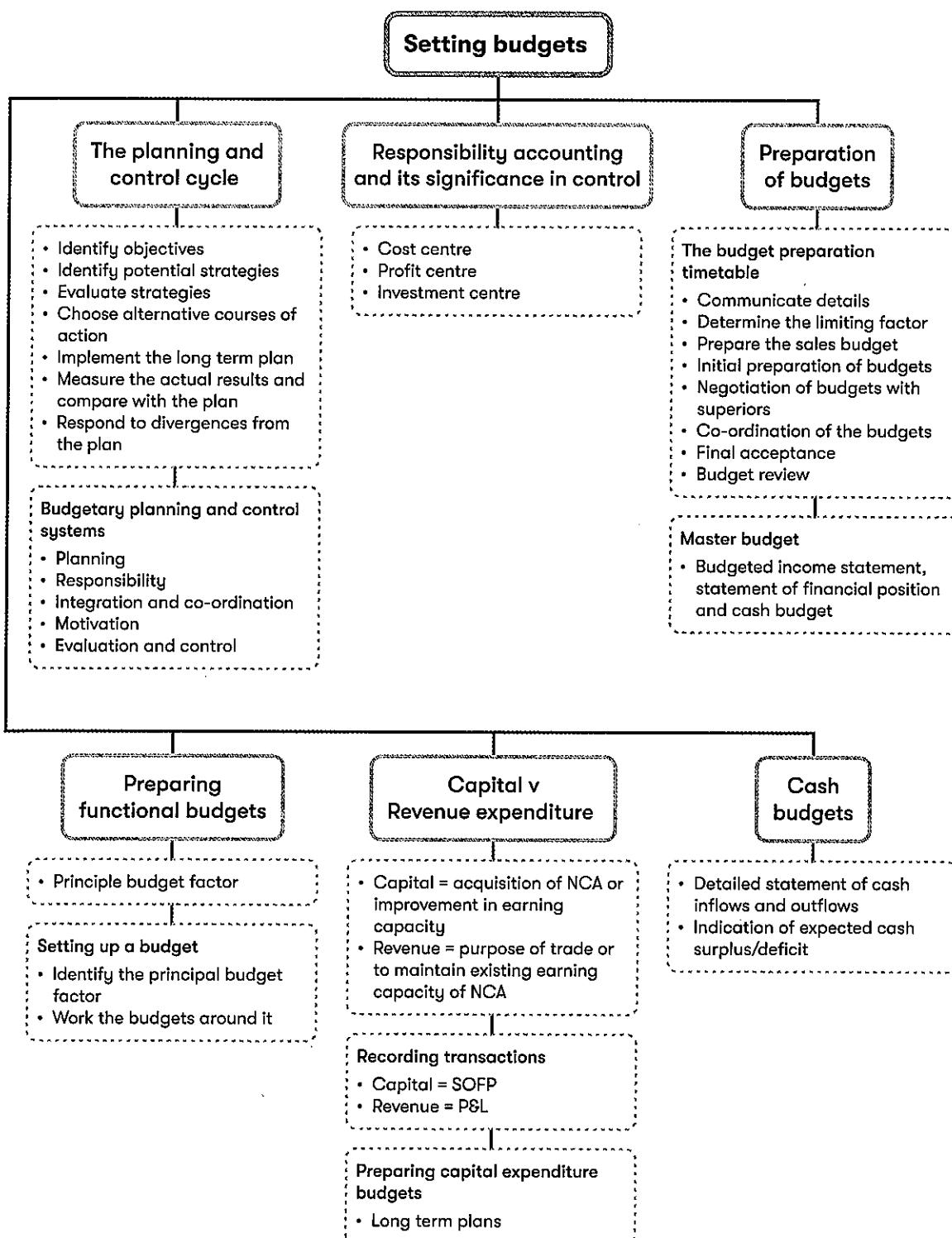
What are the receipts from January and February sales that are received in March?

Receipts in March relating to January sales \$

Receipts in March relating to February sales \$

Solution

Chapter summary



Knowledge diagnostic

1. Planning and control cycle

There are seven stages in the planning and control cycle.

2. Budgetary planning

A budget is a quantified plan of action for a forthcoming period.

3. Responsibility accounting

Divisions are divided into types of responsibility centres: cost, revenue and profit centres. These represent the level of control exercised by that division on costs, revenues and investment.

4. Preparation of budgets

The budget committee co-ordinates the preparation and administration of budgets.

5. Master budget

This pulls together all the individual budgets and is usually comprised of a budget income statement, statement of financial position and cash budget.

6. Capital v revenue transactions

Items of income and expenditure should be correctly classified. Capital expenditure is when new non-current assets are acquired, whereas revenue expenditure occurs for the purposes of trade or improving assets.

7. Principal budget factor

The principal budget factor should be identified at the start of the process, and the overall budget constructed around this limiting factor. This is often sales demand.

8. Cash budgets

Cash planning is important to businesses as it helps forecast cash surpluses or shortages.

Further study guidance

Question practice

Now try the following from the Further question practice bank (available in the digital edition of the workbook):

Section A: Q56 - Q60

Section B: Q94

Further reading

There is a technical article available on ACCA's website, called *Cash budgets*.

You are strongly advised to read this article in full as part of your preparation for the MA/FMA exam.

Activity answers

Activity 1: Purpose of a budget

The correct answer is: To formulate strategic plans

The budget is set within the framework of the organisation's strategic plan, converting it into a shorter term action plan for the forthcoming period. The budget does not in itself act as a means of formulating the strategic plan.

Activity 2: Limiting budget factor

$$54,600\text{kg} / 3.5\text{kg} = 15,600 \text{ units}$$

Activity 3: Material purchases budget

	Good units
Sales	850
Less: opening inventory	(100)
Closing inventory requirement	<u>150</u>
Production	<u>900</u>

900 good units required, but 10% of production defective.

∴ need to produce $(900/90) \times 100 = 1,000$ units

i.e. 900 good and 100 defective

∴ materials required = $1,000 \times 5 \text{ kg} = 5,000 \text{ kg}$

No inventories of raw materials are held

∴ 5,000 kg needs to be purchased

Activity 4: Capital v revenue expenditure

	Capital expenditure	Revenue expenditure
Purchase of envelopes for the office		✓
Extension to the sales office	✓	
Purchase of new delivery van	✓	
Road tax & insurance for new delivery van		✓
Purchase of 10 new cars for resale		✓
Repair of broken window in the workshop		✓
Purchase of 5 new laptops for the sales men (previously they recorded sales leads in a notebook)	✓	

Activity 5: Recording transactions

The correct answer is: Profit reported - too low, Machinery asset value - too low

The profits will be too low as they will include the full cost of the asset instead of the depreciation charge for the period and the asset value will exclude the assets altogether.

Activity 6: Cash budget transactions

	<i>Include</i>	<i>Do not include</i>
Purchase of new machinery	✓	
Payment of tax	✓	
Bad debts written off		✓
Depreciation of delivery van		✓
Road tax for delivery van	✓	
Payment to supplier	✓	

Activity 7: Cash budget

Receipts in March relating to January sales $20,000 \times \$50 \times 60\% = 600,000$

Receipts in March relating to February sales $21,500 \times \$50 \times 1.04 \times 40\% = 447,200$

12

Implementing budgets

Learning objectives

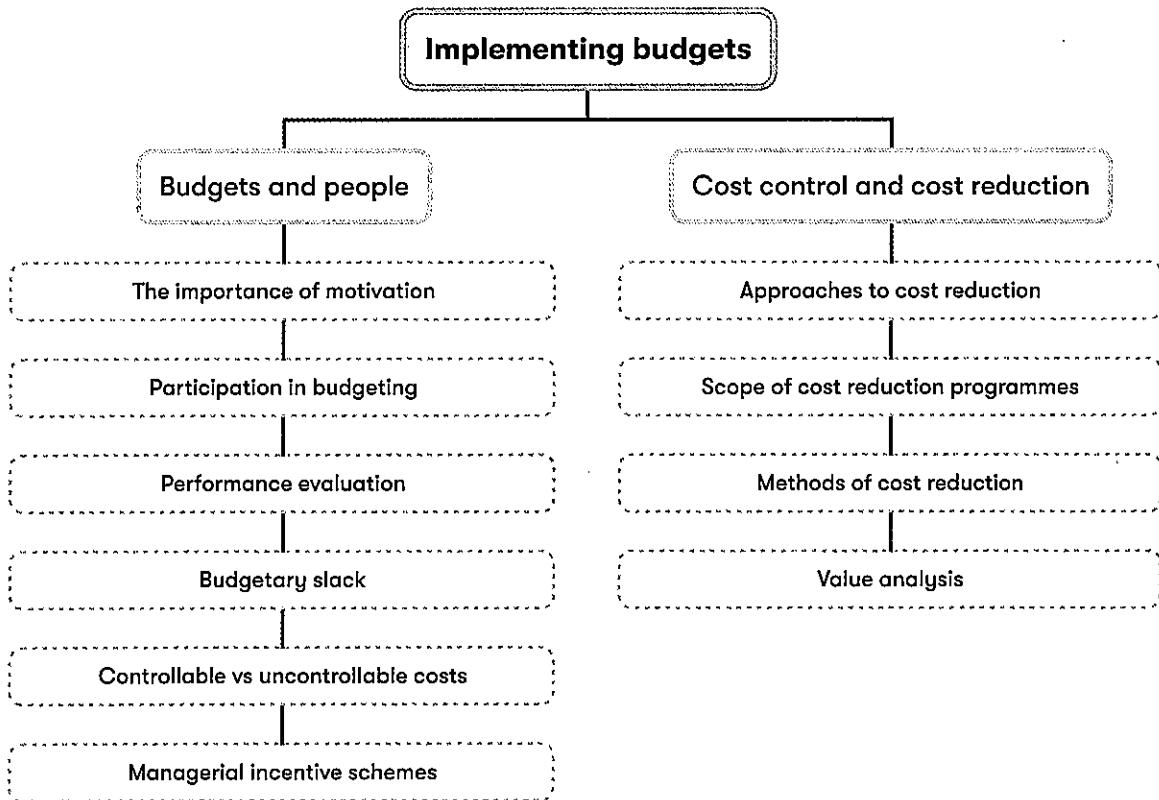
On completion of this chapter, you should be able to:

	Syllabus reference no.
Explain the importance of motivation in performance management.	D6 (a)
Identify factors in a budgetary planning and control system which influence motivation.	D6 (b)
Explain the impact of targets upon motivation.	D6 (c)
Discuss managerial incentive schemes.	D6 (d)
Discuss the advantages and disadvantages of a participative approach to budgeting.	D6 (e)
Explain top-down, bottom-up approaches to budgeting.	D6 (f)
Explain the concepts of controllable and uncontrollable costs.	D5 (e)
Compare cost control and cost reduction.	F3 (a)
Describe and evaluate cost reduction methods.	F3 (b)
Describe and evaluate value analysis.	F3 (c)

Exam context

This chapter looks at how to put budgets into action. Questions on this topic are unlikely to include calculations and would be most likely in Section A of the examination.

Chapter overview



1 Budgets and people

The purpose of a budgetary control system is to assist management in planning and controlling the resources of their organisation by providing appropriate control information. This information is only valuable if it is interpreted correctly and used purposefully by managers and employees. Used correctly, a budgetary control system can motivate but it can also produce undesirable negative reactions.

1.1 The importance of motivation

A well-designed budgetary process should encourage goal congruence.



Goal congruence: Goal congruence is when individuals make decisions that are in their self-interest and also in the best interest of the organisation.

Dysfunctional decision-making: Dysfunctional decision making occurs when goal congruence does not exist or is impaired. Managers and others take decisions that promote their self-interest at the expense of the interest of the organisation.

Maintaining motivated managers is an important aspect of setting and achieving targets.

To do this, managers should be involved in the planning process when budgets are set, so that they are not set at unachievable levels.

Challenging and achievable targets should be set that can lead to acceptable rewards.

Managers should be kept informed of any changes in strategic plans and understand the part they play in budget preparation.

1.1.1 Behavioural problems

The correct response to control information relies on the behaviour of recipients. Problems can arise because:

- The managers who set the budget are not responsible for achieving it
- Lack of goal congruence
- Poor attitudes when setting the budget
- Poor attitudes when putting plans into action
- Control is applied at different stages by different people



Essential reading

See Chapter 12, Section 1 of the Essential reading for more information on attitudes to budgeting.

The Essential reading is available as an Appendix of the digital edition of the Workbook.

1.2 Participation in budgeting

Participation in the budgeting process can improve motivation and therefore the quality of the budget decisions. There are two different approaches to generating and managing budgets:

- Top-down (imposed budget)
- Bottom-up (participative budget)

1.2.1 Top-down/imposed style budgeting



Top down budget: An imposed/top-down budget is set without allowing the budget holder to have the opportunity to participate in the budgeting process.

Top-down budgets are appropriate:

- In newly formed organisations
- In very small businesses

- During times of economic hardship
- When operational managers lack budgeting skills

1.2.2 Bottom-up/participative budgeting



Bottom-up budget: Bottom-up budgeting ensures all budget holders are given the opportunity to participate in setting their own budgets.

Advantages

- Staff doing the work have the most accurate knowledge of operations
- More achievable targets based on local knowledge
- Morale and motivation improved as people are working towards their own budgets
- Reduces the work load of top management

Disadvantages

- Time consuming
- Staff may set targets that are too easy and lack consistency (budgetary slack)
- May never get agreement if too many conflicting views
- Staff may lack skills/knowledge required

In practice, the different levels of management often agree budgets by a process of negotiation (negotiated budgeting).

1.3 Performance evaluation

Once decided, budgets become targets. As targets, they can motivate managers to achieve a high level of performance.

Employees should be kept informed about how actual results are progressing and how these compare with targets. Individuals should not be kept in the dark about their performance. The key features of feedback:

- Clear and comprehensive reports
- Reports identify **controllable** costs and revenues
- Timely reports (eg so control action can be taken)
- Accurate information

The impact of an accounting system on managerial performance depends on how the information is used.

Hopwood (1974) identified three ways of using budgetary information to evaluate managerial performance:

Style of evaluation	Comment
Budget constrained	Managers' performance is measured on their ability to meet the budget.
Profit conscious	Managers' focus is on increasing the effectiveness of a unit's operations. The goal is to generate a positive return to shareholders.
Non-accounting	Managers' focus is non-financial rather than on their ability to meet budget. Performance is evaluated using measures such as feedback from colleagues.

1.4 Budgetary slack



Budgetary slack: Budgetary slack is the difference between the minimum necessary costs and the costs built into the budget or actually incurred.

When managers set their own budgets, they may be tempted to deliberately overestimate costs and underestimate sales so that they will not be blamed in the future for overspending and poor results.

In controlling actual operations, the managers then ensure that their spending rises to meet the budget.

Slack or manipulation of accounting reports is more likely to occur if the manager is under pressure to achieve short-term budget targets.



Activity 1: Budgetary slack

Which of the following is an example of budgetary slack?

- A manager uses his/her best estimate of likely costs when setting the budget.
- A manager's advertising budget is disproportionately large in comparison with the budgeted revenue to be generated.
- A manager underestimates revenues when setting the budget to ensure that the budget target can be exceeded easily.
- A manager will consult with their team to try to establish an appropriate sales volume target.

1.5 Controllable vs uncontrollable costs

A manager should only be held accountable for costs over which they have some influence (ie controllable costs).

Managers should not be held accountable for costs over which they have no control.

1.6 Managerial incentive schemes

Businesses can encourage managers to meet budget targets by allowing them to participate in the budget process, by implementing a system of responsibility accounting (covered in Chapter 11) and by offering incentives.

1.6.1 Profit sharing schemes



Profit sharing scheme: A profit sharing scheme is a scheme in which employees receive a certain proportion of their company's year-end profits (the size of their bonus being related to their position in the company and the length of their employment to date).

Advantages

- The company will only pay what it can afford out of actual profits.
- Bonus can also be paid to non-production personnel.

Disadvantages

- Employees must wait until the year end for a bonus (ie long-term commitment without the incentive of immediate reward).
- Factors affecting profit may be outside the control of employees.
- Too many employees involved in a single scheme may not have a great motivating effect on individuals.

1.6.2 Incentive schemes involving shares



Share option scheme: A share option scheme is a scheme that gives its members the right to buy shares in the company for which they work at a set date in the future and at a price usually determined when the scheme is set up.

Employee share: An employee share ownership plan is a scheme which acquires shares on behalf of a number of employees, and it must distribute these shares within a certain number of years of acquisition.

Advantages

- Employees feel they have a stake in the business.
- May offer incentive to employees to make decisions that focus on long-term benefits (rather than just short-term profits)

Disadvantages

- Benefits are not certain as the market value of shares cannot realistically be predicted.
- Benefits are not immediate, as a scheme must be in existence for several years before members can exercise their rights.

1.6.3 Value added incentive schemes



Value added: Value added is an alternative to profit as a business performance measure and it can be used as the basis of an incentive scheme. It is calculated as follows:

$$\text{Value added} = \text{sales} - \text{cost of bought-in materials and services}$$

The advantage of value added over profit as the basis for an incentive scheme is that it excludes any bought-in costs, and is affected only by costs incurred internally, such as labour.

A basic value added figure would be agreed as the target for a business, and some of any excess value added earned would be paid out as a bonus. For example, it could be agreed that value added should be, say, treble the payroll costs and a proportion of any excess earned, say one-third, would be paid as a bonus.

Payroll costs for month	\$40,000
Therefore, value added target ($\times 3$)	\$120,000
Value added achieved	\$150,000
Therefore, excess value added	\$30,000
Employee share to be paid as bonus	\$10,000

2 Cost control and cost reduction



Cost control: Cost control is concerned with regulating the costs of operating a business and keeping costs within acceptable limits.

Cost reduction: Cost reduction is a planned and positive approach to reducing expenditure.

Cost control is like an exercise in good housekeeping; the wasteful use of valuable resources is avoided and efficiency and cost consciousness are encouraged.

Cost reduction, by contrast, starts with an assumption that current cost levels, or planned cost levels, are too high, even though cost control might be good and efficiency levels high.

2.1 Approaches to cost reduction

There are two basic approaches to cost reduction:

- Crash programmes to cut spending levels – often a reaction to cash flow or profitability problems, a company may decide on an immediate programme to reduce spending.
- Planned programmes to reduce costs – this involves a continual assessment of the organisation even during times of prosperity, to ensure that crash programmes are not needed.



Essential reading

See Chapter 12, Section 2.1 of the Essential reading for information on the difficulties of introducing cost reduction programmes.

The Essential reading is available as an Appendix of the digital edition of the Workbook.

2.2 Scope of cost reduction programmes

A cost reduction campaign should embrace the activities of the entire company.

A cost reduction campaign should have long-term and well as short-term objectives:

- In the short term only, variable costs can usually be susceptible to cost reduction efforts. Fixed costs, eg rent cannot easily be changed.
- Some fixed costs are avoidable in the short term (eg advertising) these are known as discretionary fixed costs.
- In the long term, most costs can be either reduced or avoided.

2.3 Methods of cost reduction

2.3.1 Improving efficiency

One way of reducing costs is to improve the efficiency of materials usage, the productivity of labour or the efficiency of machinery and other equipment.



Essential reading

See Chapter 12, Section 2.2 onwards for more detail on methods of cost reduction.

The Essential reading is available as an Appendix of the digital edition of the Workbook.

2.4 Value analysis



Value analysis (VA): A planned, scientific approach to cost reduction, which reviews the material composition of a product and the product's design so that modifications and improvements can be made which do not reduce the value of the product to the customer or user.

The value of the product must therefore be kept the same or else improved, at a reduced cost. The administration of a VA exercise should perhaps be the responsibility of a cost reduction committee.



Value engineering: The application of VA techniques to new products, so that new products are designed and developed to a given value at minimum cost.

2.4.1 Value

Four aspects of 'value' should be considered.



Cost value: Cost value is the cost of producing and selling an item.

Exchange value: Exchange value is the market value of the product or service.

Use value: Use value is what the article does; the purposes it fulfils.

Esteem value: Esteem value is the prestige the customer attaches to the product.



Activity 2: Value analysis

Classify the following features of a product, using the types of value set out above.

The product can be sold for \$27.50.

The product is available in six colours to suit customers' tastes.

The product will last for at least ten years.

Solution

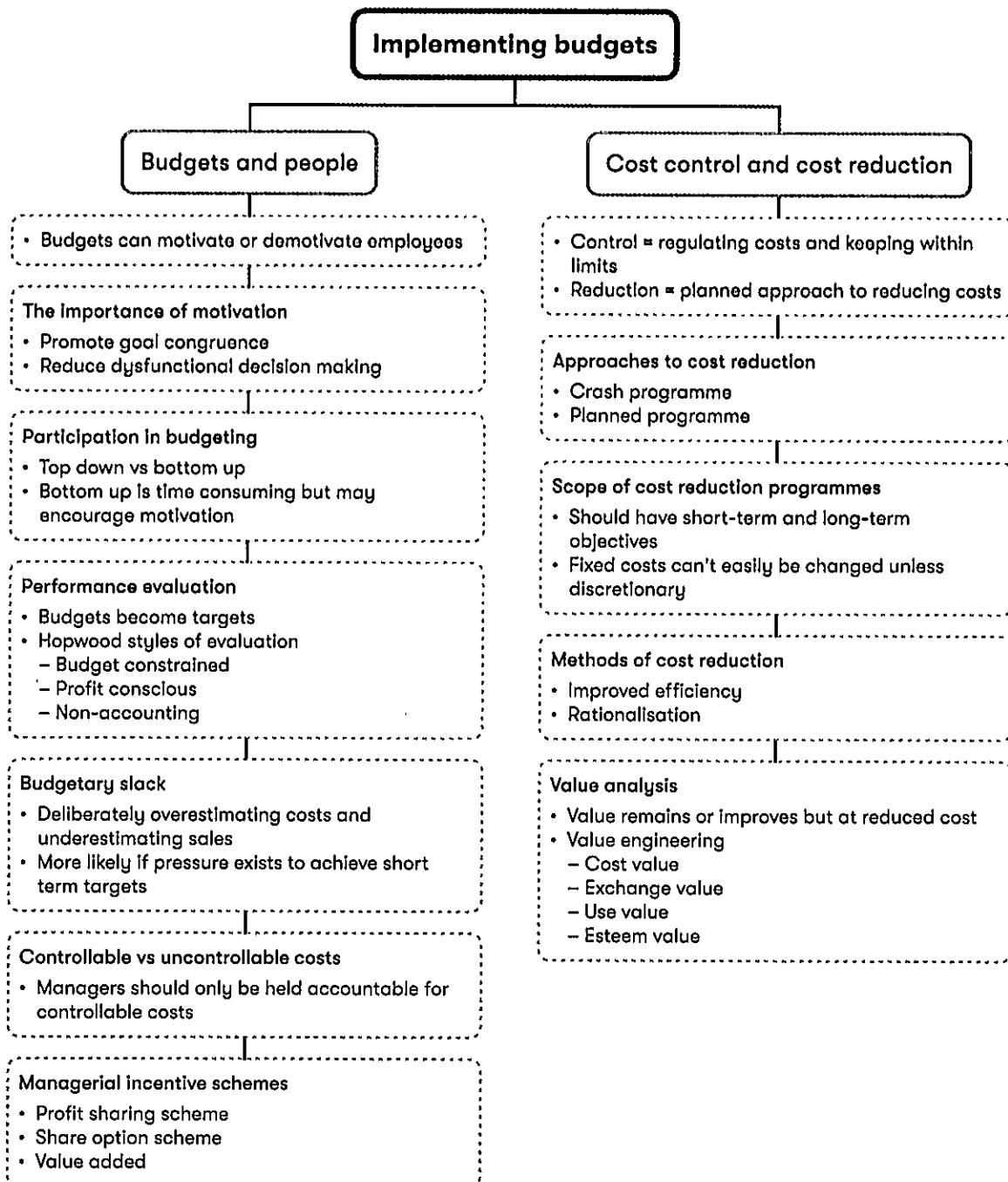


Essential reading

See Chapter 12, Section 3 of the Essential reading for more detail on value analysis.

The Essential reading is available as an Appendix of the digital edition of the Workbook.

Chapter summary



Knowledge diagnostic

1. Behavioural implications

- Motivation
- Goal congruence
- Behaviour problems
- Budgetary slack

2. Participation

- Top-down v bottom-up
- Negotiated budgets

3. Performance evaluation

Essential to inform employees how actual results are progressing.

Hopwood – 3 ways to evaluate managerial performance

4. Incentive schemes

- Profit sharing
- Share options
- Value added

5. Cost reduction and cost control

Make sure you understand the difference – cost control links to variances identified and cost reduction is a planned approach

6. Approaches to cost reduction

- Crash programmes to cut spending levels
Planned programmes to decrease costs

7. Scope of cost reduction programme

- Whole company
Short-term and long-term objectives

8. Methods of cost reduction

- Improved efficiency:
Material efficiency
Labour productivity
Machinery efficiency

9. Value analysis

Planned scientific approach to cost reduction. There are four aspects of value:

- Cost value
- Exchange value
- Use value
- Esteem value

The value of the product may therefore be kept the same or else improved at a reduced cost

Further study guidance

Question practice

Now try the following from the Further question practice bank (available in the digital edition of the workbook):

Section A: Q61 - Q65

Activity answers

Activity 1: Budgetary slack

The correct answer is: A manager underestimates revenues when setting the budget to ensure that the budget target can be exceeded easily.

The manager has failed to produce a best estimate budget but has instead tried to ensure that the target can be met.

Activity 2: Value analysis

Exchange value: The product can be sold for \$27.50.

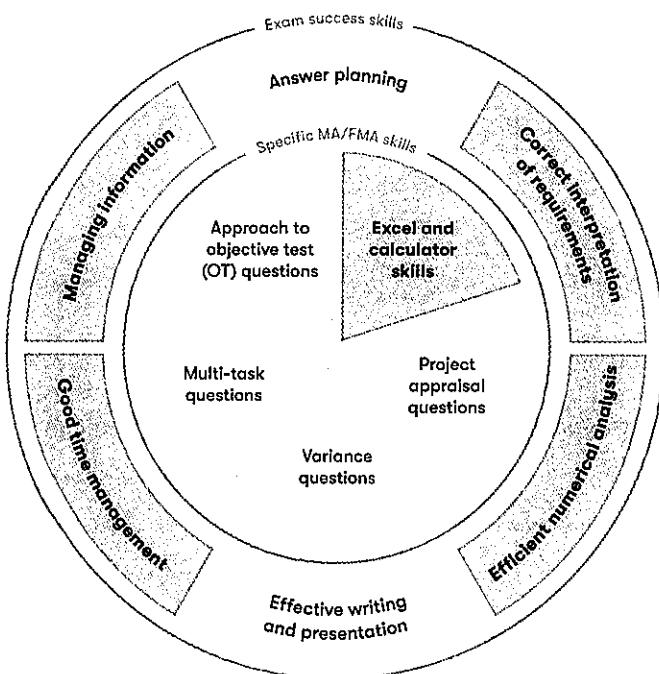
Esteem value: The product is available in six colours to suit customers' tastes.

Use value: The product will last for at least ten years.

Skills checkpoint 2

Excel and calculator skills

Chapter overview



Introduction

This checkpoint covers two areas - using spreadsheets and using your scientific calculator.

Spreadsheets are specifically mentioned on the FMA/MA syllabus and you can expect to see questions that require you to apply your knowledge of spreadsheets to management accounting questions. For example, questions may show you an extract of a budget spreadsheet and ask you to select the correct spreadsheet formula to calculate a particular figure.

You must be able to use your calculator quickly and correctly in the exam. The ability to calculate the correct answer efficiently is a fundamental skill in management accounting. You will have more time for thinking in the exam if you can make best use of your calculator to get the right answer. For example, you must be able to use your calculator to calculate the correlation coefficient, EOQ formula and standard deviation:

$$r = \frac{n\sum xy - \sum x \sum y}{\sqrt{(n\sum x^2 - (\sum x)^2)(n\sum y^2 - (\sum y)^2)}}$$

$$\sqrt{\frac{2C_oD}{C_h}}$$

$$\sigma = \sqrt{\frac{\sum(x-\bar{x})^2}{n}}$$

$$\sigma = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f}\right)^2} \text{ (frequency distribution)}$$

Excel and calculator skills

Spreadsheets

Why use spreadsheets?

Spreadsheets provide a tool for calculating, analysing and manipulating numerical data. Spreadsheets make the calculation and manipulation of data easier and quicker. For example, a spreadsheet can be set up to calculate the totals automatically.

Spreadsheets can be used for a wide range of tasks. Some common applications of spreadsheets are:

- Management accounts
- Cash flow analysis and forecasting
- Reconciliations
- Revenue analysis and comparison
- Cost analysis and comparison
- Budgets and forecasts
- What-if analysis

What-if analysis is the study of the effect on a business or model or system if variables deviate from what was expected. It allows you to explore different scenarios and the impact that they could have on the outcome. Spreadsheets are extremely useful for performing what-if analysis.

Formulae in Excel

All Excel formulae start with the equals sign =, followed by the elements to be calculated (the operands) and the calculation operators.

Formulae can be used to perform a variety of calculations. Here are some examples.

- (a) =C4*5. This **multiplies** the value in C4 by 5. The result will appear in the cell holding the formula.
- (b) =C4*B10. This **multiplies** the value in C4 by the value in B10.
- (c) =C4/E5. This **divides** the value in C4 by the value in E5. (*) means multiply and (/) means divide by.)
- (d) =C4*B10-D1. This **multiplies** the value in C4 by that in B10 and then **subtracts** the value in D1 from the result. Note that generally Excel will perform multiplication and division before addition or subtraction. If in any doubt, use brackets (parentheses): =(C4*B10)-D1.
- (e) =C4*120%. This **adds** 20% to the value in C4. It could be used to calculate a price including 20% VAT.
- (f) =(C4+C5+C6)/3. Note that the **brackets** mean Excel would perform the addition first. Without the brackets, Excel would first divide the value in C6 by 3 and then add the result to the total of the values in C4 and C5.
- (g) =2^2 gives you 2 to the power of 2, in other words 2^2 . Likewise =2^3 gives you 2 cubed and so on.
- (h) =4^(1/2) gives you the **square root** of 4. Likewise, 27^(1/3) gives you the cube root of 27 and so on.

Without brackets, Excel calculates a formula from left to right. You can control how the calculation is performed by changing the syntax of the formula. For example, the formula =5+2*3 gives a result of 11 because Excel calculates multiplication before addition. Excel would multiply 2 by 3 (resulting in 6) and would then add 5.

You may use brackets to change the order of operations. For example $=(5+2)*3$ would result in Excel firstly adding the 5 and 2 together, then multiplying that result by 3 to give 21.

Using your calculator

The illustration below shows a typical scientific calculator that is widely available. It has a natural textbook display which allows you to input and display fractions, square roots and other numeric expressions as they appear in your Workbook and exam. Your calculator may be slightly different and it is essential that you read its instruction leaflet and practise using it.

REPLAY

- ▶ This allows you to change any part of the series of keys you have pressed
- ▶ This lets you go back to previous calculations

SHIFT

Pressing this key followed by a second key performs the alternative function of the second key

FRACTIONS

This lets you put a fraction into a calculation without having to convert it into a decimal

NEGATIVE

A very useful button for minus numbers

BRACKETS

These are used just like you write a calculation so that it is done in the right order

ANSWER

This stores the last calculation result

EQUALS

Input the calculation expressions as they are written then press = to execute it

COMP mode is the usual setting for calculations. **STAT mode** lets you do statistical calculations

RECIPROCAL

This recalculates the number displayed as 1 over that number ($\frac{1}{x}$)

POWER and ROOT

Press the SHIFT button before this button if you want to find a root. This is the same as y^x or x^y

DELETE

Used with the replay button, this allows you to go back and correct your calculation

Calculator practice

(a) Make sure you are happy squaring a number:

$$8^2 = 64$$

(b) Make sure you are happy square rooting a number:

$$\sqrt{64} = 8$$

Do you know how to perform a calculation such as $2C_oD / C_h$ and then how to square root the answer that you've obtained?

- (c) The answer recall button is a great time saver; it removes the need to jot down the answer from your calculator as it is automatically stores the last answer. This is particularly useful for calculating formulae such as the economic order quantity.

Say $C_o = \$32$, $D = 25,000$, $C_h = \$6.40$.

You could first calculate the top of the fraction (the numerator) in the EOQ formula:

$$2 \times 32 \times 25,000 =$$

Your calculator will say 1600000

Then divide by \$6.40 (the denominator)

$$1600000 \div 6.4 =$$

Your calculator will say 250000

Calculating the EOQ:

$$\sqrt{\frac{2C_oD}{C_h}}$$

You need to calculate the square root of the 250000 that you have just calculated.

You can press the root button and then the 'Ans' button

$$\sqrt{Ans} =$$

Your calculator will say 500, so the EOQ is 500 units.

- (d) Brackets are a great way of performing several calculations at the same time. For example $(6+4) \times 10$ enables you to add the two numbers together before multiplying them, allowing you to get the correct answer (100). If you omitted the brackets, you would not get the correct answer (ie you get 46) or you would need to do $6+4 = 10$ and then a separate sum to multiply it by 10, which is more time consuming, especially if the numbers are bigger.

Exam success skills

The following questions are examples of the sorts of questions you could see in your exam.

For these questions, we will also focus on the following **exam success skills**:

- **Managing information.** Always start by reading the requirement. Decide what calculations you will need to perform and the information you need to pick out from the question scenario.
- **Correct interpretation of requirements.** Sometimes when you are focused on a calculation and applying a technique you have learned, it is easy to misinterpret the requirements of a question. For example, failing to complete the final step of a working, or to complete an extra step not requested. In MCQs especially the distractors will often be created such that they are an earlier or later step in a set of steps for a particular calculation.
- **Efficient numerical analysis.** There are often several ways to get the same calculation answer, but in order to be efficient and accurate in the limited exam time, it is essential that you can use your calculator expertly and accurately so that it aids your performance. Like many skills, you can get better with practice. Additionally, you may have to use a spreadsheet to say how you would perform the numerical analysis.
- **Good time management.** Many numerical questions are time consuming, it can therefore be a good idea to leave complex calculations until the end of the exam when you know how much time you have left to devote to them, as the number of marks earned per minute is often less compared to the discursive questions.

Skill activity

Regression analysis is being used to find the line of best fit ($y = a + bx$) from five pairs of data. The calculations have produced the following information:

$$\Sigma x = 78, \Sigma y = 420, \Sigma x^2 = 1,262, \Sigma y^2 = 35,350 \text{ and } \Sigma xy = 6,607$$

- (a) What is the value of 'a' in the equation for the line of best fit (to 2 decimal places)? (2 marks)

- 1.22
- 15.60
- 65.02
- 84.00

Note. Jot down the formulae from the formula sheet (the good news is that you can access this from the references tab in the exam and do not have to memorise them)!

Note. Don't confuse Σx^2 with $(\Sigma x)^2$

The following is an extract of a partially completed spreadsheet for calculating variances:

A	B	C
1 Standard cost card - Dog Toy		\$ per toy
2 Selling price		20
3 Direct material	0.2 kgs of material per unit	0.8
4 Direct labour	3 hours at \$5 per hour	15
5 Production overhead		1.5
6 Standard contribution		2.7
7		
8 Actual and budgeted activity levels in units	Budget	Actual
9 Sales	10,000	11,000
10 Production	11,500	11,600
11		
12 Actual sales revenue and variable costs	\$	
13 Sales	231,000	
14 Direct materials (purchased and used)	10,962	
15 Direct labour (35,000 hours)	182,000	
16 Variable production overhead	17,500	
17		
18 Variances	\$	
19 Total direct materials variance	-1,682	Adverse
20 Direct labour rate variances	-7,000	Adverse
21 Direct labour efficiency variances	-1,000	Adverse
22 Total variable production overhead variances	-100	Adverse

- (b) Which formula will correctly calculate the direct labour efficiency variance in cell B21? (2 marks)

- $=(35,000-(C10*3))*5$
- $=(C10*C4)-B15$
- $=B15-(C10*C4)$
- $=(C10*C4)-(35,000*5)$

Let's have a look at the answers.

Question (a)

$$b = \frac{n\sum xy - \sum x \sum y}{n\sum x^2 - (\sum x)^2}$$

$$= \frac{(5 \times 6,607) - (78 \times 420)}{(5 \times 1,262) - 78^2} = 1.22$$

Note that in order to input this into your calculator in one, you will need an extra set of brackets on the bottom (as we have shown above). If you feel more comfortable, you could do the two parts of the calculation separately, but this is more time consuming and may put pressure on you elsewhere in the exam, so it is really good to try to do it as one and it is a good idea to make sure you are comfortable doing it now so that you can practise lots before the exam.

$$\begin{aligned}
 & 1. 5 \times 6607 \\
 & 2. = \\
 & 3. - (78 \times 420) \\
 & 4. = \\
 & 5. + \\
 & 6. ((5 \times 1262) - 78^2) \\
 & = 1.216814159
 \end{aligned}$$

$$a = \frac{\sum y}{n} - \frac{b \sum x}{n}$$

You should be able to use this unrounded figure to calculate a value for b if you follow these steps:

- (a) Ans $\times 78 + 5$
- (b) =
- (c) $(420+5)-\text{Ans}$
- (d) = 65.0177

Which is 65.02 to two decimal places.

Make sure that you complete the calculation as one of the distractors was the value of b (1.22)!

Question (b)

The correct answer to (b) is:

$$=(C10*C4)-(35,000*5)$$

In order to answer this question, you need to be able to recall the labour efficiency variance (Actual production should take compared to actual production did take, with the difference being valued at the standard rate per hour). Here this is going to be actual production (C10) multiplied by the standard labour cost (C4) compared to the standard labour cost for the actual hours (35000 hours at \$5 per hour).

Make sure you get the formula the correct way round, the first distractor $=(35,000-(C10*3))*5$ was comparing how long it 'did' take at the standard cost with how long it should have taken at the standard cost and would have given a favourable variance instead of an adverse one.

Exam success skills diagnostic

Every time you complete a few questions, use the diagnostic below to assess how effectively you demonstrated the exam success skills in answering the questions. The table has been completed below for the above activity to give you an idea of how to complete the diagnostic.

Exam success skills	Your reflections/observations
Managing information	<p>Did you read the requirements first?</p> <p>Did you actively read the scenario for each question making a note of relevant points?</p>
Correct interpretation of requirements	Did you notice that you need to calculate 'a' from the regression formula, meaning you would first need to calculate

Exam success skills	Your reflections/observations
	<p>a value for 'b'?</p> <p>Did you remember that the regression formulae are given to you on the formulae sheet?</p>
Efficient numerical analysis	<p>Were you able to calculate the values of a and b using brackets and the number recall function on your calculator (to save multiple steps and having to write down multiple workings)?</p>
Good time management	<p>Did you manage to attempt the entire question in 2.4 minutes?</p> <p>Would you have known to flag this question to come back to at the end of Section A?</p> <p>Did you manage your time well by answering the easier questions first?</p>
Most important action points to apply to your next question	

Summary

Being able to calculate accurate numerical answers using either your calculator, or by selecting the correct spreadsheet formulae, is very important for the MA/FMA exam. Key skills to focus on throughout your studies will therefore include:

- Practising using your calculator before your exam, so that you know how to use it.
- Trying to think about how you could approach a calculation so that you can do it in one step.
- Practising doing basic calculations in Excel so that you are familiar with how formulae should be used.

13

Project appraisal

Learning objectives

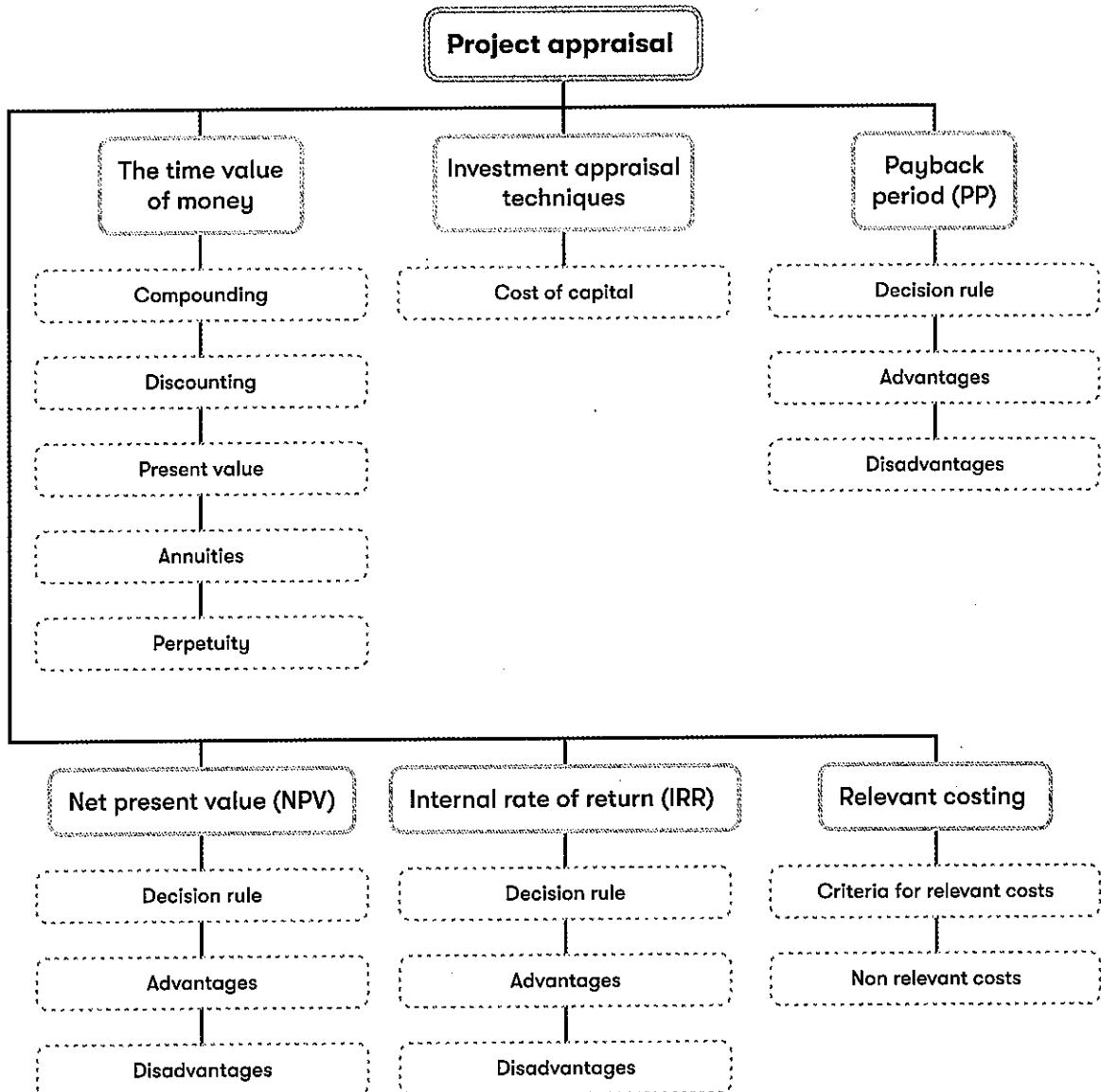
On completion of this chapter, you should be able to:

	Syllabus reference no.
Explain and illustrate the difference between simple and compound interest, and between nominal and effective interest rates.	D4 (d)
Explain and illustrate compounding and discounting.	D4 (e)
Explain the distinction between cash flow and profit and the relevance of cash flow to investment appraisal.	D4 (f)
Identify and evaluate relevant cash flows for individual decisions.	D4 (g)
Explain and illustrate net present value (NPV) and internal rate of return (IRR) methods of discounted cash flow.	D4 (h)
Calculate present value using annuity and perpetuity formulae.	D4 (i)
Calculate NPV, IRR and payback (discounted and non-discounted).	D4 (j)
Interpret the results of NPV, IRR and payback calculations of investment viability .	D4 (k)

Exam context

This chapter helps us to appraise whether the capital investment projects identified should be undertaken. It is an important chapter and you should expect it to be examined in either Section A and/or Section B of your examination.

Chapter overview



1 The time value of money

The time value of money is an important consideration in decision making.

Money is spent to earn a profit. For example, if an item of machinery costs \$6,000 and would earn profits (ignoring depreciation) of \$2,000 per year for three years, it would not be worth buying because its total profit (\$6,000) would only just cover its cost.

In addition, the size of profits or return must be sufficiently large to justify the investment. In the example given in the previous paragraph, if the machinery costing \$6,000 made total profits of \$6,300 over three years, the return on the investment would be \$300, or an average of \$100 per year. This would be a very low return, because it would be much more profitable to invest the \$6,000 somewhere else (eg in a bank).

We must therefore recognise that if a capital investment is to be worthwhile, it must earn at least a minimum profit or return so that the size of the return will compensate the investor (the business) for the length of time which the investor must wait before the profits are made.

When capital expenditure projects are evaluated, it is therefore appropriate to decide whether the investment will make enough profits to allow for the 'time value' of capital tied up. The time value of money reflects people's time preference for \$100 now over \$100 at some time in the future. Discounted cash flow (DCF) is an evaluation technique which takes into account the time value of money.

1.1 Compounding

Compounding shows how much an investment made now will be worth in the future if you earn a certain percentage rate of interest.



Compound interest: Compound interest is where interest is calculated and paid on capital plus any interest paid or payable earned up to that point.



Formula to learn

$$S_n = S_0(1 + r)^n$$

S_0 = initial investment/principal

S_n = investment at the end of n years

n = number of periods investment is held for

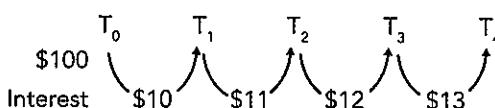
r = interest rate as decimal



Illustration 1: Compounding

If \$100 was invested in an account, which paid 10% compound interest, how much would be in the account after four years?

Solution



$$S_1 = \$100 (1 + 0.1)$$

$$\begin{aligned} S_2 &= S_1 + 0.1S_1 = S_1 (1 + 0.1) = 100 (1 + 0.1) (1 + 0.1) \\ &\quad = 100 (1 + 0.1)^2 \end{aligned}$$

$$S_3 = S_2 + 0.1S_2 = S_2(1 + 0.1) = 100(1 + 0.1)(1 + 0.1)(1 + 0.1) \\ = 100(1 + 0.1)^3$$

$$S_4 = S_3 + 0.1S_3 = S_3(1 + 0.1) = 100(1 + 0.1)(1 + 0.1)(1 + 0.1)(1 + 0.1) \\ = 100(1 + 0.1)^4$$

Or in summary the value at T4 = $100 \times 1.1^4 = \$146.41$



Activity 1: Annual compounding

B invests \$500 in a building society account earning compound interest of 10% p.a.

Required

How much will the investment be worth in five years' time? (Give your answer to two decimal places)

\$

Solution



1.1.1 Non-annual compounding

In the previous examples, interest has been calculated **annually**, but this isn't always the case. Interest may be compounded **daily, weekly, monthly or quarterly**.

Watch how often interest is compounded – make sure 'n' relates to the number of periods for which 'r' is compounded.

For example, \$10,000 invested for five years at an interest rate of 2% per month will have a final value of $\$10,000 \times (1 + 0.02)^{60} = \$32,810$. Note that n relates to the number of periods (5 years \times 12 months) that r is compounded.



Activity 2: Non-annual compounding

\$1,000 is invested at 6% six-monthly interest rate.

Required

What is the value of the investment after one year and how much interest is earned? (Give your answer to two decimal places)

\$

Solution



Effective annual rate of interest (EAR) : An effective annual rate of interest is the corresponding annual rate when interest is compounded at intervals shorter than a year.

The non-annual compounding interest rate can be converted into an effective annual rate of interest. This is also known as the **APR** (annual percentage rate) which lenders such as banks and credit companies are required to disclose.



Formula to learn

Effective annual rate of interest: $(1 + R) = (1 + r)^n$

Where:

R is the effective annual rate

r is the period rate

n is the number of periods in a year



Activity 3: Effective annual interest rate

- 1 \$300 initial investment, 2% monthly interest rate.

Required

What is the value of the investment after two years? (Give your answer to two decimal places)

\$

- 2 What is the effective annual rate of interest? (Give your answer to two decimal places)

%

Solution



Nominal rate: A nominal rate of interest is an interest rate expressed as a per annum figure although the interest is compounded over a period of less than one year. The corresponding effective rate of interest is the **annual percentage rate (APR)** (sometimes called the compound annual rate, CAR).

Most interest rates are expressed as per annum figures even when the interest is compounded over periods of less than one year. In such cases, the given interest rate is called a **nominal rate**. We can, however, also work out the **effective rate (APR or CAR)**.



Real life example: Nominal and effective rates of interest

A building society may offer investors 10% per annum interest payable half-yearly. If the 10% is a nominal rate of interest, the building society would, in fact, pay 5% every six months, compounded so that the effective annual rate of interest would be:

$$[(1.05)^2 - 1] = 0.1025 = 10.25\% \text{ per annum.}$$

Similarly, if a bank offers depositors a nominal 12% per annum, with interest payable quarterly, the effective rate of interest would be 3% compound every three months, which is:

$$[(1.03)^4 - 1] = 0.1255 = 12.55\% \text{ per annum.}$$



Activity 4: Nominal rate

\$1,000 is invested now at a nominal interest rate of 15%, interest compounded monthly.

Required

How much has the investment grown to at the end of the first year? (Give your answer to the nearest \$)

\$ |

Solution

1.2 Discounting

Discounting is the opposite of compounding. With discounting, we look at the size of an investment after a certain number of years and calculate how much we would need to invest now to build up the investment to that size, given a certain rate of interest.

Discounted cash flow techniques take account of the time value of money – the fact that money received now is worth more because it could be invested to become a greater sum at the end of a year.

1.3 Present value

Rather than calculating the terminal value of an investment, here we are calculating an equivalent value of money at an earlier point in time. This is known as the present value. Rearranging the compounding formula the present value is given by:



Formula to learn

$$S_0 = \frac{S_n}{(1 + r)^n}$$



Illustration 2: Present value

We need \$1,610 at the end of five years from now.

Required

Assuming we could earn 10% p.a. how much should be invested now? (Give your answer to the nearest \$)

Solution

$$S_0 = \frac{\$1,610}{(1.1)^5} \\ = \$1,000$$

\$1,000 is the present value (PV) of \$1,610 @ 10% in five years.

In purely monetary terms we would be indifferent between receiving \$1,000 now or \$1,610 in five years. In order to maintain the same purchasing power, we would require \$1,610 in five years' time to purchase goods costing \$1,000 now.



1.3.1 Discount factor formula

The formula to calculate a discount factor (DFn) is:

$$\frac{1}{(1 + r)^n}$$

Where r = the discount rate as a decimal and n = the number of periods

1.3.2 Tables

Present value tables will be available in the exam and are available in the Appendix of this Workbook. These tables give discount factors of between 1% – 20% and between 1 and 15 periods. (Should interest rates or periods fall outside these ranges, then use the formula to derive the answer).



Illustration 3: Present value tables

We need \$5,000 at the end of three years.

Required

Assuming we could earn interest at 8% pa, how much should we invest now?

Solution

Option 1: Using the tables

Look up the $DF_{8\%}^3 = 0.794$

$$PV = \$5,000 \times 0.794 = \$3,970$$

Option 2: Using the formula

$$\text{Discount factor} = \frac{1}{(1 + 0.08)^3}$$

$$= 0.794$$

$$PV = \$5,000 \times 0.794 = \$3,970$$

Note that the answer is the same regardless of the method used.



Activity 5: Present values

Which is worth most, at present values, assuming an annual rate of interest of 8%?

- \$1,200 in exactly one year from now
- \$1,400 in exactly two years from now
- \$1,600 in exactly three years from now
- \$1,800 in exactly four years from now

Solution

1.4 Annuities

An annuity is a constant sum of money paid or received each and every period for a given number of periods.



Annuites: An annual cash payment or receipt which is the same amount every year for a number of years.

1.4.1 Cumulative discount factors

To make the calculations easier, we can use cumulative discount factors to calculate the **present value** of an annuity.

$$\$100 \times (1 + DF_1 + DF_2 + DF_3)$$

The cumulative discount factor is a sum of the annual discount factors for the period concerned.

$$CDF_{1-3} = DF_1 + \dots + DF_3$$

A selection of these are given in the tables provided in the exam and are available in the Appendix of this workbook.



Illustration 4: Annuities

Imagine we invest \$100 at the end of each of the next three years at 10% per annum.

Required

What is the present value of this investment?

Solution

Option 1 - using the present value table

$$\text{Year 1} = \$100 \times 0.909 = 90.9$$

$$\text{Year 2} = \$100 \times 0.826 = 82.6$$

$$\text{Year 3} = \$100 \times 0.751 = 75.1$$

$$\text{Year 1-3} = 90.9 + 72.6 + 75.1 = 248.6$$

Option 2 - using the annuity table

$$\text{Year 1-3} = \$100 \times 2.487 = \$248.7$$

The answer is the same using both approaches (slight difference due to rounding) but option 2 is quicker.



Illustration 5: More complex annuity

What is the present value of \$2,000 costs incurred each year from years 3 to 6 when the cost of capital is 5%?

Solution

We need to take the annuity factor for years 1 to 6 and deduct the annuity factor for years 1 to 2. This will give us a discount factor for years 3 to 6 only.

DF for years 1 – 6 at 5% 5.076

Less DF for years 1 – 2 at 5% (1.859)

DF for years 3 – 6 3.217

$$PV = \$2,000 * 3.217 = \$6,434$$

1.5 Perpetuities

Perpetuity is an annuity, commencing at T_1 , which continues to be paid/received at regular intervals forever. Perpetuity therefore has no end. For example, you might receive an entry to a competition offering you \$1,000 per year for the remainder of your life.



Perpetuity: A perpetuity is an annuity that lasts forever.

Formula to learn

The discount factor for a perpetuity =

$$\frac{1}{r}$$

For these formulae to work, the timing of the first cash flow must be in one year's time (ie at T_1).



Activity 6: Perpetuity

If the interest rate is 10%, what would you pay for a perpetuity of \$1,000 starting in one year's time? (Give your answer to the nearest \$)

\$

2 Investment appraisal techniques

To determine whether a future investment opportunity (project) is worthwhile, a number of appraisal methods may be used:

- Payback period
- Net present value (NPV)
- Internal rate of return (IRR)

2.1 Cost of capital

For long term decision making, an important factor is the time value of money. This is the idea that money today is worth more than the same amount of money in the future. Compensation for this difference is known as the cost of capital. We use the discount factor to approximate the cost of capital.



Cost of capital: Minimum acceptable return on an investment, generally computed as a discount rate for use in investment appraisal exercises.

3 Payback period (PP)

The payback period is the time taken for the initial investment to be recovered in the cash inflows from the project. The payback method is particularly relevant if there are liquidity problems, or if distant forecasts are very uncertain.



Payback period: The number of years necessary for the cash flows of the project to payback the initial investment.

3.1 Decision rule

- Accept projects with a PP of less than the company's required payback period.
- When deciding between two projects, the one with the shorter payback period is preferred.



Illustration 6: Payback period

Project X has the following cash flows.

Year	Cash flow
0	\$ (105,000)
1	25,000
2	35,000
3	35,000
4	40,000
5	50,000

Required

What is Project X's payback period? (Give your answer in years to two decimal places)

Solution

$(\$25,000 + \$35,000 + \$35,000) = \$95,000$ will be paid back at the end of year 3, leaving \$10,000 to be repaid in year 4.

$\$10,000/\$40,000 = 0.25$ therefore payback occurs after 3.25 years.



Activity 7: Payback period

Kirby plc is considering a five year project that requires an initial cash outlay of \$550,000 on equipment. At the end of the project, the equipment is expected to have a scrap value of \$25,000. The equipment will produce annual cash operating revenues of \$150,000 for five years.

Kirby has a cost of capital of 10%.

Kirby has a required payback period of five years.

Required

Should Kirby plc go ahead with the project on the basis of payback period?

Solution

3.2 Advantages and disadvantages of payback period

Advantages	Disadvantages
Quick, simple calculation	The maximum period set is arbitrary
Easily understood concept	Ignores timing of flows within the payback period
Considers liquidity, ie cash flow	Ignores any cash flows after the end of the payback period
	Ignores the time value of money

3.3 Discounted payback period

Discounted payback period overcomes some of these disadvantages. The payback period is calculated in the same way, but there is an extra step to discount the cash flows.



Discounted payback period: The number of years necessary for the discounted cash flows of the project to payback the initial investment.



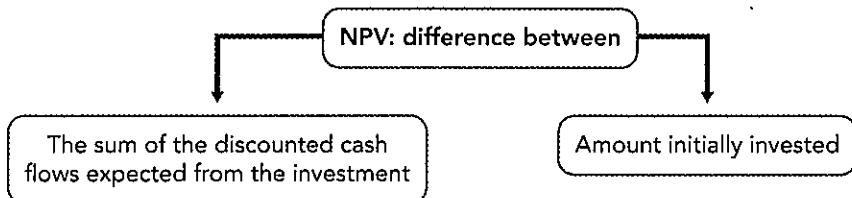
Essential reading

See Chapter 13, Section 1 of the Essential reading, for detail on how to calculate discounted payback.

The Essential reading is available as an Appendix of the digital edition of the Workbook.

4 Net present value (NPV)

The net present value method calculates the present value of all cash flows and sums them to give the net present value. If this is positive, then the project is acceptable.



Net present value (NPV): Net present value (NPV) is the difference between the present value of cash inflows and the present value of cash outflows over a period of time.

4.1 Method

- Calculate/list the expected cash flows (per year) that result from the investment or decision.
- Discount each cash flow at the cost of capital to find the PV of the cash flows.

- (c) Total the present value of cash flows, adding the present value of cash inflows and subtracting the present value of cash outflows.

4.2 Purpose

The purpose of Net Present Value is to establish the maximum amount that an investor would be willing to pay for a given set of future cash flows, given the investor's cost of capital. This takes into account the time value of money.

4.3 Decision rule

- Accept projects with an NPV greater than zero.
- In deciding between two projects, accept the one with the higher NPV.

NPV is the superior investment appraisal technique. If the NPV of a project is negative, you would always reject the project, even when all other appraisal methods are favourable.



Illustration 7: NPV

Suppose that a company is wondering whether to invest \$18,000 in a project which would make extra profits (before depreciation is deducted) of \$10,000 in the first year, \$8,000 in the second year and \$6,000 in the third year. Its cost of capital is 10% (in other words, it would require a return of at least 10% on its investment).

Required

You are required to evaluate the project using the NPV method.

Solution

In DCF, we make several assumptions. One such assumption is that DCFs (payments or receipts) occur on the last day of each year. For example, although profits are \$10,000 during the course of year 1, we assume that the \$10,000 is not received until the last day of year 1. Similarly, the profits of \$8,000 and \$6,000 in years 2 and 3 are assumed to occur on the last day of years 2 and 3 respectively. The cash payment of \$18,000 occurs 'now' at the start of year 1. To be consistent, we say that this payment occurs on the last day of the current year, which is often referred to as year 0.

Year	Cash flow	Discount factor	Present value \$
0	(18,000)	1	(18,000)
1	10,000	0.909	9,090
2	8,000	0.826	6,608
3	6,000	0.751	4,506
			<u>NPV</u> <u>2,204</u>

The NPV is positive, which means that the project will earn more than 10%. (\$20,204 would have to be invested now at 10% to earn the future cash flows; since the project will earn these returns at a cost of only \$18,000, it must earn a return in excess of 10%).



Activity 8: NPV

Kirby plc is considering a five year project that requires an initial cash outlay of \$550,000 on equipment. At the end of the project, the equipment is expected to have a scrap value of \$25,000.

The equipment will produce annual cash operating revenues of \$150,000 for five years.

Kirby has a cost of capital of 10%.

Required

Calculate the NPV of Kirby's project and advise Kirby whether to proceed.

Solution

4.4 Advantages and disadvantages of NPV

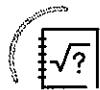
Advantages	Disadvantages
Shareholder wealth is maximised.	It can be difficult to identify an appropriate discount rate.
It takes into account the time value of money.	For simplicity, cash flows are sometimes all assumed to occur at year ends: this assumption may be unrealistic.
It is based on cash flows, which are less subjective than profit.	Some managers are unfamiliar with the concept of NPV.
Shareholders will benefit if a project with a positive NPV is accepted.	

5 Internal rate of return (IRR)



Internal rate of return (IRR): The internal rate of return (IRR) is the discount rate that gives an NPV of zero. It is also the actual return that the project generates.

To calculate the IRR we use the following formula:



Formula to learn

$$IRR = a + \left(\frac{NPV_a}{NPV_a - NPV_b} \right) \times (b-a)$$

a is the discount rate which provides the positive NPV. Use the lower discount rate as a.

NPVa is the NPV calculated using discount rate a%.

b is the discount rate which provides the negative NPV. Use the higher discount rate as b.

NPVb is the NPV calculated using a discount rate of b%.

(It is also possible to calculate an IRR using two positive NPVs or two negative NPVs but it tends to be more accurate if a positive NPV and negative NPV are used.)



5.1 Decision rule

Accept all projects with an IRR greater than the company's cost of capital or minimum acceptable rate of return.

5.2 Advantages and disadvantages of IRR

Advantages	Disadvantages
It takes into account the time value of money	Projects with unconventional cash flows can produce negative or multiple IRRs.
Results are expressed as a simple percentage	It may give conflicting recommendations with mutually exclusive projects, because the result is given in relative terms (percentages), and not in absolute terms (\$) as with NPV.



Illustration 8: IRR

From the previous example, Kirkby's project generated a positive NPV of \$34,025 when discounted at 10%. Choose a second (higher) discount rate of 15% to calculate the IRR.

Required

What is the IRR of Kirby's project? (Give your answer to one decimal place)

Solution

Given that the NPV was positive \$34,025 in the previous example, choose a higher discount rate to appraise the project.

Time	Cash flow	DF@15%	PV
0	(550,000)	1	(550,000)
1	150,000	0.870	130,500
2	150,000	0.756	113,400
3	150,000	0.658	98,700
4	150,000	0.572	85,800
5	175,000	0.497	86,975
		NPV =	<u>(34,625)</u>

$$IRR = a + \left(\frac{NPV_b}{NPV_a - NPV_b} \right) \times (b-a)$$

$$IRR = 10 + \left(\frac{34,025}{34,025 - 34,625} \right) \times (15 - 10) = 12.5\%$$

The IRR of Kirkby's project is 12.5%.

This exceeds Kirkby's cost of capital of 10%, therefore the project would be accepted.

The project generates a return of 12.5% which exceeds the return required by Kirkby's investors which is 10%.



Activity 9: IRR

Transco is considering a new project with expected returns at the following two costs of capital:

Cost of capital	NPV
10%	4,645
15%	(2,190)

Required

What is the IRR of the project? (Give your answer to one decimal place)

 %

Solution



Activity 10: Project appraisal techniques

Crispin Co wishes to maximise the wealth of its shareholders. It has a cost of capital of 12% per annum and it has correctly calculated the following measures for the new project it is considering:

- The internal rate of return (IRR) is 16%
- The return on average capital employed (ROCE) is 21% and
- The payback period is three years

Required

Which of the following is true?

- The project is worthwhile because the IRR is a positive value
- The project is worthwhile because the IRR is greater than the cost of capital
- The project is not worthwhile because the IRR is less than the ROCE
- The project is not worthwhile because the payback is less than four years

Solution

6 Relevant costing

The costs which should be used for decision making are often referred to as **relevant costs**.



Relevant cost: A relevant cost is a future cash flow arising as a direct consequence of a decision.

6.1 Criteria for relevant costs

In order for a cost to be relevant it must fulfil the following criteria:

Future

It cannot change the past.

A cost that has been incurred is irrelevant to any decision being made now. It is a **sunk cost**.

Costs that have been incurred include not only costs that have already been paid, but also costs that are the subject of legally binding contracts, even if payments due under the contract have not yet been made. These are **committed costs**.

Incremental

A relevant cost is one that arises as a direct consequence of a decision. Only costs which will differ under some or all of the available opportunities should be considered.

Cash flow

Costs or charges which do not reflect additional cash inflows or spending should be ignored for the purpose of decision making.

These include the following.

- Depreciation, as a fixed overhead incurred.
- Notional rent or interest, as a fixed overhead incurred.
- All overheads absorbed. Fixed overhead absorption is always irrelevant, since it is overheads to be incurred which affect decisions.

This means that all avoidable, differential and opportunity costs will be relevant.

6.2 Non relevant cost

The following are not relevant costs:

- Sunk costs
- Committed costs
- Notional costs



Sunk cost: A sunk cost is a cost which has already been incurred and therefore should not be taken account of in decision making.

Committed cost: A committed cost is a future cash outflow that will be incurred anyway, whatever decision is taken now about alternative opportunities.

Notional cost: A notional cost is a hypothetical accounting cost to reflect the use of a benefit for which no actual cash expense is incurred.



Activity 11: Relevant costs

A company is calculating the relevant cost of undertaking a special contract, which requires 300 litres of material A and 200 litres of material B.

The following data is available:

	In inventory (litres)	Historic cost (\$ per litre)	Current purchase price (\$ per litre)
A	100	3	4
B	200	8	7.50

Both materials are held in inventory as they are regularly used by the company for normal production.

Required

What is the relevant cost of A and B to be included in the contract cost?

Relevant cost of A = \$

Relevant cost of B = \$



Activity 12: Project appraisal - multi-task question

- 1 Pizza Co is a pizza restaurant, in a busy town centre, with sales of \$500,000 in the last year. It is considering replacing its ovens with new modern ones in anticipation of growth in customers.

The expected costs and benefits of the new ovens are as follows:

- (1) The new ovens would cost \$350,000.
- (2) Depreciation would be provided at \$70,000 per annum
- (3) \$7,000 has already been spent on staff training to evaluate the potential of the new ovens. Further training costs of \$10,000 would be required in the first year if the new system is implemented.
- (4) Sales are expected to rise to \$600,000 in Year 1 if the new ovens are purchased, thereafter increasing by 10% per annum. If the ovens are not purchased, sales are expected to rise by \$10,000 per annum.
- (5) Despite increased sales, cleaning costs are expected to fall as a result of the new ovens. These savings are estimated at 1% of total sales.
- (6) Three new staff members will be recruited to deal with additional demand at a total cost of \$45,000 per annum. Their training is included in the estimate above.
- (7) A new maintenance contract would be undertaken at a cost of \$2,000 per annum for five years.
- (8) Interest of money borrowed to finance the project would cost \$10,000 per annum.
- (9) Pizza Co's cost of capital is 10% per annum.

Required

Select whether each of the following items are relevant or irrelevant cash flows for a net present value (NPV) evaluation of whether to purchase the new ovens.

	Relevant	Irrelevant
Purchase cost of the new ovens of \$350,000		

	<i>Relevant</i>	<i>Irrelevant</i>
Depreciation of \$70,000 in each of the five years		
Staff training costs of \$10,000		
New staff salaries of \$45,000		
Staff training costs of \$7,000		
Interest costs of \$10,000 per annum		

- 2 Calculate the following values if the new ovens are installed.

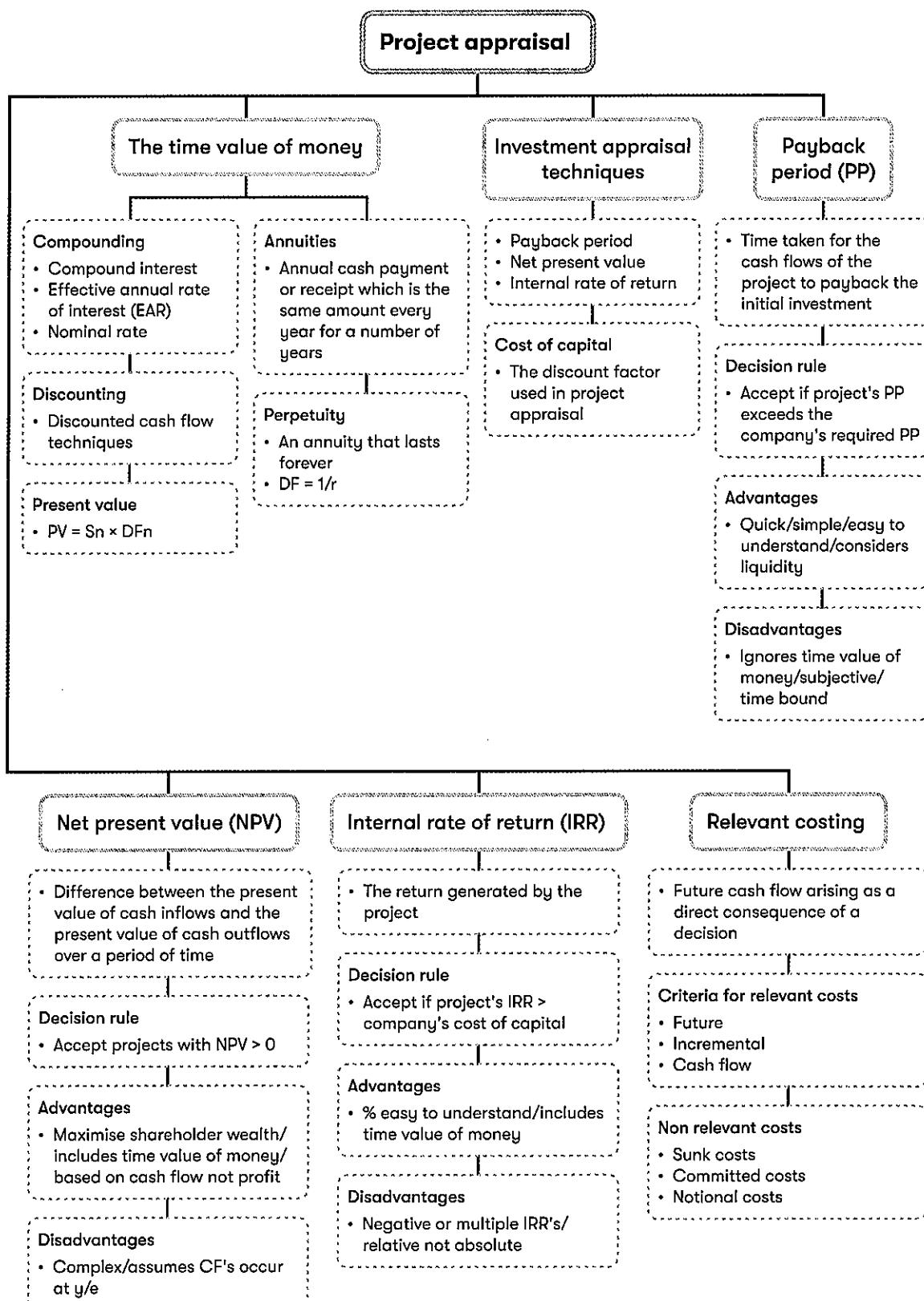
Incremental sales in Year 1 \$

Savings in cleaning costs in Year 1 \$

Present value of the maintenance costs over the life of the project \$

Solution

Chapter summary



Knowledge diagnostic

1. Cost of capital

Compensation for the time value of money, recognising that \$ today is worth more than \$ in the future, due to inflation, interest and risk.

2. Compounding

Earning interest on interest already received, Considered non-annual rates of interest – equivalent rates (EAR).

3. Discounted cash flows

Opposite of compounding, using tables or formulae.

4. Annuities

A constant sum of money for a fixed period of time, the present value is calculated using the cumulative discount tables.

Perpetuities – annuity paid or received forever.

5. Payback period (PP)

Time taken for cash flows to repay the initial investment.

6. Net present value (NPV)

The net total of the discounted cash flows of the project.

7. Internal rate of return (IRR)

The discount rate that gives an NPV of zero.

Calculated using the formula:

$$\text{IRR} = a + \left(\frac{\text{NPV}_a}{\text{NPV}_a - \text{NPV}_b} \right) \times (b-a)$$

8. Relevant costing

A relevant cost is a future, incremental cash flow.

Further study guidance

Question practice

Now try the following from the Further question practice bank (available in the digital edition of the workbook):

Section A: Q66 - Q70

Section B: Q95

Activity answers

Activity 1: Annual compounding

\$ 805.26

$$\begin{aligned}S_5 &= 500 \times (1 + 0.1)^5 \\&= \$805.26\end{aligned}$$

Activity 2: Non-annual compounding

$$\begin{aligned}S_2 &= S_0(1+r)^n \\&= \$1,000(1.06)^2 \\&= \$1,123.6\end{aligned}$$

Interest received is \$123.60

Activity 3: Effective annual interest rate

$$\begin{aligned}1 \quad S_{24} &= S_0 \times (1 + r)^n \\&= 300 \times (1.02)^{24} \\&= \$482.53 \\2 \quad 1+R &= (1+r)^n \\R &= (1+r)^n - 1 \\R &= (1+0.02)^{12} - 1 \\&= 26.82\%\end{aligned}$$

Activity 4: Nominal rate

Nominal rate = 15%

Monthly rate = 15% + 12 = 1.25% at the end of the first year (12 compound periods)

$$\begin{aligned}\text{investment} &= \$1,000 \times (1.0125)^{12} \\&= \$1,161\end{aligned}$$

Activity 5: Present values

The correct answer is: \$1,800 in exactly four years from now

PV of \$1,200 in one year = \$1,200 × 0.926 = \$1,111.20

PV of \$1,400 in two years = \$1,400 × 0.857 = \$1,199.80

PV of \$1,600 in three years = \$1,600 × 0.794 = \$1,270.40

PV of \$1,800 in four years = \$1,800 × 0.735 = \$1,323.00

Activity 6: Perpetuity

PV = \$1,000/0.1 = \$10,000

Activity 7: Payback period

Year	Cash flow	Cumulative cash flow
0	(550,000)	(550,000)
1	150,000	(400,000)

Year	Cash flow	Cumulative cash flow
2	150,000	(250,000)
3	150,000	(100,000)
4	150,000	50,000
5	175,000	225,000

If cash flows arise at the year end, the payback period is 4 years.

If cash flows accrue evenly over the year, the payback period is 3 years and 8 months
[(100/150)×12]

Activity 8: NPV

Time	Cash flow	DF@10%	PV
0	(550,000)	1	(550,000)
1	150,000	0.909	136,350
2	150,000	0.826	123,900
3	150,000	0.751	112,650
4	150,000	0.683	102,450
5	175,000	0.621	108,675
		NPV =	<u>34,025</u>

Kirby should proceed with the project because it has a positive NPV.

Activity 9: IRR

$$IRR = 10 + \left(\frac{4,645}{4,645 - 2,190} \right) \times (15 - 10) = 13.4\%$$

Activity 10: Project appraisal techniques

The correct answer is: The project is worthwhile because the IRR is greater than the cost of capital

The IRR is greater than the cost of capital, which means that the project will have a positive NPV at 12% and should therefore be accepted.

Activity 11: Relevant costs

Given that both materials are held in inventory as they are regularly used by the company for normal production, the relevant cost is the current purchase price.

The inventory of materials used in the contract will need to be replaced at the current purchase price.

The historic cost is a sunk cost and is not relevant to the decision.

		\$
A	300 litres × \$4	1,200
B	200 litres × \$7.50	<u>1,500</u>
		<u>2,700</u>

Activity 12: Project appraisal - multi-task question

1

	Relevant	Irrelevant
Purchase cost of the new ovens of \$350,000	x	
Depreciation of \$70,000 in each of the five years		x
Staff training costs of \$10,000	x	
New staff salaries of \$45,000	x	
Staff training costs of \$7,000		x
Interest costs of \$10,000 per annum		x

Depreciation is not a cash flow.

Staff training costs of \$7,000 are a sunk cost.

The cost of capital includes compensation for interest, therefore interest costs should not be included.

- 2 Increase in sales = (\$600,000 – \$500,000) = \$100,000
 Increase due to the project = \$100,000 – \$10,000 = \$90,000

Total sales in Year 1 = \$600,000

Savings (\$600,000 × 0.01) = \$6,000.

Annuity factor for five years at 10% = 3.791

Present value = (\$2,000 × 3.791) = \$7,582

Skills checkpoint 3

Part of the MA/FMA syllabus, this section contains a range of skills and techniques.

Project appraisal questions

Chapter overview



Introduction

Part of the MA/FMA syllabus covers capital budgeting - that is, budgeting for capital expenditure such as investments in plant and machinery and other non-current assets. This type of expenditure is usually large and sometimes there are several options available to a business. The business needs to know how to 'judge' the costs and benefits of an investment or project, and methods for doing this are called **project appraisal** or **investment appraisal** methods.

The syllabus states that you should be able to 'calculate NPV, IRR and payback (discounted and non-discounted)'. However, the MA/FMA examining team report repeatedly says that a common problem for students, particularly in Section B questions, is the **calculation of payback, NPV and IRR**.

Project appraisal questions

Payback questions

Payback questions could be simple payback or discounted payback. Let's start with simple payback.

Start by converting the any profit figures into cash flows

Initial investment is a negative number in Year 0 (and don't forget any scrap value)

Make a cumulative cash flow column

Positive cumulative cash flow means payback reached

Look at question requirement again, eg decimal places required

Exact payback is calculated using negative cumulative cash flow/next year's cash flow ($\times 12$ months if months are required)

(Mnemonic SIMPLE)

Discounted payback

The method for calculating the discounted payback is the same as simple payback, except that it requires an extra column showing the discount rates and one showing the discounted cash flows.

NPV

NPV questions can be quite long and this makes them perfect for a multi-task question. You could be asked to fill in figures in a proforma or formulae in cells on a spreadsheet.

Remember:

- You need relevant costs for an NPV calculation. Remember that a relevant cost is a future cash flow arising as a direct consequence of a decision, so accounting adjustments such as depreciation must be excluded.
- Only the incremental (ie additional) costs and revenues should be included. Any costs or revenues that would occur anyway (even if the project did not go ahead) must be excluded.
- Finance costs are always excluded because they are taken into account by the discount factor.
- Projects with a positive NPV are worthwhile.
- The discount rate for Year 0 is 1.
- The discount rates for other time periods will be available from the present value and annuity tables provided in the exam.

IRR

- The IRR is the discount rate that will give an NPV of zero.
- If a project earns a higher IRR than the cost of capital, it is worthwhile.
- To calculate the IRR, you need to have the NPV at two different discount rates. It is preferable to have one negative NPV and one positive NPV.

$$\text{IRR} = a + \left(\frac{\text{NPV}_a}{\text{NPV}_a - \text{NPV}_b} \right) \times (b-a)$$

Where:

a is the discount rate which provides the positive NPV

NPV_a is the amount of the positive NPV

b is the discount rate which provides the negative NPV

NPV_b is the amount of the negative NPV

- Remember that deducting a negative number is the same as adding it, eg $6 - (-2) = 6 + 2 = 8$. Some people say 'two minuses make a plus' to remember this.

Exam success skills

The following questions are examples of the sorts of questions you could see in your exam.

For these questions, we will also focus on the following **exam success skills**:

- **Managing information.** Always start by reading the requirement. It will tell you what the question is about and allow you to actively read the scenario. The scenario length in OTs and MTQs will vary and you need to ensure that as you read it, you understand the significance of the information you have been given.
- **Correct interpretation of requirements.** For example, they may tell you to give your answer to a certain number of decimal places or to the nearest thousand dollars.
- **Efficient numerical analysis.** You must be careful with calculations because distractors (incorrect answers in MCQs) are based on commonly made errors.
- **Good time management.** Each OT in Section A is worth two marks and should be allocated 2.4 minutes. The time spent on each requirement is: Number of marks \times 1.2 minutes.

Skill activity

Heet Co is considering investing \$56,000 in a new packing machine which will last for four years, after which time it will be scrapped for \$4,000. Depreciation is charged on a straight-line basis. The profit/losses are expected to be as follows:

Year	Profit/(Loss) \$
1	21,000
2	33,500
3	19,500
4	(1,000)

What is the payback period in years? (Give your answer to two decimal places.) (2 marks)

_____ years

Note. Use logical steps following the SIMPLE mnemonic.

Now suppose the question had asked for the discounted payback period instead. Heet Co has a cost of capital of 15%.

What is the discounted payback period? (2 marks)

- 1 year and 4.7 months
- 1 year and 6 months
- 1 year and 7.5 months
- 1 year and 9 months

Note. Use the same method as you would for simple payback and add an extra column for the discount rate and the discounted cash flow.

An OT question could ask you to calculate the NPV of a project.

What is the NPV of Heet's new packing machine? (Give your answer to the nearest whole \$.) (2 marks)

\$ _____

Note. Avoid numerical errors by using a careful layout to display your relevant cash flows, discount factors and the PVs.

A project currently has a net present value of \$478, using a discount rate of 15% per year. The net present value falls by \$1,500 if the discount rate increases by 2%.

What is the internal rate of return (IRR) of the project to two decimal places? (2 marks)

_____ %

Let's have a look at the questions and answers in detail.

Question (a)

STEP 1 Start by converting any profit figures into cash flows.

Here, the depreciation needs to be added back to the profit/(loss) figures to obtain the cash flows.

Depreciation per year = (Cost of machine less scrap value)/4 years = (\$56,000 - \$4,000)/4 = \$13,000

Year	Profit/(Loss) + Depn	Cash flow
	\$	\$
1	21,000 + 13,000	34,000
2	33,500 + 13,000	46,500
3	19,500 + 13,000	32,500
4	(1,000) + 13,000	12,000

STEP 2 Initial investment is a negative number in Year 0 (and don't forget any scrap value)

Year	Cash flow
	\$
0	(56,000)
1	34,000
2	46,500
3	32,500
4	12,000 + 4,000 = 16,000

STEP 3 Make a cumulative cash flow column

Year	Cash flow	Cumulative cash flow
	\$	\$
0	(56,000)	(56,000)
1	34,000	(22,000)
2	46,500	24,500

STEP 4 Positive cumulative cash flow means payback reached

Payback is reached between the years 1 and 2 ie where the cumulative cash flows change from negative to positive.

STEP 5 Look at question requirement again, eg decimal places required

Two decimal places are required, so the answer will be 1.xx years.

STEP 6 Exact payback is calculated using negative cumulative cash flow/next year's cash flow ($\times 12$ months if months required)

To calculate the exact payback point, $22,000/46,500 = 0.47$, so the payback to two decimal places = 1.47 years

If it the requirement stated that the payback needed to be in years and months, then the answer would be: 1 year and $(0.47 \times 12 \text{ months}) = 1 \text{ year and } 6 \text{ months}$.

Question (b)

The method for calculating the discounted payback is the same as simple payback except that it requires an extra column showing the discount rates and one showing the discounted cash flows.

Using the same question above with a discount rate of 15%, the discounted payback would be calculated as:

Year	Cash flow \$	Discount factor @ 15%	Cash flow \$	Cumulative cash flow \$
0	(56,000)	1	(56,000)	(56,000)
1	34,000	0.870	29,580	(26,420)
2	46,500	0.756	35,154	8,734

$$26,420/35,154 = 0.75. 0.75 \times 12 \text{ months} = 9 \text{ months}$$

Discounted payback period = 1.75 years or 1 year and 9 months

Question (c)

Remember that an NPV calculation should be based on relevant costs. Therefore, it is important that you use the cash flows generated by the project and NOT the profit figure. A clear layout in your workings will make the NPV calculation simpler for you to follow through.

Year	Cash flow \$	Discount factor @ 15%	PV \$
0	(56,000)	1	(56,000)
1	34,000	0.870	29,580
2	46,500	0.756	35,154
3	32,500	0.658	21,385
4	12,000 + 4,000 = 16,000	0.572	9,152
		NPV	39,271

The correct answer is \$39,271

Question (d)

This question requires careful reading. You must make sure you are clear about what you are being told.

A project currently has a net present value of \$478, using a discount rate of 15% per year. The net present value falls by \$1,500 if the discount rate increases by 2%.

This means that our two rates and NPVs for the IRR calculation are:

Positive NPV: a = 15%, $NPVa = \$478$

Negative NPV: b = 15 + 2 = 17%, $NPVb = \$478 - \$1,500 = (\$1,022)$

Note. This is a good example of the importance of reading the scenario carefully and performing efficient numerical analysis. If you read this too quickly, you could assume that the NPV was \$1,500 at a rate of 17%.

We now have the correct figures to plug into the formula.

$$IRR = a + \left[\frac{NPVa}{NPVa - NPVb} \times (b-a) \right] \% = 15 + \left[\frac{478}{478 - (-1,022)} \times (17-15) \right] \% = 15.64\%$$

Note. Note that $NPVb$ is a negative number and we are deducting it from $NPVa$.

Note. $478 - -1,022 = 478 + 1,022 = 1,500$

The IRR to two decimal places is 15.64%

Exam success skills diagnostic

Every time you complete a few questions, use the diagnostic below to assess how effectively you demonstrated the exam success skills in answering the questions. The table has been completed below for the above activity to give you an idea of how to complete the diagnostic.

Exam success skills	Your reflections/observations
Managing information	Did you read the requirements first? Did you actively read the scenario for each question making a note of relevant points? Eg In question (a), did you realise why you were being told that depreciation is charged on a straight-line basis?
Correct interpretation of requirements	Did you identify that question (a) required a simple payback calculation? Did you notice that you needed to answer in years, to two decimal places?
Efficient numerical analysis	In question (b), did you calculate how many months 0.75 of a year was? Or did you fall into the trap of thinking that the answer was 1 year and 7.5 months? Remember that distractors are usually based on commonly made mistakes. In question (d), did you calculate the figures for b and NPV _b correctly? Did you remember that 'two minuses make a plus'?
Good time management	Did you manage to answer all four questions within 10 mins? Did you manage your time well by answering the easier questions first?
Most important action points to apply to your next question	

Summary

Being able to answer project appraisal questions is important for the MA/FMA exam. Key skills to focus on throughout your studies will therefore include:

- Making sure you are able to identify relevant costs from a scenario. Remember that a relevant cost is a future cash flow arising as a direct consequence of a decision.
- Knowing the formula for calculating the IRR:

$$IRR = a + \left(\frac{NPV_a}{NPV_a - NPV_b} \right) \times (b-a)$$

- Knowing the decision rule for each project appraisal technique:
 - Payback - accept if the project's payback period exceeds the company's target payback period
 - IRR - accept if the project's IRR exceeds the company's cost of capital
 - NPV - accept if the project generates a positive NPV.

14

Standard costing

Learning objectives

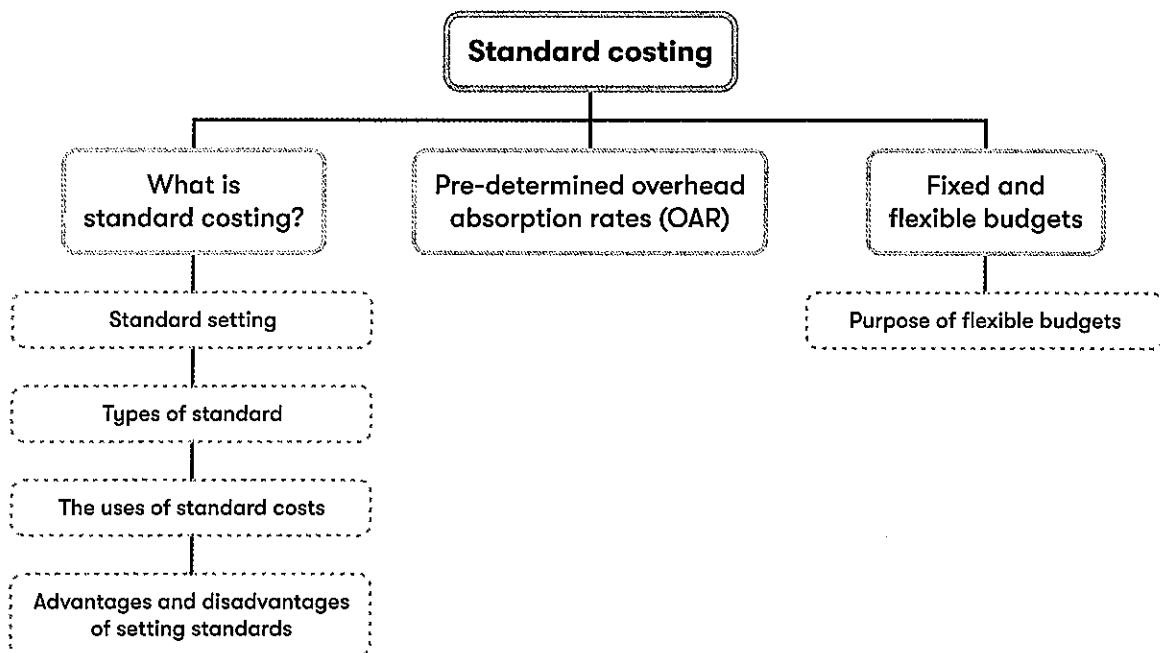
On completion of this chapter, you should be able to:

	Syllabus reference no.
Explain the purpose and principles of standard costing.	E1 (a)
Explain and illustrate the differences between standard, marginal and absorption costing.	E1 (b)
Establish the standard cost per unit under absorption and marginal costing.	E1 (c)
Explain and illustrate 'what-if' analysis and scenario planning.	D2 (f)
Explain the importance of flexible budgets in control.	D3 (a)
Explain the disadvantages of fixed budgets in control.	D3 (b)
Identify situations where fixed or flexible budgetary control would be appropriate.	D3 (c)
Flex a budget to a given level of volume.	D3 (d)
Calculate simple variances between flexed budget, fixed budget and actual sales, costs and profits.	D5 (a)

Exam context

Standard costing is a popular part of the syllabus and has been regularly examined. This chapter gives you an understanding of key terminology to be used in Chapter 15 on variance analysis. Standard costing is likely to be tested in Section A and/or B of the examination.

Chapter overview



1 What is standard costing?



Standard cost: A standard cost is a predetermined estimated unit cost, used for inventory valuation and control.

Standard cost card: A standard cost card shows full details of the standard cost of each product.

Standard costing: Standard costing is a control technique which compares standard costs and revenues with actual results. Differences between standard and actual results are called variances and these are used to improve performance.

The standard cost card of product 1234 is set out below.

STANDARD COST CARD - PRODUCT 1234

	\$	\$
<i>Direct materials</i>		
Material X – 3 kg at \$4 per kg	12	
Material Y – 9 litres at \$2 per litre	<u>18</u>	
		30
<i>Direct labour</i>		
Grade A – 6 hours at \$1.50 per hour	9	
Grade B – 8 hours at \$2 per hour	<u>16</u>	
		25
<i>Standard direct cost</i>		55
Variable production overhead – 14 hours at \$0.50 per hour	<u>7</u>	
<i>Standard variable cost of production</i>		62
Fixed production overhead – 14 hours at \$4.50 per hour	<u>63</u>	
<i>Standard full production cost</i>		125
Administration and marketing overhead	<u>15</u>	
<i>Standard cost of sale</i>		140
<i>Standard profit</i>		20
<i>Standard sales price</i>		<u>160</u>

Standard costs may be used in both marginal and absorption costing systems.



Example

Under absorption costing, there would be a row for the fixed production cost:

Direct materials 4 kg @ \$3/kg	\$12.00	
Direct labour 3 hrs @ \$10/hr	<u>\$30.00</u>	
Standard direct cost	\$42.00	
Variable production o/h 3 hrs @ 1.50/hr	<u>\$4.50</u>	
Standard variable cost of production	\$46.50	Under marginal costing
Fixed production cost 3 hr @ 4.50/hr	<u>\$13.50</u>	

Standard cost	\$60.00	Under absorption costing
---------------	---------	--------------------------



Essential reading

See Chapter 14 Section 1 of the Essential reading for standard cost card activities using absorption and marginal costing.

The Essential reading is available as an Appendix of the digital edition of the Workbook.

1.1 Standard setting

A standard is prepared by management in advance, detailing their **expectations** of the future.

Standards are not just for items of production in manufacturing businesses. They exist in many different spheres. Standard times for repairing cars, standard punctualities for train companies and standard response times for ambulances are just some of the many examples encountered.

A **standard cost** is a predetermined estimated unit cost and is calculated using management expectations of:

- Efficiency levels in the use of materials and labour;
- The expected price of materials, labour and expenses;
- Budgeted overhead costs and activity levels.

A standard cost card will usually be prepared for each product manufactured by the business.

1.2 Types of standard

There are four types of performance standard, used to set efficiency targets.

The setting of standards raises the problem of how demanding the standard should be. Should the standard represent a perfect performance or an easily attainable performance? The type of performance standard used can have behavioural implications.

Type of standard	Description
Ideal	These are based on perfect operating conditions : no wastage, no spoilage, no inefficiencies, no idle time, no breakdowns. Variances from ideal standards are useful for pinpointing areas where a close examination may result in large savings in order to maximise efficiency and minimise waste. However, ideal standards are likely to have an unfavourable motivational impact because reported variances will always be adverse. Employees will often feel that the goals are unattainable and not work so hard.
Attainable	Attainable standards are based on the hope that a standard amount of work will be carried out efficiently, machines properly operated or materials properly used. Some allowance is made for wastage and inefficiencies . If well set, they provide a useful psychological incentive by giving employees a realistic but challenging target of efficiency. The consent and co-operation of employees involved in improving the standard are required.
Current	Current standards are based on current working conditions (current wastage, current inefficiencies). The disadvantage of current standards is that they do not attempt to improve on current levels of efficiency.
Basic	Basic standards are kept unaltered over a long period of time , and may be out of date. They are used to show changes in efficiency or performance over a long period of time. Basic standards are perhaps the least useful and least common type of standard in use.

1.3 The uses of standard costs

The main uses are:

- As a control technique (variance analysis) which compares actual with standard costs and revenues.
- For inventory valuation – often less time consuming than alternative valuations methods such as FIFO or weighted average.

Other uses include:

- For prediction of costs and times for decision making, eg for allocating resources.
- For setting budgets – an accurate standard will increase the accuracy of the budget.
- In performance evaluation systems, standards are used as motivators and also as a basis for assessment.

1.4 Advantages and disadvantages of setting standards

Advantages	Disadvantages
Facilitates budgetary control	Difficult to forecast accurately
Leads to more accurate budgeting	Time consuming
Assists performance measurement	Regular revision required
Assists in target setting for staff	Demotivating if wrong
Assists in price setting	Includes existing inefficiencies
Simplifies bookkeeping	

2 Pre-determined overhead absorption rates (OAR)

This section is a quick re-cap on overhead absorption before we move onto variances calculated using flexed budgets.

Businesses need to cost their production throughout the year, not at the end of an accounting period. Therefore they use predetermined rates or estimate their absorption rates for the year.



Formula to learn

Pre-determined OAR = Budgeted overhead / Budgeted activity level

(Activity level refers to production activity, not sales.)

During the year, businesses will record overheads regularly.



Formula to learn

Overhead absorbed = Actual activity (eg labour hours) × predetermined OAR

At the end of the year, actual overheads will be known and it is likely that:

Overhead absorbed ≠ Actual overhead

Overheads absorbed may differ from actual overhead costs incurred for either or both of the following two reasons:

- Actual expenditure was more or less than budget (expenditure variance).
- Actual units produced (ie volume) were more or less than budget (volume variance).

The difference between the overhead absorbed and the actual overhead is known as the **over or under absorption**.

Note that the statement of profit or loss will show the actual overhead for the year. The actual overhead is the amount absorbed plus an adjustment for the under absorption or minus an adjustment for over absorption.

Formula to learn

Actual overhead	X
Overhead absorbed	(X)
Under/(over) absorption	<u>X/(X)</u>

Under / (over) absorption can be broken down into an expenditure and a volume variance. We will return to this in the next chapter on variance analysis.

Activity 1: Pre-determined OARs

GH Co had the following budgeted and actual figures for units of production and overheads.

	Budget	Actual
Units of production	20,000	24,000
Overheads	\$100,000	\$117,000

Required

Calculate the following:

Pre-determined absorption rate = \$ per unit

Overhead absorbed for the period = \$

Under/(over) absorption = \$

Solution

3 Fixed and flexible budgets



Fixed budget: A fixed budget is a budget which is designed to remain unchanged regardless of the volume of output or sales achieved.

Flexible budget: A flexible budget is a budget which, by recognising different cost behaviour patterns, shows the costs and revenues at different levels of activity. A flexed budget is a budget that has been adjusted to take account of the actual volume of output, for the purposes of a like-for-like comparison with the actual results.

The fixed budget is the master budget prepared before the beginning of the budget period. It is based on budgeted volumes, costs and revenues.

The term 'fixed' has the following meaning.

- The budget is prepared on the basis of an estimated volume of production and an estimated volume of sales, but no plans are made for the event that actual volumes of production and sales may differ from budgeted volumes.
- When actual volumes of production and sales during a control period (month or four weeks or quarter) are achieved, a fixed budget is not adjusted (in retrospect) to the new levels of activity.

The major purpose of a fixed budget is at the planning stage, when it seeks to define the broad objectives of the organisation.

3.1 Purpose of flexible/flexed budgets

- Designed to cope with different activity levels to keep the budget meaningful and hence preserve the relevance of variances for effective control.
- Can be used at planning stage to show different results from possible activity levels, sometimes known as 'what-if analysis'. Spreadsheets will be very useful tools when considering potential results for different scenarios.
- Necessary as control device because we can meaningfully compare actual results with relevant flexed budget, ie budgetary control.
- Differences between the flexed budget figures and actual results are called variances.



Example

Suppose W Co manufactures a single product, the bough. Budgeted results and actual results for June 20X2 are shown below. (F) denotes a favourable variance and (A) an adverse or unfavourable variance.

	Budget	Actual results	Variance
Production and sales of the bough (units)	2,000	3,000	
	\$	\$	\$
Sales revenue (a)	20,000	30,000	10,000 (F)
Direct materials	6,000	8,500	2,500 (A)
Direct labour	4,000	4,500	500 (A)
Maintenance	1,000	1,400	400 (A)

	Budget	Actual results	Variance
Depreciation	2,000	2,200	200 (A)
Rent and rates	1,500	1,600	100 (A)
Other costs	<u>3,600</u>	<u>5,000</u>	<u>1,400</u> (A)
Total costs (b)	<u>18,100</u>	<u>23,200</u>	<u>5,100</u> (A)
Profit (a) – (b)	<u>1,900</u>	<u>6,800</u>	<u>4,900</u> (F)

Comparison of a **fixed budget** with the actual results for a **different level of activity** is of little use for **control purposes**. Therefore, in this example, the variances are meaningless for the purposes of control.

Costs were higher than budget because the **volume of output was also higher**; variable costs would be expected to increase above the budgeted costs. There is no information to show whether control action is needed for any aspect of costs or revenue.

For control purposes, it is necessary to know the following.

- Were actual costs higher than they should have been to produce and sell 3,000 boughs?
- Was actual revenue satisfactory from the sale of 3,000 boughs?
- Has the volume of units made and sold varied from the budget favourably or adversely?

Therefore, the correct approach to use for the purposes of control is:

- Identify fixed and variable costs.
- Produce a **flexed budget** based on the **actual activity level**.

In this example, we now have the following estimates of cost behaviour:

- Direct materials, direct labour and maintenance costs are variable.
- Rent and rates and depreciation are fixed costs.
- Other costs consist of fixed costs of \$1,600 plus a variable cost of \$1 per unit made and sold

Now that the cost behaviour patterns are known, a budget cost allowance can be calculated for each item of expenditure. This allowance is shown in a **flexed budget** as the **expected expenditure on each item for the relevant level of activity**. The budget cost allowances are calculated as follows.

Cost type	Flexed budget
Variable cost allowances Eg material cost allowance	= original budgets × (3,000 units/2,000 units) = \$6,000 × 3/2 = \$9,000
Fixed cost allowances	= as original budget
Semi-variable cost allowances eg other cost allowances	= original budgeted fixed costs + (3,000 units × variable cost per unit) = \$1,600 + (3,000 × \$1) = \$4,600

The control analysis should therefore be based on a flexed budget as follows:

	Fixed budget (a)	Flexed budget (b)	Actual results (c)	Budget variance (c)-(b)
Production & sales (units)	2,000 \$	3,000 \$	3,000 \$	\$
Sales revenue	<u>20,000</u>	<u>30,000</u>	30,000	

	Fixed budget (a)	Flexed budget (b)	Actual results (c)	Budget variance (c)-(b)	
Variable costs					
Direct materials	6,000	9,000	8,500	500	(F)
Direct labour	4,000	6,000	4,500	1,500	(F)
Maintenance	1,000	1,500	1,400	100	(F)
Semi-variable costs					
Other costs	3,600	4,600	5,000	400	(A)
Fixed costs					
Depreciation	2,000	2,000	2,200	200	(A)
Rent and rates	1,500	1,500	1,600	100	(A)
Total costs	<u>18,100</u>	<u>24,600</u>	<u>23,200</u>	<u>1,400</u>	(F)
Profit	<u>1,900</u>	<u>5,400</u>	<u>6,800</u>	<u>1,400</u>	(F)
		\$3,500 (F)		\$1,400 (F)	
		Volume variance	Expenditure variance		
				\$4,900 (F)	
			Total variance		

Notice that the total variance has not altered. It is still \$4,900 (F) as before. The flexed budget comparison merely analyses the total variance into two separate components.

If management believes any variance is significant enough to warrant investigation, they will investigate to see whether any corrective action is necessary or whether the plan needs amending in the light of actual events.



Essential reading

See Chapter 14 Section 2 for an additional illustration showing the calculation of variances using a flexed budget.

The Essential reading is available as an Appendix of the digital edition of the Workbook.



Activity 2: Flexed budget production cost

Win Co manufactures a single product and has drawn up the following flexible budget for the year.

	Flexible budgets		
Bottles produced:	10,000	12,000	14,000
Production costs:	\$	\$	\$
Materials	30,000	36,000	42,000
Labour	27,000	31,000	35,000

Overhead	<u>20,000</u>	<u>20,000</u>	<u>20,000</u>
	<u>77,000</u>	<u>87,000</u>	<u>97,000</u>

Required

If actual production was 12,350 what is the flexed budget production cost?

Bottles produced:	12,350
Production costs:	\$
Materials	<input type="text"/>
Labour	<input type="text"/>
Overhead	<input type="text"/>
Total	<input type="text"/>

Solution



Exam focus point

In an exam do not fall into the trap of flexing fixed costs. Remember that they remain unchanged regardless of the level of activity. Even if fixed overheads are initially expressed on a 'per unit' basis in a question, remember that once you have calculated the total fixed cost for a given activity level it will remain unchanged when activity levels alter.



Activity 3: Flexible budget

Which of the following describes a flexible budget?

- A budget comprising variable production costs only
- A budget which is updated with actual costs and revenues as they occur during the budget period
- A budget which shows the costs and revenues at different levels of activity
- A sales revenue budget which is changed to reflect the actual unit sales price

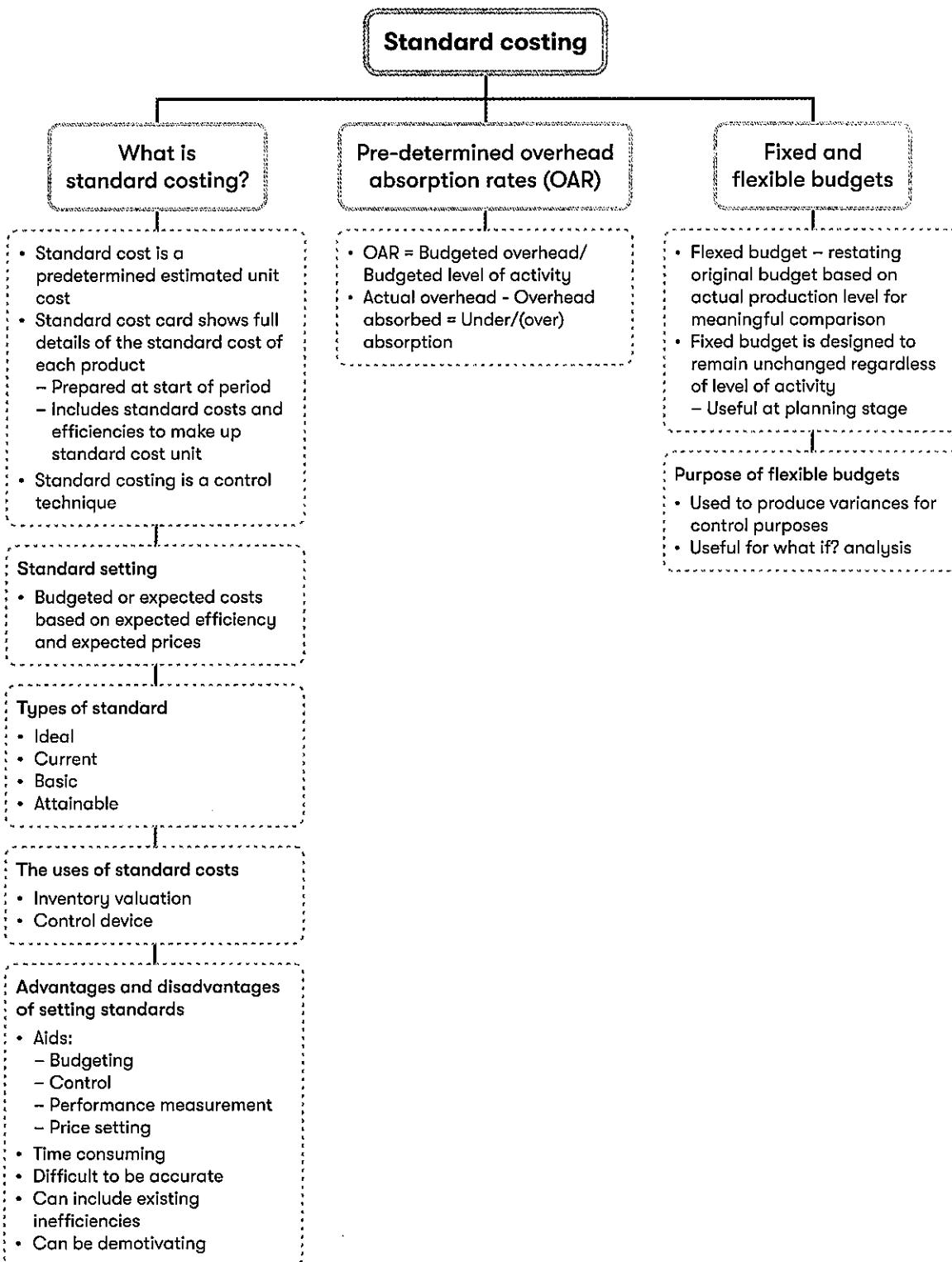


Essential reading

See Chapter 14 Section 3 of the Essential reading for more detail on when fixed and flexible budgets are appropriate.

The Essential reading is available as an Appendix of the digital edition of the Workbook.

Chapter summary



Knowledge diagnostic

1. Standards

A standard is prepared by management in advance, and details their expectations of the future.

A standard cost is a predetermined estimated unit cost used for inventory valuation and control.

A standard cost card shows full details of the standard cost of each product.

2. Standard setting

Standards can be set at based on different assumptions. There are four types: ideal, attainable, current and basic.

3. Uses of standard costs

Standards can be used to assess and control actual performance through the analysis of variances.

4. Pre-determined overhead absorption rates

Under or over absorption of overheads occurs due to the difference between the budgeted and the actual expenditure and/or the budgeted and actual activity levels.

5. Flexed budget

Restating the original budget based on the actual production volume so that meaningful comparisons can be made.

Further study guidance

Question practice

Now try the following from the Further question practice bank (available in the digital edition of the workbook):

Section A: Q71 - 73

Activity answers

Activity 1: Pre-determined OARs

Pre-determined absorption rate = \$ 5 per unit

Overhead absorbed for the period = \$ 120,000

Under/(over) absorption = \$ (3,000)

Pre-determined overhead absorption rate = \$100,000 / 20,000 units = \$5 per unit

Actual overhead = \$117,000

Overheads absorbed = 24,000 (actual units produced) × \$5 per unit = \$120,000

Under/(over) absorption = \$117,000 - \$120,000 = \$(3,000)

Activity 2: Flexed budget production cost

Bottles produced:	12,350
Production costs:	\$
Materials	37,050
Labour	31,700
Overhead	20,000
Total	<u>88,750</u>

Materials

This is a variable cost: (\$30,000/10,000) = \$3 per unit

For 12,350 units = 12,350 × \$3 = \$37,050

Labour

This is a semi-variable cost, use the high low method.

	Units	\$
High	14,000	35,000
Low	10,000	27,000
Difference	4,000	8,000

Therefore, the variable cost = (\$8,000/4,000) = \$2 per unit

Substitute to find fixed costs:

	\$
Total cost for 10,000	27,000
Less variable costs (\$2 × 10,000)	(20,000)
Fixed costs	7,000

For 12,350 units = 7,000 + (\$2 × 12,350) = \$31,700

Overhead

This is a fixed cost.

Activity 3: Flexible budget

The correct answer is: A budget which shows the costs and revenues at different levels of activity
A flexible budget recognises sales and cost behaviour patterns and is designed to change as the volume of sales or production activity changes.

15

Variance analysis

Learning objectives

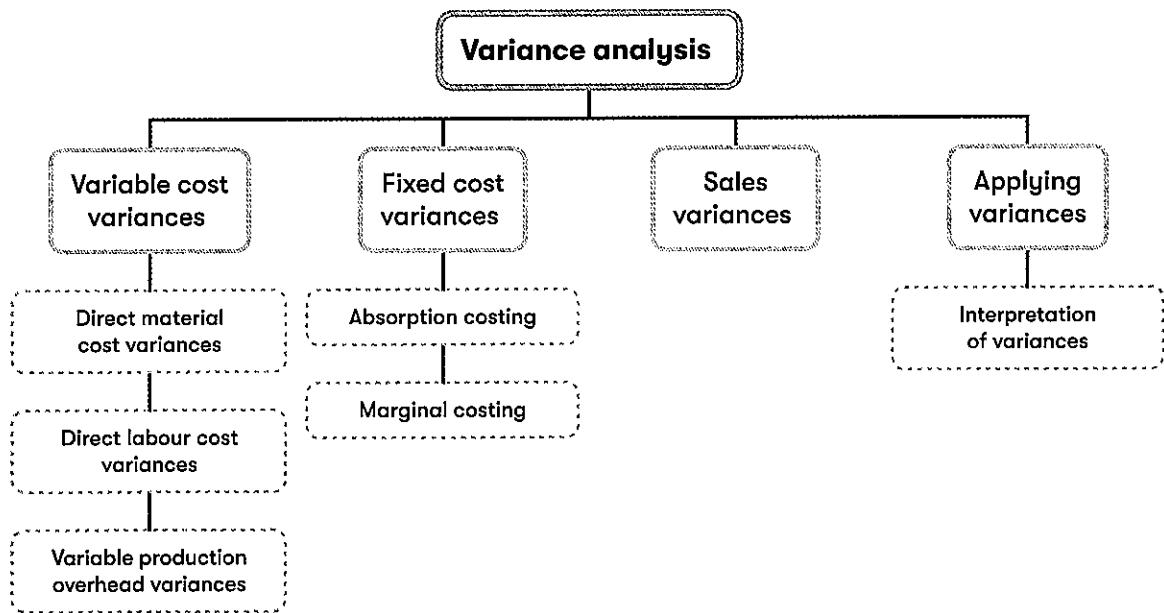
On completion of this chapter, you should be able to:

	Syllabus reference no.
Calculate sales price and volume variance.	E2 (a)
Calculate materials total, price and usage variance.	E2 (b)
Calculate labour total, rate and efficiency variance.	E2 (c)
Calculate variable overhead total, expenditure and efficiency variance.	E2 (d)
Calculate fixed overhead total, expenditure and, where appropriate volume, capacity and efficiency variance.	E2 (e)
Interpret the variances.	E2 (f)
Explain factors to consider before investigating variances, explain possible causes of the variances and recommend control action.	E2 (g)
Explain the interrelationships between the variances.	E2 (h)
Calculate actual or standard figures where the variances are given.	E2 (i)
Reconcile budgeted profit with actual profit under standard absorption costing.	E3 (a)
Reconcile budgeted profit or contribution with actual profit or contribution under standard marginal costing.	E3 (b)

Exam context

Variance calculations are a very important part of your Management Accounting studies and it is vital that you are able to calculate all of the different types of variance included in the syllabus as questions could appear in Section A of your examination and could also appear in Section B.

Chapter overview



1 Variable cost variances



Variance: The difference between a planned, budgeted or standard cost and the actual cost incurred. The same comparisons may be made for revenues. The process by which the total difference between standard and actual results is analysed is known as variance analysis.

When actual results are better than expected results, we have a favourable variance (F). If, on the other hand, actual results are worse than expected results, we have an adverse variance (A).

Variances can be divided into three main groups:

- Variable cost variances
- Fixed production overhead variances
- Sales variances

Variance analysis is used when evaluating performance as part of the control process.

Each standard cost is made up of both a quantity element and an expenditure element. Differences in quantities are known as efficiency, usage or volume variances. Differences in expenditure are known as rate, price or expenditure variances.

We must first calculate the standard cost for actual production ie the flexed budget element.

1.1 Direct material cost variances



Direct material total variance: The difference between what the output actually cost and what it should have cost, in terms of material.

Direct material price variance: The difference between the standard cost and the actual cost for the actual quantity of material used or purchased. In other words, it is the difference between what the material did cost and what it should have cost.

Direct material usage variance: The difference between the standard quantity of materials that should have been used for the number of units actually produced, and the actual quantity of materials used, valued at the standard cost per unit of material. In other words, it is the difference between how much material should have been used and how much material was used, valued at standard cost.



Formula to learn

Total material variance - based on **actual production** - what should the actual production use and what should that material cost? What did it cost?

		\$
'Should'	Actual number of units should use and should cost	X
'Did'	Actual materials used did cost	(X)
	Variance	X



Formula to learn

Material price variance - based on **actual purchases** - what should materials cost? What did they cost?

		\$
'Should'	Actual kg purchased should cost	X
'Did'	Actual kg purchased did cost	(X)
	Variance	X



Formula to learn

Material usage variance - based on actual production - how much should it use? How much did it use?

		Kgs
'Should'	Actual production should use	X
'Did'	Actual production did use	(X)
	Difference	X
	Valued at standard cost per kg	\$X



Illustration 1: Material variances

A company operates a standard costing system. It purchases and uses 35,464 kg of material at a cost of \$4.75 per kg.

The standard amount of material used per unit is 4 kgs at a cost of \$4.50 per kg and \$18.00 per unit.

In May 20X1 the budgeted production was 8,000 units and actual production was 8,900 units.

Required

- 1 Calculate the total material variance.
- 2 Calculate the material price variance.
- 3 Calculate the material usage variance.

Solution

- 1 Total material variance:

		\$
'Should'		
Actual production × standard usage ×		
standard cost per kg	8,900 units × 4 kgs × \$4.50	160,200
'Did' cost	35,464 kgs × \$4.75	<u>168,454</u>
Variance		8,254 (A)

Note that actual cost (did cost) was higher than the standard cost (should cost) and so the variance is adverse.

2 Material price variance

	\$
'Should'	
Actual purchases × standard cost per kg	35,464 kgs × \$4.50
'Did'	
Actual purchases × actual cost per kg	35,464 kgs × \$4.75
Variance	<u>168,454</u>
	8,866 (A)

3 Material usage variance

	Kgs
'Should'	
Actual production × standard usage	8,900 units × 4 kgs
'Did'	
Actual production (units) × actual usage per unit	35,464 kgs
Difference	<u>35,464</u>
Variance	136 (F)
	Valued at the standard cost per kg \$4.50
	\$612 (F)
Summary	
	\$
Price variance	8,866 (A)
Usage variance	<u>612</u> (F)
Total variance	8,254 (A)



Activity 1: News Co

News Co operates a standard costing system. It purchased and used 53,000 kg of material at a cost of \$2.38 per kg.

The budgeted production was 25,000 units which requires 50,000 kg of material at a total standard cost of \$125,000. The actual production was 27,000 units.

Required

- Calculate the total materials variance.
- Calculate the material price variance.
- Calculate the material usage variance.

Essential reading

 See Chapter 15 Section 1 of the Essential reading for information on material variances when there is closing inventory.

The Essential reading is available as an Appendix of the digital edition of the Workbook.

1.2 Direct labour cost variances



Direct labour total variance: The difference between what the output should have cost and what it did cost, in terms of labour.

Direct labour rate variance: Similar to the direct material price variance. It is the **difference between the standard cost and the actual cost for the actual number of hours paid for**.

In other words, it is the difference between what the labour did cost and what it should have cost.

Direct labour efficiency variance: Similar to the direct material usage variance. It is the **difference between the hours that should have been worked for the number of units actually produced, and the actual number of hours worked, valued at the standard rate per hour**.

In other words, it is the difference between how many hours should have been worked and how many hours were worked, valued at the standard rate per hour.



Formula to learn

Total labour variance - based on actual production - what should the actual production use and what should that labour cost? What did it cost?

		\$
'Should'	Actual units should use and should cost	X
'Did'	Actual labour used did cost	(X)
	Variance	X



Formula to learn

Labour rate variance - based on hours paid - what should they have cost? What did they cost?

		\$
'Should'	Actual hours paid should cost	X
'Did'	Actual hours paid did cost	(X)
	Variance	X



Formula to learn

Labour efficiency variance - based on actual production - how long should it take? How long did it take?

		Hours
'Should'	Actual production should take	X
'Did'	Actual production did take	(X)
	Difference	X
	Valued at standard rate per hour	\$X



Formula to learn

Idle time variance - difference between hours paid and worked

		Hours
'Should'	Hours paid	X
'Did'	Hours worked	(X)
	Difference	X
	Valued at standard rate per hour	\$X



Illustration 2: Direct labour variances

The standard direct labour cost of product X is as follows.

2 hours of grade Z labour at \$5 per hour = \$10 per unit of product X.

During period 4, 1,000 units of product X were made, and the direct labour cost of grade Z labour was \$8,900 for 2,300 hours of work.

Required

- 1 Calculate the direct labour total variance.
- 2 Calculate the direct labour rate variance.
- 3 Calculate the direct labour efficiency variance.

Solution

- 1 Total direct labour variance:

		\$
'Should'		
Actual production × standard usage × standard cost per kg	1,000 units × 2 hours × \$5	10,000
'Did'		<u>8,900</u>
Variance		1,100 (F)

- 2 Labour rate variance

		\$
'Should'		
Actual labour hours × standard cost per hour	2,300 hours × \$5	11,500
'Did'		<u>(8,900)</u>
Actual labour hours × actual cost per hour		2,600 (F)
Variance		

- 3 Direct labour efficiency variance

	Hours
'Should'	
Actual production × standard hours per unit	1,000 units × 2 hours
	2,000
'Did'	
Actual production did take	<u>2,300</u>
Difference	<u>300</u> (A)
	Valued at standard rate per labour hour
Variance	\$5
	\$1,500 (A)
Summary	\$
Rate variance	2,600 (F)
Efficiency variance	<u>1,500</u> (A)
Total variance	1,100 (F)



Activity 2: Yard Co

Yard Co operates a standard costing system and expects to produce 3,000 units of Y using 12,000 hours of labour. The standard cost of labour is \$12.50 per hour.

Last month the company actually made 2,195 units. The actual labour cost was \$110,750 for the 9,200 hours worked.

Required

- 1 Calculate the total direct labour variance.
- 2 Calculate the direct labour rate variance.
- 3 Calculate the direct labour efficiency variance.

Solution



Illustration 3: Idle time

A Co forecast to produce 300 units in April 20X1. However, actual production was 340 units.

The standard labour cost per unit is \$60 (4 hours at a rate of \$15 per hour).

The actual labour cost for 1,500 hours was \$22,600. A machine breakdown meant that the labour force worked 1,375 hours.

Required

What is the idle time variance?

Solution

Idle time variance

	Hrs
Hours paid ('Should' work)	1,500
Hours worked ('Did' work)	<u>1,375</u>
Difference	<u>125</u>
Valued at the standard rate per labour hour \$15	\$1,875 (A)



Activity 3: Flight Co

Flight Co expected to produce 200 units of its product. Actual production was 260 units. The standard labour cost of a unit was \$70 (10 hours at a rate of \$7 per hour).

The actual labour cost for 2,300 hours was \$18,600. The labour force worked 2,200 hours.

Required

What is the adverse idle time variance?

- \$700
- \$400
- \$2,100
- \$100

Solution

1.3 Variable production overhead variances



Variable production overhead expenditure variance: The difference between the amount of variable production overhead that should have been incurred in the actual hours actively worked, and the actual amount of variable production overhead incurred.

Variable production overhead efficiency variance: If you already know the direct labour efficiency variance, the variable production overhead efficiency variance is exactly the same in hours, but priced at the variable production overhead rate per hour.



Formula to learn

Variable production overhead total variance - based on actual units of production and actual labours hours.

		\$
'Should'	Actual production × standard variable overhead cost per hour × standard labour hours per unit	X
'Did'	Actual hours worked × actual variable overhead cost per hour	(X)
	Variance	X



Formula to learn

Variable production overhead expenditure variance - based on actual hours worked. What should they have cost? What did they cost?

		\$
'Should'	Actual hours worked × standard variable overhead cost per hour	X
'Did'	Actual hours worked × actual variable overhead cost per hour	(X)
	Variance	X



Formula to learn

Variable production overhead efficiency variance - based on actual production. How long should it have taken? How long did it take?

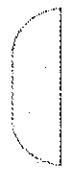
		Hours
'Should'	Actual production should take	X
'Did'	Actual production did take	(X)
	Difference	X
	Valued at standard variable overhead rate per hour	\$X

Note.

It is usually assumed that **variable overheads are incurred during active working hours**, but are not incurred during idle time (for example the machines are not running, therefore power is not being consumed, and no indirect materials are being used).



Illustration 4: Variable production overhead



Suppose that the variable production overhead cost of product X is as follows:

2 hours at \$1.50 = \$3 per unit

During period 6, 1,000 units of product X were made. The labour force worked 2,020 hours, of which 60 hours were recorded as idle time. The variable overhead cost was \$3,075.

Required

- 1 Calculate the variable overhead total variance.
- 2 Calculate the variable production overhead expenditure variance.
- 3 Calculate the variable production overhead efficiency variance.

Solution

1

		\$
'Should'		
Actual production × standard variable overhead cost per hour × standard labour hours per unit	1,000 units × \$1.50 × 2 hours	3,000
'Did'		<u>3,075</u>
Variance		75 (A)

2

		\$
'Should'		
Actual labour hours × standard variable overhead cost per hour	Labour hours - idle time (2,020 - 60) 1,960 hours × \$1.50	2,940
'Did'		<u>3,075</u>
Variance		135 (A)

	Hours
'Should'	
Actual production × standard labour hours per unit	1,000 units × 2 hours 2,000
'Did'	Labour hours - idle time (2,020 - 60) <u>1,960</u>
Difference	<u>40</u> (F)
Variance	Valued at standard variable production overhead rate per hour \$1.50
	\$60 (F)
	\$
Expenditure variance	135 (A)
Efficiency variance	<u>60</u> (F)
Total variance	75 (A)



Activity 4: Dog Co

Dog Co manufactures product D and has established that the standard variable production overhead cost of product D is as follows:

4 hours at \$2.00 = \$8 per unit

In the last month, 5,000 units of product D were manufactured. During this time the labour force were paid for 21,000 hours, but due to delay in raw materials arriving at the factory, only 20,500 hours were worked. The variable overhead cost for the month was \$42,100.

Required

- 1 Calculate the total variable production overhead variance.
- 2 Calculate the variable production overhead expenditure variance.
- 3 Calculate the variable production overhead efficiency variance.

Solution

1.4 Fixed cost variances



Exam focus point

To calculate the fixed overhead variances, you must be able to distinguish between marginal costing and absorption costing.

1.5 Absorption costing

In an **absorption costing system**, fixed overhead variances are an attempt to explain the **under- or over-absorption of fixed production overheads** in production costs.

The fixed production overhead total variance (ie the under- or over-absorbed fixed production overhead) may be broken down into two parts as usual:

- (a) An expenditure variance
- (b) A volume variance. This in turn may be split into two parts:
 - A volume efficiency variance
 - A volume capacity variance

You will find it easier to calculate and understand fixed overhead variances if you keep in mind the whole time that you are trying to 'explain' (put a name and value to) any under- or over-absorbed overhead.

Remember that the absorption rate is calculated as follows:

Overhead absorption rate = Budgeted fixed overhead/Budgeted level of activity

Remember that the budgeted fixed overhead is the **planned or expected** fixed overhead and the budgeted activity level is the **planned or expected** activity level.

If the actual fixed overhead is different from budget there will be a fixed overhead expenditure variance and if the actual activity level is different from budget there will be a fixed overhead volume variance.



Fixed overhead total variance: The difference between fixed overhead incurred and fixed overhead absorbed. In other words, it is the under- or over-absorbed fixed overhead.

Fixed overhead expenditure variance: Measures the under- or over-absorbed overhead caused by the **actual total overhead** being different from the budgeted total overhead.

Therefore, fixed overhead expenditure variance = **Budgeted (planned) expenditure – Actual expenditure.**

Fixed overhead volume variance: Measures the under- or over-absorbed overhead caused by the **actual activity level** being different from the budgeted activity level.

Therefore, fixed overhead volume variance = **(Budgeted (planned) volume – Actual volume) × standard absorption rate per unit.**

Fixed overhead volume efficiency variance: The difference between the number of hours that actual production should have taken, and the number of hours actually taken (that is, worked) multiplied by the standard absorption rate per **hour**.

Fixed overhead volume capacity variance: The difference between budgeted (planned) hours of work and the actual hours worked, multiplied by the standard absorption rate per **hour**.

There are two reasons why the actual activity level may be different from the budgeted activity level used in calculating the absorption rate.

- (a) The workforce may have worked more or less efficiently than the standard set. This deviation is measured by the fixed overhead volume efficiency variance.
- (b) The hours worked by the workforce could have been different to the budgeted hours (regardless of the level of efficiency of the workforce) because of overtime and strikes etc. This deviation from the standard is measured by the fixed overhead volume capacity variance.

Formula to learn

Total fixed overhead variance

		\$
'Should'	Fixed overheads absorbed ie Actual production × OAR per unit	X
'Did'	Actual fixed overheads incurred	(X)
	Variance	X

Formula to learn

Fixed overhead expenditure variance

		\$
'Should'	Budgeted fixed overheads	X
'Did'	Actual fixed overheads	(X)
	Variance	X

Formula to learn

Fixed overhead volume variance - absorption costing only

		\$
'Should'	Budgeted production × standard OAR per unit	X
'Did'	Actual production × standard OAR per unit	(X)
	Variance	X



Formula to learn

Fixed overhead volume efficiency variance - absorption costing only



Formula to learn

Fixed overhead volume capacity variance - absorption costing only

		Hours
'Should'	Budgeted labour hours	X
'Did'	Actual labour hours	(X)
Difference		X
Variance	Valued at standard OAR per labour hour	\$X

Remember: Fixed overhead volume efficiency variance + fixed overhead volume capacity variance = Fixed overhead volume variance.



Illustration 5: Fixed overhead variances

Suppose that a company plans to produce 1,000 units of product E during August 20X3. The expected time to produce a unit of E is five hours, and the budgeted fixed overhead is \$20,000. The standard fixed overhead cost per unit of product E will therefore be as follows:

5 hours at \$4 per hour = \$20 per unit

Actual fixed overhead expenditure in August 20X3 turns out to be \$20,450. The labour force manages to produce 1,100 units of product E in 5,400 hours of work.

Required

Calculate the following variances.

The fixed overhead total variance	\$1,550 Favourable
The fixed overhead expenditure variance	\$450 Adverse
The fixed overhead volume variance	\$2,000 Favourable
The fixed overhead volume efficiency variance	\$400 Favourable
The fixed overhead volume capacity variance	\$1,600 Favourable

Solution

The fixed overhead total variance	\$1,550 Favourable
The fixed overhead expenditure variance	\$450 Adverse
The fixed overhead volume variance	\$2,000 Favourable
The fixed overhead volume efficiency variance	\$400 Favourable
The fixed overhead volume capacity variance	\$1,600 Favourable

All the variances help to assess the under- or over-absorption of fixed overheads, some in greater detail than others.

Fixed overhead total variance

	\$	
Fixed overhead incurred	20,450	
Fixed overhead absorbed ($1,100 \text{ units} \times \20 per unit)	<u>22,000</u>	
Fixed overhead total variance	1,550	(F)
(= under-/over-absorbed overhead)		

The variance is favourable because more overheads were absorbed than budgeted.

Fixed overhead expenditure variance

	\$	
Budgeted fixed overhead expenditure	20,000	
Actual fixed overhead expenditure	<u>20,450</u>	
Fixed overhead expenditure variance	450	(A)

The variance is adverse because actual expenditure was greater than budgeted expenditure.

Fixed overhead volume variance

The production volume achieved was greater than expected. The fixed overhead volume variance measures the difference at the standard rate.

	\$	
Actual production at standard rate ($1,100 \times \$20 \text{ per unit}$)	22,000	
Budgeted production at standard rate ($1,000 \times \$20 \text{ per unit}$)	<u>20,000</u>	
Fixed overhead volume variance	2,000	(F)

The variance is favourable because output was greater than expected. Potential reasons:

- (1) The labour force may have worked efficiently and produced output at a faster rate than expected. Since overheads are absorbed at the rate of \$20 per unit, more will be absorbed if units are produced more quickly. This **efficiency variance** is exactly the same in hours as the direct labour efficiency variance but is valued in \$ at the standard absorption rate for fixed overhead.
- (2) The labour force may have worked longer hours than budgeted, and therefore produced more output, so there may be a **capacity variance**.

Fixed overhead volume efficiency variance

The volume efficiency variance is calculated in the same way as the labour efficiency variance.

1,100 units of product E should take ($\times 5$ hrs)	5,500	hrs
but did take	5,400	hrs
Fixed overhead volume efficiency variance in hours	100	hrs (F)
Valued at the standard fixed overhead absorption rate per hour	$\times \$4$	
Fixed overhead volume efficiency variance in \$	\$400	(F)

The labour force has produced 5,500 standard hours of work in 5,400 actual hours and so output is 100 standard hours (or 20 units of product E) higher than budgeted for this reason and the variance is **favourable**.

Fixed overhead volume capacity variance

The volume capacity variance is the difference between the budgeted hours of work and the actual active hours of work (excluding any idle time).

Budgeted hours of work	5,000	hrs
Actual hours of work	<u>5,400</u>	hrs
Fixed overhead volume capacity variance	400	hrs (F)
standard fixed overhead absorption rate per hour	$\times \$4$	
Fixed overhead volume capacity variance in \$	\$1,600	(F)

Since the labour force worked 400 hours longer than planned, we should expect output to be 400 standard hours (or 80 units of product E) higher than budgeted and therefore the variance is **favourable**.

The variances may be summarised as follows.

	\$	
Expenditure variance	450	(A)
Efficiency variance	400	(F)
Capacity variance	<u>1,600</u>	(F)
Over-absorbed overhead (total variance)	1,550	(F)



Activity 5: Fixed overhead variance calculations

Armour Co has budgeted to make 1,100 units of a product called Soul during the month of April 20X3. The budgeted fixed overhead cost is \$33,000 and the standard time to make a unit of Soul is three hours.

The actual fixed overhead cost during the month turns out to be \$33,980. 1,000 units of Soul were produced and the labour force worked for 3,500 hours.

Required

Calculate the following variances:

		Adverse (A) or favourable (F)
The fixed overhead total	\$ <input type="text"/>	<input type="text"/>

variance		
The fixed overhead expenditure variance	\$ []	[]
The fixed overhead volume variance	\$ []	[]
The fixed overhead volume efficiency variance	\$ []	[]
The fixed overhead volume capacity variance	\$ []	[]

Solution



Essential reading

See Chapter 15 Section 1.1 of the Essential reading for information on the possible reasons for fixed overhead variances.

The Essential reading is available as an Appendix of the digital edition of the Workbook.

1.6 Marginal costing

When using marginal costing there is only a fixed overhead expenditure variance, this is calculated as the difference between the budgeted and actual levels of fixed overhead expenditure.

2 Sales variances

Sales variances measure the effect on expected profit of a different selling price to the standard and a different volume of sales to the original budget.



Sales price variance: The sales price variance compares what the sales revenue should have been for actual sales compare to the actual sales revenue and shows the impact of a different selling price to the standard.

Sales volume variance: The sales volume variance calculates the impact on profit (under an absorption costing system) or contribution (under a marginal costing system) of a different sales volume to budgeted (planned) quantity.



Formula to learn

Sales price variance- based on the number of units **sold**. What should actual units sold sell for? What did they sell for?

		\$
'Should'	Actual sales × standard sales price per unit	X
'Did'	Actual sales × actual sales price per unit	(X)
	Variance	X



Formula to learn

Sales volume variance - How many units should be sold? How many were sold? What is the impact of this on profit (absorption costing) or contribution (marginal costing)?

		Units
'Should'	Budgeted sales	X
'Did'	Actual sales	(X)
Difference		X
Variance	Valued @ standard profit per unit (AC) @ standard contribution per unit (MC)	\$X



Illustration 6: Sales price variance

The standard selling price of product X is \$15 and the standard contribution is \$3. Budgeted sales in 20X3 were 2,300 units. Actual sales in 20X3 were 2,000 units at \$15.30 per unit.

Required

- 1 What is the sales price variance?
- 2 What is the sales volume contribution variance?
- 3 Management are evaluating the impact of the price rise on the sales variance.
Was it a good decision to raise the price of product X?

Solution

1 Sales price variance

		\$
'Should'	Actual sales (2,000 units) × standard sales price per unit (\$15)	30,000
'Did'	Actual sales (2,000 units) × actual sales price per unit (\$15.30)	<u>30,600</u>
	Variance	600 (F)

The sales price variance is favourable because the sales price was higher than expected.

2 Sales volume contribution variance

		Units
'Should'	Budgeted sales	2,300
'Did'	Actual sales	<u>2,000</u>
Difference		300
	Valued @ standard contribution per unit (\$3)	\$900 (A)
Variance		

The sales volume contribution variance is adverse because sales volumes were lower than expected.

- 3 The overall sales variance was \$300 Adverse (\$600F - \$900A) and so it was not a good idea to raise the selling price.

**Activity 6: Sales price variance calculation**

The following data is available about Product B for period 3:

Period 3 - Actual		Period 3 - Budget
Sales (units)	10,100	10,000
	\$	\$
Total sales value	52,520	51,000
Total manufacturing costs at standard cost	(43,430)	<u>(43,000)</u>
Manufacturing profit	9,090	8,000

Required

- 1 What is the sales price variance?
 \$1,010 adverse
 \$510 favourable
 \$520 favourable
 \$1,010 favourable

- 2 What is the sales volume variance?
 \$80 favourable
 \$90 favourable
 \$510 favourable
 \$520 favourable

Solution



Essential reading

See Chapter 15 Section 1.2 of the Essential reading for information the possible causes of sales variances.

The Essential reading is available as an Appendix of the digital edition of the Workbook.

3 Applying variances



Operating statement: An operating statement is a regular report for management of actual costs and revenues, usually showing variances from budget.

It is useful to provide management with an overview of the impact of all the variances. An operating statement shows how the combination of variances reconciles the budgeted profit to the actual profit.



Illustration 7: Operating statement using marginal costing

Canary Co is a manufacturer of mobile phone car kits and has the following financial data:

Budget	Unit	Total
	\$	\$
Sales	(8,000 units)	<u>75</u> <u>600,000</u>
Production	(8,700 units)	
Materials	4 kg @ \$4.50	18 <u>156,600</u>
Labour	5 hrs @ \$5	25 <u>217,500</u>
Variable overheads	5 hrs @ \$2	<u>10</u> <u>87,000</u>
		<u>53</u> <u>461,100</u>
Closing inventory	(700 units @ \$53/unit)	<u>(37,100)</u>
		<u>424,000</u>
Budgeted contributions		<u>176,000</u>
Budgeted fixed overheads		<u>130,500</u>
Actual		\$
Sales	(8,400 units)	<u>613,200</u>
Production	(8,900 units)	
Materials	purchased 35,464 kgs for \$163,455 (used 34,928 kgs)	<u>161,043</u>
Labour	(45,400 hours paid and worked)	<u>224,515</u>
Variable overheads		<u>87,348</u>
		<u>472,906</u>
Closing inventory	(500 units @ \$53/unit))	<u>(26,500)</u>
		<u>446,406</u>
Actual contribution		<u>166,794</u>
Actual fixed overheads		<u>134,074</u>

Required

Produce an operating statement using marginal costing principles.

Solution

	\$
Budgeted contribution (8,000 units at \$22/unit)	<u>176,000</u>
Sales volume variance	<u>8,800</u>
Flexed contribution (ie contribution from actual sales)	<u>184,800</u>
Sales price variance	<u>(16,800)</u>

			168,000
Cost variances:	F	A	
Materials – price		3,867	
– usage	3,024		
Labour – wage rate	2,485		
– efficiency		4,500	
Var. O/head – expenditure	3,452		
– efficiency		1,800	
	<u>8,961</u>	<u>10,167</u>	<u>(1,206)</u>
Actual contribution			166,794
Less: Fixed costs:			
Budgeted		130,500	
Expenditure variance		<u>3,574</u> (A)	<u>(134,074)</u>
Actual profit			<u>32,720</u>



Exam focus point

You will not have to produce an operating statement in your examination, but you could have to calculate any of the elements and you must understand the layout and purpose of an operating statement, as well as the differences between an operating statement prepared under absorption costing compared to marginal costing.

	Absorption costing	Marginal costing
Sales volume variance	Valued at standard profit per unit	Valued at standard contribution per unit
Treatment of fixed overhead (FOH) variances	FOH Expenditure variance FOH Volume variance: <ul style="list-style-type: none"> • Capacity • Efficiency 	FOH Expenditure variance only

In addition, when you are preparing an operating statement under absorption costing, you reconcile budgeted profit to flexed budgeted profit to actual profit.



Activity 7: Operating statement using absorption costing

Using the same data used in Canary Co illustration, produce an operating statement that reconciles budgeted profit to actual profit under absorption costing principles. Remember the budgeted and actual profit under absorption costing will not be the same as those calculated under marginal costing.

	\$
Budgeted profit	<input type="text"/>
Sales volume variance	<input type="text"/>
Flexed profit (ie standard profit from actual sales)	<input type="text"/>
Sales price variance	<input type="text"/> <input type="text"/>
	\$(F) \$(A)
Cost variances:	
Materials – price	<input type="text"/>
– usage	<input type="text"/>
Labour – rate	<input type="text"/>
– efficiency	<input type="text"/>
Variable overheads	
– expenditure	<input type="text"/>
– efficiency	<input type="text"/>
Fixed overheads – expenditure	<input type="text"/>
– efficiency	<input type="text"/>
– capacity	<input type="text"/> <input type="text"/>
	<input type="text"/> <input type="text"/> <input type="text"/>
Actual profit	<input type="text"/>

Solution

3.1 Interpretation of variances

Care must be taken when interpreting variances, especially when they are being used to assess the performance of employees.

The following table may help you to think about some of the **operational causes** of variances.

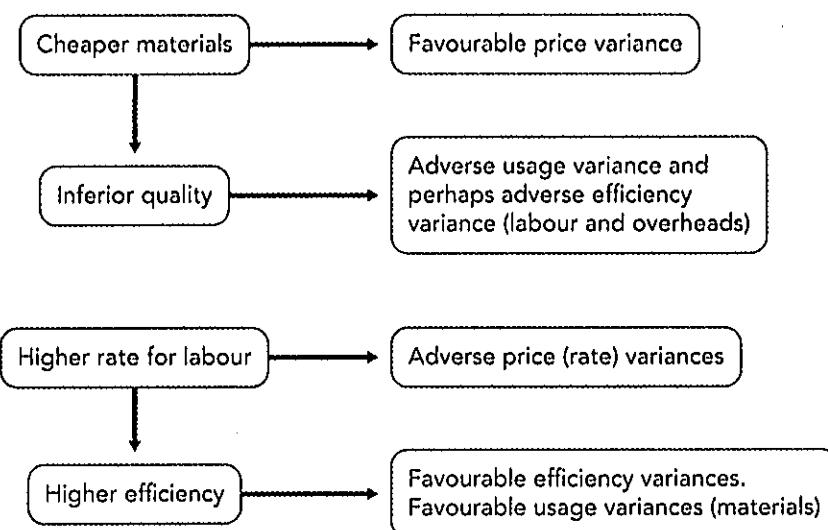
Variance	Favourable	Adverse
Material price	<ul style="list-style-type: none"> Unforeseen discounts received Greater care in purchasing Change in material standard 	<ul style="list-style-type: none"> Price increase Careless purchasing Change in material standard
Material usage	<ul style="list-style-type: none"> Material used of higher quality than standard More efficient use of material Errors in allocating material to jobs 	<ul style="list-style-type: none"> Excessive waste or theft Defective material Stricter quality control Errors in allocating material to jobs
Labour rate	<ul style="list-style-type: none"> Use of workers at a rate of pay lower than the standard 	<ul style="list-style-type: none"> Wage rate increase
Labour efficiency	<ul style="list-style-type: none"> Output produced more quickly than expected because of worker motivation, better quality materials etc Errors in allocating time to jobs Higher grade of labour than originally planned 	<ul style="list-style-type: none"> Lost time in excess of standard Output lower than standard set because of lack of training, sub-standard materials etc Errors in allocating time to jobs
Fixed overhead expenditure	<ul style="list-style-type: none"> Savings in costs incurred More economical use of services 	<ul style="list-style-type: none"> Increase in cost of services used Excessive use of services Change in type of service used
Fixed overhead volume	<ul style="list-style-type: none"> Production or level of activity greater than budgeted 	<ul style="list-style-type: none"> Production or level of activity less than budgeted

Overhead expenditure variances ought to be traced to the individual costs centres where the variances occurred.

3.1.1 Interdependence of variances

In order to interpret variances effectively any interdependence between variances must be identified, ie It is not always possible to look at individual variances in isolation.

When two variances are interdependent one will usually be adverse and the other favourable.



It is therefore important in analysing any variance that the overall consequence should be considered. An unfavourable variance may give concern by itself, but a favourable variance may have unfavourable interdependent variances.

3.1.2 When to investigate variances

Once variances have been calculated, which variances need investigating must be decided.

General factors for consideration would be:

- Size of the variance
- Controllability of variance
- Cost of investigation
- Interrelationships with other variances
- Level of standard
- Trend emerging

3.1.3 Control action

If the cause of the variance is controllable action can be taken to bring the system back under control in future. If the variance is uncontrollable, but not simply due to chance, it will be necessary to review forecasts of expected results and maybe revise the budget.



Essential reading

See Chapter 15 Section 1.3 of the Essential reading for information on possible control action when variances arise.

The Essential reading is available as an Appendix of the digital edition of the Workbook.



Activity 8: Control action

Sweatshop Co has found that it has had an increasing adverse labour efficiency variance for the last 3 months. You learn that the company is using lots of temporary workers in a bid to keep up with increased demand for its single product, the Z.

Required

Which TWO of the following control actions could be implemented by the company to try to eliminate this?

- Increase the hourly rate paid to temporary workers
- Offer paid overtime to the company's existing skilled workers
- Implement training for the temporary employees
- Reduce the number of supervisors

3.1.4 Deriving actual data from standard cost details and variances

Rather than being given actual data and asked to calculate the variances, you may be given the variances and required to calculate the actual data on which they were based, this process is often referred to as backward variances.



Illustration 8: Backward variances - labour rate



XYZ uses standard costing. The following data relates to labour grade II:

Actual hours worked	10,400	hours
Standard allowance for actual production	8,320	hours
Standard rate per labour hour	\$5	
Labour rate variance	\$416	(A)

Required

What was the actual rate of pay per labour hour?

- \$4.95
- \$4.96
- \$5.04
- \$5.05

Solution

The correct answer is: \$5.04

		\$
Should	Actual labour hours (10,400) × standard labour rate (\$5)	52,000
Did	Actual labour hours (10,400) × actual labour rate (\$?)	+ <u>52,416*</u>
Labour rate variance		416
		(A)

Working backwards we can derive the actual cost per labour hour ($\$52,416 / 10,400 = \5.04).

You should have been able to eliminate the first two options because both are below the standard rate per hour, as an adverse variance means that the actual rate must be higher than the standard rate.



Exam focus point

If you have to work backwards to derive actual results always jot down the variance calculation(s) and fill in the information you have; the missing number will then be easier to spot.



Activity 9: Backwards variances - standard labour hours

The direct labour cost for Cricket Co for last month was as follows:

Actual hours worked	28,000	hours
Total direct labour cost	\$117,600	
Direct labour rate variance	\$8,400	(A)
Direct labour efficiency variance	\$3,900	(A)

Required

To the nearest thousand (in hours), what are the total standard labour hours last month?

Solution



Activity 10: Calculating actual contribution

Ladybird Co uses standard marginal costing. Last month the standard contribution on actual sales was \$23,000 and the following variances arose:

\$	
Total variable cost variance	3,250 adverse
Sales price variance	4,000 favourable
Sales volume contribution variance	7,500 adverse

Required

What was the actual contribution for last month?

\$

Solution

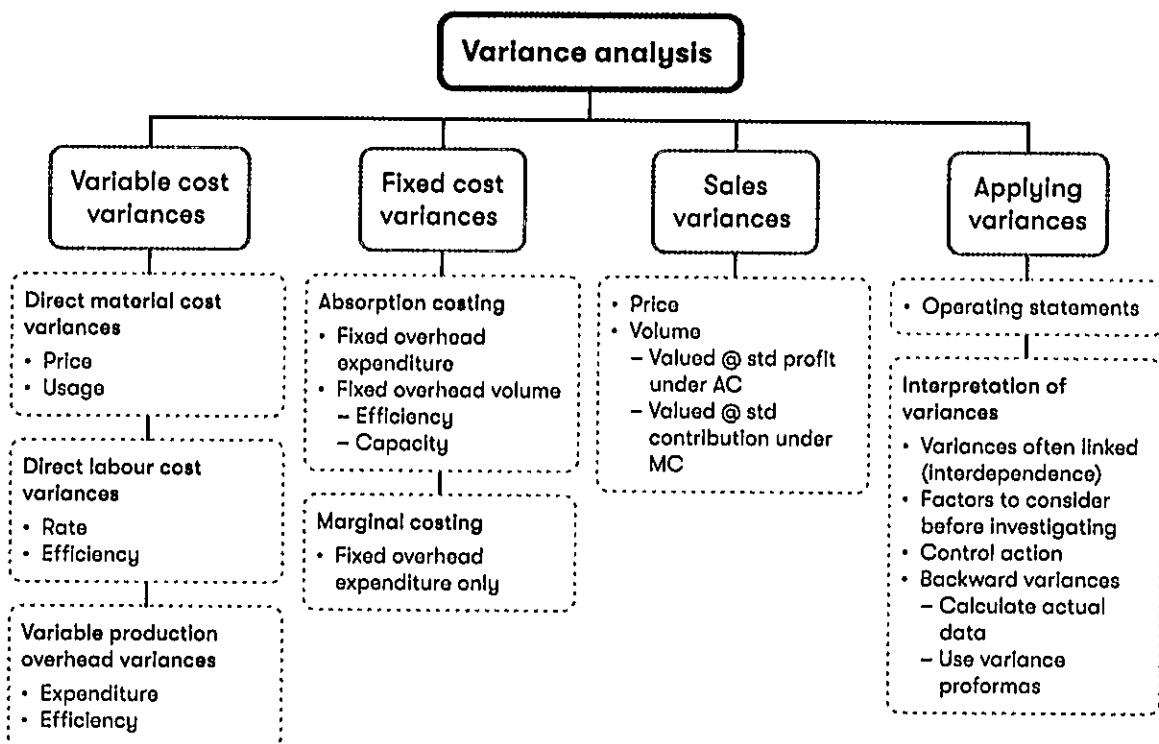


PER alert

PER performance objective 13 requires you to 'Plan and control performance' and PER objective 14 requires you to 'Monitor performance'.

The knowledge covered in this chapter will help you demonstrate your competence in these areas.

Chapter summary



Knowledge diagnostic

1. Variances

Variances show the differences between actual results and expected results and provide information for performance evaluation and control purposes.

2. Variable cost variances

Variable cost variances can be calculated for materials, labour and overheads.

3. Fixed overhead variances

Using marginal costing there is just a fixed overhead expenditure variance.

Using absorption costing an additional fixed overhead volume variance can be calculated and this can be further sub-divided into capacity and efficiency.

4. Sales variances

Sales price variances and sales volume variances measure the effect on profit of different selling prices and volumes to the standard.

5. Interpretation of variances

The interpretation of variances is a crucial element of the control process. Variances are often interdependent and this must be taken into account when deciding on the control action to implement.

6. When to investigate variances

Before deciding whether to investigate a variance, factors such as size, trend and controllability should be considered.

The interdependencies between variances should also be considered.

7. Operating statements

Operating statements show how the combination of variances reconcile budgeted profit and actual profit. Be prepared to produce part of the operating statement only, for example budgeted materials cost to actual materials cost.

8. Absorption costing v marginal costing variances

The differences in variance calculations between using absorption and marginal costing include:

Under marginal costing

- Only the fixed overhead expenditure variance is needed
- Sales volume variance calculated based on standard contribution
- Operating statement reconciles budgeted contribution to actual contribution and then to actual profit.

9. Backward variances

Sometimes an exam question may be set which requires you to work from a set of variances back to actual or budgeted data.

Further study guidance

Question practice

Now try the following from the Further question practice bank (available in the digital edition of the workbook):

Section A: Q74 - Q78

Activity answers

Activity 1: News Co

1 Total material variance:

	\$
'Should'	
Actual production × standard usage × standard cost per kg	27,000 units × 2 kgs* × \$2.50
'Did'	<u>53,000 kgs × \$2.38</u>
Variance	<u>135,000</u> <u>126,140</u> 8,860 (F)

*Standard usage = 50,000 kg / 25,000 units = 2 kg per unit

Standard cost per kg = \$125,000 / 50,000 kg = \$2.50 per kg

2 Material price variance

	\$
'Should'	
Actual purchases × standard cost per kg	53,000 kgs × \$2.50
'Did'	<u>53,000 kgs × \$2.38</u>
Variance	<u>132,500</u> <u>126,140</u> 6,360 (F)

3 Material usage variance

	Kgs
'Should'	
Actual production × standard usage	27,000 units × 2 kgs
'Did'	<u>53,000 kgs</u>
Actual production (units) × actual usage per unit	<u>(53,000)</u>
Difference	<u>1,000</u> (F)
Variance	Valued at the standard cost per kg \$2.50 <u>\$2,500</u> (F)

Activity 2: Yard Co

1

	\$
Total labour variance	
Actual units should cost (2,195 × 4 hrs × \$12.50)	109,750
Actual labour used did cost	<u>110,750</u>
	1,000 (A)

Rate variance	\$	
Actual hours paid should cost ($9,200 \times \$12.50$)	115,000	
Actual hours paid did cost	<u>110,750</u>	
	4,250	(F)

3

Efficiency variance	Hrs	
Actual production should use ($2,195 \times 4$ hrs)	8,780	
Actual production did use	<u>9,200</u>	
	420	(A)
@ std cost \$12.50	\$5,250	(A)

Activity 3: Flight Co

The correct answer is: \$700

	Hours	
Actual hours worked	2,200	
Actual hours paid	<u>2,300</u>	
Difference	100	(A)
Valued at standard labour rate per hour \$7	\$700	(A)

Activity 4: Dog Co

1 Total variable production overhead variance

	\$	
'Should'		
Actual production \times standard variable overhead cost per hour \times standard labour hours per unit	$5,000 \text{ units} \times \2×4 hours	40,000
'Did'		
Variance	<u>42,100</u>	2,100 (A)

2

	\$	
'Should'		
Actual labour hours \times standard variable overhead cost per hour	$20,500 \text{ hours} \times \2	41,000
'Did'		
Variance	<u>42,100</u>	1,100 (A)

3

	Hours	Hours
'Should'	$5,000 \text{ units} \times 4$	20,000

Actual production × standard labour hours per unit	hours			
'Did'	Labour hours worked	20,500		(20,500)
Difference		500	(A)	(500) A
	Valued at standard variable production overhead rate per hour \$2	\$1,000	(A)	\$1,000 A
Variance				

Activity 5: Fixed overhead variance calculations

		Adverse (A) or favourable (F)
The fixed overhead total variance	\$3,980	(A)
The fixed overhead expenditure variance	\$980	(A)
The fixed overhead volume variance	\$3,000	(A)
The fixed overhead volume efficiency variance	\$5,000	(A)
The fixed overhead volume capacity variance	\$2,000	(F)

The standard fixed overhead cost of a Soul is \$33,000 / 1,100 units = \$30 per unit

3 hours at \$10 per hour = \$30 per unit

The fixed overhead total variance

	\$
Amount of overhead absorbed (1,000 units × \$30 per unit)	30,000
Fixed overhead incurred	<u>33,980</u>
FIXED OVERHEAD TOTAL VARIANCE (under absorbed)	3,980 (A)

The fixed overhead expenditure variance

	\$
Budgeted fixed overhead expenditure	33,000
Actual fixed overhead expenditure	<u>33,980</u>
FIXED OVERHEAD EXPENDITURE VARIANCE	980 (A)

The fixed overhead volume variance

Budgeted production 1,100 units

Actual production	<u>1,000</u>	units
	100	units (A)
Valued at the standard absorption rate per unit	$\times \$30$	-
FIXED OVERHEAD VOLUME VARIANCE	<u>3,000</u>	(A)
 Or		
Budgeted labour hours (3 hrs \times 1,100 units)	3,300	hrs
Standard hours produced (3 hrs \times 1,000 units)	<u>3,000</u>	hrs
	300	hrs (A)
Valued at the standard OAR per hour	$\times \$10$	
FIXED OVERHEAD VOLUME VARIANCE	3,000	(A)
 The fixed overhead efficiency variance		
1,000 units of Soul should take (3 hrs)	3,000	hours
But did take	<u>3,500</u>	hours
	500	hours (A)
Valued at the standard absorption rate per hour	$\times \$10$	
FIXED OVERHEAD VOLUME EFFICIENCY VARIANCE	<u>\$5,000</u>	(A)
 The fixed overhead capacity variance		
Budgeted hours of work (3 hrs \times 1,100 units)	3,300	hours
Actual hours of work	<u>3,500</u>	hours
	300	hours (F)
Valued at standard absorption rate per hours ($\times \$10$)	$\times \$10$	-
FIXED OVERHEAD VOLUME CAPACITY VARIANCE	<u>\$2,000</u>	(F)

Activity 6: Sales price variance calculation

1 The correct answer is: \$1,010 favourable

	\$
'Should'	Actual sales (10,100 units) \times standard sales price per unit (\$5.10*)
'Did'	Actual sales (2,000 units) \times actual sales price per unit (\$15.30)
	Variance
	1,010
	(F)

*Standard selling price per unit = \$51,000/10,000 units = \$5.10.

2 The correct answer is: \$80 favourable

	units
'Should'	Budgeted sales
	10,000

'Did'	Actual sales	<u>10,100</u>
Difference		100
	Valued @ standard profit per unit	\$80
Variance	(\$0.80) *	(F)

*Standard profit = \$80,000/10,000 units = \$0.80

Activity 7: Operating statement using absorption costing

Budgeted profit	\$	56,000
Sales volume variance		<u>2,800</u>
Flexed profit (ie standard profit from actual sales)		58,800
Sales price variance		<u>(16,800)</u>
		42,000

	\$(F)	\$(A)
Cost variances:		
Materials – price		3,867
– usage	3,024	
Labour – rate	2,485	
– efficiency		4,500
Variable overheads		
– expenditure	3,452	
– efficiency		1,800
Fixed overheads – expenditure		3,574
– efficiency		2,700
– capacity	<u>5,700</u>	
	<u>14,661</u>	<u>16,441</u>
Actual profit		<u>(1,780)</u>
		40,220

Working

Sales volume variance

	Units
Budgeted sales	8,000
Actual sales	<u>8,400</u>
	400
Valued @ standard profit per unit \$7	\$2,800
	(F)

Activity 8: Control action

The correct answers are:

- Offer paid overtime to the company's existing skilled workers
 - Implement training for the temporary employees

Response Option	Explanation
Increase the hourly rate paid to temporary workers	There is no evidence that increasing their salary will make them work faster
Offer paid overtime to the company's existing skilled workers	As the company's existing workforce will complete the work they are likely to be quicker compared to the temps as they have more experience.
Implement training for the temporary employees	Increased training should also improve the efficiency of production.
Reduce the number of supervisors	Reducing the amount of supervision is likely to have the opposite effect, ie increasing the time taken to make each unit rather than decreasing it.

Activity 9: Backwards variances - standard labour hours

Labour rate variance	\$
Should	Actual labour hours (28,000) x standard labour rate (?)*
Did	Actual labour hours x actual labour rate
Labour rate variance	<u>117,600</u>
	8,400 (A)

*Standard labour cost = \$109,200/28,000 hours = \$3.90 per hour

Labour efficiency variance		hours
Should	Actual units should take	£ 27,000
		<u>28,000</u>
Did	Actual units did take	
Difference		£ 1,000
Labour efficiency variance	Valued @ standard cost (\$3.90) per hour, calculated from labour rate variance	\$3,900 (A)

Activity 10: Calculating actual contribution

	\$
	23,000
Standard contribution on actual sales (flexed contribution)	
Sales price variance	4,000 (F)
Total variable cost variance	<u>3,250</u> (A)
Actual contribution	23,750

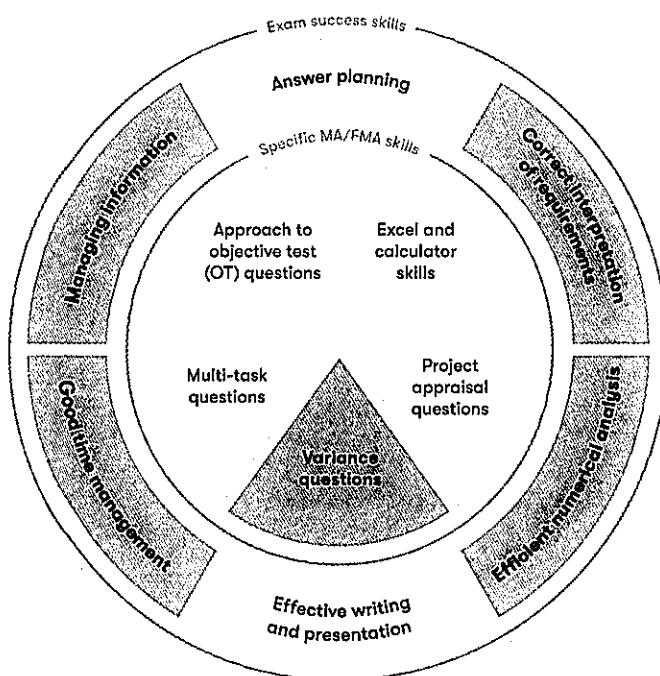
The sales volume variance reconciles the budgeted contribution to the flexed contribution and therefore is not required in this calculation.



Skills checkpoint 4

Variance questions

Chapter overview



Introduction

The ability to evaluate performance is an important concept in management accounting and for your MA/FMA exam. Variance analysis allows us to compare budgeted performance to actual performance in a meaningful way by flexing the budget so that we can compare like with like. In order to answer variance questions in your exam, you need to ensure that you:

- Have learnt the variance formulae
- Understand the differences between marginal costing system variances and absorption costing system variances
- Understand the format of an operating statement
- Understand that variances can be calculated using a flexed budget to compare like with like

Variance questions

Tips:

- Differences between marginal and absorption costing variances:
 - In a standard absorption costing system, the sales volume variance is based on profit per unit
 - In a standard marginal costing system, the sales volume variance is based on contribution per unit
 - In a standard absorption costing system, the total fixed overhead variance includes expenditure and volume variances
 - In a standard marginal costing system, the total fixed overhead variance includes an expenditure variance only
- Operating statements: Under absorption costing:

	\$
Budgeted profit	X
Sales volume profit variance	<u>X</u>
Standard profit from actual sales	X
Sales price variance	X
Variable cost variances	X
Fixed cost expenditure variance	X
Fixed cost volume variance	<u>X</u>
Actual profit	X =

Under marginal costing:

	\$
Budgeted contribution	X
Sales volume contribution variance	<u>X</u>
Standard contribution from actual sales	X
Sales price variance	X
Variable cost variances	<u>X</u>
Actual contribution	X
Actual fixed overhead (ie difference between budgeted fixed overhead and fixed overhead expenditure variance)	<u>X</u>
Actual profit	X =

- Using flexed budgets to calculate variances:
 - For variances to be meaningful you must compare 'like with like' and eradicate any volume differences. For example, you could compare a flexed budget for 35,000 units to the actual cost for 35,000.
 - Any variance calculated against the flexed budget will therefore exclude changes caused by changes in volume, leaving only variances due to efficiency and price effects.

Exam success skills

The following questions are examples of the sorts of questions you could see in your exam.

For these questions, we will also focus on the following **exam success skills**:

- **Managing information.** With the amount of information contained in a variance scenario question, it is easy to feel put off, feeling like there is too much to do. Begin by reading the requirements (using active reading as highlighted in Checkpoint 1).
- **Correct interpretation of requirements.** Make sure that you note whether you need to identify whether the variance is favourable or adverse, as well as calculating a value. Remember that sales variances are the opposite to cost variances, ie selling more units than planned, or selling them for a higher price will result in favourable sales variances, whereas using more material than budgeted or paying a higher price per unit will result in adverse variances.
- **Efficient numerical analysis.** You must be careful with calculations because distractors (incorrect answers in MCQs) are based on commonly made errors. For example, one of the distractors may be the value of the variance in hours instead of in \$.
- **Good time management.** Note that you will probably find variance calculations some of the most time-consuming, especially backward variance calculations, so don't be alarmed if these take you longer. You should be able to save some time on discursive questions. However, you may want to flag complex variance calculations and do them at the end of the exam section with the remaining time.

Skill activity

Adam Co manufactures one product, the Ryan whose output level varies from month to month. No inventory is held. Extracts from the flexed budget are given below, together with actual figures for November 20X9.

		Flexed budget 35,000 units	Budgeted 40,000 units	Actual 35,000 units
		\$	\$	\$
Sales revenue		700,000	800,000	735,000
Direct materials	Variable cost	420,000	480,000	430,000
Direct labour	Variable cost	87,500	100,000	80,000
Indirect labour	Semi-variable cost	22,500	25,000	31,000
Indirect materials	Fixed cost	6,000	6,000	6,500
Profit		164,000	189,000	187,500

(a) Which TWO of the following are reasons why Adam Co would want to use fixed and flexed budget?

- Flexed budgets allow comparison of what the cost should have been for the 40,000 units of output compared to the actual costs for 35,000 units
- Flexed budgets allow comparison of what the cost should have been for the 35,000 units of output compared to the actual costs for 35,000 units
- Fixed budgets are predominantly used at the planning stage to define the broad objectives of the organisation
- A fixed budget will need to be adjusted once the actual production volumes are known. (2 marks)

Note. Make sure that you know what the purpose of flexed budgets is, ie to compare like with like. As a result you should be able to eliminate any options which look to compare the cost of the budgeted unit of output (40,000 units).

Note. Remember that fixed budgets are NEVER adjusted and so the final statement can also be eliminated.

(b) Complete the table to show the revenue, cost and profit variances for November 20X9. (6 marks)

		Flexed budget 35,000 units	Budgeted 40,000 units	Actual 35,000 units	Variance	
		\$	\$	\$	\$	Adverse/ Fav?
Sales revenue		700,000	800,000	735,000		
Direct materials	Variable cost	420,000	480,000	430,000		
Direct labour	Variable cost	87,500	100,000	80,000		
Indirect labour	Semi-variable cost	22,500	25,000	31,000		
Indirect materials	Fixed cost	6,000	6,000	6,500		
Profit		164,000	189,000	187,500		

Note. When doing the calculations, make sure you use the flexed budget column and ignore the fixed budget column for 40,000 units. Also, remember to think carefully before selecting favourable or adverse in the final column - the actual sales revenue was higher than the flexed budget, so this is favourable, but the actual direct materials were higher than the flexed budget. Since this is a cost, the variance is adverse.

(c) The direct labour cost data relating to the Ryan for December 20X9 was as follows:

Actual hours worked and paid	87,360 hours
Total direct labour cost	\$235,200
Direct labour rate variance	\$16,800 Adverse
Direct labour efficiency variance	\$7,800 Adverse

To the nearest hour, what were the total standard labour hours last month? (2 marks)

_____ hours

Note. Start off by jotting down the proformas for the direct labour rate variance and direct labour efficiency variance. You can then populate the proforma with the information given in the question. This methodical approach should ensure that you get the right answer as efficiently as possible.

(Total = 10 marks)

Let's have a look at the questions and answers in detail.

Question (a)

The correct answers are:

- Flexed budgets allow comparison of what the cost should have been for the 35,000 units of output compared to the actual costs for 35,000 units
- Fixed budgets are predominantly used at the planning stage to define the broad objectives of the organisation

You needed knowledge of the purpose of flexible budgets to answer this question. It should have been fairly quick to answer, allowing you some extra time for the calculation aspects. However, do not rush, take your time and make sure that you read the options carefully.

For example, you may have been tempted to select: A fixed budget will need to be adjusted once the actual production volumes are known. However, fixed budgets are never adjusted.

Question (b)

		Flexed budget 35,000 units	Budgeted 40,000 units	Actual 35,000 units	Variance	
		\$	\$	\$	\$	Adverse/ Fav?
Sales revenue		700,000	800,000	735,000	35,000	Fav
Direct material	Variable cost	420,000	480,000	430,000	10,000	Adverse
Direct labour	Variable cost	87,500	100,000	80,000	7,500	Fav
Indirect labour	Semi- variable cost	22,500	25,000	31,000	8,500	Adverse
Indirect material	Fixed cost	6,000	6,000	6,500	500	Adverse
Profit		164,000	189,000	187,500	23,500	Fav

The secret to success here was understanding that for variances to be meaningful, you must compare a flexed budget for 35,000 units to the actual cost for 35,000. This means that any volume differences are eradicated, and that any variance calculated against the flexed budget will therefore exclude changes caused by changes in volume, leaving only variances due to efficiency and price effects. Once you had identified that you needed to compare the flexed budget with the actual budget, it was a case of subtracting one number from another.

However, you needed to think carefully before deciding if it was going to be favourable or adverse, and applying logic slowly is the best way to do this. For example, for the sales variance, the actual result was higher than flexed budgeted sales for 35,000 units. This is going to be favourable because it is a good (or favourable) result to achieve more revenue for the units than planned. However, with the cost variances, the opposite is true. It is bad news (ie an adverse variance) when the costs are higher than they should have been for the same number of units, ie direct materials, indirect materials and indirect labour in this case.

Question (c)

Jot down the proformas for both the labour rate variance and the labour efficiency variance and insert the figures you have.

Labour rate variance

	\$
Actual hours should cost	?
Actual hours did cost	<u>235,200</u>
Variance	<u>16,800</u> Adverse

Labour efficiency variance

	Hours
Actual units should take	
Actual hours did take	<u>87,360</u>

Difference	Hours
Variance valued at standard cost per labour hour \$	<u>7,800</u> Adverse

Fill in the gaps, using your knowledge of variances:

From the labour rate variance, we can work out what the actual hours should have cost.

Actual hours should have cost: $\$235,200 - \$16,800 = \$218,400$.

(We deduct the variance because it was adverse, meaning that the 'should cost' must have been lower than the actual cost).

- As we know what actual hours cost, we can work out what the standard cost per labour hour is. Remember, actual hours should cost = actual hours worked (87,360 hours) \times the standard cost per hour.

$\$218,400 / 87,360 \text{ hours} = \2.50 per hour

- As we have the standard cost per labour hour ($\$2.50$) we can translate the labour efficiency variance into the difference in hours: $\$7,800 / \$2.50 = 3,120$ hours. As the variance is adverse, this means it took 3,120 more hours to produce actual production than it should have, or the standard time for actual production was 3,120 hours less than the actual time, meaning the standard time for actual production was $87,360 - 3,120 = 84,240$ hours.

From a time management point of view, part (c) was very time consuming, so you should have completed the earlier parts of the task first. It may be necessary to flag a complex OTQ like this and come back to it at the end of the exam if you have time. Knowing how to approach it and practising questions like this should give you confidence and mean you make better use of your time in the exam.

Exam success skills diagnostic

Every time you complete a few questions, use the diagnostic below to assess how effectively you demonstrated the exam success skills in answering the questions. The table has been completed below for the above activity to give you an idea of how to complete the diagnostic.

Exam success skills	Your reflections/observations
Managing information	Did you read the three requirements first? Did you notice the column headings in (b) so that you could eliminate the fixed budget column and only focus on the flexed budget and actual results?
Correct interpretation of requirements	Did you identify the need to select TWO options in (a)?
Efficient numerical analysis	In question (b) did you realise that the fixed budget had already been flexed, so you did not need to work out the 'should' or 'did' elements, instead you just had to subtract one from the other?
Good time management	Did you manage to attempt the entire question in 12 minutes?
Most important action points to apply to your next question	

Summary

Being able to answer variance questions is important for the MA/FMA exam. Key points to consider include:

- To save learning all of the formulae, you can apply 'should' and 'did' to each situation but remember that it will always be what actual production 'should' and 'did' cost or use, never budgeted.
- The cost behaviour is important, fixed budgets are never flexed.
- Try to think about potential causes of variances and the interrelationships between variances.
- Attempt questions in the order best suited to your skills and knowledge, leaving more time-consuming and complex calculations until the end.

16

Target setting

Learning objectives

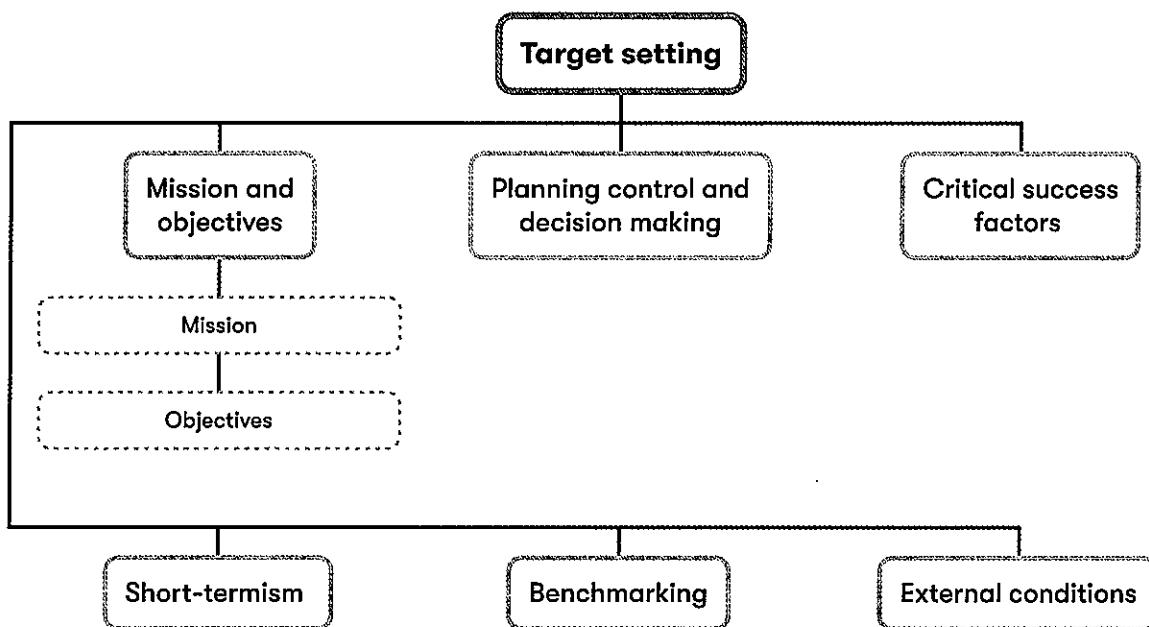
On completion of this chapter, you should be able to:

	Syllabus reference no.
Discuss the purpose of mission statements and their role in performance measurement.	F1 (a)
Discuss the purpose of strategic and operational and tactical objectives and their role in performance measurement.	F1 (b)
Discuss the relationship between short-term and long-term performance.	F4 (b)
Discuss the role of benchmarking in performance measurement.	F4 (f)
Discuss critical success factors and key performance indicators and their link to objectives and mission statements	F2 (b) (iii)
Establish critical success factors and key performance indicators in a specific situation	F2 (b) (iv)
Discuss the impact of economic and market conditions on performance measurement.	F1 (c)
Explain the impact of government regulation on performance measurement.	F1 (d)

Exam context

This chapter links to the organisational objectives and goals covered in chapter 1. It is most likely to be tested in section A of the examination.

Chapter overview



1 Mission and objectives

We looked briefly at objectives and goals in Chapter 1. Here we return to goals and objectives in the context of performance measurement. Performance measurement helps to ensure that the business is being run as efficiently as possible. So when we talk about performance measurement, we are talking about control of performance. We will look at how mission statements are linked to objectives and to key performance indicators and we will look at different types of performance measure.

1.1 Mission

This represents the vision of top management: what is it that they are trying to achieve?

Mission statements are formal statements of an organisation's mission which describe the organisation's basic purpose and what it is trying to achieve. They might be reproduced in a number of places (eg at the front of an organisation's annual report, on publicity material, in the chairman's office and in communal work areas). There is no standard format, but they should possess certain characteristics.

A good mission statement should have the following characteristics:

- Brevity
- Flexibility
- Distinctiveness



Mission statement: Formal statement of an organisation's mission which describe the organisation's basic purpose and what it is trying to achieve.



Activity 1: Mission statement

Which of the following statements would NOT be expected to appear within a mission statement for a cafe?

- The cafe believes in paying a fair price to its suppliers and only serves fair trade tea and coffee.
- The cafe serves homemade food.
- The cafe exists to provide a return for its investors and refreshments for visitors to the park.
- The cafe aims to attract 200 customers this week.

1.2 Objectives

Most organisations will set themselves quantified objectives in order to enact their mission. There should be goal congruence within the goals set for different parts of the organisation.

Characteristics of objectives:

- S pecific
- M easurable
- A ttainable
- R elevant
- T ime-bounded



Activity 2: Setting objectives

Your mission is to become the Finance Director of a FTSE 100 company within 10 years. What is a suitable objective to set regarding studying this course?

Solution

1.3 Primary and secondary objectives

Some objectives are more important than others. There is a **primary corporate objective** and other **secondary objectives** which are strategic objectives which should combine to ensure the achievement of the primary corporate objective.



Activity 3: Secondary objective

If a company sets its primary objective to be growth in profits, what secondary objectives might it use?

Solution

2 Planning, control and decision making

Information for management accounting is likely to be used for planning, control and decision making.

2.1 Planning

At the planning stage a company will establish its objectives and select appropriate strategies to achieve those objectives.

2.1.1 Establishing objectives

The objectives of a firm may be:

Profit making firm	Non-profit making firm
Increase market share	User satisfaction
Increase sales revenue	Level of service provision
Increase profits	Value for money
Reduce costs	

2.1.2 Levels of objective



Different objectives will be required at different levels in the organisation to enable the company to achieve its primary objective.

Management should ensure that there is consistency between objectives horizontally as well as vertically.

Long-term strategic planning (corporate plan) involves determining an organisation's long-term goals and then selecting appropriate strategies to attain those objectives.

Shorter term planning involves developing tactical and operational plans in order to achieve the goals of the corporate plan.



Strategic objectives: Set the overall long-term objectives for the organisation as a whole.

Tactical objectives: The 'middle tier' of objectives, designed to plan and control individual functions within the organisation. Tactical objectives are then implemented by setting operational objectives.

Operational objectives: Day to day performance targets to ensure that the organisation's operations are carried out efficiently or effectively.

Strategic objectives would include such matters as required levels of company profitability. Tactical objectives would concern the efficient and effective use of an organisation's resources; for example, target productivity. Operational objectives would include guidelines for ensuring that specific tasks are carried out. For example, the manager of a sales territory may specify weekly sales targets for each sales representative.



Activity 4: Strategic objectives

Buster sells vacuum cleaners.

Required

- Which TWO of the following are suitable measures of performance at the strategic level?

- Number of vacuum cleaners sold
- Return on investment
- Market share
- Number of customer complaints

2.1.3 Control

There are two key mechanisms within the control process:

- (a) Actual performance is compared with planned performance of the organisation as set out in the detailed operational plan and adjusted in response.
- (b) The corporate plan is reviewed to reflect significant new information.

2.1.4 Decision making

Managers at all levels within an organisation make decisions.

It is the role of management accountants to provide information so that management at whatever level can reach an informed decision.

3 Critical success factors

A **critical success factor (CSF)** is a performance requirement that is fundamental to competitive success.

These are examples of 'critical success factors'.

- Profitability
- Market share
- Productivity
- Product leadership goals
- Personnel development
- Employee attitudes
- Public responsibility

Critical success factors can be set and used by identifying objectives and goals, determining which factors are critical for accomplishing each objective and then determining a small number of performance measures for each factor.



Critical success factor: A performance requirement that is fundamental to competitive success.

An organisation can measure how well it is achieving the CSFs through the use of **key performance indicators (KPIs)**. CSFs represent 'what' an organisation needs to do in order to be successful. KPIs are the measures that are then used to assess whether or not the CSFs are being achieved.

These key performance measures are therefore a vital part of the control system for reviewing how successfully a strategy has been implemented and how well an organisation is performing.

Definitions of CSFs highlight that, in order to be successful, organisations have to perform well across a range of key processes. Therefore, CSFs and KPIs should focus on key operational processes and should avoid focusing on financial performance alone.

3.1 The link between mission statement and KPIs

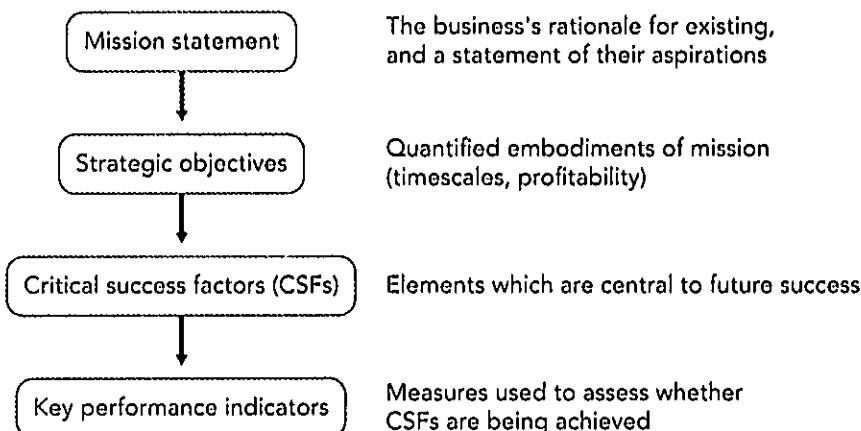


Illustration 1: CSFs and KPIs

TDM is a private educational institution based in Western Europe. It offers a variety of courses, including degrees both at Bachelor and Masters levels and courses aimed at professional qualifications. TDM has always concentrated on the quality of its courses and learning materials. TDM has never seen the need for market and customer research, as it has always achieved its sales targets. Its students consistently achieve passes on a par with the national average. TDM has always had the largest market share in its sector even though new entrants continually enter the market. TDM has a good reputation and has not felt the need to invest significantly in marketing activities. In recent years, TDM has experienced an increasing rate of employee turnover.

Required

Suggest four CSFs and KPIs for TDM

Solution

Four critical success factors which may be appropriate for TDM are:

- (1) Customer satisfaction with courses and learning materials
- (2) Employee satisfaction
- (3) The quality of its teaching and materials
- (4) Reputation and brand image

KPIs for each of the CSFs could be:

Customer satisfaction

Student satisfaction rating – At the end of a course, or at the end of a module within a course, students could be asked to complete a questionnaire rating their satisfaction with various aspects of the course (for example, the knowledge levels of the staff, the quality of the supporting materials and the approachability/availability of staff to ask them questions).

Client retention – A number of the students attending the courses aimed at professional qualifications are likely to have been funded by their employers. If employers continue to send their students to TDM rather than one of its rivals in the market, this suggests they are happy with the level of tuition and service their students are receiving. The pass rates that students achieve are likely to be a significant influence on client satisfaction in this respect.

Employee satisfaction

Staff turnover – The quality of TDM's teaching staff is crucial in maintaining customer satisfaction, so it is important for TDM to retain its best staff.

Staff absenteeism – High levels of absence are likely to also indicate dissatisfaction among the staff. If absenteeism is rising in conjunction with employee turnover, then there is a danger that the quality of service provided for students will suffer.

Quality of teaching and materials

Market share – It will be important to monitor TDM's market share, because the share of the market TDM can capture will have a direct impact on its revenues.

Accreditations – TDM's courses will be accredited by academic and professional bodies. TDM has always concentrated on the quality of its courses and learning materials, so external accreditations will provide an independent corroboration of this quality. The quality of course tuition and learning materials, in turn, is likely to feed back into the level of customer satisfaction with TDM's courses.

Reputation and brand image

Brand reputation – TDM has never seen the need for market and customer research, and has always had a good reputation. However, given the continuing entrance of new competitors into the market, TDM needs to ensure that its brand reputation is maintained. This is important if TDM is to ensure that potential customers will choose to come on its courses rather than going to one of its competitors.

Pass rates – If students, or their employers, think that selecting one tuition provider in preference to another can affect their chances of passing their exam, they are likely to select the tuition provider with the highest pass rate.

4 Short-termism

As well as conflict between objectives, there can also be conflict between time frames.

Managers' performance is often measured on short-term results, trying to achieve these may involve the sacrifice of longer-term objectives.

For example, trying to maximise profit in the short term may involve postponing R&D expenditure, advertising or other investment which would contribute to growth in long term.



Short-termism: Short-termism is when there is a bias towards short-term rather than long-term performance. It is often due to the fact that managers' performance is measured on short-term results.

4.1 Methods to encourage a long-term view:

Steps that could be taken to encourage managers to take a long-term view, so that the 'ideal' decisions are taken, include the following.

- Making short term targets realistic as, if budget targets are unrealistically tough, a manager will be forced to make trade-offs between the short and long term.
- Providing sufficient management information to allow managers to see what trade-offs they are making: Managers must be kept aware of long-term aims as well as shorter-term (budget) targets.
- Evaluating manager's performance in terms of contribution to long-term as well as short-term objectives.
- Link rewards to share price; this may encourage goal congruence.
- Set quality based targets as well as financial targets. Multiple targets can be used.

5 Benchmarking

A business will attempt to seek the best available performance against which it can measure its own performance. By adopting what is regarded as **best practice** as a target, the business

attempts to improve its own performance. In this way, the business can be as good as, or better than, the best in class in the most important areas of operation.

Benchmarking uses a challenging target for improving the operations of the business. It can benefit from the knowledge and practices of other businesses, without having to make all its own mistakes, and it can obtain a competitive advantage.

Benchmarking is now widely used in not for profit organisations, because there are less issues with confidentiality and sharing best practice.

5.1 Types of benchmarking



Internal benchmarking: A method of comparing one operating unit or function with another within the same organisation.

Competitive benchmarking: Information is gathered about other direct competitors, using techniques including reverse engineering.

Functional benchmarking: Where internal functions are compared regardless of industry, this may occur when non-competing businesses have similar processes.

Strategic benchmarking: A type of competitive benchmarking aimed at strategic action and organisational change.



Activity 5: Benchmarking

A manufacturing company benchmarks the performance of its accounts receivable department with that of a leading credit card company.

Required

Which type of benchmarking is the company using?

- Internal benchmarking
- Competitive benchmarking
- Functional benchmarking
- Strategic benchmarking

6 External conditions

External conditions can also affect performance. An organisation must be aware of the following external conditions when measuring performance:

- Market conditions: the entry of a new competitors to the market is likely to impact on performance.
- General economic conditions: overall demand and supply will be impacted by changes in interest and inflation rates.
- Government influence: taxation, legislation and a government's economic policy will affect a business's performance.



Essential reading

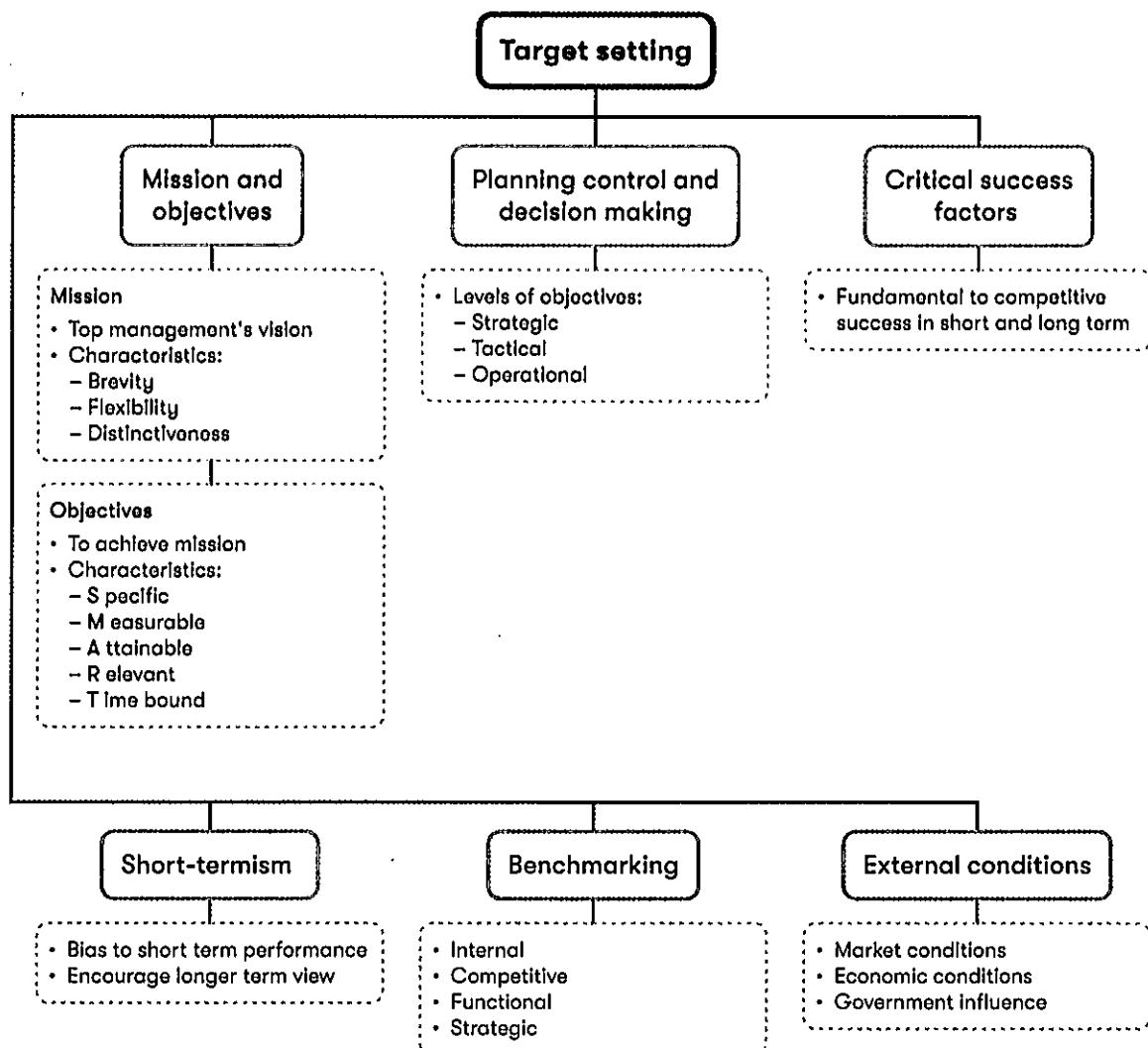
See Chapter 16 Section 1 of the Essential reading, for more detail on the government's influence. The Essential reading is available as an Appendix of the digital edition of the Workbook.



PER alert

PER performance objective 14a relates to the key external factors, including financial factors, affecting organisational performance. The knowledge you've gained in this chapter will help you demonstrate your competence in this area.

Chapter summary



Knowledge diagnostic

1. Mission

Top management's vision

2. Objectives

SMART

Primary v secondary

Strategic, tactical, competitive

3. Critical success factors

Goals which are fundamental to competitive success

4. Benchmarking

Internal

Competitive

Functional

Strategic

5. External conditions

Market conditions, general economic conditions and government influence can impact on performance measurement.

Further study guidance

Question practice

Now try the following from the Further question practice bank (available in the digital edition of the Workbook):

Section A: Q79 - Q83

Activity answers

Activity 1: Mission statement

The correct answer is: The cafe aims to attract 200 customers this week.

The cafe aims to attract 200 customers this week – this is a specific objective.

Activity 2: Setting objectives

Pass MA CBE within 6 weeks of finishing my course.

Activity 3: Secondary objective

Secondary objectives might then be concerned with sales growth, continual technological innovation, customer service, product quality, efficient resource management (eg labour productivity) or reducing the company's reliance on debt capital.

Conflict: There may be conflict between objectives. For example, growth in sales volumes might result in higher levels of bad debts.

Activity 4: Strategic objectives

The correct answers are:

- Return on investment
- Market share

Number of vacuum cleaners sold and number of customer complaints would be used lower down the hierarchy.

Activity 5: Benchmarking

The correct answer is: Functional benchmarking

Functional benchmarking is where internal functions (accounts receivable department) are compared regardless of industry. This may occur when non-competing businesses have similar processes.

17

Financial performance measurement

Learning objectives

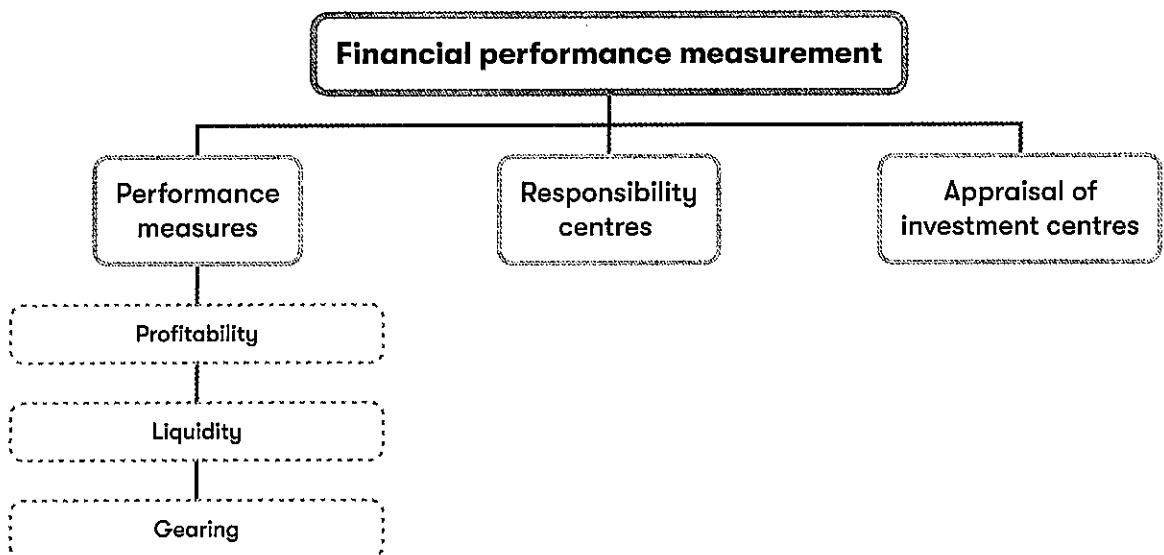
On completion of this chapter, you should be able to:

	Syllabus reference no.
Discuss and calculate measures of financial performance (profitability, liquidity, activity and gearing).	F2 (a)
Distinguish between cost, profit, investment and revenue centres.	A3 (i)
Describe the differing needs for information of cost, profit, investment and revenue centre managers.	A3 (j)
Discuss measures that may be used to assess managerial performance and the practical problems involved.	F4 (e)
Calculate return on investment and residual income.	F2 (f)(i)
Explain the advantages and limitations of return on investment and residual income.	F2 (f)(ii)

Exam context

This chapter looks at how to evaluate financial performance. You should expect questions assessing financial performance in both section A and B of the examination and must ensure that you learn all the ratios.

Chapter overview



1 Performance measures

Performance measure can be divided into two groups:

- **Financial performance measures** (this chapter)
- **Non-financial performance measures** (Chapter 18)

Financial performance measures include **profit, revenue, costs, share price and cash flow**.

Non-financial performance measures include **product quality, reliability and customer satisfaction**.

Performance measures can be **quantitative or qualitative**.

This chapter will focus on financial performance. In the exam you need to be able to discuss and calculate measures of financial performance (profitability, liquidity, activity and gearing).

1.1 Profitability

Profitability ratios look at how efficiently a business can make profit from the resources it has available. Profitability can be measured by return on capital employed (ROCE), operating profit margin, gross profit margin, asset turnover and return on equity (ROE).

Formula to learn

$$\text{Return on capital employed (ROCE)} = \frac{\text{PBIT}}{\text{Capital employed}} \%$$

PBIT = Profit before interest and tax.

Capital employed = TALCL = Total assets less current liabilities. It is equal to the capital invested in the business (equity plus non-current liabilities).

ROCE shows how much profit has been made in relation to the amount of resources invested.

Formula to learn

$$\text{Operating profit margin} = \frac{\text{PBIT}}{\text{Revenue}} \%$$

The profit margin (also known as the profit to sales ratio or return on sales) provides a simple measure of performance for management. Investigation of unsatisfactory profit margins enables control action to be taken, either by reducing excessive costs or by raising selling prices

Formula to learn

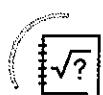
$$\text{Gross profit margin} = \frac{\text{Gross profit}}{\text{Revenue}} \%$$

Gross profit is the company's net sales revenue minus its cost of goods sold. It is the sales revenue a company retains after incurring the direct costs associated with producing the goods it sells, and the services it provides. Gross profit margin shows the gross profit generated as a percentage of sales

Formula to learn

$$\text{Asset turnover} = \frac{\text{Revenue}}{\text{Capital employed}}$$

Asset turnover is a measure of how efficiently the assets of a business are being used to generate sales



Formula to learn

$$\text{Return on equity} = \frac{\text{PAT and preference dividends}}{\text{Equity shareholders' funds}} \%$$

ROE shows how much profit each unit of shareholders' equity generates, it is an indicator of how effectively management are using equity financing to fund operations and grow the company



Return on equity: The return on equity ratio (ROE) measures the ability of a firm to generate profits from its shareholders' investment in the company. It shows how much profit each unit of shareholders' equity generates. ROE is also an indicator of how effectively management is using equity financing to fund operations and grow the company. It is expressed as a percentage and calculated by dividing net income by shareholders' equity.

Profit margin: The profit margin (profit to sales ratio) is calculated as $(\text{profit} \div \text{revenue}) \times 100\%$.

Asset turnover: Asset turnover is a measure of how well the assets of a business are being used to generate sales. It is calculated as $(\text{sales} \div \text{capital employed})$.

1.2 Liquidity

Liquidity ratios determine a company's ability to cover short-term obligations and its ability to convert assets in cash quickly.



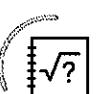
Formula to learn

$$\text{Current ratio} = \frac{\text{Current assets}}{\text{Current liabilities}}$$

The current ratio is the 'standard' test of liquidity and is the ratio of current assets to current liabilities. The idea behind the current ratio is that a company should have enough current assets that give a promise of 'cash to come' to meet its future commitments to pay off its current liabilities. Obviously, a ratio in excess of 1 should be expected. Otherwise, there would be the prospect that the company might be unable to pay its debts as they fall due.



Current ratio: The current ratio is the 'standard' test of liquidity and is the ratio of current assets to current liabilities.



Formula to learn

$$\text{Quick ratio (or acid test ratio)} = \frac{\text{Current assets} - \text{inventories}}{\text{current liabilities}}$$

Companies may not be able to convert all their current assets into cash very quickly. In particular, some manufacturing companies might hold large quantities of raw material inventories, which must be used in production to create finished goods inventories. Finished goods inventories might be warehoused for a long time or sold on lengthy credit terms. In such businesses, where inventory turnover is slow, most inventories are not very 'liquid' assets, because the cash cycle is so long. For these reasons, we calculate a harsher test of liquidity, known as the quick ratio or acid test ratio. This ratio should ideally be at least 1 for companies with a slow inventory turnover. For companies with a fast inventory turnover, a quick ratio can be comfortably less than 1 without suggesting that the company is in cash flow trouble



Quick ratio: The quick ratio, or acid test ratio, is the ratio of current assets less inventories to current liabilities.



Formula to learn

$$\text{Inventory days} = \frac{\text{Inventories}}{\text{Cost of sales}} \times 365$$

Inventory days (also known as inventory turnover period) is a calculation of the number of days that inventory is held for.



Formula to learn

$$\text{Inventory turnover} = \frac{\text{Cost of sales}}{\text{Inventories}}$$

Inventory turnover is a measure of how vigorously a business is trading. A lengthening inventory turnover period from one year to the next indicates either a slowdown in trading or a build-up in inventory levels, perhaps suggesting that the investment in inventories is becoming excessive.



Formula to learn

$$\text{Receivables collection period} = \frac{\text{Trade receivables}}{\text{Credit sales}} \times 365$$

The estimated average accounts receivable collection period is a rough measure of the average length of time it takes for a company's receivables to pay what they owe. The estimate of receivables days is only approximate because the statement of financial position value of receivables might be abnormally high or low compared with the organisation's 'normal' level.



Formula to learn

$$\text{Payables payment period} = \frac{\text{Trade payables}}{\text{Credit purchases}} \times 365$$

Accounts payable payment period or days provides a rough measure of the average length of time it takes a company to pay what it owes. This ratio often helps to assess a company's liquidity. An increase is often a sign of a lack of long-term finance or poor management of current assets, resulting in the use of extended credit from suppliers, an increased bank overdraft and so on.



Accounts receivable collection period: The estimated average accounts receivable collection period is a rough measure of the average length of time it takes for a company's receivables to pay what they owe and is calculated as (trade receivables/sales) × 365 days or (trade receivables/credit sales) × 12 months.

Inventory turnover period: Inventory turnover period is a calculation of the number of days that inventory is held for and is calculated as (inventory ÷ cost of sales) × 365 days or (inventory ÷ cost of sales) × 12 months.

Inventory turnover: Cost of sales ÷ inventory is termed inventory turnover, and is a measure of how vigorously a business is trading.

Accounts payable payment period: Accounts payable payment period or days provides a rough measure of the average length of time it takes a company to pay what it owes. It is

ideally calculated by the formula (payables/credit purchases) \times 365 days or (payables/credit purchases) \times 12 months. Cost of sales can be used as an approximation for purchases.

1.3 Gearing

Debt ratios are concerned with how much the company owes in relation to its size and whether it is getting into heavier debt or improving its situation.

- When a company is heavily in debt, and seems to be getting even more heavily into debt, banks and other would-be lenders are very soon likely to refuse further borrowing and the company might well find itself in trouble.
- When a company is earning only a modest profit before interest and tax, and has a heavy debt burden, there will be very little profit left over for shareholders after the interest charges have been paid.

$$\text{Gearing} = \frac{\text{Debt}}{\text{Debt} + \text{Equity}}$$

$$\text{Interest cover} = \frac{\text{PBIT}}{\text{Interest charges}}$$

The interest cover ratio shows whether a company is earning enough profits before interest and tax to pay its interest costs comfortably, or whether its interest costs are high in relation to the size of its profits, so that a fall in profit before interest and tax (PBIT) would then have a significant effect on profits available for ordinary shareholders.



Gearing: Gearing is concerned with the amount of debt in a company's long-term capital structure. Gearing ratios provide a long-term measure of liquidity.

Interest cover: The number of times a company can afford to cover its interest costs from the profits it is generating.



Activity 1: Performance measurement

The following figures are extracted from the accounts of Big Bond Co:

	20X9	20X8
Total production cost	\$3,269,000	\$2,541,000
Gross profit	\$1,503,000	\$1,291,000
Profit before interest and tax	\$295,000	\$287,000
Total assets less current liabilities	\$3,005,500	\$2,861,000
Average number of employees in the year	260	248
Number of books produced	29,361	27,498

Required

Calculate the following ratios for 20X9 and 20X8:

- (1) Operating profit margin
- (2) Gross profit margin
- (3) ROCE
- (4) Sales per employee
- (5) Average production cost per book

- (6) Average number of books produced per employee

Solution

1.4 Limitations of ratios

- On their own, they do not provide information to enable managers to gauge performance or make control decisions.
- The ratios used must be carefully defined.
- Measures compared over a period of time at historical cost will not be properly comparable where inflation in prices has incurred during the period, unless an adjustment is made to the measures to make allowance for price level differences.
- The performance of different companies cannot be properly compared where each company uses different accounting policies.

2 Responsibility centres

2.1 Divisionalisation

As a company grows, and possibly also spreads geographically, it is likely to need some form of divisionalisation. Divisional managers are given the authority to make decisions concerning the activities of their divisions.

2.2 Responsibility accounting

Responsibility accounting is the term used to describe decentralisation of authority, with the performance of the decentralised units or responsibility centres measured in terms of accounting results.

If the principle of controllability is applied, a manager should be made responsible and accountable only for the costs (and revenues) that they are in a position to control.



Within a system of responsibility accounting there are four main types of responsibility centre: cost centre, profit centre, revenue centre and investment centre.

Cost centre: A cost centre acts as a collecting place for certain costs before they are analysed further.

Profit centre: A profit centre is any unit of an organisation (for example, division of a company) to which both revenues and costs are assigned, so that the profitability of the unit may be measured.

Revenue centre: A revenue centre is similar to a cost centre and a profit centre but is accountable for revenues only.

Investment centre: An investment centre is a profit centre whose performance is measured by its return on capital employed.



Activity 2: Responsibility accounting

Identify for each of the responsibility centres below, the elements over which managers have control and a principle performance measure.

Type of responsibility centre	Example of responsibility centre	Manager has control over	Principal performance measures
Cost centre	Design department		
Revenue centre	Car dealer		
Profit centre	Canteen car factory		
Investment centre	New overseas sales outlet		

3 Appraisal of investment centres

Where a manager of a division is allowed some discretion about the nature of the investment undertaken by the division, assessment of results by profit alone (as for a profit centre) is inadequate. **The profit earned must be related to the amount of capital invested.** Such divisions are sometimes called investment centres for this reason.

Performance can be measured by return on investment (ROI) and by residual income (RI).

The amount of capital employed attributed to an investment centre should consist only of directly attributable non-current assets and working capital (net current assets).

3.1 Return on investment (ROI)

ROI is often used as a measure to monitor the performance of an investment centre. It shows how much profit has been earned in relation to the amount of capital invested in the centre.



Formula to learn

$$\text{ROI} = \frac{\text{Controllable divisional profit}}{\text{Divisional capital employed}} \times 100\%$$

The main reason for the widespread use of ROI is that it ties in directly with the accounting system and is identifiable from the income statement and balance sheet. Return on Capital Employed (ROCE) provides the same relative profit/capital employed measure, but for the entire company.



Return on investment: Return on investment (ROI) (also called return on capital employed (ROCE)) is calculated as $(\text{profit}/\text{capital employed}) \times 100\%$ and shows how much profit has been made in relation to the amount of resources invested.



Activity 3: Return on investment

News Inc. has two publications which it treats as separate investment centres, Real News and Tabloid Trash, which show results for the year as follows:

	RN \$'000	TT \$'000
Profit	6,000	3,000
Capital employed	40,000	12,000

Required

Which investment centre has been more successful?

Solution

3.2 ROI and goal congruence

In certain circumstances the use of ROI as a performance measure might not lead to goal congruent decisions.



Activity 4: Goal congruence

E-Wheels is an investment centre of a bicycle retailer Cycle Corp. Its current divisional profit is \$300,000 which has been generated from an investment of \$1m. The target return on investment is 20%.

The divisional manager of E-Wheels has the opportunity to upgrade the web servers at a cost \$100,000. It is expected that as a result of the ability to handle increased internet traffic an additional \$25,000 of profits could be earned.

Required

Would the manager proceed with the upgrade if they were paid a bonus based on ROI?

Solution

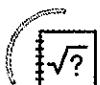
3.3 Residual income (RI)

An alternative way of measuring the performance of an investment centre is residual income (RI). RI is an absolute measure of the centre's profits after deducting a notional or imputed interest charge based on the total invested in the division multiplied by the company's cost of the capital.

RI can avoid some of the behavioural problems of dysfunction decision making that arise with the use of ROI.



Residual income: RI is an absolute measure of the centre's profits after deducting a notional or imputed interest charge based on the total invested in the division multiplied by the company's cost of the capital.



Formula to learn

$$\text{Residual Income} = \text{Controllable profit} - (\text{controllable investment} \times \text{cost of capital})$$



Illustration 1: Residual income and goal congruence

Returning to the E-wheels activity, would the divisional manager accept the proposed upgrade project if the bonus was based on RI?

Solution

	\$'000
Divisional RI without the project:	
Divisional profit	300
Imputed interest charge ($20\% \times \$1m$)	<u>(200)</u>
	100
Divisional RI with the project:	
Divisional profit	325
Imputed interest charge ($20\% \times \$1,100,000$)	<u>(220)</u>
	105

The RI would increase therefore the manager would accept the project. In this particular circumstance, RI would lead to a goal congruent decision since the project ROI of 25% is acceptable to the company.



Activity 5: ROI and RI

Fizz Co is a soft drinks manufacture with two divisions. Shareholders are expecting a return of at least 15%.

	Profit \$m	Investment \$m
Cola	64	320
Tropical	16	64

Required

Which manager will receive a bonus for the best performance if ROI or RI is used to measure performance?

- If ROI = Cola, if RI = Tropical
- If ROI = Cola, if RI = Cola
- If ROI = Tropical, if RI = Tropical
- If ROI = Tropical, if RI = Cola

Solution



Activity 6: ROI

Atwell Co has a capital employed of \$300,000. It has a cost of capital of 13% per year and its residual income is \$6,000.

Required

What is the company's return on investment?

- 2%
- 10%
- 13%
- 15%

Solution



3.4 The advantages and disadvantages of RI compared with ROI

The advantages of using RI

- Acceptable projects increase the RI of a division giving a simpler decision rule
- Goal congruent decisions more likely to occur.
- RI can be more flexible as different costs of capital can be applied to investments with different risk characteristics

The disadvantages of using RI

- Comparisons between divisions and projects are more difficult
- RI does not relate the size of a centre's income to the size of the investment

- Requires a cost of capital

3.5 RI versus ROI: marginally profitable investments

RI will increase if a new investment is undertaken which earns a profit in excess of the imputed interest charge on the value of the asset acquired. This means that 'marginally profitable' investments are likely to be undertaken by the investment centre manager.

In contrast, when a manager is judged by ROI, a marginally profitable investment would be less likely to be undertaken because it would reduce the average ROI earned by the centre as a whole.



Essential reading

See Chapter 17 Section 1 of the Essential reading, for detail on management performance measures.

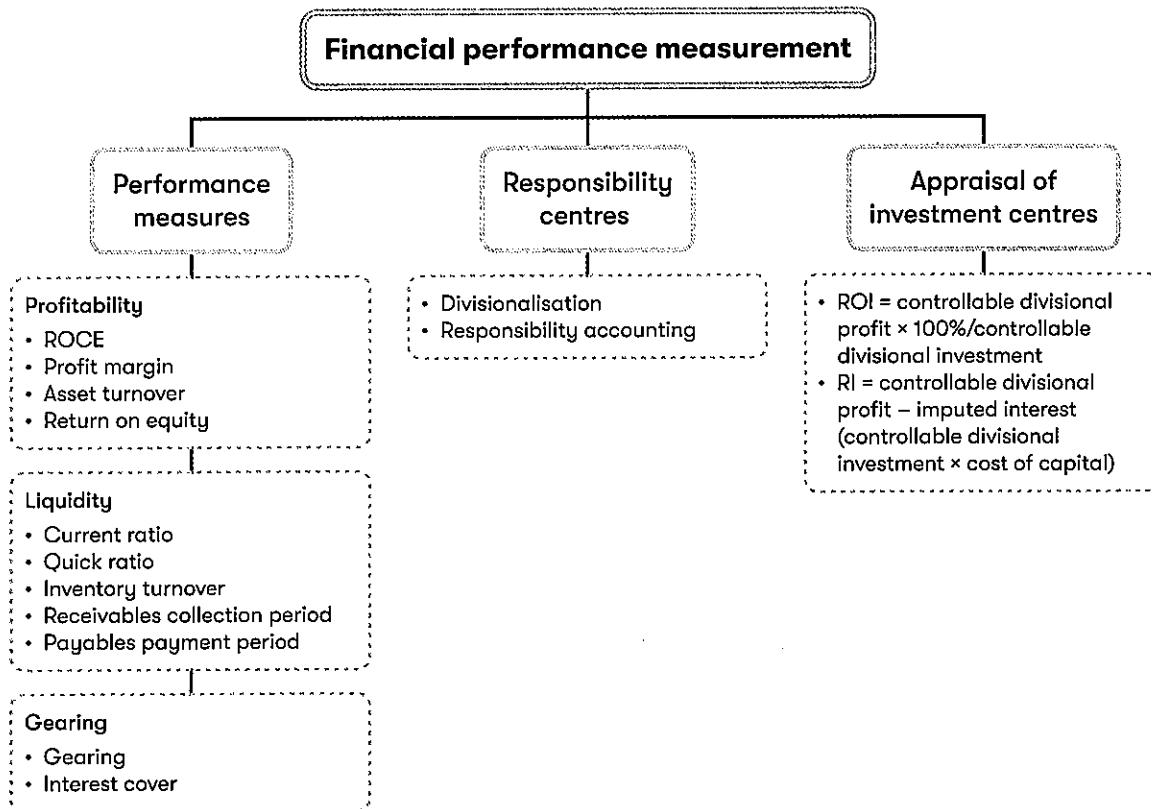
The Essential reading is available as an Appendix of the digital edition of the Workbook.



PER alert

PER performance objective 14b, c and d relate to performance measurement. The knowledge you've gained in this chapter will help you demonstrate your competence in this area.

Chapter summary



Knowledge diagnostic

1. Profitability ratios

Profitability ratios look at how efficiently a business can make profit from the resources it has available. Profitability can be measured by return on capital employed (ROCE), operating profit margin, gross profit margin, asset turnover and return on equity (ROE). Ensure you have learnt the ratios.

2. Liquidity ratios

Liquidity ratios determine a company's ability to cover short-term obligations and its ability to convert assets in cash quickly.

3. Gearing ratios

Gearing ratios are concerned with how much the company owes in relation to its size and whether it is getting into heavier debt or improving its situation.

4. Return on investment

Controllable profit + controllable investment × 100%.

Return on investment (ROI) (also called return on capital employed (ROCE)) is calculated as (profit/capital employed) × 100% and shows how much profit has been made in relation to the amount of resources invested.

5. Residual income

RI is an absolute measure of the centre's profits after deducting a notional or imputed interest charge based on the total invested in the division multiplied by the company's cost of the capital.

Further study guidance

Question practice

Now try the following from the Further question practice bank (available in the digital edition of the Workbook):

Section A: Q84 - Q88

Further reading

There is a technical article available on ACCA's website, called *Ratio Analysis*.

You are strongly advised to read this article in full as part of your preparation for the MA/FMA exam.

Activity answers

Activity 1: Performance measurement

	20X9	20X8
Operating profit margin	$\$295,000 + \$4,772,000^* = 6.2\%$	$\$287,000 + \$3,832,000^{**} = 7.5\%$
Gross profit margin	$\$1,503,000 + \$4,772,000 = 31.5\%$	$\$1,291,000 + \$3,832,000 = 33.7\%$
ROCE	$\$295,000 + \$3,005,500 = 9.8\%$	$\$287,000 + \$2,861,000 = 10\%$
Sales per employee	$\$4,772,000 + 260 = \$18,354$	$\$3,832,000 + 248 = 15,542$
Average production cost per book	$\$3,269,000 + 29,361 = \111	$\$2,541,000 + 27,498 = \92
Average number of books produced per employee	$29,361 + 260 = 113$	$27,498 + 248 = 111$

* Sales 20X9 = $\$1,503,000 + \$3,269,000 = \$4,772,000$

**Sales 20X8 = $\$1,291,000 + \$2,541,000 = \$3,832,000$

Activity 2: Responsibility accounting

Type of responsibility centre	Example of responsibility centre	Manager has control over	Principal performance measures
Cost centre	Design department	Costs only	Variance analysis
Revenue centre	Car dealer	Revenue only	Sales revenue
Profit centre	Canteen car factory	Costs and revenues	Profit
Investment centre	New overseas sales outlet	Costs, revenues and investments	Return on investment

Activity 3: Return on investment

	RN	TT
ROI	15%	25%

Tabloid Trash is more successful as it has generated a better return on the capital invested.

Activity 4: Goal congruence

Divisional ROI without the project = $\$300,000/\$1,000,000 = 30\%$

Divisional ROI with the project = $\$325,000/\$1,100,000 = 29.5\%$

Although the project ROI is acceptable to the company (25%), the manager would not be motivated to accept a project which lowers divisional ROI.

Activity 5: ROI and RI

The correct answer is: If ROI = Tropical, if RI = Cola

If ROI = Tropical, if RI = Cola

	Cola	Tropical
ROI	$64/320 = 20\%$	$16/64 = 25\% \text{ Bonus}$
RI	$64m - (320m \times 15\%) = 16m \text{ Bonus}$	$16m - (64m \times 15\%) = 6.4m$

Activity 6: ROI

The correct answer is: 15%

ROI = Profit/capital employed.

RI = Profit - (capital employed × cost of capital)

$6,000 = \text{Profit} - (300,000 \times 13\%)$

$\text{Profit} = 6,000 + 39,000 = 45,000$

$\text{ROI} = 45,000/300,000 = 15\%$

18

Assessing non-financial performance

Learning objectives

On completion of this chapter, you should be able to:

	Syllabus reference no.
Discuss the importance of non-financial performance measures.	F4 (a)
Discuss and calculate non-financial measures.	F2 (a)
Discuss the relationship between short-term and long-term performance.	F4 (b)
Discuss the advantages and limitations of the balanced scorecard.	F2 (b) (i)
Describe performance indicators for financial, customer, internal business process and innovation and learning.	F2 (b) (ii)
Discuss the measurement of performance in non-profit seeking and public sector organisations.	F4 (d)
Explain the concepts of economy, efficiency and effectiveness.	F2 (c) (i)
Describe performance indicators for economy, efficiency and effectiveness.	F2 (c) (ii)
Establish performance indicators for economy, efficiency and effectiveness in a specific situation.	F2 (c) (iii)
Discuss the meaning of each of the efficiency, capacity and activity ratios.	F2 (c) (iv)
Calculate the efficiency, capacity and activity ratios in a specific situation.	F2 (c) (v)
Establish measures of resource utilisation in a specific situation.	F2 (e) (ii)
Describe performance measures which would be suitable in contract and process costing environments.	F2 (d) (i)
Describe measures of performance utilisation in service and manufacturing environments.	F2 (e) (i)
Distinguish performance measurement issues in service and manufacturing industries	F2 (g) (i)
Describe performance measures appropriate for service industries	F2 (g) (ii)

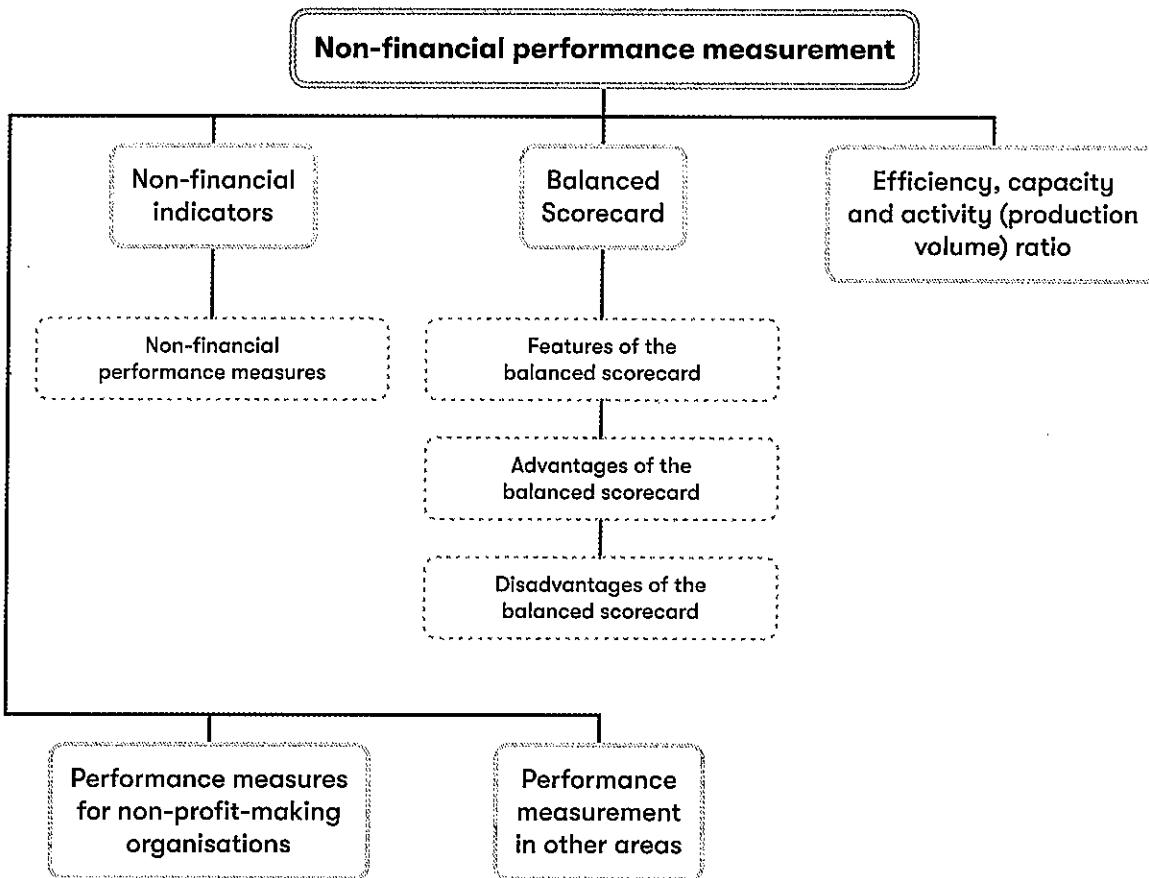
Syllabus reference
no.

Discuss the measurement of performance in service industry situations F4 (c)

Exam context

This chapter considers ways of assessing non-financial performance, there are lots of techniques you need to learn and be prepared to apply in section A and B of the examination.

Chapter overview



1 Non-financial indicators

Financial measures do not convey the full picture of a company's performance, especially in a modern business environment. Today, organisations are competing in terms of product quality, delivery, reliability, after-sales service and customer satisfaction. Successful execution of these variables is essential for success but none of these are directly measured by a traditional accounting system.

Many companies are therefore using a combination of quantitative and qualitative non-financial indicators (NFIs) such as the following:

- Quality
- Number of customer complaints
- Number of warranty claims
- Lead times
- Rework
- Delivery to time
- Non-productive hours
- System (machine) down time

Unlike traditional variance reports, measures such as these can be provided quickly for managers, per shift or on a daily or even hourly basis as required. They are likely to be easy to calculate, and easier for non-financial managers to understand and therefore to use effectively to take action.

The benefit of non-financial indicators is that anything can be compared if it is meaningful to do so.



Activity 1: Non-financial indicators

Which TWO of the following are non-financial indicators that can be used to measure performance?

- Defects per product per month
- Non-productive hours per month
- Return per machine per month
- Profit per product per month

1.1 Non-financial performance measures

The use of non-financial performance measures has increased in recent years.

A key reason why non-financial performance measures are used is that they are considered to be leading indicators of financial performance. For example, if customer satisfaction is low this could imply a future fall in profits due to decreased sales demand. The non-financial measure of poor customer satisfaction has given an indication that the financial measure of future sales may change.

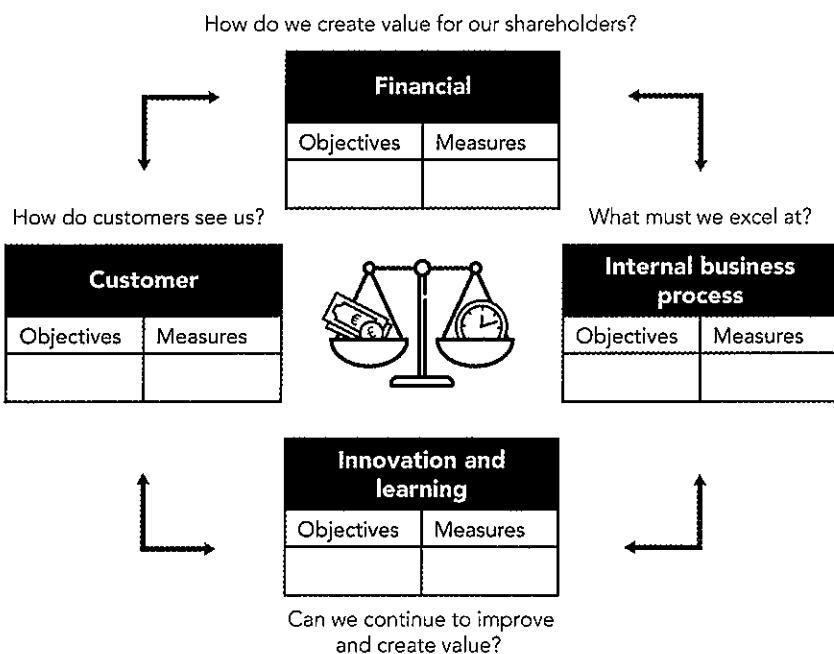
You can appreciate the benefits of non-financial performance indicators when you contrast them with financial performance measures and the effect both might have on management.

- (a) **Non-financial performance measures** can provide managers with incentives to improve long-term financial performance. Focusing on customer satisfaction encourages repeat business, which is good for long-term profitability.
- (b) **Financial performance measures** used alone may provide managers with shorter-term incentives, which could be detrimental to the business in the long term. For example, price increases applied in the short term to meet financial targets could damage customer relations in the long term if quality has not improved.

2 The balanced scorecard

A popular approach in current management thinking to performance measurement is the use of a 'balanced scorecard', consisting of a variety of indicators both financial and non-financial.

The balanced scorecard focuses on four different perspectives and aims to establish goals for each perspective together with measures which can be used to evaluate whether these goals have been achieved.



Perspective	Explanation
Financial	Covers traditional measures such as growth, profitability and shareholder value
Customer	Gives rise to targets that matter to customers: cost, quality, delivery, inspection, handling and so on
Internal business process (also known as process efficiency)	Aims to improve internal processes, decision making and resource utilisation
Innovation and learning (also known as growth)	Considers the business's capacity to maintain its competitive position through the acquisition of new skills and the development of new products

The scorecard is 'balanced' in the sense that managers are required to think in terms of all four perspectives, to prevent improvements being made in one area at the expense of another.

2.1 Features of the balanced scorecard

- Traditional measures are mainly inward looking and narrow in focus with over emphasis on financial measures and short term goals.
- The Balanced Scorecard focuses on both internal and external factors and links performance measures to key elements of a company's strategy.
- It requires a balanced consideration of both financial and non-financial measures and goals to prevent improvements being made in one area at the expense of another.
- It attempts to identify the needs and concerns of customers to identify new products and markets and focuses on comparison with competitors to establish best practice.



Activity 2: The balanced scorecard

For each of the following performance indicators, for a general insurance company, identify one balanced scorecard perspective being measured.

Performance indicator	Balanced scorecard perspective
% of policies renewed	
Staff training days	
Return on capital employed	
% revenue from new products	
% of premiums paid out as claims	
% of policy documents sent out within 5 working days	

2.2 Advantages and disadvantages

As with all techniques, problems can arise when the balanced scorecard is applied.

Advantages	Explanation
All four perspectives considered by managers	Managers need to look at both internal and external matters affecting the organisation. They also need to link together financial and non-financial measures. Therefore, they can see how factors in one area affect all other areas.
Consistency between objectives, control systems and staff	It can be difficult to incorporate objectives into control systems such as budgets. So, targets set by a budget, say, may conflict with objectives. Moreover, staff may put their own interpretation on objectives against the actual intention of the original objective. The balanced scorecard should improve communication between different levels of the organisation. The balanced scorecard strives to keep all these factors in balance.

Disadvantages	Explanation
Conflicting measures	Some measures in the scorecard, such as research funding and cost reduction, may naturally conflict. It is often difficult to determine the balance that will achieve the best results.
Selecting measures	Not only do appropriate measures have to be devised but the number of measures used must also be agreed. Care must be taken that the impact of the results is not lost in a sea of information.
Expertise	Measurement is only useful if it initiates appropriate action. Non-financial managers may have difficulty with the usual profit measures. With more measures to consider this problem will be compounded.
Interpretation	Even a financially trained manager may have difficulty in putting the figures into an overall perspective.

3 Efficiency, capacity and activity (production volume) ratio

The following ratios can be used to assess labour performance. They are referred to as control ratios and use standard hours.

Note that these ratios were covered in Chapter 7 Accounting for labour.

Standard hour = standard hour/unit \times actual number of units made.

The standard hour is the quantity of work achievable at standard performance, expressed in terms of a standard unit of work done in a standard period of time.

The three main control ratios are the efficiency, capacity and activity ratios.

Formula to learn

$$\text{Efficiency ratio} = \frac{\text{Standard hours produced}}{\text{Actual hours worked}} \times 100\%$$

The efficiency ratio measures the efficiency of the labour force by comparing equivalent standard hours for work produced and actual hours worked.

Formula to learn

$$\text{Capacity ratio} = \frac{\text{Actual hours worked}}{\text{Budgeted hours}} \times 100\%$$

The capacity ratio compares actual hours worked and budgeted hours and measures the extent to which planned utilisation has been achieved. (Utilisation in this context refers to the proportion of available time that was actually worked.)

Formula to learn

$$\text{Activity (production volume) ratio} = \frac{\text{Standard hours produced}}{\text{Budgeted hours}} \times 100\%$$

The activity or production volume ratio compares the number of standard hours to the actual work produced and budgeted hours.

Activity 3: Efficiency, capacity and activity ratios

Barnes Co budgeted to make 12,000 standard units of output during a budget period of 36,000 hours (each unit should take 3 hours each).

During the period, the company actually made 14,000 units which took 40,000 hours.

Required

Calculate the efficiency, capacity and activity ratios.

4 Performance measures for non-profit-making organisations (NPMOs)

NPMOs includes organisations such as charities and much of the public sector. By definition, NPMOs can't be judged by profitability, nor do they generally have to be successful against competition, so other methods of assessing performance have to be used.

Performance is usually judged in terms of 'value for money' using the 3Es. Economy, efficiency and effectiveness are relevant considerations for all types of organisation but they are particularly useful when judging the performance of NPMOs.

Economy lies in operating at minimum cost. However, being very unwilling to spend money will reduce effectiveness. Efficiency consists of attaining desired results at minimum cost. It therefore combines effectiveness with economy.

The assessment of economy, efficiency and effectiveness should be a part of the normal management process of any organisation, public or private.



Economy: Economy refers to the procurement of appropriate quantity and quality of resources at the minimum cost.

Efficiency: Efficiency refers to maximum useful output from the resources or alternatively, the required output from the minimum resource input.

Effectiveness: Effectiveness means using resources such that the output of the activity achieves the desired result.



Activity 4: Non-profit-making organisations

The Travelwise bus service is government owned. The government requires it provide local bus services for the rural and urban residents of Angloland at low prices, which are set by the government. Best Buses Co is a privately owned bus company that also operates in Angloland. It is not subject to government regulation and most of its journeys are in the large cities of Angloland where customer numbers are high.

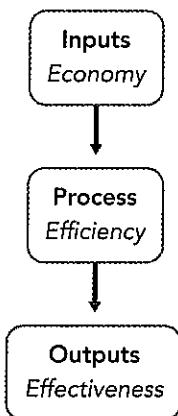
Required

Which of the following factors should NOT be allowed for when comparing the ROCE of the two organisations to assess the efficiency of their management?

- Differences in objectives pursued
 - Differences in prices
 - Differences in geographic area served
 - Differences in customer complaints
-

4.1 Studying and measuring the 3Es

Economy, efficiency and effectiveness can be studied and measured with reference to the following:



Inputs

- (a) Money
- (b) Resources – the labour, materials, time and so on consumed, and their cost

For example, in a state-run hospital this would include the price paid for drugs (compared with a budget or open market prices).

Process. For example, in a state-run hospital this could be the cost per successful heart operation. This is usually some ratio of economy and effectiveness measures.

Outputs; in other words, the **results of an activity**, measurable as the services actually produced, and the quality of the services.

In the case of a state-run hospital this may include, for example, the percentage of patients recovering from heart surgery.



Activity 5: 3Es

Using the 3Es, suggest a range of performance measures for a public sector library.



Solution



Value for money: Value for money involves simultaneously achieving economy, efficiency and effectiveness.

5 Performance measurement in other areas

5.1 Performance measurement in service and manufacturing industries

The key to performance measurement in service industries is to ensure that what you are measuring has been clearly defined.

Performance measurement in manufacturing is increasingly using non-financial measures.

In a contract environment each contract undertaken is unique. Detailed planning should be undertaken, and performance targets set.

5.2 Performance measures for contract and process costing environments

Performance measures need to be thought out carefully for contract environments. The high degree of standardisation in process costing environments means that it is ideal for setting performance standards. Non-financial performance measures for manufacturing include cost (behaviour), quality, time and innovation.

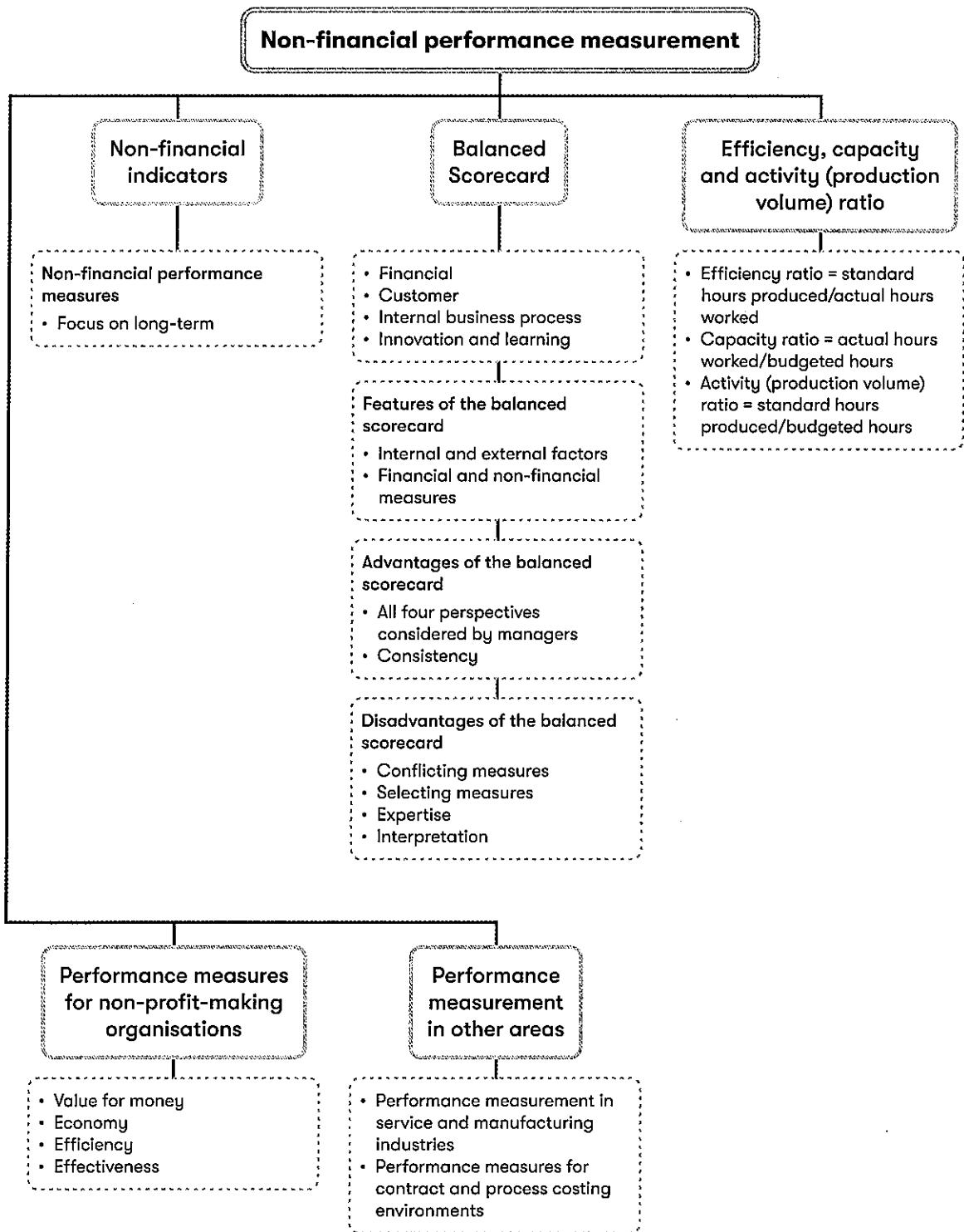


Essential reading

See Chapter 18 of the Essential reading, for additional detail on performance measurement in service and manufacturing industries and contract and process costing environments

The Essential reading is available as an Appendix of the digital edition of the Workbook.

Chapter summary



Knowledge diagnostic

1. Non-financial performance measures

More useful in modern environment with multiple factors

2. Efficiency, capacity and activity ratios

Control ratios used for management reports.

3. Balanced scorecard

4 dimensions:

- Financial
- Customer
- Internal business
- Innovation and learning

4. Value for money

Performance is often evaluated using the 3Es

- Economy
- Effectiveness
- Efficiency

5. Service and manufacturing industries

The key to performance measurement in service industries is to ensure that what you are measuring has been clearly enough defined.

Performance measurement in manufacturing is increasingly using non-financial measures.

6. Contract and process costing

In a contract environment each contract undertaken is unique. Detailed planning should be undertaken and performance targets set.

The high degree of standardisation in a process costing environment means that it is ideal for setting performance standards.

Further study guidance

Question practice

Now try the following from the Further question practice bank (available in the digital edition of the Workbook):

Section A: Q89 - Q93

Section B: Q96

Activity answers

Activity 1: Non-financial indicators

The correct answers are:

- Defects per product per month
- Non-productive hours per month

Indicators focussing on return and profit are financial indicators

Activity 2: The balanced scorecard

Performance indicator	Balanced scorecard perspective
% of policies renewed	Customer
Staff training days	Innovation and learning
Return on capital employed	Financial
% revenue from new products	Innovation and learning
% of premiums paid out as claims	Financial
% of policy documents sent out within 5 working days	Internal business process

Activity 3: Efficiency, capacity and activity ratios

Efficiency ratio = $(14,000 \times 3 \text{ hours})/40,000 \text{ hours} = 105\%$

Capacity ratio = $40,000 \text{ hours}/36,000 \text{ hours} = 111\%$

Production volume ratio = $(14,000 \times 3 \text{ hours})/36,000 \text{ hours} = 117\%$

$E \times C = PV$

$105\% \times 111\% = 117\%$

The production volume ratio of 117% (more output than budgeted and more standard hours produced than budgeted), is explained by the 111% capacity working, and by good efficiency of 105%.

Activity 4: Non-profit-making organisations

The correct answer is: Differences in customer complaints

Efficiency is the 'achievement of either maximum useful output from the resources devoted to an activity or the required output from the minimum resource input'.

Effectiveness is 'utilisation of resources such that the output of the activity achieves the desired result'

Differences in customer complaints would measure effectiveness.

Activity 5: 3Es

Economy = cost of inputs = getting a good deal

Value for money in sourcing library staff of appropriate quality

Competitive tendering for computers, security, cleaning

Efficiency = input to output ratio = getting a lot for the efforts

Cost per loan (cost of book/number of times loaned out)

Effectiveness = compared to objective = doing the right things

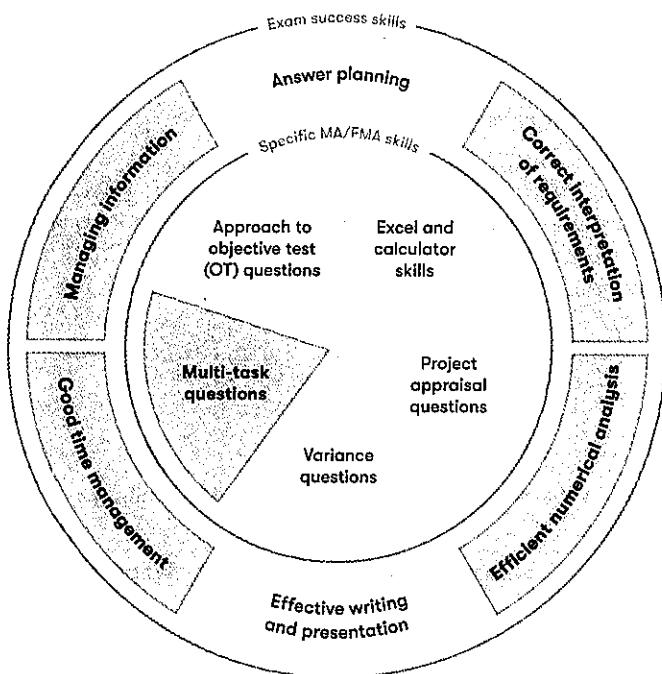
Number of active members

Number of overview due books returned

Skills checkpoint 5

Multi-task questions

Chapter overview



Introduction

Multi-task questions (MTQs) in Section B comprise 30% of your exam (via three 10-mark questions, broken down into sub-questions of varying mark allocations). It is therefore important that you give adequate revision time to practising these questions. The technical content is the same as in Section A of the exam. However, the format and the mark allocation varies.

Syllabus areas covered by MTQs:

- Section D - Budgeting (note that this can include forecasting techniques (syllabus area B2) and spreadsheets (syllabus area B4))
- Section E - Standard costing
- Section F - Performance measurement

Multi-task questions

The biggest difference between Section A OTQs and Section B MTQs is the way they are presented. For example, an OTQ is always worth two marks and any fill in the blank OTQs are likely to only need a single answer. MTQs are made up of several 'tasks' and some tasks may be worth more than others. For example, an MTQ could contain a task showing a table with several fill in the blank boxes, for say, six marks, followed by two OTQs worth two marks each (total MTQ

score = 10 marks). Even if you get one of the answers in one of the boxes incorrect, this will not affect your ability to score on the other answer boxes. Fill in the blank questions require accurate calculation and careful number entry, so it's worth taking your time over these types of question.

Exam success skills

The following questions are examples of the sorts of questions you could see in your exam.

For these questions, we will also focus on the following **exam success skills**:

- **Managing Information.** The volume of information presented in an MTQ can feel overwhelming. However, it is structured in such a way that any new information relevant to the task will be presented with it. You should read the requirements before you read the detail in the scenario, so that you are aware of what you are looking to extract from reading it.
- **Correct interpretation of requirements.** Sometimes when you are focused on a calculation and applying a technique you have learned, it is easy to misinterpret the requirements of a question. For example, failing to comply with instructions about the number of decimal places in a fill in the blank question.
- **Efficient numerical analysis.** There are usually several calculations to perform in an MTQ, including fill in the blank questions. As we've already said, fill in the blank questions require careful, accurate calculations and careful number entry.
- **Good time management.** You should be guided by the mark allocation in MTQs as the tasks can have different requirements. There is no set format for these questions, so you need to react to what is presented in the exam. However, the rule of 1.2 minutes per mark still applies. You may have completed Section A of the exam in less time, which is good news for Section B, as the scenarios could be more time consuming to read and digest. As with Section A, the discursive tasks in Section B are usually quicker to attempt and may give you more time for the calculations. You do not have to answer the tasks in order, you should play to your exam strengths, which means attempting the questions you are most confident about first.

Skill activity

The director of Bread Co, a bakery, is reviewing the performance of one of its divisions, the morning goods division.

The following information is available for the year ending 30 June 20X5 for the morning goods division:

Morning goods division	
\$	
Sales	160,000
Operating profit	6,000
Capital employed	40,000

The total morning goods industry sales for the year ending 30 June 20X5 were \$2.5m.

Task 1

Calculate the following performance measures for the morning goods division:

Return on investment (to the nearest whole number)		%
Return on sales (to two decimal places)		%
Asset turnover (to the nearest whole number)		times
Residual income (using an imputed interest charge of 10%)	\$	
Market share (to one decimal place)		%

(6 marks)

Task 2

For each of the following statements about return on investment (ROI), decide whether they are true or false. (2 marks)

	True	False
Using ROI means that managers will be more likely to make goal congruent decisions than using RI		
ROI enables comparisons of performance between different size divisions		
ROI is directly related to net present value (NPV)		
ROI is an absolute performance measure		

Task 3

Which TWO of the following are non-financial indicators that can be used to measure performance? (2 marks)

- Sales per employee per month
- Defective production unit per employee per month
- Staff absenteeism rates per month
- Return per product per month

Let's have a look at the answers.

Task 1

Return on investment	15	%
Return on sales (to two decimal places)	3.75	%
Asset turnover (to the nearest whole number)	4	times
Residual income (using an imputed interest charge of 10%)	\$2,000	
Market share (to one decimal place)	6.4	%

Workings

Return on investment: $(6,000/40,000) \times 100\% = 15\%$

Return on sales: $(6,000/160,000) \times 100\% = 3.75\%$

Asset turnover: $160,000/40,000 = 4$ times

Residual income: $6,000 - (0.1 \times 40,000) = \$2,000$

Market share: $(160,000/2,500,000) \times 100\% = 6.4\%$

There were five calculations to perform here for six marks (the residual income calculation was worth two marks as it involved an additional step). In order to perform these calculations, you need to be able to recall the formulae required quickly and accurately.

Make sure that you have learned the formulae from the Workbook.

You also need to follow the instructions carefully. For example, the return on sales required an answer to two decimal places, whereas the asset turnover calculation required you to state an answer to the nearest whole number.

Make sure you follow the question instructions carefully.

Note that if you get one of the calculations wrong, you will not lose all six of the marks, as each one is marked individually.

Task 2

	True	False

Using ROI means that managers will be more likely to make goal congruent decisions than using RI		✓
ROI enables comparisons of performance between different size divisions	✓	
ROI is directly related to net present value (NPV)		✓
ROI is an absolute performance measure		✓

You will score 0.5 marks for each correct answer in a question like this, so don't worry if there is one you are not sure about. You may find it helpful to jot down the formulae for ROI and RI (or use the calculations you did in the first part) to remind yourself about the techniques. To answer questions like these you need sound technical knowledge about the advantages and disadvantages of each technique, so make sure you dedicate revision time to discursive elements as well as calculations.

Explanation of answers:

	Explanation
ROI ensures that managers will be more likely to make goal congruent decisions	False. RI is more likely to lead to goal congruent decisions as it is an absolute value.
ROI enables comparisons of performance between different size divisions	True. As ROI gives a percentage value, divisions of different sizes can be ranked based on their relative performance.
ROI is directly related to net present value (NPV)	False. ROI is based on profits and not cashflows and does not require a cost of capital.
ROI is an absolute performance measure	False. RI gives an absolute value, whereas ROI gives a percentage return, also known as a relative value.

Make sure you include an answer for every item, even if you are not sure, as there is no negative marking and you have a 50% chance of getting the right answer!

Task 3

The correct answers are:

- Defective production unit per employee per month
- Staff absenteeism rates per month

Higher than usual or target defective production units imply that there is an issue with quality, either materials, labour or machines used, all of which would be non-financial indicators of performance. Additionally, higher levels of staff absenteeism could indicate an internal issue, such as poor morale and will affect the ability to produce good quality output for that month.

The other two measures given would also measure performance but do so via financial performance measures.

Make sure you read the question carefully, anything relating to profit, costs, sales revenue or other financial measures are incorrect as you are trying to identify non-financial measures.

Exam success skills diagnostic

Every time you complete a Section B MTQ, use the diagnostic below to assess how effectively you demonstrated the exam success skills in answering the questions. The table has been completed below for the 'mini exam' activity to give you an idea of how to complete the diagnostic.

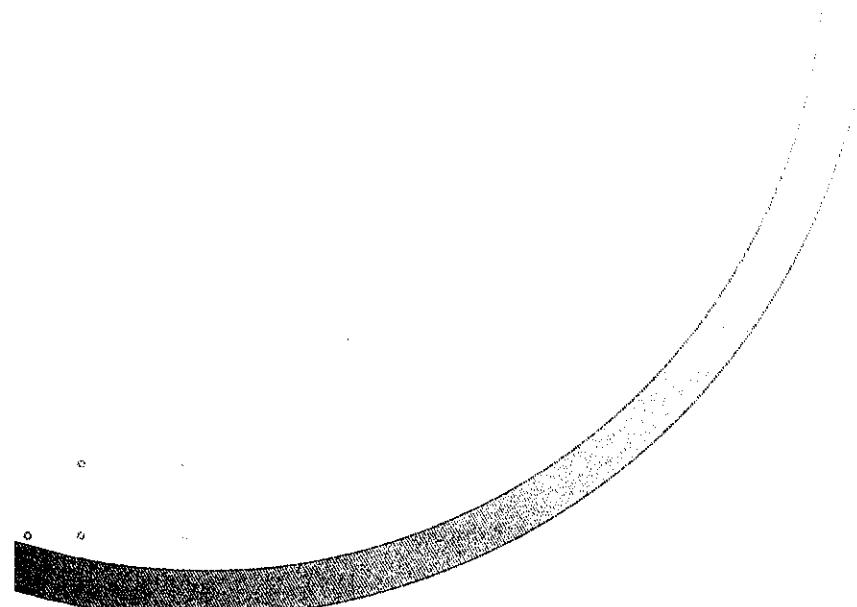
Exam success skills	Your reflections/observations
Managing information	Did you read each of the requirements first?

Exam success skills	Your reflections/observations
Correct interpretation of requirements	<p>Did you identify the need to give answers to different decimal places in Task 1?</p> <p>It would have been disappointing to get the answer correct, but fail to get the marks because you didn't follow the instructions given.</p>
Efficient numerical analysis	<p>How careful were you with your calculations and number entry for the fill in the blanks table in Task 1?</p>
Good time management	<p>Did you manage to answer the entire question within 12 mins?</p> <p>Did you attempt the tasks in the order set, or did you think about how long each one would take and devise an action plan to give you the most time for the calculation elements?</p>
Most important action points to apply to your next question	

Summary

Being able to answer MTQs is very important for the MA/FMA exam. Key skills to focus on throughout your studies will therefore include:

- Practising MTQs as part of your exam preparation, endeavouring to attempt all elements in the time allowed (12 minutes).
- Remembering that you don't have to answer the task in order and that the answer from one task will never be needed to answer a subsequent one.
- Reading the question carefully and using the mark allocation to guide how long it should take to answer (and how complex it is likely to be).
- Being careful and accurate with your calculations for the fill in the blank tables.



1

Accounting for management

Essential reading

1 Types of information

Information within an organisation can be analysed into the three levels assumed in Anthony's hierarchy (Anthony, 1965): **strategic**; **tactical**; and **operational**.

1.1 Strategic information

Strategic information is used by **senior managers** to plan the objectives of their organisation, and to assess whether the objectives are being met in practice. Such information includes **overall profitability**, the **profitability of different segments of the business** and **capital equipment needs**.

Strategic information therefore has the following features.

- It is derived from both **internal** and **external** sources.
- It is summarised at a **high level**.
- It is relevant to the **long term**.
- It deals with the **whole organisation** (although it might go into some detail).
- It is often prepared on an '**ad hoc**' basis.
- It is both **quantitative** and **qualitative**.
- It cannot provide complete certainty, given that the future cannot be predicted.

1.2 Tactical information

Tactical information is used by **middle management** to decide how the resources of the business should be employed, and to monitor how they are being and have been employed. Such information includes **productivity measurements** (output per man hour or per machine hour), **budgetary control** or **variance analysis reports**, and **cash flow forecasts**.

Tactical information therefore, has the following features:

- It is primarily generated internally.
- It is summarised at a **lower level**.
- It is relevant to the **short and medium term**.
- It describes or analyses activities or departments.
- It is prepared **routinely** and **regularly**.
- It is based on **quantitative measures**.

1.3 Operational information

Operational information is used by '**front-line**' **managers** such as supervisors or head clerks to ensure that specific tasks are planned and carried out properly within a factory or office and so on. In the payroll office, for example, information at this level will relate to day-rate labour and will include the hours worked each week by each employee, the rate of pay per hour, details of the deductions and, for the purpose of wages analysis, details of the time each person spent on individual jobs during the week. In this example, the information is required weekly, but more urgent operational information, such as the amount of raw materials being input to a production process, may be required daily, hourly or, in the case of automated production, second by second.

Operational information has the following features:

- It is derived almost entirely from **internal sources**.
- It is **highly detailed**, being the processing of **raw data**.
- It relates to the **immediate term**, and is prepared **constantly**, or **very frequently**.
- It is **task-specific** and largely **quantitative**.



2

Data and presenting information

Essential reading

1 Sampling examples

1.1 Random sampling from a numbered list

Once a numbered list of all items in the population has been made, it is easy to select a random sample, simply by generating a list of random numbers.

For instance, if you wanted to select a random sample of children from a school, it would be useful to have a list of names.

0 J Absolam

1 R Brown

2 S Brown

...

Now the numbers 0, 1, 2 and so on can be used to select the random sample. It is normal to start the numbering at 0, so that when 0 appears in a list of random numbers, it can be used.

1.2 Stratified sampling example

The number of cost and management accountants in each type of work in a particular country are as follows.

Partnerships	500
Public companies	500
Private companies	700
Public practice	800
	<hr/>
	2,500

If a sample of 20 was required, the sample would be made up as follows.

	Sample
Partnerships	$(500/2,500) \times 20$
Public companies	$(500/2,500) \times 20$
Private companies	$(700/2,500) \times 20$
Public practice	$(800/2,500) \times 20$
	<hr/>
	20

1.3 Systematic sampling example

If it were decided to select a sample of 20 from a population of 800, then every 40th ($800 \div 20$) item after a random start in the first 40 should be selected. The starting point could be found using the random number tables. If, (say, 23 was chosen, then the sample would include the 23rd, 63rd, 103rd, 143rd ... 783rd items. The gap of 40 is known as the **sampling interval**.

1.4 Multistage sampling example

A survey of spending habits is being planned to cover the whole of Country A. It is obviously **impractical to draw up a sampling frame**, so **random sampling is not possible** and multistage sampling is to be used instead.

The country is divided into a number of areas and a small sample of these is selected at random. Each of the areas selected is subdivided into smaller units and again, a smaller number of these is selected at random. This process is repeated as many times as necessary and finally, a random sample of the relevant people living in each of the smallest units is taken. A fair approximation to a random sample can be obtained.

Thus, we might choose a random sample of eight areas and, from each of these areas, select a random sample of five towns. From each town, a random sample of 200 people might be selected so that the total sample size is $8 \times 5 \times 200 = 8,000$ people.

3

Cost classification and behaviour

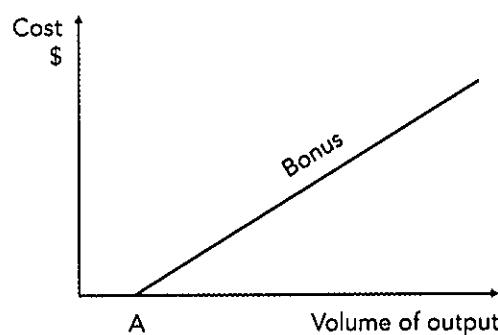
Essential reading

1 Cost behaviour graphs

We covered the fixed, variable, stepped fixed and semi-variable cost behaviour graphs in the main chapter.

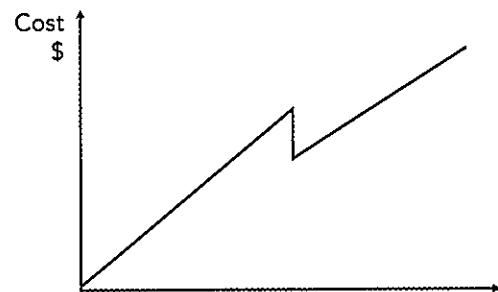
1.1 Other cost behaviour patterns

Bonus payments for productivity to employees might be variable once a certain level of output is achieved, as the following diagram illustrates:

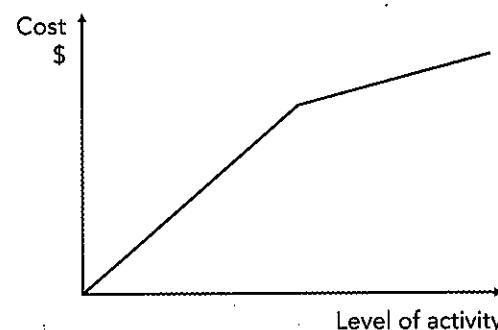


Up to output A, no bonus is earned.

Imagine if, up to a given level of activity, the purchase price per unit of raw material is constant. After that point, a quantity discount is given so the price per unit is lower for further purchases and also retrospectively to all units already purchased. The graph would be as follows.



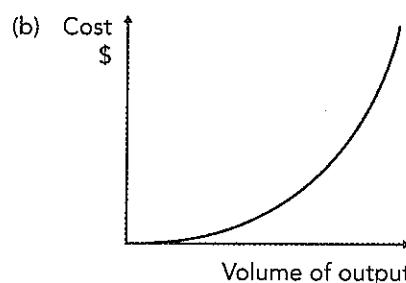
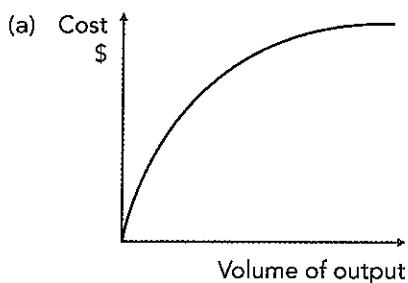
Imagine if, up to a given level of activity, the purchase price per unit of raw material is constant. After that point, a discount is given so that the price per unit is lower for further purchases but not for the units already purchased. The graph would be as follows.



1.2 Non-linear or curvilinear variable costs

If the relationship between total variable cost and volume of output can be shown as a curved line on a graph, the relationship is said to be **curvilinear**.

Two typical relationships are as follows.



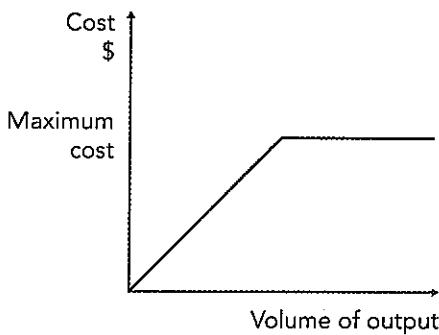
Each extra unit of output in graph (a) causes a **less than proportionate** increase in cost, whereas in graph (b) each extra unit of output causes a **more than proportionate** increase in cost.

The cost of a piecework scheme for individual workers with differential rates could behave in a **curvilinear** fashion if the rates increase by small amounts at progressively higher output levels.

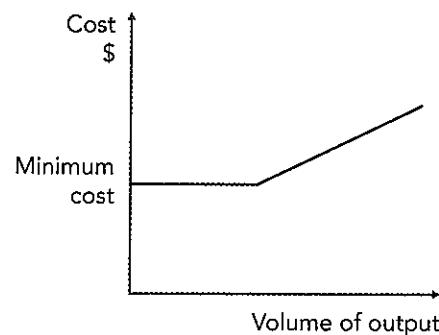
1.3 Other cost behaviour patterns

Examples of two other cost behaviour patterns are shown below.

(a) Cost behaviour pattern (1)



(b) Cost behaviour pattern (2)



- Graph (a) represents an item of cost which is variable with output up to a certain maximum level of cost.
- Graph (b) represents a cost which is variable with output, subject to a minimum (fixed) charge.

1.4 Cost behaviour and cost per unit

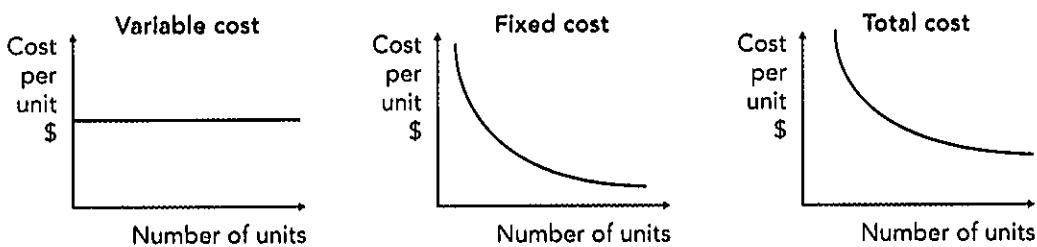
The following table relates to different levels of production of the zed. The variable cost of producing a zed is \$5. Fixed costs are \$5,000.

	1 zed \$	10 zeds \$	50 zeds \$
Total variable cost	5	50	250
Variable cost per unit	5	5	5
Total fixed cost	5,000	5,000	5,000
Fixed cost per unit	5,000	500	100
Total cost (fixed and variable)	5,005	5,050	5,250
Total cost per unit	5,005	505	105

What happens when activity levels rise can be summarised as follows:

- The variable cost per unit remains constant.
- The fixed cost per unit falls.
- The total cost per unit falls.

This may be illustrated graphically as follows.



Activity 9: Fixed, variable, mixed costs

For each cost, state whether it is likely to be fixed, variable or mixed.

- Telephone bill
- Annual salary of the chief accountant
- The management accountant's annual membership fee to ACCA (paid by the company)
- Cost of materials used to pack 20 units of product X into a box
- Wages of warehouse operators

2 Linear equations

As we said before, a linear equation is a straight line and has the general form $y = a + bx$ where:

y is the dependent variable whose value depends on the value of x

x is the independent variable whose value helps to determine the corresponding value of y

a is a constant; that is, a fixed amount

b is also a constant, being the coefficient of x (that is, the number by which the value of x should be multiplied to derive the value of y).

Let us establish some basic linear equations. Suppose that it takes Joe Bloggs 15 minutes to walk one mile. How long does it take Joe to walk two miles? Obviously, it takes him 30 minutes. How did you calculate the time? You probably thought that if the distance is doubled, then the time must be doubled. How do you explain (in words) the relationships between the distance walked and the time taken? One explanation would be that every mile walked takes 15 minutes.

That is an explanation in words. Can you explain the relationship with an equation?

First, you must decide which is the dependent variable and which is the independent variable. In other words, does the time taken depend on the number of miles walked or does the number of miles walked depend on the time it takes to walk a mile? Obviously, the time depends on the distance. We can therefore let y be the dependent variable (time taken in minutes) and x be the independent variable (distance walked in miles).

We now need to determine the constants a and b . There is no fixed amount, so $a = 0$. To ascertain b , we need to establish the number of times by which the value of x should be multiplied to derive the value of y . Obviously, $y = 15x$ where y is in minutes. If y were in hours, then $y = x/4$.

2.1 Example: Deriving a linear equation

A salesperson's weekly wage is made up of a basic weekly wage of \$100 and commission of \$5 for every item they sell. Derive an equation which describes this scenario.

Solution

x = number of items sold

y = weekly wage

a = \$100

b = \$5

Therefore $y = 5x + 100$



3 Coding

Here are some examples of types of codes.

(a) Sequence (or progressive) codes

Numbers are given to items in ordinary numerical sequence, so that there is no obvious connection between an item and its code. For example:

000042 4 cm nails

000043 Office stapler

000044 Hand wrench

(b) Group classification codes

These are an improvement on simple sequences codes, in that a digit (often the first one) indicates the classification of an item. For example:

4NNNN Nails

5NNNN Screws

6NNNN Bolts

(Note. 'N' stands for another digit; 'NNNNN' indicates there are five further digits in the code.)

(c) Faceted codes

These are a refinement of group classification codes, in that each digit of the code gives information about an item. For example:

The first digit:

1 Nails

2 Screws

3 Bolts

etc ...

The second digit:

1 Steel

2 Brass

3 Copper

etc ...

The third digit:

1 50mm

2 60mm

3 75mm

etc ...

A 60 mm steel screw would have a code of 212.

(d) Significant digit codes

These incorporate some digit(s) which is/are part of the description of the item being coded.

For example:

5000 Screws 5060 60 mm screws

5050 50 mm screws 5075 75 mm screws

(e) **Hierarchical codes**

This is a type of faceted code where each digit represents a classification, and each digit further to the right represents a smaller subset than those to the left. For example:

3 = Screws 32 = Round headed screws

31 = Flat headed screws 322 = Steel (round headed) screws

and so on.

A coding system does not have to be structured entirely on any one of the above systems. It can mix the various features according to the items which need to be coded.

Activity answers



Activity 9: Fixed, variable, mixed costs

Telephone bill - Mixed

Annual salary of the chief accountant - Fixed

The management accountant's annual membership fee to ACCA (paid by the company) - Fixed

Cost of materials used to pack 20 units of product X into a box - Variable

Wages of warehouse operators - Variable

4

Forecasting

Essential reading

1 Moving averages with an even number of results

In the illustration called 'Moving averages', the moving averages were taken of the results in an odd number of time periods, and the average then related to the mid-point of the overall period.

If a moving average were taken of results in an even number of time periods, the basic technique would be the same, but the mid-point of the overall period would not relate to a single period. For example, suppose an average were taken of the following four results.

Spring	120	
Summer	90	
Autumn	180	average 115
Winter	70	

The average would relate to the mid-point of the period, between summer and autumn.

The trend line average figures need to relate to a particular time period; otherwise, seasonal variations cannot be calculated. To overcome this difficulty, we take a moving average of the moving average. An example will illustrate this technique.

Illustration 8: Moving averages over an even number of periods

These are the sales volumes for Linden Co:

Year	Quarter	Volume of sales '000 units
20X5	1	600
	2	840
	3	420
	4	720
20X6	1	640
	2	860
	3	420
	4	740
20X7	1	670
	2	900
	3	430
	4	760

Required

Calculate a moving average trend line of the results of Linden Co.

Solution

A moving average of four will be used, since the volume of sales would appear to depend on the season of the year, and each year has four quarterly results. The moving average of four does not relate to any specific period of time; therefore, a second moving average of two will be calculated on the first moving average trend line.

Year	Quarter	Actual volume of sales '000 units (A)	Moving total of 4 quarters' sales '000 units (B)	Moving average of 4 quarters' sales '000 units (B÷4)	Mid-point of 2 moving averages trend line '000 units (C)
20X5	1	600			
	2	840			
	3	420	2,580	645.0	650.00
	4	720	2,620	655.0	657.50
20X6	1	640	2,640	660.0	660.00
	2	860	2,640	660.0	662.50
	3	420	2,660	665.0	668.75
	4	740	2,690	672.5	677.50
20X7	1	670	2,730	682.5	683.75
	2	900	2,740	685.0	687.50
	3	430	2,760	690.0	
	4	760			

By taking a mid point (a moving average of two) of the original moving averages, we can relate the results to specific quarters (from the third quarter of 20X5 to the second quarter of 20X7).



Activity 12: Trend in sales

What can you say about the trend in sales of Linden Co in the illustration above?

2 Seasonal variations using the multiplicative model

Refer back to our illustration, Linden Co taking the first two years of data only. We can use the equation here to work out the seasonal variations. The trend is calculated in exactly the same way as before. So if $TS = T \times SV$ then $SV = TS/T$ and we can calculate $SV = TS/T$ for the multiplicative model.

Year	Quarter	Actual (TS)	Trend (T)	Seasonal percentage (TS/T)
20X5	1	600		
	2	840		
	3	420	650.00	0.646
	4	720	657.50	1.095
20X6	1	640	660.00	0.970

Year	Quarter	Actual (TS)	Trend (T)	Seasonal percentage (TS/T)
	2	860	662.50	1.298
	3	420		
	4	740		

Suppose that seasonal variations for the next four quarters are 0.628, 1.092, 0.980 and 1.309 respectively. The summary of the seasonal variations expressed in proportional terms is therefore as follows.

Year	Q_1 %	Q_2 %	Q_3 %	Q_4 %
20X5			0.646	1.095
20X6	0.970	1.298	0.628	1.092
20X7	<u>0.980</u>	<u>1.309</u>		
Total	<u>1.950</u>	<u>2.607</u>	<u>1.274</u>	<u>2.187</u>
Average	<u>0.975</u>	<u>1.3035</u>	<u>0.637</u>	<u>1.0935</u>

Instead of summing to zero, as with the additive approach, the averages should sum (in this case) to 4.0, 1.0 for each of the four quarters. They actually sum to 4.009 so 0.00225 has to be deducted from each one.

	Q_1	Q_2	Q_3	Q_4
Average	0.97500	1.30350	0.63700	1.09350
Adjustment	<u>-0.00225</u>	<u>-0.00225</u>	<u>-0.00225</u>	<u>-0.00225</u>
Final estimate	<u>0.97275</u>	<u>1.30125</u>	<u>0.63475</u>	<u>1.09125</u>
Rounded	0.97	1.30	0.64	1.09

Note that the proportional model is better than the additive model when the trend is increasing or decreasing over time. In such circumstances, seasonal variations are likely to be increasing or decreasing too. The additive model simply adds absolute and unchanging seasonal variations to the trend figures whereas the proportional model, by multiplying increasing or decreasing trend values by a constant seasonal variation factor, takes account of changing seasonal variations.

Activity answers



Activity 12: Trend in sales

There is an upward trend in sales.

5

**Summarising and
analysing data**

Essential reading

1 Advantages and disadvantages of mean, median and mode

1.1 Mean

Advantages

- Used most frequently
- Most commonly understood
- Uses all data

Disadvantages

- May not be a value in the distribution
- Distorted by extreme high/low values
- Ignores dispersion (spread)

1.2 Mode

Advantages

- Most popular item
- Not distorted by high/low values
- Corresponds to an actual value in the distribution

Disadvantages

- Ignores dispersion
- Does not take into account all data

1.3 Median

Advantages

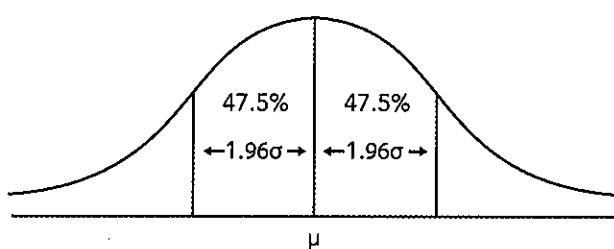
- Not distorted by high/low values
- Corresponds to an actual value in the distribution

Disadvantages

- Ignores dispersion
- Limited use

2 Normal distribution

As we said in the main body of the Workbook, 95% of the frequencies in a normal distribution occur in the range ± 1.96 standard deviations from the mean.



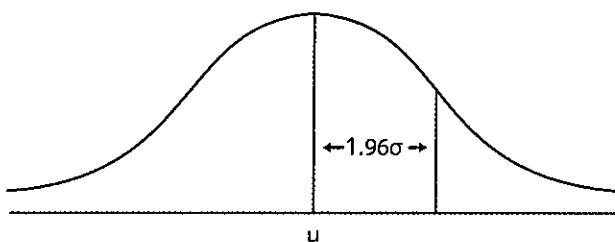
Although there is an infinite number of normal distributions, depending on values of the mean and the standard deviation, the relative dispersion of frequencies around the mean, measured as proportions of the total population, is exactly the same for all normal distributions. In other words, whatever the normal distribution, 47.5% of outcomes will always be in the range between the mean and 1.96 standard deviations below the mean. 49.5% of outcomes will always be in the range between the mean and 2.58 standard deviations below the mean, and so on.

A **normal distribution table**, given on the FMA/MA formula sheet and in this Workbook, gives the proportion of the total between the mean and a point above or below the mean for any multiple of the standard deviation.



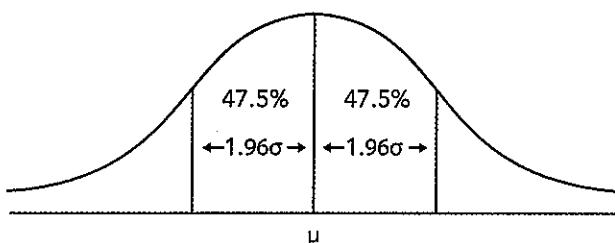
Example

What is the probability that a randomly picked item will be in the shaded area of the diagram below?



Look up 1.96 (ie $z = 1.96$) in the normal distribution table and you will obtain the value .475. This means there is a 47.5% probability that the item will be in the shaded area.

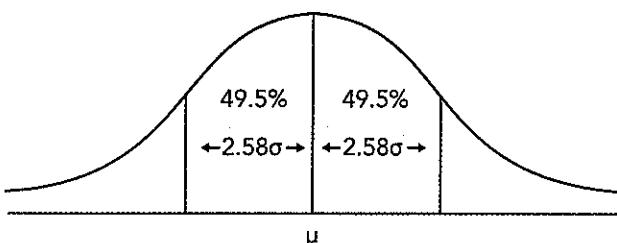
Since the normal distribution is symmetrical, 1.96σ below the mean will also correspond to an area of 47.5%.



$$\text{The total shaded area} = 47.5\% \times 2 = 95\%$$

We can also show that 99% of the frequencies occur in the range ± 2.58 standard deviation from the mean.

Using the normal distribution table, a z score of 2.58 corresponds to an area of 0.4949 (or 49.5%).



$$49.5\% \times 2 = 99\%$$

$$\text{If mean, } \mu + 2.58\sigma = \underline{\hspace{2cm}} \quad 49.5\% \text{ and}$$

$$\text{mean, } \mu - 2.58\sigma = \underline{\hspace{2cm}} \quad \underline{\hspace{2cm}} \quad 49.5\%$$

$$\text{Range} = \text{mean} \pm 2.58\sigma = \underline{\hspace{2cm}} \quad \underline{\hspace{2cm}} \quad 99.0\%$$

Therefore, 99% of frequencies occur in the range mean (μ) ± 2.58 standard deviations (σ), as proved by using normal distribution tables.

3 Calculating probabilities using z scores



Illustration 9: Probabilities and the normal distribution

A frequency distribution is normal, with a mean of 100 and a standard deviation of 10.

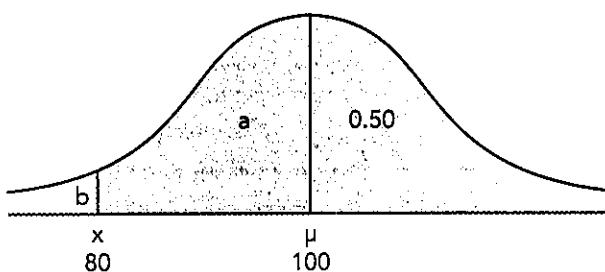
Required

Calculate the proportion of the total frequencies which will be:

- (1) Above 80
- (2) Above 90
- (3) Above 100
- (4) Above 115
- (5) Below 85
- (6) Below 95
- (7) Below 108
- (8) In the range 80 – 110
- (9) In the range 90 – 95

Solution

- (1) If the value of x is below the mean, the total proportion is 0.5 plus the proportion between the value and the mean (area a).



The proportion of the total frequencies which will be above 80 is calculated as follows.

$(80 - 100) / 10 = 2$ standard deviations below the mean.

From the tables, where $z = 2$ the proportion is 0.4772.

The proportion of frequencies above 80 is $0.5 + 0.4772 = 0.9772$.

- (2) The proportion of the total frequencies which will be above 90 is calculated as follows:

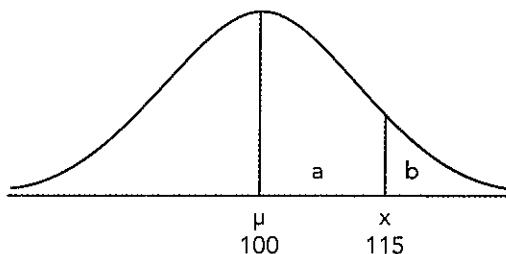
$(90 - 100) / 10 = 1$ standard deviation below the mean.

From the tables, when $z = 1$, the proportion is 0.3413.

The proportion of frequencies above 90 is $0.5 + 0.3413 = 0.8413$.

- (3) 100 is the mean. The proportion above this is 0.5. (The normal curve is symmetrical and 50% of occurrences have a value greater than the mean, and 50% of occurrences have a value less than the mean.)

- (4) If the value is above the mean, the proportion (b) is 0.5 minus the proportion between the value and the mean (area a)).



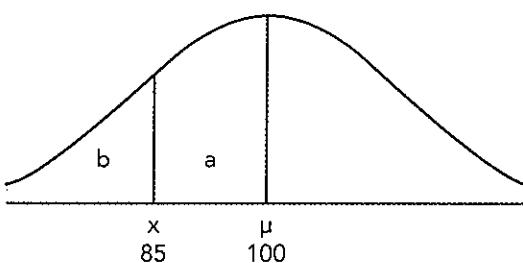
The proportion of the total frequencies which will be above 115 is calculated as follows.

$$(115 - 100) / 10 = 1.5 \text{ standard deviations above the mean.}$$

From the tables, where $z = 1.5$, the proportion is 0.4332.

The proportion of frequencies above 115 is therefore $0.5 - 0.4332 = 0.0668$.

- (5) If the value is below the mean, the proportion (b) is 0.5 minus the proportion between the value and the mean (area (a)).



The proportion of the total frequencies which will be below 85 is calculated as follows.

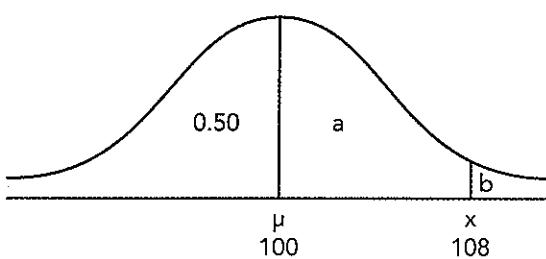
$$(85 - 100) / 10 = 1.5 \text{ standard deviations below the mean.}$$

The proportion of frequencies below 85 is therefore the same as the proportion above 115 = 0.0668.

- (6) The proportion of the total frequencies which will be below 95 is calculated as follows:
 $(95 - 100) / 10 = 0.5 \text{ standard deviations below the mean.}$

When $z = 0.5$, the proportion from the tables is 0.1915. The proportion of frequencies below 95 is therefore $0.5 - 0.1915 = 0.3085$.

- (7) If the value is above the mean, the proportion required is 0.5 plus the proportion between the value and the mean (area (a)).



The proportion of the total frequencies which will be below 108 is calculated as follows.

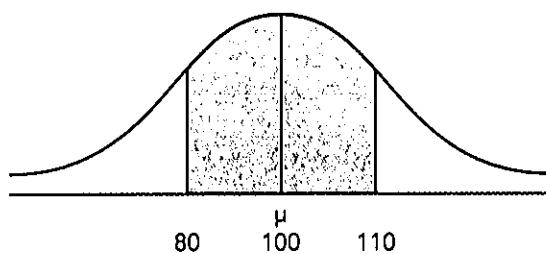
$$(108 - 100) / 10 = 0.8 \text{ standard deviations above the mean.}$$

From the tables for $z = 0.8$ the proportion is 0.2881.

The proportion of frequencies below 108 is $0.5 + 0.2881 = 0.7881$.

- (8) The proportion of the total frequencies which will be in the range 80–110 is calculated as follows. The range 80 to 110 may be divided into two parts:

- (i) 80 to 100 (the mean)
- (ii) 100 to 110



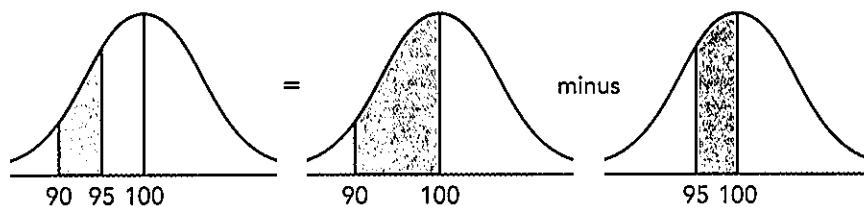
The proportion in the range 80 to 100 is (2 standard deviations) 0.4772.

The proportion in the range 100 to 110 is (1 standard deviation) 0.3413

The proportion in the total range 80 to 110 is $0.4772 + 0.3413 = 0.8185$.

(9) The range 90 to 95 may be analysed as:

- (i) The proportion above 90 and below the mean
- (ii) Minus the proportion above 95 and below the mean



Proportion above 90 and below the mean (1 standard deviation)	0.3413
Proportion above 95 and below the mean (0.5 standard deviations)	<u>0.1915</u>
Proportion between 90 and 95	<u>0.1498</u>



6

Accounting for materials

Essential reading

1 Inventory costs

Inventory costs include purchase costs, holding costs, ordering costs and costs of running out of inventory. As we said in the main body of the chapter, the costs of purchasing inventory are usually one of the largest costs faced by an organisation. Therefore, once obtained, inventory has to be carefully controlled and checked.

1.1 Reasons for holding inventories

- To ensure sufficient goods are available to meet expected demand
- To provide a buffer between processes
- To meet any future shortages
- To take advantage of bulk purchasing discounts
- To absorb seasonal fluctuations and any variations in usage and demand
- To allow production processes to flow smoothly and efficiently
- As a necessary part of the production process (such as when maturing cheese)
- As a deliberate investment policy, especially in times of inflation or possible shortages

1.2 Holding costs

If inventories are too high, holding costs will be incurred unnecessarily. Such costs occur for a number of reasons.

- (a) **Costs of storage and stores operations.** Larger inventories require more storage space and possibly extra staff and equipment to control and handle them.
- (b) **Interest charges.** Holding inventories involves the tying up of capital (cash) on which interest must be paid.
- (c) **Insurance costs.** The larger the value of inventories held, the greater insurance premiums are likely to be.
- (d) **Risk of obsolescence.** The longer an inventory item is held, the greater the risk of obsolescence.
- (e) **Deterioration.** When materials in store deteriorate to the extent that they are unusable, they must be thrown away with the likelihood that disposal costs would be incurred.

1.3 Costs of obtaining inventory

On the other hand, if inventories are kept low, small quantities of inventory will have to be ordered more frequently, thereby increasing the following ordering or procurement costs.

- (a) **Clerical and administrative costs** associated with purchasing, accounting for and receiving goods
- (b) **Transport costs**
- (c) **Production run costs**, for inventory which is manufactured internally rather than purchased from external sources.

1.4 Stockout costs (running out of inventory)

An additional type of cost which may arise if inventory is kept too low is the type associated with running out of inventory. There are a number of causes of stockout costs.

- Lost contribution from lost sales
- Loss of future sales due to disgruntled customers
- Loss of customer goodwill
- Cost of production stoppages
- Labour frustration over stoppages
- Extra costs of urgent, small quantity, replenishment orders

1.5 Objective of inventory control

The overall objective of inventory control is, therefore, to maintain inventory levels so that the total of the following costs is minimised.

- Holding costs
- Stockout costs
- Ordering costs



7

Accounting for labour

Essential reading

1 Recording labour costs

1.1 Attendance time

The bare minimum record of employees' time is a simple attendance record showing days absent because of holiday, sickness or other reason.

Some businesses may record time of arrival, time of breaks, time of departure and so on, using employee swipe cards.

Employee attendance tracker

JANUARY															MONTHLY TOTALS			
EMPLOYEE NAME	SUN	MON	TUES	WEDS	THURS	FRI	SAT	SUN	MON	TUES	WEDS	THURS	FRI	W	H	S	O	
Employee 1														6	0	2	0	
Employee 2														2	1	0	0	
Employee 3														4	0	1	1	

1.2 Job time

Job cards are often used in the construction industry to record the labour time spent on a particular project. Cards are prepared for each job or batch. When an employee works on a job, they record on the job card the time spent on that job. Job cards are therefore likely to contain entries relating to numerous employees. On completion of the job, it will contain a full record of the times and quantities involved in the job or batch.

Sometimes they are used to send job details to workers and workers fill them in (usually online) showing the work done. For example, a boiler repair service business may use this system for its engineers. The job card will show details of the job, such as the address and information about the problem to be fixed. The engineer updates the card with the status of the job, recording the work done and the time spent.

1.3 Time sheets

Even though salaried staff are paid a flat rate monthly, they may be required to prepare timesheets. The reasons are as follows:

- Timesheets provide management with information (eg product costs).
- Timesheet information may provide a basis for billing for services provided (eg service firms where clients are billed based on the number of hours work done).
- Timesheets are used to record hours spent and so support claims for overtime payments by salaried staff.

Some systems automatically track time spent by the employee relating to a particular client. The employee clicks on a 'clock' relating to the client before they start work and clicks on it again when they stop work relating to that client.



9

Process costing

Essential reading

1 Losses with a disposal cost

You must also be able to deal with losses that have a **disposal cost**.

The basic calculations required in such circumstances are as follows:

- Increase the process costs by the cost of disposing of the units of normal loss and use the resulting cost per unit to value good output and abnormal loss/gains.
- The normal loss is given no value in the process account.
- Include the disposal costs of normal loss on the debit side of the process account.
- Include the disposal costs of abnormal loss in the abnormal loss account and therefore in the transfer of the costs of abnormal loss to the statement of profit or loss.



Illustration 9: Losses with a disposal cost

Suppose that input to a process was 1,000 units at a cost of \$4,500. Normal loss is 10% and there are no opening and closing inventories. Actual output was 860 units and loss units had to be disposed of at a cost of \$0.90 per unit.

Required

Calculate the cost per unit and prepare the process and abnormal loss account.

Solution

$$\text{Normal loss} = 10\% \times 1,000 = 100 \text{ units. } \therefore \text{Abnormal loss} = 900 - 860 = 40 \text{ units}$$

$$\text{Cost per unit} = \frac{\$4,500 + (100 \times \$0.90)}{900} = \$5.10$$

The relevant accounts would be as follows:

PROCESS ACCOUNT

	Units	\$		Units	\$
Cost of input	1,000	4,500	Output	860	4,386
Disposal cost of			Normal loss	100	-
normal loss	-	90	Abnormal loss	40	204
	<u>1,000</u>	<u>4,590</u>		<u>1,000</u>	<u>4,590</u>

ABNORMAL LOSS ACCOUNT

	\$		\$
Process a/c	204	Statement of profit or loss	240
Disposal cost (40 × \$0.90)	<u>36</u>		<u>-</u>
	<u>240</u>		<u>240</u>

2 Different rates of input

In many industries, materials, labour and overhead may be **added at different rates** during the course of production.

- (a) Output from a previous process (for example, the output from process 1 to process 2) may be introduced into the subsequent process all at once, so that closing inventory is 100% complete in respect of these materials.

- (b) Further materials may be added gradually during the process, so that closing inventory is only partially complete in respect of these added materials.
- (c) Labour and overhead may be 'added' at yet another different rate. When production overhead is absorbed on a labour hour basis, however, we should expect the degree of completion on overhead to be the same as the degree of completion on labour.

When this situation occurs, **equivalent units**, and a **cost per equivalent unit**, should be calculated separately for each type of material, and also for conversion costs.



Illustration 10: Different rates of input

Suppose that Columbine Co is a manufacturer of processed goods, and that results in Process 2 for April 20X3 were as follows.

Opening inventory	Nil
Material input from Process 1	4,000 units

Costs of input:

	\$
Material from Process 1	6,000
Added materials in Process 2	1,080
Conversion costs	1,720

Output is transferred into the next process, Process 3.

Closing work in process amounted to 800 units, complete as to:

Process 1 material	100%
Added materials	50%
Conversion costs	30%

Required

Prepare the account for Process 2 for April 20X3.

Solution

STATEMENT OF EQUIVALENT UNITS (OF PRODUCTION IN THE PERIOD)

Input units	Output	Equivalent units of production							
		Process material		Added materials		Labour and overhead			
		Total units	Units	%	Units	%	Units	%	
4,000	Completed product'n	3,200	3,200	100	3,200	100	3,200	100	
	Closing inventory	800	800	100	400	50	240	30	
<u>4,000</u>		<u>4,000</u>	<u>4,000</u>		<u>3,600</u>		<u>3,440</u>		

STATEMENT OF COST (PER EQUIVALENT UNIT)

Input	Cost	Equivalent production in units	Cost per unit
	\$		\$
Process 1 material	6,000	4,000	1.50
Added materials	1,080	3,600	0.30
Labour and overhead	<u>1,720</u>	<u>3,440</u>	<u>0.50</u>
	<u>8,800</u>		<u>2.30</u>

STATEMENT OF EVALUATION (OF FINISHED WORK AND CLOSING INVENTORIES)

Production	Cost element	Number of equiv units	Cost per equiv unit	Total	Cost
			\$	\$	\$
Completed production		3,200	2.30		7,360
Closing inventory:	Process 1 material	800	1.50	1,200	
	Added material	400	0.30	120	
	Labour and overhead	240	0.50	<u>120</u>	
					<u>1,440</u>
					<u>8,800</u>

PROCESS ACCOUNT

	Units	\$		Units	\$
Process 1 material	4,000	6,000	Process 3 a/c	3,200	7,360
Added material		1,080			-
Conversion costs	<u> </u>	<u>1,720</u>	Closing inventory c/f	<u>800</u>	<u>1,440</u>
	<u>4,000</u>	<u>8,800</u>		<u>4,000</u>	<u>8,800</u>



10

Costing methods

Essential reading

1 Job costing



Illustration 6: Job accounts

Fateful Morn is a jobbing company. On 1 June 20X2, there was one uncompleted job in the factory. The job card for this work is summarised as follows:

Job card: Job no 6832

Costs to date	\$
Direct materials	630
Direct labour (120 hours)	350
Factory overhead (\$2 per direct labour hour)	240
Factory cost to date	<u>1,220</u>

During June, three new jobs were started in the factory, and costs of production were as follows:

Direct materials	\$
Issued to: Job 6832	2,390
Job 6833	1,680
Job 6834	3,950
Job 6835	4,420
Damaged inventory written off from stores	2,300
Material transfers	\$
Job 6834 to Job 6833	250
Job 6832 to Job 6834	620
Materials returned to store	\$
From Job 6832	870
From Job 6835	170
Direct labour hours recorded	
Job 6832	430 hrs
Job 6833	650 hrs
Job 6834	280 hrs
Job 6835	410 hrs

The cost of labour hours during June 20X2 was \$3 per hour, and production overhead is absorbed at the rate of \$2 per direct labour hour. Production overheads incurred during the month amounted to \$3,800. Completed jobs were delivered to customers as soon as they were completed, and the invoiced amounts were as follows:

Job 6832	\$5,500
Job 6834	\$8,000
Job 6835	\$7,500

Administration and marketing overheads are added to the cost of sales at the rate of 20% of factory cost. Actual costs incurred during June 20X2 amounted to \$3,200.

Required

Prepare the job accounts for each individual job during June 20X2 (the accounts should only show the cost of production, and not the full cost of sale).

Prepare the summarised job cost cards for each job, and calculate the profit on each completed job.

Solution

Job accounts

JOB 6832

\$		\$	
Balance b/f	1,220	Job 6834 a/c (materials transfer)	620
Materials (stores a/c)	2,390		
Labour (wages a/c)	1,290	Stores a/c (materials returned)	870
Production overhead (o'hd a/c)	<u>860</u>	Cost of sales a/c (balance)	<u>4,270</u>
	<u>5,760</u>		<u>5,760</u>

JOB 6833

\$		\$	
Materials (stores a/c)	1,680	Balance c/f	5,180
Labour (wages a/c)	1,950		
Production overhead (o'hd a/c)	1,300		
Job 6834 a/c (materials transfer)	<u>250</u>		
	<u>5,180</u>		<u>5,180</u>

JOB 6834

\$		\$	
Materials (stores a/c)	3,950	Job 6833 a/c (materials transfer)	250
Labour (wages a/c)	840		
Production overhead (o'hd a/c)	560	Cost of sales a/c (balance)	5,720
Job 6832 a/c (materials transfer)	<u>620</u>		
	<u>5,970</u>		<u>5,970</u>

JOB 6835

\$		\$	
Materials (stores a/c)	4,420	Stores a/c (materials returned)	170
Labour (wages a/c)	1,230		
Production overhead (o'hd a/c)	<u>820</u>	Cost of sales a/c (balance)	<u>6,300</u>
	<u>6,470</u>		<u>6,470</u>

Job cards, summarised

	Job 6832	Job 6833	Job 6834	Job 6835
	\$	\$	\$	\$
Materials	1,530*	1,930	4,320**	4,250
Labour	1,640	1,950	840	1,230
Production overhead	1,100	1,300	560	820
Factory cost	4,270	5,180 (c/f)	5,720	6,300
Admin and marketing o'hd (20%)	854		1,144	1,260
Cost of sale	5,124		6,864	7,560
Invoice value	5,500		8,000	7,500
Profit/(loss) on job	376		1,136	(60)

*\$(630 + 2,390 - 620 - 870)

**\$(3,950 + 620 - 250)

2 Service costing



Illustration 7: Service cost per unit

A university with annual running costs of \$3 million has the following students:

Classification	Number	Attendance	
		Weeks	Hours
3 year	2,700	30	28
4 year	1,500	30	25
Sandwich	1,900	35	20

Required

Calculate a cost per suitable cost unit for the university to the nearest cent.

Solution

We need to begin by establishing a cost unit for the university. Since there are three different categories of students, we cannot use 'a student' as the cost unit. Attendance hours would seem to be the most appropriate cost unit. The next step is to calculate the number of units.

Number of students	Weeks	Hours	Total hours per year
2,700	× 30	× 28	= 2,268,000
1,500	× 30	× 25	= 1,125,000
1,900	35	× 20	= 1,330,000
			<u>4,723,000</u>

The cost per unit is calculated as follows:

$$\text{Cost per unit} = \text{Total cost} / \text{Number of units} = \$3,000,000 / 4,723,000 = \$0.64$$

3 By-products

The most common method of accounting for by-products is to deduct the **net realisable value** of the by-product from the cost of the main products. There are other methods such as treating the by-product income as a separate source of income.



Illustration 8: Accounting for by-products

During November 20X3, Splatter Co recorded the following results.

Opening inventory:

Main product P, nil

By-product Z, nil

Cost of production \$120,000

Sales of the main product amounted to 90% of output during the period, and 10% of production was held as closing inventory at 30 November.

Sales revenue from the main product during November 20X2 was \$150,000.

A by-product Z is produced, and output had a net sales value of \$1,000. Of this output, \$700 was sold during the month, and \$300 was still in inventory at 30 November.

Required

Calculate the profit for November for the by-product when:

- (1) By-product income is treated as a separate source of income
- (2) Net realisable value of the by-product is deducted from the cost of production in the period.

Solution

(1) By-product income treated as a separate source of income

	\$	\$
Sales, main product		150,000
Opening inventory		0
Cost of production	120,000	
	120,000	
Closing inventory (10%)	12,000	
Cost of sales, main product		108,000
Profit, main product		42,000
Other income		700
Total profit		42,700

The closing inventory of the by-product again has no value in the cost accounts.

(2) Net realisable value of the by-product deducted from the cost of production in the period

	\$	\$
Sales, main product		150,000
Opening inventory		0
Cost of production (120,000 - 1,000)	<u>119,000</u>	
	119,000	
Less closing inventory (10%)		<u>11,900</u>
Cost of sales		<u>107,100</u>
Profit, main product		<u>42,900</u>

As with the other three methods, closing inventory of the by-product has no value in the books of accounting, but the value of the closing inventory (\$300) has been used to reduce the cost of production, and in this respect, it has been allowed for in deriving the cost of sales and the profit for the period.

4 Joint products in process accounts



Illustration 9: Joint products and process accounts

Three joint products are manufactured in a common process, which consists of two consecutive stages. Output from Process 1 is transferred to Process 2, and output from Process 2 consists of the three joint products, Hans, Nils and Bumpsydaisies. All joint products are sold as soon as they are produced.

Data for period 2 of 20X6 are as follows:

	Process 1	Process 2
Opening and closing inventory	None	None
Direct material		
Direct material (30,000 units at \$2 per unit)	\$60,000	—
Conversion costs	\$76,500	\$226,200
Normal loss	10% of input	10% of input
Scrap value of normal loss	\$0.50 per unit	\$2 per unit
Output	26,000 units	10,000 units of Han
		7,000 units of Nil
		6,000 units of Bumpsydaisy

Selling prices are \$18 per unit of Han, \$20 per unit of Nil and \$30 per unit of Bumpsydaisy.

Required

- (1) Prepare the Process 1 account.
- (2) Prepare the Process 2 account using the sales value method of apportionment.
- (3) Prepare a profit statement for the joint products.

Solution**(1) Process 1 equivalent units**

	Total units	Equivalent units	\$
Output to Process 2	26,000	26,000	
Normal loss	3,000	0	
Abnormal loss (balance)	<u>1,000</u>	<u>1,000</u>	
	<u>30,000</u>	<u>27,000</u>	
			\$
Direct materials		60,000	
Conversion costs		<u>76,500</u>	
		136,500	
Less scrap value of normal loss ($3,000 \times \$0.50$)		<u>1,500</u>	
		135,000	

Cost per equivalent unit = $\$135,000 / 27,000 = \5

PROCESS ACCOUNT 1

	\$		\$
Direct materials	60,000	Output to Process 2 ($26,000 \times \$5$)	130,000
Conversion costs	<u>76,500</u>	Normal loss (scrap value)	1,500
		Abnormal loss a/c ($1,000 \times \$5$)	<u>5,000</u>
	<u>136,500</u>		136,500

(2) Process 2 equivalent units

	Total units	Equivalent units
Units of Hans produced	10,000	10,000
Units of Nils produced	7,000	7,000
Units of Bumpsydaisies produced	6,000	6,000
Normal loss (10% of 26,000)	2,600	0
Abnormal loss (balance)	<u>400</u>	<u>400</u>
	<u>26,000</u>	<u>23,400</u>

Costs of Process 2

	\$
Material costs – from Process 1	130,000
Conversion costs	<u>226,200</u>
	356,200
Less scrap value of normal loss ($2,600 \times \$2$)	<u>5,200</u>
	<u>351,000</u>

Cost per equivalent unit = $\$351,000 / 23,400 = \15

Cost of good output ($10,000 + 7,000 + 6,000$) = 23,000 units $\times \$15 = \$345,000$

The sales value of joint products, and the apportionment of the output costs of \$345,000, is as follows.

	Sales value	Costs (Process 2)	
	\$	%	\$
Hans ($10,000 \times \$18$)	180,000	36	124,200
Nils ($7,000 \times \$20$)	140,000	28	96,600
Bumpsydaisy ($6,000 \times \$30$)	<u>180,000</u>	<u>36</u>	<u>124,200</u>
	<u>500,000</u>	<u>100</u>	<u>345,000</u>

PROCESS 2 ACCOUNT

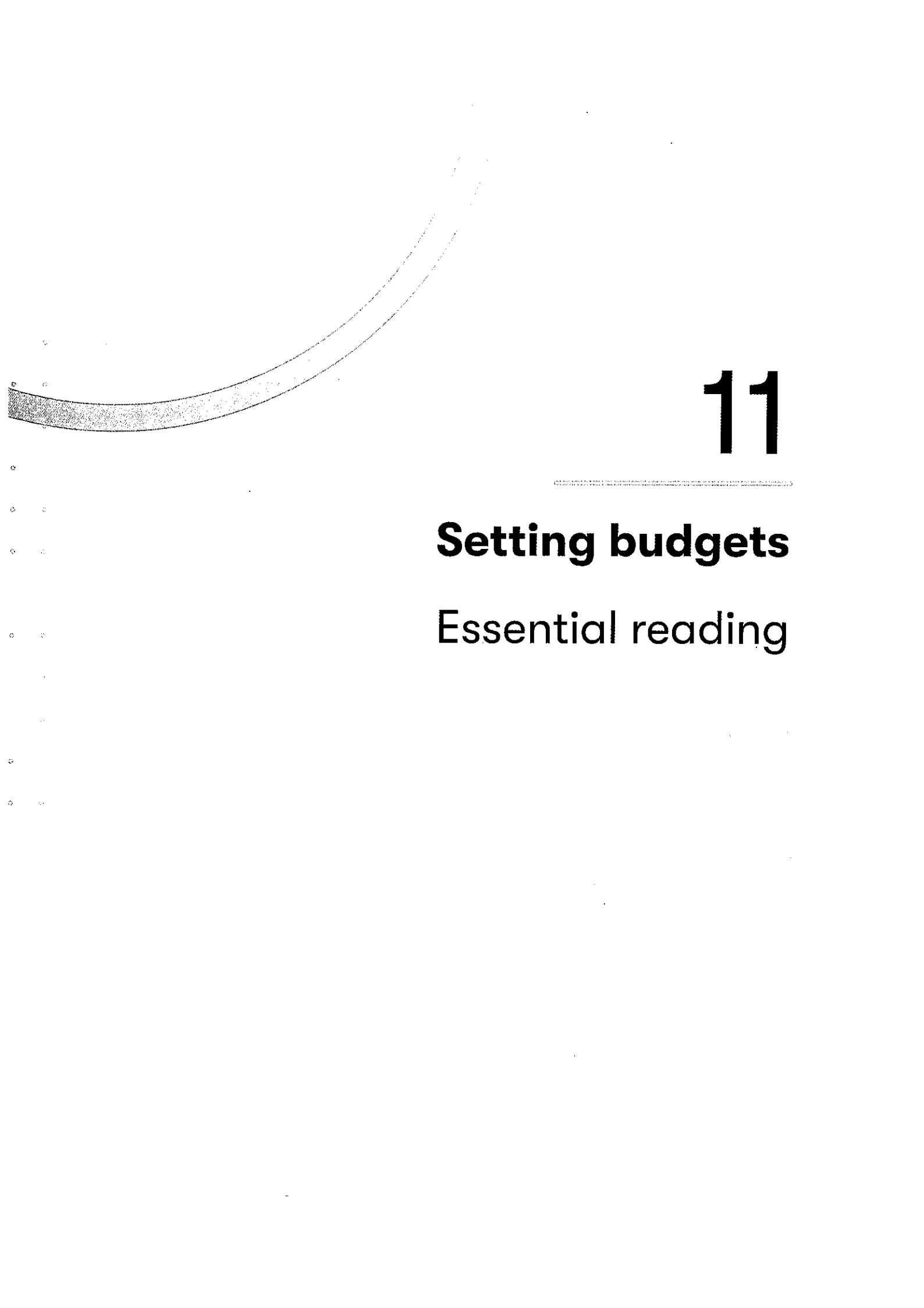
	\$		\$
Process 1 materials	130,000	Finished goods accounts	
Conversion costs	226,200	– Hans	124,200
		– Nils	96,600
		– Bumpsydaisies	124,200
		Normal loss (scrap value)	5,200
		Abnormal loss a/c	<u>6,000</u>
	<u>356,200</u>		<u>356,200</u>

(3) PROFIT STATEMENT

	Hans	Nils	Bumpsydaisies
	\$'000	\$'000	\$'000
Sales	180.0	140.0	180.0
Costs	124.2	96.6	124.2
Profit	55.8	43.4	55.8
Profit/sales ratio	31%	31%	31%



i



11

Setting budgets

Essential reading

1 Administration of the budget

The budget manual is a collection of instructions governing the responsibilities of persons and the procedures, forms and records relating to the preparation and use of budgetary data.

Managers responsible for preparing budgets should ideally be the managers responsible for carrying out the budget.

The budget committee is the co-ordinating body in the preparation and administration of budgets.

Having seen why organisations prepare budgets, we will now turn our attention to the administrative procedures that ensure that the budget process works effectively.

1.1 The budget period

The budget period is the time period to which the budget relates. Except for capital expenditure budgets, the budget period is commonly the accounting year (subdivided into 12 or 13 control periods).

1.2 Budget documentation: the budget manual

The budget manual is a collection of instructions governing the responsibilities of persons and the procedures, forms and records relating to the preparation and use of budgetary data.

One of the functions of the budget is to improve communication. A budget manual should be produced so that everyone can refer to it for information and guidance about the budgeting process. The budget manual does not contain the actual budgets for the forthcoming period; it is more of an instruction/information manual about the way budgeting operates in a particular organisation.

A budget manual will usually be prepared by the management accountant. One of the functions of the budget is to improve communication. A budget manual should be produced so that everyone can refer to it for information and guidance about the budgeting process. The budget manual does not contain the actual budgets for the forthcoming period; it is more of an instruction/information manual about the way budgeting operates in a particular organisation. A budget manual will usually be prepared by the management accountant.

1.3 Responsibility for the preparation of budgets

Managers responsible for preparing budgets should ideally be the managers who are responsible for carrying out the budget. For example, the sales manager should draft the sales budget and selling overhead cost centre budget and the purchasing manager should draft the material purchases budget.

1.4 Budget committee

The co-ordination and administration of budgets is usually the responsibility of a budget committee (with the managing director as chairman). The budget committee is assisted by a budget officer who is usually an accountant. Every part of the organisation should be represented on the committee, so there should be a representative from sales, production, marketing and so on. Functions of the budget committee include the following:

- Co-ordination of the preparation of budgets, which includes the issue of the budget manual
- Issuing of timetables for the preparation of functional budgets
- Allocation of responsibilities for the preparation of functional budgets
- Provision of information to assist in the preparation of budgets
- Communication of final budgets to the appropriate managers
- Continuous assessment of the budgeting and planning process, in order to improve the planning and control function

2 Controllable costs

Responsibility accounting attempts to associate costs, revenues, assets and liabilities with the managers most capable of controlling them. As a system of accounting, it therefore distinguishes between controllable and uncontrollable costs. Most variable costs within a department are thought to be controllable in the short term because managers can influence the efficiency with which resources are used, even if they cannot do anything to raise or lower price levels.

A cost which is not controllable by a junior manager or supervisor might be controllable by a senior manager. For example, there may be high direct labour costs in a department caused by excessive overtime working. The supervisor may feel obliged to continue with the overtime in order to meet production schedules, but their senior may be able to reduce costs by deciding to hire extra full-time staff, thereby reducing the requirements for overtime.

A cost which is not controllable by a manager in one department may be controllable by a manager in another department. For example, an increase in material costs may be caused by buying at higher prices than expected (controllable by the purchasing department) or by excessive wastage and spoilage (controllable by the production department) or by a faulty machine producing a high number of rejects (controllable by the maintenance department).

Some costs are non-controllable, such as increases in expenditure items due to inflation. Other costs are controllable, but in the long term, rather than the short term. For example, production costs might be reduced by the introduction of new machinery and technology but, in the short term, management must attempt to do the best they can with the resources and machinery at their disposal.

2.1 The controllability of fixed costs

It is often assumed that all fixed costs are non-controllable in the short run. This is not so.

- Committed fixed costs are those costs arising from the possession of plant, equipment, buildings and an administration department to support the long-term needs of the business. These costs (depreciation, rent, administration, salaries) are largely non-controllable in the short term because they have been committed by longer-term decisions affecting longer-term needs. When a company decides to cut production drastically, the long-term committed fixed costs will be reduced, but arrangements for settling redundancy terms and the sale of assets cannot be made quickly and in the short term.
- Discretionary fixed costs, such as advertising, sales promotion, research and development, training costs and consultancy fees, are costs that are incurred as a result of a top management decision, but which could be raised or lowered at fairly short notice (irrespective of the actual volume of production and sales).

2.2 Controllability and apportioned costs

Managers should only be held accountable for costs over which they have some influence. This may seem quite straightforward in theory, but it is not always so easy in practice to distinguish controllable from uncontrollable costs. **Apportioned overhead costs provide a good example.**

Suppose that a manager of a production department in a manufacturing company is made responsible for the costs of their department. These costs include **directly attributable overhead items**, such as the costs of indirect labour employed in the department, the cost of metered power units consumed and indirect materials consumed in the department. However, the department's overhead costs also include an apportionment of costs from other cost centres, such as the following:

- Rent and rates for the building which the department shares with other departments
- Share of the costs of the maintenance department
- A share of the costs of the central data processing department

Should the production manager be held accountable for any of these apportioned costs?

Managers should not be held accountable for costs over which they have no control. In this example, apportioned rent and rates costs would not be controllable by the production department manager.

Managers should be held accountable for costs over which they have some influence. In this example, it is the responsibility of the maintenance department manager to keep maintenance costs within budget and of the production department manager, to keep central production department costs within budget. But their costs will be partly variable and partly fixed, and the variable cost element will depend on the volume of demand for their services (the rate of usage of the service). If the production department's staff treat their equipment badly, we might expect higher repair costs, and the production department manager should therefore be made accountable for the repair costs that their department makes which the maintenance department incur on its behalf.

3 Preparing capital expenditure budgets

Recurring and minor non-current asset purchases may be covered by an annual allowance provided for in the **capital expenditure budget**. Major projects will need to be considered individually and will need to be fully appraised.

The capital expenditure budget is essentially a non-current assets purchase budget, and it will form part of the longer-term plan of a business enterprise.

Sales, production and related budgets cover, in general, a 12-month period. A detailed capital expenditure budget should be prepared for the budget period but additional budgets should be drawn up for both the medium and long term. This requires an in-depth consideration of the organisation's requirements for land, buildings, plant, machinery, vehicles, fixtures and fittings and so on for the short, medium and long term.

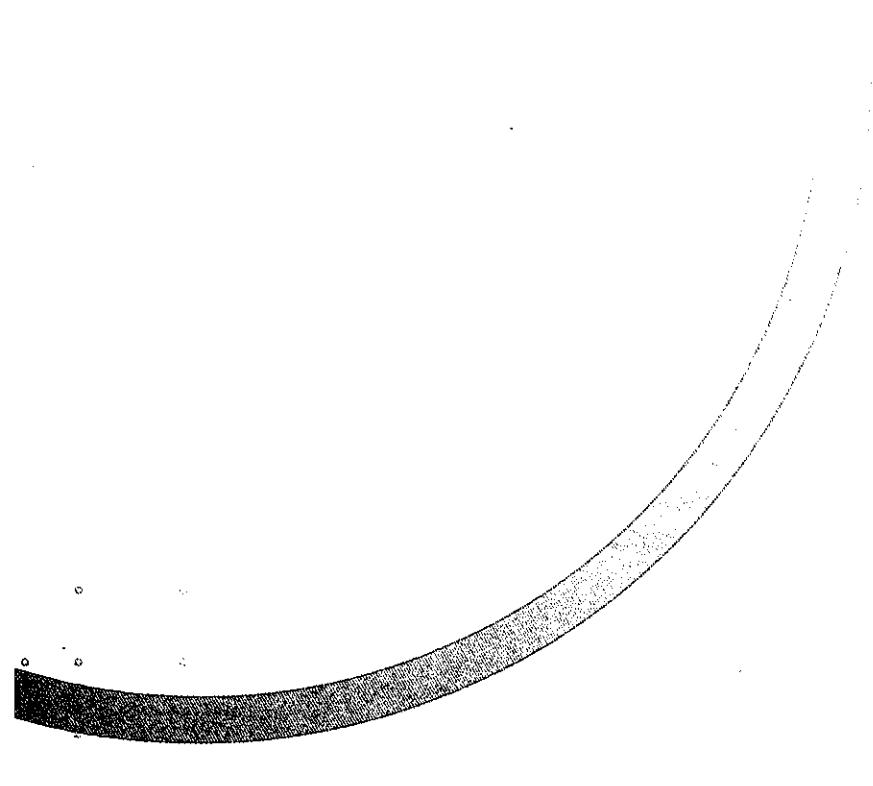
Suitable financing must be arranged as necessary. If available funds are limiting the organisation's activities, then it will more than likely limit capital expenditure. The capital expenditure budget should take account of this.

Some forms of capital expenditure may be budgeted for by means of a set annual 'allowance' for the purchase and replacement of non-current assets. Examples here would be sets of new tools, or relatively minor expenditure such as a few new desks and chairs.

As part of the overall budget co-ordination process, the capital expenditure budget must be reviewed in relation to the other budgets. Proposed expansion of production may well require significant non-current assets expenditure, which should be reflected in the budget.

Before major capital expenditure is incurred, we need to be confident that the expenditure is worthwhile. We therefore need to appraise the project on which the expenditure is to be made, to see if it is likely to be of positive value to the business. In Chapter 13, we will look at the methods of project appraisal that are available to do this.





12

Implementing budgets

Essential reading

1 The importance of motivation

1.1 Poor attitudes when setting budgets

If managers are involved in preparing a budget, poor attitudes or hostile behaviour towards the budgetary control system can begin at the planning stage.

- (a) Managers may complain that they are too busy to spend much time on budgeting.
- (b) They may build 'slack' into their expenditure estimates.
- (c) They may argue that formalising a budget plan on paper is too restricting and that managers should be allowed flexibility in the decisions they take.
- (d) They may set budgets for their budget centre and not co-ordinate their own plans with those of other budget centres.
- (e) They may base future plans on past results, instead of using the opportunity for formalised planning to look at alternative options and new ideas.

On the other hand, managers may not be involved in the budgeting process. Organisational goals may not be communicated to them and they might have their budget decided for them by senior management or an administrative decision. It is hard for people to be motivated to achieve targets set by someone else.

1.2 Poor attitudes when putting plans into action

Poor attitudes also arise when a budget is implemented.

- (a) Managers might put in only just enough effort to achieve budget targets, without trying to beat targets.
- (b) A formal budget might encourage rigidity and discourage flexibility.
- (c) Short-term planning in a budget can draw attention away from the longer-term consequences of decisions.
- (d) There might be minimal co-operation and communication between managers.
- (e) Managers will often try to make sure that they spend up to their full budget allowance, and do not overspend, so that they will not be accused of having asked for too much spending allowance in the first place.

1.3 Poor attitudes and the use of control information

The attitude of managers towards the accounting control information they receive might reduce the information's effectiveness.

- (a) Management accounting control reports could well be seen as having a relatively low priority in the list of management tasks. Managers might take the view that they have more pressing jobs on hand than looking at routine control reports.
- (b) Managers might resent control information; they may see it as part of a system of trying to find fault with their work. This resentment is likely to be particularly strong when budgets or standards are imposed on managers without allowing them to participate in the budget-setting process.
- (c) If budgets are seen as pressure devices to push managers into doing better, control reports will be resented.
- (d) Managers may not understand the information in the control reports because they are unfamiliar with accounting terminology or principles.
- (e) Managers might have a false sense of what their objectives should be. A production manager might consider it important to maintain quality standards, regardless of cost. They would then dismiss adverse expenditure variances as inevitable and unavoidable.
- (f) If there are flaws in the system of recording actual costs, managers will dismiss control information as unreliable.
- (g) Control information might be received weeks after the end of the period to which it relates, in which case, managers might regard it as out of date and no longer useful.
- (h) Managers might be held responsible for variances outside their control.

It is therefore obvious that accountants and senior management should try to implement systems that are acceptable to budget holders, and which produce positive effects.



2 Cost reduction

2.1 Difficulties introducing cost reduction programmes

- (a) There may be resistance from employees to the pressure to reduce costs. They may feel threatened by the change. The purpose and scope of the campaign should be fully explained to employees to reduce uncertainty and (hopefully) resistance.
- (b) The programme may be limited to a small area of the business, with the result that costs are reduced in one cost centre, only to reappear as an extra cost in another cost centre.
- (c) Cost reduction campaigns are often introduced as a rushed, desperate measure instead of a carefully organised, well-thought-out exercise.

Cost reduction does not happen of its own accord. **Managers must make positive decisions to reduce costs.**

- (a) A planned programme of cost reduction must begin with the assumption that some costs can be significantly reduced. The benefits of cost savings must be worthwhile, and should exceed the costs of achieving them.
- (b) Areas for potential cost reduction should be investigated, and unnecessary costs identified.
- (c) Cost reduction measures should be proposed, agreed, implemented and then monitored.

2.2 Methods of cost reduction

2.2.1 Material costs

Costs of materials can be reduced by lowering the costs of wastage. Other ways of reducing materials costs are as follows:

- (a) A company could seek lower prices for purchases of materials and components. Bulk purchase discounts might be obtainable. Alternatively, a more cost-conscious approach to buying, with a system of putting all major purchase contracts out to tender, might help to reduce prices.
- (b) A company could improve stores control and cut stores costs. The economic ordering quantity (Chapter 6) will minimise the combined costs of ordering items for inventory and stockholding costs. Stockholding costs might be reduced by dealing with problems of obsolescence, deterioration of items in store or theft.
- (c) It might be possible to use alternative materials. Cheaper substitute materials might be available.

2.2.2 Labour costs



Work study: Work study is a means of raising the production efficiency (productivity) of an operating unit by the reorganisation of work. There are two main parts to work study: method study and work measurement.

Method study: Method study is the systematic recording and critical examination of existing and proposed ways of doing work in order to develop and apply easier and more effective methods, and reduce costs.

Work measurement: Work measurement involves establishing the time for a qualified worker to carry out a specified job at a specified level of performance.

Organisation and methods: Organisation and methods (O&M) is a term for techniques, including method study and work measurement, that are used to examine clerical, administrative and management procedures in order to make improvements.

Methods of reducing labour costs	Detail
Changing the methods of work	A work study or O&M programme might be set up to look for cost savings from improved work methods.
Replacing people with machinery	The substitution of labour by automatic equipment can reduce costs substantially.

2.2.3 Other aspects of cost reduction

- Finance costs eg taking credit from suppliers, changing credit terms to customers, cheaper sources of finance.
- Rationalisation eg elimination of duplication and concentration of resources.
- Careful evaluation of capital expenditure.

3 Value analysis

Two features of VA distinguish it from other approaches to cost reduction.

- (a) It encourages innovation and a more radical outlook for ways of reducing costs.
- (b) It recognises the various types of value which a product or service provides, analyses this value, and then seeks ways of improving or maintaining aspects of this value at a lower cost. Other techniques often ignore this value aspect.

Not every exercise in VA results in suggestions for radically different ways of making a product or service. But VA can result in radical ideas for change, because ideas for cost reduction are not constrained by the existing product design.

Conventional cost reduction techniques try to achieve the lowest production costs for a specific product design whereas VA recognises that the real goal should be the least-cost method of making a product that achieves its desired function, not the least-cost method of accomplishing a product design to a mandatory and detailed specification.

VA involves the systematic investigation of every source of cost and technique of production with the aim of cutting all unnecessary costs. An unnecessary cost is an additional cost incurred without adding use, exchange or esteem value to a product.

There might be a conflict between reducing costs and maintaining the aesthetic value (esteem value) of a product. Whereas a VA exercise should not result in a sacrifice of the product's function in order to cut costs, it might result in a product that is not as pleasing aesthetically. Where cost cutting and aesthetics are incompatible, there should be a clear direction from senior management about which is more important.

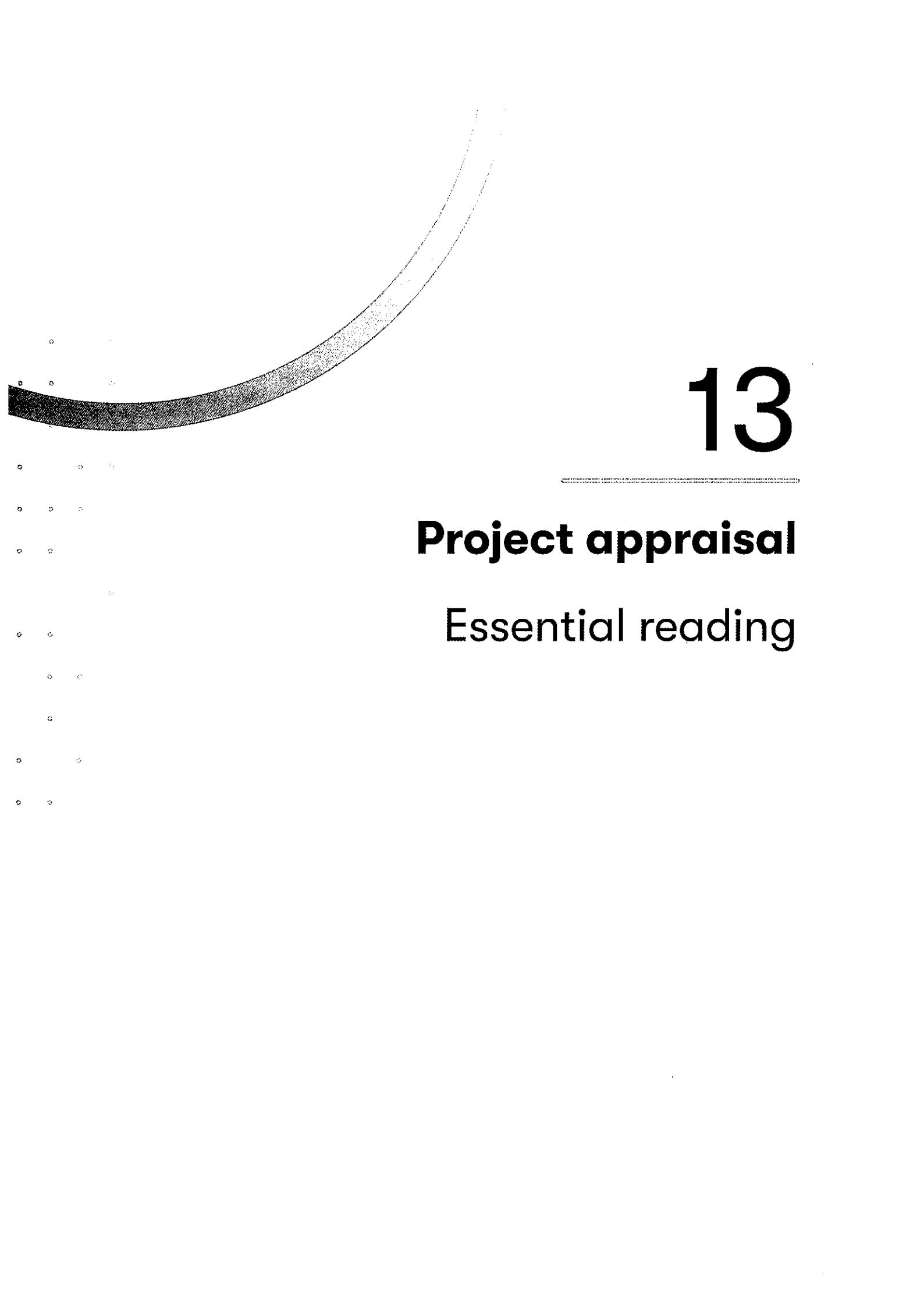
3.1 The scope of VA

Value analysis concentrates on product design, components, material costs and production methods.

Area	Method
Product design	At the design stage , VA is called value engineering . The designer should be cost conscious and avoid unnecessary complications. Simple product design can avoid production and quality control problems, thereby resulting in lower costs.
Components and material costs	The purchasing department should beware of lapsing into habit with routine buying decisions. Buyers ought to be fully aware of technology changes, and significant changes in material prices that new technology creates. The purchasing department has a crucial role to play in reducing costs and improving value by obtaining the desired quality materials at the

Area	Method
	lowest possible price.
Production methods	These ought to be reviewed continually, on a product-by-product basis, especially with changing technology.

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13

Project appraisal

Essential reading

1 Discounted payback method

The discounted payback method applies discounting to arrive at a payback period after which the cumulative present values become positive.

We have seen how discounting cash flows is a way of reflecting the time value of money in investment appraisal. The further into the future a cash flow is expected to be, the more uncertain it tends to be, and the returns or interest paid to the suppliers of capital (ie to investors) in part reflects this uncertainty. The discounted payback technique is an adaptation of the payback technique, explained in the chapter, taking some account of the time value of money. To calculate the discounted payback period, we establish the time at which the NPV of an investment becomes positive.



Illustration 9: Discounted payback period

A company is wondering whether to invest \$18,000 in a project which would generate extra cash flows of \$10,000 in the first year, \$8,000 in the second year and \$6,000 in the third year. Its cost of capital is 10%.

Required

Calculate the discounted payback period

Solution

We calculate the discounted payback period as follows:

Year	Cash flow \$	DF @10%	Present value \$	Cumulative PV \$
0	(18,000)	1	(18,000)	(18,000)
1	10,000	0.909	9,090	(8,910)
2	8,000	0.826	6,608	(2,302)
3	6,000	0.751	4,506	2,204

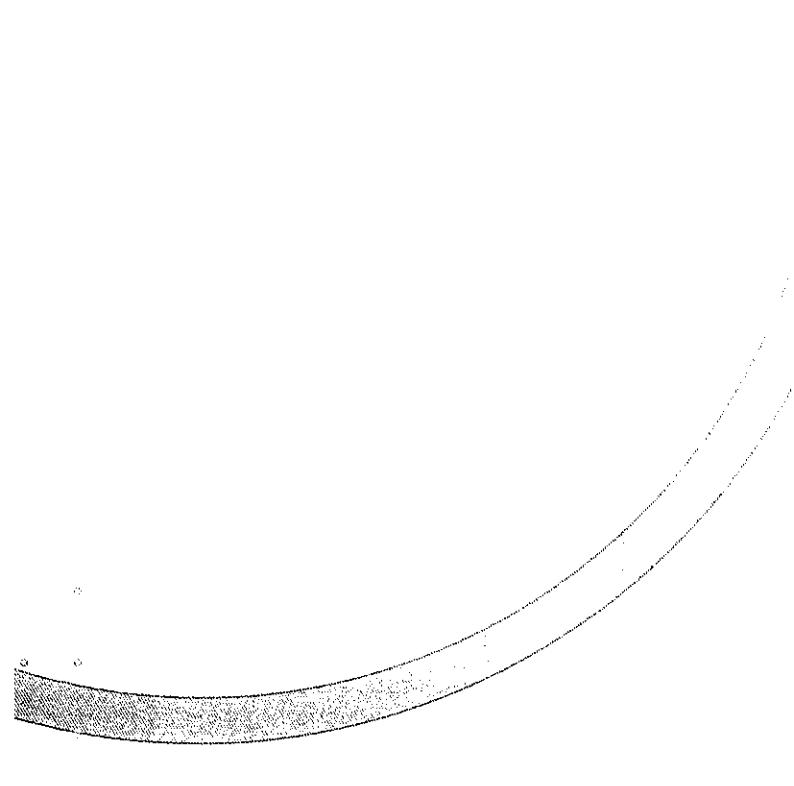
If we assume now that cash flows in year 3 are even, instead of occurring on the last day of the year, the discounted payback period can be estimated as follows:

$$= 2 \text{ years} + 2,302/4,506 \text{ years}$$

$$= 2.51 \text{ years, say } 2\frac{1}{2} \text{ years}$$

This compares with a non-discounted payback period of 2 years for the same project, since the initial outlay of \$18,000 is recouped in monetary terms by year 2. The discounted payback period of $2\frac{1}{2}$ years suggests that if the project must be terminated within that period, it will not have added value to the company.

13



14

Standard costing

Essential reading

1 Standard cost card



Activity 4: Standard cost card - absorption costing

Bloggs makes one product, the joe. Two types of labour are involved in the preparation of a joe, skilled and semi-skilled. Skilled labour is paid \$10 per hour and semi-skilled \$5 per hour. Twice as many skilled labour hours as semi-skilled labour hours are needed to produce a joe, four semi-skilled labour hours being needed.

A joe is made up of three different direct materials. Seven kilograms of direct material A, four litres of direct material B and three metres of direct material C are needed. Direct material A costs \$1 per kilogram, direct material B \$2 per litre and direct material C \$3 per metre.

Variable production overheads are incurred at Bloggs Co at the rate of \$2.50 per direct labour (skilled) hour.

A system of absorption costing is in operation at Bloggs Co. The basis of absorption is direct labour (skilled) hours. For the forthcoming accounting period, budgeted fixed production overheads are \$250,000 and budgeted production of the joe is 5,000 units.

Administration, selling and distribution overheads are added to products at the rate of \$10 per unit.

A mark-up of 25% is made on the joe.

Required

Using the above information, draw up a standard cost card for the joe.



Activity 5: Standard cost card - marginal costing

What would a standard cost card for product joe show under a marginal system?

2 Flexed budget for control



Illustration 1: Budgetary control

The budgeted and actual results of Crunch for September were as follows. The company uses a marginal costing system. There were no opening or closing inventories.

	Fixed budget		Actual	
Sales and production	1,000 units	\$	700 units	\$
Sales	20,000		14,200	
Variable cost of sales				
Direct materials	8,000		5,200	
Direct labour	4,000		3,100	
Variable overhead	2,000		1,500	
		14,000		9,800
Contribution		6,000		4,400
Fixed costs		5,000		5,400

Profit/(loss)	1,000	(1,000)
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Required

Prepare a budget that will be useful for management control purposes.

Solution

We need to prepare a flexed budget for 700 units.

	Budget		Flexed budget		Actual	
	1,000 units		Per unit	700 units	700 units	Variances
	\$	\$	\$	\$	\$	\$
Sales	20,000	(20)		14,000	14,200	200 (F)
Variable costs						
Direct material	8,000	(8)		5,600	5,200	400 (F)
Direct labour	4,000	(4)		2,800	3,100	300 (A)
Variable production overhead	2,000	(2)		1,400	1,500	100 (A)
	14,000	(14)		9,800	9,800	
Contribution	6,000			4,200	4,400	
Fixed costs	5,000	(N/A)		5,000	5,400	400 (A)
Profit/(loss)	1,000			(800)	(1,000)	200 (A)

Note that the differences between actual results (what revenues and costs **were** for 700 units) and the flexed budget (what revenues and costs **should** be for 700 units) have been noted in the right-hand column as **variances**. (F) denotes a situation where actual results were better than the flexed budget results whereas (A) denotes a situation where actual results were worse than flexed budget results.

By flexing the budget in the exercise above we removed the effect on sales revenue of the difference between **budgeted sales volume** and **actual sales volume**. But there is still a variance of \$200 (F). This means that the actual **selling price** must have been different to the budgeted selling price, resulting in a \$200 (F) selling price variance.

3 When fixed and flexible budgets are appropriate

Both sorts of budget are used essentially for cost control, although they also provide management with a yardstick to measure achievement and may thus encourage the attainment of objectives.

Fixed budgets are useful at the **planning stage**, as they provide a **common ground** for the preparation of all the many types of budget. At the end of the period, actual results may be compared with the fixed budget and analysed for control. However, this analysis may be distorted by uncorrected errors underlying the estimates on which the fixed budget was constructed.

A **flexible budget** may be needed at the planning stage to **complement the master budget**; output may be budgeted at a number of different possible levels, for instance. During the period a flexed budget may then be updated using the actual level of activity and the results compared.

As a result, flexible budgets assist management control by providing more dynamic and comparable information. Relying only on a fixed budget would give rise to massive variances; since forecast volume is very unlikely to be matched, the variances will contain large volume

differences. Flexed budgets are more likely to pinpoint actual problem areas over which control may be exercised.

Activity answers

Activity 4: Standard cost card - absorption costing

STANDARD COST CARD - PRODUCT JOE

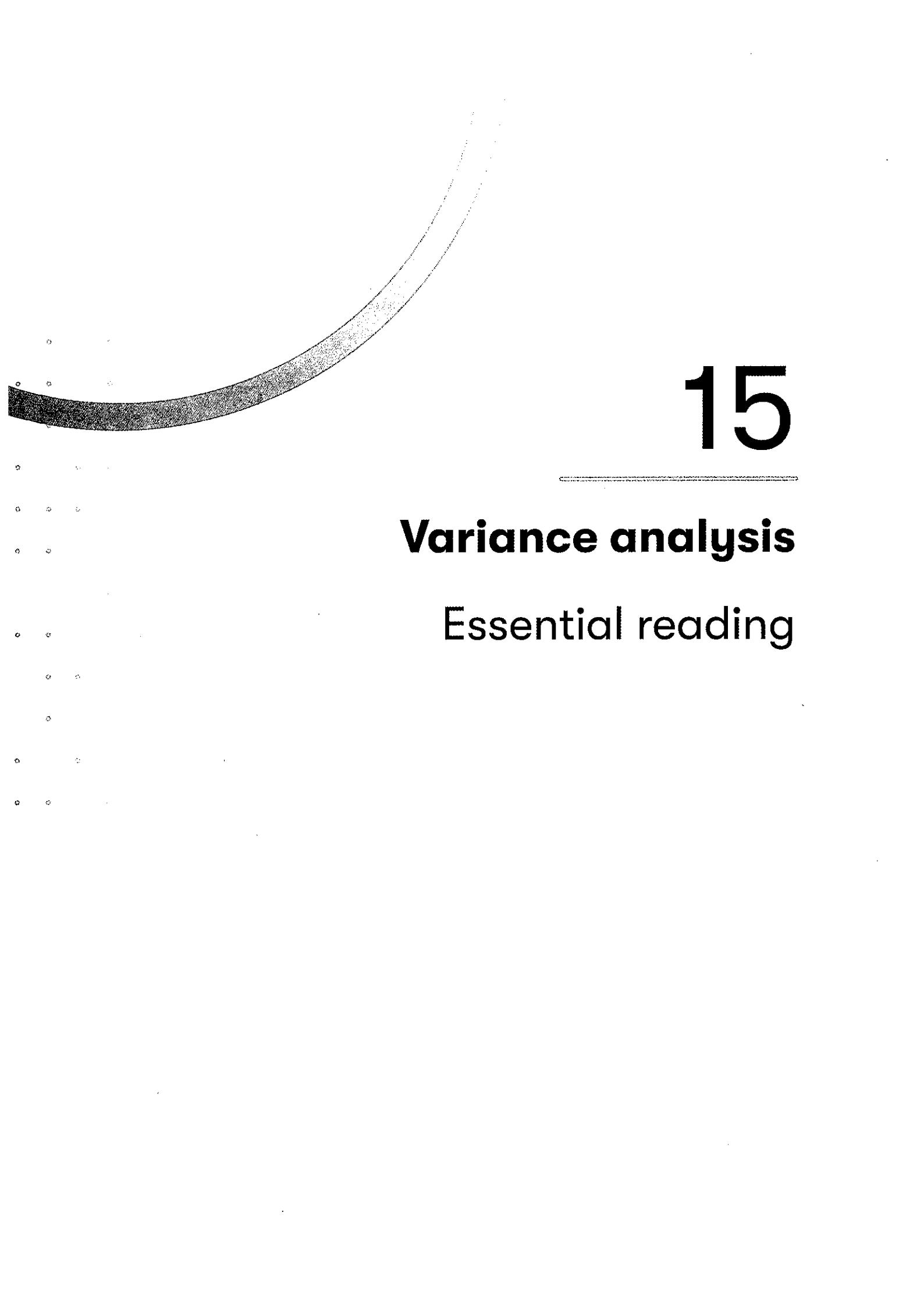
	\$	\$
Direct materials		
A – 7 kg × \$1	7	
B – 4 litres × \$2	8	
C – 3 m × \$3	9	
		<u>24</u>
Direct labour		
Skilled – 8 × \$10	80	
Semi-skilled – 4 × \$5	<u>20</u>	
		<u>100</u>
Standard direct cost		124
Variable production overhead – 8 × \$2.50	<u>20</u>	
Standard variable cost of production		144
Fixed production overhead – 8 × \$6.25*	<u>50</u>	
Standard full production cost		194
Administration, selling and distribution overhead		<u>10</u>
Standard cost of sale		204
Standard profit (25% × 204)		<u>51</u>
Standard sales price		<u>255</u>

* Overhead absorption rate = \$250,000 / (5,000 × 8) = \$6.25 per skilled labour hour

Activity 5: Standard cost card - marginal costing

STANDARD COST CARD - PRODUCT JOE

	\$
Direct materials	24
Direct labour	<u>100</u>
Standard direct cost	124
Variable production overhead	<u>20</u>
Standard variable production cost	144
Standard sales price	<u>255</u>
Standard contribution	<u>111</u>



15

Variance analysis

Essential reading

1 Materials variances and opening and closing inventory

Direct material price variances are usually extracted at the time of the receipt of the materials rather than at the time of usage.

Suppose that a company uses raw material P in production, and that this raw material has a standard price of \$3 per metre. During one month 6,000 metres are bought for \$18,600, and 5,000 metres are used in production. At the end of the month, inventory will have been increased by 1,000 metres. In variance analysis, the problem is to decide the **material price variance**. Should it be calculated on the basis of **materials purchased** (6,000 metres) or on the basis of **materials used** (5,000 metres)?

The answer to this problem depends on how **closing inventories** of the raw materials will be valued.

- (a) If they are valued at **standard cost** (1,000 units at \$3 per unit), the price variance is calculated on material purchases in the period.
- (b) If they are valued at **actual cost** (first in, first out) (1,000 units at \$3.10 per unit) the price variance is calculated on materials used in production in the period.

A **full standard costing system** is usually in operation and therefore the price variance is usually calculated on purchases in the period. The variance on the full 6,000 metres will be written off to the costing statement of profit or loss account, even though only 5,000 metres are included in the cost of production.

There are two main advantages in extracting the material price variance at the time of receipt.

- If variances are extracted at the time of receipt they will be brought to the attention of managers earlier than if they are extracted as the material is used. If it is necessary to correct any variances then management action can be more timely.
- Since variances are extracted at the time of receipt, all inventories will be valued at standard price. This is administratively easier and it means that all issues from inventory can be made at standard price. If inventories are held at actual cost it is necessary to calculate a separate price variance on each batch as it is issued. Since issues are usually made in a number of small batches this can be a time-consuming task, especially with a manual system.

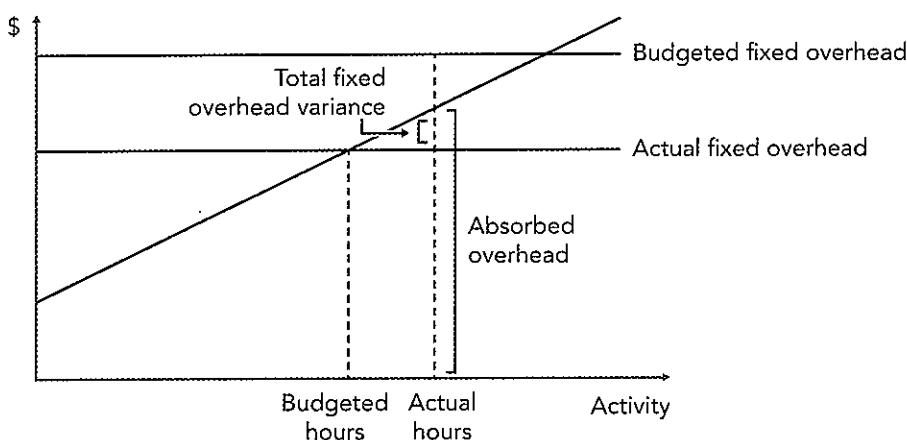
The price variance would be calculated as follows.

	\$
6,000 metres of material P purchased should cost (\$3)	18,000
but did cost	<u>18,600</u>
Price variance	<u>600</u> (A)

1.1 Fixed overhead variance reasons

In general, a favourable cost variance will arise if actual results are less than expected results. Be aware, however, of the **fixed overhead volume variance** and the **fixed overhead volume capacity variance** which give rise to favourable and adverse variances in the following situations.

- A favourable fixed overhead volume variance occurs when actual production is greater than budgeted (planned) production.
- An adverse fixed overhead volume variance occurs when actual production is less than budgeted (planned) production.
- A favourable fixed overhead volume capacity variance occurs when actual hours of work are greater than budgeted (planned) hours of work.
- An adverse fixed overhead volume capacity variance occurs when actual hours of work are less than budgeted (planned) hours of work.



1.2 Significance of sales variances

The possible **interdependence** between sales price and sales volume variances should be obvious to you. A reduction in the sales price might stimulate greater sales demand, so that an adverse sales price variance might be counterbalanced by a favourable sales volume variance. Similarly, a price rise would give a favourable price variance, but possibly at the cost of a fall in demand and an adverse sales volume variance.

It is therefore important in analysing an unfavourable sales variance that the overall consequence should be considered; that is, has there been a counterbalancing favourable variance as a direct result of the unfavourable one?

1.3 Control action

The **control action which may be taken will depend on the reason why the variance occurred**. Some reasons for variances are outlined in the paragraphs below.

Measurement errors

In practice it may be extremely difficult to establish that 1,000 units of product A used 32,000 kg of raw material X. Scales may be misread, the pilfering or wastage of materials may go unrecorded, items may be wrongly classified (as material X3, say, when material X8 was used in reality), or employees may make adjustments to records to make their own performance look better.

An investigation may show that **control action is required to improve the accuracy of the recording system** so that measurement errors do not occur.

Out of date standards

Price standards are likely to become out of date when changes to the costs of material, power, labour and so on occur, or in **periods of high inflation**. In such circumstances, an **investigation of variances is likely to highlight a general change in market prices** rather than efficiencies or inefficiencies in acquiring resources.

Standards may also be out of date where operations are subject to **technological development** or if **learning curve effects** have not been taken into account. Investigation of this type of variance will provide information about the inaccuracy of the standard and **highlight the need to frequently review and update standards**.

Efficient or inefficient operations

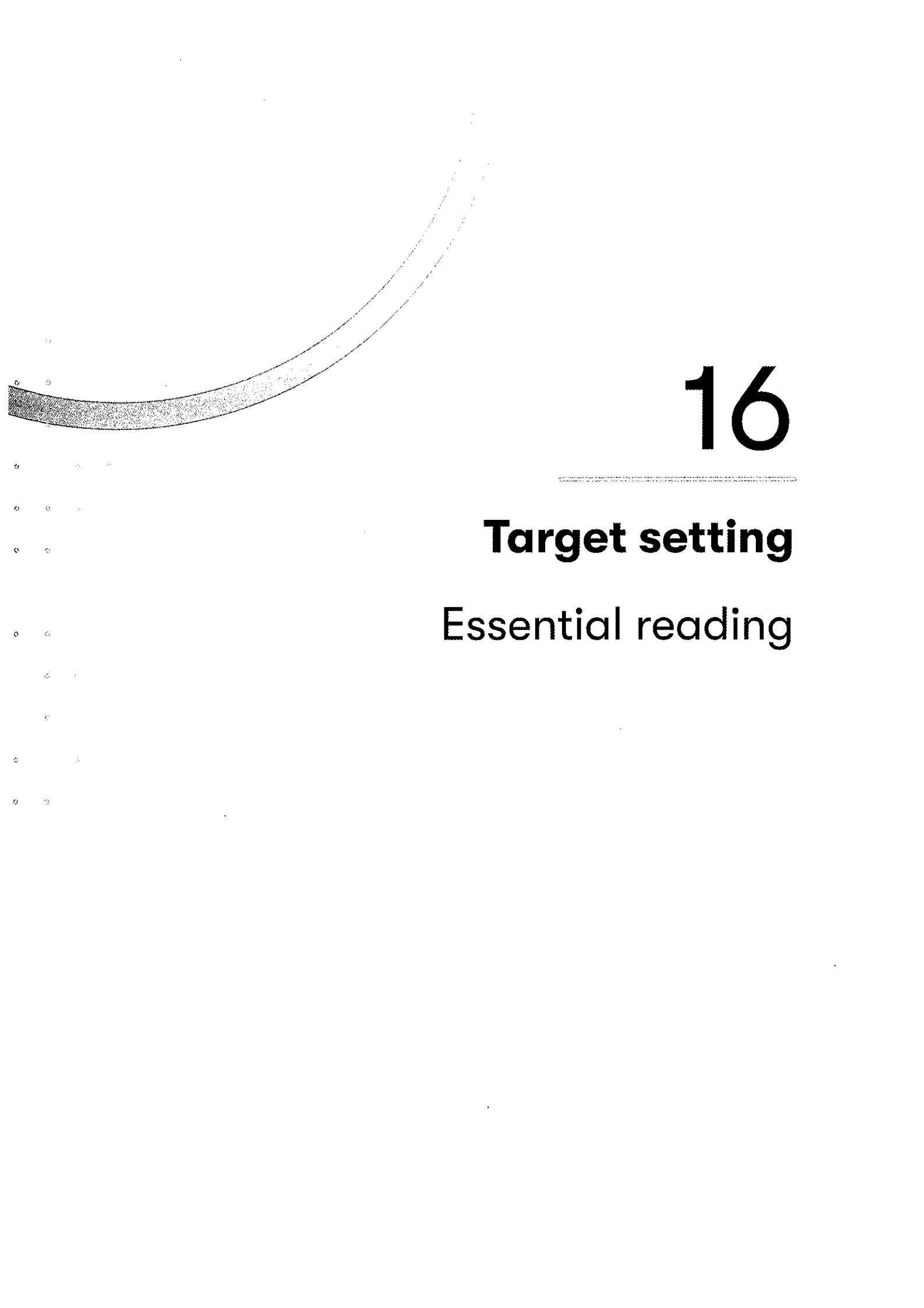
Spoilage and better quality material/more highly skilled labour than standard are all likely to affect the efficiency of operations and therefore cause variances. **Investigation of variances in this category should highlight the cause of the inefficiency or efficiency and will lead to control action to eliminate the inefficiency being repeated or action to compound the benefits of the efficiency**. For example, stricter supervision may be required to reduce wastage levels.

Random or chance fluctuations

A standard is an **average** figure. It represents the mid-point of a range of possible values and therefore actual results are likely to deviate unpredictably within the predictable range.

As long as the variance falls within this range, it will be classified as a random or chance fluctuation and **control action will not be necessary**.





16

Target setting

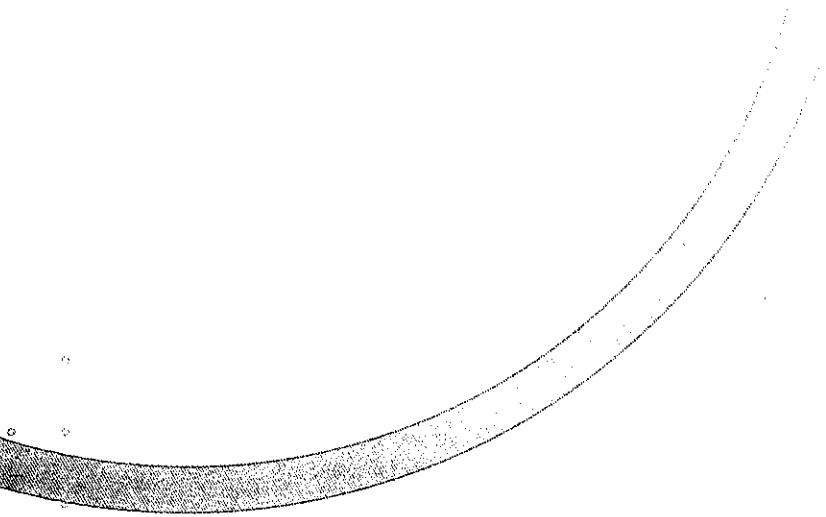
Essential reading

1 Government influence

The government does not have a direct interest in private sector organisations (except for those in which it actually holds shares). However, the government does often have a strong indirect interest in businesses' affairs.

- **Taxation** The government raises taxes on sales and profits and on shareholders' dividends. It also expects businesses to act as tax collectors for income tax and sales tax.
- **Encouraging new investment** The government might provide funds towards the cost of some investment projects. It might also encourage private investment by offering tax incentives.
- **Encouraging a wider spread of share ownership** In the UK, the government has made some attempts to encourage more private individuals to become company shareholders, by means of attractive privatisation issues (such as in the electricity, gas and telecommunications industries) and tax incentives, such as ISAs (Individual Savings Accounts), to encourage individuals to invest in shares.
- **Legislation** The government also influences businesses through legislation, including the Companies Acts, legislation on employment, health and safety regulations, legislation on consumer protection and consumer rights and environmental legislation.
- **Economic policy** A government's economic policy will affect business activity. For example, it will have implications for the revenues of exporting firms and for the purchase costs of importing firms.





17

Financial performance measurement

Essential reading

1 Management performance measures

Possible management performance measures include the following:

- Subjective measures
- Judgement of outsiders
- Upward appraisal
- Accounting measures

We have not so far distinguished between measures of performance of individual managers and measures of performance of what it is they manage.

The distinction is very important. A manager may improve performance of a poorly performing division, but the division could still rank as one of the poorest performing divisions within the organisation. If the manager is assessed purely on the division's results then they will not appear to be a good performer.

The problem is deciding which performance measures should be used to measure management performance and which should be used to measure the performance of the business.

It is difficult to devise performance measures that relate specifically to a manager to judge their performance as a manager. It is possible to calculate statistics to assess the manager as an employee (days absent, professional qualifications obtained, personality and so on), but this does not measure managerial performance.

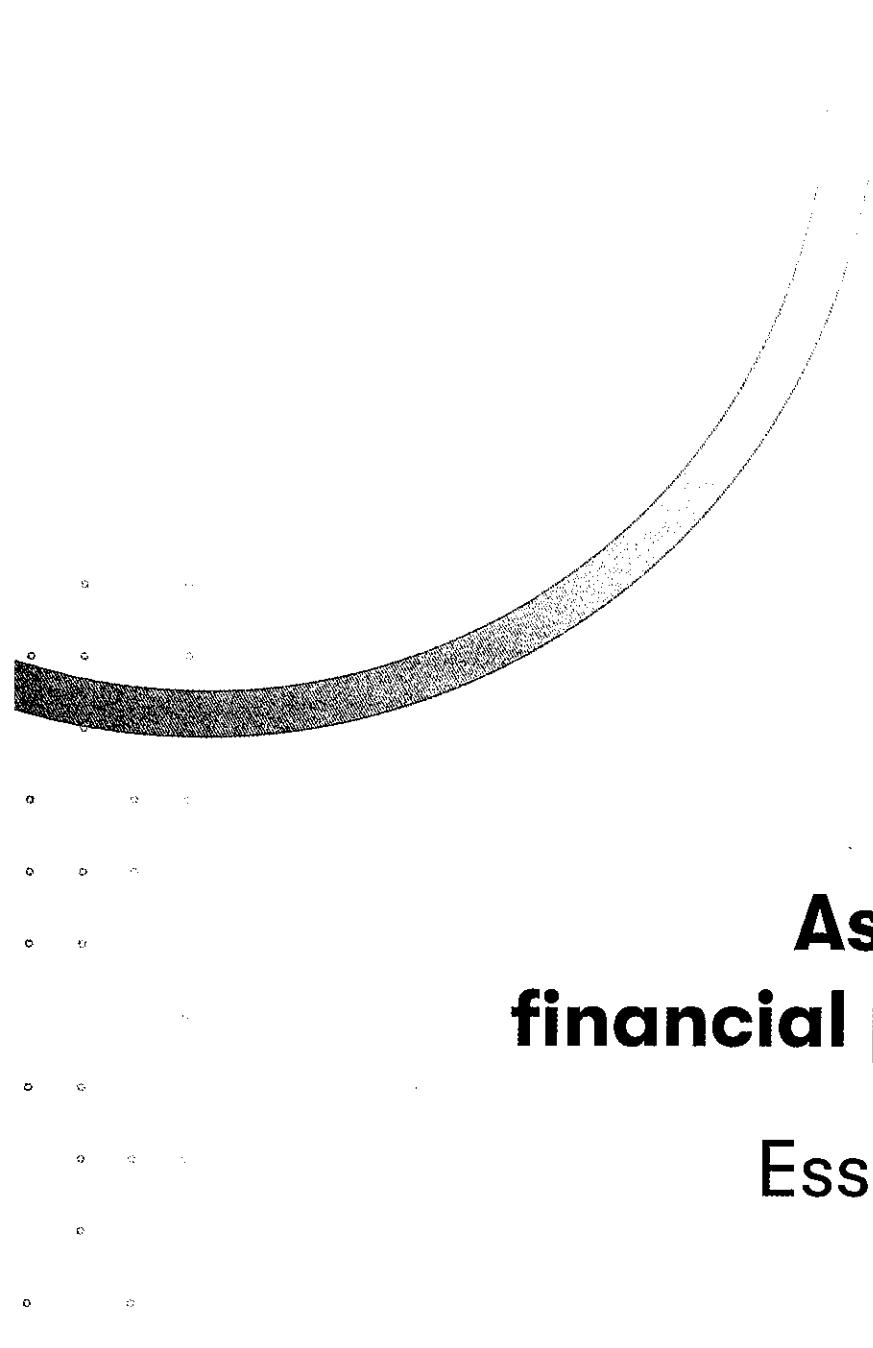
We looked at responsibility accounting in previous chapters and mentioned that it is necessary to consider a manager in relation to their area of responsibility. If we want to know how good a manager is at marketing, the marketing performance of their division is the starting point. Then we must consider to what extent the manager is able to influence the performance, and the performance trend.

Remember that it is unreasonable to assess managers' performance in relation to matters that are beyond their control. Management performance measures should therefore only include those items that are directly controllable by the manager in question.

1.1 Possible management performance measures

Measures	Detail
Subjective measures	An example is ranking performance on a scale of 1 to 5. This approach is imprecise but does measure managerial performance rather than divisional performance. The process must be perceived by managers to be fair. The judgement should be made by somebody impartial, but close enough to the work of each manager to appreciate the efforts they have made and the difficulties they face.
Judgement of outsiders	An organisation might, for example, set up a bonus scheme for directors under which they would receive a bonus if the share price outperforms the FTSE 100 index for more than three years. This is fair in that the share price reflects many aspects of performance, but it is questionable whether they can all be influenced by the directors concerned.
Upward appraisal	This involves staff giving their opinions on the performance of their managers. To be effective this requires healthy working relationships.
Accounting measures	These can be used, but must be tailored according to what or whom is being judged.

The balanced scorecard (Chapter 18) can also be used to monitor performance, as it includes non-financial performance measures to give a more balanced view of performance.



18

Assessing non-financial performance

Essential reading

1 Performance measures for service industries

The key to performance measurement in service industries is to ensure that what you are measuring has been clearly defined. Performance measures covering the following six dimensions have been suggested for service organisations:

- Competitive performance
- Financial performance
- Quality of service
- Flexibility
- Resource utilisation
- Innovation

1.1 Service businesses

A service business does not produce a physical product. Instead it provides a service, for example a haircut, or insurance.

- A service is **intangible**. The actual benefit being bought cannot be touched.
- The production and consumption of a service are **simultaneous**, and therefore it cannot be inspected for quality in advance.
- Services are **perishable**; that is, they cannot be stored. For example, a hairdresser cannot do haircuts in advance and keep them stocked away in case of heavy demand.
- A service is **heterogeneous**. The service received will vary each time. Services are more reliant on people. People are not robots, so how the service is delivered will not be identical each time.

1.2 ‘Dimensions’ of performance measurement

Performance measurement in service businesses is made more difficult because of the four factors listed above. However, performance measurement is possible, the key being to ensure what you are measuring has been sufficiently well defined. A range of performance measures covering six ‘dimensions’ mentioned above are used.



Illustration 1: Competitiveness and resource utilisation

A service business has collected some figures relating to its year just ended.

	Budget	Actual
Customer enquiries		
New customers	6,000	9,000
Existing customers	4,000	3,000
Business won		
New customers	2,000	4,000
Existing customers	1,500	1,500
Types of services performed		
Service A	875	780
Service B	1,575	1,850
Service C	1,050	2,870
Employees		
Service A	5	4
Service B	10	10
Service C	5	8



Required

Calculate figures that illustrate competitiveness and resource utilisation.

Solution

Competitiveness can only be measured from these figures by looking at how successful the organisation is at converting enquiries into firm orders.

Percentage of enquiries converted into firm orders

	Budget	Actual
New customers (W1)	33%	44%
Existing customers (W1)	37.5%	50%

Resource utilisation can be measured by looking at average services performed per employee.

	Budget	Actual	Rise
Service A (W2)	175	195	+11.4%
Service B (W2)	157.5	185	+17.5%
Service C (W2)	175	358.75	+105%

Workings

- (1) For example, $2,000/6,000 = 33\%$
- (2) For example, $875/5 = 175$

2 Performance measurement for manufacturing industries

There are four overarching measures for manufacturing environments.

- **Cost:** cost behaviour
- **Time:** bottlenecks, inertia
- **Quality:** factors inhibiting
- **Innovation:** new product flexibility

3 Performance measures for contract and process costing environments

In a **contract** environment each contract undertaken is unique. Products are made to the specific requirements of individual customers. This has a number of implications for performance measurement.

Detailed planning should be undertaken and performance targets set. As so many variables are involved, this is a complicated process, and the likelihood of targets not being achieved is significant.

- (a) **Suppliers may be different for each contract**, making it **harder to set standards** for quality, speed of delivery and so on.
- (b) **Customer satisfaction** measures are particularly **important** in this environment (payment might depend contractually on customer satisfaction). Feedback on performance should be obtained from the customer during the contract.

- (c) Because each contract will be different the organisation will have to be extremely flexible. Measures of success in adapting to new requirements will provide a key indicator. Measures of employee skills will be equally important.
- (d) It is likely that the contract will need to be completed within a certain time and therefore an ongoing check must be kept of performance in relation to the deadline.
- (e) The size and consequences of overspending may be huge.
- (f) The long timescale means that progress must be measured very carefully, since there is more likelihood of slippage if deadlines seem a long way off.

In a **batch** production environment, products are more **standardised**, although some costs and activities may be unique to a specific batch. Standardisation of products means that materials requirements and labour and machinery capabilities are also more standardised. **Performance standards** can be set for materials quality and usage, labour efficiency, suppliers and so on.

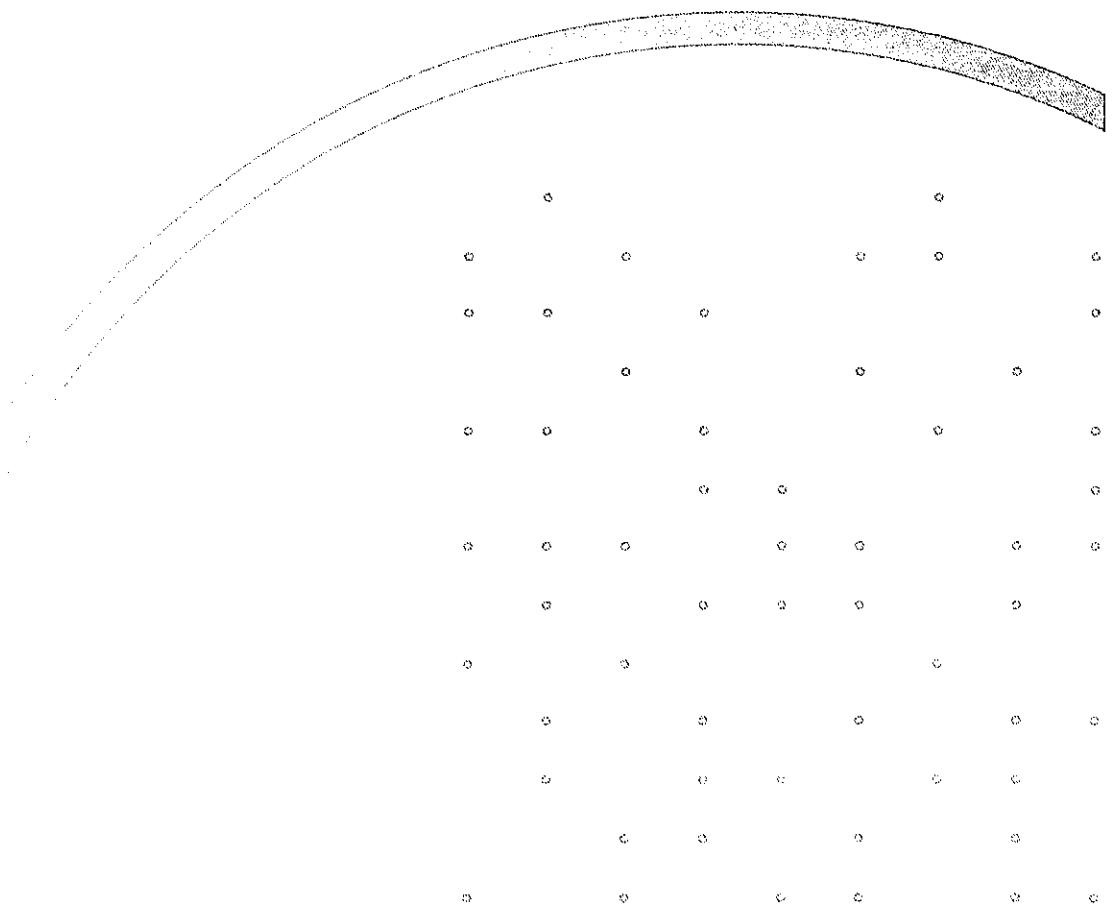
The high degree of standardisation in a **process costing** environment means that it is ideal for **setting performance standards**. However, costs, materials usage/wastage, labour inefficiencies, machine breakdowns and so on cannot be traced to a specific item. These features can only be measured on an average per unit basis. A measure like 'cost per unit' in a processing environment reflects **average performance over a period of time**. It may therefore be more difficult to improve on existing performance standards, as inefficiencies may not be easily identifiable.

A number of performance indicators can be used to assess operations.

- Quality
- Number of customer complaints and warranty claims
- Lead times
- Rework
- Delivery to time
- Non-productive hours
- System (machine) down time

These indicators can also be expressed in the form of ratios or percentages for comparative purposes. Like physical measures, they can be produced quickly and trends can be identified and acted on rapidly.

Further question practice



Section A questions

- 1 Which of the following statements is false?
 - Management accounts detail the performance of an organisation over a defined period and the state of affairs at the end of that period.
 - There is no legal requirement to prepare management accounts.
 - Limited liability companies must prepare financial accounts
 - The format of management accounts is entirely at management discretion.

- 2 Diane carries out routine processing of invoices in the purchasing department of L Co. Joanne is Diane's supervisor. Lesley is trying to decide how many staff will be needed if some proposed new technology is implemented. Tracey is considering the new work that L Co will be able to offer and the new markets it could enter, once the new technology is well established.

Required

Which member of L Co carries out tactical activities?

- Diane
- Joanne
- Lesley
- Tracey

- 3 Which of the following statements is false?

- Financial accounting information can be used for internal reporting purposes.
- Routine information can be used to make decisions regarding both the long term and the short term.
- Management accounting provides information relevant to decision making, planning, control and evaluation of performances.
- Cost accounting can only be used to provide inventory valuations for internal reporting.

- 4 Which of the following is NOT part of the planning stage in the decision-making process?

- Deciding on the optimal way in which an objective might be achieved
- Identifying ways which might contribute to the achievement of specified objectives
- Obtaining data about actual results
- Identifying goals or objectives

- 5 Which of the following statements about stratified sampling is/are true?

- (1) The sample selected will be representative of the population.
 - (2) The structure of the sample will reflect that of the population if the same proportion of individuals is chosen from each stratum.
 - (3) It requires prior knowledge of each item in the population.
- 1 and 3 only
 - 2 and 3 only
 - 1, 2 and 3
 - 3 only

- 6 Which of the following is an example of discrete data from a primary source?

- A report in a newspaper giving retail sales for the month
 - An eyewitness account of the number of customers
 - A website showing the average height for children aged seven
 - A colleague's measurement of the distance from the office to the head office
- 7 Which of the following is a disadvantage of quota sampling?
- It is expensive
 - It is administratively complicated
 - A sampling frame is necessary
 - It can result in certain biases
- 8 A survey of heights of lampposts is carried out to find out if there is any variation across the country.
What sort of data is being collected in such a survey?
- Quantitative Discrete
 - Qualitative Discrete
 - Quantitative Continuous
 - Qualitative Continuous
- 9 The costs of materials for product B are made up as follows.
- Material P: \$1,000
 Material Q: \$600
 Material R: \$1,025
 Material S: \$375
- Required**
- If the material proportions were displayed on a pie chart, what would be the angle of the section representing material Q?
- 72 degrees
 - 120 degrees
 - 144 degrees
 - 204 degrees
- 10 The following table shows the typical salary of part-qualified accountants in five different regions of Flatland.

Area	Salary \$
South-East	21,500
Midlands	20,800
North-East	18,200
North-West	17,500
South-West	16,700

Required

What is the best diagram to draw to highlight the differences between areas?

- Pie chart
 - Percentage component bar chart
 - Line graph
 - Simple bar chart
- 11 You have just calculated for the last two six-monthly periods, the running costs of a factory, broken down into five categories. You are using a computer package which can produce pie charts, time series graphs and scatter diagrams, among others.

Required

What graphics will be best to illustrate the relative sizes of the cost categories in this situation?

- Line graphs
- Pie charts
- Time series graphs
- Scatter diagrams

- 12 1 Postage cost
2 Invoice processed
3 Supplier account

Required

Which of the above items might be a suitable cost unit within the accounts payable department of a company?

- Item 1 only
- Item 2 only
- Item 3 only
- Items 2 and 3 only

- 13 Which TWO of the following are direct expenses?
- The cost of special designs, drawing or layouts
 - The hire of tools or equipment for a particular job
 - Salesperson's wages
 - Rent, rates and insurance of a factory

- 14 What is the name of a cost that contains both fixed and variable elements, and so is partly affected by changes in the level of activity?
- A direct cost
 - An unavoidable cost
 - A semi-variable cost
 - A prime cost

- 15 A company employs three drivers to deliver goods to its customers.

Required

What sort of costs are the salaries paid to these drivers?

- A part of prime cost
- A direct production expense
- A production overhead

- A selling and distribution overhead
- 16 Variable costs are conventionally deemed to:
- Be constant per unit of output
 - Vary per unit of output as production volume changes
 - Be constant in total when production volume changes
 - Vary in total from period to period when production is constant
- 17 The valuation department of a large firm of surveyors wishes to develop a method of predicting its total costs in a period.

The following past costs have been recorded at two activity levels

	Number of valuations (V)	Total cost (TC) \$
Period 1	420	82,200
Period 2	515	90,275

Required

How could the total cost model for a period be represented?

- $TC = \$46,500 + 85V$
- $TC = \$42,000 + 95V$
- $TC = \$46,500 - 85V$
- $TC = \$51,500 - 95V$

- 18 A company's weekly costs (\$C) were plotted against production level (P) for the last 50 weeks and a regression line calculated to be $C = 1,000 + 250P$.

Required

Which statement about the breakdown of weekly costs is true?

- Fixed costs are \$1,000. Variable costs per unit are \$5.
- Fixed costs are \$250. Variable costs per unit are \$4.
- Fixed costs are \$250. Variable costs per unit are \$1,000.
- Fixed costs are \$1,000. Variable costs per unit are \$250.

- 19 The value of the correlation coefficient between x and y is 0.9.

Required

Which of the following is correct?

- There is a weak relationship between x and y.
- x is 90% of y.
- If the values of x and y were plotted on a graph, the line relating them would have a slope of 0.9.
- There is a very strong relationship between x and y.

- 20 The correlation coefficient between A and B is 0.4 and the correlation coefficient between C and D is -0.7.

Required

Which of the following statements is correct?

- There is a stronger relationship between A and B than between C and D.
 - There is a stronger relationship between C and D than between A and B.
 - The relationship between A and B and between C and D is the same.
 - There is insufficient information to determine which relationship is stronger.
- 21 Four years ago, material X cost \$5 per kg and the price index most appropriate to the cost of material X stood at 150.
The same index now stands at 430.
- Required**
- What is the best estimate of the current cost of material X per kg?
- \$1.74 ($\$5 \times 150 + 430$)
 - \$9.33 ($\$5 \times (430 - 150) + 150$)
 - \$14.33 ($\$5 \times 430 + 150$)
 - \$21.50 ($\$5 \times 430 + 100$)
- 22 The following data has been calculated:
 $\Sigma X = 100$, $\Sigma Y = 400$, $\Sigma X^2 = 2,040$, $\Sigma Y^2 = 32,278$, $\Sigma XY = 8,104$ and $n = 5$
- Required**
- Which of the following values for a and b are correct in the formula $Y = a + bX$?
- $a = 28$, $b = -2.6$
 - $a = 28$, $b = +2.6$
 - $a = -28$, $b = -2.6$
 - $a = -28$, $b = +2.6$
- 23 Over a period, a firm made purchases of \$800, \$1,000, \$1,100 and \$1,200 on items, the unit cost of which were \$5.00, \$6.25, \$5.50 and \$6.00 respectively.
- Required**
- What is the mean price paid per item?
- \$5.69
 - \$5.70
 - \$5.71
 - \$5.72
- 24 Consider $\Sigma f = 23$, $\Sigma fx = 79$ and $\Sigma fx^2 = 1,161$
- Required**
- What is the standard deviation (to two decimal places)?
-
- 25 A statistician wishes to compare the dispersion of four frequency distributions. Data for the distributions are as follows:

Distribution	Mean	Standard deviation
1	\$140	\$33
2	\$25,104	\$6,290

Distribution	Mean	Standard deviation
3	77 kg	27 kg
4	154 miles	32 miles

The relative dispersion of the distributions is to be measured using the coefficient of variation.

Required

Which frequency distribution has the largest coefficient of variation?

- Distribution 1
 - Distribution 2
 - Distribution 3
 - Distribution 4
- 26 A business is deciding whether to buy a new machine. The machine may contribute extra profits of \$15,000 or \$19,000 or a loss of \$1,000, with associated probabilities of 0.2, 0.6 and 0.1 respectively.

Required

What is the expected profit?

- \$35,000
 - \$14,300
 - \$19,000
 - £11,667
- 27 A normal distribution has a mean of 200 and a variance of 1,600.

Required

Approximately 20% of the population is above which of the following values?

- 234
 - 240
 - 251
 - 278
- 28 The following data relates to an item of raw material.
- | | |
|--|-----------|
| Unit cost of raw material | \$20 |
| Usage per week | 250 units |
| Cost of ordering material, per order | \$400 |
| Annual cost of holding inventory, as a % of cost | 10% |
| Number of weeks in a year | 48 |

Required

What is the economic order quantity, to the nearest unit?

- 316
- 693
- 1,549
- 2,191

- 29 The following data relates to the material control account of Duckboard Co, a manufacturing company, for the month of October.

	\$
Opening inventory	18,500
Closing inventory	16,100
Deliveries from suppliers	142,000
Returns to suppliers	2,300
Cost of indirect materials issued	25,200

Required

How would the issue of direct materials have been recorded in the cost accounts?

- Dr Material control account \$119,200. Cr WIP control account \$119,200
- Dr WIP control account \$119,200. Cr Material control account \$119,200
- Dr Material control account \$116,900. Cr WIP control account \$116,900
- Dr WIP control account \$116,900. Cr Material control account \$116,900

- 30 Bovver Co manufactures one product (the Tate). The following information relates to the Tate.

EOQ	6,000 units
Average usage	150 units per day
Minimum usage	90 units per day
Maximum usage	195 units per day
Lead time	25-30 days

Required

What is the maximum inventory level?

units

- 31 The following information is available:

Date		Units	Unit price	Value
			\$	\$
1 Jan	Balance b/f	100	5.00	500.00
3 Mar	Issue	40		
4 Jun	Receipt	50	5.50	275.00
6 Jun	Receipt	50	6.00	300.00
9 Sep	Issue	70		

Required

What is the value of the issue on 9 September if FIFO is used?

- \$350
- \$355
- \$395

- \$420

32 Consider the following:

Date		Units	Unit price	Value
			\$	\$
1 Jan	Balance b/f	100	5.00	500.00
3 Mar	Issue	40		
4 Jun	Receipt	50	5.50	275.00
6 Jun	Receipt	50	6.00	300.00
9 Sep	Issue	70		

Required

What is the value of the issue on 9 September if LIFO is used?

- \$350
 \$395
 \$410
 \$420

33 Gross wages incurred in department 1 in June were \$54,000. The wages analysis shows the following summary breakdown of the gross pay. Overtime was worked to catch up on a backlog after several employees were off sick.

	Paid to direct labour	Paid to indirect labour
	\$	\$
Ordinary time	25,185	11,900
Overtime: basic pay	5,440	3,500
premium	1,360	875
Shift allowance	2,700	1,360
Sick pay	<u>1,380</u>	<u>300</u>
	<u>36,065</u>	<u>17,935</u>

Required

What is the direct wages cost for department 1 in June?

- \$25,185
 \$30,625
 \$34,685
 \$36,065

34 The wages control account for A Co for February is shown below.

	\$		\$
Bank	128,400	Work in progress control	79,400
Balance c/d	<u>12,000</u>	Production overhead control	<u>61,000</u>
	<u>140,400</u>		<u>140,400</u>

	\$	\$
	Balance b/d	12,000

Required

Which of the following statements about wages for February is NOT correct?

- Wages paid during February amounted to \$128,400.
- Wages for February were prepaid by \$12,000.
- Direct wages cost incurred during February amounted to \$79,400.
- Indirect wages cost incurred during February amounted to \$61,000.

- 35 Slocombe Co budgeted to produce 10,000 units of its product (the Brahms) in the budgeted time of 50,000 hours. During that period, the company produced 12,500 units in a total time of 68,750 hours.

Required

What is the capacity ratio for the period (to one decimal place)?

	%
--	---

- 36 A company had 500 workers at the beginning of a period. During the period, 70 workers left the company for various reasons and 46 new workers were employed.

Required

What is the labour turnover rate for the period (to the nearest %)?

	%
--	---

- 37 An employee is paid on a piecework basis. The basis of the piecework scheme is as follows:

Number of units	Payment
1 to 100 units	\$0.25 per unit
101 to 200 units	\$0.35 per unit
201 to 299 units	\$0.45 per unit

Only the additional units qualify for the higher rates. Rejected units do not qualify for payment. During a particular day, the employee produced 250 units, of which 31 were rejected as faulty.

Required

What did the employee earn for their day's work?

- \$68.55
- \$82.50
- \$98.55
- \$112.50

- 38 A company absorbs overheads based on labour hours. Data for the latest period are as follows:

Budgeted labour hours	8,500
Budgeted overheads	\$148,750

Actual labour hours	7,928
Actual overheads	\$146,200

Required

Based on the data given above, what is the labour hour overhead absorption rate?

- \$17.20 per hour
- \$17.50 per hour
- \$18.44 per hour
- \$18.76 per hour

39 A company absorbs overheads based on labour hours. Data for the latest period are as follows:

Budgeted labour hours	8,500
Budgeted overheads	\$148,750
Actual labour hours	7,928
Actual overheads	\$146,200

Required

Based on the data given above, what is the amount of under-/over-absorbed overhead?

- \$2,550 under-absorbed overhead
- \$2,550 over-absorbed overhead
- \$7,460 over-absorbed overhead
- \$7,460 under-absorbed overhead

40 Factory overheads can be absorbed by which of the below methods?

- (1) Direct labour hours
- (2) Machine hours
- (3) As a percentage of prime cost
- (4) \$x per unit
- (1), (2), (3) or (4)
- (1) or (2) only
- (1), (2) or (3) only
- (2), (3) or (4) only

41 Which of the following would be the most appropriate basis for apportioning machinery insurance costs to cost centres within a factory?

- The number of machines in each cost centre
- The floor area occupied by the machinery in each cost centre
- The value of the machinery in each cost centre
- The operating hours of the machinery in each cost centre

42 A factory consists of two production cost centres (A and B) and two service cost centres (C and D). The total allocated and apportioned overhead for each is as follows.

A	B	C	D
\$95,000	\$82,000	\$46,000	\$30,000

It has been estimated that each service cost centre does work for the other cost centres in the following proportions.

	A	B	C	D
Percentage of service cost centre X to	40	40	-	20
Percentage of service cost centre Y to	30	60	10	-

Required

After the reapportionment of service cost centre costs has been carried out using a method that fully recognises the reciprocal service arrangements in the factory, what is the total overhead for production cost centre A?

- \$122,400
 - \$124,716
 - \$126,000
 - \$127,000
- 43 B Co makes a product which has a variable production cost of \$21 per unit and a sales price of \$39 per unit. At the beginning of 20X5, there was no opening inventory and sales during the year were 50,000 units. Budgeted and actual fixed costs (production, administration, sales and distribution) totalled \$328,000. Budgeted and actual production was 70,000 units.

Required

What is the value of closing inventory under- absorption costing?

\$

- 44 Davy Crockett Co makes hats, mainly for fancy dress costumes. The company expected to produce 25,000 hats during the year which would be expected to incur \$125,000 in fixed costs. The total cost of each hat is \$30 (including fixed costs) and the company can sell them for \$40 each. Sales during the year were 15,000 hats from a production volume of 20,000. Actual fixed costs were \$80,000 and there was no opening inventory.

Required

What is the marginal costing net profit for the year?

\$

- 45 HMF Co produces a single product. The budgeted fixed production overheads for the period are \$500,000. The budgeted output for the period is 2,500 units. Opening inventory at the start of the period consisted of 900 units and closing inventory at the end of the period consisted of 300 units. Using marginal costing principles, the profit was \$800,000.

Required

If absorption costing principles were applied, what would the profit for the period be?

- \$925,000
- \$675,000
- \$920,000
- \$680,000

- 46 A chemical is manufactured in two processes, X and Y. Data for process Y for last month are as follows:

Material transferred from process X	2,000 litres @ \$4 per litre
Conversion costs incurred	\$12,240
Output transferred to finished goods	1,600 litres

No losses occur in the process.

Closing work in progress is fully complete for material, but is only 50% processed.

Required

What is the value of the closing work in progress (to the nearest \$)?

- \$1,360
- \$2,160
- \$2,960
- \$4,320

- 47 20,000 litres of liquid were put into a process at the beginning of the month at a cost of \$4,400. The output of finished product was 17,000 litres. The normal level of waste in this process is 20% and the waste which is identified at the end of the process can be sold at \$0.50 per litre.

Required

What is the abnormal gain or loss and what is the cost per unit?

- Abnormal gain \$1,000, cost per unit \$0.15
- Abnormal loss \$1,000, cost per unit \$0.15
- Abnormal loss \$1,000, cost per unit \$0.28
- Abnormal gain \$1,000, cost per unit \$0.28

- 48 A food manufacturing process has a normal wastage of 10% of input. In a period, 3,000 kg of material was input and there was an abnormal loss of 75 kg. No inventories are held at the beginning or end of the process.

Required

What was the quantity of good production achieved?

 kg

- 49 A company makes a product, which passes through a single process.

Details of the process for the last period are as follows:

Materials	5,000 kg at 50c per kg
Labour	\$700
Production overheads	200% of labour

Normal losses are 10% of input in the process, and without further processing, any losses can be sold as scrap for 20c per kg.

The output for the period was 4,200 kg from the process.

There was no work in progress at the beginning or end of the period.

Required

What is the value of the abnormal loss for the period?

\$

- 50 In a process account, how are abnormal losses valued?
- At good production cost less scrap value
 - At their scrap value
 - The same as good production
 - Nil
- 51 Which of the following is a feature of job costing?
- Production is carried out in accordance with the wishes of the customer
 - It is associated with continuous production of large volumes of low-cost items
 - It establishes the cost of services rendered
 - It uses equivalent units
- 52 Which of the following ideas is NOT usually associated with a TQM environment?
- Continuous improvement
 - Right first time
 - Reduced customer service
 - Zero defects
- 53 SH Co manufactures three joint products and one by-product from a single process.
- Data for May is as follows.
- | | |
|---------------------------------|----------|
| Opening and closing inventories | Nil |
| Raw materials input | \$90,000 |
| Conversion costs | \$70,000 |
| Output | |
- | | Units | Sales price per unit \$ |
|-----------------|-------|-------------------------|
| Joint product J | 2,500 | 36 |
| K | 3,500 | 40 |
| L | 2,000 | 35 |
| By-product M | 4,000 | 1 |
- By-product sales revenue is credited to the process account. Joint costs are apportioned on a physical units basis.
- Required**
- What were the full production costs of product K in May?
- \$45,500
 - \$46,667
 - \$68,250
 - \$70,000
- 54 Samakand Preparations Co operates a continuous process, producing three products and one by-product. Output from the process for one month was as follows:

	Selling price per unit	Output
	\$	Units
Joint product		
A	38	20,000
B	54	40,000
C	40	35,000
By-product		
D	4	20,000

Total output costs were \$4,040,000.

The saleable value of the by-product is deducted from process costs before apportioning costs to each joint product.

Required

Using the sales revenue basis for allocating joint costs, what is the unit valuation for joint product B (to two decimal places)?

- \$49.50
- \$50.00
- \$45.00
- \$100

- 55 Robbie Co manufactures three products in a common process. Details of production and sales for a period are as follows:

Product	Production (units)	Sales (units)	Selling price per unit \$
Gary	20,000	18,000	50
Howard	15,000	10,000	40
Jason	10,000	6,000	90

Common costs for the period are \$1,500,000.

Required

Using the sales value method, what is the cost allocated to product Howard during the period, assuming that no other costs are incurred in production?

\$

- 56 Which of the below may be considered to be objectives of budgeting?

- (1) Co-ordination
- (2) Communication
- (3) Expansion
- (4) Resource allocation
- (1), (2), (3) and (4)

- (2) and (3) only
 - (1), (2) and (4) only
 - (1) and (3) only
- 57 A manufacturing company always carries finished goods inventory equal to 20% of the next month's budgeted sales.
Sales for the current month are 2,000 units and are budgeted to be 20% higher next month.

Required

How many units will be produced in the current month?

- 2,080
 - 1,920
 - 2,000
 - 2,400
- 58 What does the statement 'sales is the principal budget factor' mean?
- The level of sales will determine the level of cash at the end of the period.
 - The level of sales will determine the level of profit at the end of the period.
 - The company's activities are limited by the level of sales it can achieve.
 - Sales is the largest item in the budget.
- 59 PQ Co plans to sell 24,000 units of product R next year. Opening inventory of R is expected to be 2,000 units and PQ Co plans to increase inventory by 25% by the end of the year.

Required

How many units of product R should be produced next year?

- 23,500 units
 - 24,000 units
 - 24,500 units
 - 30,000 units
- 60 Which of these costs would NOT be included in the cash budget of a travel company?
- Depreciation of computer terminals
 - Commission paid to travel agents
 - Capital cost of a new computer
 - Advertising expenses
- 61 The following statements have been made about participative budgeting:
- (1) Morale and motivation are improved
 - (2) They may cause managers to introduce budgetary slack
 - (3) They are quicker to produce than non-participative budgets

Required

Which statements is/are true?

- (3) only
- (1) only
- (1) and (2) only
- (2) and (3) only

- 62 What is goal congruence (in terms of organisational control systems)?
- When the goals of management and employees harmonise with the goals of the organisation as a whole
 - When the goals of management harmonise with the goals of employees
 - When the work-related goals of management harmonise with their personal goals
 - When an organisation's goals harmonise with those of its customers
- 63 Are the following statements true or false?
- (1) Work measurement is the systematic recording and critical examination of existing and proposed ways of doing work in order to develop and apply easier and more effective methods, and reduce costs.
 - (2) Work study is a means of raising the production efficiency (productivity) of an operating units by the reorganisation of work.
- Both statements are true
 - Both statements are false
 - Statement (1) is true and statement (2) is false
 - Statement (1) is false and statement (2) is true.
- 64 Which TWO of the following refer to cost control?
- Often carried out on an ad hoc basis
 - Directed towards reducing expected costs below current or standard levels
 - The regulation of the costs of operating a business
 - Concerned with keeping costs within acceptable levels
- 65 Which of the following refers to esteem value?
- The market value of the product or service
 - The cost of producing and selling an item
 - The prestige the customer attaches to the product
 - What the article does; the purpose it fulfils
- 66 Which of the below are examples of revenue expenditure?
- (1) Purchasing inventory
 - (2) Maintenance costs of production equipment
 - (3) Purchasing a factory building
 - (4) Paying employee salaries
- (1), (2) and (3) only
 - (1), (2) and (4) only
 - (1), (3) and (4) only
 - (2), (3) and (4) only
- 67 Which method of investment appraisal leads to the selection of projects that maximise shareholder wealth?
- Discounted payback
 - Payback
 - Net present value

- Internal rate of return
- 68 The following information relates to a two-year project
- | | |
|------------------------|-------------|
| Initial investment | \$1 million |
| Cash inflow Year 1 | \$750,000 |
| Cash inflow Year 2 | \$500,000 |
| Cost of capital Year 1 | 10% |
| Cost of capital Year 2 | 15% |
- Required**
- What is the net present value of the project (to the nearest \$500)?
- (12,000)
 (\$55,000)
 \$77,000
 \$116,500
- 69 HMF Co is evaluating a project which requires investments of \$5,000 now and \$2,000 at the end of Year 1. The cash inflow will be \$7,000 at the end of Year 2 and \$6,000 at the end of Year 3. The cost of capital is 16%.
- Required**
- What is the NPV to the nearest \$?
- \$
- 70 Which of the following statements are true?
- (1) An investment with a positive NPV is viable.
(2) IRR is technically superior to NPV.
(3) Both IRR and NPV give the same accept or reject decision, regardless of the pattern of the cash flows.
- (1) and (2) only
 (1) only
 (3) only
 (1), (2) and (3)
- 71 JC Co operates a bottling plant. The liquid content of a filled bottle of product T is 2 litres. During the filling process, there is a 30% loss of liquid input due to spillage and evaporation. The standard price of the liquid is \$1.20 per litre.
- Required**
- What is the standard cost of the liquid per bottle of product T, to the nearest cent?
- \$2.40
 \$2.86
 \$3.12
 \$3.43
- 72 What is an attainable standard?
- A standard which includes no allowance for losses, waste and inefficiencies. It represents the level of performance which is attainable under perfect operating conditions.

- A standard which includes some allowance for losses, waste and inefficiencies. It represents the level of performance which is attainable under efficient operating conditions.
- A standard which is based on current operating conditions.
- A standard which is kept unchanged, to show the trend in costs.

73 Are the below statements true or false?

- (1) A standard cost is a planned unit cost.
 - (2) Standard costing can be used as a control device.
- Both statements are true
 - Both statements are false
 - Statement (1) is true and statement (2) is false
 - Statement (2) is true and statement (1) is false

74 Extracts from H Co's records for June are as follows:

	Budget	Actual
Production	3,936 units	3,840 units
Direct labour cost	\$15,744	\$17,280

Required

What is the total direct labour cost variance?

- \$1,536 (F)
- \$1,536 (A)
- \$1,920 (F)
- \$1,920 (A)

75 W Co uses a standard absorption costing system. The following data relate to one of its products:

	\$ per unit	\$ per unit
Selling price		27.00
Variable costs	12.00	
Fixed costs	<u>9.00</u>	
		21.00
Profit		<u>6.00</u>

Budgeted sales for control period 7 were 2,400 units, but actual sales were 2,550 units. The revenue earned from these sales was \$67,320. Profit reconciliation statements are drawn up using absorption costing principles.

Required

What sales variances would be included in such a statement for period 7?

- Price: \$1,530 (F) Volume: \$900 (F)
- Price: \$1,530 (A) Volume: \$900 (F)
- Price: \$1,530 (F) Volume: \$900 (A)
- Price: \$1,530 (A) Volume: \$900 (A)

76 A standard marginal costing system:

- (1) Calculates fixed overhead variances using the budgeted absorption rate per unit

- (2) Calculates sales volume variances using the standard contribution per unit
(3) Values finished goods stock at the standard variable cost of production

Required

Which of the above statements is/are correct?

- (1), (2) and (3)
- (2) and (3) only
- (1) and (2) only
- (1) and (3) only

- 77 Diddly Co earned a profit of \$305,000 in the last month. Variances were as follows:

Labour:

Rate 15,250 (F)

Efficiency 10,750 (A)

Material:

Usage 8,675 (A)

Price 9,825 (F)

Variable overheads:

Efficiency 6,275 (A)

Expenditure 2,850 (F)

Fixed overheads:

Expenditure 7,000 (F)

Sales:

Price 25,000 (A)

Volume 32,000 (F)

Required

What was Diddly Co's budgeted profit for last month?

- \$321,225
- \$288,775
- \$371,925
- \$254,300

- 78 The B Co uses a standard absorption costing system and produces one product, the Blob. The following information is available for September.

Standard cost per Blob	\$31
Budgeted sales (units)	7,100
Actual sales (units)	6,600
Sales price variance	\$1,250 (A)
Sales volume variance	\$4,500 (A)

Required

What is the sales revenue for September?

- \$252,250
- \$256,750
- \$262,750
- \$265,250

79 Are the following statements true or false?

- (1) Vision and mission are derived from goals
- (2) All goals can be measured
- Both statements are true
- Both statements are false
- Statement (1) is true and statement (2) is false
- Statement (2) is true and statement (1) is false

80 In the statements below, which objectives are correctly described?

- (1) OPERATIONAL: Designed to plan and control individual functions within the organisation
- (2) TACTICAL: Day-to-day performance targets to ensure operations are carried out effectively and efficiently
- (3) STRATEGIC: Set the overall long-term objectives for the organisation as a whole
- (1), (2) and (3)
- (1) only
- (3) only
- (2) only

81 Are the below statements true or false?

- (1) Critical success factors are quantified embodiments of mission.
- (2) Strategic objectives are measures used to assess performance.
- Both statements are true
- Both statements are false
- Statement (1) is true and statement (2) is false
- Statement (2) is true and statement (1) is false

82 Which TWO of the following are methods for helping to encourage managers to take a long-term view?

- Make managers' short-term targets more challenging
- Link managers' rewards to share price
- Set financial targets only and avoid quality based targets
- Provide sufficient management information about business aims

83 Comparing internal operations with non-competing businesses, regardless of industry, is known as which of the following?

- Strategic benchmarking
- Functional benchmarking
- Internal benchmarking
- Competitive benchmarking

84 The following information relates to P Co at 31 December 20X4:

	\$
Revenue	3,000
Gross profit	990

Net profit	450
Non-current assets	1,920

Required

What is the net profit percentage?

- 15%
- 33%
- 66%
- 85%

85 The following information relates to P Co at 31 December 20X7:

	\$
Revenue	3,000
Gross profit	990
Net profit	450
Inventory	125
Trade receivables	260
Cash	1,920

Required

What is the accounts receivable collection period?

- 32 days
- 49 days
- 95 days
- 211 days

86 Which of the following is a feature of the residual income performance measure?

- It is a relative measure.
- It measures divisional performance based on multiple values.
- It generally decreases as assets get older.
- It helps you to select a proposal that will maximise wealth in absolute terms.

87 In the last year a division's controllable return on investment was 25% and its controllable profit was \$80,000. The cost of finance appropriate to the division was 18% per annum.

Required

What was the division's controllable residual income in the last year?

- \$5,600 $\$80,000 \times (0.25 - 0.18)$
- \$22,400 $\$80,000 - (\$80,000 \div 0.25 \times 0.18)$
- \$74,400 $\$80,000 - (\$80,000 \times (0.25 - 0.18))$
- \$76,400 $\$80,000 - (\$80,000 \times 0.25 \times 0.18)$

88 The following information relates to P Co at 31 December 20X0:

	\$
Revenue	3,000
Gross profit	990
Net profit	450
Inventory	125
Trade receivables	260
Cash	1,920

Inventories	1,550
Short-term payables	2,100
Receivables	1,300
Cash at bank	1,250

Required

Which of the following is the quick ratio for P Co to two decimal places?

- 1.95
- 1.21
- 0.62
- 0.74

89 Which of the following is a non-financial performance measure?

- Share price
- Delivery time
- Cash flow
- Revenue

90 Term:

- (1) Economy
- (2) Efficiency
- (3) Effectiveness

Definition:

- (4) Ensuring outputs succeed in achieving objectives
- (5) Getting out as much as possible for what goes in
- (6) Spending money frugally

Required

Match the definition to the term.

- 1 = 4, 2 = 5, 3 = 6
- 3 = 4, 2 = 5, 1 = 6
- 2 = 4, 3 = 5, 1 = 6
- 1 = 4, 3 = 5, 2 = 6

91 Which of the following is NOT a perspective associated with the balanced scorecard?

- Customer perspective
- Financial perspective
- Reliability perspective
- Innovation and learning perspective

92 The following information is available for the month of June.

Budgeted hours 2,850 standard hours

Standard hours produced 3,150 standard hours

Actual hours worked 3,000

The following information is available for the month of July.

Budgeted hours	2,750 standard hours
Standard hours produced	2,800 standard hours
Actual hours worked	3,000

Required

Calculate the percentage change in the activity ratio from June to July. Work to the nearest whole percentage.

- 92%
- 8%
- 9%
- 109%

93 In the context of the balanced scorecard, the following statements have been made:

- (1) The performance measure 'Time taken to develop new products' relates to the innovation and learning perspective.
- (2) The performance measure 'Percentage of on-time deliveries' relates to the customer perspective.
- (3) The performance measure 'Return on capital employed' relates to the internal business perspective.

Required

Which of the statements is/are correct?

- (1) only
- (1) and (2) only
- (2) and (3) only
- (3) only

Section B questions

- 94 JCR Co is preparing its cash forecast for the final quarter of 20X9.

The following is JCR's forecast statement of profit or loss for the three months ending 31 December 20X9, together with forecast statements of financial position at that date and also at the end of quarter three.

Forecast statement of profit or loss for the three months ending 31 December 20X9

	\$'000
Revenue	1,290
Cost of sales	<u>(900)</u>
Gross profit	390
Depreciation	(30)
Overheads	<u>(150)</u>
Profit from operations	<u>210</u>

Forecast statements of financial position

	31 December 20X9 \$'000	30 September 20X9 \$'000
Non-current assets	1,575	1,140
Current assets		
Inventory	150	150
Receivables	128	68
Cash	<u>15</u>	<u>15</u>
	<u>293</u>	<u>233</u>
Total assets	<u>1,868</u>	<u>1,373</u>
Equity and liabilities		
Equity share capital	900	900
Retained earnings	<u>750</u>	<u>300</u>
	<u>1,650</u>	<u>1,200</u>
Current liabilities		
Payables	150	113
Accruals of overheads	68	<u>218</u>
	60	<u>173</u>
Total equity and liabilities	<u>1,868</u>	<u>1,373</u>

Required

- (a) Calculate the forecast cash receipts and cash payments for the quarter to 31 December 20X9.

	\$'000
Sales receipts	
Purchase payments	
Overhead payments	

(6 marks)

- (b) JCR Co currently sells its product for \$50 but it is anticipated that there will be a price increase of 5% from 1 February. The sales quantities are expected to be as follows:

January	25,000 units
February	27,000 units
March	29,400 units

All sales are on credit and 30% of cash is received in the month following the sale and the remainder, two months after the sale.

Required

What are the receipts from January and February sales that are received in March?

\$	
Receipts in March relating to January sales	
Receipts in March relating to February sales	

(2 marks)

- (c) Which of the following statements applies to a fixed budget? (2 marks)

- It is continuously updated by adding another accounting period when the earliest accounting period has come to an end.
- It is amended in response to changes in the level of activity.
- It is amended in response to changes in costs.
- It is produced before the control period and not subsequently changed in response to changes in activity, costs or revenues.

(Total = 10 marks)

- 95 (a) Gym Co manufactures weights for the hotel industry, which it sells for \$24 each. Variable costs of production are currently \$12 per unit. New production technology is now available which would cost \$500,000, but which could be used to make the weights for a variable cost of only \$9 per unit.

Fixed costs are expected to increase by \$40,000 per year, 75% of which will be directly as a result of installing the new technology. Gym Co charges depreciation at 20% and seeks a return on its investments of at least 10%.

The new technology would have an expected life of 5 years and a resale value after that time of \$120,000. Sales of weights are estimated to be 50,000 units per year.

The management accountant has started preparing a spreadsheet to calculate the NPV of the project, and an extract is shown below:

	A	B	C	D	E	F	G
1	Year	0	1	2	3	4	5
2	Investment \$						
3	Resale value \$						
4	Contribution \$						
5	Fixed costs \$						
6	Depreciation \$						
7	Net cash flow \$						
8	Discount factor (to 3dp)						

Required

Which figures should be shown in the following cells? (Use a minus sign to indicate cash outflows.)

B2 (1 mark) \$

G3 (resale value) \$

C4 (2 marks) \$

C5(2 marks) \$

C6 (1 mark) \$

D8 (1 mark)

(8 marks)

- (b) Which TWO of the following are advantages of the NPV method of investment appraisal?
(2 marks)

- It takes into account the time value of money
- It is the superior investment appraisal technique
- It does not require the company's cost of capital
- It is based on profits

(Total = 10 marks)

- 96 (a) BR Co is concerned that it is not making sufficient use of the manufacturing capacity and has decided to investigate by calculating some performance measurement ratios.

The following information relates to quarter 3:

Budgeted hours	3,000 standard hours
Standard hours for work produced	3,675 standard hours
Actual hours worked	3,900

Required

Calculate the following ratios for BR Co for quarter 3 (to the nearest whole percent).

Capacity ratio = %

Activity ratio = %

Efficiency ratio = % (6 marks)

- (b) In quarter 4 the capacity ratio was 115% and the efficiency ratio was 97%.

Required

Which TWO of the following statements about quarter 4 are correct?

(2 marks)

- More labour hours were worked than budgeted
- Labour hour produced fewer units per hour than budgeted
- Labour hours produced more units per hour than budgeted
- Fewer labour hours were worked than budgeted

(c) BR Co is considering using benchmarking.

Required

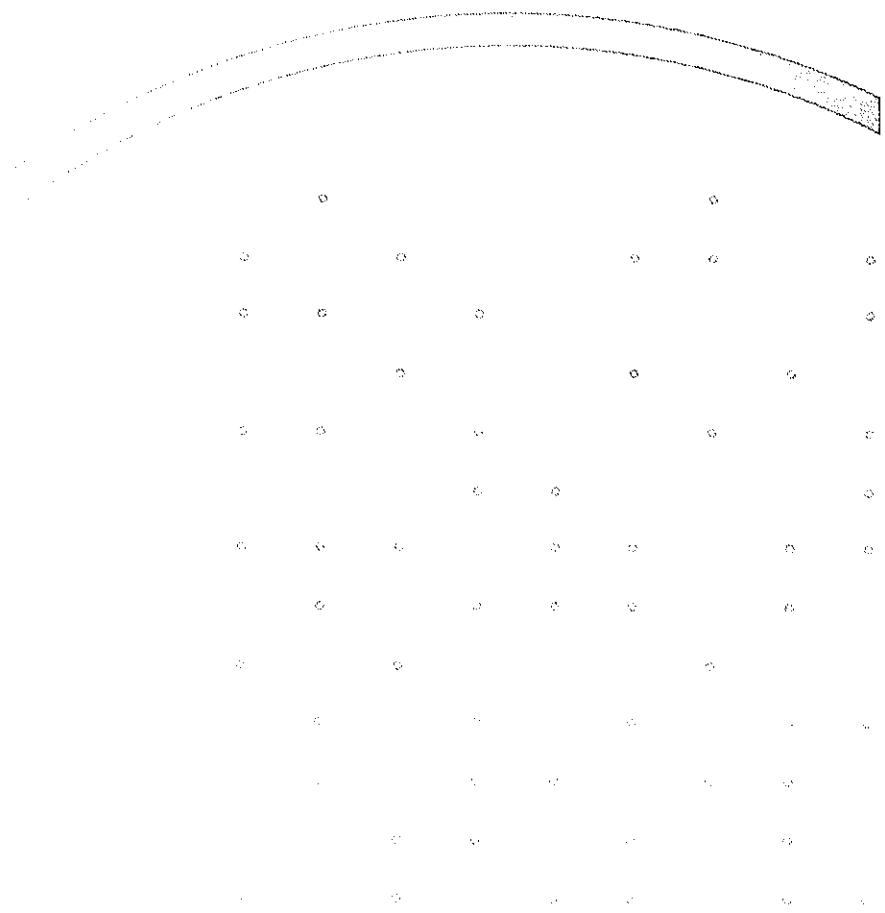
Which TWO of the following statements about benchmarking are true?

(2 marks)

- Benchmarking is only suitable for organisations with profit as an objective.
- The aim of benchmarking is to improve performance by adopting best practice.
- Benchmarking is quick to implement as no calculations are required
- Functional benchmarking involves comparing similar processes, regardless of industry.

(Total = 10 marks)

Further question solutions



Section A questions

- 1 The correct answer is: Management accounts detail the performance of an organisation over a defined period and the state of affairs at the end of that period.

Financial accounts (not management accounts) detail the performance of an organisation over a defined period and the state of affairs at the end of that period. **Management accounts** are used to aid management record, plan and control the organisation's activities and to aid the decision-making process.

- 2 The correct answer is: Lesley

Diane and Joanne work at operational level, as they are concerned with routine activities. Lesley is at an intermediate level and is managing resources. She is therefore part of tactical management. Tracey is concerned with direction setting for the business and is therefore part of strategic management.

- 3 The correct answer is: Cost accounting can only be used to provide inventory valuations for internal reporting.

Cost accounting can also be used to provide inventory valuations for external reporting

- 4 The correct answer is: Obtaining data about actual results

Obtaining data about actual results is part of the control process

- 5 The correct answer is: 1, 2 and 3

The sample selected will be representative, since it guarantees that every important category will have elements in the final sample. So 1 is true. The structure of the sample will reflect that of the population if the same proportion of individuals is chosen from each stratum. So 2 is true. The main disadvantage of stratified sampling is that it requires prior knowledge of each item in the population. So 3 is true.

- 6 The correct answer is: An eyewitness account of the number of customers

An eyewitness's account is primary data and the number of customers is discrete data. A report in a newspaper is secondary data. A website is secondary data and height is continuous data. Distance is continuous data.

- 7 The correct answer is: It can result in certain biases

Quota sampling is cheap and administratively easy, so the first two options are false. No sampling frame is necessary because the interviewer questions every person they meet up to the quota, so the third option is false. The method can result in certain biases. For example, an interviewer in a shopping centre may fill their quota by only meeting people who can go shopping during the week.

- 8 The correct answer is: Quantitative Continuous

The heights of lampposts is an example of quantitative data, as they can be measured. Since the lampposts can take on any height, the data is continuous. You should have been able to eliminate the first and fourth options immediately, since qualitative data is data that cannot be measured but which reflect some quality of what is being observed.

- 9 The correct answer is: 72 degrees

Material	Cost \$	Percentage %	Degrees
P	1,000	33.3	120
Q	600	20	72*
R	1,025	34.2	123
S	<u>375</u>	<u>12.5</u>	<u>45</u>
	<u>3,000</u>	<u>100</u>	<u>360</u>

* $600/3,000 \times 360^\circ = 72^\circ$

- 10 The correct answer is: Simple bar chart

The best diagram to draw to highlight the differences between areas is a simple bar chart. A simple bar chart is a chart consisting of one or more bars, in which the length of each bar indicates the magnitude of the corresponding data items. This is the best diagram to draw to highlight the differences of typical salaries in different areas.

- 11 The correct answer is: Pie charts

Pie charts illustrate the way in which one or more totals are broken down into their components.

- 12 The correct answer is: Items 2 and 3 only

It would be appropriate to use the cost per invoice processed and the cost per supplier account for control purposes. Therefore, items (2) and (3) are suitable cost units.

Postage cost, item (1), is an expense of the department, therefore not a suitable cost unit.

If you selected the second or third options, you were probably rushing ahead and not taking care to read all the options. Items (2) and (3) are suitable cost units, but neither of them are the only suitable suggestions.

- 13 The correct answers are:

- The cost of special designs, drawing or layouts
- The hire of tools or equipment for a particular job

Special designs and the hire of tools etc for a particular job can be traced to a specific cost unit. Therefore, they are direct expenses.

Salesperson's wages are a selling and distribution overhead, and rent, rates and insurance of a factory are production overheads.

- 14 The correct answer is: A semi-variable cost

A direct cost is one that can be directly related to a unit of output; an unavoidable cost is one that would be incurred whether or not a certain activity took place.

- 15 The correct answer is: A selling and distribution overhead

The deliveries occur after a sale is made, therefore drivers' wages are a selling and distribution overhead. The first three options are all a part of production cost, incurred before an item is sold.

- 16 The correct answer is: Be constant per unit of output

Variable costs are conventionally deemed to increase or decrease in direct proportion to changes in output. The second and fourth options imply a changing unit rate, which does not comply with this convention. The third option relates to a fixed cost.

- 17 The correct answer is: $TC = \$46,500 + 85V$

Workings as below:

	Number of valuations (V)	Total cost (TC) \$
Period 2	515	90,275
Period 1	420	<u>82,200</u>
Change due to variable cost	<u>95</u>	<u>8,075</u>

$$\text{Variable cost per valuation} = \$8,075/95 = \$85$$

$$\text{Period 2: fixed cost} = \$90,275 - (515 \times \$85) = \$46,500$$

Using good MCQ technique, you should have managed to eliminate the third and fourth options as incorrect options straightaway. The variable cost must be added to the fixed cost, rather than subtracted from it. Once you had calculated the variable cost as \$85 per valuation (as shown above), you should have been able to select the first option without going on to calculate the fixed cost (we have shown this calculation above for completeness).

- 18 The correct answer is: Fixed costs are \$1,000. Variable costs per unit are \$250.
If $C = 1,000 + 250P$, then fixed costs are \$1,000 and variable costs are \$250 per unit.
- 19 The correct answer is: There is a very strong relationship between x and y.
The correlation coefficient of 0.9 is very close to 1 and so there is a very strong relationship between x and y.
- 20 The correct answer is: There is a stronger relationship between C and D than between A and B.
It does not matter what the sign of the correlation coefficient is – the size of the correlation coefficient between C and D (0.7) is larger than that between A and B (0.4). Therefore, the relationship between C and D is stronger than between A and B.
- 21 The correct answer is: \$14.33 ($\$5 \times 430 \div 150$)
The calculation of ($\$5 \times 430 \div 150$) applies the relative increase in the price index to the specific material X.
- 22 The correct answer is: $a = 28$, $b = +2.6$

$$b = \frac{(5 \times 8,104) - (100 \times 400)}{(5 \times 2,040) - 100^2} = 2.6$$

$$a = \frac{400}{5} - 2.6 \times \frac{100}{5} = 28$$

- 23 The correct answer is: \$5.69

x \$	fx \$	f
\$5.00	800	$800 \div 5.00$
\$6.25	1,000	$1,000 \div 6.25$
\$5.50	1,100	$1,100 \div 5.50$
\$6.00	1,200	$1,200 \div 6.00$

x	fx	f
	<u>4,100</u>	
		720

$$\Sigma fx / \Sigma f = 4,100 / 720 = \$5.69$$

24 6.22

$$\sigma = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f}\right)^2} = \sqrt{\frac{1,161}{23} - \left(\frac{79}{23}\right)^2} = \sqrt{38.68} = 6.22$$

25 The correct answer is: Distribution 3

Coefficient of variation = Standard deviation / Mean

Distribution	Coefficient of variation	
1	$\$33 / \$140 = 0.24$	
2	$\$6,290 / \$25,104 = 0.25$	
3	$27 \text{ kg} / 77 \text{ kg} = 0.35$	largest
4	$32 / 154 = 0.21$	

Distribution 3 is therefore correct.

If you chose any of the other options, you did not calculate the coefficient of variation using the correct formula.

26 The correct answer is: \$14,300

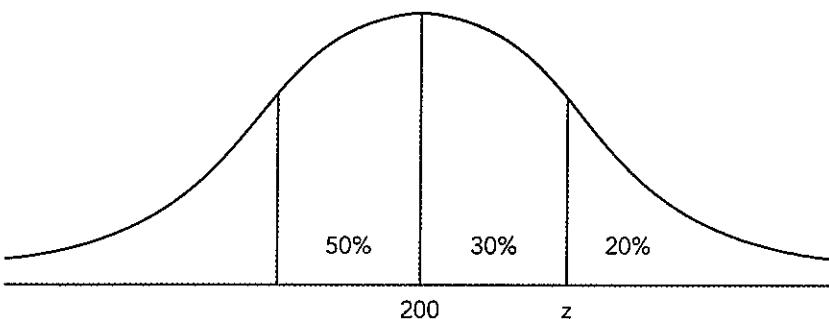
$$\begin{aligned} \text{Expected profit} &= (15,000 \times 0.2) + (19,000 \times 0.6) + (-1,000 \times 0.1) \\ &= 3,000 + 11,400 - 100 \\ &= \$14,300 \end{aligned}$$

If you selected \$35,000, you have totalled all profits.

If you selected \$19,000, you have selected the option with the highest probability.

If you selected \$11,667, you have averaged the profits without using the probabilities.

27 The correct answer is: 234



We need to find the point z standard deviations above the mean such that 20% of the frequencies are above it and 30% (50% – 20%) of the frequencies lie between the point z and the mean.

From normal distribution tables, it can be seen that 30% of frequencies lie between the mean and the point 0.84 standard deviations from the mean.

$$z = \frac{x-\mu}{\sigma}$$

$$0.84 = \frac{x-200}{\sqrt{1,600}} = \frac{x-200}{40}$$

$$33.6 = x - 200$$

$x = 200 + 33.6 = 233.6$ or 234 to the nearest whole number.

If you selected 240, you incorrectly added one standard deviation to the mean instead of 0.84 standard deviations.

If you selected 251, you have added 1.28 standard deviations to the mean instead of 0.84 standard deviations.

If you selected 278, you have found $200 + (1.96 \times 40)$ which accounts for 47.5% of the area from 200 to point z.

- 28 The correct answer is: 2,191

$$\text{EOQ} = \sqrt{\frac{2 \times \$400 \times 250 \times 48}{\$20 \times 10\%}} = 2,191$$

If you selected 316, you used weekly usage in the calculations instead of the annual usage.

If you selected 693, you did not take 10% of the material cost as the annual inventory holding cost.

If you selected option 1,549 you omitted the 2.

- 29 The correct answer is: Dr WIP control account \$116,900. Cr Material control account \$116,900

The easiest way to solve this question is to draw up a stores ledger control account.

STORES LEDGER CONTROL ACCOUNT

	\$		\$
Opening inventory b/f	18,500	Payables (returns)	2,300
Payables/cash (deliveries)	142,000	Overhead account (indirect materials)	25,200
		WIP (balancing figure)	116,900
		Closing inventory c/f	<u>16,100</u>
	<u>160,500</u>		<u>160,500</u>

If you selected the third option, you determined the correct value of the direct materials issued, but you reversed the entries.

If you selected first or second option, you placed the figure for returns on the wrong side of your account, and in the first option, you reversed the entries for the issue of direct materials from stores.

- 30 9,600 units

Reorder level = maximum usage × maximum lead time

$$= 195 \times 30 = 5,850 \text{ units}$$

Maximum inventory level = reorder level + reorder quantity – (minimum usage × minimum lead time)

$$= 5,850 + 6,000 - (90 \times 25)$$

$$= 9,600 \text{ units}$$

- 31 The correct answer is: \$355

Using FIFO, the issue on 9 September would consist of the remaining 60 units from the opening balance (40 units were issued on 3 March) plus 10 units from the batch received on 4 June.

\$	
60 units × \$5	300
10 units × \$5.50	55
	<u>355</u>

If you selected **\$350**, you used the opening inventory rate of \$5 for all the units issued: you didn't notice that 40 of these units had already been issued on 3 March.

If you selected **\$395**, you ignored the opening inventory and based your calculations only on the receipts during the year.

\$420 is incorrect because it values all the issues at the latest price paid, \$6 per unit.

- 32 The correct answer is: \$410

Using LIFO, the issue on 9 September would consist of the 50 units received on 6 June, plus 20 of the units received on 4 June.

\$	
50 units × \$6	300
20 units × \$5.50	110
	<u>410</u>

\$350 is incorrect because it is based on the opening inventory rate of \$5 per unit – this is certainly not the latest batch received.

\$395 is a FIFO calculation based on the receipts on 4 and 6 June.

\$420 is incorrect because it values all the issues at the latest price paid, \$6 per unit. However, there were only 50 units in this batch. The price for the remaining 20 units issued is the \$5.50 per unit paid for the next latest batch received.

- 33 The correct answer is: \$30,625

The only direct costs are the wages paid to direct workers for ordinary time, plus the basic pay for overtime.

$$\$25,185 + \$5,440 = \$30,625.$$

If you selected **\$25,185**, you forgot to include the basic pay for overtime of direct workers, which is always classified as a direct labour cost.

If you selected **\$34,685**, you have included overtime premium and shift allowances, which are usually treated as indirect costs. However, if overtime and shift work are incurred specifically for a particular cost unit, then they are classified as direct costs of that cost unit. There is no mention of such a situation here.

\$36,065 includes sick pay, which is classified as an indirect labour cost.

- 34 The correct answer is: Wages for February were prepaid by \$12,000.

The credit balance on the wages control account indicates that the amount of wages incurred and analysed between direct wages and indirect wages was **higher** than the wages paid through the bank. Therefore, there was a \$12,000 balance of **wages owing** at the end of February and the

second statement is not correct. Therefore, the correct option is Wages for February were prepaid by \$12,000.

The first statement is correct. \$128,400 of wages was paid from the bank account.

The third statement is correct. \$79,400 of direct wages was transferred to the work in progress control account.

The fourth statement is correct. \$61,000 of indirect wages was transferred to the production overhead control account.

35 %

$$\text{Labour capacity ratio} = \text{Actual hours worked} / \text{Hours budgeted} \times 100\% = (68,750 / 50,000) \times 100\% = 137.5\%$$

36 %

$$\text{Labour turnover rate} = (\text{Replacements} / \text{Average number of employees in period}) \times 100\%$$

$$\text{Average number of employees} = (500 + [500 - 70 + 46]) / 2 = 488$$

$$\text{Labour turnover rate} = (46/488) \times 100\% = 9\%$$

37 The correct answer is: \$68.55

$$\text{Number of units qualifying for payment} = 250 - 31 = 219$$

	\$
First 100 units @ \$0.25	25.00
Next 100 units @ \$0.35	35.00
Last 19 units @ \$0.45	8.55
	<u>68.55</u>

\$82.50 is not correct because it includes payment for the 31 rejected units. If you selected \$98.55, you calculated the correct number of units qualifying for payment, but you evaluated all of them at the higher rate of \$0.45 per unit. \$112.50 is incorrect because it includes the 31 rejected units, and evaluates them all at the higher rate of \$0.45 per unit.

38 The correct answer is: \$17.50 per hour

$$\text{Overhead absorption rate} = \text{Budgeted overheads} / \text{Budgeted labour hours} = \$148,750 / 8,500 = \$17.50 \text{ per hour.}$$

If you selected \$17.20 per hour, you divided the actual overheads by the budgeted labour hours. \$18.44 per hour is based on the actual overheads and actual labour hours. If you selected \$18.76 per hour, you divided the budgeted overheads by the actual hours.

39 The correct answer is: \$7,460 under-absorbed overhead

Workings as below

	\$
Overhead absorbed = \$17.50 × 7,928 =	138,740
Overhead incurred =	<u>146,200</u>
Under-absorbed overhead =	<u>7,460</u>

If you selected the first or second option, you calculated the difference between the budgeted and actual overheads and interpreted it as an under- or over-absorption. If you selected the third

option, you performed the calculations correctly but misinterpreted the result as an over-absorption.

- 40 The correct answer is: (1), (2), (3) or (4)

All of the overhead absorption methods are suitable, depending on the circumstances.

Method (1), direct labour hours, is suitable in a labour-intensive environment. **Method (2)**, machine hours, is suitable in a machine-intensive environment. **Method (3)**, a percentage of prime cost, can be used if it is difficult to obtain the necessary information to use a time-based method.

Method (4), a rate per unit, is suitable if all cost units are identical.

- 41 The correct answer is: The value of the machinery in each cost centre

The insurance cost is likely to be linked to the cost of replacing the machines, therefore the most appropriate basis for apportionment is the value of machinery.

The other options would all be possible apportionment bases in the absence of better information, but the value of the machinery in each cost centre is preferable.

- 42 The correct answer is: \$127,000

Workings in table below:

	Production centre A	Production centre B	C	D
	\$	\$	\$	\$
Overhead costs	95,000	82,000	46,000	30,000
First C apportionment	18,400	18,400	(46,000)	9,200
			0	39,200
First D apportionment	11,760	23,520	3,920	(39,200)
			3,920	0
Second C apportionment	1,568	1,568	(3,920)	784
			0	784
Second D apportionment	235	471	78	(784)
			78	0
Third C apportionment	31	31	(78)	16
			0	16
Third D apportionment (approx)	6	10	0	(16)
	<u>127,000</u>	<u>126,000</u>	0	0

- 43 \$ 513,800

OAR = Budgeted fixed costs / budgeted prod'n volume = \$328,000/70,000 = \$4.69

Closing inventory volume = 70,000 units - 50,000 units = 20,000 units

Value of closing inventory = 20,000 units × (\$21 + \$4.69) = \$513,800

- 44 \$ 145,000

	\$	\$
Sales (at \$40 per unit)		600,000
Opening inventory		-
Variable production cost ($\$25 \times 20,000$)*		500,000
Less closing inventory ($\$25 \times 5,000$)		<u>125,000</u>
Variable cost of sales		<u>375,000</u>
Contribution		225,000
Less fixed costs		<u>80,000</u>
Profit		<u>145,000</u>

*Variable production cost per unit = Total cost per unit – fixed cost per unit
 $= \$30 - (\$125,000/25,000 \text{ units}) = \25 per unit

- 45 The correct answer is: \$680,000

Workings in table below:

	Units
Opening inventory	900
Closing inventory	<u>300</u>
Decrease	$600 \times (\$500,000/2,500) = \$120,000 \text{ lower}$

Profit under-absorption costing = $\$800,000 - \$120,000 = \$680,000$

- 46 The correct answer is: \$2,960

Step 1. Determine output and closing WIP

Input	Output	Total	Equivalent units of production			
			Process X	%	Conversion costs	%
Units		Units	Units		Units	
2,000	Finished units	1,600	1,600	100	1,600	100
	Closing inventory (bal)	<u>400</u>	<u>400</u>	100	<u>200</u>	50
<u>2,000</u>		<u>2,000</u>	<u>2,000</u>		<u>1,800</u>	

Step 2. Calculate cost per unit of output and WIP

Input	Cost	Equivalent units	Cost per equivalent unit	
			\$	\$
Process X material	8,000	2,000		4.00
Conversion costs	12,240	1,800		<u>6.80</u>
				<u>10.80</u>

Step 3. Calculate total cost of closing WIP

Using the unit rates from Step 2:

Cost element		Number of equivalent units	Cost per equivalent unit	Total
				\$
Work in progress	Process X material	400	4.00	1,600
	Conversion costs	200	6.80	1,360
				<u>2,960</u>

If you selected \$1,360, you only included the conversion costs in your calculation. If you selected \$2,160, you did not account for the fact that closing WIP was fully complete for materials and multiplied total cost per equivalent unit by 200. \$4,320 does not allow for the fact that the work in progress (WIP) is incomplete when calculating the total cost of WIP.

- 47 The correct answer is: Abnormal gain \$1,000, cost per unit \$0.15

PROCESS ACCOUNT

	Litres	\$		Litres	\$
Materials	20,000	4,400	Normal waste		
			(4,000 × \$0.50)	4,000	2,000
			Finished goods	17,000	2,550
Abnormal gain	<u>1,000</u>	<u>150</u>			
	<u>21,000</u>	<u>4,550</u>		<u>21,000</u>	<u>4,550</u>

$$\text{Normal loss} = 20\% \times 20,000 \text{ litres} = 4,000 \text{ litres}$$

$$\text{Expected output} = 20,000 - 4,000 = 16,000 \text{ litres}$$

$$\begin{aligned}\text{Cost per unit} &= \text{Process costs} - \text{scrap proceeds of normal loss} / \text{Expected output} \\ &= (\$4,400 - (4,000 \times \$0.50)) / 16,000 \text{ litres} = \$0.15\end{aligned}$$

- 48 2,625 kg

$$\begin{aligned}\text{Good production} &= \text{input} - \text{normal loss} - \text{abnormal loss} \\ &= 3,000 - (10\% \times 3,000) - 75 \\ &= 3,000 - 300 - 75 \\ &= 2,635 \text{ kg}\end{aligned}$$

- 49 \$ 300

Input	kg	5,000
Normal loss (10% × 5,000 kg)		(500)
Abnormal loss		(300)
Output		<u>4,200</u>

$$\text{Cost per kg} = (\text{Input costs} - \text{scrap value of normal loss}) / \text{Expected output}$$

$$= (\$4,600^* - \$100) / (5,000 - 500) = \$1.00$$

Value of abnormal loss = $300 \times \$1.00 = \300

	\$
* Materials (5,000 kg × 0.5)	2,500
Labour	700
Production overhead	<u>1,400</u>
	<u>4,600</u>

- 50 The correct answer is: The same as good production

Abnormal losses have the same value as good production.

- 51 The correct answer is: Production is carried out in accordance with the wishes of the customer

Job costing is a costing method applied where work is undertaken to customers' special requirements. The second option describes process costing, the third describes service costing and the fourth describes process costing.

- 52 The correct answer is: Reduced customer service

The TQM philosophy includes accepting that the only thing that matters is the customer.

- 53 The correct answer is: \$68,250

Net process costs

	\$
Raw materials	90,000
Conversion costs	70,000
Less by-product revenue	<u>(4,000)</u>
Net process costs	<u>156,000</u>

Apportionment of net process costs

	Product	Units	Apportioned costs	
			\$	\$
	J	2,500	$\$156,000 \times (2,500/8,000)$	48,750
	K	3,500	$\$156,000 \times (3,500/8,000)$	68,250
	L	<u>2,000</u>	$\$156,000 \times (2,000/8,000)$	<u>39,000</u>
		<u>8,000</u>		<u>156,000</u>

If you selected \$45,500 or \$46,667, you apportioned a share of the process costs to the by-product; and with \$46,667 or \$70,000, you did not deduct the by-product revenue from the process costs.

- 54 The correct answer is: \$49.50

Workings as below:

Joint product	Sales revenue
	\$

Joint product	Sales revenue	
A	760,000	$(\$38 \times 20,000)$
B	2,160,000	$(\$54 \times 40,000)$
C	<u>1,400,000</u>	$(\$40 \times 35,000)$
Total sales revenues	<u>4,320,000</u>	

Joint costs to be allocated = Total output costs – sales revenue from by-product D

$$= \$4,040,000 - \$80,000 (\$4 \times 20,000)$$

$$= \$3,960,000$$

Costs allocated to joint product B = $(\$2,160,000 / \$4,320,000) \times \$3,960,000$

$$= \$1,980,000$$

Unit valuation (joint product B) = $\$1,980,000 / 40,000 = \49.50 (to two decimal places)

If you selected \$45.00, you forgot to deduct the sales revenue (from by-product D) from the joint costs to be allocated.

If you selected \$50.00, you excluded by-product D from your calculations completely.

If you selected \$100.00, you divided the total sales revenue (instead of the joint costs to be allocated) by the number of units of joint product D.

55 \$ 360,000

Remember to allocate costs according to **sales value of production**, rather than sales value of units sold:

Sales value of production:	\$
Gary (20,000 units × \$50)	1,000,000
Howard (15,000 × \$40)	600,000
Jason (10,000 × \$90)	<u>900,000</u>
	<u>2,500,000</u>

Common costs allocated to Howard = $(\$600,000 / \$2,500,000) \times \$1,500,000$

$$= \$360,000$$

56 The correct answer is: (1), (2) and (4) only

Co-ordination is an objective of budgeting. Budgets help to ensure that the activities of all parts of the organisation are co-ordinated towards a single plan. Communication is an objective of budgeting. The budgetary planning process communicates targets to the managers responsible for achieving them, and it should also provide a mechanism for junior managers to communicate to more senior staff their estimates of what may be achievable in their part of the business.

Expansion is not in itself an objective of budgeting. Although a budget may be set within a framework of expansion plans, it is perfectly possible for an organisation to plan for a reduction in activity. Resource allocation is an objective of budgeting. Most organisations face a situation of limited resources and an objective of the budgeting process is to ensure that these resources are allocated among budget centres in the most efficient way.

57 The correct answer is: 2,080

	Units	Comment
Sales	2,000	Current month sales

	Units	Comment
Less opening inventory	(400)	20% of sales (2,000) in the current month
Add closing inventory	<u>480</u>	20% of budgeted sales ($2,400 \times 20\% = 480$)
	<u>2,080</u>	

- 58 The correct answer is: The company's activities are limited by the level of sales it can achieve.
The principal budget factor is the factor which limits the activities of an organisation.
 Although cash and profit are affected by the level of sales (first and second options), sales is not the only factor which determines the level of cash and profit.
- 59 The correct answer is: 24,500 units

	Units
Required for sales	24,000
Required to increase inventory ($2,000 \times 0.25$)	<u>500</u>
	<u>24,500</u>

- If you selected 23,500 units, you subtracted the change in inventory from the budgeted sales. However, if inventories are to be increased, then extra units must be made for inventory. 24,000 units is the budgeted sales volume, which would only be equal to budgeted production if there were no planned changes to inventory volume. If you selected 30,000 units you increased the sales volume by 25%, instead of adjusting inventory by this percentage.

- 60 The correct answer is: Depreciation of computer terminals
 Depreciation is not a cash flow, so it would not be included in a cash budget.
- 61 The correct answer is: (1) and (2) only
 (1) and (2) are true but (3) is false because participative budgets consume more time than non-participative budgets.
- 62 The correct answer is: When the goals of management and employees harmonise with the goals of the organisation as a whole
 Goal congruence is when employees make decisions that are in both their own self interest and the best interest of the organisation.
- 63 The correct answer is: Statement (1) is false and statement (2) is true.
 The first statement describes method study, not work measurement, so (1) is false. (2) is true.
- 64 The correct answers are:
 - The regulation of the costs of operating a business
 - Concerned with keeping costs within acceptable levels
 The first two options refer to cost reduction rather than cost control.

- 65 The correct answer is: The prestige the customer attaches to the product
 The first option is the exchange value. The second option is the cost value. The fourth option is the use value.
- 66 The correct answer is: (1), (2) and (4) only
 Purchasing a building would be classed as capital expenditure. Expenditure on maintaining the earning capacity of non-current assets is classed as revenue expenditure.
- 67 The correct answer is: Net present value
 The main benefit of using net present value is that it maximises shareholder wealth.
- 68 The correct answer is: \$77,000
 Discounting at 10% for one year = $1/1.10$ and for two years = $1/1.10 \times 1/1.10$ but if the interest changes in year 2 to 15% then the discount rate is $1/1.10 \times 1/1.15$.

Year	Cash flow	PV factor	PV
0	(\$1,000,000)	1	(\$1,000,000)
1	\$750,000	$1/1.10 = 0.909$	\$681,750
2	\$500,000	$1/1.0 \times 1/1.15 = 0.909 \times 0.870$	\$395,415
		NPV =	\$77,165

Alternatively:

$$\begin{aligned} \text{NPV} &= -\$1,000,000 + \$750,000/1.10 + \$500,000/(1.10 \times 1.15) \\ &= \$77,000 \text{ (to the nearest \$500)} \end{aligned}$$

- 69 \$ 2,323

Net present value			
Year	Cash flow	Discount factor	Present value
	\$		\$
0	(5,000)	1.000	(5,000)
1	(2,000)	0.862	(1,724)
2	7,000	0.743	5,201
3	6,000	0.641	<u>3,846</u>
Net present value			<u>2,323</u>

- 70 The correct answer is: (1) only
 It is true that an investment with a positive NPV is financially viable. The IRR is not superior to the NPV. NPV and IRR only give the same accept or reject decision when the cash flows are conventional.
- 71 The correct answer is: \$3.43
 Required liquid input = 2 litres \times (100/70) = 2.86 litres
 Standard cost of liquid input = $2.86 \times \$1.20 = \3.43 (to the nearest cent)

If you selected \$2.40, you made no allowance for spillage and evaporation. \$2.86 is the figure for the quantity of material input, not its cost. If you selected \$3.12, you simply added an extra 30% to the finished volume. However, the wastage is 30% of the liquid input, not 30% of output.

- 72 The correct answer is: A standard which includes some allowance for losses, waste and inefficiencies. It represents the level of performance which is attainable under efficient operating conditions.

An attainable standard assumes efficient levels of operation, but includes allowances for normal loss, waste and machine downtime.

A standard which includes no allowance for losses, waste and inefficiencies. It represents the level of performance which is attainable under perfect operating conditions describes an **ideal standard**.

A standard which is based on currently attainable operating conditions describes a **current standard**.

A standard which is kept unchanged, to show the trend in costs describes a **basic standard**.

- 73 The correct answer is: Both statements are true

A standard cost is a predetermined estimated unit cost. Standard costing can be used as a control device by comparing actual results to standards and obtaining variances.

- 74 The correct answer is: \$1,920 (A)

Standard labour cost per unit = $\$15,744 / 3,936 \text{ units} = \4 per unit

\$	
Standard direct labour cost for 3,840 units ($\times \$4$)	15,360
Actual direct labour cost	<u>17,280</u>
	<u>1,920 (A)</u>

- 75 The correct answer is: Price: \$1,530 (A) Volume: \$900 (F)

Workings

\$	
Revenue from 2,550 units should have been ($\times \$27$)	68,850
but was	<u>67,320</u>
Sales price variance	<u>1,530 (A)</u>

Actual sales	2,550 units
Budgeted sales	<u>2,400 units</u>
Variance in units	150 units (F)
\times standard profit per unit ($(\$27 - \$12)$)	$\times \$6$
Sales volume variance in \$	<u>\$900 (F)</u>

If you selected any of the other options, you calculated the monetary values of the variances correctly, but misinterpreted their direction.

- 76 The correct answer is: (2) and (3) only

Statement (1) is not correct. Fixed overhead is not absorbed into production costs in a marginal costing system.

Statement (2) is correct. Sales volume variances are calculated using the standard contribution per unit (and not the standard profit per unit which is used in standard absorption costing systems).

Statement (3) is correct. As stated above, fixed overhead is not absorbed into production costs in a marginal costing system.

- 77 The correct answer is: \$288,775

Remember you are working in **reverse** (you have been given actual profit), so all **adverse** variances have to be **added back** to actual profit and **favourable** variances **deducted** to arrive at budgeted profit.

	Fav	Adv	
	\$	\$	\$
Actual profit			305,000
Variances:			
Labour:	Rate	(15,250)	
	Efficiency	10,750	
Material:	Price	(9,825)	
	Usage	8,675	
Variable overheads:	Efficiency	6,275	
	Expenditure	(2,850)	
Fixed overheads:	Expenditure	(7,000)	
Sales:	Price	25,000	
	Volume	<u>(32,000)</u>	
		(66,925)	50,700
Net favourable variance			<u>(16,225)</u>
Budgeted profit			<u>288,775</u>

- 78 The correct answer is: \$262,750

Sales volume variance

Should have sold	7,100 units
but did sell	<u>6,600 units</u>
	500 units (A)
× unit profit margin	<u>× \$p</u>
	4,500 (A)

Sales price variance

$$\text{Selling price} = \text{cost} + \text{profit margin} = \$31 + \$9 = \$40$$

Sales revenue from 6,600 units should have been (× \$40)	\$
	264,000

but was

_____?
1,250 (A)

$$\begin{aligned}\text{Sales revenue} &= \$264,000 - \$1,250 \\ &= \$262,750\end{aligned}$$

- 79 The correct answer is: Both statements are false

Goals are derived from vision and mission so the first statement is false.

Not all goals can be measured. For example, the goal of a university may be to 'seek truth' and this cannot necessarily be measured. The second statement is therefore also false.

- 80 The correct answer is: (3) only

Designed to plan and control individual functions within the organisation = TACTICAL

Day to day performance targets to ensure operations are carried out effectively and efficiently = OPERATIONAL

- 81 The correct answer is: Both statements are false

Strategic objectives (not critical success factors) are quantified embodiments of mission. Key performance indicators are measures used to assess performance. Critical success factors are elements which are central to future success.

- 82 The correct answers are:

- Link managers' rewards to share price
- Provide sufficient management information about business aims

Making managers' short-term targets more challenging will not encourage a long-term view because managers will be forced to make trade-offs between the short and long term. It is better to make short-term targets realistic.

Setting quality-based targets will encourage a longer term view because it is thought that good quality products and services leads to long-term profitability. Although low quality products and services can lead to short-term financial savings, in the long run, low quality can lead to loss of sales.

- 83 The correct answer is: Functional benchmarking

This may occur when non-competing businesses have similar operations.

- 84 The correct answer is: 15%

$$\text{Net profit percentage} = 450/3,000 \times 100\% = 15\%$$

- 85 The correct answer is: 32 days

$$\begin{aligned}\text{Accounts receivable payment period} &= \text{trade receivables}/\text{revenue} \times 365 \text{ days} \\ &= 260/3,000 \times 365 \text{ days} \\ &= 32 \text{ days}\end{aligned}$$

- 86 The correct answer is: It helps you to select a proposal that will maximise wealth in absolute terms

Residual income is an **absolute** measure (compared to return on investment, which is a relative measure) which allows you to select a proposal that will maximise your wealth in absolute terms.

It measures divisional performance based on a **single value** and as assets get older it generally **increases**. This is because the number subtracted from traceable profits decreases as the book value decreases

- 87 The correct answer is: \$22,400 $\$80,000 - (\$80,000 \div 0.25 \times 0.18)$

Residual income (RI) = traceable profit – imputed interest charge on traceable investment

You are given the return on investment and know that:

ROI = traceable profit/traceable investment

Therefore, to arrive at the traceable investment, you can rearrange the formula above to:

Traceable investment = traceable profit/ROI = $\$80,000/25\% = \$80,000/0.25 = \$320,000$.

Substituting \$320,000 back into the first formula, together with other information in the question, gives an RI of \$22,400.

$$RI = \$80,000 - (\$320,000 \times 0.18) = (\$80,000 - \$57,600) = \$22,400$$

- 88 The correct answer is: 1.21

$$(\$1,300 + \$1,250)/\$2,100 = 1.21$$

If you selected 1.95, you calculated the current ratio and included inventory in your calculation.

0.62 is receivables divided by payables.

0.74 is inventory divided by payables.

- 89 The correct answer is: Delivery time

The other options are all financial performance measures.

- 90 The correct answer is: 3 = 4, 2 = 5, 1 = 6

Ensuring outputs succeed in achieving objectives = Effectiveness

Getting out as much as possible for what goes in = Efficiency

Spending money frugally = Economy

- 91 The correct answer is: Reliability perspective

The fourth perspective not listed is the internal business perspective.

- 92 The correct answer is: 8%

June

Activity ratio = (Output measured in std hrs/Budgeted hrs) × 100%

$$= (3,150/2,850) \times 100\%$$

= 111% (to the nearest whole percent)

July

Activity ratio = (Output measured in std hrs/Budgeted hrs) × 100%

$$= (2,800/2,750) \times 100\%$$

= 102% (to the nearest whole percent)

Difference between June and July activity ratio = 111 – 102

$$= 9$$

9 as a percentage of June's activity ratio of 111

$$= 9/111 \times 100\%$$

$$= 8\%$$

- 93 The correct answer is: (1) and (2) only

The performance measure 'Return on capital employed' relates to the financial perspective.

Section B questions

- 94 (a) Sales receipts = $1,290 + 68 - 128 = 1,230$
 Purchase payments = $900 + 113 - 150 = 863$
 Overhead payments = $150 + 60 - 68 = 142$
- (b) Receipts in March relating to January sales $25,000 \times \$50 \times 70\%$
 Receipts in March relating to February sales $27,000 \times \$50 \times 1.05 \times 30\%$
- (c) The correct answer is: It is produced before the control period and not subsequently changed in response to changes in activity, costs or revenues.

Response Option	Explanation
It is continuously updated by adding another accounting period when the earliest accounting period has come to an end.	This statement describes a rolling budget.
It is amended in response to changes in the level of activity.	This statement describes a flexible budget which is designed to change as volumes of output change.

A fixed budget remains fixed and is not amended.

- 95 (a) B2 \$500,000
 G3 \$120,000
 C4 \$150,000
 C5 \$30,000
 C6 \$0
 D8 0.826
- Extra contribution per unit: $\$12 - \$9 = \$3$
 $\$3 \times 50,000 \text{ units} = \$150,000$
- Extra fixed costs attributable to new technology are $\$30,000 (75\% \times \$40,000)$
 Depreciation is not a cash flow and should therefore not be included.
- (b) The correct answers are:
- It takes into account the time value of money
 - It is the superior investment appraisal technique

Response Option	Explanation
It takes into account the time value of money	As NPV discounts future cash flows it takes into account the time value of money.
It is the superior investment appraisal technique	NPV is considered to be the superior investment appraisal technique because NPV always correctly ranks projects and directly answers the question about the impact on shareholder wealth.
It does not require the company's cost of capital	A cost of capital is required to discount the cashflows in an NPV calculation. The IRR is the technique which does not require a cost of capital to be calculated because it calculates the breakeven cost of capital.
It is based on profits	NPV is based on cash and not profits.

96 (a) Capacity ratio = 130%

Activity ratio = 123%

Efficiency ratio = 94%

Capacity ratio = (actual hours worked/budgeted hours) × 100% = (3,900/3,000) × 100% = 130%

Activity ratio = (standard hours produced/budgeted hours) × 100% = (3,675/3,000) × 100% = 122.5% = 123% to nearest whole percent

Efficiency ratio = (standard hours produced/actual hours worked) × 100% = (3,675/3,900) × 100% = 94.23% = 94% to the nearest whole percent

(b) The correct answers are:

- More labour hours were worked than budgeted
- Labour hour produced fewer units per hour than budgeted

A capacity ratio of over 100% means that more labour hours were worked than budgeted. An efficiency ratio of less than 100% means that efficiency was less than budgeted ie the labour force produced fewer units per hour than budgeted.

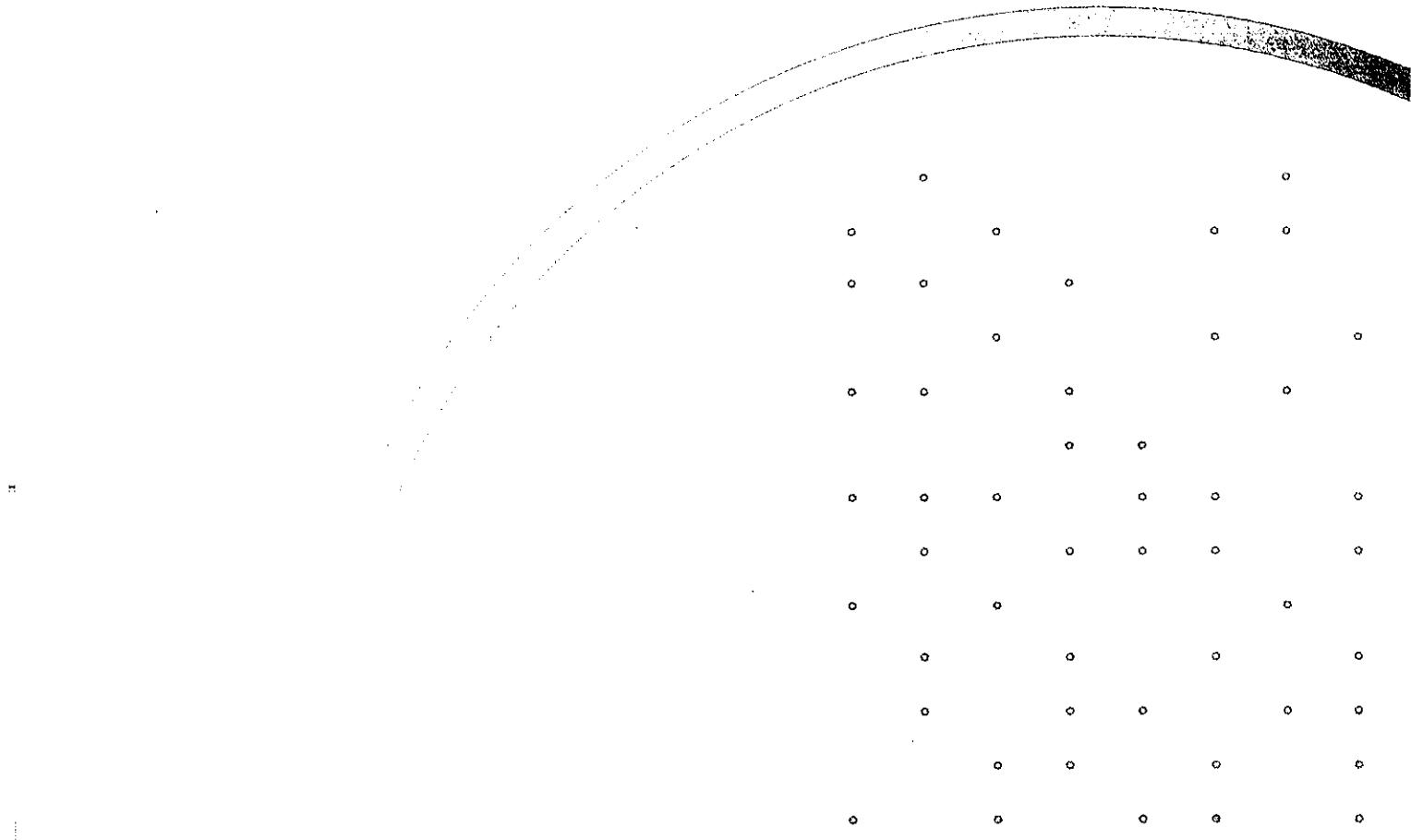
(c) The correct answers are:

- The aim of benchmarking is to improve performance by adopting best practice.
- Functional benchmarking involves comparing similar processes, regardless of industry.

Benchmarking is suitable for non-profit seeking organisations as well as those with profit as an objective.

Benchmarking can be time consuming to implement because it can be difficult to decide which activities to benchmark, and against who or what to benchmark.

Appendix 1: Formulae sheet given in the exam



Regression analysis

$$y = a + bx$$

$$a = \frac{\sum y}{n} - \frac{b \sum x}{n}$$

$$b = \frac{n \sum xy - \sum x \sum y}{n \sum x^2 - (\sum x)^2}$$

$$r = \frac{n \sum xy - \sum x \sum y}{\sqrt{(n \sum x^2 - (\sum x)^2)(n \sum y^2 - (\sum y)^2)}}$$

Economic order quantity

$$\sqrt{\frac{2C_0 D}{C_h}}$$

Economic batch quantity

$$\sqrt{\frac{2C_0 D}{C_h(1 - \frac{D}{R})}}$$

Arithmetic mean

$$\bar{x} = \frac{\sum x}{n} \quad \bar{x} = \frac{\sum fx}{\sum f} \text{ (frequency distribution)}$$

Standard deviation

$$\sigma = \sqrt{\frac{\sum (x - \bar{x})^2}{n}} \quad \sigma = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f}\right)^2} \text{ (frequency distribution)}$$

Variance

$$= \sigma^2$$

Coefficient of variation

$$CV = \frac{\sigma}{\bar{x}}$$

Expected value

$$EV = \sum px$$

Present value table

Present value of \$1, that is $(1+r)^{-n}$ where r = interest rate; n = number of periods until payment or receipt.

Periods (n)	Interest rates (r)									
	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
1	0.990	0.980	0.971	0.962	0.952	0.943	0.935	0.926	0.917	0.909
2	0.980	0.961	0.943	0.925	0.907	0.890	0.873	0.857	0.842	0.826
3	0.971	0.942	0.915	0.889	0.864	0.840	0.816	0.794	0.772	0.751
4	0.961	0.924	0.888	0.855	0.823	0.792	0.763	0.735	0.708	0.683
5	0.951	0.906	0.863	0.822	0.784	0.747	0.713	0.681	0.650	0.621
6	0.942	0.888	0.837	0.790	0.746	0.705	0.666	0.630	0.596	0.564
7	0.933	0.871	0.813	0.760	0.711	0.665	0.623	0.583	0.547	0.513
8	0.923	0.853	0.789	0.731	0.677	0.627	0.582	0.540	0.502	0.467
9	0.914	0.837	0.766	0.703	0.645	0.592	0.544	0.500	0.460	0.424
10	0.905	0.820	0.744	0.676	0.614	0.558	0.508	0.463	0.422	0.386
11	0.896	0.804	0.722	0.650	0.585	0.527	0.475	0.429	0.388	0.350
12	0.887	0.788	0.701	0.625	0.557	0.497	0.444	0.397	0.356	0.319
13	0.879	0.773	0.681	0.601	0.530	0.469	0.415	0.368	0.326	0.290
14	0.870	0.758	0.661	0.577	0.505	0.442	0.388	0.340	0.299	0.263
15	0.861	0.743	0.642	0.555	0.481	0.417	0.362	0.315	0.275	0.239
Periods (n)	Interest rates (r)									
	11%	12%	13%	14%	15%	16%	17%	18%	19%	20%
1	0.901	0.893	0.885	0.877	0.870	0.862	0.855	0.847	0.840	0.833
2	0.812	0.797	0.783	0.769	0.756	0.743	0.731	0.718	0.706	0.694
3	0.731	0.712	0.693	0.675	0.658	0.641	0.624	0.609	0.593	0.579
4	0.659	0.636	0.613	0.592	0.572	0.552	0.534	0.516	0.499	0.482
5	0.593	0.567	0.543	0.519	0.497	0.476	0.456	0.437	0.419	0.402
6	0.535	0.507	0.480	0.456	0.432	0.410	0.390	0.370	0.352	0.335
7	0.482	0.452	0.425	0.400	0.376	0.354	0.333	0.314	0.296	0.279
8	0.434	0.404	0.376	0.351	0.327	0.305	0.285	0.266	0.249	0.233
9	0.391	0.361	0.333	0.308	0.284	0.263	0.243	0.225	0.209	0.194
10	0.352	0.322	0.295	0.270	0.247	0.227	0.208	0.191	0.176	0.162
11	0.317	0.287	0.261	0.237	0.215	0.195	0.178	0.162	0.148	0.135
12	0.286	0.257	0.231	0.208	0.187	0.168	0.152	0.137	0.124	0.112
13	0.258	0.229	0.204	0.182	0.163	0.145	0.130	0.116	0.104	0.093
14	0.232	0.205	0.181	0.160	0.141	0.125	0.111	0.099	0.088	0.078
15	0.209	0.183	0.160	0.140	0.123	0.108	0.095	0.084	0.079	0.065

Annuity table

Present value of an annuity of 1 ie $\frac{1-(1+r)^{-n}}{r}$

Where r = discount rate; n = number of periods

Periods (n)	Discount rate (r)									
	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
1	0.990	0.980	0.971	0.962	0.952	0.943	0.935	0.926	0.917	0.909
2	1.970	1.942	1.913	1.886	1.859	1.833	1.808	1.783	1.759	1.736
3	2.941	2.884	2.829	2.775	2.723	2.673	2.624	2.577	2.531	2.487
4	3.902	3.808	3.717	3.630	3.546	3.465	3.387	3.312	3.240	3.170
5	4.853	4.713	4.580	4.452	4.329	4.212	4.100	3.993	3.890	3.791
6	5.795	5.601	5.417	5.242	5.076	4.917	4.767	4.623	4.486	4.355
7	6.728	6.472	6.230	6.002	5.786	5.582	5.389	5.206	5.033	4.868
8	7.652	7.325	7.020	6.733	6.463	6.210	5.971	5.747	5.535	5.335
9	8.566	8.162	7.786	7.435	7.108	6.802	6.515	6.247	5.995	5.759
10	9.471	8.983	8.530	8.111	7.722	7.360	7.024	6.710	6.418	6.145
11	10.368	9.787	9.253	8.760	8.306	7.887	7.499	7.139	6.805	6.495
12	11.255	10.575	9.954	9.385	8.863	8.384	7.943	7.536	7.161	6.814
13	12.134	11.348	10.635	9.986	9.394	8.853	8.358	7.904	7.487	7.103
14	13.004	12.106	11.296	10.563	9.899	9.295	8.745	8.244	7.786	7.367
15	13.865	12.849	11.938	11.118	10.380	9.712	9.108	8.559	8.061	7.606
(n)	Discount rate (r)									
	11%	12%	13%	14%	15%	16%	17%	18%	19%	20%
1	0.901	0.893	0.885	0.877	0.870	0.862	0.855	0.847	0.840	0.833
2	1.713	1.690	1.668	1.647	1.626	1.605	1.585	1.566	1.547	1.528
3	2.444	2.402	2.361	2.322	2.283	2.246	2.210	2.174	2.140	2.106
4	3.102	3.037	2.974	2.914	2.855	2.798	2.743	2.690	2.639	2.589
5	3.696	3.605	3.517	3.433	3.352	3.274	3.199	3.127	3.058	2.991
6	4.231	4.111	3.998	3.889	3.784	3.685	3.589	3.498	3.410	3.326
7	4.712	4.564	4.423	4.288	4.160	4.039	3.922	3.812	3.706	3.605
8	5.146	4.968	4.799	4.639	4.487	4.344	4.207	4.078	3.954	3.837
9	5.537	5.328	5.132	4.946	4.772	4.607	4.451	4.303	4.163	4.031
10	5.889	5.650	5.426	5.216	5.019	4.833	4.659	4.494	4.339	4.192
11	6.207	5.938	5.687	5.453	5.234	5.029	4.836	4.656	4.486	4.327
12	6.492	6.194	5.918	5.660	5.421	5.197	4.988	4.793	4.611	4.439
13	6.750	6.424	6.122	5.842	5.583	5.342	5.118	4.910	4.715	4.533
14	6.982	6.628	6.302	6.002	5.724	5.468	5.229	5.008	4.802	4.611
15	7.191	6.811	6.462	6.142	5.847	5.575	5.324	5.092	4.876	4.675

Area under the normal curve

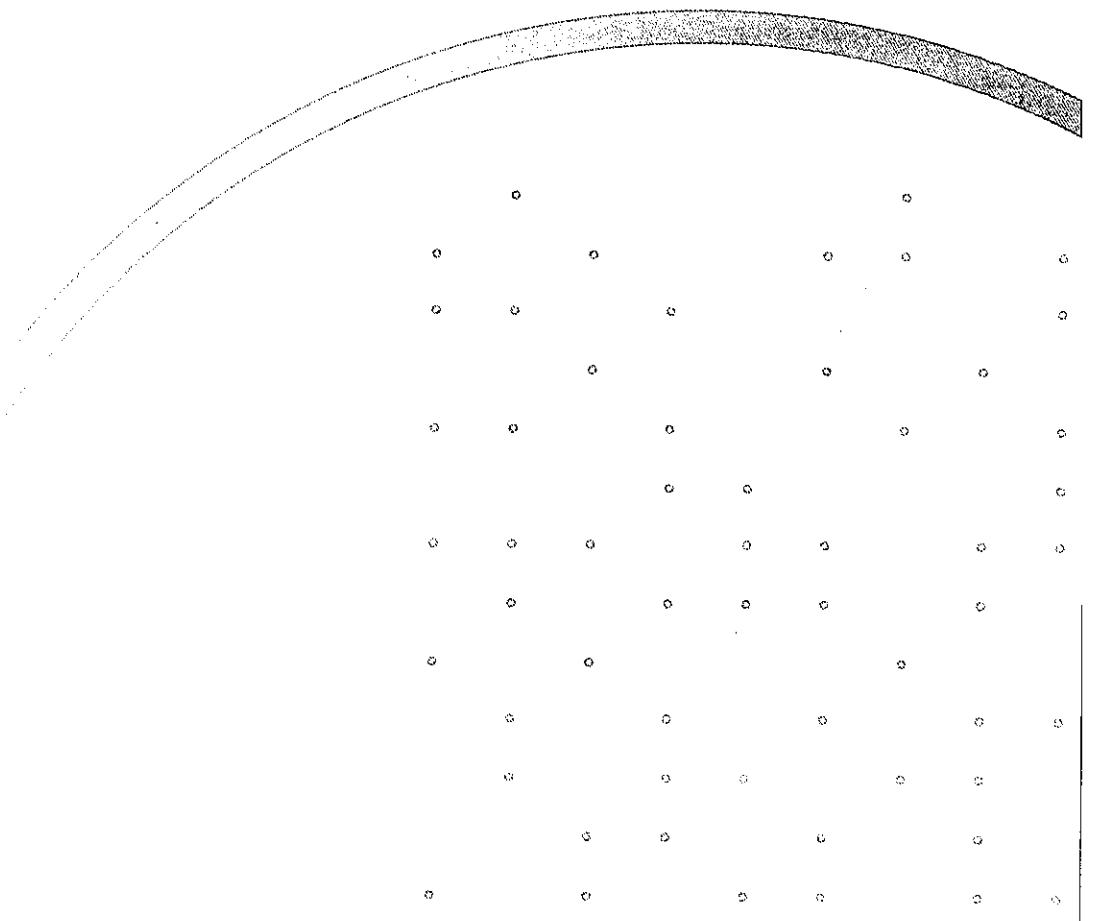
To find the area under the normal curve between the mean and a point Z standard deviations above the mean, use the table below. The corresponding area for a point Z standard deviations below the mean can be found through using symmetry.

$$Z = \frac{(x-\mu)}{\sigma}$$

Standard normal distribution table

$Z = \frac{(x-\mu)}{\sigma}$	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	.0000	.0040	.0080	.0120	.0159	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0753
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224
0.6	.2257	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2518	.2549
0.7	.2580	.2611	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2995	.3023	.3051	.3078	.3106	.3133
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4430	.4441
1.6	.4452	.4463	.4474	.4485	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4762	.4767
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4865	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4980	.4980	.4981
2.9	.4981	.4982	.4983	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990

Glossary



Chapter 1: Accounting for management

Cost accounting: Cost accounting is the 'gathering of cost information and its attachment to cost objects, the establishment of budgets, standard costs and actual costs of operations, processes, activities or products; and the analysis of variances, profitability or the social use of funds'. (CIMA Official Terminology)

Management accounting: Management accounting is the 'application of the principles of accounting and financial management to create, protect, preserve and increase value for the shareholders of for-profit and not-for-profit enterprises in the public and private sectors'. (CIMA Official Terminology)

Data: Data is the raw material for data processing. Data relates to facts, events and transactions and so forth.

Information: Information is data that has been processed in some way to make it meaningful to the person who receives it. Information is anything that is communicated. Information is sometimes referred to as processed data. The terms 'information' and 'data' are often used interchangeably. It is important to understand the difference between these two terms. Researchers who conduct market research surveys might ask members of the public to complete questionnaires about a product or a service. These completed questionnaires are data; they are processed and analysed in order to prepare a report on the survey. This resulting report is information and may be used by management for decision-making purposes.

Chapter 2: Data and presenting information

Bar chart: A bar chart is a method of presenting information in which quantities are shown in the form of bars on a chart, the length of the bars being proportional to the quantities.

Cluster sampling: Cluster sampling is a non-random sampling method that involves selecting one definable subsection of the population as the sample, that subsection taken to be representative of the population in question.

Line graphs: A line graph is a type of chart used to visualise relationships between variables. It consists of a horizontal x-axis and a vertical y-axis.

Machine/sensor data: This is data that comes from the output of devices that detect input from their surroundings.

Transactional data: This is data that comes from the transactions of an organisation.

Human/social data: This is data from humans and is often non-numerical. Social data sometimes includes data about the social media user such as their location. Human/social data can be more difficult for data analysis software to handle.

Multistage sampling: Multistage sampling is a probability sampling method which involves dividing the population into a number of sub-populations and then selecting a small sample of these sub-populations at random. Each sub-population is then divided further, and then a small sample is again selected at random. This process is repeated as many times as is necessary.

Pie chart: A pie chart is a chart which is used to show pictorially the relative size of component elements of a total.

Primary data: Primary data is data collected specifically for a particular purpose.

Secondary data: Secondary data is data which has already been collected elsewhere, for some other purpose, but can still be used or adapted for the survey being conducted.

Numerical data: As the name suggests, numerical data is data that is expressed in numbers. It can be discrete or continuous.

Discrete data: Discrete data is data which can only take on a finite or countable number of values within a given range (eg month of birth).

Continuous data: Continuous data is data that can take on any value. It is measured rather than counted (eg weight).

Categorical data: Categorical data is data that is descriptive rather than numeric. For example, age, educational level, eye colour, satisfaction levels, quality ratings. It can be nominal or ordinal.

Nominal data: Nominal data can be thought of as a name or a label and has no set order. You can count nominal data but you can't order or measure it. For example, eye colour.

Ordinal data: Ordinal data has a set order or scale. For example, levels of satisfaction data, collected on a scale of one to ten.

Sample data: Sample data is data arising as a result of investigating a sample. A sample is a selection from the population.

Population data: Population data is data arising as a result of investigating the population. A population is the group of people or objects of interest to the data collector.

Quota sampling: Quota sampling is a method of sampling in which randomness is forfeited in the interests of cheapness and administrative simplicity. Investigators are told to interview all the people they meet up to a certain quota.

Sampling frame: A sampling frame is a numbered list of all items in a population.

Simple random sample: A simple random sample is a sample selected in such a way that every member in the population has an equal chance of being included, and should therefore be free from bias.

Stratified sampling: Stratified sampling is a method of sampling which involves dividing the population into strata or categories. Random samples are then taken from each stratum or category.

Systematic sampling: Systematic sampling is a sampling method which works by selecting every nth item after a random start.

Table: A table is a matrix of data in rows and columns with the rows and columns being titled. It is two dimensional, so shows two variables.

Chapter 3: Cost classification and behaviour

Cost centre: A **cost centre** is a location, function or item of equipment in respect of which costs may be ascertained and related to cost units for control purposes.

Cost classification: The arrangement of cost items into logical groups, for example by their function (administration, production etc) or by their nature (materials, wages etc). The eventual aim of costing is to determine the cost of producing a product or service.

Cost object: A **cost object** is anything for which cost data is desired eg products, product lines, jobs, customers or departments and divisions of a company.

Cost unit: A **cost unit** is a unit of product or service in relation to which costs may be ascertained.

Direct cost: A **direct cost** is a cost that can be traced in full to the product, service or department that is being costed.

Fixed cost: A **fixed cost** is a cost which tends to be unaffected by increases or decreases in the volume of output.

Indirect costs: **Indirect production costs** are those costs which are incurred in the course of making a product/service but which cannot be identified with a particular cost unit.

Prime cost: Prime cost = Direct materials + Direct labour + Direct expenses

Semi-variable cost: A **semi-variable/semi-fixed/mixed cost** is a cost which contains both fixed and variable components and so is partly affected by changes in the level of activity.

Stepped fixed cost: A **stepped fixed cost** is a cost which is fixed in nature but only within certain levels of activity.

Variable cost: A **variable cost** is a cost which tends to vary with the volume of output.

Chapter 4: Forecasting

Coefficient of determination (r^2): The coefficient of determination r^2 measures the proportion of the total variation in the value of one variable that can be explained by variations in the other variable. It denotes the strength of the linear association between two variables.

Correlation: Two variables are said to be correlated if a change in the value of one variable is accompanied by a change in the value of another variable.

Correlation coefficient (r): The correlation coefficient (r) measures the degree of linear correlation between two variables. The nearer r is to +1 or -1, the stronger the relationship.

Interpolation: Interpolation means using a line of best fit to predict a value within two extreme points of the observed range.

Extrapolation: Extrapolation means using a line of best fit to predict a value outside the two extreme points of the observed range.

Seasonal variations (SV): Seasonal variations are short-term fluctuations in recorded values, due to different circumstances that affect results at different times of the day or week or year or any regularly repeating pattern.

Cyclical variations (CV): Recurring patterns over a longer period of time, not generally of a fixed nature (ie recession/depression/economic growth).

Random variations (RV): Irregular/unpredictable variations, due to rare/chance occurrences (hurricanes, floods, nuclear war).

Time series: A time series is a series of figures or values recorded over time.

Trend (T): The trend is the underlying long-term movement over time in the values of the data recorded (eg growth, inflation).

Chapter 5: Summarising and analysing data

Arithmetic mean: The arithmetic mean is calculated by adding all the observations and dividing by the number of observations. The arithmetic mean of a variable x is shown as \bar{x} (' x bar').

Big data: Big data refers to the mass of data that society creates each year, extending far beyond the traditional financial and enterprise data created by companies. Sources of big data include social networking sites, internet search engines, and mobile devices.

Data analytics: Data analytics is the process of collecting and examining data in order to extract meaningful business insights, which can be used to inform decision making and improve performance.

Descriptive analysis/analytics: Descriptive analysis summarises or describes what the data shows.

Expected value: An expected value is a weighted average value of the different possible outcomes from a decision, where weightings are based on the probability of each possible outcome.

Grouped data: Grouped data is where the frequency is shown in terms of a range (for example 0 - 100 units, 101 to 200 units and so on).

Ungrouped data: Ungrouped data is where the frequency is shown in terms of a specific measure/value.

Inferential analysis: Inferential analysis makes predictions about a population based on a sample.

Median: The median is the value of the middle member of an array. The middle item of an odd number of items is calculated as the

$\frac{(n + 1)\text{th}}{2}$ item.

Mode: The mode or modal value is the most frequently occurring value.

Standard deviation σ : Standard deviation σ is one of the most important measures of dispersion (spread of data). The standard deviation measures the spread of data around the mean.

Variance σ^2 : The variance is the square of the standard deviation (variance = σ^2).

Structured data: Structured data is data that is contained within a field or a data record, making it easy to analyse. It is in a standardised format (such as rows and columns in a spreadsheet) and/or resides in a specified location in a document (such as the expiry date on a credit card). Structured data is easy to analyse, store and search.

Semi-structured data: Semi-structured data is data that doesn't reside in a fixed field but does contain some properties that allow it to be analysed and organised to some extent. For example, emails contain structured data such as the date, sender name and email address but the actual content of the email is unstructured.

Unstructured data: Unstructured data is data that is not easily contained within structured data fields (such as video, audio and images). It is difficult to analyse, manage and search.

Chapter 6: Accounting for materials

Periodic stocktaking: Periodic stocktaking is a process whereby all inventory items are physically counted and valued at a set point in time, usually at the end of an accounting period.

Continuous stocktaking: Continuous stocktaking is counting and valuing selected items at different times on a rotating basis. This involves a specialist team counting and checking a number of inventory items each day, so that each item is checked at least once a year. Valuable items or items with a high turnover could be checked more frequently.

Chapter 7: Accounting for labour

Labour turnover: Labour turnover measures the number of employees leaving/being recruited in a period of time expressed as a percentage of the total labour force.

Standard hour of production: Standard hour of production is a concept used in standard costing, and refers to the number of units that can be produced by one worker, working in the standard way, at the standard rate for one hour.

Chapter 8: Accounting for overheads

Absorption costing: A method for sharing overheads between different products on a fair basis using an overhead absorption rate.

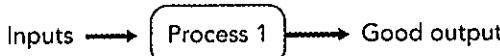
Marginal costing: Marginal costing is an alternative method of costing to absorption costing. In marginal costing, only variable costs are charged as a cost of sale and a contribution is calculated (sales revenue minus variable cost of sales). Closing inventories of work in progress or finished goods are valued at marginal (variable) production cost. Fixed costs are treated as a period cost, and are charged in full to the statement of profit or loss account of the accounting period in which they are incurred.

Overhead absorption: The process whereby overhead costs allocated and apportioned to production cost centres are added to unit, job or batch costs.

Chapter 9: Process costing

Process costing is a costing method used where it is not possible to identify separate units of production, or jobs, usually because of the continuous nature of the production process involved. Process costing involves the averaging of the total costs of each process over the total output of that process. Examples of processes where process costing may be used are:

- Oil refining
- Paper production
- Food and drink production
- Chemical production



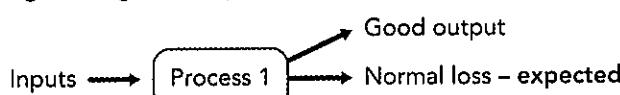
Abnormal gain: This is the shortfall of actual spoilage from normal spoilage. It is given a negative cost.

Abnormal loss: This is the excess of actual spoilage over normal spoilage. The abnormal loss should be valued at the same cost per unit as a good unit and any losses or gains taken to the statement of profit or loss (SOP/L) for the period.

Conversion cost: Labour and overhead costs together are called **conversion costs**.

Equivalent units: Equivalent units are notional whole units which represent incomplete work, and which are used to apportion costs between work in process (WIP) and completed output. It is necessary to establish the degree of completion for WIP.

Normal loss: Normal loss is the loss that is expected from a business's experience of the process eg wastage or evaporation. It is not given a cost.



Chapter 10: Costing methods

Job: A job is a cost unit that consists of a single order or contract. Each job is separately identifiable and costs can be attributed to each job eg construction of a rail link.

Batch: A batch is a cost unit that consists of a separate, readily identifiable group of units, eg production of 10,000 disposable razors. Here the cost of a single unit is too small to be measured in \$'s. The **cost per unit** manufactured in a batch is the total batch cost, divided by the number of units in the batch.

Joint products: Joint products are two or more products which are output from the same processing operation, but which are indistinguishable from each other up to their point of separation.

By-products: A by-product is a supplementary or secondary product (arising as the result of a process) whose value is small relative to that of the principal product.

Service costing: Service costing (or function costing) is a costing method concerned with establishing the costs, not of items of production, but of services rendered.

Target costing: Target costing involves setting a target cost by subtracting a desired profit margin from a competitive market price.

Target cost: Target cost is an estimate of a product cost which is determined by subtracting a desired profit margin from a competitive market price. This target cost may be less than the planned initial product cost but it is expected to be achieved by the time the product reaches the maturity stage of the product life cycle.

Total quality management (TQM): Total quality management (TQM) is the process of applying a zero defect philosophy to the management of all resources and relationships within the firm as a means of developing and sustaining a culture of continuous improvement that focuses on meeting customers' expectations.

Chapter 11: Setting budgets

Budget: A quantitative statement for a defined period of time, which may include planned revenues, expenses, assets, liabilities and cash flows. A budget facilitates planning.

Capital expenditure: Capital expenditure is expenditure which results in the acquisition of non-current assets, or an improvement in their earning capacity.

Non-current asset: A non-current asset is an asset which is acquired and retained in the business with a view to earning profits and not merely turning into cash. It is normally used over more than one accounting period.

Revenue expenditure: Revenue expenditure is expenditure which is incurred for either of the following reasons:

- (a) For the purpose of the trade of the business; this includes expenditure classified as selling and distribution expenses, administration expenses and finance charges
- (b) To maintain the existing earning capacity of non-current assets

Cash budget: A cash budget is a detailed budget of cash inflows and outflows incorporating both revenue and capital items.

Controllable cost: ‘A cost that can be controlled, typically by a cost, profit or investment centre manager’. (CIMA Official Terminology)

Functional budget: Functional (or departmental) budgets are the budgets for the various functions and departments of an organisation. They therefore include production budgets, marketing budgets, sales budgets, personnel budgets, purchasing budgets and research and development budgets.

Master budget : The **master budget** consists of a budgeted statement of profit or loss, a budgeted statement of financial position and a cash budget.

Responsibility centre: A function or department of an organisation that is headed by a manager who has direct responsibility for its performance.

Responsibility accounting: A system of accounting that segregates revenue and costs into areas of personal responsibility in order to monitor and assess the performance of each part of an organisation.

The principal budget factor : The principal budget factor (or key budget factor or limiting budget factor) is the factor that limits an organisation’s performance for a given period and is often the starting point in budget preparation.

Chapter 12: Implementing budgets

Bottom-up budget: Bottom-up budgeting ensures all budget holders are given the opportunity to participate in setting their own budgets.

Budgetary slack: Budgetary slack is the difference between the minimum necessary costs and the costs built into the budget or actually incurred.

Cost control: Cost control is concerned with regulating the costs of operating a business and keeping costs within acceptable limits.

Cost reduction: Cost reduction is a planned and positive approach to reducing expenditure.

Cost value: Cost value is the cost of producing and selling an item.

Exchange value: Exchange value is the market value of the product or service.

Use value: Use value is what the article does; the purposes it fulfils.

Esteem value: Esteem value is the prestige the customer attaches to the product.

Goal congruence: Goal congruence is when individuals make decisions that are in their self-interest and also in the best interest of the organisation.

Dysfunctional decision-making: Dysfunctional decision making occurs when goal congruence does not exist or is impaired. Managers and others take decisions that promote their self-interest at the expense of the interest of the organisation.

Profit sharing scheme: A profit sharing scheme is a scheme in which employees receive a certain proportion of their company’s year-end profits (the size of their bonus being related to their position in the company and the length of their employment to date).

Share option scheme: A share option scheme is a scheme that gives its members the right to buy shares in the company for which they work at a set date in the future and at a price usually determined when the scheme is set up.

Employee share: An employee share ownership plan is a scheme which acquires shares on behalf of a number of employees, and it must distribute these shares within a certain number of years of acquisition.

Top down budget: An imposed/top-down budget is set without allowing the budget holder to have the opportunity to participate in the budgeting process.

Value added: Value added is an alternative to profit as a business performance measure and it can be used as the basis of an incentive scheme. It is calculated as follows: Value added = sales - cost of bought-in materials and services.

Value analysis (VA): A planned, scientific approach to cost reduction, which reviews the material composition of a product and the product's design so that modifications and improvements can be made which do not reduce the value of the product to the customer or user.

Value engineering: The application of VA techniques to new products, so that new products are designed and developed to a given value at minimum cost.

Work study: Work study is a means of raising the production efficiency (productivity) of an operating unit by the reorganisation of work. There are two main parts to work study: method study and work measurement.

Method study: Method study is the systematic recording and critical examination of existing and proposed ways of doing work in order to develop and apply easier and more effective methods, and reduce costs.

Work measurement: Work measurement involves establishing the time for a qualified worker to carry out a specified job at a specified level of performance.

Organisation and methods: Organisation and methods (O&M) is a term for techniques, including method study and work measurement, that are used to examine clerical, administrative and management procedures in order to make improvements.

Chapter 13: Project appraisal

Annuities: An annual cash payment or receipt which is the same amount every year for a number of years.

Compound interest: Compound interest is where interest is calculated and paid on capital plus any interest paid or payable earned up to that point.

Cost of capital: Minimum acceptable return on an investment, generally computed as a discount rate for use in investment appraisal exercises.

Discounted payback period: The number of years necessary for the discounted cash flows of the project to payback the initial investment.

Effective annual rate of interest (EAR) : An effective annual rate of interest is the corresponding annual rate when interest is compounded at intervals shorter than a year.

Internal rate of return (IRR): The internal rate of return (IRR) is the discount rate that gives an NPV of zero. It is also the actual return that the project generates.

Net present value (NPV): Net present value (NPV) is the difference between the present value of cash inflows and the present value of cash outflows over a period of time.

Nominal rate: A nominal rate of interest is an interest rate expressed as a per annum figure although the interest is compounded over a period of less than one year. The corresponding effective rate of interest is the **annual percentage rate (APR)** (sometimes called the compound annual rate, CAR).

Payback period: The number of years necessary for the cash flows of the project to payback the initial investment.

Perpetuity: A perpetuity is an annuity that lasts forever.

Relevant cost: A relevant cost is a future cash flow arising as a direct consequence of a decision.

Sunk cost: A sunk cost is a cost which has already been incurred and therefore should not be taken account of in decision making.

Committed cost: A committed cost is a future cash outflow that will be incurred anyway, whatever decision is taken now about alternative opportunities.

Notional cost: A notional cost is a hypothetical accounting cost to reflect the use of a benefit for which no **actual** cash expense is incurred.

Chapter 14: Standard costing

Fixed budget: A fixed budget is a budget which is designed to remain unchanged regardless of the volume of output or sales achieved.

Flexible budget: A flexible budget is a budget which, by recognising different cost behaviour patterns, shows the costs and revenues at different levels of activity. A flexed budget is a budget that has been adjusted to take account of the actual volume of output, for the purposes of a like-for-like comparison with the actual results.

Standard cost: A **standard cost** is a predetermined estimated unit cost, used for inventory valuation and control.

Standard cost card: A **standard cost card** shows full details of the standard cost of each product.

Standard costing: Standard costing is a **control technique** which compares **standard** costs and revenues with **actual** results. Differences between standard and actual results are called **variances** and these are used to improve performance.

Chapter 15: Variance analysis

Direct labour total variance: The difference between what the output should have cost and what it did cost, in terms of labour.

Direct labour rate variance: Similar to the direct material price variance. It is the **difference between the standard cost and the actual cost for the actual number of hours paid for**. In other words, it is the difference between what the labour did cost and what it should have cost.

Direct labour efficiency variance: Similar to the direct material usage variance. It is the **difference between the hours that should have been worked for the number of units actually produced, and the actual number of hours worked, valued at the standard rate per hour**. In other words, it is the difference between how many hours should have been worked and how many hours were worked, valued at the standard rate per hour.

Direct material total variance: The difference between what the output actually cost and what it should have cost, in terms of material.

Direct material price variance: The difference between the standard cost and the actual cost for the actual quantity of material used or purchased. In other words, it is the difference between what the material **did cost** and what it **should have cost**.

Direct material usage variance: The difference between the standard quantity of materials that should have been used for the number of units actually produced, and the actual quantity of materials used, valued at the standard cost per unit of material. In other words, it is the difference between how much material should have been used and how much material was used, valued at standard cost.

Fixed overhead total variance: The difference between fixed overhead incurred and fixed overhead absorbed. In other words, it is the under- or over-absorbed fixed overhead.

Fixed overhead expenditure variance: Measures the under- or over-absorbed overhead caused by the **actual total overhead** being different from the budgeted total overhead. Therefore, **fixed overhead expenditure variance = Budgeted (planned) expenditure – Actual expenditure**.

Fixed overhead volume variance: Measures the under- or over-absorbed overhead caused by the **actual activity level** being different from the budgeted activity level. Therefore, **fixed overhead volume variance = (Budgeted (planned) volume – Actual volume) × standard absorption rate per unit**.

Fixed overhead volume efficiency variance: The difference between the number of hours that actual production should have taken, and the number of hours actually taken (that is, worked) multiplied by the standard absorption rate per hour.

Fixed overhead volume capacity variance: The difference between budgeted (planned) hours of work and the actual hours worked, multiplied by the standard absorption rate per hour.

Operating statement: An operating statement is a regular report for management of actual costs and revenues, usually showing variances from budget.

Sales price variance: The sales price variance compares what the sales revenue should have been for actual sales compare to the actual sales revenue and shows the impact of a different selling price to the standard.

Sales volume variance: The sales volume variance calculates the impact on profit (under an absorption costing system) or contribution (under a marginal costing system) of a different sales volume to budgeted (planned) quantity.

Variable production overhead expenditure variance: The difference between the amount of variable production overhead that should have been incurred in the actual hours actively worked, and the actual amount of variable production overhead incurred.

Variable production overhead efficiency variance: If you already know the direct labour efficiency variance, the variable production overhead efficiency variance is exactly the same in hours, but priced at the variable production overhead rate per hour.

Variance: The difference between a planned, budgeted or standard cost and the actual cost incurred. The same comparisons may be made for revenues. The process by which the total difference between standard and actual results is analysed is known as variance analysis.

Chapter 16: Target setting

Critical success factor: A performance requirement that is fundamental to competitive success.

Internal benchmarking: A method of comparing one operating unit or function with another within the same organisation.

Competitive benchmarking: Information is gathered about other direct competitors, using techniques including reverse engineering.

Functional benchmarking: Where internal functions are compared regardless of industry, this may occur when non-competing businesses have similar processes.

Strategic benchmarking: A type of competitive benchmarking aimed at strategic action and organisational change.

Mission statement: Formal statement of an organisation's mission which describe the organisation's basic purpose and what it is trying to achieve.

Short-termism: Short-termism is when there is a bias towards short-term rather than long-term performance. It is often due to the fact that managers' performance is measured on short-term results.

Strategic objectives: Set the overall long-term objectives for the organisation as a whole.

Tactical objectives: The 'middle tier' of objectives, designed to plan and control individual functions within the organisation. Tactical objectives are then implemented by setting operational objectives.

Operational objectives: Day to day performance targets to ensure that the organisation's operations are carried out efficiently or effectively.

Chapter 17: Financial performance measurement

Accounts receivable collection period: The estimated average accounts receivable collection period is a rough measure of the average length of time it takes for a company's receivables to

pay what they owe and is calculated as $(\text{trade receivables}/\text{sales}) \times 365$ days or $(\text{trade receivables}/\text{credit sales}) \times 12$ months.

Inventory turnover period: Inventory turnover period is a calculation of the number of days that inventory is held for and is calculated as $(\text{inventory} \div \text{cost of sales}) \times 365$ days or $(\text{inventory} \div \text{cost of sales}) \times 12$ months.

Inventory turnover: Cost of sales \div inventory is termed inventory turnover, and is a measure of how vigorously a business is trading.

Accounts payable payment period: Accounts payable payment period or days provides a rough measure of the average length of time it takes a company to pay what it owes. It is ideally calculated by the formula $(\text{payables}/\text{credit purchases}) \times 365$ days or $(\text{payables}/\text{credit purchases}) \times 12$ months. Cost of sales can be used as an approximation for purchases.

Cost centre: A cost centre acts as a collecting place for certain costs before they are analysed further.

Profit centre: A profit centre is any unit of an organisation (for example, division of a company) to which both revenues and costs are assigned, so that the profitability of the unit may be measured.

Revenue centre: A revenue centre is similar to a cost centre and a profit centre but is accountable for revenues only.

Investment centre: An investment centre is a profit centre whose performance is measured by its return on capital employed.

Current ratio: The current ratio is the 'standard' test of liquidity and is the ratio of current assets to current liabilities.

Gearing : Gearing is concerned with the amount of debt in a company's long-term capital structure. Gearing ratios provide a long-term measure of liquidity.

Interest cover: The number of times a company can afford to cover its interest costs from the profits it is generating.

Quick ratio: The quick ratio, or acid test ratio, is the ratio of current assets less inventories to current liabilities.

Residual income: RI is an absolute measure of the centre's profits after deducting a notional or imputed interest charge based on the total invested in the division multiplied by the company's cost of the capital.

Return on equity: The return on equity ratio (ROE) measures the ability of a firm to generate profits from its shareholders' investment in the company. It shows how much profit each unit of shareholders' equity generates. ROE is also an indicator of how effectively management is using equity financing to fund operations and grow the company. It is expressed as a percentage and calculated by dividing net income by shareholders' equity.

Profit margin: The profit margin (profit \div sales ratio) is calculated as $(\text{profit} \div \text{revenue}) \times 100\%$.

Asset turnover: Asset turnover is a measure of how well the assets of a business are being used to generate sales. It is calculated as $(\text{sales} \div \text{capital employed})$.

Return on investment: Return on investment (ROI) (also called return on capital employed (ROCE)) is calculated as $(\text{profit}/\text{capital employed}) \times 100\%$ and shows how much profit has been made in relation to the amount of resources invested.

Chapter 18: Assessing non-financial performance

Economy: Economy refers to the procurement of appropriate quantity and quality of resources at the minimum cost.

Efficiency: Efficiency refers to maximum useful output from the resources or alternatively, the required output from the minimum resource input.

Effectiveness: Effectiveness means using resources such that the output of the activity achieves the desired result.

Value for money: Value for money involves simultaneously achieving economy, efficiency and effectiveness.

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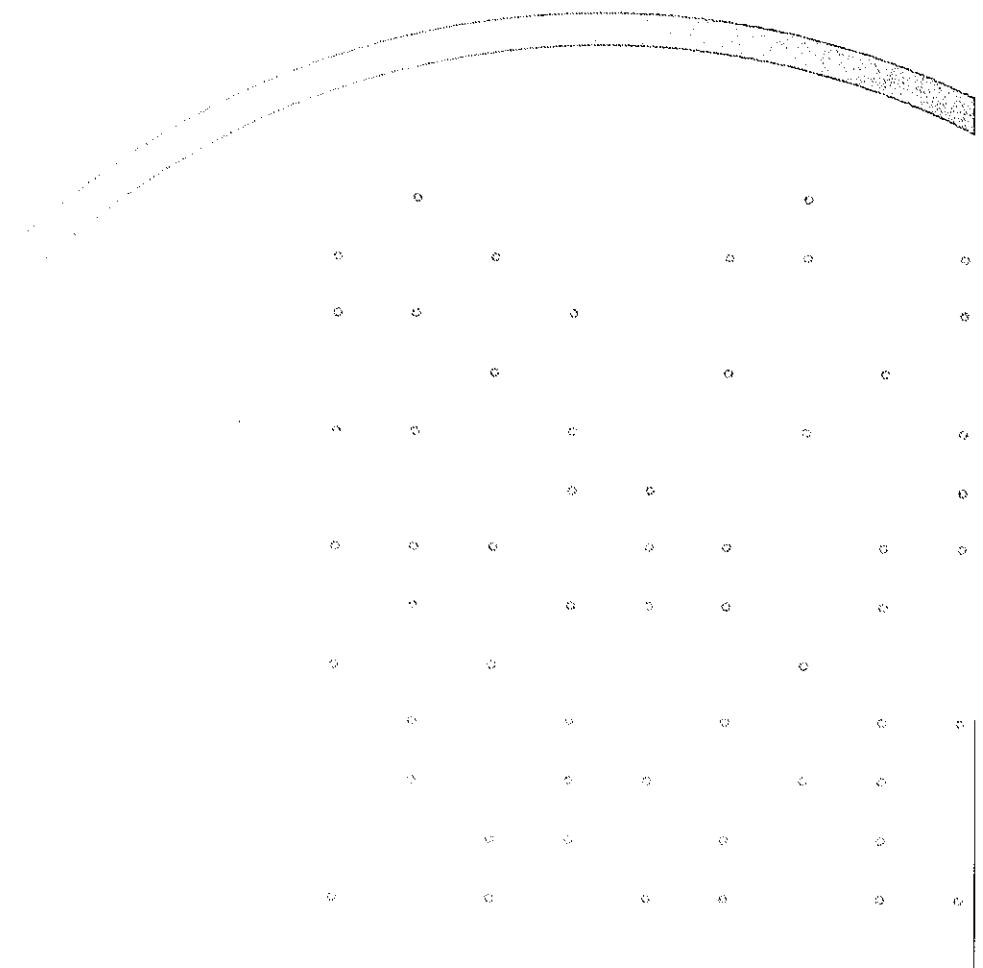
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