

LONGHORN
SECONDARY
Mathematics
TEACHER'S

GUIDE 3

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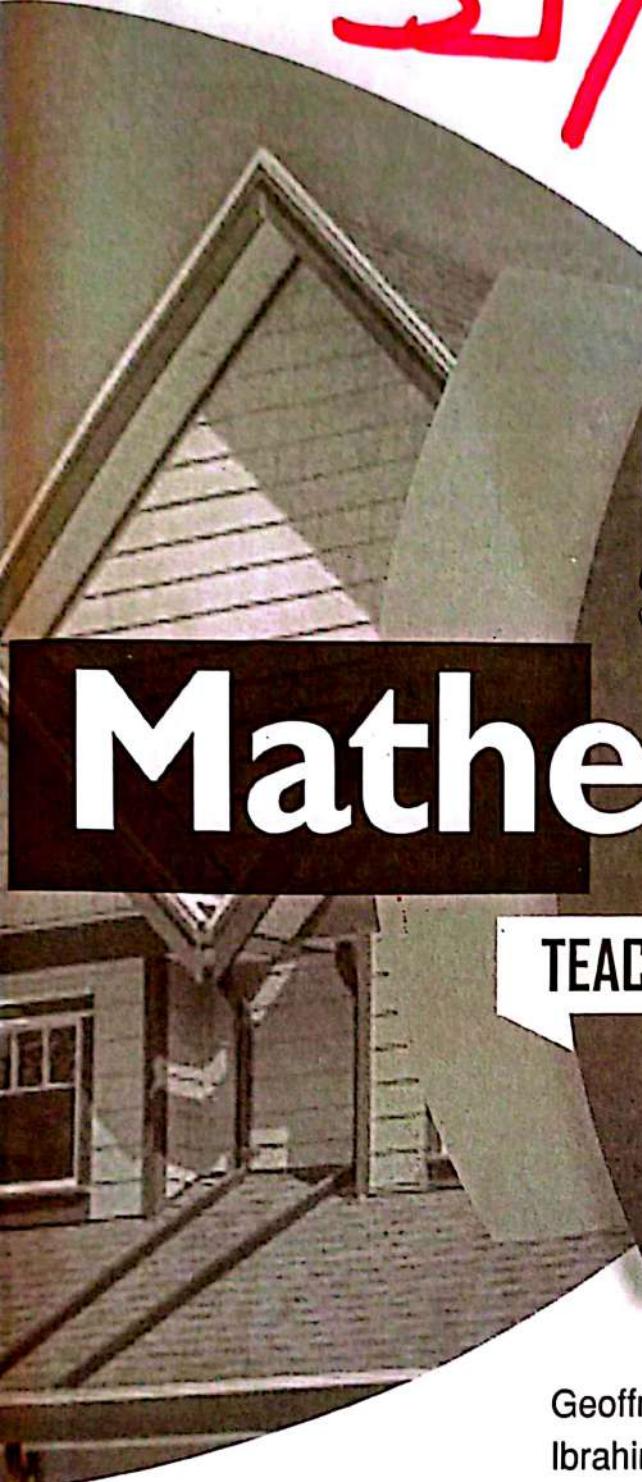
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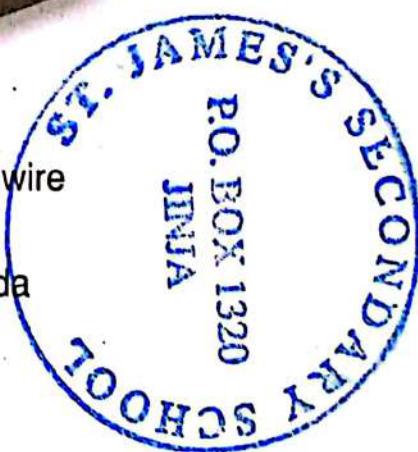


Longhorn Secondary Mathematics

TEACHER'S GUIDE

3

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Contents

Topic 1: Equation of a Straight Line.....	1
1.1: Gradient or Slope of a Straight Line	2
1.2: Gradients of parallel and Perpendicular lines.....	3
1.3: x and y Intercepts of a Linear Graph	4
1.4: Equations of Straight Lines (Pg 16 LB)	9
<i>Sample Assessment Grid of Activity of Integration 1</i>	<i>11</i>
Topic 2: Trigonometry 1	13
2.1: Trigonometric Functions	14
2.2: Angles of Elevation and Depression.....	17
<i>Sample Assessment Grid of Activity of Integration 2</i>	<i>18</i>
Topic 3 : Data Collection or Display.....	19
3.1: Measures of Central Tendency	20
3.2: Measures of Spread or Dispersion	22
3.3: Grouped Frequency Distributions.....	23
3.4: Mean, mode and median of grouped data.....	23
3.5: Assumed mean (Working mean)	24
3.6: Histogram	25
3.7: Cumulative Frequency Curve	29
<i>Assessment grid for Activity of integration 3.....</i>	<i>36</i>
Topic 4: Vectors.....	37
4.1: Revision of Vectors	38
4.2: Magnitude of a vector	38
4.3: Equal Vectors	39
4.4: Multiplication by a Scalar.....	39
4.5: Position Vectors	39
4.6: Addition of Vectors	40
4.7: Subtraction of Vectors	40
4.8: Mid Points.....	41
4.9: Proportional Division of a Line.....	42

4.10: Parallel Vectors	45
4.11: Collinear Points	45
<i>Sample Activity of Integration 4 Assessment Grid</i>	<i>45</i>
Topic 5 : Ratio and Proportion.....	45
5.1: Meaning of Ratios	46
5.2: Increase and Decrease in a given Ratio	46
5.3: Direct and Inverse Proportion.....	46
5.4: Proportional Parts	46
5.5: Scales.....	50
5.6: Scatter Graphs	50
<i>Assessment grid for Activity of integration 5</i>	<i>55</i>
Topic 6: Business Mathematics.....	57
6.1: Percentage Change	58
6.2: Compound Interest	59
6.3: Formula for Compound Interest	59
6.4: Appreciation and Depreciation	60
6.5: Foreign Currency.....	61
6.6: Hire Purchase	62
6.7: Mortgages	62
6.8: Income Tax.....	63
<i>Assessment grid for Activity of integration 6</i>	<i>64</i>
Topic 7 : Trigonometry 2.....	65
7.1: Trigonometrical Ratios of Angles greater than 90°	66
7.2: Trigonometric Ratios of 30° , 45° and 90°	68
7.3: Trigonometric Graphs.....	68
7.4: Sine and Cosine Rules	69
<i>Sample Assessment Grid of Activity of Integration 7</i>	<i>72</i>
Topic 8 : Matrices.....	73
8.1: Meaning of a Matrix?.....	74
8.2: Equality of Matrices	74

8.3: Addition and Subtraction of Matrices.....	75
8.4: Scalar Multiplication	76
8.5: Multiplication of Matrices	77
8.6: Identity and Zero Matrices.....	79
8.7: Determinant and Inverse of a 2×2 Matrix	79
<i>Assessment grid for Activity of integration 8</i>	<i>81</i>

Topic 9 : Matrix Transformation..... 83

9.1: Transformations Represented by 2×2 matrices.....	84
9.2: Identifying Matrices of Transformations	87
9.3: Identifying Transformation Matrices by Calculation.....	87
9.4: Using the inverse matrix to find the object given the image	88
9.5: Identifying the relationship between area scale factor and the determinant of a transformation matrix.....	88
9.6: Combined Transformations	90
9.7: Successive Transformations involving Matrices.....	91
<i>Assessment grid for activity of integration 9.....</i>	<i>92</i>

Topic 10 : Simultaneous Equations..... 93

10.1: Forming Simultaneous Equations.....	94
10.2: Solving Linear Simultaneous Equations Algebraically	96
10.3: Graphical Solution of Simultaneous Equation	99
10.4: Solving Simultaneous Equations Using matrices	106
Sample Assessment Grid of Activity of Integration 10.....	109

Topic 11: Probability 111

11.1: Experimental Probability 3 periods	112
11.2: Impossibilities and Certainties 2 periods	112
11.3: Theoretical Probability 2 periods	113
11.4: Mutually Exclusive and Independent Events 2 periods	113
11.5: Tree Diagrams (3 periods	114
11.6: Probability and Sets.....	115
<i>Assessment grid for Activity of integration 11.....</i>	<i>117</i>



Topic 12 : Quadratic Equations.....	119
12.1: Solving Quadratic Equations by Factorisation	120
12.2: Solving Quadratic Equations by Completing the Square	121
12.3: Solving Quadratic Equations using the Quadratic Formula	122
12.4: Forming Quadratic Equations from its Roots.....	122
12.5: Quadratic Functions and their Graphs	123
12.6: Simultaneous Equations: One Linear, One Quadratic	123
<i>Assessment Grid for Activity of integration 12.....</i>	130
Topic 13 : Circle Properties.....	131
13.1: Circle Definitions (Revision) 1 Period	132
13.2: Length of an Arc 1 Period	132
13.3: Area of a Sector 2 period	133
13.4: Area of a Triangle Using Trigonometry 2 Period	134
13.5: Chord Properties Of Circles 2 Periods	135
13.6: Area of a Segment 2 Period	135
13.7: Angle Properties of a Circle 3 Period	136
13.8: Tangent Properties of a Circle 2 Periods.....	138
<i>Assessment Grid for Activity of integration 13.....</i>	140
Glossary	141
References for mathematics.....	142

Prelude

The **mathematics** syllabus builds upon the concepts, skills, attitudes and values developed at primary school level which provides a strong baseline for further mathematical studies.

Mathematics develops the learner's critical thinking capacity, creativity and problem solving skills thereby enabling them to recognize and apply mathematical laws and principles in different aspects of life.

In addition, the independent mathematical thinking and problem solving skills the learner acquires will be helpful throughout their lives as these provide the essential tools required for a wide range of career paths including many of those in the fields of science and technology.

The primary focus of this syllabus is to develop a mathematical understanding, logical reasoning, problem solving and analytical thoughts. It emphasizes the essential mathematical skills that all citizens need for full and effective participation in civil, social and economic life.

Therefore, you should provide opportunities for learners to interact with real life situations in and outside the classroom such that they build more from existing knowledge and experience by posing challenges to learners. This basically makes them think about their own ideas and experiences as well as adding new knowledge and skills.

The learner needs to be able to calculate, estimate and measure, interpret and use data in order to manage his or her day to day life and actively contribute to the workforce.

A note on the activity-based/competence-based teaching of mathematics

The competence based or activity based approach of teaching mathematics aims at providing a learning environment, opportunities, interactions, tasks and instructions that foster deep understanding by putting the learner at the Centre of the experience. It emphasizes knowledge, understanding, application and behavioral change rather than just absorbing knowledge. Therefore, you need to build on the learners' experiences while creating activities through which they can explore the meaning of what is being learnt and understand how it's applied in practical settings. Here, teaching and learning becomes more of identifying and solving problems experienced by learners than accumulation of large amounts of knowledge.

Generic skills

Generic skills basically enable learners to access and deepen learning across the whole mathematics syllabus. They are not separate subjects but instead concepts built with in the syllabus and are part of the learning outcomes. They are assessed as part of the subject learning outcomes. These include; critical thinking and problem solving, creativity and innovation, communication, co-operation and self-directed learning, mathematical computations and ICT proficiency. All these allow young people to develop into life-long learners who can adapt to change and cope up with the challenges of life.

A note on K, U, S, V, A in the teaching of technology and design

The acronym KUSVA stands for knowledge, understanding, skills, values ; attitude. During the teaching of mathematics, let learners explore their environment; guide them to understand how things work until they demonstrate new mathematical behaviours like logical reasoning, problem solving and analytical thoughts in their society.

Crosscutting Issues

Cross cutting issues are concepts that learners need to know across all subjects. These enhance the learner's understanding of the connections between subjects and so the dynamics of life. Examples of cross cutting issues include; environmental awareness, health awareness, life planning skills, mixed abilities and involvement in socio economic challenges, citizenship and patriotism.

The structure of the teacher's guide

About this guide

As the name suggests, the teacher's guide is only a manual that identifies what and suggests instructions of how to conduct a specific activity regarding the understanding of a given mathematical concept. This implies that your expertise as a professional teacher where all possible and relevant enhancements during the conduct of the activity is highly acknowledged. You know your learners best and as a consequence, you may re-structure the activities to suit your prevailing circumstances but without losing the standard.

The guide comprises of 13 topics which are just a representation of topics in the learner's book. Every topic in the teacher's guide is preceded with a topic overview which unveils the whole idea about what to be taught. It highlights the competencies and gives you a clue of how you would introduce a specific topic.

In addition, the guide avails a comprehensive section of teacher preparation that clarifies what exactly the teacher needs to have before registering a successful mathematics lesson. This may include; the teaching and learning resource appropriate grouping learners among others. The guide also suggests possible responses from learners and some extra information relevant to a topic.

Using the guide

Our major aim is to ensure that learners attain a comprehensive understanding of a certain concept but this time by doing an activity with logically flowing tasks. The guide clearly spells out what you and the learner should be doing at each stage during the activity. However, always ensure that all the required materials for a particular activity are in place. Try to follow the proposed tasks in the guide most especially during lesson development as this shall increase the degree of correlation between the two ends. The possible responses for each task in the activity are not absolute. You are therefore advised to add more content such as to accommodate a wide range of responses.

Time management is an important aspect in the competence based teaching. Therefore, ensure that you prepare and organize the learners to do everything within the given time. It is prudent to leave at least 5 minutes before the end of the lesson. This would give room for learners to get ready for the next teacher.

A Note on Assessment and Record Keeping

It should be noted that right from the start that the Teaching-Learning process in this Curriculum is Activity based as opposed to the outgoing Curriculum that is more of Theoretical and Exam-oriented Approach. Therefore, much of the content in the Learner's Book is determined by Activities. All Activities should be carried out during the Lesson and Assessment can therefore start right away during the Lesson or at the end of your Lesson in form of Formative Assessment and then at the end of a given topic in form of Summative Assessment.

In the competency based curriculum every subject requires the teacher to ensure that there is self-discovery among the learners. It is not merely theoretical. Therefore, most of the Lessons are activity based and they need to be translated into Real Life Situations. So, there is need for the Learner to develop Life skills and Values that will enable one to be relevant in real life. This is where the Teacher's input becomes necessary. The area of emphasis may rotate around the development of the following skills;

- **Critical Thinking:** - One has to look at the situation around him /her to make an Informed Decision.
- **Creativity and Innovation:** - The Learner should be trained to be creative.
- **Communication skills:** - One has to be trained on the most appropriate ways of communicating and conveniently drive the point home without any hindrance.
- **Self-directed Learning:** - The Learner should be guided on how to discover things on his/her own. This has been captured in the Learner's Book. In many instances, the Learner will be doing tasks on his/her own and the Teacher will simply guide or facilitate, and also award marks where necessary.
- **Cooperation and Collaborative skills:**

This can be acquired by emphasizing team work where Learners will work in groups or even in pairs and even carryout project work.

On other hand, there are values that need to be emphasized and developed in the Learner like: - Honesty, Integrity, Empathy, Appreciation, Kindness, Self-Respect and Respect for others, Tolerance, Sharing and Responsible behaviour. As the teacher prepares for a given Activity, he/she generates the Awareness of the Learner about it, then make the Learner to develop Interest to participate. The Desire for this Activity should be generated naturally then finally the real Action that is assessed for tangible Results, Output or progress.

In a nut shell, the proposed Activity should possess the aspect of 'AIDA' for it to enhance meaningful and purposeful Learning.

The Teacher should also note that in all Activities, there must be time for the Learner to Discover, Understand, Explain, Apply and Analyze. These should form the core for Lesson development and assessment.

The Learner has to benefit from whatever is taught and should be able to apply them in Real Life.

ACTIVITY OF INTEGRATION

The activity of integration is a new Term in the Teaching-Learning Process under

the revised ordinary Level Curriculum. It involves developing a situation or scenario in Real Life and directs the Learner to mobilize the different Resources and even the Cognitive ability to overcome a challenge at hand.

This is the Last activity to solve a given problem through the integration of knowledge, Skills and Behaviour acquired in the topic. Therefore, the Activities carried out in class depending on a particular chapter should enable the Learner to demonstrate the Competency stated in the Introduction. Every Introduction to a given chapter in the Learner's book has got the Competency stated.

Therefore, the Activity of Integration forms the basis of assessment and evaluation more especially at the end of every topic. Each learner's Book is made up of a given number of topics. Each topic has got an activity of Integration.

It should be noted that the difference between this curriculum and the former curriculum is in methodology and assessment. The teacher has to shift from telling the learner what he or she knows to what this Learner can practically do in order to solve a future problem. This partly explains why the teacher has to plan adequately for every Lesson before the actual teaching takes place. So, the Scheme of work and Lesson Plan should be prepared adequately and they should be well coordinated to enhance meaningful learning.

The main aim of the Activity of integration is to solve a society problem. Assessment can be done over time depending on what the Teacher plans. A Society Problem can be a scenario in Real Life situations. When one critic observes the Activities of Integration in the Learner's Book, they all Address Real Life situations. So, the Role of the teacher is to prepare the Learner to carry out this Activity basing on prescribed steps in the Lesson Plan and then assess the Learner at each stage

Therefore, in the Activity of Integration there should be three main issues: -

- i) The Situation or scenario. It's based on Real Life.
- ii) Support pictures to drive the message with ease to the Learner.
- iii) The task to be performed by the Learner.

These have been clearly highlighted in the Learner's Book. The role of the teacher is to set an enabling environment for this Activity to be done as he/she facilitates and observes the Learner, after which the Teacher uses the Criterion Referenced Assessment for the purpose of Evaluation.

What is the Criterion Referenced Assessment?

It is the kind of Assessment that follows a set standard to assess and evaluate the Learner. The Teacher bases on a given kind of standard to award marks at each stage of the Activity of Integration. The Teacher should be aware that in the Curriculum, no Learner fails. One should focus on the best that a Learner can do and then award marks accordingly. Therefore, the Learner should know what the Teacher wants him/her to do.

In order to effectively carryout this kind of evaluation, the teacher must have a Guide. This Guide should base on the following Criterion: -

- i) **The Relevance:** - How Relevant are the Responses of the Learner to the Activity



in Question.

- ii) **Accuracy:** - Has the Learner accurately brought the right ideas required in the activity or not?
- iii) **Coherence:** - Are the items or responses presented by the Learner relating well with the activity in question or not? Do they have any Logical flow to realize the purpose for which this Activity is made?
- iv) **Excellence:** - What unique and Quality item or Response has the Learner perfected to outshine the rest?

This Guide is abbreviated as '**RACE**' and it leads the teacher to come up with an assessment Grid for the activity of Integration. The Assessment Grid will provide the basis for evaluating the Learner either at termly level or at the end of year.

It should be noted at this point that unlike the Out-going Curriculum where Summative evaluation is conducted by Uganda National Examination Board at the end of four years of Ordinary Level, with the Revised Curriculum, evaluation starts in S.1. So, in this case the Teacher is required to submit 20% of the Learner's Assessment Record per year to UNEB. At the end of the Learner's four years Education cycle, UNEB will subject the Learner to a National Exam that will be assessed out of 80 marks.

The Assessment Grid following the '**RACE**' Guide: -

Under this Grid, there should be the desired output of the Activity, in other words:
- What is expected of the Learner in this Activity.

Secondly, there should be a basis of Evaluation. In this case the teacher should identify Key performance targets in achieving the expected result or output. This depends on the levels, steps or stages. They should be between two and three levels.

Thirdly is the Criterion of Evaluation under the format of Relevancy, Accuracy Coherence and Excellence.

The Learner earns 1-3 marks depending on the Level of Achievement and this applies under the slots of Relevance, Accuracy and Coherence. When it comes to excellence, the learner scores only one mark, in case one qualifies for it.

Descriptor	Identifier
Some learning outcomes achieved, but not sufficient for overall achievement	1
Most Learning outcomes achieved, enough for overall achievement	2
All learning outcomes achieved- achievement with ease	3

SAMPLE SCHEME OF WORK FOR MATHEMATICS

SCHOOL:

TEACHER'S NAME:

SUBJECT: Mathematics

WEEK	PERIOD	TOPIC	COMPETENCY	LEARNING OUTCOMES	TEACHING/ LEARNING RESOURCES	METHOD(S)	REFERENCES	Remarks
1	6	Ratio and proportions	The learner understands ratio and proportions and use them in a range of contexts.	Understand and apply equivalent ratios	ICT especially calculator to assist in the calculations.	Learner centred method using the techniques: <ul style="list-style-type: none"> • Group work to be used to develop communication, problem solving skills, cooperation. • Discussion will aid critical thinking skills. • Activities entail: discovery, analysis, explanatory and application. 	- Learner's book - Teacher's guide - Internet	

SAMPLE LESSON PLAN

School:		Date:	
Subject:	Mathematics	Time:	8:00 am – 9.20 am
Teacher:		Duration:	80 minutes
Class:	Senior three	Number of learners:	Boys:
			Girls:
Term:	2		

Theme:	Patterns and algebra
Topic:	Ratio and proportions
Competency:	The learner understands ratio and proportion and uses them in a range of contexts.
Key Learning Outcome:	Self assured individual who relates well to a range of personality types.
Specific Learning Outcomes:	<p>By the end of the lesson, the learner should be able to:</p> <ul style="list-style-type: none"> (i) Understand and apply equivalent ratios. (ii) Understand and apply direct and inverse proportional reasoning.
Generic Skills:	<ul style="list-style-type: none"> (i) Critical thinking and problem solving. (ii) Communication skills. (iii) Cooperation.
Values and Attitudes:	<ul style="list-style-type: none"> • Integrity and honesty. • Self-control.
Crosscutting Issue(s):	Diversity and inclusion



Pre-requisite Knowledge:	Learners already have knowledge of division of numbers.
Learning materials	Markers, pens, pencils, rulers, manila paper
References	New syllabus book, learners' book, teacher's guide book

LESSON DEVELOPMENT

TIME/DURATION	STAGE/STEP	TEACHER'S ACTIVITY	LEARNER'S ACTIVITY
8:00- 8:15am (15 Minutes)	Pre-Activity	<ul style="list-style-type: none">- Reminds the learners about the topic and informs them about the new subtopic of the lesson which is 'ratio and proportion'.- Organises learners to form groups.-Asks the learners to read the introduction of subtopic 5.1 in the learner's book.	<ul style="list-style-type: none">-Listen carefully.-Learners move into groups.- Silently, read.

During the Activity 5.1

TIME/DURATION	TEACHER'S ACTIVITY	LEARNER'S ACTIVITY	
8:15 – 8 :25 am (10 Minutes)	<ul style="list-style-type: none"> (a) Observes the learners. (b) -Encourages them to actively participate in the discussions. - Walks around noting the learners' discussions. 	<ul style="list-style-type: none"> (a) Learners start reading through activity 5.1. (b) Group members discuss and write down what the group responses on a piece of paper or manila paper. 	
TIME/DURATION	STAGE/STEP	TEACHER'S ACTIVITY	LEARNERS' ACTIVITY
8:25 -8:40am (15 Minutes)	Post-activity 5.1	<ul style="list-style-type: none"> - Asks learners to organise representatives from 3 groups who are going to take two minutes each to share with explanation their groups' responses. - Harmonizes the discussion by defining ratios and explaining how to apply equivalent ratios in real life Incorporates use of calculator in the explanation. 	<ul style="list-style-type: none"> -Respond by choosing their own representative. - Group representatives present to the whole class. - Write notes in their exercise books.

During the Activity 5.2

TIME/DURATION	TEACHER'S ACTIVITY	LEARNER'S ACTIVITY	
8:40-8:50am (10 Minutes)	<ul style="list-style-type: none"> - Assigns the learners to read activity 5.2. - Walks around, observes and takes record of the various opportunities, weaknesses and areas that need improvement. 	<ul style="list-style-type: none"> - They read through activity 5.2. - They discuss in their groups how to increase and decrease a given ratios. - Group leaders write work to be presented. 	
TIME/DURATION	STAGE/STEP	TEACHER'S ACTIVITY	LEARNERS' ACTIVITY
8:50 -9:20am (30 Minutes)	Post-activity 5.1	<ul style="list-style-type: none"> - Asks two group representatives who are going to take 3 minutes each to share with explanations their groups' responses. - Complements the discussion explaining how to increase and decrease a given ratios with the aid of examples. - Discusses any questions from learners. - read through example 5.3. 	

		<ul style="list-style-type: none">- Gives an assignment from Exercise 5.1.and 5.2- Gives feedback on the lesson.- Ends the lesson at 9:17 am to preparation for next lesson.	<ul style="list-style-type: none">- Group representatives present to whole class.- Write notes in their exercise books.- Asks relevant question.- Study example 5.3.- Does the assignment in note books.- Learners will have immediate feedback with their group members.- Learners get ready for the next lesson.
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Teacher Self-Evaluation:

Topic

1

Equation of a Straight Line



Competency: The learner understands and uses linear equations and their graph.

- ❖ Ensure that the contents of this topic are covered within the allocated 15 periods.
- ❖ Emphasise the use of the key words in the learner's book.
- ❖ Use them repeatedly such that learners understand their meaning as used in this topic.

In this topic guide learners to:

- a) understand the relationship between a linear equation and its graph.
- b) determine the x and y intercepts of a given linear graph.
- c) determine the gradient of a straight line.
- d) state the gradient of a straight line when given the equation.
- e) apply the relationship of gradients of parallel and perpendicular lines to determine the equation of a straight line.

Introduction

Check for learner's prior knowledge by asking questions about their understanding and use of linear equation and their respective graph. Explore the meaning of the road side of climbing slope learners to look out for examples that can relate to steepness.

1.1: Gradient or Slope of a Straight Line (pg 2 LB)

In this section, emphasis should be put on variation of steepness and the ratio of change in y to change in x ; in the cartesian plane.

Activity 1.1

- ❖ Arrange learners in pairs and let them attempt the activity.
- ❖ Observe them as they attempt the activity, looking out for competences like communication, team work.
- ❖ Clearly record down your observations against individual names.
- ❖ Discuss with the learners the possible answers to the activity as follows;

Possible answers to activity 1.1

- c) The angle keeps on increasing as the foot moves closer to the wall.
- d) The steepness of the ladder keeps increasing as the distance between the wall and foot of the ladder decreases.
- e) $\frac{AB}{BC} = \frac{1}{2}$, $\frac{DE}{EF} = 3$. f) Represent steepness / slope of the line.

- ❖ Discuss more with the learners more examples of where the relationship in (d) can be experienced.
- ❖ Let learners study example 1.1 and then work through Quick practice Pg 4 LB

Answer to quick practice 1

- a) 1
- b) $\frac{2}{3}$

Activity 1.2

- ❖ Arrange learners in pairs and let them attempt the activity.
- ❖ Observe them as they attempt the activity, looking out for competences like communication, team work.
- ❖ Clearly record down your observations against individual names.
- ❖ Discuss with the learners the possible answers to the activity as follows;

Possible answers to activity 1.2

- a) 0
 b) undefined
 b) horizontal and vertical lines
- (i) Calculate the values of AB and BC.
 (ii) Calculate the values of DE and EF.

1.2: Gradients of parallel and Perpendicular lines (Pg 5 LB)

The teacher showed ensure that learners can use the slope of two lines to determine whether the lines are parallel or perpendicular.

Activity 1.3

- ❖ Inform the learners about the goals of the activity.
- ❖ Organise the learners in small groups to do the activity.
- ❖ Move around the class observing learners participation and competencies while solving the task.
- ❖ Guide the learners to find the relationship between perpendicular lines, and parallel lines.

Possible answer to activity 1.3 (page 5 LB)

- b) i) Gradient of AB = $\frac{3}{2}$, ii) Gradient of CD = $\frac{3}{2}$
 c) Same value of the gradient c) Gradient of RT = $\frac{1}{3}$, Gradient of PQ = -3
 d) AB is parallel to CD f) They are perpendicular

Activity 1.4

- ❖ Alert the learners what the activity is about.
- ❖ Let them continue in the same groups from the last activity.
- ❖ Walk around the class taking note of competences like problem solving and team work.
- ❖ Call the whole class and hold a learner-led discussion of their results.

Possible answer to activity 1.4 (page 6 LB)

- (b) i) $\frac{1}{3}$ ii) -3
 (c) $\frac{1}{3} \times -3 = -1$
 (d) Line PQ is perpendicular to line RT.

Harmonise their results and guide those that require extra help.

Ask learners to study example 1.2 individually

Expected response to quick practice (Pg 9 LB)

- a) A parallel to each other b) Neither

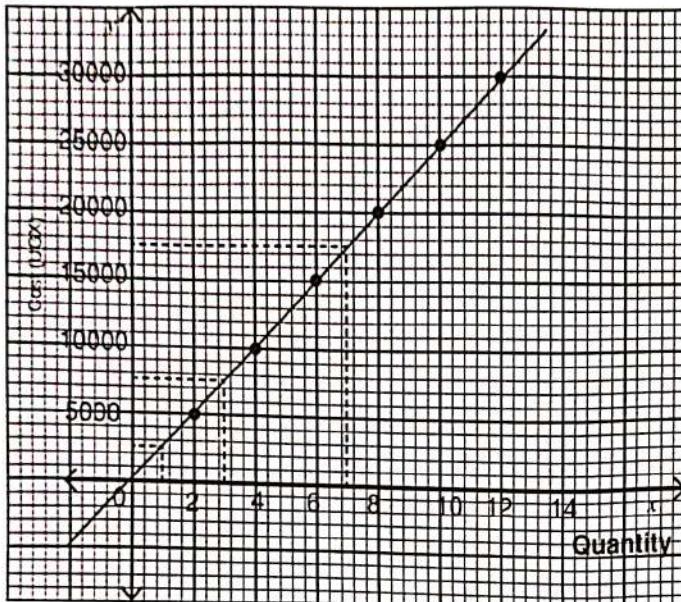
Answers to Exercise 1.1 Pg 9 LB

1. a) $\frac{3}{5}$ b) $-\frac{4}{3}$ c) $\frac{7}{2}$ d) 0

2. a) 3 b) $\frac{1}{3}$ c) $-\frac{9}{4}$ d) undefined

e) $\frac{1}{6}$ f) $\frac{3}{2}$ g) $\frac{1}{4}$

4. a)



b) Cost of 1 kg = 2500 sh

3 kg = 7500 sh

7 kg = 12500 sh

5. a) Parallel

6. $\frac{195}{3000} = \frac{13}{200}$

b) Perpendicular

7. $x = 15$

c) Perpendicular

8. a) $\frac{4.5}{12} = \frac{3}{8}$ b) yes

d) Neither

c) it exceeds by $\frac{1}{8}$

1.3: x and y Intercepts of a Linear Graph (Pg 12 LB)

In this section much emphasis should be put on graph sketching using intercepts.

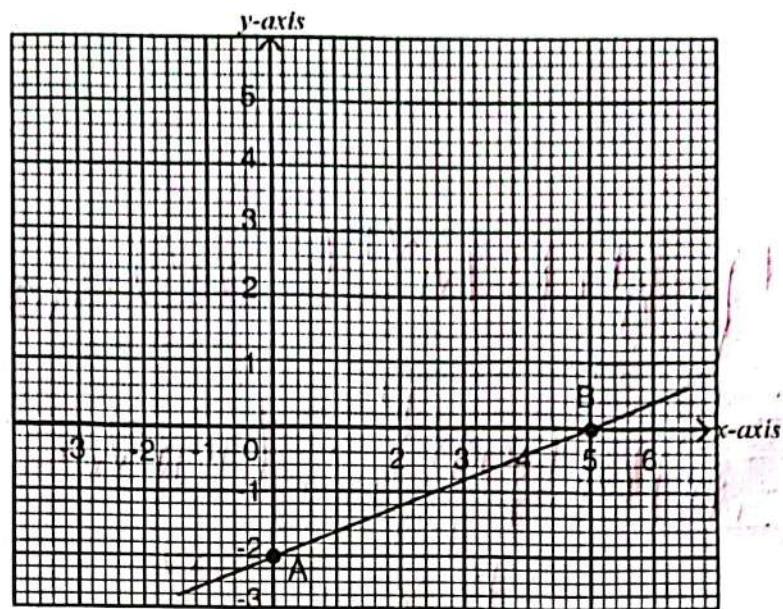
Activity 1.5

- ❖ Ensure that learners sketch and ask them about the shape of the graphs and why they pass through the axes.

Possible answer to activity 1.5

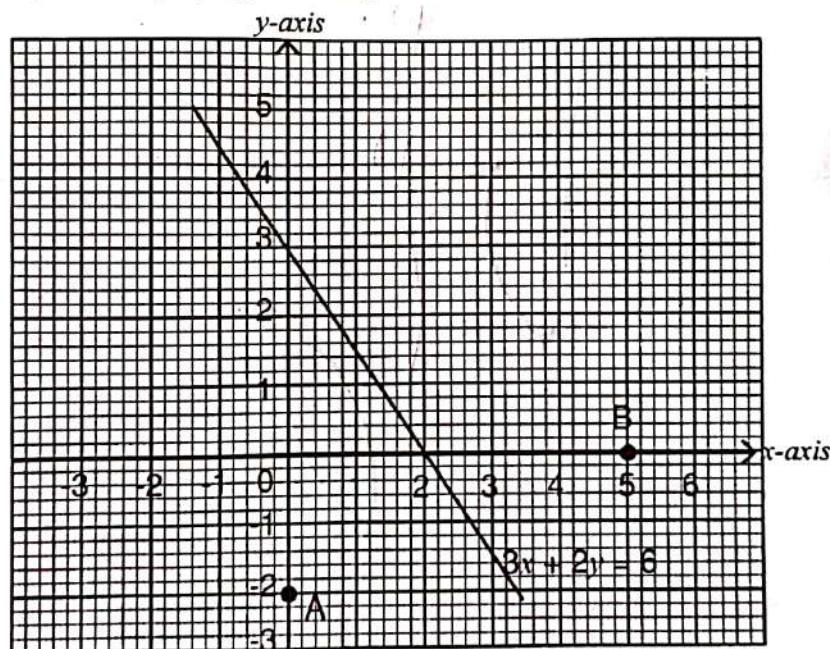
a) A (0, -2)

b) B (5, 0)

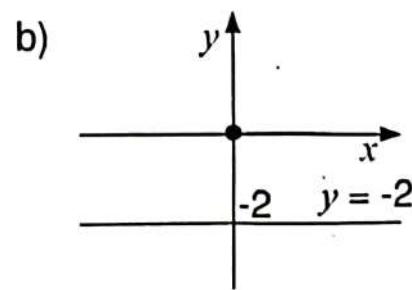
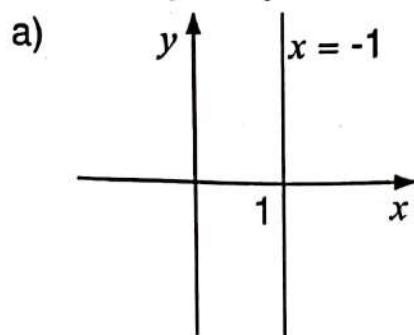


(d) 5(e) -2

- f) 2 points, This is because a straight line has a constant gradient, any 2 points will maintain its gradient.

Answer to quick practice (Pg 14 LB)

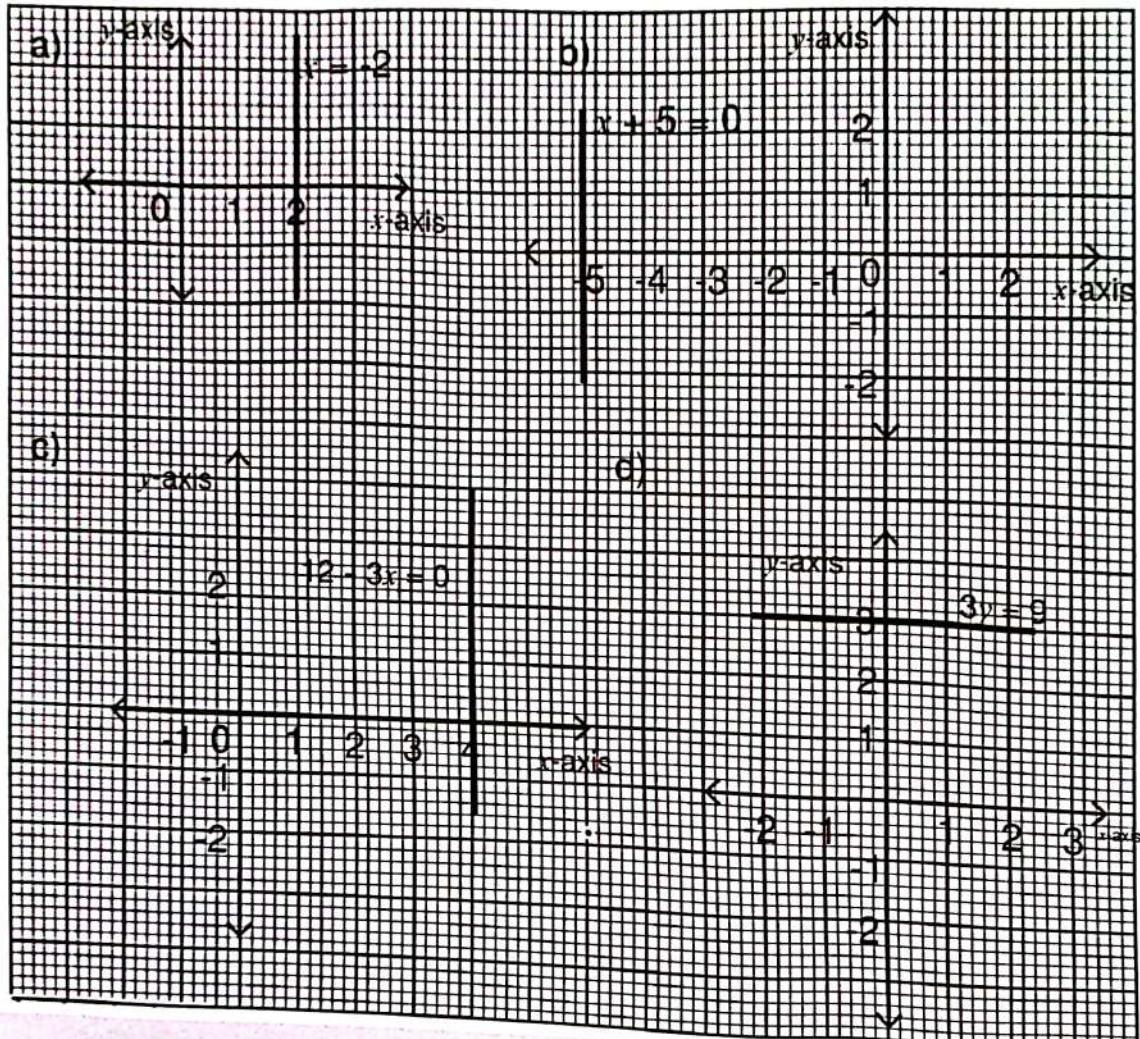
Emphasise labelling of axes and lines

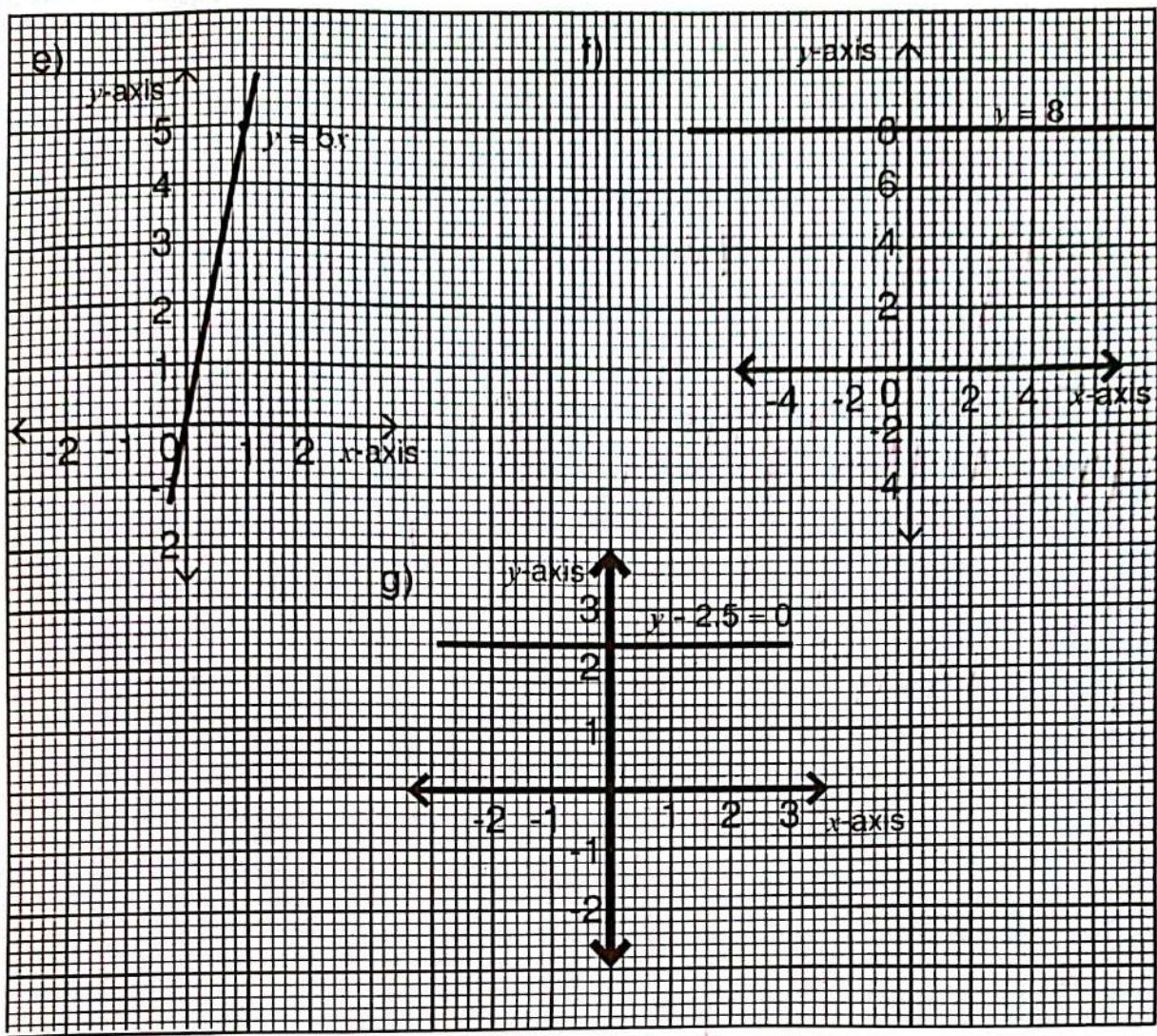
Answer quick practice (Pg 15)

Answers to Exercise 1.2 (Pg 14 LB)

1. a) x -intercept = 3 b) x -intercept = -2
 y -intercept = 2 y -intercept = 4
c) x -intercept = -3 d) y -intercept = -3
no y -intercept no x -intercept

2.





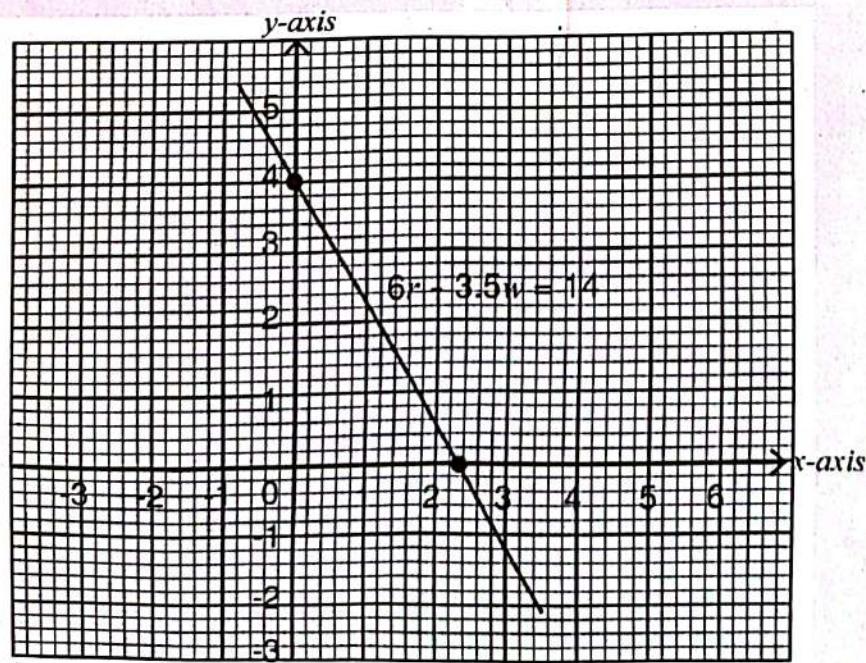
3. x - intercept no y - intercept

$$x = -3$$

y - intercept no y - intercept

$$y = 6$$

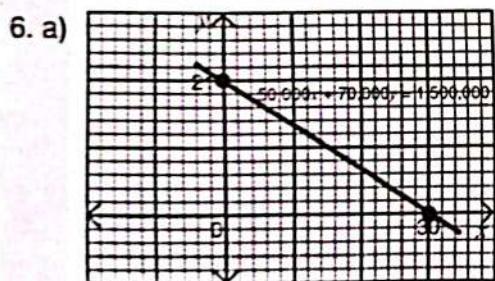
4. a)



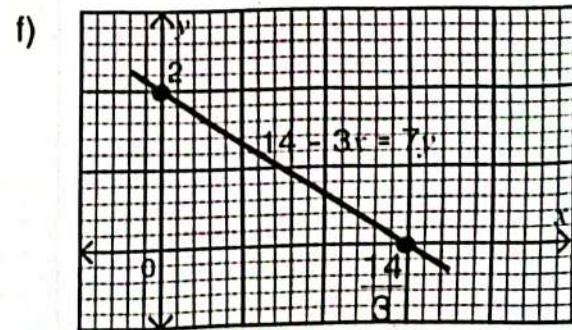
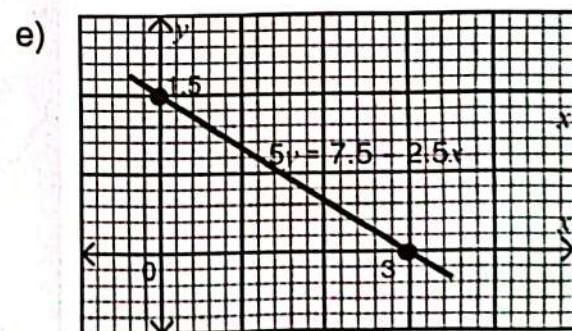
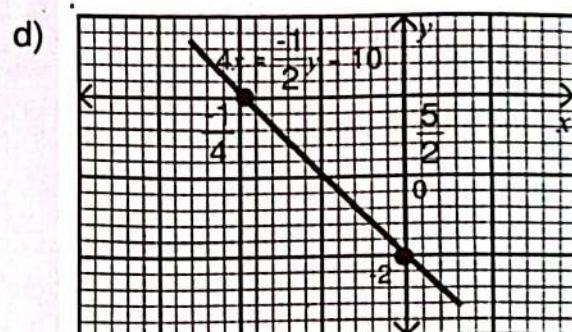
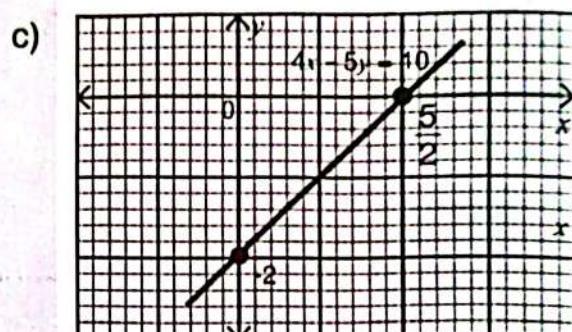
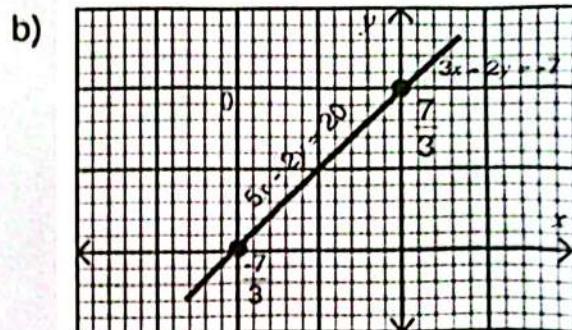
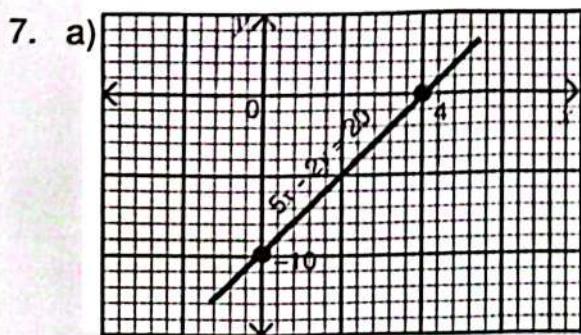
b) (r, w)

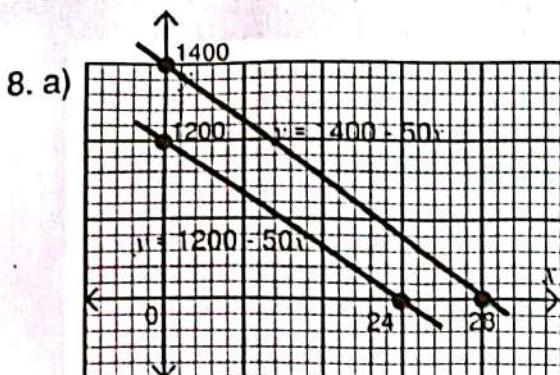
$$(0, 4), (2.3, 0), \left(1, \frac{16}{7}\right)$$

5. a) x -intercept = 8
 y -intercept = -16
- b) x -intercept = $\frac{-13}{2}$
 y -intercept = $\frac{13}{4}$
- c) x -intercept = 2
 y -intercept = 5
- d) x -intercept = 6
 y -intercept = -9
- e) x -intercept = -10
 y -intercept = 6
- f) x -intercept = -4
 y -intercept = -3



- b) 30 science tickets , 0 - Art tickets $(30, 0)$
 16 science tickets, 10 - Art tickets $(16, 10)$





The graphs are parallel to each other

1.4: Equations of Straight Lines (Pg 16 LB)

This section will focus at formulating the equations of lines under different conditions.

Activity 1.6

- ❖ Time the activity for about 5 minutes.
- ❖ Arrange the learners in small groups to do the activity 1.6.
- ❖ Observe the learners as they do the activity and take note of how they relate, and cooperate.
- ❖ Guide the learners as they generate the equation of the line while relating the gradient and the intercept.

Possible answer to activity 1.6

a) $\frac{4}{2} = 2$ b) $\frac{y-2}{x-1} = \frac{y-2}{x+1}$

c) Both results are the same

d) $2 = \frac{y-4}{0-x}$ e) $y = 2x + 4$

Gradient = 2, y - intercept = 4

- ❖ Emphasise the relationship between y-intercept and gradient is given by the equations of the

line.

Answer to quick practice (page 17 LB)

a) $y = \frac{2}{5}x - 2$ b) $y = \frac{-9}{8}x - \frac{11}{8}$

Answer to quick practice (Pg 18 LB)

a) $y = 5x - 33$ b) $y = \frac{-1}{5}x - \frac{9}{5}$

Answers to Exercise 1.3 (Pg 18 LB)

1. a) $\frac{-1}{6}$ b) $\frac{-1}{7}$
 c) 1 d) $\frac{-5}{2}$
 e) $\frac{4}{13}$

2. a) $y = -2x + 5$

b) $y = \frac{2}{3}x + 4$
 c) $y = \frac{-5}{4}x - \frac{2}{7}$
 d) $y = -x + \frac{4}{9}$

3. a) $y = -2x + 7$

b) $y = \frac{3}{2}x - \frac{17}{2}$
 c) $y = \frac{-4}{5}x - 8\frac{2}{5}$
 d) $y = \frac{-2}{9}x - \frac{5}{6}$

4. $y = 15,000x + 4000$

a) $m = 5, c = 8$
 b) $m = 1, y = -6$
 c) $m = \frac{8}{3}, c = 0$
 d) $m = \frac{-2}{9}, c = 0$
 e) $m = \frac{6}{7}, c = -6$

Longhorn Secondary Mathematics Teacher's Guide 3

6. a) $y = -1.6x + 24$ or $1.5y + 2.4x = 36$

b) 0 - pepper plants

7. a) $y = \frac{2x}{3} + 5$

b) $y = \frac{-3x}{4} - \frac{13}{4}$

c) $y = \frac{-3x}{4} + \frac{7}{8}$

d) $y = \frac{2x}{3} + 2$

e) $y = \frac{4x}{17} + \frac{23}{51}$

8. a) $y = -x + 6$

b) $y = \frac{-8x}{3} + \frac{26}{3}$

c) $y = \frac{-1}{3}x + 2$

d) $y = \frac{4x}{5} - \frac{26}{3}$

9. $k = 4$

10. $y = \frac{-7x}{6} + \frac{5}{3}$

11. a) $y = 22500x + 50,000$

b) shape shows that there will be an increase in the cost of hosting and using the web as time increases.

c) UGX. 335,000.

Sample Assessment Grid of Activity of Integration 1

Output	Basis of evaluation	Relevancy	Accuracy	Coherence	Excellence
Total cost of the party	Equation formed used to find the cost	Score 3: Identifies the 3 relevant information (equation, number of people confirmed, total amount/cost)	Score 3: Accurately form the equation, accurate number of people confirmed. Accurate total cost.	Score 3: If the working flows logically till the final answer.	Learner scores 1 point upon giving any exceptional feature that is unsolicited in the instructions
			Score 2: Identifies any 2 relevant information	Score 2: Accurately find any 2 aspects of activity.	Score 2: logically flow with a few distortion.
			Score 1: Identifies only 1 relevant information.	Score 1: Accurately find only 1 aspect of the total cost.	Score 1: Limited flow.
		Total = 10	Max : 3	Max : 3	Max : 1

Total cost of party = Rent + $\frac{2}{3}$ class size × Fee

$$= 400,000 + \frac{2}{3}(285) \times 5,500$$

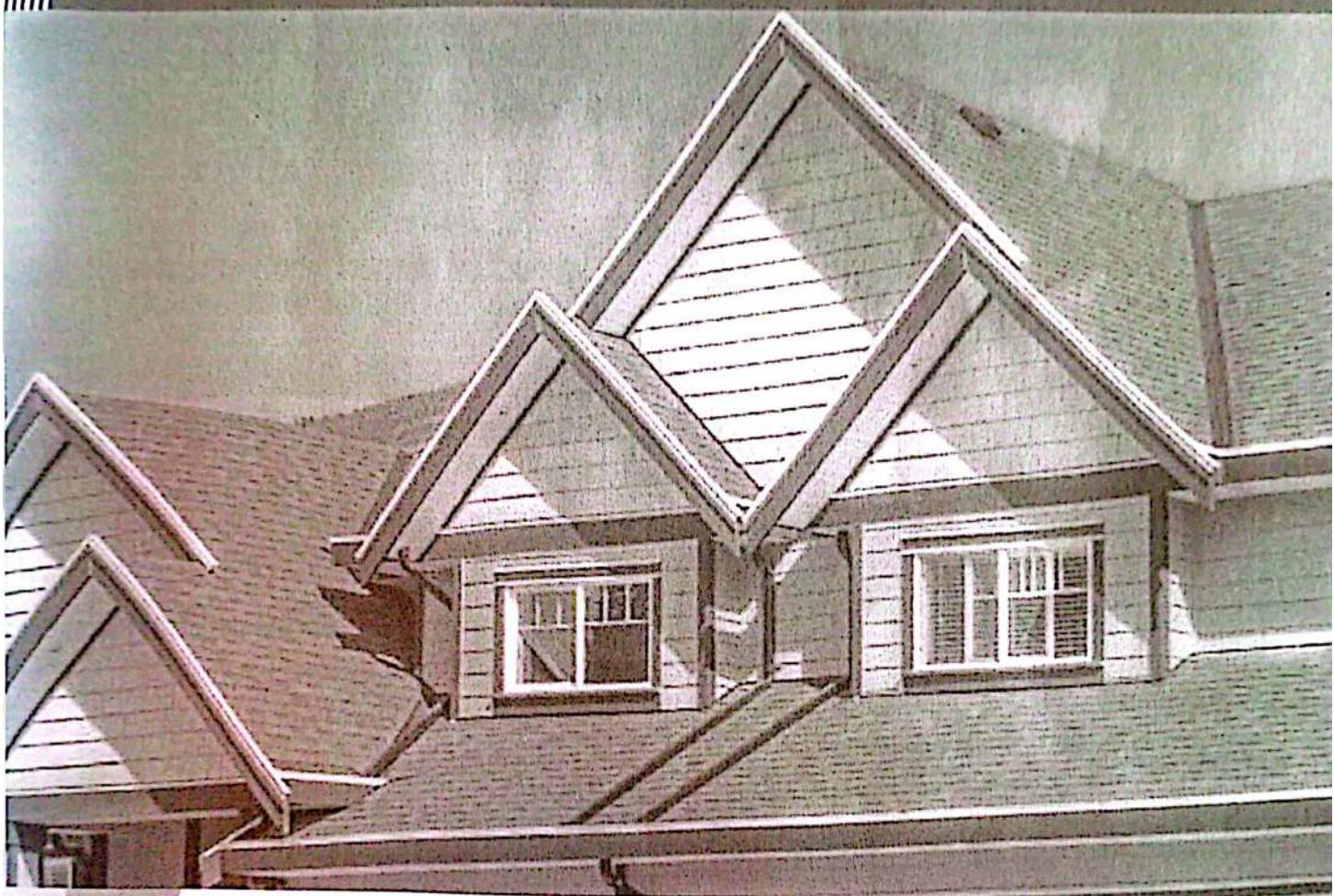
$$= 400,000 + 190 \times 5500$$

$$= 400,000 + 1,045,000.$$

$$= 1,445,000$$

∴ Andrew should budget to spend at-least UGX. 1,445,000

Topic 2 Trigonometry 1



Competency: The learner understands and uses the three basic trigonometric functions.

- ❖ Ensure that the contents of this topic are covered within the allocated 15 periods.
- ❖ Emphasise the use of the key words in the learner's book.
- ❖ Use the words repeatedly so that learners understand their meaning as used in this topic.

In this topic guide learners to:

- a) derive sine, cosine and tangent functions from the unit circle.
- b) read and use calculators to find value of trigonometric functions.
- c) use sine, cosine and tangent in calculating lengths of sides and angles of right-angled triangles.
- d) find angles of elevation and depression.

Introduction

Briefly introduce the topic with a scenario of climbing a hill or mountain. Ask the learner's how they would determine the height of the hill. With further discussion, guide the learners to identify real life situations where we can relate angles and lengths for example roofs.

2.1: Trigonometric Functions

2.1.1 The sine of an angle (pg 24 LB)

Activity 2.1

- ❖ Ensure learners have the necessary material; a graph paper, pencil, pair of compasses, calculator, protractor, ruler and note book.
- ❖ Arrange the learners in pairs.
- ❖ Allow the learners attempt the activity.
- ❖ Observe how learners interact and communicate with each other.
- ❖ Pay attention to communication skills.
- ❖ Discuss with the learners the possible answer of the activity.

Possible answer to activity 2.1

θ	\overline{OP}	\overline{PN}	$\frac{\overline{PN}}{\overline{OP}}$
20°	5	1.7	0.34
45°	5	3.5	0.7
60°	5	4.5	0.9

- ❖ As the value of θ increase the value of the ratio increases.
- ❖ Emphasise the biggest value of the $\sin\theta$ which is 1.
- ❖ Emphasise the relationship between $\sin\theta$, opposite and hypotenuse.
- ❖ Support learners on how to use different kind of calculators to find the sines of the angles and the sine inverses.
- ❖ Emphasise the degree of accuracy of recording the answer (significant figures and decimal places).

Possible answers to quick practice 1 (Pg 26 LB)

- a) (i) 0.7660 (ii) 0.4003 (iii) 0.9379
 b) (i) 29.0° (ii) 64.7°

Possible answers to quick practice 2 (Pg 26 LB)

- a) $p = 34.8 \text{ cm}$ b) $\theta = 26.6^\circ$

Answers to Exercise 2.1 (Pg 26 LB)

1. a) 0.6423 b) 0 c) 0.2756
 d) 0.9877 e) 0.7923
 f) 0.4633 g) 0.1392
 h) 0.9770 i) 0.4719
2. a) 17.5° b) 54.6° c) 30.5°
 e) 46.2° f) 40.5° g) 23.6°

3. $\sin 30 = \frac{1}{2}$ $\sin 60 = \frac{\sqrt{3}}{2}$

4. a) $\sin D = \frac{3}{5}$

$$\sin E = \frac{4}{5}$$

b) $\sin D = \frac{12}{37}$

$$\sin E = \frac{35}{37}$$

5. a) $x = 3.3 \text{ cm}$ b) $d = 3.7 \text{ cm}$

c) $p = 9.6 \text{ cm}$ d) $c = 64.6 \text{ cm}$

6. Length of the wire = 83.4 m

7. 23.1 km

8. 2.0 m

9. a) 045.6° b) $\theta = 24.0^\circ$

c) $\theta = 44.5^\circ$ d) $\theta = 42.4^\circ$

2.1.2 The Cosine (Pg 27 LB)

Activity 2.2

- ❖ Arrange learners in small groups.
- ❖ Let the learners attempt the activity.
- ❖ Observe the learners communication skills, respect for each other handling of the material.
- ❖ Discuss the possible answers of the activity.

Possible answer to activity 2.2

θ	\overline{OA}	$\frac{\overline{OA}}{\overline{OB}}$
0°	5	1
20°	4.7	0.94
50°	3.3	0.66
70°	1.8	0.36

- ❖ OA - is near the angle XOB.
- ❖ As the angle increase the ratio reduce.
- ❖ Emphasise the use of calculator / technology and degree of accuracy of cosine and its inverse.

Answers to quick practice 3

(Pg 29 LB)

a) (i) 0.857 (ii) 0.245

Answers to Exercise 2.2 (Pg 29 LB)

1. a) 0.866 b) 0.707 c) 1
d) 0.961 e) 0.831 f) 0.193
g) 0
2. a) 71.9° b) 87.1° c) 90.0°
d) 30.1° e) 4.4° f) 0° g) 63.5°

- ❖ Let them study example 2.4

Answers to quick practice 4

(Pg 29 LB)

a) $x = 9.1 \text{ cm}$ b) $d = 23.4 \text{ cm}$

Answers to Exercise 2.3 (Pg 29 LB)

1. a) $\frac{3}{4}$ or 0.6000 b) $\frac{8}{17}$ or 0.4706
c) $\frac{3}{\sqrt{2}}$ or 0.4472 d) $\frac{1}{2}$ or 0.5000
2. a) $a = 100 \cos 48^\circ$
 $a = 100 \sin 42^\circ$
b) $a = 78 \cos 55^\circ$
 $a = 78 \sin 35^\circ$
3. 67.4° , 22.6° and 90°
4. 66.4°

5. a) $x = 8.4 \text{ cm}$ b) $y = 10.9 \text{ cm}$
c) $d = 27.7 \text{ cm}$ d) $c = 26.2 \text{ cm}$
6. $71.4^\circ, 54.3^\circ, 45.3^\circ$
7. 42.4 km
8. a) $x = 13.0 \text{ cm}$ b) $y = 20.8 \text{ cm}$
c) $c = 78.2 \text{ cm}$ d) $d = 47.1 \text{ cm}$
9. 5.5 m
10. a) $T = 52.0^\circ$ b) $T = 61.3^\circ$

2.1.3 Tangent ratio (Pg 30 LB)

This section will focus on the relationship between the sides of a right angled triangle without the hypotenuse.

Activity 2.3

- ❖ Arrange learners in pairs to do the activity.
- ❖ Guide as you observe the learners communication skills, interaction and respect for each other.
- ❖ Discuss the learners solutions and give guidance.
- ❖ Ensure that learners know how to use the different calculators available.

TN - opposite of the angle
ON - adjacent of the angle
❖ Emphasise that as the angle increases, the ratio also increases.

Answers to Exercise 2.4 (Pg 31 LB)

1. a) $\tan C = \frac{16}{12} = 1.33$
 $\tan D = \frac{12}{16} = 0.75$
b) $\tan C = \frac{9}{12} = 0.75$
 $\tan D = \frac{12}{9} = 1.33$
c) $\tan C = \frac{15}{8} = 1.88$
 $\tan D = \frac{8}{15} = 0.53$
d) $\tan C = \frac{12}{5} = 2.4$
 $\tan D = \frac{5}{12} = 0.42$
2. a) 0.6249 b) 1.1918
c) 0.2272 d) 19.0811
e) 0.1139 f) 3.9578
3. a) 24.4° b) 57.9° c) 38.0°
d) 74.9°

Possible answer to activity 2.3

θ	ON	TN	Ratio $\frac{\overline{TN}}{\overline{ON}}$
30°	4.4	2.5	0.568
45°	3.5	3.5	1
60°	2.5	4.4	1.76

- ❖ Have the learners study example 2.5

Answers to quick practice 5 (Pg 32 LB)

- a) $n = 36.7 \text{ cm}$ b) $\theta = 16^\circ$

Answers to quick practice 6 (Pg 35 LB)

117.8 m

Answers to Exercise 2.5 (Pg 33 LB)

1. a) $y = 10.8 \text{ cm}$ b) $a = 14.2 \text{ cm}$
2. 8.5 m
3. a) $\theta = 24.9^\circ$ b) $\theta = 2.5^\circ$
c) $\theta = 55.6^\circ$ d) $\theta = 66.5^\circ$
 $\alpha = 23.5^\circ$
4. 7.6 m
5. $B = 0.67 \text{ m}$ $C = 2.47 \text{ m}$
6. a) $x = 6.0 \text{ cm}$ $y = 6.9 \text{ cm}$
b) $c = 283.2 \text{ cm}$
7. 23.3°
8. a) 5.6 km b) 19.6 km and 285.9°

2.2: Angles of Elevation and Depression (Pg 34 LB)**Activity 2.4**

- ❖ Group learners in small groups.
 - ❖ Observe the learners as they attempt the activity.
 - ❖ Discuss with the learners about their findings and the special nations attached to different angles.
- ❖ Allow them to study examples 2.6 and 2.7. Then let them attempt their quick practice questions.
- ❖ Give an assignment from exercise 2.6.

**Answers to quick practice 6
(Pg 35 LB)**

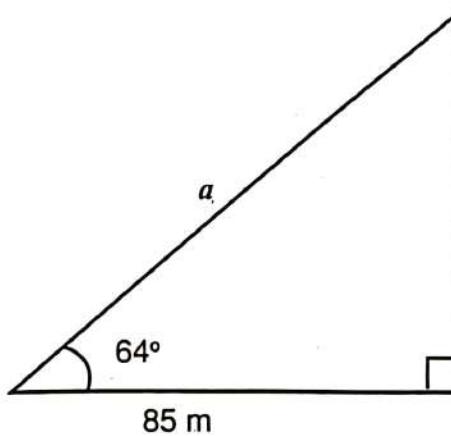
20.9 m

**Answers to quick practice 7
(Pg 36 LB)**

750.3 m

Answers to Exercise 2.6 (Pg 36 LB)

1. a) $C = 30^\circ$ b) $\alpha = 45^\circ$
c) 45°
2. 256.0 m
3. $h = 15.3 \text{ m}$
4. 4.7 m
5. Observe the learners while doing the activity.
6. $H = 638.8 \text{ m}$

Solution of Sample activity of integration

$$\cos 64^\circ = \frac{\text{adj}}{\text{Hyp}}$$

$$\cos 64^\circ = \frac{85}{a}$$

$$\therefore a = 193.4 \text{ m}$$

The engineer should plan for 193.4 m of road.

Sample Assessment Grid of Activity of 2

Output	Basis of evaluation	Relevancy	Accuracy	Coherence	Excellence
The banner fitting in the space.	<ul style="list-style-type: none"> ❖ Write a trigonometric ratio for wall height. ❖ Calculate the wall height. ❖ Subtracting the banner height. ❖ Write a conclusion. 	<p>Score 3: - Identifies all 4 relevant parts; forming a trigonometric ratio for wall height, calculating the wall height, subtracting the banner height, interpreting the results to establish whether the banner will fit..</p> <p>Score2: Identifies 2-3 relevant parts from; forming a trigonometric ratio for wall height, calculating the wall height, subtracting the banner height, interpreting the results to establish whether the banner will fit.</p> <p>Score1: Identifies 1 relevant part from; forming a trigonometric ratio for wall height, calculating the wall height, subtracting the banner height, interpreting the results to establish whether the banner will fit.</p>	<p>Score 3: Accurately applies all 4 relevant parts; writing a trigonometric ratio for wall height, calculating the wall height, subtracting the banner height, interpreting the results to determine whether the banner will fit.</p> <p>Score2: Accurately applies 2-3 relevant parts; writing a trigonometric ratio for wall height, calculating the wall height, subtracting the banner height, interpreting the results to determine whether the banner will fit.</p> <p>Score1: Accurately applies 1 relevant part; writing a trigonometric ratio for wall height, calculating the wall height, subtracting the banner height, interpreting the results to determine whether the banner will fit.</p>	<p>Score 3: Logical flow in the use of all relevant parts.</p> <p>Score2: Logical flow with distortions in the use of the relevant parts.</p> <p>Score1: Limited flow in the use of the relevant parts.</p>	<p>Learner earns 1 point if he/she has added any exceptional feature unsolicited in the instructions.</p>
					Total

Topic

3

Data Collection or Display



Competency: The learner collects and represents different sorts of data.

- ❖ Ensure that the contents of the topic are covered within the allocated 15 periods.
- ❖ Emphasise the use of key words such that learners understand their meaning as used in this topic.

In this topic, guide learners to:

- a) understand mode, mean and median as measures of location / central tendency and knows how to find them and when to use them.
- b) understand range as a measure of dispersion / spread and how to find it.
- c) draw and use frequency tables for ungrouped data.
- d) draw and use frequency table for grouped data.
- e) estimate measures of location and dispersion for grouped data.
- f) calculate the mean using assumed mean.
- g) draw a histogram with equal class intervals and use it to estimate the mode.
- h) draw a cumulative frequency curve (ogive) and use it to estimate the median.

Introduction

Introduce the topic to the learners by inquiring how best they can collect information from fellow students about their favorite fruits and how best they would determine the most or least desired. Create a scenario where learners are expected to collect data about age, height, weight etc and ask them how they would present it and how is the data spread.

3.1: Measures of Central Tendency (Pg 40 LB)

In this section emphasis should be put on the meaning of mean/average, mode and median.

3.1.1 The Mean

Ask the learners about prior knowledge of mean from the early knowledge in S.1 and primary school.

Activity 3.1

- ❖ Arrange learners in group of about 15 learners.
- ❖ Let the learners attempt the activity as you observe how they communicate to each other.
- ❖ Each group will have a different answer depending on their data.
- ❖ Emphasise the value of respect for each other as they attempt the quiz.
- ❖ Discuss with the learners the possible answers of the activity and explain what the result represent.
- ❖ Emphasise the notation and symbols used.

Response to Quick practice 1 (Pg 41 LB)

$$\text{a) } = 16.2 \quad \text{b) } 73$$

Quick Practice 2 (Pg 42 LB)

$$\text{Mean} = 36.97 \text{ hours}$$

Quick practice 3 (Pg 44 LB)

$$43.2\%$$

$$48.2\%$$

Answers to Exercise 3. 1 (Pg 42 LB)

1. a) 49 b) 2800
2. a) 7.2 b) 3.1
c) $\frac{23}{18}$ or $1\frac{5}{8}$ d) 183.3
3. 13
5. 99.7

6.a)

Score	Frequency	f_x
63	1	63
66	3	198
67	2	134
68	1	68
69	7	483
70	3	210
71	2	142
72	2	144
73	4	292
74	2	148
80	1	80
		$\sum f = 28 \quad \sum f_x = 1962$

$$\text{b) mean} = 70.1$$

$$7. \text{ mean} = 57.1$$

$$8. \text{ mean} = 253 \text{ million}$$

3.1.2 The Median (Pg 43 LB)

Activity 3.2

Materials: Measuring tape or weighting scale and paper.

- ❖ Arrange learners in small groups of all learners.
- ❖ Let the learners attempt the activity.
- ❖ Guide the learners on how to use the instruments provided upon request.
- ❖ Move around and observe how they communicate, take measurements and intercept.
- ❖ Note the observations against individual learners names.
- ❖ Let the group leaders present their findings to whole class.
- ❖ Discuss with the learners more examples of how to use median and the data sets that can be used.

Quick Practice 3 Answer

36.97 hours

Quick Practice 4

51

Emphasise the arrangement of data before getting the median.

Quick Practice

23

Quick practice

87

Activity 3.3

- ❖ Let individual learners attempt the activity.
- ❖ Observe the learners as they attempt the activity.

Possible answers to activity 3.3

- a) 227,000
- b) 322,975
- c) The median value is very close to the data than the mean. Median is a better value of central tendency.

Quick practice 5

- a) 2,220,833,3
- b) 2,245,000

3.1.3 The mode (Pg 45 LB)

Activity 3.4

- ❖ A text book with passages or many words.
- ❖ Arrange the learners in small groups(pairs).
- ❖ Let the learners attempt the ability in pairs.
- ❖ Observe the learners as they attempt and record their findings.
- ❖ Call learners back as a whole class and let them discuss their findings. Guide them to reach that desired results.
- ❖ Emphasise the meaning of bimodal.

Quick practice 6 answers.

- a) 6 and 3
- b) 7

Answers to Exercise 3.2 (Pg 46 LB)

1. d) median = 3.6
2. a) 18
- b) 14 and 23
- c) 0, 1, 2, 3
- d) 97

3. a) mode = 4
mean = 6.9
median = 6
b) mode = 6
mean = 5.7
median = 6
c) mode = 6, 5, 6
mode = 2.0
median = 3.5
4. Mean = 16
Median = 4.3
median, since its very close to the data
5. Mean = 77.6
Median = 75
Median, its result is very close to the data.
6. (2, 2, 2) any other contribution well proved.

7. a)

Score	Frequency	cf
28	2	2
29	1	3
30	6	9
31	3	12
32	1	13
33	3	16
34	3	19
35	3	22
36	3	25
37	9	34
38	7	41
39	4	45
40	2	47
42	1	48
$\Sigma f = 48$		

b) 37 c) 35

8. mean = 166.2
Mode = 170
Median = 165
9. a) Mean = 22.8 mode = 30 median = 33
b) Mean = 8.3, mode = 15, median = 15
10. Take measurements of your friends attempt the activity.
11. a) 1344750 b) 1639500
c) None d) Median. its result is very close to the given data.

3.2: Measures of Spread or Dispersion

3.2.1 The Range (Pg 48 LB)

Activity 3.5

- ❖ Material: Calculator and note book
- ❖ Organise the learners in pairs.
- ❖ Let the learners attempt the activity as instructed.
- ❖ Ask the learners to share their findings with their immediate neighbour.
- ❖ Call the class back to order and discuss their findings as you guide them how to find the desired result.

Possible answers

- a) 40 b) 25

Emphasise the use of key words and ensure that learners understand their meaning.

Quick practice 7 (Pg 49 LB)

- a) 44 b) 64 c) 97.5 d) 33.3

Quick practice 8

- a) 3.5 b) 0.75

Answers to Exercise 3.3 (Pg 49 LB)

1. a) 52 b) 17 c) 12.3 d) 145

2. a) Range = 11
Median = 42

b) Range = 24
Median = 113

c) Range = 13
Median = 12.3

2. 8

4. 13

5. 7

6. 0.15

7. 7

3.3: Grouped Frequency Distributions (Pg 50 LB)

In this section you will focus on working with data that is grouped.

Activity 3.6

- ❖ In groups let the learners attempt the activity.
- ❖ Ask the learners to complete the given, as you observe them how they are tallying the data.

Possible answers to activity 3.6

a)

Mark	Tally	Frequent
20 - 29	/	1
30 - 39	/	1
40 - 49		2
50 - 59		4
60 - 69		11
70 - 79		10
80 - 89		4
90 - 99		2

b) 60 - 69

c) Using 40-49, it becomes 39.5-49.5.

- ❖ At this point emphasise the class boundaries.
- ❖ Guide the learners on how to determine the class boundaries and interval.

3.4: Mean, mode and median of grouped data (Pg 51)

In this section emphasise should be put on use of formulae to find means, mode, and median of grouped data.

Activity 3.7

- ❖ Let the learners attempt the activity individually.
- ❖ Observe and guide on how to find the mid point.
- ❖ Allow learners complete the table.

Possible answers to activity 3.7

Marks	Mid-point (x)	Frequency (f)	fx
20 - 29	24.5	1	24.5
30 - 39	34.5	1	34.5
40 - 49	44.5	2	89
50 - 59	54.5	4	218
60 - 69	64.5	11	709.5
70 - 79	74.5	10	745
80 - 89	84.5	4	338
90 - 99	94.5	2	189
		$\sum f = 35$	$\sum fx = 2347.5$

$$\frac{\sum fx}{\sum f} = \frac{2347.5}{35} = 67.07$$

Answers to quick Practice 9

a)	No. of tweezers	Tally	Frequent	x	fx	cf
	12 - 16		3	14	42	3
	17 - 21		6	19	114	9
	22 - 26		9	24	216	18
	27 - 31		12	29	348	30
	32 - 36		8	34	272	38
	37 - 41		5	39	195	43
	42 - 46		2	44	85	45
	90 - 99		2			

$$\sum f = 45$$

$$\sum fx = 1275$$

- b) 27 - 3 c) 28.33 d) 27.38

3.5: Assumed mean (Working mean) (Pg 53 LB)

You have learnt how to find the mean. In this section, you are going to find the mean by first estimating it.



Activity 3.8

- ❖ Arrange the learners into groups
- ❖ Tell them the aim of the activity
- ❖ As they are engaged, move around the class observing them and writing the competences seen.
- ❖ Call the whole class for group discussion.

Possible responses for activity 3.8.

Estimated mean = 180

Mean of subtractions = 0.833

True mean = 180.83

Answers to Exercise 3.5 (Pg 56 LB)

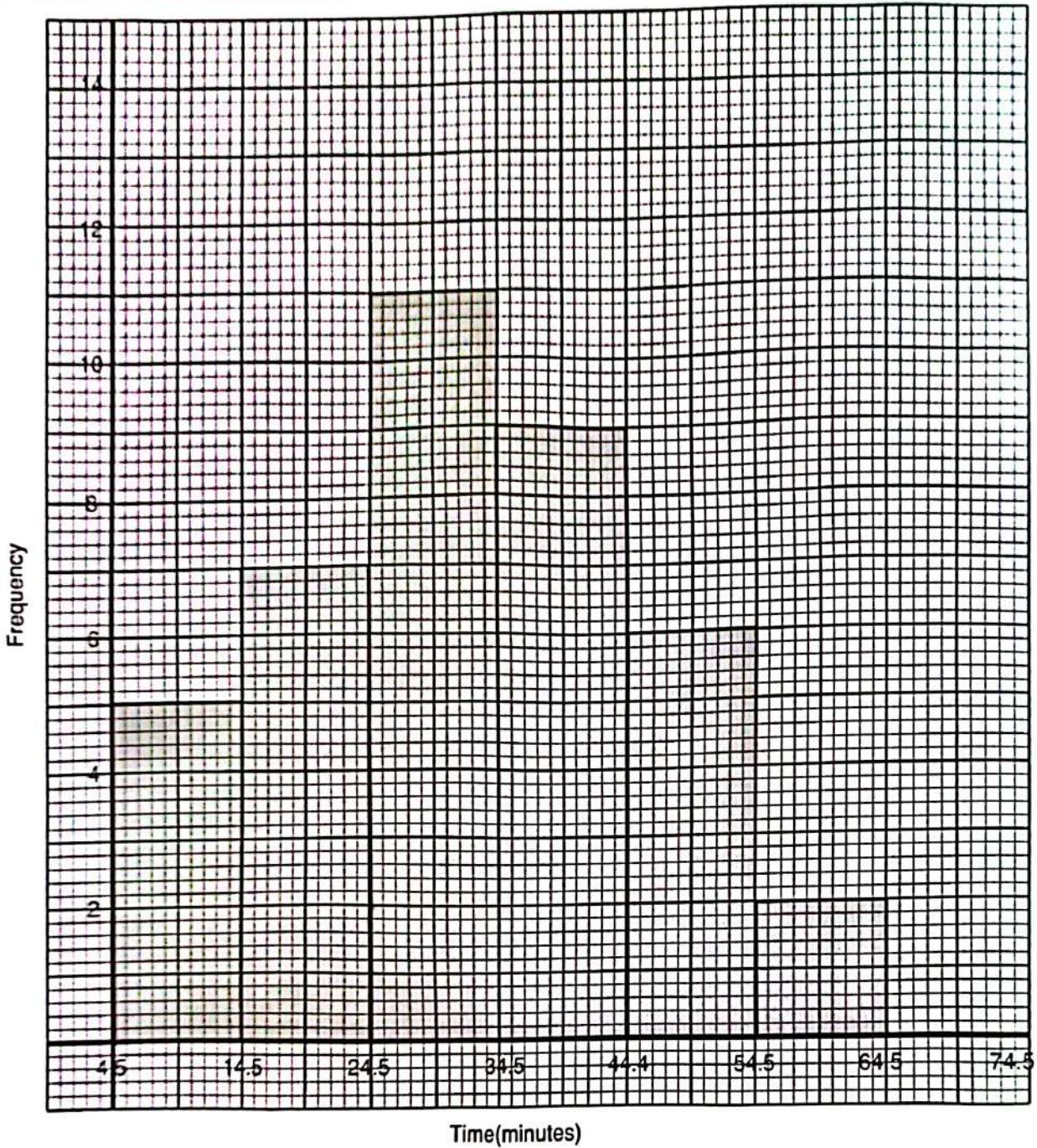
1. a) 73 b) 77 c) 72
2. a) 155 b) 141 c) 123
3. a) 47.4 b) 290 c) 59.5
4. 3.97
5. a) 7 b) 8.74
6. 24.1

3.6: Histogram (Pg 56 LB)

In Book 1, topic 9, you learnt how to draw bar charts with bars which do not touch. In this section, you will draw another diagram that uses bars to represent frequency but is different from a bar graph.

Possible responses for activity 3.9.

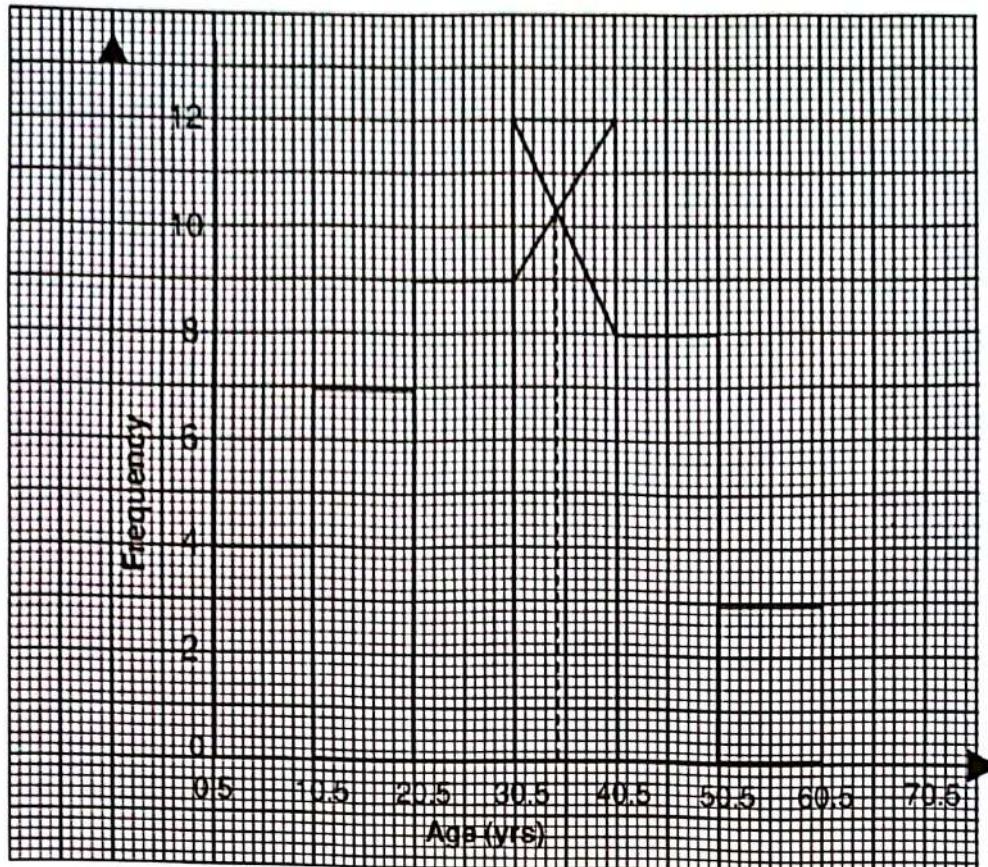
- ❖ Organise the learners into groups to work through activity 3.9.
- ❖ Mention the goal of the activity.
- ❖ Walk around the class monitoring the competencies being exhibited and note.
- ❖ Hold a whole class discussion led by group representatives.
- ❖ Harmonise the discussion points.



1.

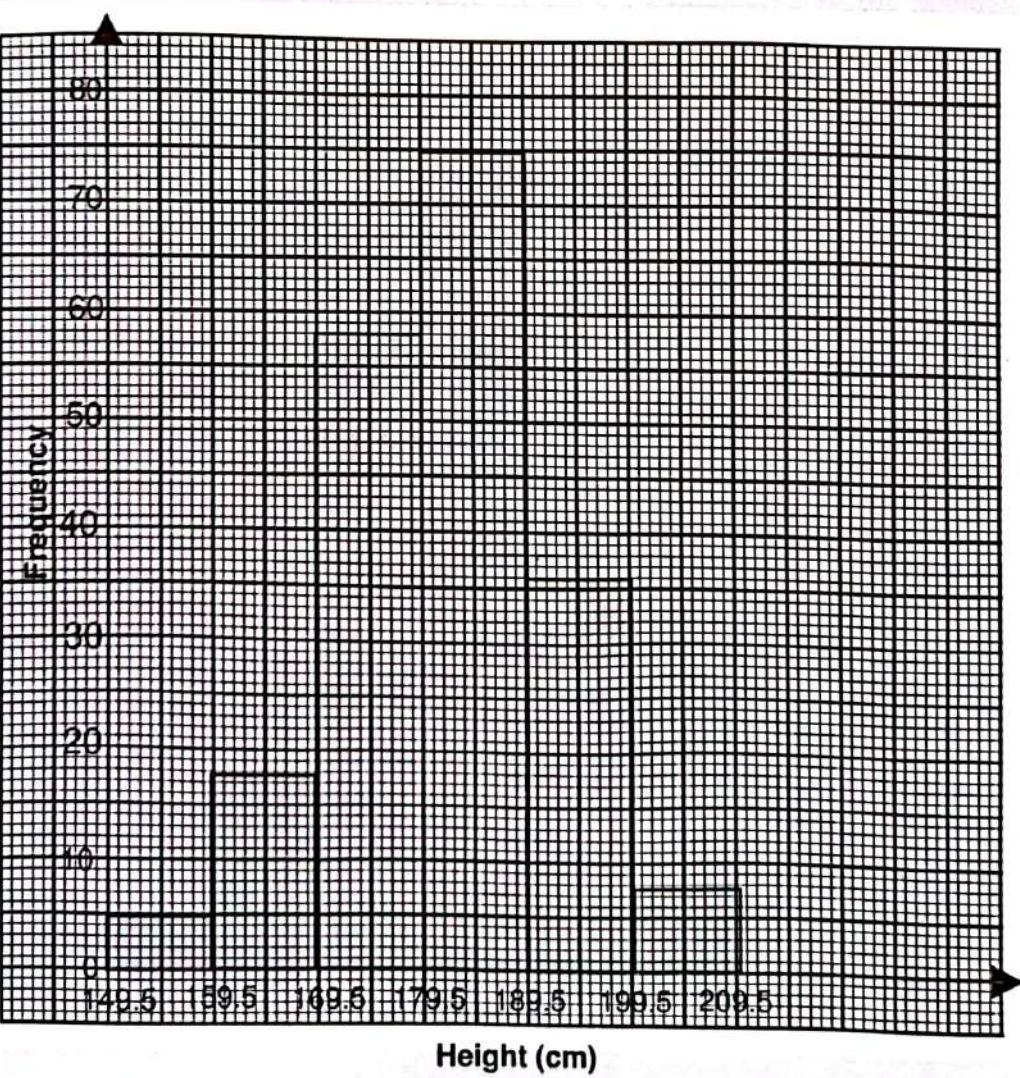


2.(a)



(b) Mode = 34.5

3.



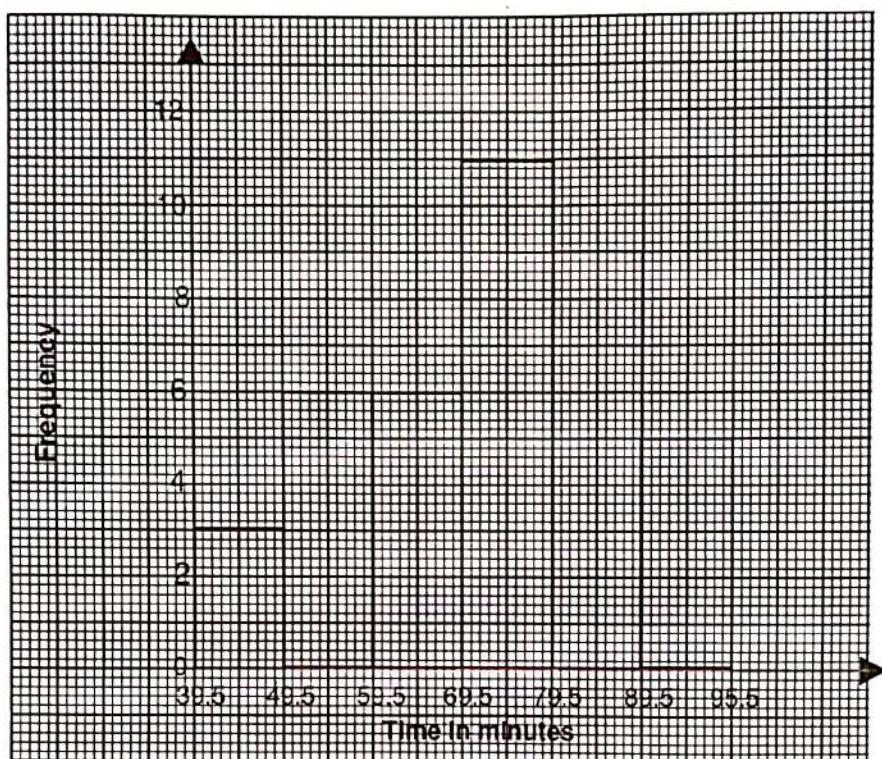
4. a)

x	Tally	f	x	fx
40 - 49		3	44.5	133.5
50 - 59		6	54.5	327.0
60 - 69		6	64.5	387.0
70 - 79		11	74.5	819.5
80 - 89		9	84.5	760.5
90 - 99		5	94.5	472.5

b) Mean

$$\begin{aligned} &= \frac{\sum fx}{\sum f} \\ &= \frac{2900}{40} \\ &= 72.5 \end{aligned}$$

c)



5. a) 56 b) Mode = 33.05

3.7: Cumulative Frequency Curve (Pg 60 LB)

In this section, you are going to look at a line graph that involves cumulative frequency.

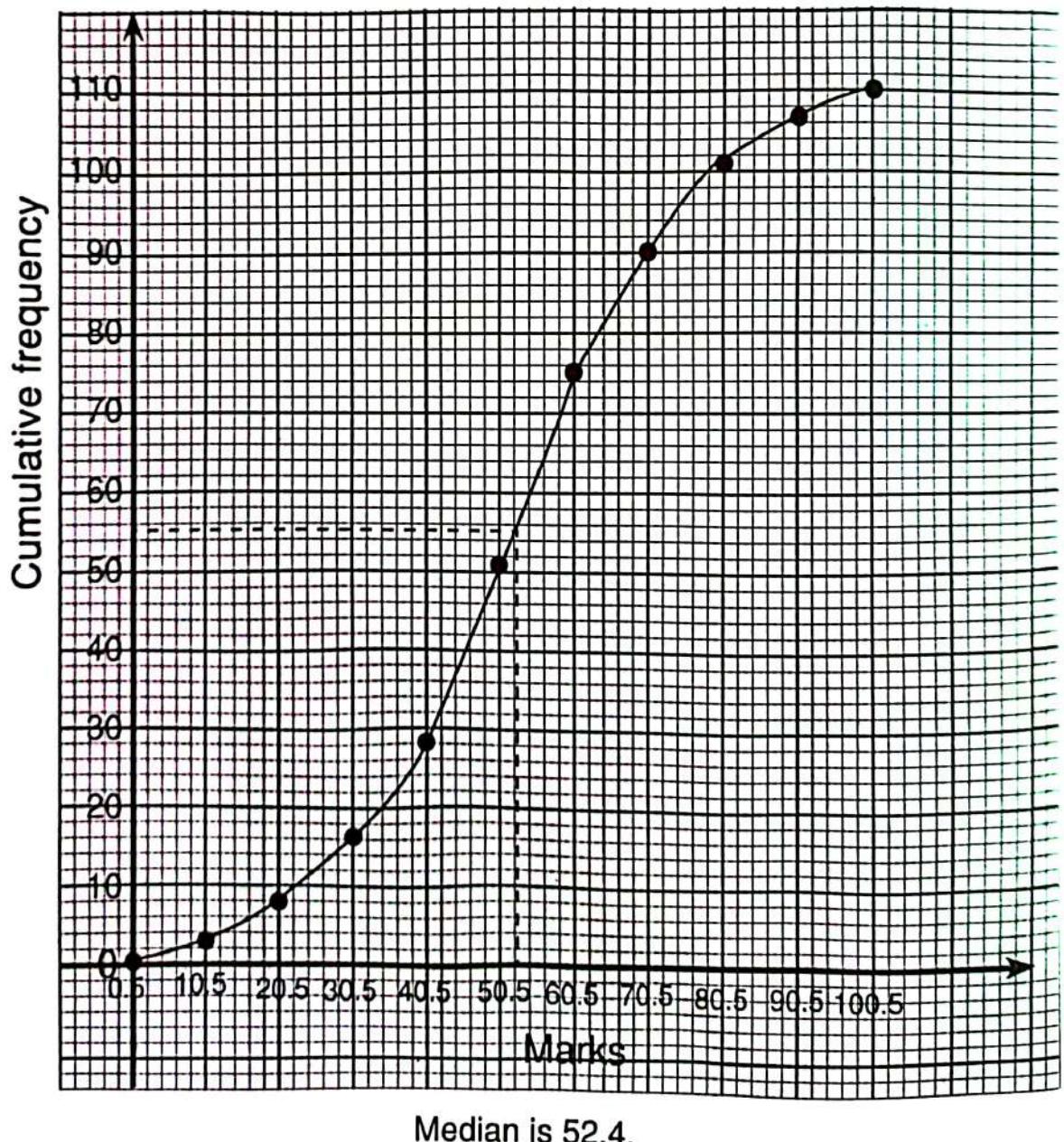
Activity 3.9

- ❖ Have the learners move into groups.
- ❖ Address to them the aim of the activity.
- ❖ Circulate around the room and record the learners' progress towards the standard skill level. These can be transferred to the learners' grade page.
- ❖ Process the results of the activity through whole group discussion where opinions are defended.
- ❖ Reinforce the concepts and skills about an Ogive.
- ❖ Provide the learners with an opportunity to enhance their understanding of an

- Ogive by studying example 3.11 and working out its quick practice question.
 ♦ Ask them to work through exercise 3.7

Possible responses for activity 3.10.

mark	<i>f</i>	C.f	U.C.B
1 – 10	3	3	10.5
11 – 20	5	8	20.5
21 – 30	8	16	30.5
31 – 40	12	28	40.5
41 – 50	23	51	50.5
51 – 60	24	75	60.5
61 – 70	15	90	70.5
71 – 80	11	101	80.5
81 – 90	6	107	90.5
91 – 100	3	110	100.5

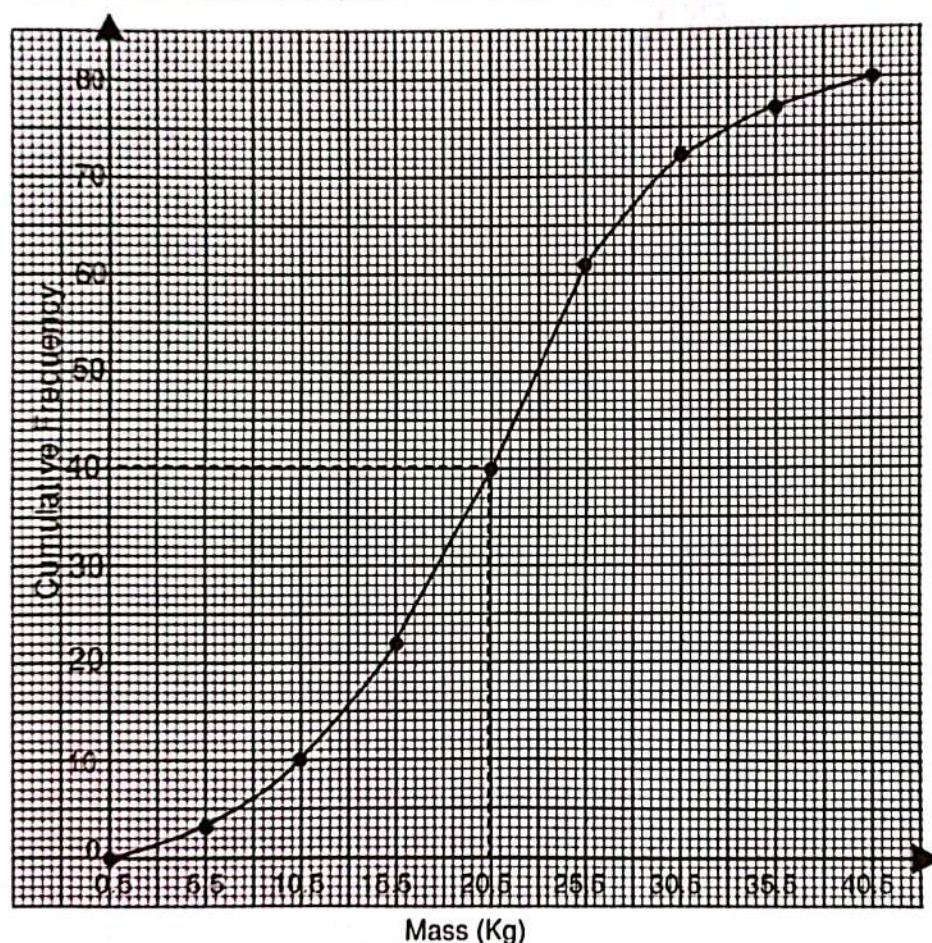


Median is 52.4.

Answers to Exercise 3.7 (Pg 62 LB)

1. a)

Mass (kg)	U. C.B	frequency	c.f
1 – 5	5.5	3	3
6 – 10	10.5	7	10
11 – 15	15.5	12	22
16 – 20	20.5	18	40
21 – 25	25.5	21	61
26 – 30	30.5	11	72
31 – 35	35.5	5	77
36 – 40	40.5	3	80

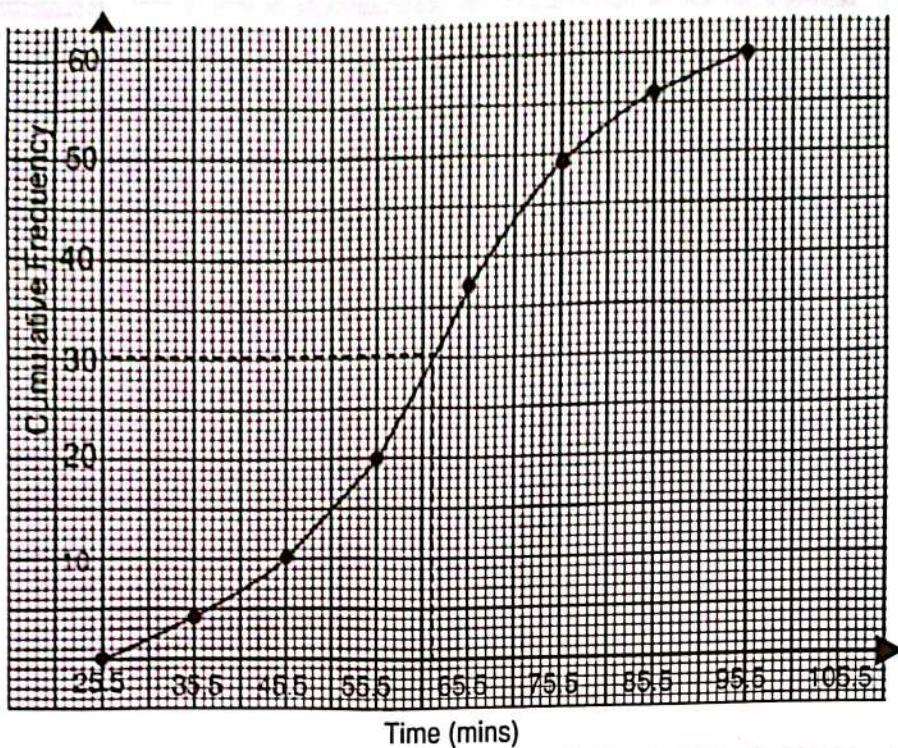


The median is 20.5

b)

Time (min)	U. C.B	frequency	c.f
26 – 35	35.5	4	4
36 – 45	45.5	6	10
46 – 55	55.5	10	20
56 – 65	65.5	17	37
66 – 75	75.5	12	49
76 – 85	85.5	7	56
86 – 95	95.5	4	60

b)



The median is 61.7

2.

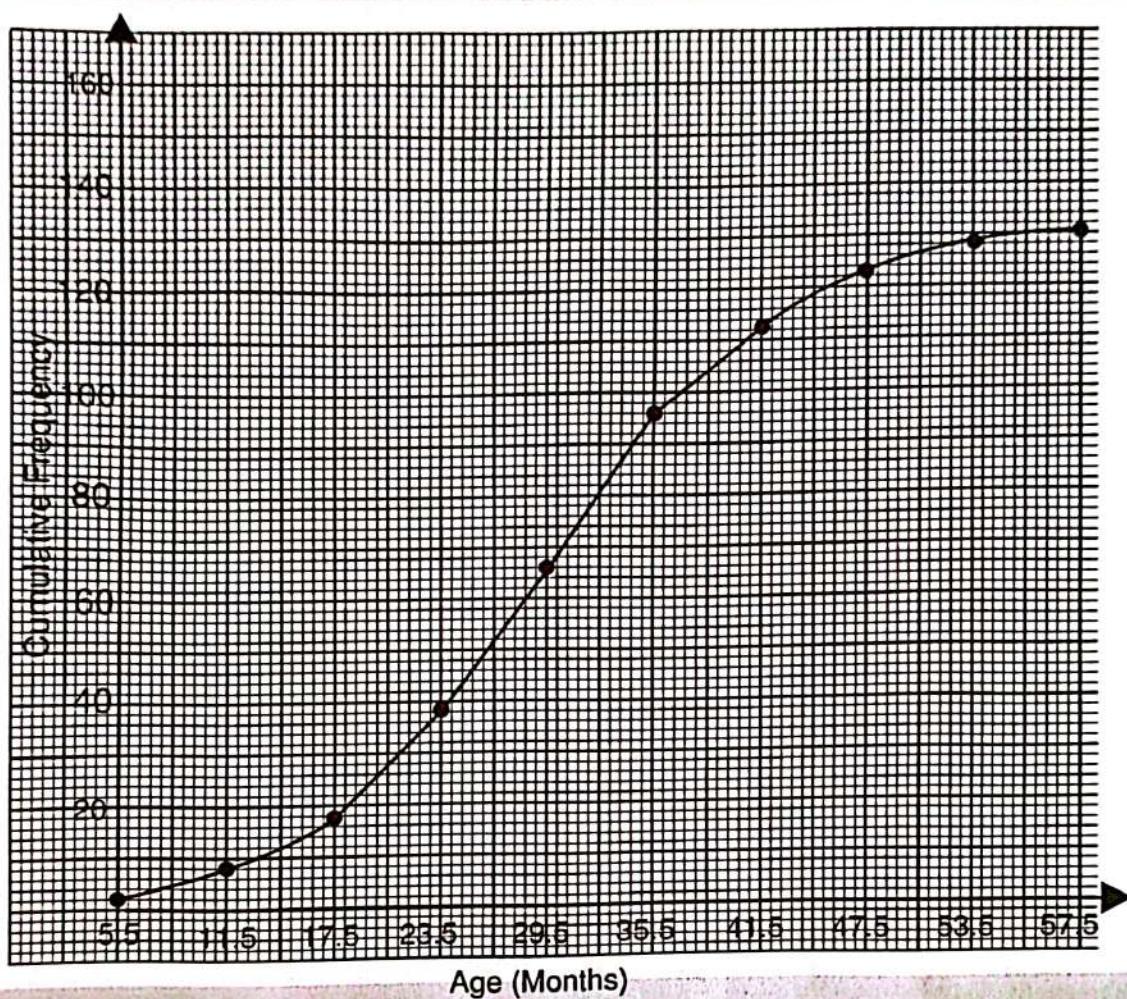
Age (months)	f	$c.f$	U. C.B
0 – 5	2	2	5.5
6 – 11	6	8	11.5
12 – 17	11	19	17.5
18 – 23	20	39	23.5
24 – 29	27	66	29.5
30 – 35	31	97	35.5
36 – 41	16	113	41.5
42 – 47	10	123	47.5
48 – 53	5	128	53.5
54 – 59	2	130	57.5

$$\text{Median} = \text{L.C. B} + \left(\frac{\sum f}{2} - cf_b \right) \times i$$

$\underline{f_m}$

$$\text{Median} = 23.5 + \left(\frac{\frac{130}{2} - 39}{27} \right) \times 6$$

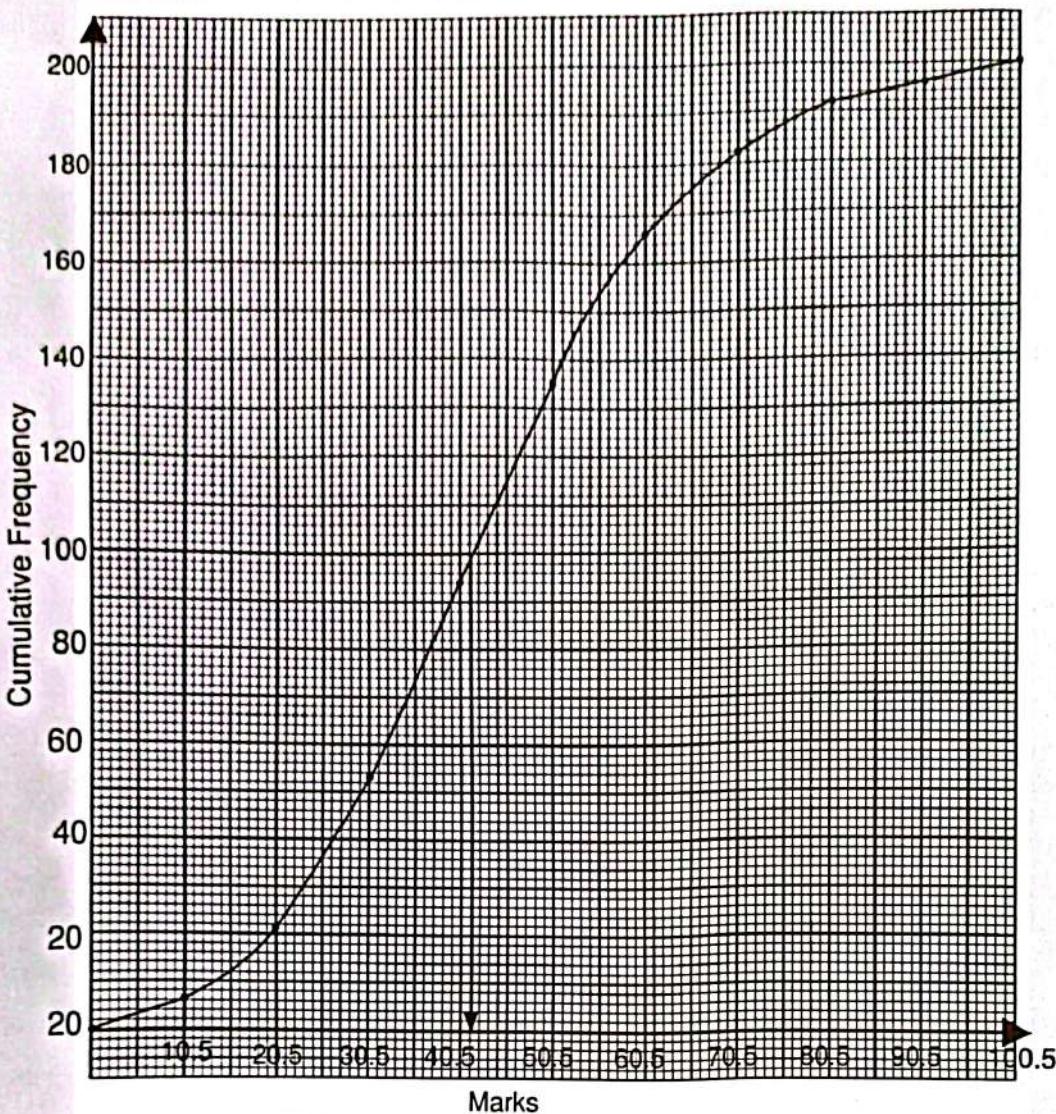
$$\begin{aligned}
 &= 23.5 + \left(\frac{65 - 39}{27} \right) \times 6 \\
 &= 23.5 + 5.778 \\
 &= 23.5 + 5.8 \\
 &= 29.5
 \end{aligned}$$



3. (a)

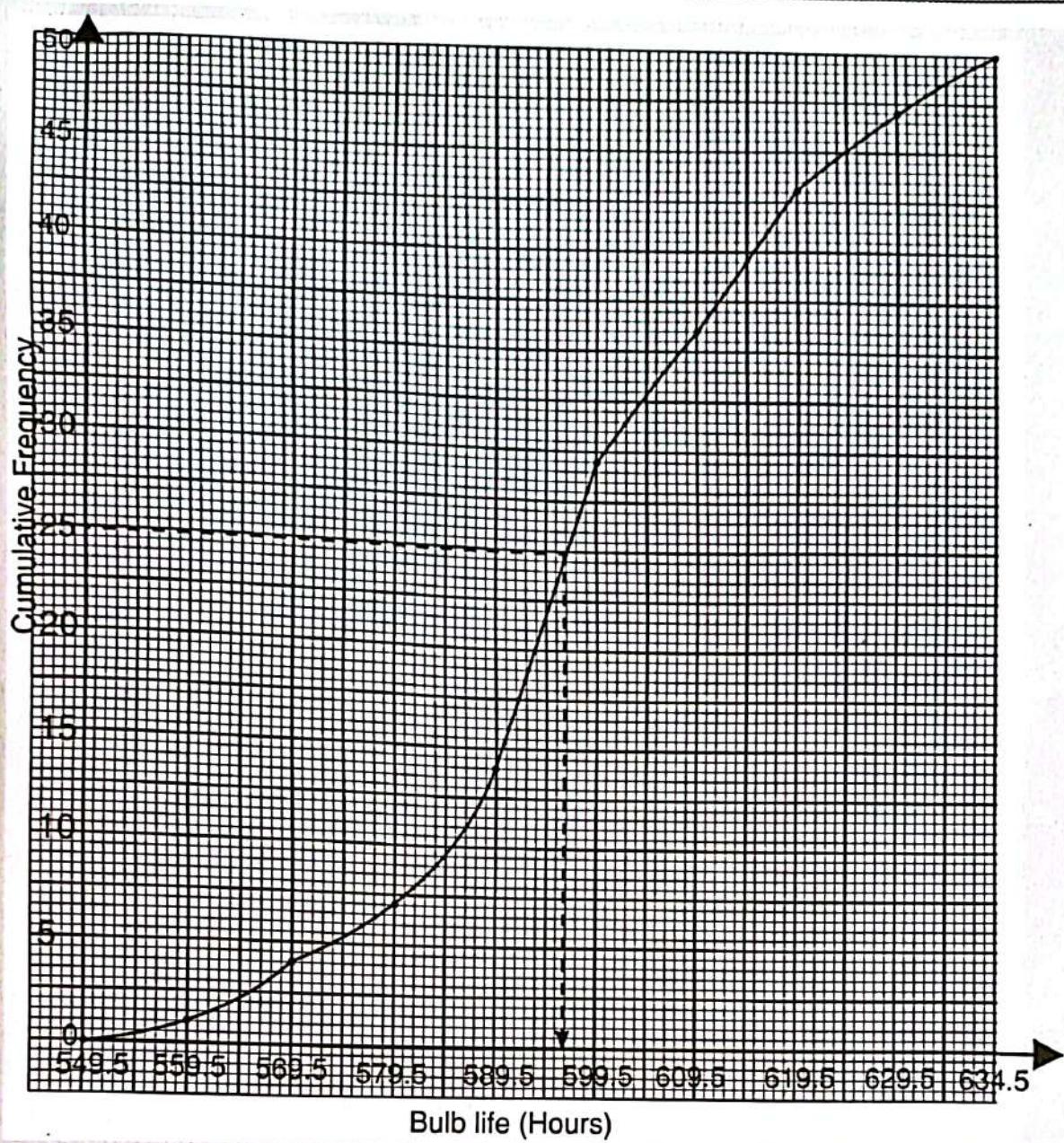
Mark	f	$c.f$	U. C.B
1 – 10	6	6	10.5
11 – 20	15	21	20.5
21 – 30	33	54	30.5
31 – 40	40	94	40.5
41 – 50	42	136	50.5
51 – 60	30	166	60.5
61 – 70	16	182	70.5
71 – 80	9	191	80.5
81 – 90	5	196	90.5
91 – 100	4	200	100.5
		200	

b)



Marks	Tally	Freq,f	C.f	U.C.B
550-559	/	1	1	559.5
560-569	///	3	4	569.5
570-579	///	3	7	579.5
580-589		7	14	589.5
590-599		15	29	599.5
		7	36	609.5
610-619		7	43	619.5
620-629		4	47	629.5
630-639	///	3	50	639.5
		50		

b)



c) Median = 595.5

Assessment grid for Activity of Integration 3

Output	Basis of evaluation	Relevancy	Accuracy	Coherence	Excell.	
Identify time wasting	Computes mean and range and interprets results	Score 3: Identifies all 4 relevant parts; drawing frequency table showing x,f and fx columns, calculating the mean time, working out the range, drawing a conclusion from results obtained from above.	Score: 3 Accurately applies all 4 relevant parts; draws a frequency table showing x,f and fx columns, calculates the mean time, working out the range, draws a conclusion from results obtained from above.	Score 3: Logical flow in the use of all relevant parts.	Learn earns 1 point if he/she has added any extra feature unsolicited in the instructions.	
		Score 2: Identifies 2-3 relevant parts from; drawing frequency table showing x,f and fx columns, calculating the mean time, working out the range, drawing a conclusion from results obtained from above.	Score: 2 Accurately applies 2-3 relevant parts; draws a frequency table showing x,f and fx columns, calculates the mean time, working out the range, draws a conclusion from results obtained from above.	Score: 2 Logical flow with distortions in the use of the relevant parts.		
		Score 1: Identifies 1 relevant part from; drawing frequency table showing x,f and fx columns, calculating the mean time, working out the range, drawing a conclusion from results obtained from above.	Score 1: Accurately applies 1 relevant part; draws a frequency table showing x,f and fx columns, calculates the mean time, working out the range, draws a conclusion from results obtained from above.	Score 1: Limited flow in the use of the relevant parts.		
Total						

(a) Frequency Table

Time (x)	Frequency (f)	$\sum fx$
2	3	6
4	4	16
5	5	25
6	6	36
8	6	48
10	5	50
12	2	24
$\sum f = 31$		$\sum fx = 205$

$$(b) \text{ Mean} = \frac{\sum fx}{\sum f} = \frac{205}{31} = 6.6 \text{ mins}$$

$$(c) \text{ Range} = 12 - 2 = 10 \text{ mins}$$

(d) The range shows a big time lag between fastest students and the slowest by 10 minutes. The mean also shows a similar picture, by almost 5 minutes, so there is a problem of time wasting.

Topic 4 Vectors



Competency: The learner understands the nature of vector quantities, manipulate and represent them in-order to solve problems

- ❖ Ensure that the content of thin this topic are covered within the allocated time periods i.e 15 periods.
- ❖ Emphasize the use of keywords in the learners book, their meanings use them continuosly for learners to understand their meanings as used in the topic.

In this topic , guide learners to:

- a) describe position vectors geometrically and as column vectors.
- b) find the vector of a directed line segment when position vectors of the end points are known.
- c) find the position vector of the mid-point of a line segment.
- d) use vector method to divide a line proportionately internally and externally.
- e) use vectors to show parallelism.
- f) use vector methods to show collinearity.

Introduction

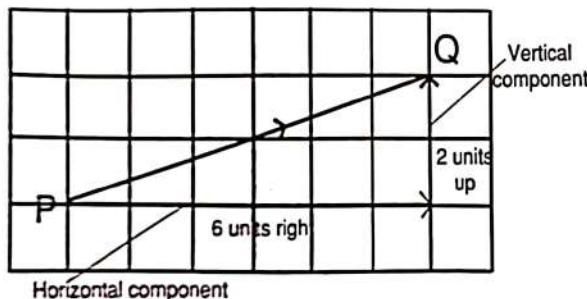
In this topic, you are going to learn more about vectors.

4.1: Revision of Vectors(02 periods) Pg 68 LB

In book 2, topic 2, you studied about vectors . You are going to learn more about vectors. The activity that follows will help you to revise what you learnt in Senior two.

Activity 4.1

A vector is represented in a coordinate plane by an arrow drawn from a point to another. The diagram below shows a vector named \overrightarrow{PQ} .



The initial point or starting point of the vector is P. The terminal point or the ending point of the vector is Q.
Instructional procedures:

- ❖ Arrange the learners into groups to do activity 4.2
- ❖ Let learners attempt the activity in groups
- ❖ Observe them as they do the activity watching out for competencies like communication and leadership skills.
- ❖ Note these down against the individual learners' name.
- ❖ Discuss with the learners the possible answers of the activities as follows.

Possible answers to activity 4.1

a) Is a quantity which has both magnitude and direction. for example displacement, velocity and momentum

b) Is a quantity which has direction only. for example speed, mass area.

$$\text{c) } \overrightarrow{AB} = \begin{pmatrix} p \\ q \end{pmatrix}$$

$$\text{d) } \overrightarrow{AB} = \begin{pmatrix} 1 \\ 2 \end{pmatrix}$$

$$\overrightarrow{CD} = \begin{pmatrix} 4 \\ 3 \end{pmatrix}$$

$$\overrightarrow{EF} = \begin{pmatrix} 5 \\ 2 \end{pmatrix}$$

$$\overrightarrow{GH} = \begin{pmatrix} 4 \\ 0 \end{pmatrix}$$

4.2: Magnitude of a vector (03 periods) Pg 69 LB

Activity 4.2

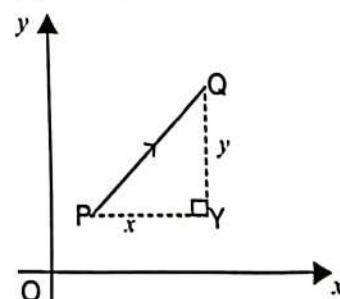
Answers to Quick Practice

1. 7.81 2. 6.40

The magnitude of a vector \overrightarrow{PQ} is called the **modulus** of \overrightarrow{PQ} or its length.

It is written as $|\overrightarrow{PQ}|$. In general,

if $\overrightarrow{PQ} = \begin{pmatrix} x \\ y \end{pmatrix}$ then $|\overrightarrow{PQ}| = \sqrt{x^2 + y^2}$



Instructional procedures

- ❖ Organise learners into pairs to do activity 4.1
- ❖ Move around as they do activity watching for competences

such as critical thinking and communication skills.

- ❖ Record against individual learners name,

Possible solutions to activity 4.2

b) $\overrightarrow{AB} = \begin{pmatrix} 7 \\ 5 \end{pmatrix}$

c) Right angled triangle

d) $a^2 + b^2 = c^2$

$$\overrightarrow{AB}^2 = 7^2 + 5^2$$

$$\overrightarrow{AB} = 74$$

$$\overrightarrow{AB} = 8.60 = 8.6 \text{ (to 1 d.p.)}$$

4.3: Equal Vectors (03 periods) Pg 69 LB

Activity 4.3

Instructional Procedure

- ❖ Arrange learners into groups to do the activity
- ❖ Circulate around the classroom watching the competencies such as teamwork and leadership skills
- ❖ Note to the individual name.

Instructional Procedure

- ❖ Arrange learners into groups to do the activity
- ❖ Circulate around the classroom watching the competencies such as teamwork and leadership skills
- ❖ Note to the individual name.

Possible answers to activity 4.3

- a) They travel the same distance and the same direction.

$$\overrightarrow{AB} = \begin{pmatrix} 5 \\ 6 \end{pmatrix} \quad \overrightarrow{LM} = \begin{pmatrix} 1 \\ 4 \end{pmatrix}$$

(i) $\overrightarrow{AB} = \begin{pmatrix} 1 \\ 4 \end{pmatrix}$ (ii) \overrightarrow{LM} and \overrightarrow{PQ}

- ❖ They are in the same direction and

equal length.

- ❖ Have the whole class group discussion and let the group leaders present on behalf of their results.
- ❖ Conclude the discussion and help the learner to individual basis.

4.4: Multiplication by a Scalar (01 period) Pg 69 LB

Activity 4.4

Instructional Procedures

Arrange learners into groups to do activity 4.4

Circulate around the classroom watching individual competencies such as team work , respect and honesty.

Note these on individual learners name.

Possible answers for activity 4.4

b) $\overrightarrow{a} = \begin{pmatrix} 3 \\ 1 \end{pmatrix}, \overrightarrow{b} = \begin{pmatrix} 6 \\ 4 \end{pmatrix}$

c) Vector \overrightarrow{a} is twice vector \overrightarrow{b} .

d) $\overrightarrow{p} = \begin{pmatrix} 2 \\ 4 \end{pmatrix}, \overrightarrow{q} = \begin{pmatrix} 2 \\ 4 \end{pmatrix}$

e) Vectors \overrightarrow{p} and \overrightarrow{q} are equal but opposite in direction.

4.5: Position Vectors (Pg 70 LB)

Activity 4.5

- ❖ Arrange the learners into groups to do the activity

- ❖ Observe learners attempting the activity and note any competences like teamwork and cooperation like teamwork and cooperation against the individuals learners name.

Possible answers for the activity 4.5

A is (3, 5) or (3, 5) B is (-2, 14)

C is (0, -3) E is (-6, -2)

G is (7, -2) H is (5, 0)

c) $\overrightarrow{OA} = \begin{pmatrix} 3 \\ 5 \end{pmatrix}$ $\overrightarrow{OB} = \begin{pmatrix} 2 \\ 4 \end{pmatrix}$

$\overrightarrow{OC} = \begin{pmatrix} 0 \\ -3 \end{pmatrix}$ $\overrightarrow{OG} = \begin{pmatrix} 7 \\ -2 \end{pmatrix}$

d) $\overrightarrow{OH} = \begin{pmatrix} 5 \\ 0 \end{pmatrix}$ Their position vectors and coordinates are the same

e) T(512)

Answers for exercise 4.1 (Pg 72 LB)

1. a) $\begin{pmatrix} 12 \\ 6 \end{pmatrix}$ b) $\begin{pmatrix} 12 \\ 6 \end{pmatrix}$ c) $\begin{pmatrix} 20 \\ 8 \end{pmatrix}$

e) $\begin{pmatrix} 4 \\ 3 \end{pmatrix}$ f) $\begin{pmatrix} 3 \\ -4 \end{pmatrix}$

2. a) 4.47 b) 15.00

c) 10.00 d) 4.12

e) 10.00 f) 12.

g) 12 h) 11.4

3. 10.82

4. a) $\overrightarrow{OA} = \begin{pmatrix} 6 \\ -5 \end{pmatrix}$ b) $\overrightarrow{OB} = \begin{pmatrix} 7 \\ 1 \end{pmatrix}$

c) $\overrightarrow{OC} = \begin{pmatrix} 3 \\ 3 \end{pmatrix}$ d) $\overrightarrow{OD} = \begin{pmatrix} -5 \\ 0 \end{pmatrix}$

e) $\overrightarrow{OE} = \begin{pmatrix} 7 \\ -5 \end{pmatrix}$ f) $\overrightarrow{OF} = \begin{pmatrix} 4 \\ -6 \end{pmatrix}$

g) $\overrightarrow{OG} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$ h) $\overrightarrow{OH} = \begin{pmatrix} 5 \\ 6 \end{pmatrix}$

i) $\overrightarrow{OL} = \begin{pmatrix} 7 \\ 5 \end{pmatrix}$ j) $\overrightarrow{OJ} = \begin{pmatrix} 0 \\ 6 \end{pmatrix}$

k) $\overrightarrow{OK} = \begin{pmatrix} 1 \\ -3 \end{pmatrix}$

5. a) 7.81 b) 12.37

c) 4.74 d) 23.43

e) 16.49 f) 2.83

g) 0.35 h) 1.41

4.6: Addition of Vectors - 01 Periods (LB 73 Page)**Activity 4.6**

- ❖ Arrange learner's into groups to do the activity.
- ❖ Let learner's attempt the activity in groups as you move around observing competences such as communication skills and note against the individual learner
- ❖ Call learners back as a whole class and let them discuss their findings. Guide them to reach the desired results.

Possible answers to activity 4.6

a) (i) $\overrightarrow{AB} = \begin{pmatrix} 2 \\ 4 \end{pmatrix}$ (ii) $\overrightarrow{BC} = \begin{pmatrix} 4 \\ 1 \end{pmatrix}$

b) $\overrightarrow{BC} = \begin{pmatrix} 6 \\ 5 \end{pmatrix}$

c) $\overrightarrow{AC} = \overrightarrow{AB} + \overrightarrow{BC}$

4.7: Subtraction of Vectors - 2 Periods (Page 74 LB)**Activity 4.7**

- ❖ Let learners attempt the activity in their groups. Observe them as they attempt it while guiding them along and note down any individual learner's competence skills like team work.
- ❖ Gather learners in a whole and let them discuss their results. Guide them in the discussion so as to make desired conclusion.

Possible answers for exercise 4.2**Activity 4.7**

a) (i) It is because we think subtraction of a number as addition of it's negative.

$$(ii) -\underline{w} = -1 \begin{pmatrix} 3 \\ 1 \end{pmatrix}$$

$$\underline{w} = \begin{pmatrix} -3 \\ -1 \end{pmatrix}$$

(iii) $-3 \underline{w}$ and $2u - 3 \underline{w}$

$$-3 \begin{pmatrix} 3 \\ 1 \end{pmatrix} = \begin{pmatrix} 9 \\ -3 \end{pmatrix}$$

$$2u = \begin{pmatrix} 7 \\ 4 \end{pmatrix}$$

$$= 2 \begin{pmatrix} 7 \\ 4 \end{pmatrix} - 3 \begin{pmatrix} 3 \\ 1 \end{pmatrix}$$

$$= \begin{pmatrix} 14 \\ 8 \end{pmatrix} - \begin{pmatrix} 9 \\ 3 \end{pmatrix}$$

$$= \begin{pmatrix} 5 \\ 5 \end{pmatrix}$$

$$b) \overrightarrow{OA} = \begin{pmatrix} 1 \\ 4 \end{pmatrix}$$

$$\overrightarrow{OB} = \begin{pmatrix} 7 \\ 3 \end{pmatrix}$$

$$\overrightarrow{OA} \cdot \overrightarrow{OB}$$

$$\begin{pmatrix} 1 \\ 4 \end{pmatrix} \cdot \begin{pmatrix} 7 \\ 3 \end{pmatrix}$$

$$= \begin{pmatrix} -1 \\ 1 \end{pmatrix}$$

Answers to Exercise 4.2 (Pg 75 LB)

$$1. (a) \begin{pmatrix} 1 \\ -1 \end{pmatrix} (b) \begin{pmatrix} 2 \\ 2 \end{pmatrix} (c) \begin{pmatrix} 4 \\ -8 \end{pmatrix} (d) \begin{pmatrix} 7 \\ 5 \end{pmatrix}$$

$$(e) \begin{pmatrix} 4 \\ -8 \end{pmatrix} (f) \begin{pmatrix} 11 \\ 11 \end{pmatrix} (g) \begin{pmatrix} 7 \\ -13 \end{pmatrix}$$

$$2. (a) \begin{pmatrix} 2 \\ 9 \end{pmatrix} (b) \begin{pmatrix} 9 \\ 5 \end{pmatrix} (c) \begin{pmatrix} 7 \\ -4 \end{pmatrix}$$

$$3. \begin{pmatrix} 6 \\ 2 \end{pmatrix}$$

4. B is $(5, 5)$

$$5. \overline{AD} = \begin{pmatrix} 5 \\ -2 \end{pmatrix}$$

$$6. a) 2.828 b) 8.544 c) 14.87$$

$$d) 32.18 e) 10$$

$$7. a) (8, 9) b) (-3, 3)$$

$$8. R = (3, 4)$$

$$9. a) \begin{pmatrix} 13 \\ 0 \end{pmatrix} b) \begin{pmatrix} 10 \\ 18 \end{pmatrix} c) \begin{pmatrix} 13 \\ 28 \end{pmatrix}$$

$$e) \begin{pmatrix} 4 \\ 8 \end{pmatrix} f) \begin{pmatrix} 5.5 \\ 4 \end{pmatrix}$$

10.

$$11. a) \begin{pmatrix} 13 \\ 0 \end{pmatrix}$$

$$b) \overline{AD} = \begin{pmatrix} 1 \\ 4 \end{pmatrix}, \overline{BC} = \begin{pmatrix} 10 \\ 2 \end{pmatrix}, \overline{AD} = \begin{pmatrix} 5 \\ 1 \end{pmatrix}$$

$$c) \overline{ZA} = \overline{ZY} + \overline{YX} + \overline{XA}$$

$$= \underline{z} + \underline{y} + \underline{x}$$

$$= \begin{pmatrix} 1 \\ 4 \end{pmatrix} + \begin{pmatrix} 4 \\ 3 \end{pmatrix} + \begin{pmatrix} 1 \\ 4 \end{pmatrix}$$

$$= \begin{pmatrix} 6 \\ 5 \end{pmatrix}$$

$$= \underline{r}$$

4.8: Mid Points (Page 76 LB)

Sometimes coordinates of the end points of a line segment are given. You are going to lead the learners to find how least to find the coordinates of the mid point of the line segment.

Activity 4.8

Let learners do the activity in pairs. Observe them as they do the activity guiding them and noting down any individual competences gather learners back into one group and lead them into discussing their findings and arrive at the same desired law.

Expected responses to Activity 4.8

$$a) (i) \overline{OB} = \begin{pmatrix} 4 \\ 8 \end{pmatrix} \text{ and } \overline{OM} = \begin{pmatrix} 2 \\ 4 \end{pmatrix}$$

- (ii) $\overline{QM} = \frac{1}{2}\overline{OB}$ and $\overline{OB} = 20\text{cm}$
- (iii) M is (2, 4)
- b) (i) $\overline{PQ} = \begin{pmatrix} 8 \\ -2 \end{pmatrix}$ and $\overline{PN} = \begin{pmatrix} 4 \\ 1 \end{pmatrix}$
- (ii) $\overline{QN} = \begin{pmatrix} 6 \\ 7 \end{pmatrix}$
- (iii) N is (6, 7)

Let learner now read through the explanation following the activity in LB and example 4.1. Ask them to do the practice that follows;

4.9: Proportional Division of a Line (Page 76 LB)

Point out to the learners that many times we need to divide a whole in more than two equal parts.

Activity 4.9

- ❖ Let learners work through the activity in their groups.
- ❖ Observe them and guide them to arrive at the desired results.
- ❖ Make note of individual competence skills like communication and active participation.
- ❖ Ask learners to discuss as a whole class their results and guide them to the expected conclusion.
- ❖ Ask them to write their own notes from their discussion.

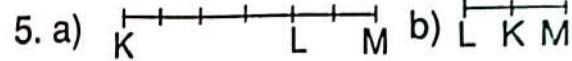
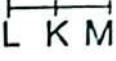
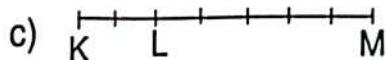
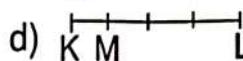
Expected responses to Activity 4.9

- b) P is (3, 2)
- c) $\overline{QR} = \begin{pmatrix} 9 \\ 6 \end{pmatrix}$ and R = $\begin{pmatrix} 9 \\ 6 \end{pmatrix}$
- d) 3 : 4
- e) 4 : 1

Ask learners to read through the given explanation and examples 4.2

and 4.3 and do the quick practices.

Answers to Exercise 4.3 (Pg 78 LB)

1. a) $\begin{pmatrix} 3 \\ 2 \end{pmatrix}$ b) M(2, 5)
2. a) 5 : 3 b) 7 : 4 c) 2 : 9
3. Q(4, 8)
4. a) (-1, 5) b) (2, 10) c) (3, 6.5)
5. a)  b) 
- c) 
- d) 
6. N(5.5, 1.5)
7. a) 1 : 8 b) 5 : 3 c) 1 : 1 d) -1 : 4 e) 1 : -1 f) 4 : -3
8. a) $\begin{pmatrix} 3 \\ 6 \end{pmatrix}$ b) (5, 5)

4.10: Parallel Vectors (Page 79 LB)

Find out what the learners know about parallel lines. Now we are going to find out what relationship there is between parallel vectors.

Activity 4.10

- ❖ Let learners go through the activity in pairs as you move around guiding and assisting them where necessary.
- ❖ Note down individual learners competence skills like communication and active participation.
- ❖ Call learners attention back and ask them to give their findings to the whole class.
- ❖ Guide the discussion to find the needed conclusion.

Possible answers to Activity 4.10

- b) $\overline{AB} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$ and $\overline{BC} = \begin{pmatrix} 6 \\ 4 \end{pmatrix}$
 c) Those in \overline{DC} are twice those in \overline{AB} .
 d) \overline{DC} is twice \overline{AB} in length and they are in the same direction.

4.11: Collinear Points (Pg 80 LB)**Activity 4.11**

- ❖ Ask learners to do the activity in their groups.
- ❖ Go round guiding and noting individual learners' competence skills like cooperative and leaderships.
- ❖ Let learners come back as a whole class and ask group leaders to present their responses to the activity as you guide them to arrive at the desired.

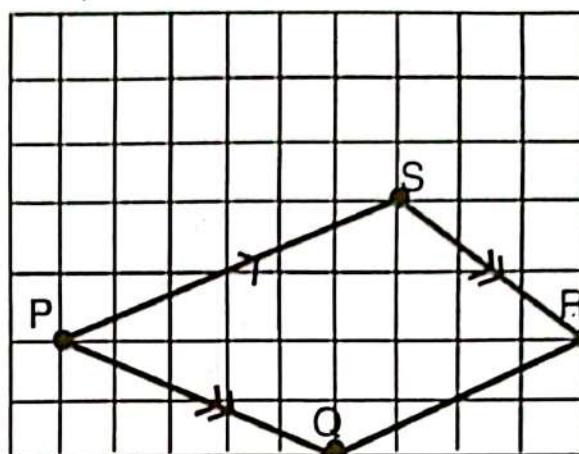
Possible responses to Activity 4.11

- a) and b) practical
 c) $\overline{CD} = \begin{pmatrix} 4 \\ -1 \end{pmatrix}$ and $\overline{DE} = \begin{pmatrix} 8 \\ 2 \end{pmatrix}$
 d) $\overline{DE} = 2\overline{CD}$
 e) D f) lie on a line (they are collinear)

Make a conclusion about collinear points by discussing the notes following the activity in the learners' book. Let learners study Example 4.4 and write their own notes. They can now try the Quick practice question.

Answers to Exercise 4.4 (Pg 81 LB)

1. a)



b) $\overline{PS} = \begin{pmatrix} 4 \\ 2 \end{pmatrix}, \overline{RP} = \begin{pmatrix} 7 \\ 0 \end{pmatrix}$

2. a) B(9, 6)

b) M is (1, 2.5) N is (8, 3.5)

c) $\overline{OM} = \frac{1}{2}\overline{OA} = \frac{1}{2}\begin{pmatrix} 2 \\ 5 \end{pmatrix} = \begin{pmatrix} 1 \\ 2.5 \end{pmatrix}$

d) $\overline{CN} = \frac{1}{2}\overline{CB} = \frac{1}{2}\begin{pmatrix} 9-7 \\ 6-7 \end{pmatrix} = \begin{pmatrix} 1 \\ 2.5 \end{pmatrix}$

Opposite sides equal and parallel

3. $\overline{AC} = \begin{pmatrix} 5-7 \\ 4-7 \end{pmatrix} = \begin{pmatrix} 2 \\ -3 \end{pmatrix}$

$\overline{CE} = \begin{pmatrix} 1-5 \\ -2-4 \end{pmatrix} = \begin{pmatrix} 4 \\ -6 \end{pmatrix}$

3. $\overline{CE} = 2\overline{AC} \Rightarrow CE \parallel AC$ and as they have C in common AC and E are collinear.

4. E is (5, 6) and F(10, 2)

6. a) X is (10, 7) b) $\overline{KM} = \begin{pmatrix} 4 \\ 8 \end{pmatrix}$
 $\overline{KX} = \begin{pmatrix} 4 \\ 2 \end{pmatrix}$ $\overline{KM} = 2\overline{KX} \Rightarrow KM \parallel KX$ and since they have X in common KXM is a straight line.

7. $\overline{CD} = \begin{pmatrix} 2 \\ 8 \end{pmatrix}$

8. a) $\overline{PQ} = \begin{pmatrix} 6 \\ 12 \end{pmatrix}, \overline{QP} = \begin{pmatrix} 4 \\ 8 \end{pmatrix}$

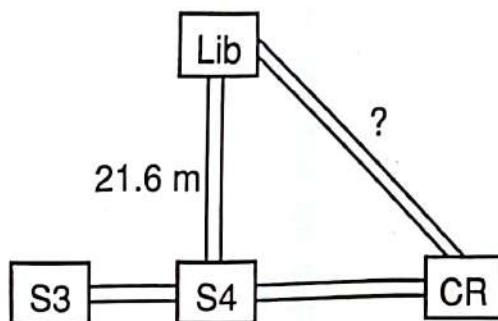
b) $\overline{PQ} = \frac{3}{2}\overline{QP} \Rightarrow PQ \parallel QR$ and as they have Q in common PQR is a line.

Sample Activity of Integration 4 Assessment Grid

Output	Basis of evaluation	Relevancy /3	Accuracy /3	Coherence /3	Excellence /1
Length of concrete path	Determines the required distance using vector knowledge.	Score: 3 Identifies all 4 relevant parts; drawing a sketch, using ratios to find the distance between S4 block and computer room, using modulus formula to find and then state the required distance.	Score: 3 Accurately applies all 4 relevant parts; draws a sketch, uses ratios to find the distance between S4 block and computer room, using modulus formula to find and then state the required distance.	Score 3: Logical flow in the use of all relevant parts..	Learner earns 1 point if he/she has added any exceptional feature unsolicited in the instructions
		Score: 2 Identifies 2-3 relevant parts from; drawing a sketch, using ratios to find the distance between S4 block and computer room, using modulus formula to find and then state the required distance.	Score: 2 Accurately applies 2-3 relevant parts; draws a sketch, uses ratios to find the distance between S4 block and computer room, using modulus formula to find and then state the required distance.	Score: 2 Logical flow with distortions in the use of the relevant parts.	
		Score: 1 Identifies 1 relevant part from; drawing a sketch, using ratios to find the distance between S4 block and computer room, using modulus formula to find and then state the required distance.	Score: 1 Accurately applies 1 relevant part; draws a sketch, uses ratios to find the distance between S4 block and computer room, using modulus formula to find and then state the required distance.	Score: 1 Limited flow in the use of the relevant parts.	
Total	10	3	3	3	1

Possible solution to Activity of Integration 4

Sketch



$$\text{Total ratio} = 1 + 3 = 4$$

$$\text{Distance between S4 and CR} = \frac{3}{4} \times 19.2 \\ = 14.4\text{m}$$

The shortest distance between two places is a straight line joining the library to the computer room.

The modulus (distance)

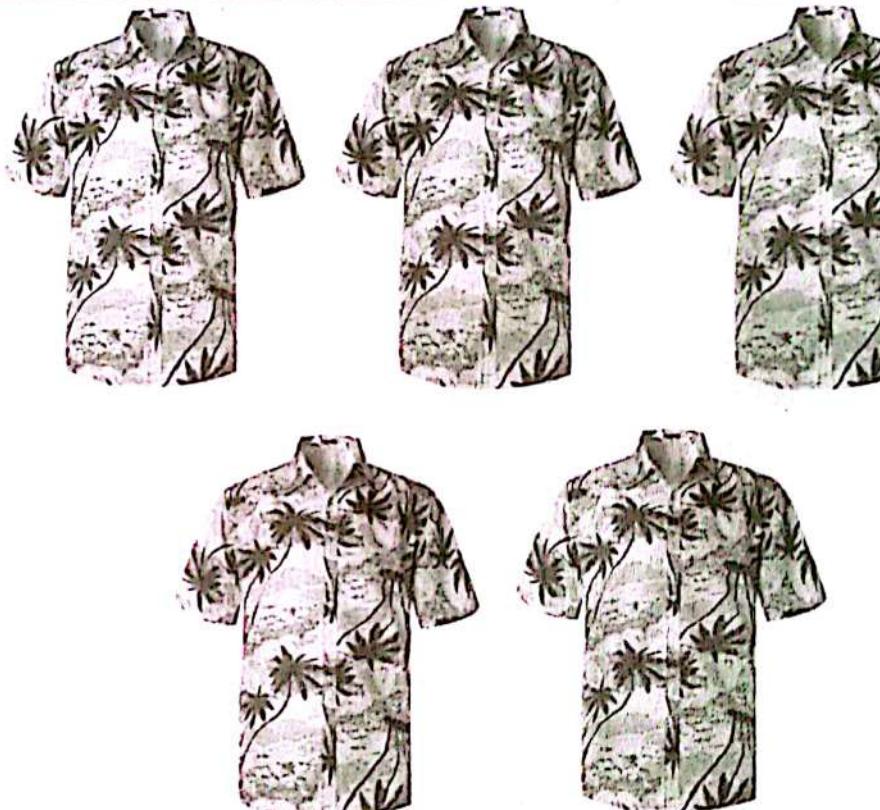
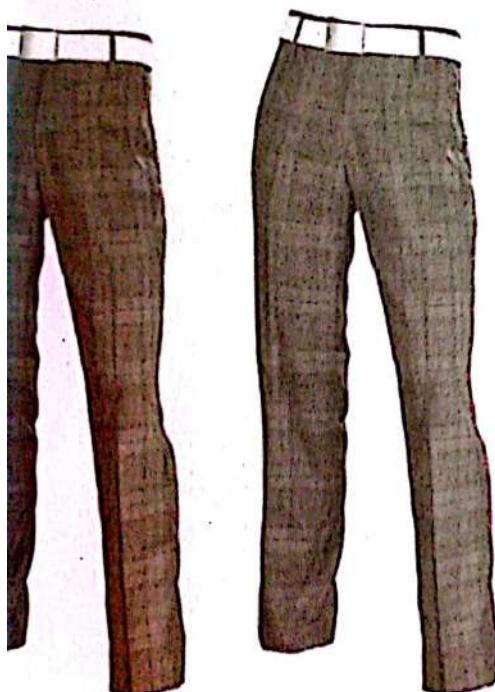
$$= \sqrt{(21.6^2 + 14.4^2)} \\ \approx 26 \text{ metres}$$

The distance will be 26 metres that he will have to construct with concrete.

Topic 5

5

Ratio and Proportion



Competency: The learner understands ratio and proportion and use them in a range of context.

- ❖ Ensure that the contents of this topic are covered within the allocated 12 periods.
- ❖ Emphasize the use of the key words in the learners to understand their meanings as used in this topic.

In this topic, guide the learner to;

- a) understand and apply equivalent ratios
- b) understand and apply direct and inverse proportional reasoning.
- c) understand and apply ratio, proportional and scale.
- d) draw and interpret the line of best fit when looking for relationship in bivariate data on a scatter diagram.

Introduction

Ask learners to internalise the introduction from their guides. Use their experience to develop the idea of ratio and proportion. For instance, how one object is related to the other in terms of size, length among others.

5.1: Meaning of Ratios (Pg 84 LB)

In this section much emphasis should be put on use of words such as 'smaller', 'more', 'faster' and so on.

Activity 5.1

Instructional procedures.

- ❖ Arrange the learners in pairs.
- ❖ Let the learners attempt the activity in pairs.
- ❖ Observe them as they do the activity watching out for competence like communication skills.
- ❖ Note these down against the individual learner's name.
- ❖ Discuss with the learners the possible answers of the activity as follows:-

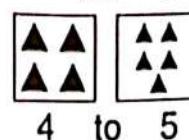
- ❖ Organise learners back into a whole class to discuss their findings.
- ❖ Discuss with learners more of how ratios are defined.
- ❖ The exercise 5.1 gives an opportunity to learners to practice their skills.

Possible answers to Activity 5.1

- a) Apples are not more than bananas.
Apples are 2 times 4 the number of

bananas.

- b) Bananas are not less than Apples.
Bananas are $\frac{1}{4}$ the number of apples.
- c) $9 \text{ to } \underline{12} = \underline{6} \text{ to } \underline{8} = \underline{3} \text{ to } \underline{4}$



Quick Practice

a) $6 \text{ cm} : 42 \text{ cm}$

$$\frac{6 \text{ cm}}{1 \text{ cm}} ; \frac{42 \text{ cm}}{7 \text{ cm}}$$

$$1 : 7$$

b) $1 \text{ hr } 30 \text{ mins} : 2 \text{ hrs}$
changing to minutes

$$1 \text{ hr} = 60 \text{ mins}$$

$$(60 \text{ mins} + 30 \text{ mins}) = (2 \times 60) + 30$$

$$90 \text{ mins} : 120 \text{ mins}$$

$$30 \text{ mins} : 4 \text{ mins}$$

$$3 : 4$$

c) $0.0 : 0.6$

$$\frac{3}{100} : \frac{6}{10}$$

$$\text{LCM} = 100$$

$$\left(\frac{3}{100} \times 100 \right) ; \left(\frac{6}{10} \times 100 \right)$$

$$3 : 60$$

$$1 : 20$$

d) $500 \text{ ml} \text{ to } 2\frac{1}{2} \text{ litres}$

Changing to litres

$$1 \text{ l} = 100 \text{ ml}$$

$$500 \text{ ml} = \left(\frac{500}{100} \right) \text{l}$$

= 5 litres

$$5l = \left(\frac{2 \times 2 + 1}{2} \right) l$$

$$5l = \frac{5}{2} l$$

LCM of land 2 = 2

$$\left(\frac{5}{2} \times 2 \right) ; \left(\frac{5}{2} \times 2 \right) l$$

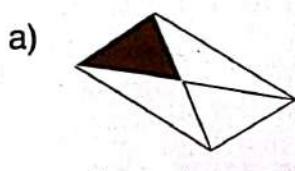
$$10l : 5l$$

$$2 : 1$$

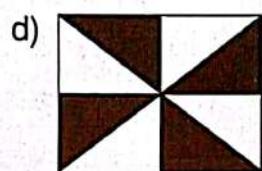
Answers to Exercise 5.1 (Pg 86 LB)

1. a) 1 : 1 b) 50 : 3
- c) 4 : 3 d) 16 : 3
2. a) 7 : 4 b) 3 : 2 c) 3 : 4
- d) 2 : 9 e) 10 : 1 f) 2 : 3

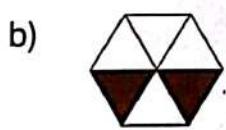
3.



$$\underline{1 : 4}$$

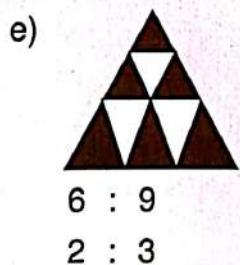


$$\begin{array}{r} 4 : 8 \\ 1 : 2 \end{array}$$



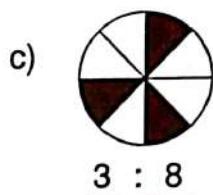
$$\underline{2 : 6}$$

$$\underline{1 : 3}$$



$$6 : 9$$

$$\underline{2 : 3}$$



$$\underline{3 : 8}$$

4. UGX 6,000

5. a) $\frac{4}{16}, \frac{25}{100}$

b) $\frac{6}{9}, \frac{8}{12}, \frac{96}{144}$

c) $\frac{25}{30}, \frac{150}{30}$

d) $\frac{35}{84}, \frac{60}{144}, \frac{150}{360}$

e) a = 29 f) b = 1

6. a) 8 : 3 b) 1 : 200 c) 5 : 2

d) 7 : 60 e) 1 : 3 f) 1 : 2

g) 25 : 32 h) 1 : 25

7. 285 km

8. a) UGX 5,500 b) 62.5

9. a) 4 : 3 b) 1 : 5 c) 6 : 17
d) 3 : 7 e) 1 : 2

5.2: Increase and Decrease in a given Ratio (Pg 87 LB)

When there is an increase or decrease in quantities. What happens to the ratio to the original quantity?

Activity 5.2

- ❖ Let learners get together as a whole class to discuss the results of the activity.
- ❖ Guide them in their discussions in the following ordered pairs.
- ❖ Let learners do exercise 5.2 for practice.

Possible answers to Activity 5.2

a) $(400 + 2000) : 4000$

$$6000 : 400$$

$$6 : 4$$

$$3 : 2$$

b) $\frac{3}{2} \times 4000$

$$\begin{array}{r} 12000 \\ \times 2 \\ \hline = 6000 \end{array}$$

You get the new value.

c) $(5000 - 1500) : 5000$

$$3500 : 5000$$

$$3500 : 2500$$

$$7 : 10$$

d) $\frac{7}{10} \times 5000$

$$= 35000$$

You get the new value again.

Answers to Exercise 5.2 (Pg 88 LB)

1. 5 : 4
2. 35 : 32, 64 : 65
3. a) UGX 480,000 b) 36 cm^2
c) 240 m d) 3.75 kg
e) 0.032 km f) 70 cm
g) 92.4 g
4. 6 cm by 4.5 cm ; 9 : 4
5. UGX 7,500

5.3: Direct and Inverse Proportion (3 periods) (Pg 88 LB)

5.3.1 Direct proportion

Activity 5.3

Instructional procedures.

- ❖ Organise learners into groups to do activity.
- ❖ Observe learners attempting the activity and note any competences like leadership skills against the individual learner.

- ❖ Allow learner get together as whole class to discuss the results of the activity.
- ❖ Guide them in their discussion in the groups.
- ❖ Exercise 5.3 helps the learners practice their skills.

Possible answers to Activity 5.3

a) 8 sets = UGX 20,000

$$8 \text{ sets} : 20000$$

$$2 \text{ set} : 5,000$$

$$1 \text{ set} : 2,500$$

$$\frac{1}{2500}$$

$$\frac{20 \text{ sets}}{20} = \frac{50,000}{20}$$

$$1 \text{ set} : 2500$$

$$\frac{1}{2500}$$

- b) They are the same.
- c) They are equal to each other.
- d) It increases too.
- e) It reduces also.

Answers to Exercise 5.3 (Pg 90 LB)

1. a) $k = 4$, so $\frac{c}{d} = 4$ or $c = 4d$
b) $d = 48$
2. a) $k = \frac{9}{24}$, so $\frac{r}{t} = \frac{9}{24}$
b) $r = 6$ c) $t = 6.4$
3. 640
4. 2 min
5. a) $\frac{p}{q^2} = 3$ $p = 3q^2$
b) $p = 75$ c) $q = 4$
6. a) $I = 4$ b) $t = 48$ hrs
7. $R = 48,983.9$ Newtons

5.3.2 Inverse Proportion

(Page LB 91)

Activity 5.4

Instructional procedure.

- ❖ In groups let learners do activity 5.4.
- ❖ Observe learners attempting the activity and note any competences like honesty and respect against the individual learner.
- ❖ Allow learners to get together as a whole class to discuss the results of the activity.
- ❖ Conclude the discussion and correct any misconception.
- ❖ Give learners exercise 5.4 to practice their skills.

Possible answers to Activity 5.4

- a) Let distance be d , speed s and time be t

$$t = \frac{d}{s}$$

b) $t = \frac{80}{20} = 4$ hours

c)

Speed (km / hr)	20	40	50	60	80
Time (hrs)	4	2	1.6	$\frac{1}{3}$	1

d) As speed increases, time decreases

e) The time taken increases.

Answers to Exercise 5.4 (Pg 93 LB)

1. a) $6 = mn$ b) $m = 1$
2. 36 men
3. a) $k = 20$ b) $p = 0.8$

4. $t = 3.2$ hrs

5. a) $72 = pq^2$ b) $p = 8$

c) $q = \pm 7.1$

6.

t	25	4	100	1.56
x	5	12.5	$\frac{3}{2}$	20

7. 120

8. 3

9. a) $K = DE^3$ b) $D = 384$

c) $E = 4$

5.4: Proportional Parts (2 Periods) Page 94 LB

Activity 5.5

Instructional procedure.

- ❖ Organise learners into groups to do activity 5.5
- ❖ Move around the classroom observing the learners doing the activity and note any competences like communications skills.
- ❖ Allow learners to get together as whole class to discuss the results of the activity.
- ❖ Guide them in their discussions in the following groups.
- ❖ Exercise 5.5 offers an opportunity for the learner to practice their skills.

Possible answers for Activity 5.5 (Pg 94 LB)

- b) 8
- c) $\frac{1}{8}$
- d) $AB = 15$ cm $BC = 25$ cm.

Answers to Exercise 5.5 (Pg 95 LB)

1. a) 28.8 b) 3 kg
- c) UGX 6m : 3.5 m : 0.5 m
- d) 315 km
- e) 50000 m : 17500 m : 12500 m
- f) $48^\circ : 96^\circ : 144 : 72^\circ$
2. 81.9 cm : 63.7 cm : 27.3 cm
3. UGX 44,100 : UGX 31,500
4. a) 4.1 b) 18 marks
5. 12.8 cm
6. 1960 m^2
7. 18
8. a) 2 : 3 b) 282,000

5.5: Scales (01 periods (Page 96 LB))**Activity 5.6****Instructional procedures.**

- ❖ Organise learners into groups to do activity 5.6
- ❖ Observe learners doing the activity and note any competences like leadership skills, communication skills and record against learner's name.
- ❖ Call the whole class group discussion and allow group leaders to present their findings.
- ❖ Correct any misconception.
- ❖ Conclude the discussion and give the exercise 5.6 to practice their skills.

Possible answers for Activity 5.6

(a). Map Ground

$$6 \text{ cm} = 30 \text{ km}$$

$$1 \text{ cm} = \frac{30}{6} \text{ km}$$

$$1 \text{ cm} = 5 \text{ km}$$

$$1 \text{ km} = 100,000 \text{ cm}$$

$$5 \text{ km} = (5 \times 100,000) \text{ cm}$$

$$= 500,000 \text{ cm}$$

Scale is 1 : 500,000

- b) (i) 3,800,000 cm
- (ii) 38 km

Answers to Exercise 5.6 (Pg 97 LB)

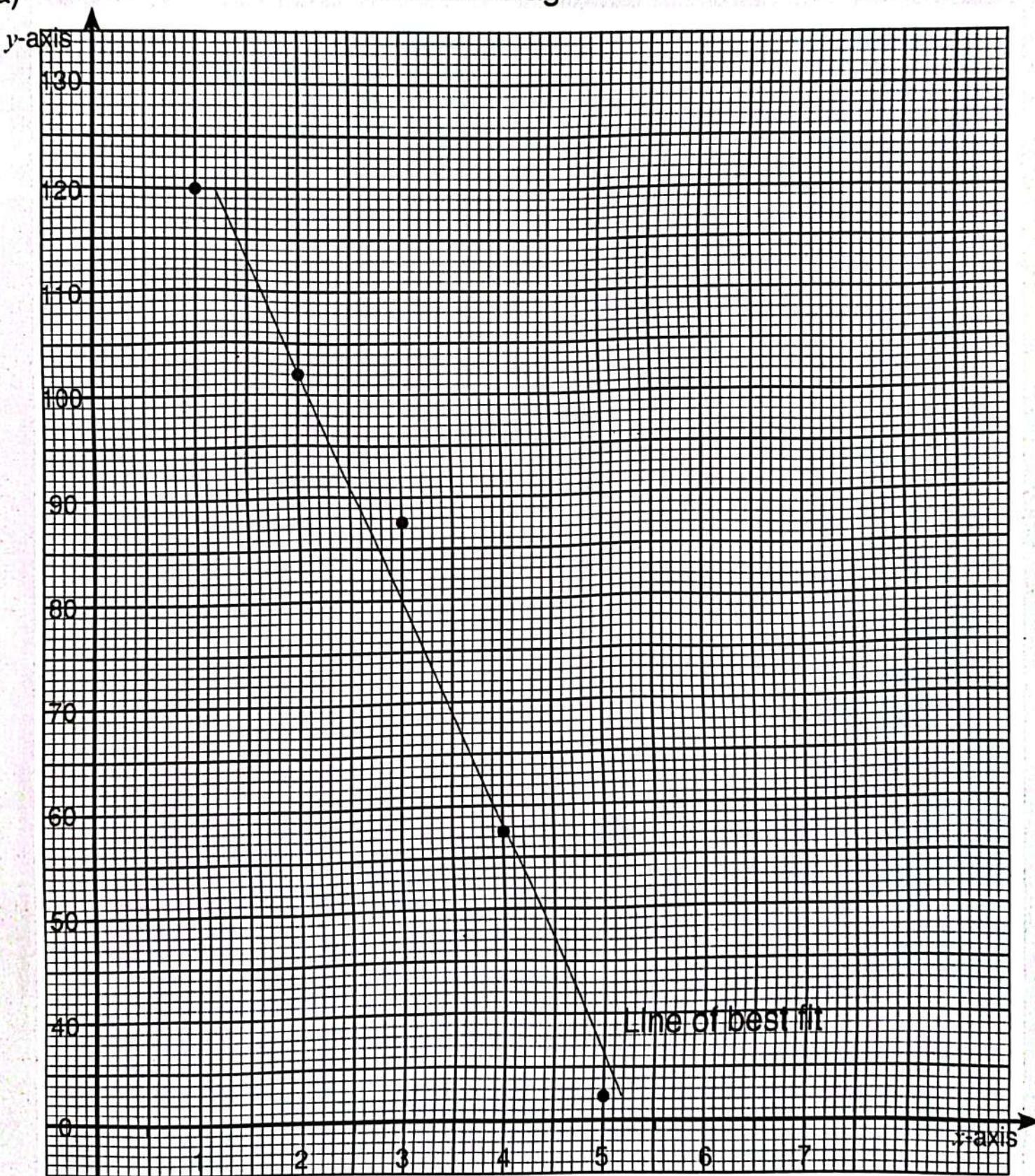
1. a) 1:2:2 b) 1:2 . 4
- c) 1:76.5 d) 1:4:5
- e) 1:8.5
2. a) 1 : 2000 n b) 1 : 2000n
- b) 1:21000n d) 1 : 20,000n
3. a) (i) 6 km (ii) 11 km (iii) 18.5 km
- b) (i) 3200m (ii) 9000 m
- (iii) 5800 m
- c) (i) 600 cm (ii) 1575 cm
- (iii) 870 cm
4. length = 8.2 cm width = 4.2 cm
5. a) 5 cm b) $1.20 \times 108 \text{ cm}$
- c) 2.5 cm d) 4.5 cm

5.6: Scatter Graphs (3 periods (Pg 98 LB))**Activity 5.7****Instructional procedures**

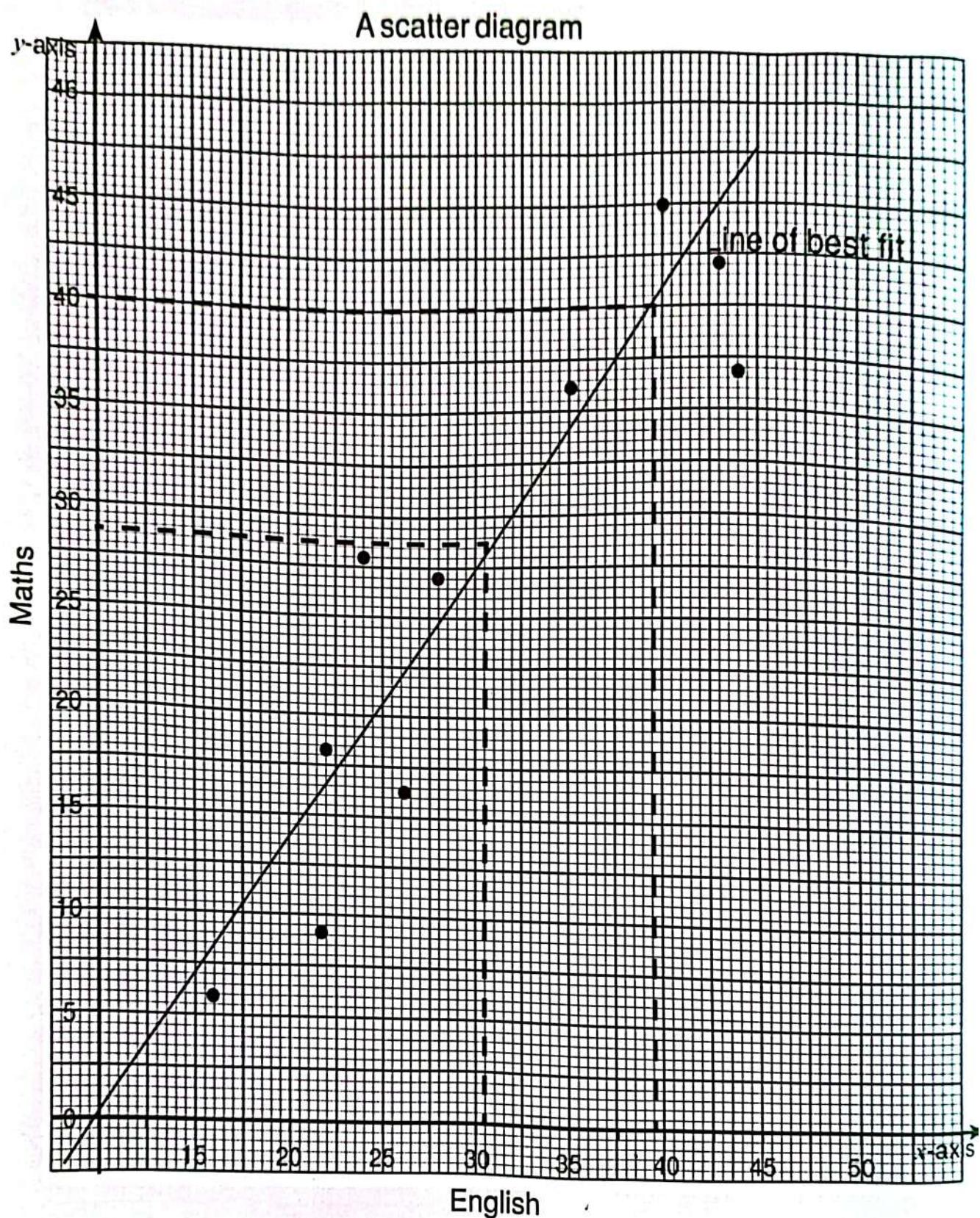
- ❖ Organise learners into groups to do the activity.
- ❖ Observe learners doing the activity and note any competence such as honesty and respect against learner's name.

1. (a)

A scatter diagram

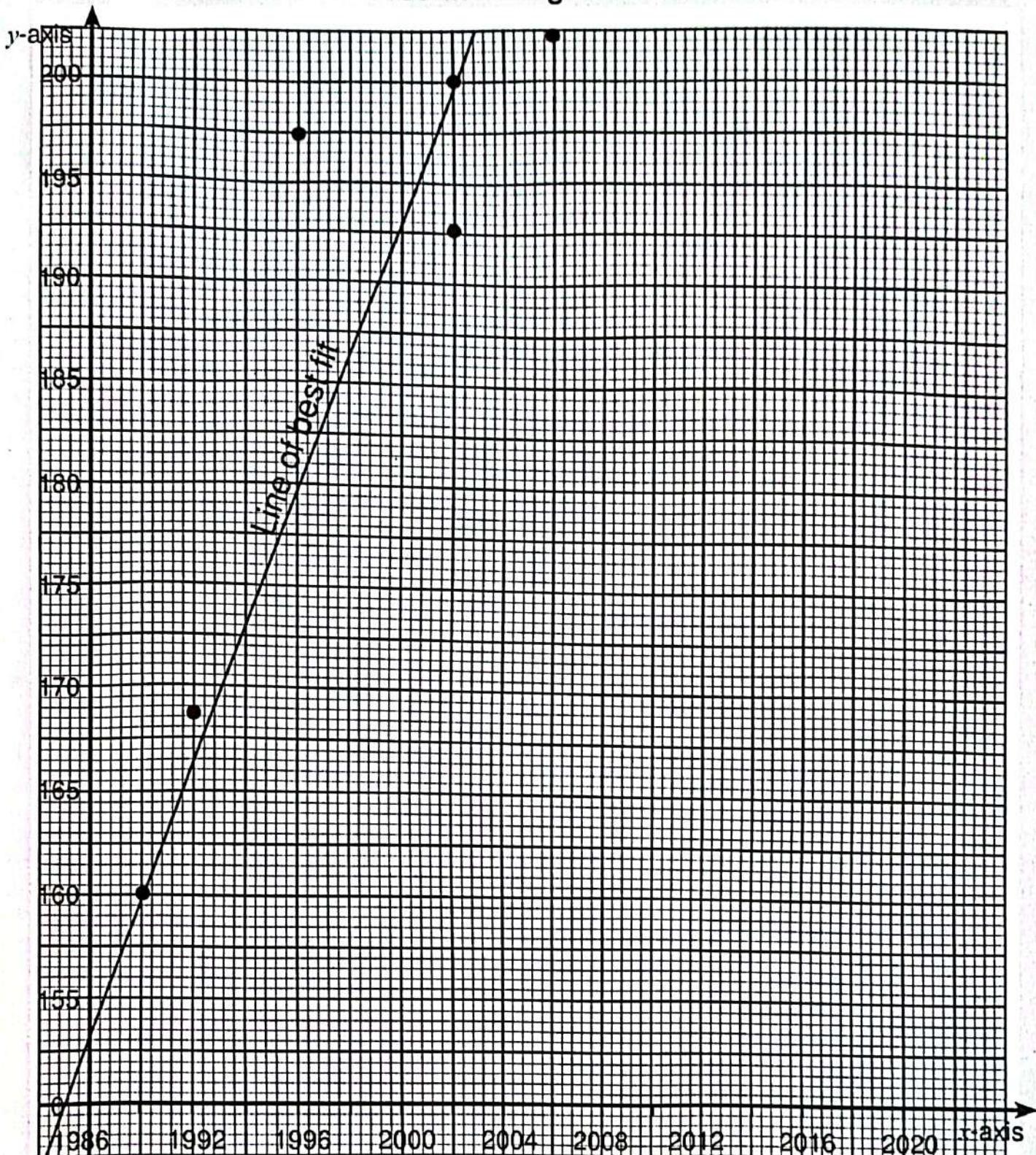


3.



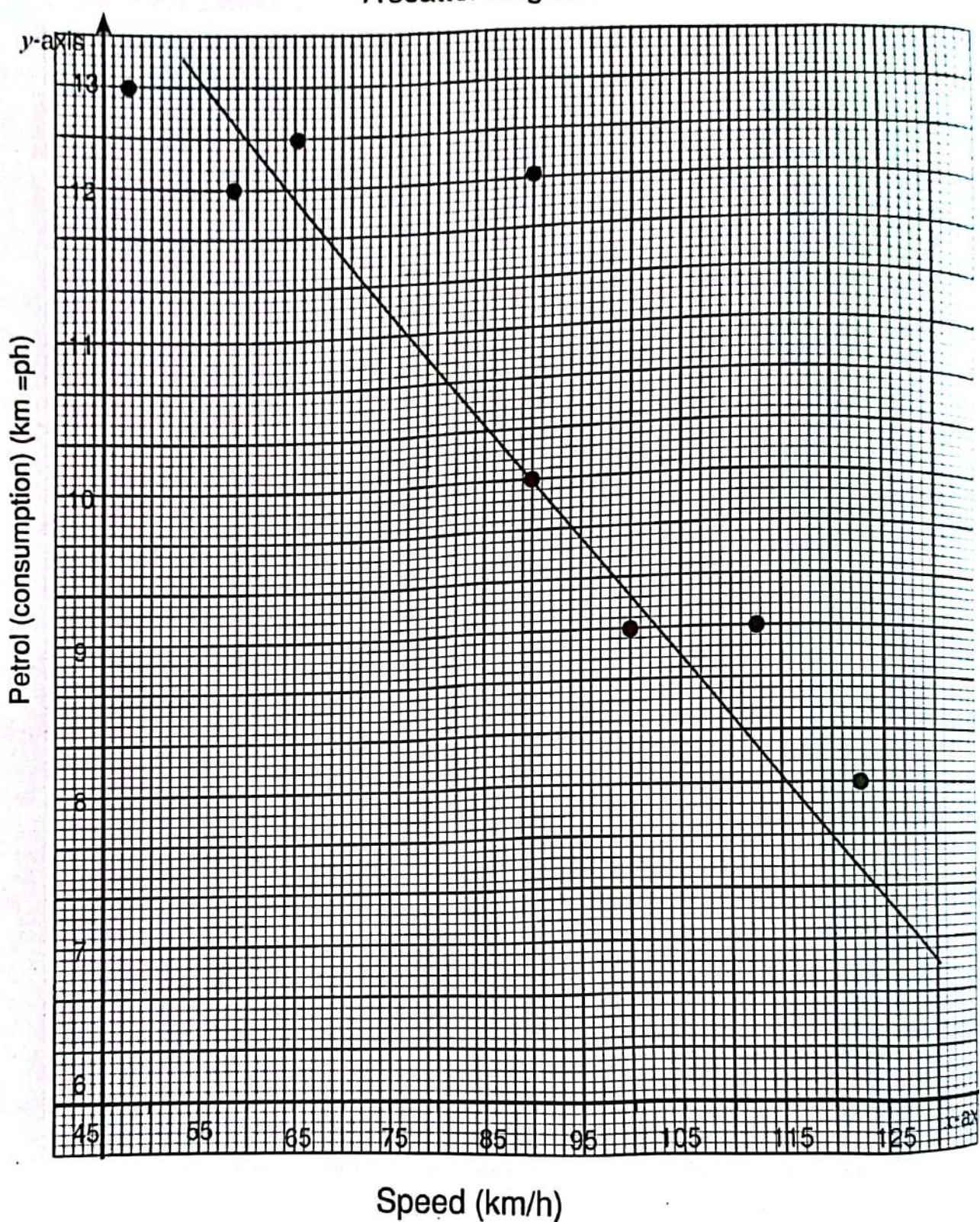
4.

A scatter diagram



5.

A scatter diagram



Assessment grid for Activity of integration 5

Output	Basis of evaluation	Relevancy	Accuracy	Coherence	Excellence
Cleaning the city streets in time	Forms an equation, solves it and analyses the result.	Score 3: Identifies all 3 relevant parts; team A's cleaning fractional part, team B's cleaning fractional part, forming related equation.	Score 3: Accurately applies all 5 relevant parts; team A's cleaning fractional part; team B's cleaning fractional part, forming related equation, forming related equation, solves equation and interprets the result.	Score 3: Logical flow in the use of all relevant parts.	Learner earns 1 point if he/she has added any exceptional feature unsolicited in the instructions.
	Score 2: Identifies 2 relevant parts from; Team A's cleaning fractional part; team B's cleaning fractional part, forming related equation.	Score 2: Accurately applies 3-4 relevant parts; team A's cleaning fractional part; team B's cleaning fractional part, forming related equation, forming related equation, solves equation and interprets the result.	Score 2: Logical flow with distortions in the use of the relevant parts.		
	Score 1: Identifies 1 relevant part from; Team A's cleaning fractional part; team B's cleaning fractional part, forming related equation.	Score 1: Accurately applies 1-2 relevant parts; team A's cleaning fractional part; team B's cleaning fractional part, forming related equation, forming related equation, solves equation and interprets the result.	Score 1: Limited flow in the use of the relevant parts		
	Total				10

Solution to Assessment grid for Activity of integration 5

In 400 hours, team A can clean all the city streets.

In 1 hour, team A can clean $\frac{1}{400}$ th of all the city streets.

In 300 hours, team B can clean all the city streets.

In 1 hour, team B can clean $\frac{1}{300}$ th of all the city streets.

Together, the two teams can all the city streets in x hours.

$$\begin{array}{c} \text{Fractional part} \\ \text{of team A's} \\ \text{cleaning} \end{array} + \begin{array}{c} \text{Fractional part} \\ \text{of team B's} \\ \text{cleaning} \end{array} = \begin{array}{c} \text{One} \\ \text{whole} \\ \text{job} \end{array}$$

$$\frac{x}{400} + \frac{x}{300} = 1$$

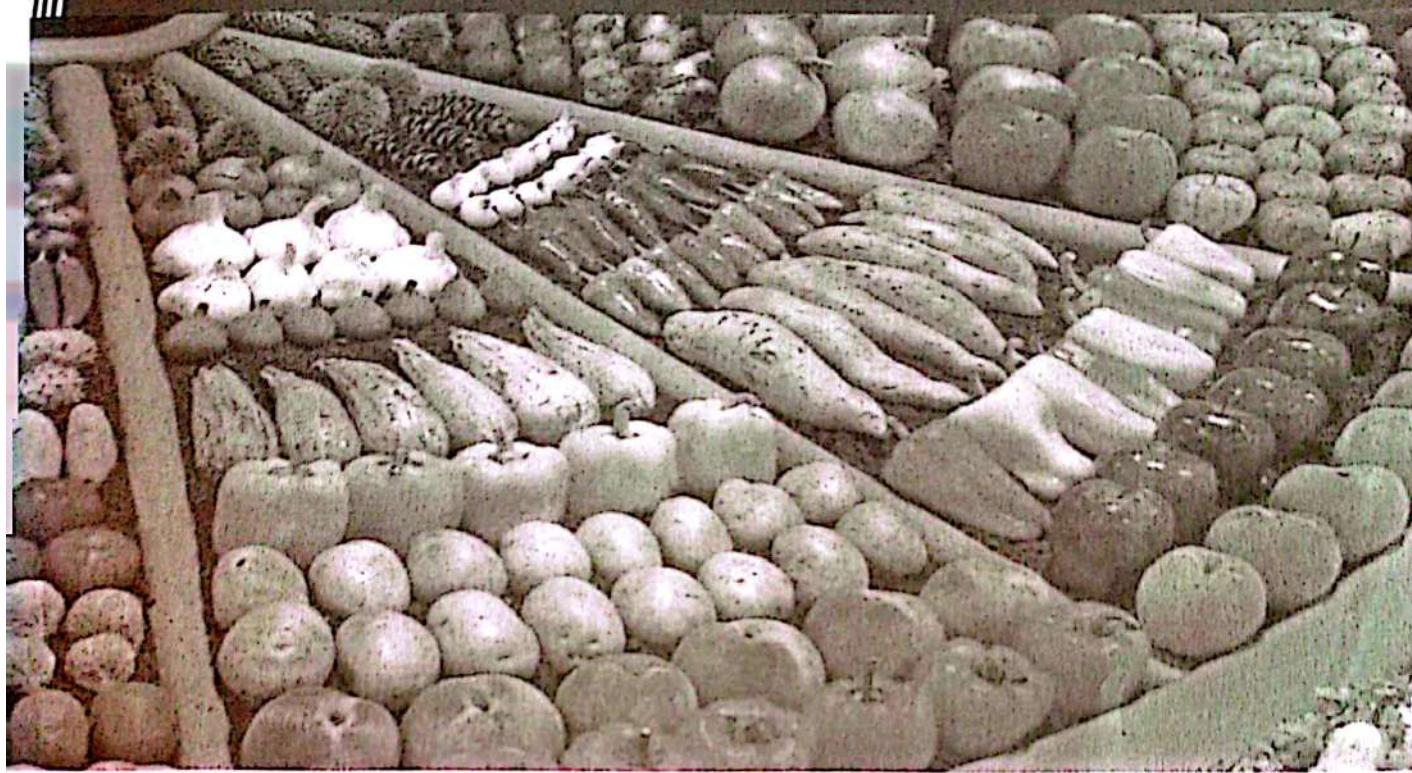
$$x = 171.4 \text{ hours}$$

Since both teams will take just over 171 hours (slightly over 7 days) cleaning the city streets, the time will not be enough before the cameras begin rolling.

Topic

6

Business Mathematics



Competency: The learner understands and applies Business Mathematics when solving problems

- ❖ Ensure that the contents of the topic are covered within the allocated periods i.e 12 periods.
- ❖ Make sure the key words in the learner's book are used all the time for the learner to understand their meanings in the topic.

In this topic, guide learners to:

- a) relate the concepts of Business Mathematics to everyday situations.
- b) use a multiplier to calculate percentage change.
- c) calculate compound interest.
- d) understand and calculate depreciation and appreciation.
- e) understand and convert local and foreign currencies.
- f) understand and calculate hire purchase.
- g) describe and determine mortgage of assets.
- h) calculate income tax given income tax bands.

Topic overview.

This topic aims at making the learner understand and apply the different terms in business including their calculations. The topic is very relevant in daily life as everyone is always transacting some kind of business so terms like profit and loss, interest, hire purchase, mortgage and income tax are met in the topic.

Introduction

The teacher introduces the topic by outlining the importance of mathematics in any business however, small it may be. Remind learners of what profit and loss is in business. The teacher then leads learners through the introduction in the learner's book and guide them to appreciate the importance of mathematics in any business.

6.1: Percentage Change (Time allocated: 01 period) (Pg 104 LB)

Teacher reviews the meaning of the word percentage..

Activity 6.1

Instruction procedures.

- ❖ Arrange learners in groups or pairs to work through the activity.
- ❖ Observe learners as they do the activity by walking around the classroom answering queries that arise.
- ❖ Look out for individual competencies like cooperation and communication skills.

Possible answers to activity 6.1

- a) 105% b) 10.5: 100
c) $\frac{105}{100}$, 1.05 d) 840

- ❖ Call learner's attention as a whole group to discuss their results.
- ❖ Guide learners to discover the multiplying factor both as a fraction and as a decimal.
- ❖ Guide learners through the notes that follow the activity.
- ❖ Let learners study example 6.2 and ask them to do the quick practice questions that follow:-

Answer: (a) UGX. 3700
(b) UGX 24,480

- ❖ Allow learners to study example 6.3 and ask them to do the quick practice.
- Answer: 63 cases
- ❖ Ask learners to study example 6.4 as do the practice questions.
- ❖ Give learners an assignment from exercise 6.5 in the learner's book.

Answers to Exercise 6.1 (Pg 105 LB)

1. a) 140% b) 160% c) 178%
d) 400% e) $112\frac{1}{2}\%$
2. a) 1.25 b) 1.84 c) 1.125
d) 1.6 e) 2.82
3. a) 50% b) 93% c) $66\frac{2}{3}\%$
d) 35% e) 55%
4. a) $\frac{65}{100}$ b) $\frac{23}{100}$ c) $\frac{88}{100}$
d) $\frac{44}{100}$

5. a) UGX 71,500 b) 370 km
c) 5610 km d) 104 g
6. a) 600 m b) 3243 kg
c) UGX 189,000 d) 36.4 km
7. a) 63.25 kg 8. UGX 286,000
9. a) 1,600,000 b) 841.5 km
10. UGX 595,000

6.2: Compound Interest (Time:1 period) Pg 106 LB

Teacher quickly reviews simple interest by asking learners to define simple interest. Let learners know that they are going to meet another type of interest.

Activity 6.2

Instructional procedures

- ❖ Group learners to work through the activity.
- ❖ Observe learners as they work through the activity by walking about in the classroom.,
- ❖ Lookout for individual competencies like active participation and communication skills.

Possible answers to activity 6.2

- (a) UGX. 300,000
- (b) UGX. 3,300,000
- (c) UGX. 330,000
- (d) UGX. 3,630,000
- (e) UGX630,000

- ❖ Call learner's attention back as a whole group to discuss their results.
- ❖ Guide learners in their discussion leading to their understanding of compound interest and its

calculations. Emphasize the terms amount and principal.

- ❖ Let learners write their own notes in their exercise books.
 - ❖ Let learners study example 6.5 and do the quick practice questions.
- Answer: (a) UGX 314,978
(b). UGX 64,928

- ❖ Give learners an assignment from exercise 6.2.

Answers to exercise 6.2

Answers to Exercise 6.2 (Pg 107 LB)

- 1(a). (i). UGX 484,000
(ii). UGX 84,000
- (b). (i). UGX 4,082,400
(ii). UGX 582,400
2. UGX 1,717,350
3. UGX 10,000
4. UGX 14,601,600
- 5 (a).UGX 4,905,000
(b). UGX 5,346,450
(c). UGX 5,827,630.8
6. UGX 708,750
7. UGX 3,244,800

6.3: Formula for Compound Interest (01 Period) Pg 108 LB

The teacher should convince the learners of the importance of the formula when the number of years is large.

- ❖ Organise learners into groups or pairs and let them work through the activity.
- ❖ Observe learners as they work through the activity by walking around the room.
- ❖ Make note if individual competencies like active participation and cooperation.

Possible answers to activity 6.3

- UGX 530,000, b) 1.06
- $500\,000 \times (1.06)^n$
- Call learner's attention back as a whole group to discuss their results.
- Guide learners through their discussion to discover the formula for calculating compound interest.
- Guide learners through example 6.6 and allow them to write their own notes in their exercise books.

The idea of half or quarterly yearly should be made clear and its implication of the rate and time.

Also give and work through one example involving finding time given the amount, principal and rate.

- ❖ Let learners work through the quick practice questions.

Answer: UGX 14,981,058.17

- ❖ Give question 1 and 2 from exercise 6.3 as assignment.

Answers:

- (a). UGX 10 536 960
 (b). UGX 7019 548.59.
 (c). UGX 816 216.02
- UGX 10,278,854.75

6.4: Appreciation and Depreciation (Pg 109 LB)

Introduce the sub topic using real life examples like land, vehicles, TV sets, and so on. Ask the learners whether these gain or lose value as time passes.

- ❖ Let learners do this activity in groups or pairs.
- ❖ Observe learners as they work through this activity, watching out for individual competencies like communication skill and active participation.

Possible outcomes to activity 6.4

- UGX 26 million
- UGX 27.04 million
- UGX 25.5 million
- UGX 22.95 million
- Let learners get back as a whole group to discuss their results.
- Guide them to understand the words appreciation and depreciation.

Introduce the formulae for appreciation
For example;

$$A = P(1 + \frac{n}{100})^n \text{ and for depreciation}$$

$$A = P(1 - \frac{n}{100})^n$$

With the letters standing for the same quantities as in the compound interest formula.

- ❖ Allow learners to write their own notes in their own notes in their exercise books.
- ❖ Ask learners to study examples 6.7 and 6.8 and do the subsequent practice questions.

Answers: UGX 36, 204, 429.38 and UGX 12,254,195.15

Give an assignment from questions 3

Answers to Exercise 6.3 (Pg 110 LB)

3. UGX 44,079,842.3
4. 26 years
6. 6.116 years
7. 1650
8. UGX 5,000,000
9. UGX 12,370,400
10. UGX 4,200,000

6.5: Foreign Currency Exchange (01 Period) Pg 111 LB

Check for learner's prior knowledge if what the word currency means and about the different countries currencies. Point on that every country has its own currency used locally. So for one to transact business in another country you need to get that country's currency.

- ❖ Let learners work through the activity in pairs.
- ❖ Observe learners as they work through the activity. Watch our for individual competencies like communication skills and active participation.

Possible outcomes to Activity 6.5

- a) K shs. 132,394.36
- b) Shs 5,074,764.4

- ❖ Organize learners back into one group and guide them, discuss their

findings. Lead them to acquire the skill to exchange currencies.

- ❖ Lead them through the notes in their learner's book and let them make their own notes in their books.
- ❖ Make sure the learners understand the difference between buying and selling as stated in the table.
- ❖ Let learners study the given examples 6.9 and 6.12 each time doing the quick practice thereafter.

Answers: QP 6.9:

- (a). UGX 84,288
- (b). UGX 155,840

QP 6.10 Y 116 457.85

QP 11 : \$ 4,510.7

QP 12: RWF 1,027,342.90

- ❖ Given an assignment from exercise 6.4

Answers to Exercise 6.4 (Pg 114 LB)

- 1 a) UGX 465,460
b) UGX 9,164,800
c) UGX 12,884,260
d) UGX 4,178,886.9
e) UGX 8,255,321
- 2 a) £1427.66
b) Y 12177.52
c) 793184.48
d) 1717.12
3. \$ 9,892.01
4. Y 15,972.02
a) RWF 47,937,798.5
- 6 a) UGX 3,616,750
b) UGX 3,622,250

6.6: Hire Purchase (2 Periods) Pg 114 LB

Introduce the sub topic by pointing out why people sometimes have to purchase items on credit or by paying in bits until the full amount is paid.

- ❖ Let learners go through the activity in groups of six.
- ❖ Observe them as they do the activity making note of individual competencies like communication skills cooperation in group.

Possible answers to activity 6.6

- a) Buying by paying part then the rest in bits.
- b) They do not have enough money to pay full amount once.
- c. (i) UGX 99,000
 (ii) UGX 371.600
 (iii) Cash is better.

You pay an extra UGX 41,600 by second option.

- ❖ Call learner's attention into a whole group and guide them to discuss their results.
- ❖ Lead them to understand the terms deposit, instalments, and hire purchase price.
- ❖ Allow them write their own notes in their books.
- ❖ Let learners study examples 6.13 and 6.14 and do the quick practice exercises.

Answers: QP 6.13 : UGX 322 590

QP 6.14: UGX 67,000

Give an assignment from exercise 6.5.

Answers to Exercise 6.5 (Pg 116 LB)

- 1 a) UGX 6,994,000
 b). UGX 395,000
 c) UGX 1,001,000
 d). UGX 41,950,000
2. UGX 1,120,000
3. UGX 45,000
4. 15%
5. UGX 1,850,000
6. a) UGX 299,000
 b). UGX 15,958.33
7. a). UGX 774,000
 b). UGX 1,110,000

6.7: Mortgages (01 period) Pg 116 LB

Ask your learners what they would do if they wanted to purchase a house but they do not have enough money needed. Let them give ideas.

- ❖ Let learners work through the activity in pairs.
- ❖ Observe the learners as they go through the activity and watch out for individual competencies like communication skills and active participation.

Possible answers to activity 6.7

- a) UGX 15 million
- b) UGX 135 million
- c) UGX 1,181,918,950
- d) UGX 3,283,108.2

- ❖ Call learners back as one group to discuss the results with you guidance.

- ❖ Lead the learners through the notes in their learner's book in order to understand what a mortgage is and the terms, deposit or down payment, amount of mortgage etc.
- ❖ Allow learners to write their own notes in their books.
- ❖ Let them study example 6.15 and do the quick practice question.

Answer : a) UGX 12 million

- UGX 108 million
- UGX 2.16 million
- UGX286, 556,152.2

Give assignment from exercise 6.6

Answers to Exercise 6. 6 (Pg 118 LB)

- UGX 107,450,861.8
- a) UGX 60,000,000
b) UGX 1.14 billion
c) UGX 11,400,000
- UGX 1,437,202.92
- The second option :
UGX 872,220,868

6.8: Income Tax (02 period) Pg 119 LB

Explain to learners why governments need taxes. This will make them like paying taxes in future. Mention the services governments have to provide for example; education, health, roads etc.

- ❖ Let learners do the activity in groups of not more than six.
- ❖ Move around and observe learners as they do the activity. Make note of individual competencies like communication skills and cooperation with others.

Possible answers to activity 6.8

- Money government levies on its citizens.
- Medical, housing, marriage, insurance, transparent.
- UGX 261,000
- UGX 220,000
- (i). UGX 2,400 14,725,
22,800
(ii). 39, 925
- Let learners get back as one group and discuss their results with your guidance.
- Lead learners through notes in their learner's book and explain the terms gross income, allowances, taxable income, net income and tax slabs.
- Let learners write their own notes in their books.
- Allow learners to study example 6.16 with your assistance and ask them to do the quick practice question 6.16

Answers to QP 6.16

- UGX 926,000
- UGX 149,135
- UGX 1,300,865

Answers to Exercise 6. 7 (Pg 121 LB)

- a) UGX 593,750
b) UGX 149,062.5
c) UGX 794,437.5
- a) UGX 1,800,000
b) UGX 405,085.5

- | | |
|----------------------|------------------|
| c) 8.714% | (ii) UGX 465,500 |
| 3 a) UGX 312,000 | (iii) UGX 81,750 |
| 4 a) (i) UGX 434,500 | b. 9.08% |

Assessment grid for Activity of integration 6

Output	Basis of evaluation	Relevancy /3	Accuracy /3	Coherence /3	Excellent /10
Better Savings option	<ul style="list-style-type: none"> • Computes compound interest for market's SACCO. • Computes compound interest for factory's SACCO. • Compares the 2 results • Chooses the better option 	Score: 3 Identifies all 4 relevant parts; computing compound interest for market's SACCO, computing compound interest for factory's SACCO, comparing the two and choosing the better option, stating the reason why.	Score: 3 Accurately applies all 4 relevant parts; computes compound interest for market's SACCO, computes compound interest for factory's SACCO, compares the two and chooses the better option, states the reason why.	Score 3: Logical flow in the use of all relevant parts.	Learner earns 1 point if he/she has added any exceptional feature unsolicited in the instructions
		Score: 2 Identifies 2-3 relevant parts from; computing compound interest for market's SACCO, computing compound interest for factory's SACCO, comparing the two and choosing the better option, stating the reason why.	Score: 2 Accurately applies 2-3 relevant parts; computes compound interest for market's SACCO, computes compound interest for factory's SACCO, compares the two and chooses the better option, states the reason why.	Score: 2 Logical flow with distortions in the use of the relevant parts.	
		Score: 1 Identifies 1 relevant part from; computing compound interest for market's SACCO, computing compound interest for factory's SACCO, comparing the two and choosing the better option, stating the reason why.	Score: 1 Accurately applies 1 relevant part; computes compound interest for market's SACCO, computes compound interest for factory's SACCO, compares the two and chooses the better option, states the reason why.	Score: 1 Limited flow in the use of the relevant parts.	
Total	10				

The factory's SACCO's option is better because it yields more interests.

Market SACCO

$$6,000,000 \times \left[1 + \frac{3.5}{100}\right]^1 = \text{UGX. } 6,210,000 \text{ (1 year)}$$

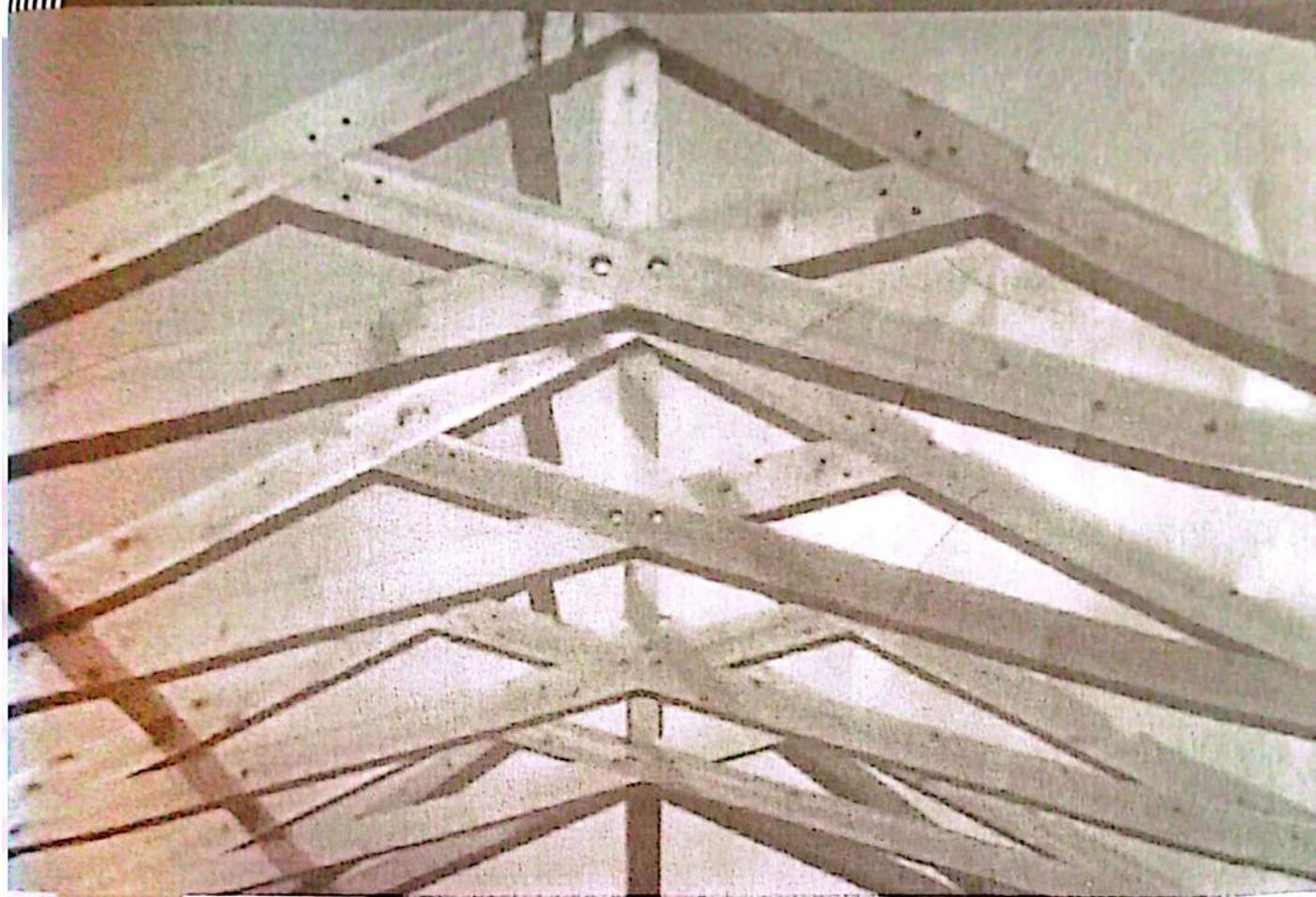
Factory SACCO

$$5,500,000 \times \left[1 + \frac{4.8}{100}\right]^6 = \text{UGX. } 7,286,691 \text{ (12 months)}$$

Topic

7

Trigonometry 2



Competency: The learner understands and applies the three basic trigonometric functions.

- ❖ Ensure that the contents of this topic are covered within the allocated 12 periods.
- ❖ Emphasise the use of key words in the learners book.
- ❖ Use the words repeatedly so that learners understand their meanings as used in this topic.

In this topic guide learners to,

- a) determine trigonometric ratios of angles greater than 90° .
- b) use the graphs of trigonometric functions to determine values of sine, cosine and tangent of any angle
- c) apply sine and cosine rules to solve real life problems.

Introduction

In this topic, you are going to guide the learner to understand and apply the three basic trigonometric functions namely cosine, sine and tangent. Show how trigonometry is all around us by pointing out different shapes in nature and man made objects.

Emphasize that trigonometry means calculations with triangles and mention a variety of fields where it is applied. Refer to the introduction in the learners book.

7.1: Trigonometrical Ratios of Angles greater than 90° (Pg 126 LB)

(Time 4 periods)

Start with a quick review of the ratios of angles less than 90° . Remind the learners that these apply to right angled triangles only.

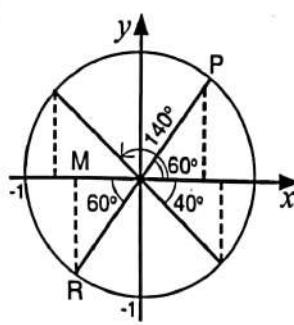
Activity 7.1

Instruction procedures

- ❖ Arrange learners into groups and let them work through the activity
- ❖ Observe the learners as they work through it actively by moving around the groups
- ❖ Take note of individual competencies like communication skills and critical thinking.

Possible outcomes to activity 7.1

a) & b)

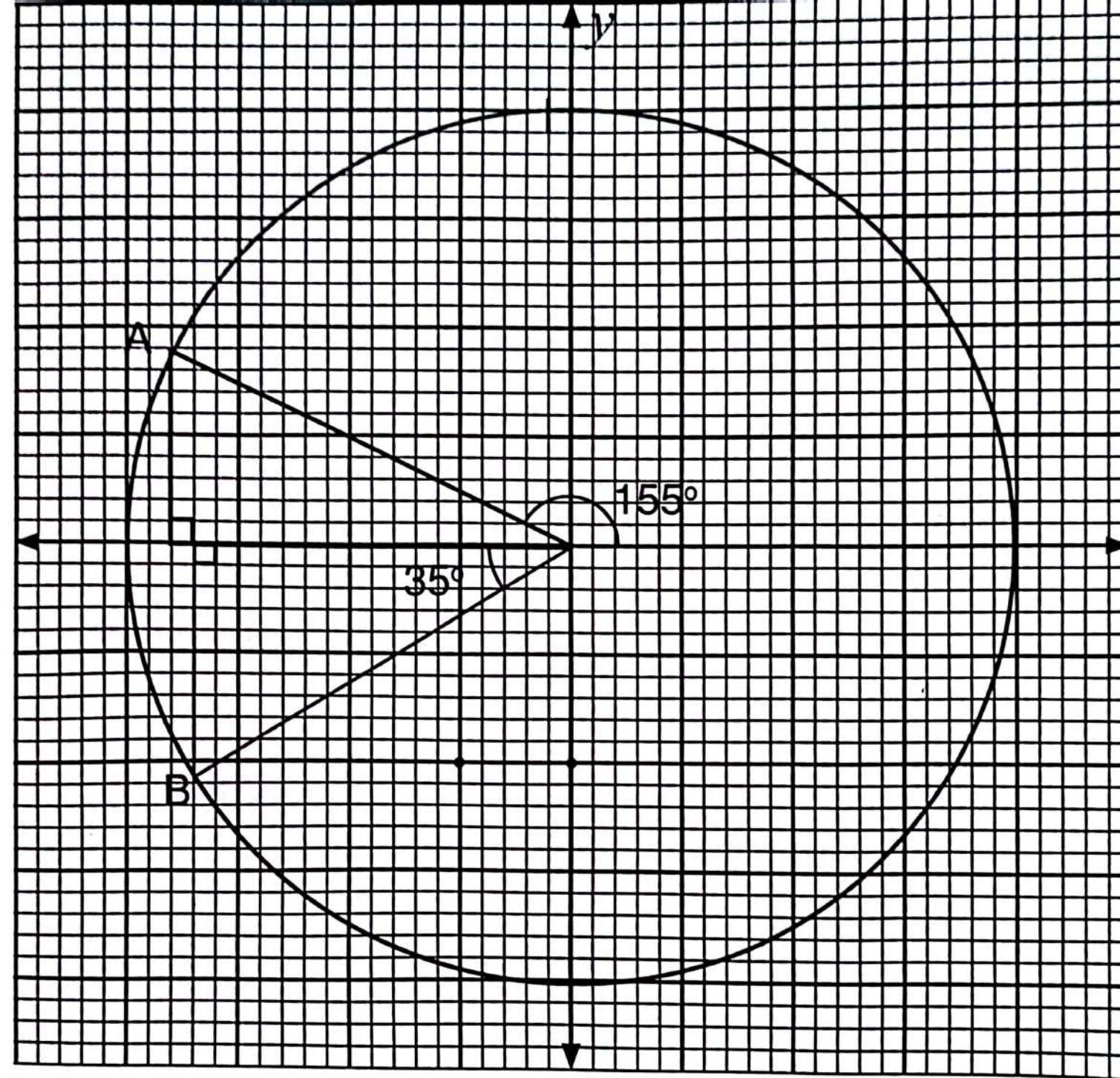


- c) $\cos 60^\circ = 0.50$
 $\sin 60^\circ = 0.87$
 $\tan 60^\circ = 1.7$
- d) $\cos 240^\circ = 0.5$
 $\sin 240^\circ = 0.87$
 $\tan 240^\circ = 1.7$
- e) $\cos 140^\circ \approx -0.77$
 $\sin 140^\circ \approx 0.64$
 $\tan 140^\circ \approx -0.84$
- h) $\cos 320^\circ \approx 0.77$
 $\sin 320^\circ \approx -0.64$
 $\tan 320^\circ \approx -0.84$
- i) 1st quadrant: cosine is positive
sine is positive
tangent is positive
2nd quadrant : Only sine is positive
3rd quadrant : Only tangent is positive
4th quadrant : Only cosine is positive
- ❖ Let learners get back into one group and guide them to discuss their results.
- ❖ Guide the learners to discuss the signs for each ratio in the four quadrants
- ❖ Let learners write their own notes in their books

Possible answers for Activity 7.2

- a) $\sin 58^\circ = 0.848$
 $\sin 242^\circ = -0.8829$
 $\sin 326^\circ = -0.5592$
- b) $\cos 58^\circ = 0.5299$
 $\cos 242^\circ = -0.4695$
 $\cos 326^\circ = 0.829$

2.



7. a) $\frac{8}{10}$ b) $\frac{6}{8}$
 8. a) $\frac{-8}{17}$ b) $\frac{-15}{8}$
 9. a) 0.9397 b) -0.2419 c) -0.3443 d) -0.1736
 e) -0.9397 f) 2.606 g) -0.4695

7.2: Trigonometric Ratios of 30° , 45° and 90° (01 period) (Pg 129 LB)

Since these are acute angles, their ratios are obtained using right angled triangles.

Activity 7.3

- ❖ Assist learners to form groups of about 6 and work through the activity.
- ❖ move around guiding learners to discover the ratios as they do the activity.
- ❖ Take note of individual competences like cooperation and critical thinking.

Possible answers to Activity 7.3

a) $BN = \sqrt{3}$; i) $\sin 30^\circ = \frac{1}{2}$

(ii) $\cos 30^\circ = \frac{\sqrt{3}}{2}$

(iii) $\tan 30^\circ = \frac{1}{\sqrt{3}}$

(iv) $\cos 60^\circ = \frac{1}{2}$

(v) $\sin 60^\circ = \frac{\sqrt{3}}{2}$

(vi) $\tan 60^\circ = \sqrt{3}$

b) $PR = \sqrt{2}$

c) (i) $\sin 45^\circ = \frac{1}{\sqrt{2}}$

(ii) $\sin 45^\circ = \frac{1}{\sqrt{2}}$

(iii) $\tan 45^\circ = 1$

- ❖ Allow learners write their own notes in their book.
- ❖ Let learners study example 7.4 and do quick practice.

Answers to Quick practice

a) $-\frac{\sqrt{3}}{2}$ b) $\frac{\sqrt{2}}{2}$ c) $\sqrt{3}$

d) $\frac{\sqrt{3}}{2}$ e) $\frac{\sqrt{3}}{2}$

7.3: Trigonometric Graphs (Pg 130 LB)

Remind learners of the graph they drew by plotting points on the Cartesian plane. In this sub topic, you are going to guide them to discover that the axes can represent angles and trigonometric ratios.

Activity 7.4

- ❖ Call learners attention back as a whole class and let group leaders discuss their results.
- ❖ Assist your learners understand how the graph the graph is drawn and then use it to read off ratios of the different angles in the range.
- ❖ let learners write their own notes in their notes.
- ❖ Ask learners to study example 7.5 and do quick practice 7.5

Possible answers to activity 7.4

Values may differ by 1 in the last digits

- a) (i) 0.16 (ii) 0.5
 (iii) -0.76 (iv) 0.87

- b) (i) $\theta = -50^\circ$ or $\theta = 50^\circ$
 (ii) $\theta = 114^\circ$ or 248°

❖ Let learners study example 7.4 and do QP 7.5

Answers to Quick practice

- a) 30° or 150°
 c) -326.7° , -33.3° , 33.3°

Answers to Exercise 7.2 (Pg 133 LB)

1. a) $\frac{\sqrt{3}}{2}$ b) -1 c) $\frac{1}{2}$ d) $-\frac{1}{2}$

e) $\frac{\sqrt{2}}{2}$ f) $-\frac{\sqrt{3}}{3}$ g) 0

h) $\frac{\sqrt{2}}{2}$ i) $-\sqrt{3}$ j) $-\frac{\sqrt{3}}{2}$

2. a) -0.64 b) -0.82

3. 50.2°

4. a) (i) 53.1° (ii) 113.6°

b) 180

5. a) -30° or 210° b) 36.9°

6. 36.9° or 323.1°

7. 340°

8. 300°

9. a) 23° , 156° , 384°

b) 220° or 320°

c) 15° , 165° , 375° or 250°

d) 229° or 311°

10. a) (i) 0.96 (ii) -0.95 (iii) -0.84
 (iv) 0.9 (v) 0.78

- b) (i) -62° , 72° or 289°
 (ii) -59° , 57° or 57° or 304°
 (iii) -148° , 155° or 210°

12. $6\sqrt{2}$

7.4: Sine and Cosine Rules (02 Periods) (Pg 135 LB)

All the trigonometric ratios so far are used to find the angles and lengths of sides of right angled triangles. You are going to lead your learners to find the general rules for any triangle.

7.4.1 The Sine Rule for any Triangle**Activity 7.5**

- ❖ Get the learners into groups and ask them to work through the activity.
 ❖ Observe them working by moving around the classroom guiding them accordingly.
 ❖ Make note of individual competencies like critical thinking and active participation.

Possible answers to Activity 7.5

b) $\overline{BD} = c \sin A$

c) $\overline{BD} = a \sin C$

d) $c \sin A = a \sin C$

$$\frac{c}{\sin C} = \frac{a}{\sin A}$$

f) $\overline{AE} = b \sin C$ also $\overline{AE} = c \sin B$
 $b \sin C = c \sin B$

$$\frac{b}{\sin B} = \frac{c}{\sin C}$$

Therefore $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

- ❖ Let learners come back as one group leaders to present their results for discussion.
- ❖ Guide the discussion to lead to the required formula or rule.
- ❖ Let learners write their own notes in their books.
- ❖ Clarify to the learners that the formula formed in the activity is the sine rule and point out when it can be used.
- ❖ Let the learners go through example 7.5 with your assistance where needed.
- ❖ Ask them to do the quick practice question.

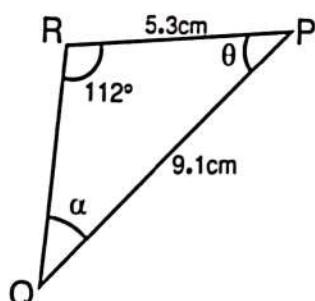
Possible answers to Quick practice 7.6 (Pg 150 LB)

a) $CA = 27.4 \text{ cm}$ b) $\overline{BC} = 17.59 \text{ cm}$

Solution to Quick Practice 7.7

Let learners study Example 7.8 and do QP. 7.8

Solution to QP. 7.8



$$\frac{9.1}{\sin 112^\circ} = \frac{5.3}{\sin \alpha}$$

$$\sin \alpha = \frac{5.3 \sin 112^\circ}{9.1}$$

$$\alpha = 32.68^\circ$$

$$\begin{aligned}\text{Therefore } \alpha &= 180^\circ - (112^\circ + 32.68^\circ) \\ &= 32.32^\circ\end{aligned}$$

Let learners work through example 7.9 and do Quick Practice.

Give an assignment from Exercise 7.3

Answers to Exercise 7.3 (Pg 136 LB)

1. 6.557 cm 2. 51.72
3. $\angle B = 24.57^\circ$, $C = 47.35^\circ$
4. $x = 19.09 \text{ cm}$, $d = 18.66 \text{ m}$, $p = 4.901 \text{ cm}$, $r = 6.035 \text{ cm}$
5. 10.69 km 6. 694.7 m
7. a) 32.72° b) 43.11°
c) 36.01° d) 36.82°
8. 23.03 m and 23.55 m.

7.4.2 The Cosine Rule (Pg 137 LB)

Activity 7.6

- ❖ Let learners in groups work through the activity.
- ❖ Move about in the classroom guiding learners.
- ❖ Observe and note individual competencies like communication skills and cooperation.

Possible answers to Activity 7.6

- b) $b^2 = x^2 + h^2$
- c) $a^2 = (c - x)^2 + h^2$
 $a = c^2 - 2cx + x^2 + h^2$
- d) $h^2 = b^2 - x^2$ and $h^2 = a^2 - (c^2 - 2cx + x^2)$ from (b) and (c) above.
 $a^2 - c^2 + 2cx = b^2$
so $a^2 - c^2 + 2cx - x - x^2 - b^2 - x^2$

$$\text{e)} \cos A = \frac{x}{b} \quad x = b \cos A$$

$$\text{f)} a^2 = b^2 + c^2 - 2c \times b \cos A$$

$$\text{i.e. } a^2 = b^2 + c^2 - 2bc \cos A$$

- ❖ As a whole group, discuss their results. Assist them to arrive at formula or rule $a^2 = b^2 + c^2 - 2bc \cos A$. Give the other forms of the rule

$$\text{ie. } b^2 = a^2 + c^2 - 2ac \cos B$$

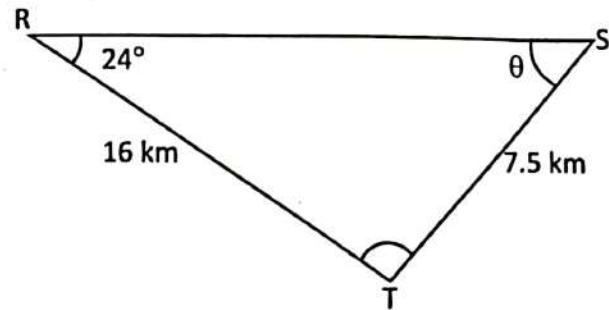
$$c^2 = a^2 + b^2 - 2ab \cos C$$

- ❖ let learners write their own notes in the books
- ❖ Ask them to study Example 7.6 and do the Quick Practice question.

Answers to Exercise 7.4 (Pg 138 LB)

1. a) 17.43cm b) 13.94cm
c) 18.06 cm
2. a) 3.866 cm b) 6.756 cm
c) 16.99 cm d) 31.46 cm
e) 1.745 cm
3. a) 12.48 b) 13.83 cm
4. a) 113.5° b) 68.60° c) 68.62 cm
d) 79.65°
5. a) 111.31° , 43.52° and 25.17°
b) 53.80° , 81.55° and 44.65°
6. 26.89 m
7. 11.31 km
8. 10.73°

Solution to Sample Activity of integration 7 below



$$\frac{7.5}{\sin 24^\circ} = \frac{16}{\sin \theta}$$

$$7.5 \sin \theta = 16 \sin 24^\circ$$

$$\sin \theta = 0.8677$$

$$\theta = 60.2^\circ$$

$$\angle T = 180^\circ - (24^\circ + 60.2^\circ) = 95.8^\circ$$

$$\frac{RS}{\sin 95.8^\circ} = \frac{7.5}{\sin 24^\circ}$$

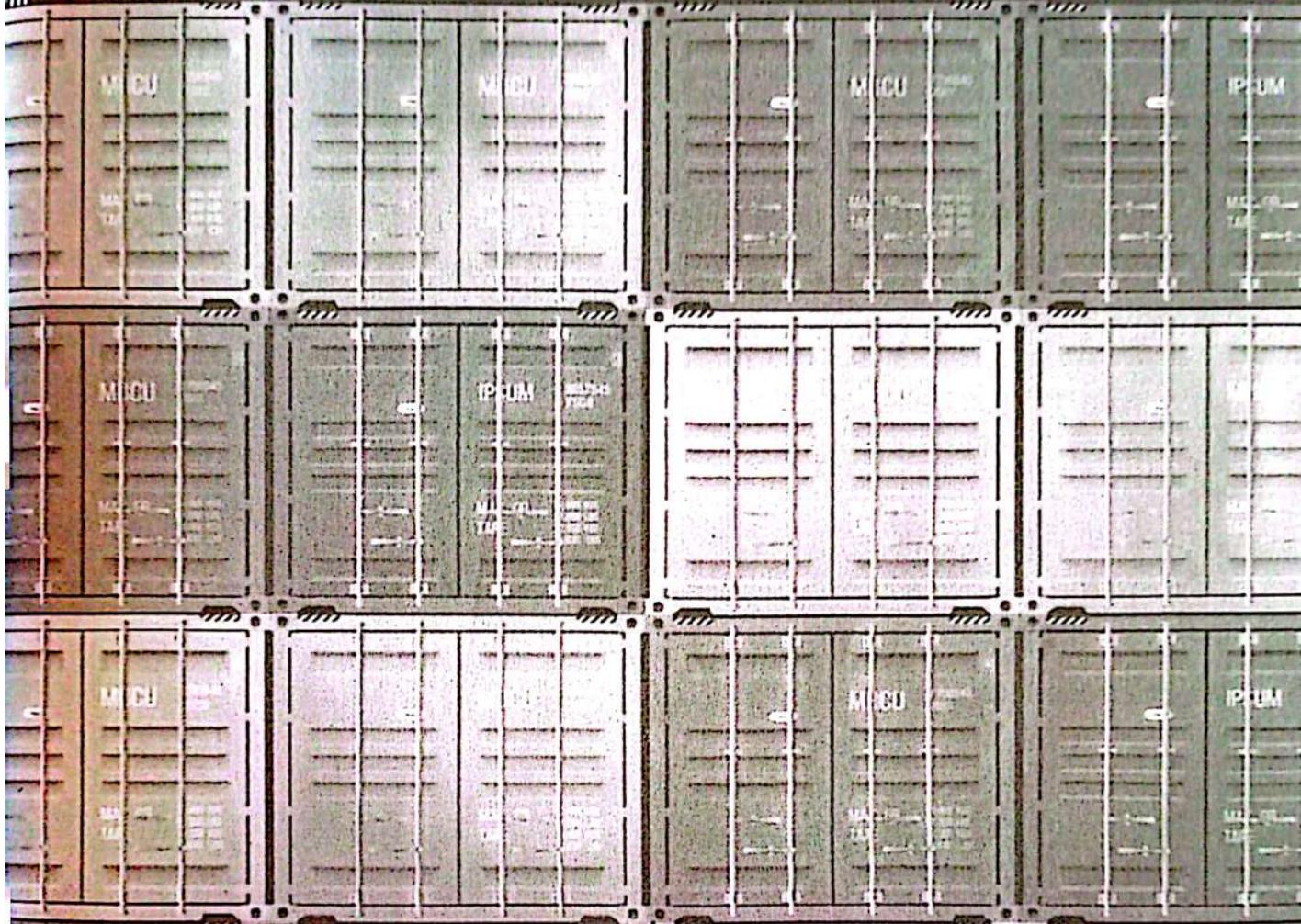
$$RS = \frac{7.5 \sin 95.8^\circ}{\sin 24^\circ} = 18.3$$

They should plan for pipes of length 18.3 km

Sample Assessment Grid of Activity of Integration 7

Output	Basis of evaluation	Relevancy /3	Accuracy /3	Coherence /3	Excellence /1
• Angle between lines joining town to school and reservoir to school.	Score 3: Identifies all 3 relevant parts; using the sine rule to find angle opposite the 16 km side, finding the third angle, using the sine rule to work out the direct distance from the reservoir to the school.	Score 3: Accurately applies all 3 relevant parts; uses the sine rule to find angle opposite the 16 km side, finds the third angle, uses the sine rule to work out the direct distance from the reservoir to the school.	Score 3: Accurately applies all 3 relevant parts; uses the sine rule to find angle opposite the 16 km side, finds the third angle, uses the sine rule to work out the direct distance from the reservoir to the school.	Score 3: Logical flow in the use of all relevant parts.	
• Angle between lines joining town to reservoir and town to school.	Score 2: Identifies 2 relevant parts from; using the sine rule to find angle opposite the 16 km side, finding the third angle, using the sine rule to work out the direct distance from the reservoir to the school.	Score 2: Accurately applies 2 relevant parts; uses the sine rule to find angle opposite the 16 km side, finds the third angle, uses the sine rule to work out the direct distance from the reservoir to the school.	Score 2: Accurately applies 2 relevant parts; uses the sine rule to find angle opposite the 16 km side, finds the third angle, uses the sine rule to work out the direct distance from the reservoir to the school.	Score 2: Logical flow with distortions in the use of the relevant parts.	
Distance from reservoir to school	• Distance directly from reservoir to school.	Score 1: Identifies 1 relevant part from; using the sine rule to find angle opposite the 16 km side, finding the third angle, using the sine rule to work out the direct distance from the reservoir to the school.	Score 1: Accurately applies 1 relevant part; uses the sine rule to find angle opposite the 16 km side, finds the third angle, uses the sine rule to work out the direct distance from the reservoir to the school.	Score 1: Limited flow in the use of the relevant parts.	
		TOTAL			

Topic 8 Matrices



Competency: The learner understands and uses matrices.

- ❖ Ensure that the contents of the topic are covered within the allocated time i.e 12 periods
- ❖ Ensure that the key words in the learner's book are used all the time for the learner to understand them thoroughly.

In this topic guide the learners to:

- a) state a matrix and state its order
- b) know when matrices can be added or multiplied.
- c) find the determinant of a 2×2 matrix
- d) find the inverse of a 2×2 matrix and know why it may not be possible to do so.
- e) apply the knowledge of matrices in solving real life problems.

Introduction

Take your learners through the introduction in the learner's book giving more explanations about the importance of matrices in real life.

8.1: Meaning of a Matrix? (01 period) Pg 142 LB

Forming a matrix and stating its order..

Activity 8.1

Instructional procedures:

- ❖ Help learners to form groups and let them do the activity.
- ❖ Observe learners as they do the activity by moving around the classroom giving assistance where needed.
- ❖ Take note of individual competences like communication skills and active participation.

Possible responses for Activity 8.1

- (b). Omoding family consumed 3 Kgs of sugar, Sempa's family 3 Kgs, Mugume's 2 Kgs and Wamba's 4 Kgs.

$$(c) \begin{pmatrix} 8 & 9 & 6\frac{1}{2} & 7 \\ 3 & 3\frac{1}{2} & 2 & 4 \\ 4 & 2 & 3 & 5 \end{pmatrix}$$

- (d) The 9 respondents Sempa's family's consumption of maize flour and the 5 respondents Wambi's family's bread consumption.

- ❖ Let learners get back as one group and ask the group leaders to present their results. Guide the discussion leading to the formation of a matrix.

- ❖ Use the table at the top of page 143 in the learner's book, explain how a matrix is developed from a table, and make sure your learners distinguish between rows and columns as these determine the order of a matrix. Give several more examples of stating orders of and building matrices.

Answers to Exercise 8.1 (Pg 143 LB)

3. a) 6 b) 12 c) 8 d) mn

e) 5 f) x^2

4. a) $\begin{pmatrix} 20 & 5 & 35 \\ 25 & 6 & 32 \end{pmatrix}$

b) $\begin{pmatrix} 6500 \\ 80000 \\ 9000 \end{pmatrix}$

5 a) 2×2 b) 2×1

c) 3×2 d) 1×3

e) 2×3 f) 3×3 g) 3×1

6. $\begin{pmatrix} 18 & 14 \\ 11 & 7 \\ 7 & 0 \end{pmatrix}$

7. $\begin{pmatrix} 2 & 1 & 3 \\ 1 & 3 & 2 \\ 3 & 1 & 2 \\ 0 & 4 & 2 \end{pmatrix}$ and $\begin{pmatrix} 2 & 2 & 2 \\ 1 & 4 & 1 \\ 2 & 3 & 1 \\ 1 & 5 & 0 \end{pmatrix}$

8.2: Equality of Matrices (01 Period) Pg 144 LB

You are going to guide your learners to understand the idea of equal and unequal matrices.

Activity 8.2**Instructional procedures**

- ❖ Let learners work, in pairs through this activity.
- ❖ Guide learners to discover the principle of equal matrices.
- ❖ Observe them and make note of individual competencies like critical and problem solving skills.

Possible responses to Activity 8.2

- (i) The elements in both matrices, in the same relative positions are equal.
(ii) Again the two have the same elements in the same order.
 - (i) Although the elements are the same they are in different positions in each matrix.
(ii) Same elements but different orders.
- ❖ Let learners come back as a whole group and discuss their 5 results with their guidance.
- ❖ Ask them to write their own notes in their books.
- ❖ Let learners study example 8.1 and work through quick practice 8.1.

Answers to QP 8.1

1. $a = b = -5, c = 6$ 2. $x = -6, y = -4$

8.3: Addition and Subtraction of Matrices (02 period) Pg 145 LB

This subtopic is very important as it introduces two useful operations on matrices.

Activity 8.3

- ❖ Let learners work through the activity in groups.
- ❖ Observe learners as they do the activity. Watch out for competencies like communication skills and cooperation.

Possible responses for Activity 8.3

- (b). Omoding family consumed 3 Kgs of sugar, Sempa's family 3 Kgs, Mugume's 2 Kgs and Wamba's 4 Kgs.

a). (i)
$$\begin{pmatrix} 9 & 5 & 3 & 1 \\ 8 & 4 & 2 & 2 \\ 10 & 6 & 3 & 1 \end{pmatrix}$$
 and

$$\begin{pmatrix} 7 & 5 & 2 & 0 \\ 6 & 3 & 2 & 1 \\ 8 & 4 & 1 & 3 \end{pmatrix}$$

(ii)
$$\begin{pmatrix} 16 & 10 & 5 & 1 \\ 14 & 7 & 4 & 3 \\ 18 & 10 & 4 & 4 \end{pmatrix}$$

b)
$$\begin{pmatrix} 1 & 4 & -1 & -2 \\ 2 & 5 & -8 & 0 \end{pmatrix}$$

c) Impossible

- ❖ Call learners to attention as one group and let their group leaders present their results for discussion
- ❖ Guide learners to discover the reason why it is impossible to add in (c) of the activity.

- ❖ Explain the notation e.g A, B and give examples to prove commutatively and associatively in addition to matrices.
- ❖ Ask the learners to study the examples and do the QP.

Answers to Quick Practise 8.2

a) $\begin{pmatrix} 5 & 12 \\ -15 & -7 \end{pmatrix}$ b) $\begin{pmatrix} -1 & 2 \\ -9 & 13 \\ 1 & 5 \end{pmatrix}$
c) impossible

Answers to Quick Practise 8.3

$p = 4, r = 8$

Give an assignment of numbers 1-3
(exercise 8.2)

8.4: Scalar Multiplication (01 period) Pg 146 LB

Ensure that the learners understand what a scalar means. The rest will be easy.

Possible outcomes to Activity 8.4

a) $\begin{pmatrix} 4 & 8 \\ 16 & 12 \end{pmatrix}$ b) $\begin{pmatrix} 4 & 8 \\ 16 & 12 \end{pmatrix}$

c) Equal results

d) $3B = 3 \begin{pmatrix} 1 & 2 \\ 4 & 3 \end{pmatrix} = \begin{pmatrix} 3 & 6 \\ 12 & 9 \end{pmatrix}$

- ❖ Let learners gather as one group to discuss their results. Guide them understand how to multiply by a scalar.
- ❖ Let them write their own notes in their books.
- ❖ Let them study the related examples and do the quick practice questions.

Solutions: Quick Practise 8.3:

$$\begin{pmatrix} -1 & 22 & 47 \\ 15 & -16 & 51 \\ 3 & 17 & -4 \end{pmatrix}$$

Quick Practice

$$\begin{pmatrix} -4 & -2 \\ 2 & 4 \end{pmatrix}$$

Give assignment of the rest of exercise 8.2.

Answers to Exercise 8.2 (Pg 147 LB)

1. a) not equal b), c) and d) equal

2. a) $\begin{pmatrix} 5 & 2 \\ -6 & 2 \end{pmatrix}$ b) impossible

c) $\begin{pmatrix} 4 \\ -1 \\ 1 \\ 1 \end{pmatrix}$ d) $\begin{pmatrix} 2 & -8 \\ -4 & -2 \\ -6 & -14 \end{pmatrix}$

3. a) $a = -6, b = -5$

b) $a = -2.5, b = -4$

c) $c = 2, d = 1, e = -3, f = -6$

4. a) $\begin{pmatrix} 12 \\ 10 \end{pmatrix}$ b) $\begin{pmatrix} 12 & 3 \\ 0 & 6 \end{pmatrix}$

c) $(10 \cdot 6 \cdot 14)$ d) $\begin{pmatrix} -4 & -6 \\ 3 & 7 \end{pmatrix}$

e) $\begin{pmatrix} -8 & 0 & 20 \\ -12 & 4 & -16 \end{pmatrix}$

f) $\begin{pmatrix} -9 & 5.4 & 1.8 \\ 8.1 & 0 & -13.5 \end{pmatrix}$

5. a) $\begin{pmatrix} 6 & -18 \\ -1 & 14 \end{pmatrix}$ b) $\begin{pmatrix} 4 & -3 & 10 & 2 \\ 4 & -15 & 9 & -10 \end{pmatrix}$

c) $\begin{pmatrix} -1.7 & 2.0 & -4.2 \\ 10.8 & -2.0 & 2.6 \end{pmatrix}$ d) impossible

6. a) $\begin{pmatrix} 1250 & 750 & 650 \\ 1180 & 820 & 600 \end{pmatrix}$

and $\begin{pmatrix} 1350 & 825 & 570 \\ 1130 & 760 & 840 \end{pmatrix}$

b) $\begin{pmatrix} 2600 & 1575 & 1220 \\ 2310 & 1580 & 1440 \end{pmatrix}$

7. a) $c = 6, d = 3$ and $e = 0$

b) $p = 6, q = 2, r = 2$ and $u = 2$

c) $x = 6.5, y = 2.5$

8. a) $\begin{pmatrix} 9 & -3 \\ -21 & 3 \end{pmatrix}$ b) $\begin{pmatrix} -14 & 16 \\ 2 & -18 \end{pmatrix}$

b) $\begin{pmatrix} -2 & 6 \\ -2 & -14 \end{pmatrix}$ c) $\begin{pmatrix} -36 & 48 \\ 28 & -92 \end{pmatrix}$

9. a) $\begin{pmatrix} 5260 & 1580 & 2420 & 1870 \\ 1960 & 2910 & 1490 & 2050 \end{pmatrix}$

b) $\begin{pmatrix} 6430 & 2220 & 1770 & 1980 \\ 1960 & 3200 & 1820 & 2750 \end{pmatrix}$

c) $\begin{pmatrix} 1169 & 3800 & 4140 & 3850 \\ 4010 & 6110 & 3310 & 5800 \end{pmatrix}$

10. a) $\begin{pmatrix} 14 & 7 \\ -5 & 8 \end{pmatrix}$ b) $\begin{pmatrix} 18 & 2 \\ 6 & 5 \end{pmatrix}$

Activity 8.5

Instructional procedures.

- ❖ Let learners do the activity in their groups.
- ❖ Observe them as they do the activity making note of competencies like active participation and creativity.

Possible solutions to Activity 8.5

a) $(500 \ 300 \ 1200)$

b) $\begin{pmatrix} 3 \\ 4 \\ 2 \end{pmatrix}$ and $\begin{pmatrix} 5 \\ 2 \\ 3 \end{pmatrix}$

c) $(500 \ 300 \ 1200) \begin{pmatrix} 3 \\ 4 \\ 2 \end{pmatrix} =$

$$(500 \times 3 + 300 \times 4 + 1200 \times 2) = (5100)$$

$$(500 \ 300 \ 1200) \begin{pmatrix} 5 \\ 2 \\ 3 \end{pmatrix} =$$

$$(500 \times 5 + 300 \times 2 + 1200 \times 3) = (6700)$$

e) By multiplying each element in the row matrix by a corresponding element in the column matrix and add the values.

❖ Organise learners into one group (class) for discussions by group leaders

❖ Guide learners to discover how multiplication of matrices is done (row by column). Emphasize compatibility where columns of left hand matrix must be equal to rows in other matrix.

❖ Allow learners to write their own notes in their books.

8.5: Multiplication of Matrices (03 Periods) Pg 149 LB

Learners usually find this a very difficult sub-topic to understand. So take care and ensure that your learners learn how to multiply by combining rows by columns.

- ❖ Let learners to write their own notes in their books.
- ❖ Let learners study examples 8.6, 8.7, 8.8 and 8.9 each time working out the given quick practice question.

Solution to Quick Practise 8.4

- a) (82) b) (61) c) impossible

Quick Practise. 8.5

a) $\begin{pmatrix} 38 & 27 \\ 54 & 37 \end{pmatrix}$ b) $\begin{pmatrix} 13 & 13 \\ 66 & 62 \end{pmatrix}$

c) No.

Quick Practise 8.9

a) $\begin{pmatrix} 120 & 150 & 38 \\ 182 & 224 & 64 \end{pmatrix}$ and $\begin{pmatrix} 12000 \\ 18000 \\ 15000 \end{pmatrix}$

b) UGX 4,710,000.

Give an assignment from exercise 8.3.

Answers to Exercise 8.3 (Pg 152 LB)

1. a) Yes, 1×2 b) Yes, 2×3

c) No d) yes, 6×4

2. a) $\begin{pmatrix} 13 \\ 22 \end{pmatrix}$ b) $\begin{pmatrix} 16 & 46 \\ 9 & 30 \end{pmatrix}$

c) $\begin{pmatrix} 10 & 13 \\ 20 & 11 \end{pmatrix}$ d) $\begin{pmatrix} 11 \\ 7 \end{pmatrix}$

e) (29) f) $\begin{pmatrix} 6 & 12 \\ 12 & 24 \end{pmatrix}$

3. a) 4 or 4 b) 6 c) = 4 d = 4

d) = 4 e) b = 2, c = 1, a = 1,
d = 2

4. $x = 12, a = 0, c = 8, d = 15,$

$$b = 0, y = 10$$

5. a) $\begin{pmatrix} 1 \\ 2 \\ 5 \end{pmatrix}$ and $\begin{pmatrix} 3200 \\ 6100 \\ 4800 \end{pmatrix}$

b) (35 52 45) c) 364 kg

d) UGX 1,095,800

6. a) $\begin{pmatrix} 5 & 3 \\ 0 & 4 \end{pmatrix}$ b) $\begin{pmatrix} 41 & 24 \\ 48 & 17 \end{pmatrix}$

c) $\begin{pmatrix} 19 & 8 \\ 76 & 21 \end{pmatrix}$

7. a) (i) $\begin{pmatrix} 340 & 30 & 430 \\ 260 & 270 & 420 \\ 410 & 190 & 140 \\ 120 & 110 & 150 \end{pmatrix}$

(ii) (4600 8000 9400 3800)

b) UGX 7 954 000, 4 502 000
and 7 224 000

c) UGX 16 270 000

(ii) (4600 8000 9400 3800)

b) UGX 7,954,000, 4,502,000
and 7,454,000 respectively

c) UGX 16,084,000

8. a) $\begin{pmatrix} 109 & 136 \\ 127 & 159 \\ 66 & 78 \end{pmatrix}$

b) Calories burned per minute

$$(40 \ 10 \ 60) \begin{pmatrix} 109 & 136 \\ 127 & 159 \\ 66 & 78 \end{pmatrix} = (9\ 590\ 11\ 710)$$

i.e 9,590 calories for the 55 kg and 11,710 calories for the other.

8.6: Identity and Zero Matrices (01 period) Pg 154 LB

Activity 8.6

Instructional procedures

- ❖ Let learners do the activity in their groups.
- ❖ Observe them as they do the activity by moving about.
- ❖ Look for individual competencies of communication skills and mathematics computation.

Possible outcomes for activity 8.6

a) (i) $\begin{pmatrix} 6 & 7 & 2 \\ 3 & 5 & 1 \end{pmatrix}$ (ii) $\begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}$
 (iii) $\begin{pmatrix} 2 & 3 & 0 \\ 5 & 1 & 6 \end{pmatrix}$

- b) $TA = AT$ for any matrix A and the zero matrix of the same order.

(i) $\begin{pmatrix} 6 & 3 \\ 2 & 4 \end{pmatrix}$ (ii) $\begin{pmatrix} 2 & 7 \\ 5 & 3 \end{pmatrix}$

(iii) $\begin{pmatrix} 3 & 5 & 7 \\ 6 & 0 & 8 \\ 9 & 11 & 1 \end{pmatrix}$

- d) $TA = AT$ for any A and T of the same order

❖ Get learners together as a group and let group leaders present their results for discussion

❖ Let learners write their own note

8.7: Determinant and Inverse of a 2×2 Matrix (03 period) Pg 155 LB

Activity 8.7

- ❖ Let the learners do the activity in their groups.
- ❖ Observe them as they work through the activity making note of competencies like active participation and computation.

Possible outcomes to activity 8.7

- (a). (i) 1 (ii) 4
 (b) (i) $\frac{1}{1} \begin{pmatrix} 3 & -4 \\ -5 & 7 \end{pmatrix}$ (ii) $\frac{1}{4} \begin{pmatrix} 8 & -5 \\ 4 & -2 \end{pmatrix}$
 (c) $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$. It gives the identity matrix.

Answer to Quick Practice.

a) $\begin{pmatrix} 2 & -\frac{5}{4} \\ 1 & -\frac{2}{4} \end{pmatrix}$ b) No inverse

NB: Emphasise the property of singular matrix and give more examples like:

- i) If $\begin{pmatrix} x & 4 \\ 2 & 5 \end{pmatrix}$ is a singular matrix, what is the value of x?
 ii) Given that the determinant of $B = \begin{pmatrix} a-3 & 5 \\ 2 & a \end{pmatrix}$ is zero, find the possible values of a.

Answers to Exercise 8.4 (Pg 157 LB)

1. $PQ = \begin{pmatrix} 1 & 2 \\ -2 & -4 \end{pmatrix}$; No

2. $\begin{pmatrix} 2 & 2 \\ -2 & -2 \end{pmatrix} \begin{pmatrix} 2 & 2 \\ -2 & -2 \end{pmatrix} = N^2$

$$\begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix} = N^2$$

3. a) $\begin{pmatrix} 4 & -3 & 8 \\ 7 & 1 & -5 \end{pmatrix}$

b) $\begin{pmatrix} 4 & 2 & -10 \\ 6 & 16 & 2 \\ 10 & 26 & 6 \end{pmatrix}$

4. No

5. a) 4 b) 5 c) 54 d) 106

6. a) -3 b) $\begin{pmatrix} 0.2 & 0.3 \\ 0.2 & 0.8 \end{pmatrix}$

7. $\begin{pmatrix} a-b & 2a-2b \\ c-d & 2c-2d \end{pmatrix}$

8. a) $\begin{pmatrix} 1 & -4 \\ -2 & 9 \end{pmatrix}$ b) $\begin{pmatrix} 1 & 3 \\ 2 & 5 \end{pmatrix}$

c) Impossible

d) $\begin{pmatrix} 3 & \frac{5}{2} \\ -\frac{1}{8} & \frac{-3}{16} \end{pmatrix}$

9. a) -6 b) ± 8 c) ± 14 d) -4 or 3

- e) -4 or 7 f) -3.5 or 5

Assessment grid for Activity of integration 8

Output	Basis of evaluation	Relevancy	Accuracy	Coherence	Excellent
Organised information for the two periods of the groups.	Determination of total sales for the two groups.	Score: 3 Identifies and shows all basic calculations	Score: 3 Accurately calculates all the 5 basic steps.	Score: 3: Logical flow of all 5 basic calculations.	Learners earn 1 point for any exceptive step in the calculations.
		Score: 2 Identifies and shows 3-4 basic calculations	Score: 2 For 3-4 accurate calculations	Score: 2 Logical flow of 3-4 basic calculations.	
		Score: 1 Identifies and shows 1-2 basic calculations	Score: 1 For 1-2 basic calculations accurate.	Score: 1 Logical flow of 1-2 basic calculations.	
	Total				

**Suggested solution to the sample activity of integration 8**

In the current season

	Milk (litres)	Maize (bags)	Beans (bags)
Kapo	2520	35	10
Funa	2314	41	9

This Month

	Milk (litres)	Maize (bags)	Beans (bags)
Kapo	3254	42	8
Funa	2719	32	11

To get the information, first arrange the information into matrix form;

$$\begin{pmatrix} 2520 & 35 & 10 \\ 2314 & 41 & 9 \end{pmatrix} \text{ and } \begin{pmatrix} 3254 & 42 & 8 \\ 2719 & 32 & 11 \end{pmatrix}.$$

The corresponding elements of the two matrices are added.

$$\begin{pmatrix} 2520 & 35 & 10 \\ 2314 & 41 & 9 \end{pmatrix} + \begin{pmatrix} 3254 & 42 & 8 \\ 2719 & 32 & 11 \end{pmatrix}.$$

$$\begin{pmatrix} 2520 + 3254 & 35 + 42 & 10 + 8 \\ 2314 + 2719 & 41 + 32 & 9 + 11 \end{pmatrix}$$

$$\begin{pmatrix} 5774 & 77 & 18 \\ 5033 & 73 & 20 \end{pmatrix}$$

The total sales are got by adding the items for the different groups.

Milk = 10,807 litres

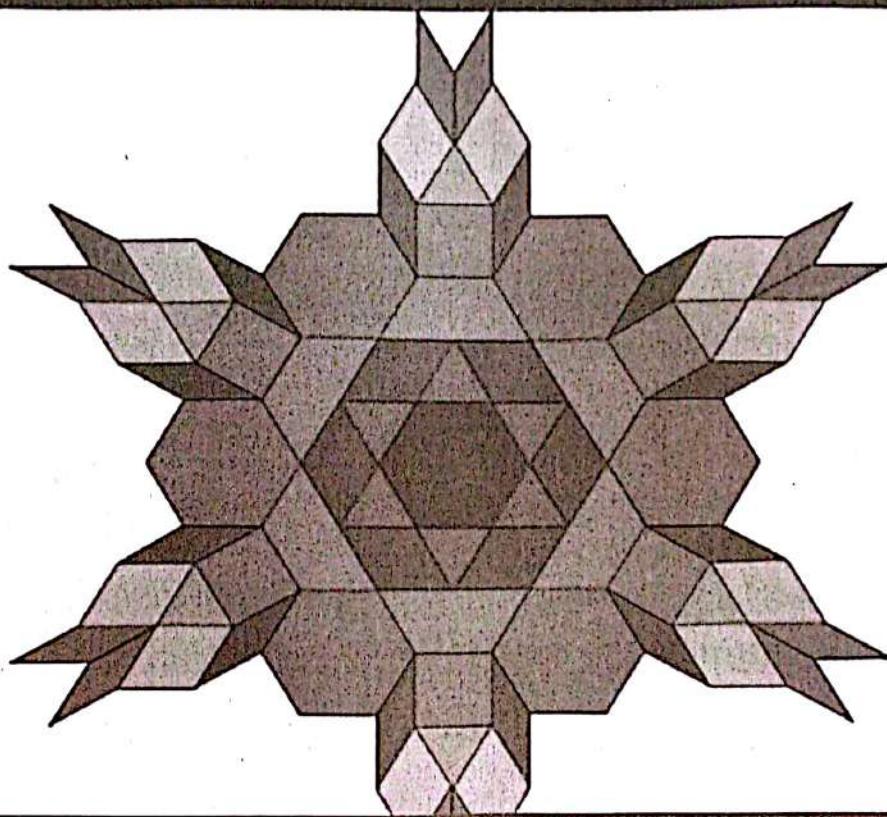
Maize = 150 bags

Beans = 38 bags

Topic

9

Matrix Transformation



Competency: The learner understands and uses matrices to transform shapes on a coordinate grid.

- ❖ Ensure that the contents of the topic are covered within the allocated 12 periods.
- ❖ Make sure the key words in the learners book are used all the time for the learner to understand their meanings in the topic.

In this topic guide learners to:

- (a) identify transformation matrices for reflection, rotation and enlargement.
- (b) determine the image given the object and transformation matrix, on a coordinate grid.
- (c) identify the matrix of transformation when the object and its image are given.
- (d) determine the inverse of a transformation matrix.
- (e) use the inverse matrix to find the object when the image is given.
- (f) identify the relationship between area scale factor and determinant of the transformation matrix.
- (g) determine a single matrix for successive transformations.

Introduction

Review the learner's knowledge about the transformation of reflection, rotation, translation and enlargement.

Ensure that they can identify each one of those transformations from a diagram. Ask them to list the properties of each transformation above.

Tell them that they are now going to discover another way of transforming shapes in the Cartesian plane.

9.1: Transformations Represented by 2×2 matrices (Pg 162 LB)

In books 1 and 2, you studied about reflection, rotation and enlargement. You are going to see how these transformations are related to matrices

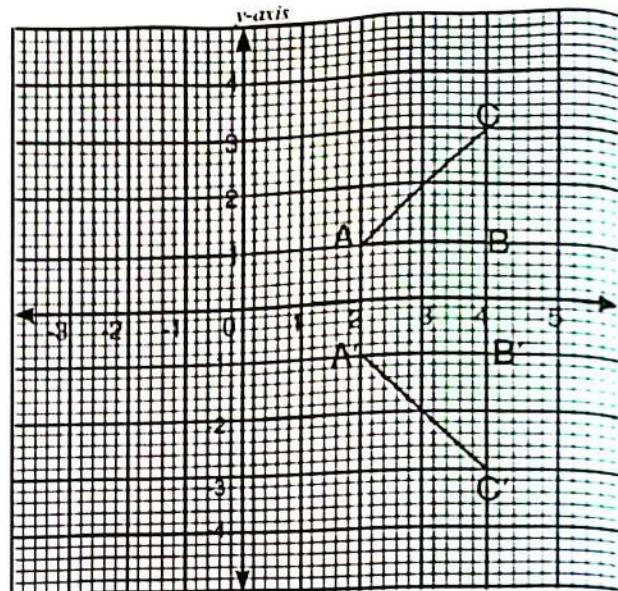
Activity 9.1

- ❖ Let learners work in pairs through the activity.
- ❖ Observe them as they do the activity taking note of competences like communication skills and active participation.

(a) $\begin{pmatrix} A \\ 2 \end{pmatrix}$, $\begin{pmatrix} B \\ 4 \end{pmatrix}$ and $\begin{pmatrix} C \\ 1 \end{pmatrix}$.

(b) $A'(2, -1)$, $B'(4, -1)$ and $C'(4, -3)$

(c) See graph



- (d) A reflection
(e) A reflection in the x-axis.

- ❖ Organise learners into one group and let group leaders present their results for discussion.
- ❖ Guide learners in identifying the transformation that the matrix represents.
- ❖ Let learners write their own notes in their books.

NOTE

- ❖ Emphasise that the transformation matrix is always written on the left of the object matrix.

- ❖ Ask learners to study example 9.1 and do quick practice 9.1.

Quick Practice

The vertices of triangle EFG are $E(-3, 5)$, $F(-4, 0)$, $G(-1, 4)$. After transformation by the following matrices, determine what transformation each matrix represents.

a) $\begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$ b) $\begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$

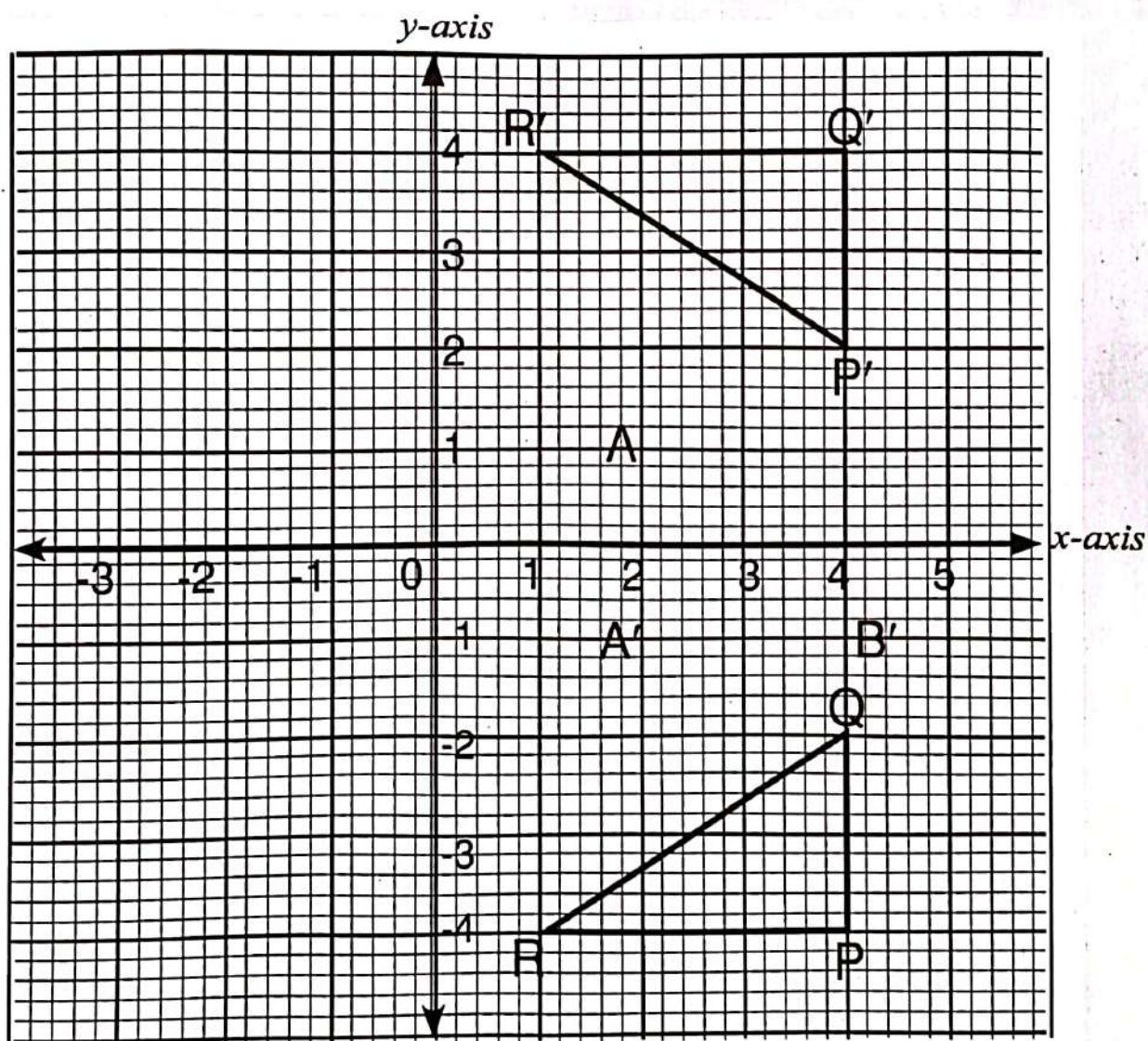
- (a) Reflection in y -axis b) Half-turn about $(0, 0)$

❖ Give an assignment from exercise 9.1.

Answer to Exercise 9. 1 (Pg 165 LB)

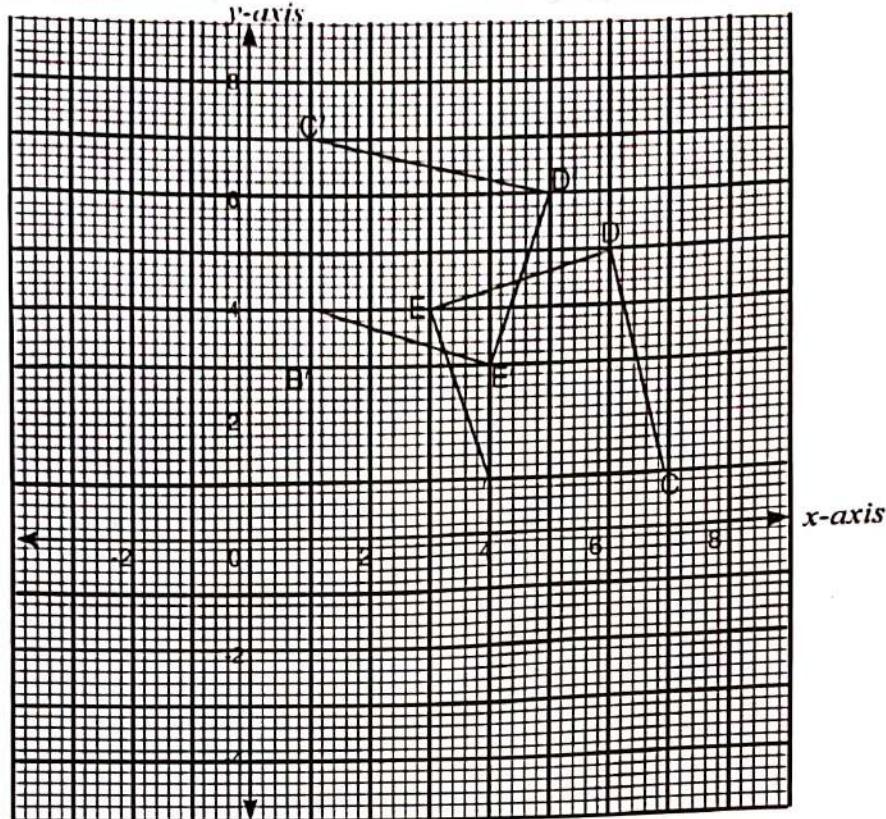
1. a) $(-2, -3)$ b) $(3, -4)$
2. a) $B'(-2, -3), C'(-3, 2), D'(-5, 1)$
b) $B'(3, -2), C'(-2, -3), D'(-1, -5)$
c) $B'(-3, -2), C'(2, -3), D'(1, -5)$
d) $B'(-6, 4), C'(4, 6), D'(2, 10)$
e) $B'(-9, 2), C'(6, 3), D'(3, 5)$

3. a)

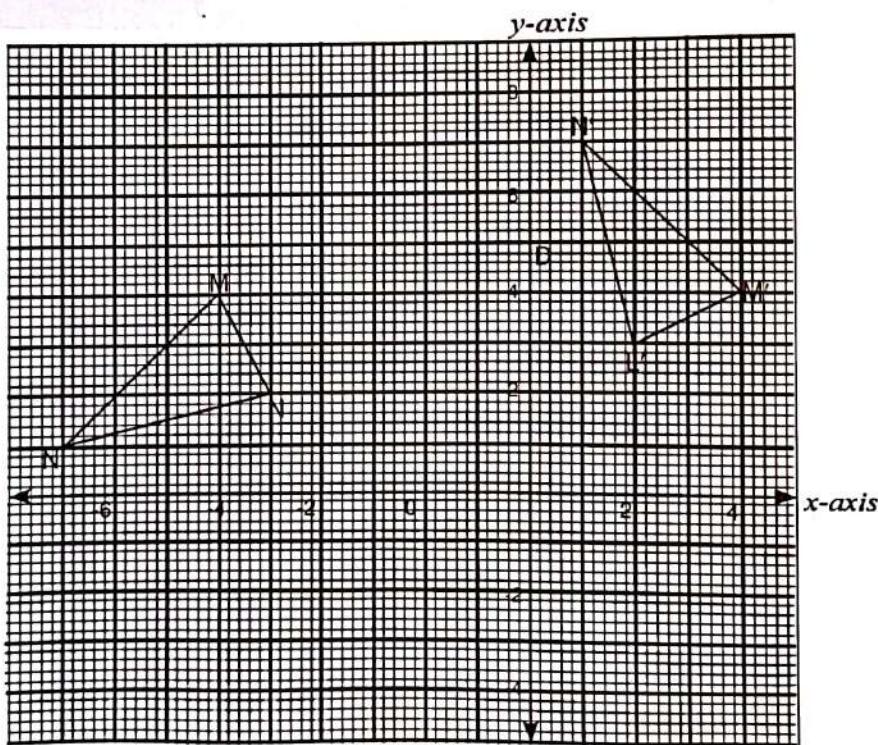


A reflection in the x -axis

b)

*A reflection in $y = x$*

c)

 *-90° about $(0, 0)$*

4. a) A positive quarter turn around $(0, 0)$.
- b) Enlargement centre $(0, 0)$ scale factor $\frac{1}{2}$.
- c) Reflection in y -axis.
- d) Half-turn about $(0, 0)$.
- e) Enlargement centre $(0, 0)$ scale factor -2

9.2: Identifying Matrices of Transformations (Pg 166 LB)

By the end of the Activity your learners should be able to determine the matrix of a transformation.

Activity 9.2

Instructional procedures.

- ❖ Assist learners form groups and do the activity.
- ❖ Observe them as they do the activity and look out for individual competences like mathematical computation and co-operation skills. Make note of these against the learner's name.

Possible outcomes for activity 9.2.

- $I'(3, 4)$ and $J'(5, 6)$
 - $\begin{pmatrix} 3 \\ 4 \end{pmatrix}$ and $\begin{pmatrix} 5 \\ 6 \end{pmatrix}$
 - I' is first column and J' the second of the transformation matrix.
 - $\begin{pmatrix} 7 & 9 \\ 6 & 8 \end{pmatrix}$
- ❖ Point out the unit square OIKJ and its use in writing matrices of matrices of some transformations using the notes in the LB after the activity.
 - ❖ Let learners write their own notes in their books.
 - ❖ Ask learners to work through example 9.2 and do the given quick practice.

Answers to Quick Practice 9.2.

a) $\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$ b) $\begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$

Answer to Exercise 9.2 (Pg 168 LB)

- | | |
|---|---|
| 1. $\begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$ | 2. $\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$ |
| 3. $\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$ | 4. $\begin{pmatrix} 2 & 0 \\ 0 & 2 \end{pmatrix}$ |
| 5. $\begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$ | 6. $\begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix}$ |
| 7. $\begin{pmatrix} 3 & 0 \\ 0 & 3 \end{pmatrix}$ | 8. $\begin{pmatrix} \frac{1}{2} & 0 \\ 0 & \frac{1}{2} \end{pmatrix}$ |

9.3: Identifying Transformation Matrices by Calculation (Pg 168 LB)

Point it out that not all transformation matrices can be found using the unit square. Some will be found by calculation.

Activity 9.3

Instructional procedures

- ❖ Ask earners to do the activity in groups. Observe them as they do the activity by moving around the classroom.
- ❖ Make note of individual competences like communication skills and cooperation.

Possible outcomes for activity 9.3.

(a) $A \begin{pmatrix} A & B & C \\ 3 & 2 & 6 \\ 1 & -4 & -3 \end{pmatrix}$

(b) $B' \begin{pmatrix} A' & B' & 'C \\ 1 & -4 & -3 \\ -4 & -2 & -6 \end{pmatrix}$

$$(c) \begin{pmatrix} a & b \\ c & d \end{pmatrix} \begin{pmatrix} 3 & 2 & 6 \\ 1 & -4 & -3 \end{pmatrix} = \begin{pmatrix} 1 & -4 & -3 \\ -4 & -2 & -6 \end{pmatrix}$$

$$(d) \begin{aligned} 3a + b &= 1 \\ 2a - 4b &= -4 \quad \text{and} \\ 2c - 4b &= -2 \end{aligned}$$

$$(e) a = 0, b = 1, c = \frac{-9}{7}, d = \frac{-1}{7}$$

$$(f) M = \begin{pmatrix} 0 & 1 \\ -1 & \frac{-1}{7} \end{pmatrix}$$

- ❖ Let learners get back into one group and discuss their results. Guide them discover the required matrix of transformation.
- ❖ Let learners make their own notes in their books.
- ❖ Ask them to study example 9.3 and do the quick practice question.

Answers to Quick Practice 9.3.

$$Q = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$$

9.4: Using the inverse matrix to find the object given the image (Pg 169 LB)

Point it out to the learners that sometimes we have to do the reverse i.e finding the object given the image and matrix.

Activity 9.4

Instructional procedures.

- ❖ Let learners do the activity in pairs. Observe them as they work.
- ❖ Make note of individual competences like communication skills and active participation.

Possible outcomes for activity 9.4.

$$(a) \begin{pmatrix} \frac{1}{2} & 0 \\ 0 & \frac{1}{2} \end{pmatrix}$$

$$(b) \begin{pmatrix} C' & D' & E' \\ 1 & 4 & 2 \end{pmatrix} \begin{pmatrix} 2 & 8 & 4 \\ 2 & -6 & -6 \end{pmatrix} = \begin{pmatrix} 1 & 3 & 3 \end{pmatrix}$$

$$(c) C(1, -1), D(4, 3) \text{ and } E(2, 3)$$

- ❖ Organise learners into a whole class and let them discuss their results. Guide them to understand the method.
- ❖ Emphasize the fact that it means undoing what was done to the object. So we use the inverse matrix.
- ❖ Let learners write their own notes in their books.
- ❖ Ask learners to study example 9.4 then do Quick Practice 9.4.

Answers to Quick Practice 9.4.

P is (-2, 1), Q(3, 1) and R(2, 4).

Give an assignment from exercise 9.3

Answer to Exercise 9.3 (Pg 170 LB)

1. A(1, 1), B(-2, 3), C(1, -4) and D(2, 1)
2. $\begin{pmatrix} 2 & 0 \\ 6 & -2 \end{pmatrix}$
3. K(-4, 2), L(-2, 6), and M(2, 1)
4. $\begin{pmatrix} \frac{1}{3} & 0 \\ 0 & \frac{-1}{3} \end{pmatrix}$

9.5: Identifying the relationship between area scale factor and the determinant of transformation matrix (Pg 172 LB)

Check the learners' prior knowledge of area scale factor which is now going to be related to the determinant of the transformation matrix.

Activity 9.5**Instructional procedures.**

- ❖ Let the learners do the activity in pairs as you move around guiding them.
- ❖ Observe them as they work and take note of individual competences like communication skill and cooperation.

Possible outcomes for activity 9.4.

- K is (2, 6), L'(10, 8) and M'(10, 2).
- Area KLM = 6 units
- Area K'L'M' = 24 units
- $\det A = 4$
- $\frac{\text{image area}}{\text{object area}} = 4$
- $\frac{\text{image area}}{\text{object area}} = \text{determinant of } A.$

- ❖ Organise learners back into one group and let them discuss their results. Guide them to discover the relation between the determinant and the area scale factor.
- ❖ Allow learners to write their own notes in their books.
- ❖ Let them study examples 9.5 and 9.6 and do Quick Practices 5 and 6.

Answers to Quick Practice 9.5

50 sq units

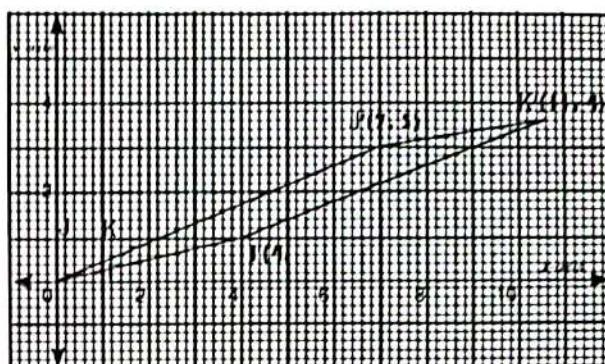
Answers to Quick Practice 9.6

- a) 87.5 sq units b) 127 sq units

Give an assignment from Exercise 9.4.

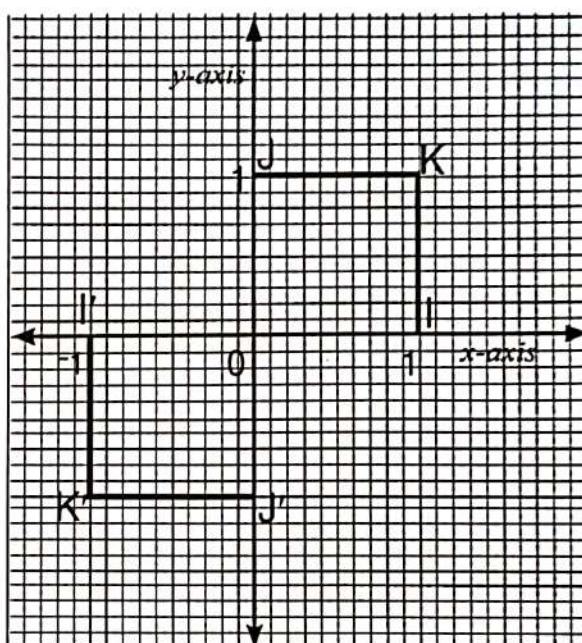
Answers to Exercise 9.4. (Pg 173 LB)

1. a)



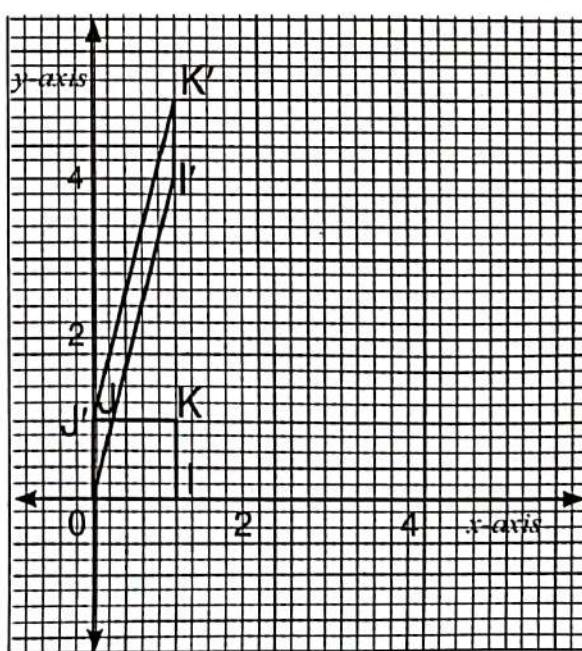
Area = 5 square units

b)



Area = 1 square unit

d)



Area = 1 square unit

2. (a) 9 (b) 1 (c) 8 (e) 0 (f) $\frac{1}{2}$
3. (a) 6 sq units (b) 30 sq units
4. 64.2 sq units
5. $\begin{pmatrix} -3 & -1 \\ 1 & 2 \end{pmatrix}$, 5 sq units
6. (a) P is (4, 0), Q'(-6, -8) and R'(-6, -8), S'(-2, 0)
(b) 4 : 1

9.6: Combined Transformations (Pg 174 LB)

An object may undergo two or more transformations and the final image may be related to the object by a transformation.

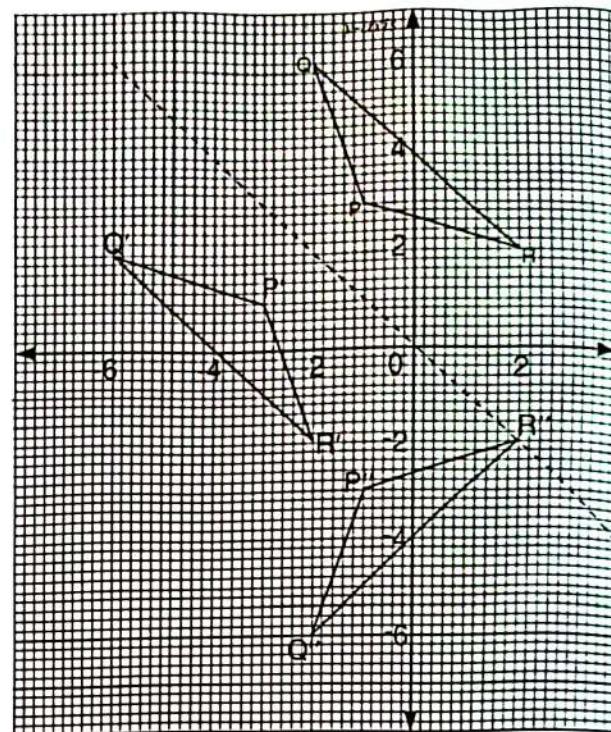
Activity 9.6

Instructional procedures.

- ❖ Help learners form groups of six or so and ask them to do the activity.
- ❖ Observe them as they do the activity and take note of individual competences like critical thinking and active participation.

Possible outcomes for activity 9.6.

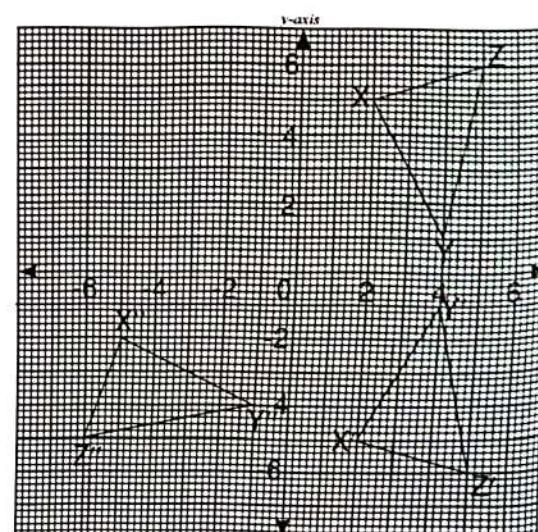
- See graph
- P' is (-3, 1), Q'(-6, 2) and R'(-2, -2).
- P'' is (-1, -3), Q''(-2, -6), R'' is (2, -2)
- Reflection in the x-axis



- ❖ Let learners come together as group to discuss their results.
- ❖ Guide them to discover the final image and lead them through the notes in the Learners Book about the order in which to carry out transformation .
- ❖ Let learners write their own notes in their books.
- ❖ Ask them to study examples 9.1 and do Quick Practice question 5.

Answers to Quick Practice.

(a)



- (b) X' is $(2, -5)$, Y' is $(4, -1)$, Z' is $(5, -6)$,
 X'' is $(-5, -2)$, Y'' is $(-1, -4)$, Z'' is $(-6, -5)$
- (c) Reflection in $x + y = 0$
- ❖ Organize learners into a whole group and ask group leaders to present their results for discussion.
 - ❖ Guide the discussion to lead leaders to understand successive transformations.
 - ❖ All learners to write their own notes in their books.
 - ❖ Give an assignment from Exercise 9.5.

Answers to Exercise 9.5.

1. (a) Reflection followed by rotation
 (b) Translation followed by reflection
 (c) $(-8, 0)$ (d) $(-7, 2)$
 (e) $(3, -6)$ (f) $(-14, -2)$
2. (a) $A'(1, 4)$ (b) $P'(-2, 3)$
 $B'(6, 4)$ $Q'(-3, 8)$
 $C'(5, 1)$ $R'(1, 6)$
 (c) $E'(2, 7)$ (d) $R'(5, 11)$
 $F'(4, 11)$ $S'(4, 5)$
 $C'(7, 6)$ $T'(7, 9)$
3. (a) Translation $\begin{pmatrix} -1 \\ -6 \end{pmatrix}$ then reflection
 (b) Reflection in $x + y = 0$ then -90° about $(0, 0)$.
4. (a) $P'(-1, 2)$, $Q'(-3, -1)$, $R'(-5, 1)$
 (b) $P'(1, -1)$, $Q'(-2, 1)$, $R'(0, 3)$
5. (a) $L'(-2, 3)$, $M'(-1, 4)$, $N'(1, 2)$
 (b) $L'(4, 0)$, $M'(2, 2)$, $N'(6, 6)$
6. (a) $R'(-4, 1)$, $S'(-7, -1)$, $T'(-7, -4)$

- (b) $R'(-1, 4)$, $S'(1, 7)$, $T'(4, 7)$
 (c) $R'(-4, -1)$, $S'(-7, 1)$, $T'(-7, 4)$
 (d) $R'(-4, 2.5)$, $S'(-0.5, 1.5)$, $T'(-0.5, 0)$

9.7: Successive Transformations involving Matrices (Pg 177 LB)

The important point to emphasize here is the order in which to do the transformation e.g **RXY** means **Y** then **X** then **R**.

Activity 9.7

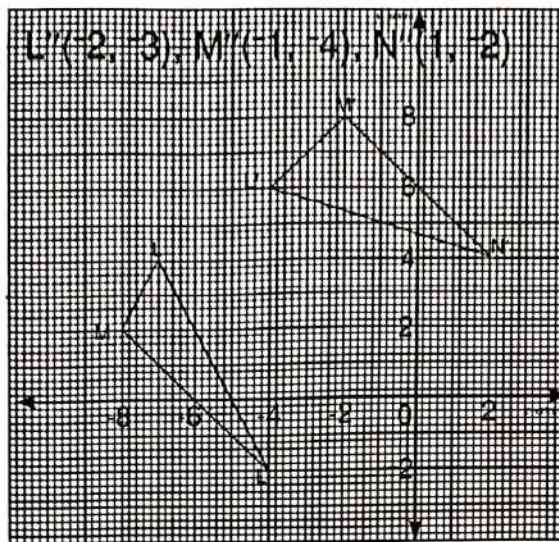
Instructional procedures.

- ❖ Let learners do the activity in groups as you move around the classroom guiding them.
- ❖ Observe learners making note of individual competences cooperation and active participation. them as they do the activity

Possible outcomes for activity 9.7.

- (a) $L'(2, -7)$, $M'(-3, -5)$ and $N'(-3, -3)$.
 - (b) $L''(2, 7)$, $M''(-3, 5)$, $N''(-3, 3)$
 - (c) $\begin{pmatrix} 0 & 1 \\ 1 & 1 \end{pmatrix}$
- ❖ Organise learners into a simple group and let them discuss their results with your guidance. You must stress the order in which they are read and done as before.
 - ❖ Let them write their own notes in their books.
 - ❖ Ask learners to study example 9.9 then do Quick Practice 9.8.
 - (a) $L'(-4, 6)$, $M'(-2, 8)$, $N'(2, 4)$

- (b) $L'(-2, -3)$, $M'(-1, -4)$, $N'(-1, -2)$



Give an assignment from Exercise 9.6.

Answers to Exercise 9.6 (Pg 181 LB)

1. (a) $(-12, -4)$ (b) $(-12, -21)$
 (c) $\left(\frac{2}{3}, \frac{5}{2}\right)$
2. (a) $(4, 3)$ (b) $(2, -3)$

- (c) $(-4, -11)$
3. (a) $P'(1, -4)$, $Q'(4, -3)$, $R'(6, -7)$
 (b) $P''(-4, -1)$, $Q''(-3, -4)$, $R''(-7, -6)$
 (c) $\begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$ Enlargement
 centre $(0,0)$ s.f = -1 or half-turn about $(0,0)$
4. (a) $F'(-4, -6)$, $G'(-1, -7)$, $H'(-1, -4)$
 (b) $F''(-10, -6)$, $G''(-8, -7)$, $H''(-5, -4)$
 (c) $\begin{pmatrix} -1 & -1 \\ -1 & 0 \end{pmatrix}$
5. (a) (i) +90 about $(0, 0)$
 (ii) $\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$
 (b) $A''(-6, 2)$, $B''(-10, -2)$, $C''(4, 8)$
 (c) $\begin{pmatrix} 0 & -\frac{1}{2} \\ \frac{1}{2} & 0 \end{pmatrix}$

Assessment grid for activity of integration 9

Output	Basis of evaluation	Relevance /3	Accuracy /3	Coherence /3	Excellence /1
An application letter	<ul style="list-style-type: none"> ❖ Atleast two designs with two different transformations 	Score 3: draws two different designs with atleast two different transformations. Score 2: draws two different designs with atleast one transformations or draws one design with two transformation. Score 1: draws one design.	Score 3: accurately draws two different designs with atleast two different transformations. Score 2: accurately draws two different designs with atleast one transformations or draws one design with two transformation. Score 1: Accurately draws one design	Score 3: Logically draws two different designs with atleast two different transformations. Score 2: Logically draws two different designs with atleast one transformations or draws one design with two transformation. Score 1: Logically draws one design.	A learner earns 1 point if he/she has added any exceptional feature unsolicited in the instructions.
	Total				

Topic

10

Simultaneous
Equations



Competency: The learner understands, forms and solves simultaneous equations.

- ❖ Ensure that the contents of this topic are covered within the allocated 15 periods.
- ❖ Emphasise the use of the key words in the learner's book.
- ❖ Ensure that the learners understand the meaning of the key words used in this topic.

In this topic guide learners to:

- a) solve simultaneous equations using substitution method.
- b) solve simultaneous equations using elimination method.
- c) solve simultaneous equations using matrix method.
- d) draw graphs of simultaneous equation and estimates the equations.

Introduction

Start by finding out if the students know the meaning of the word simultaneous. From their responses guide them to understand what a simultaneous equation is. A pair of equations involving two unknowns that are to have the same value in each equation.

Guide learners on daily life application of simultaneous equation.

Examples: In addition to those on learners book, we also have;

- Helping us get the best deal.
- The best
- Deciding on a loan
- In cost and demand etc.

10.1: Forming Simultaneous Equations (Pg 186 LB)

Here first emphasise and review the writing of Mathematical statement or sentences containing unknown into Algebraic linear equations.

Ensure that they are able to replace unknowns in sentences with letters of their preference.

Let the learners also know how to represent an algebraic two digit number with letters. For example if you have two digit number as 26 means $(2 \times 10) + 6$.

So a two digit number cannot be represented directly with letters as xy but instead as $10x + y$.

Activity 10.1

- ❖ Organise the learners into small groups. And each group attempts the activity.

- ❖ Observe them as; They do the activity. Watch out for the competencies spelt out in the learners book.
- ❖ Note down what you have observed and assist the learners where necessary.
- ❖ Groups present to the whole class and members suggest improvement to each presentation.
- ❖ Guide the learners in the discussion of the presentations to harmonise.

Possible answer to Activity 10.1

a) Let the numbers be any letters x and y .

(i) The quantities are any two numbers.

(ii) In words;

When the two numbers are added it gives 27.

When one number is subtracted from the other the answer is 13.

Symbols: $x + y = 27$

$$x - y = 13$$

b) (i) quantities are: note books and ball point pens

(ii) In words;

Three note books plus two ball point pens cost 6,500/=

One note book plus two ball point pens cost 3,500/=

In symbols;

Let x – represent the note books bought

y - represent the ball point pens bought.

$$3x + 2y = 6,500$$

$$x + 2y = 3,500$$

- ❖ Discuss with the learners the three summarised steps of forming simultaneous equations in the learners book.
- ❖ Give more examples for the learners to employ the three stated

step. And atleast two numbers for learners to do individually.

- ❖ Take the learners through the example and allow them to choose any letters of their choice instead of only x and y used.

Quick practice

- ❖ Allow individual learners to practice it in their books as you move around to mark.

Answers to Exercise 10.1 (Pg 187 LB)

In each of these cases learner may choose different letter.

1. quantities: one of the numbers + another number = 34

one of the number - another number = 4

symbols: let the numbers be x and y .

$$x + y = 34$$

$$x - y = 4$$

2. Quantities: chemistry mark and math mark.

equations: Math mark - Chemistry mark = 15

Math mark + Chemistry mark = 145

Symbols: Let m&c represent Math & Chemistry marks.

$$m - c = 15$$

$$m + c = 145$$

NB: There is a likelihood of learners not interpreting the word "is less than"

3. Quantities: any two numbers.

equations: big number - small number = 6

5(single number) = 2(big number)

Symbols: Let big number be x and small be y .

$$x - y = 6$$

$$5y = 2x$$

4. Quantities: Geography text book and Math text books.

equations: 3(Geography text books) + 4(Math text books)
= 215,500

2(Geography text books) + 3(Math text books)
= 153,000

Symbols: Let x - Geography text books , y - Math text books.

$$3x + 4y = 215,500$$

$$2x + 3y = 153,000$$

5. Quantities: Cows and goats.

equations: $2(\text{cows}) + 5(\text{goats}) = 3,650,000$

$$3(\text{cows}) + 6(\text{goats}) = 5,100,000$$

Symbols: Let c - represent cows & G represent goats.

$$2c + 5G = 3,650,000$$

$$3c + 6G = 5,100,000$$

6. Quantities: Length and width of the rectangle.

equations: $2(\text{length}) + 2(\text{width}) = 320 \text{ m}$

$$\text{Length} - \text{width} = 40 \text{ m}$$

Symbols: Let a - length & b - width.

$$2a + 2b = 320$$

$$a - b = 40$$

10.2: Solving Linear Simultaneous Equations Algebraically (Pg 187 LB)

Let the learner know that a simultaneous equation can be solved in many ways. And if possible first list down the methods.

- Substitution Iteration
- Elimination Graphical etc
- Matrix

10.3.1: Substitution Method

Activity 10.2 Page 188 of LB

- ❖ Organise the learners into small groups and each group attempts the activity.
- ❖ Observe them as they do the activity. Look out for the competencies given in the learners book.
- ❖ Note down what you have observed

and assist the learner.

- ❖ Let each group first present their finding for part(a) of the activity and note down the time they took to get the answer.
- ❖
- ❖ Guide the learners as they continue with the activity from (b) upto (e).
- ❖ Give chance for at least two group to present that next part of the activity.

Possible answer to activity 10.2

- a) Learner will be replacing the unknowns x and y with any integers of their choice until they find a pair that can satisfy both equations.
This might take sometime and even some groups may never arrive at a pair that can satisfy.
- b) From equation (2) we make y the subject.

$$\begin{aligned}2x + y &= -4 \\y &= -4 - 2x\end{aligned}$$

c) Replace y in equation(1)

$$\begin{aligned}3x + 4y &= -1 \\3x + 4(-4 - 2x) &= -1 \\3x - 8x &= 1 + 16 \\-5x &= 15 \\x &= -3\end{aligned}$$

Solving for y

$$\begin{aligned}y &= -4 - 2(-3) \\y &= -4 + 6 \\y &= 2\end{aligned}$$

e) Put $x = -3$ & $y = 2$ in equation (1) & (2)

$$\begin{aligned}2x + y &= -4 \\2(-3) + 2 &= -4 \\-6 + 2 &= -4 \\-4 &= -4 \text{ true}\end{aligned}$$

Equation (2)

$$\begin{aligned}3x + 4y &= -1 \\3(-3) + 4(2) &= -1 \\-9 + 8 &= -1 \\-1 &= -1 \text{ true}\end{aligned}$$

The answer is $x = -3$ and $y = 2$ turning a pair $(-3, 2)$

Now the teacher can explain what substitution method is.

Guide the students through example 10.3.

Quick Practice

Allow individual learners to practice it in their books as you move around to mark.

NB: Pay attention to the following areas of difficult when using this method by students.

- They do not number the original equations or the equations that they create. So insist repeatedly that the students number equations.
- They make mistakes in substitution because of not making use of brackets. Learners should use brackets when substituting.
- Choosing a variable to make a subject in one of the two equations. Learners should choose the equation where the variable to make a subject does not result in them working with fraction. E.g If $3x + y = 10$, then make y the subject and not x .

STUDY TIP

Guide the learners through the tip and example 10.4.

$$C + D = 40 \dots\dots\dots (1)$$

$$C + \frac{3}{5}D \dots\dots\dots (11)$$

Put (1) into (i)

$$\frac{3}{5}D + D = 40$$

$$3D + 5D = 200$$

$$8D = 200$$

$$D = 25$$

$$\text{From (i)} C + D = 40$$

$$C + 25 = 40$$

$$C = 15$$

$$\text{Therefore } C = 15, D = 25$$

Answers to Exercise 10.2 (Pg 189 LB)

1. a) (5, 5) is the solution
b) (10, 5) is the solution
c) (2, 3) is the solution
2. 74 and 38
3. Length = 51 cm and width = 33 cm
4. a) $x = 1$, and $y = 1$
b) $x = 2$, and $y = 2$
c) $c = 3$, and $d = 1$
d) $m = 1$, and $n = 2$
5. $l = 30.5$ cm, and $w = 3.5$
6. a) $x = 6$, and $y = 6$
b) $a = 3$, and $b = 8$
c) $x = \frac{4}{7}$ and $y = \frac{4}{7}$
7. a) $c = 6,500,000 + 1500 n$
b) $c = 18,500,000 / n$

10.2.2: Elimination Method (Pg 190 LB)

Activity 10.3

- ❖ Organise the learners into small groups. Each group them attempt the activity.
- ❖ Observe them as they do the activity. Watch out for competencies in the learners group.
- ❖ Note down what you have observe and members suggest improvement to each presentation.
- ❖ Guide the learners in the discuss of the presentation to harmonise.

Possible answer to activity 10.3

- a) $x = 13$
 $y = 13.5$
- b) $x = 2$

c) $x = 2, y = 3$

d) $b = 2, a = 4$

Therefore $a = 4$, and $b = -2$

- It satisfies both equations.
- Now explain in detail to students what elimination method means.
- Guide them through example 10.4 step by step.
- Emphasise for when to add or subtract the two equations when eliminating a certain variable. ie we add when the sign on the coefficient of the variable to be eliminated is different. And subtract if their signs are the same.

Quick practice Question

Allow the individual learners to practice it in their books as you move around to mark.

Answers to quick practice

- a) $x = 3$ and $y = -2$
- b) $c = -2$, and $d = -5$
- At this point let the learners be exposed to equations where the coefficient of the corresponding variable to be eliminated are not equal.
 - Let the learners know that they should be first made equal before eliminating.
 - Clarify the point further as you take them through example 10.6

Quick practice 10.6

- Let individual learner practice and mark their books.

Possible answer

$x = 3, y = 1$

Example 10.7

Guide the learner through example 10.7

Response to quick practice 10

$$x = 1.4 \text{ kg} \quad y = 1.9 \text{ kg}$$

Answers to Exercise 10.3 (Pg 191 LB)

1. a) $x = 2, y = 1$

b) $p = 5$ and $q = 2$

c) $m = \frac{4}{11}, n = \frac{9}{11}$

d) $c = 3$ and $d = 5$

2. $b = 4$ and $a = 3$

the x larger number is 20 and the smaller number is 15

4. a) $x = 3, y = -2$

b) $c = \frac{-17}{3}, d = \frac{-38}{9}$

3.5. Cost of mango = 1,200/=

Cost of pineapple = 2,700/=

6. $\frac{15}{25} = \frac{3}{5}$

7. Mother 24 years

Father 28 years

8. $x = 3$ and $y = 2$

9. a) $x = 3; y = -4$

b) No roots

Teaching and learning material

Students: Text book, graph papers and Geometry set.

Teacher: Graph chalk board and coloured chalk.

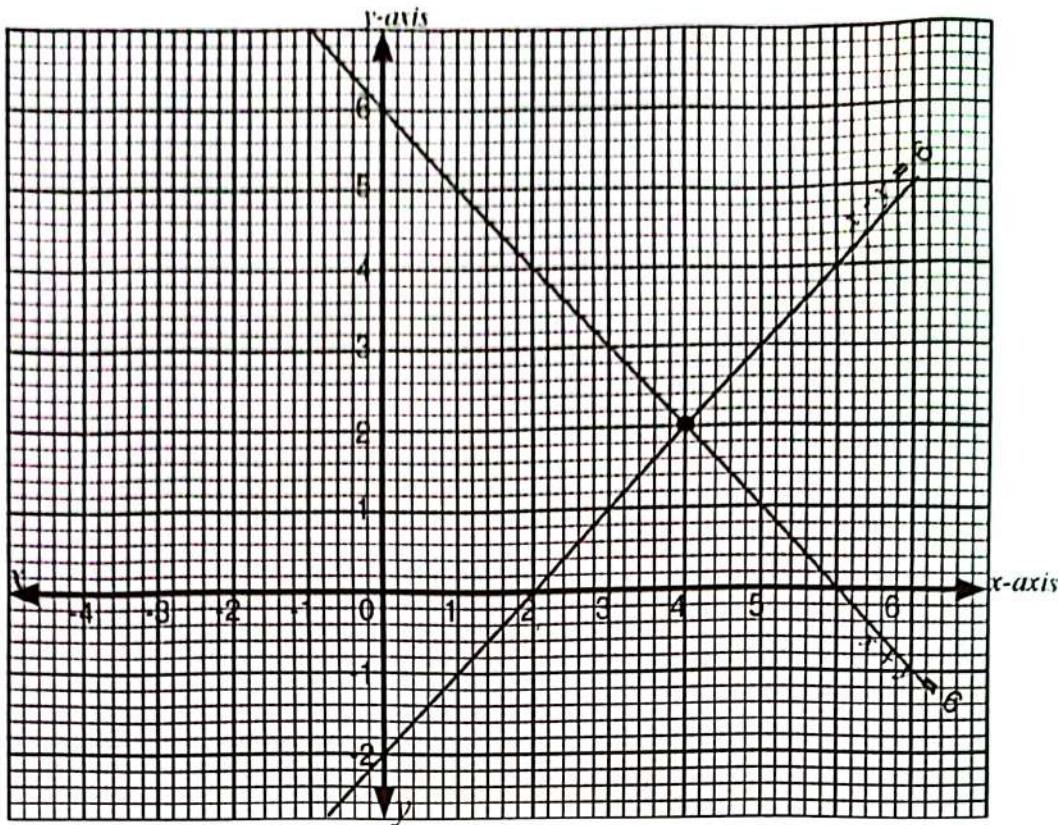
Activity 10.4

- ❖ Organise the students in their respective learning centre.
- ❖ Let them attempt the activity in their respective groups.
- ❖ Observe the learners as they go through this activity. Look out for individual learner participation, cooperation with others, and how he /she communicates with members of group. Try to find out what skills they are using.
- ❖ In groups, the learners present their answers to the whole class.
- ❖ You can now wrap up their answers.

Possible response to activity 10.4

10.3: Graphical Solution of Simultaneous Equation (Pg 192 LB)

- Ensure first that the learners already know how to draw graph of straight line.
- Review with them some few examples for them to build confidence.



- c) Coordinates is (4, 2)
 - d) the values represent the solution to the equation.
 - h) The equation in (g) above has no solution meaning they have no point of intersect or they do not intersect. Hence they must be parallel lines.
- ❖ Guide the learners through example 10.7 and 10.8 in the learners book.
 ❖ Let individual learners answer the quick practice in their books as you move around to mark. Guide the learners through the correct answers.

Answers to Exercise 10.4 (Pg 194 LB)

1. a) (-2, 2) b) (0, 2) c) (-1, -3)

2. a) $x + y = 6$

$$x - y = 2$$

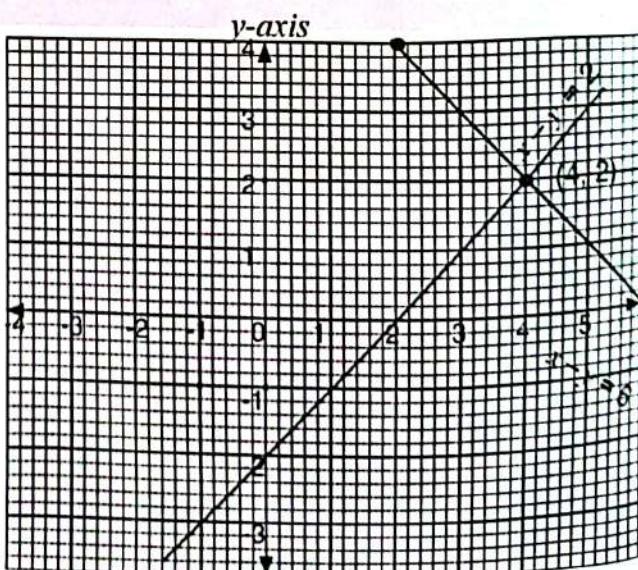
$$x + y = 6$$

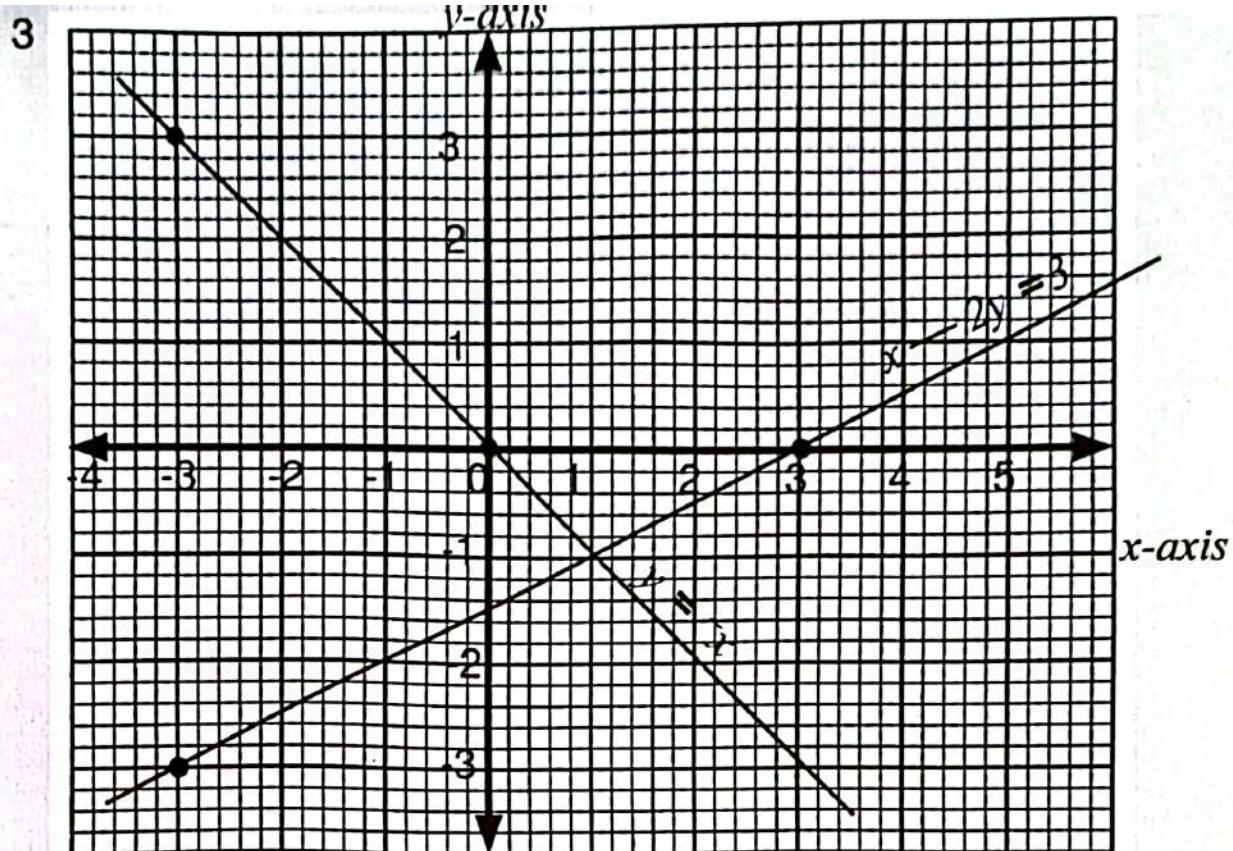
x	2	4	3
y	4	2	3

$$x - y = 2$$

x	0	2	3
y	-2	0	1

Solution is (4, 2)





No roots

The solution is $(1, -1)$

c) $x - 6 = y$

$$2x - y = 8$$

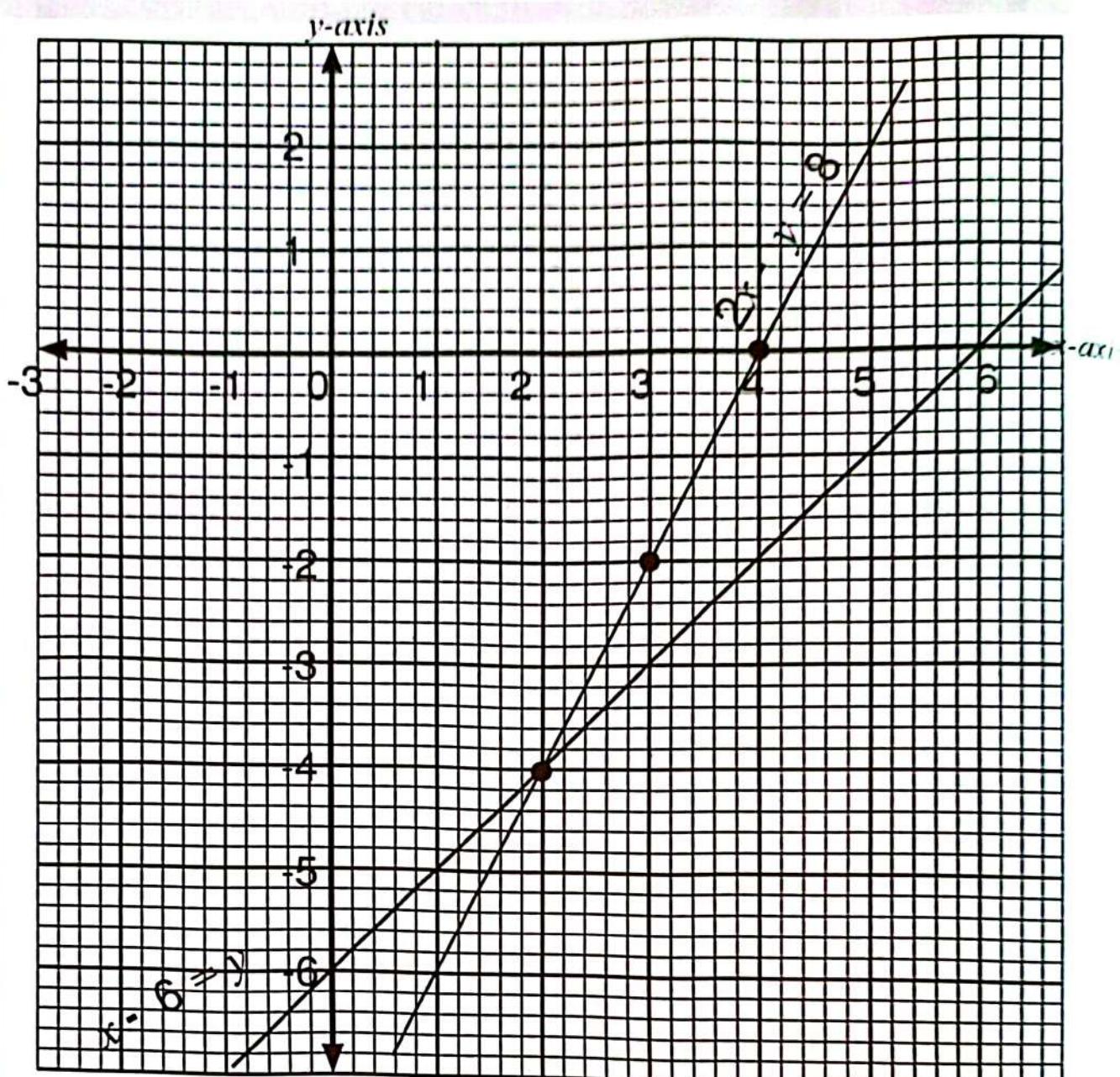
For $x - 6 = y$

x	2	5	4
y	-4	-1	-2

For $2x - y = 8$

x	2	3	4
y	-4	-2	0

Solution $(2, -4)$



d) $y = 3x + 2$

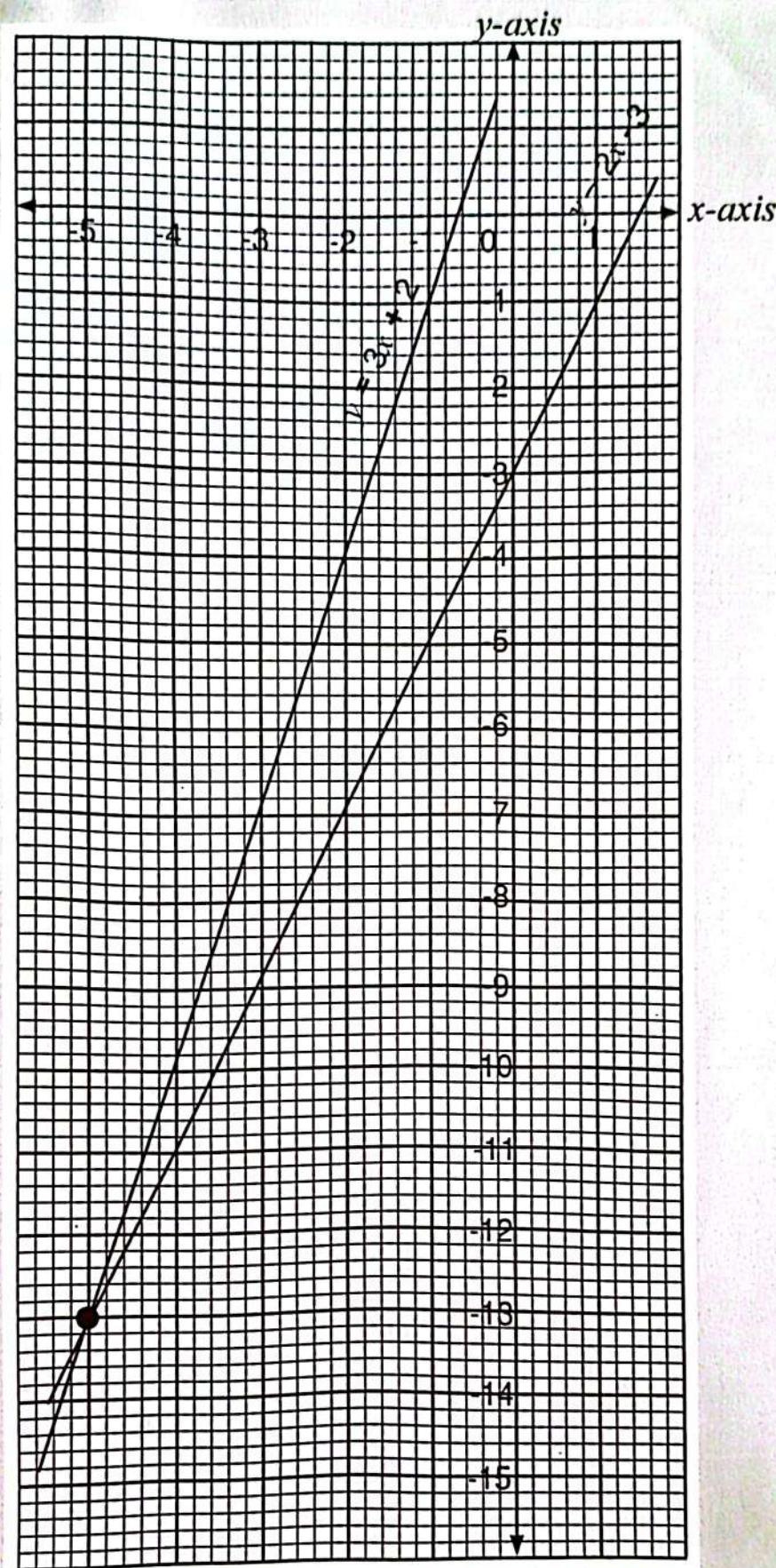
$$y = 2x - 3$$

For $y = 3x + 2$

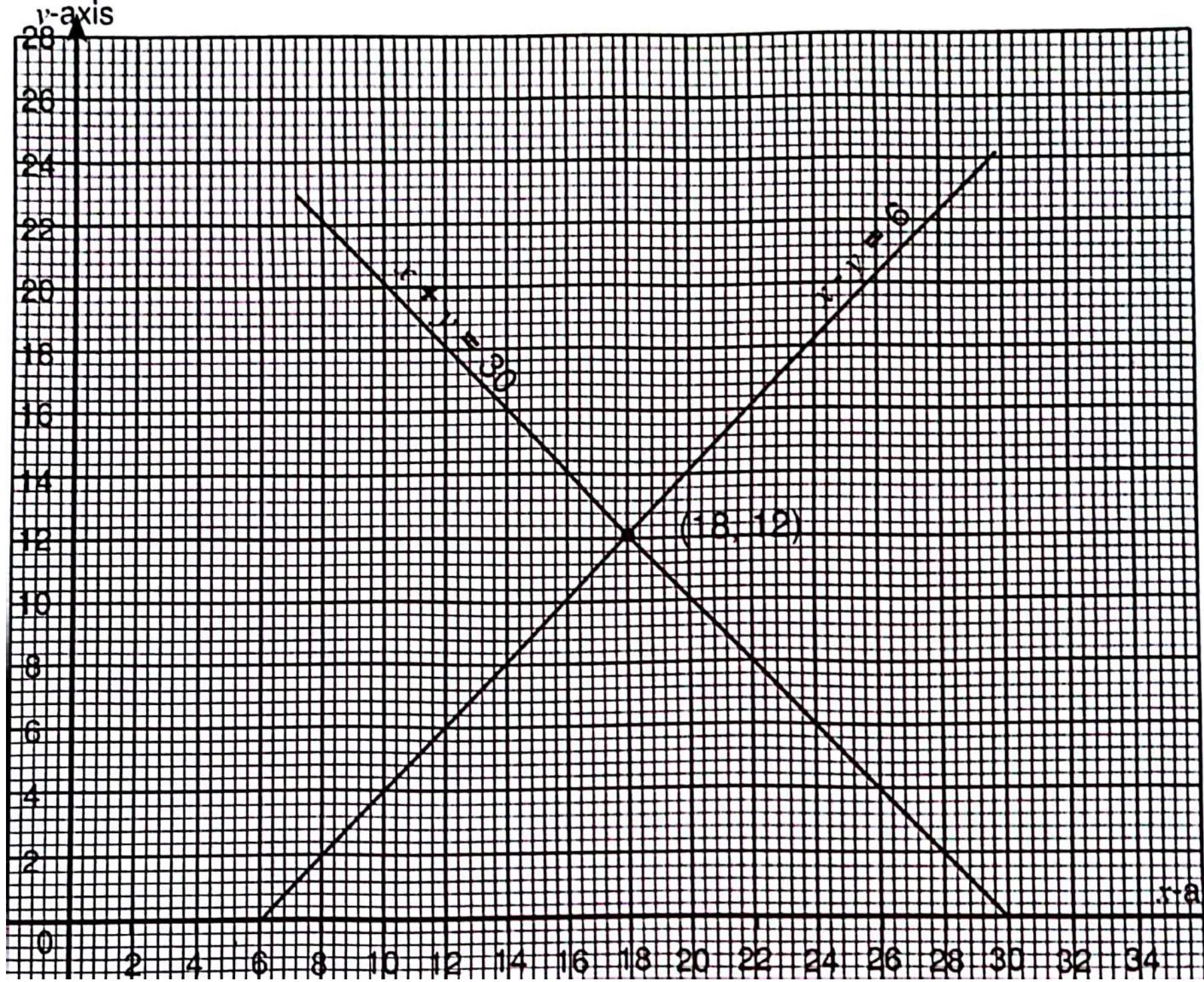
x	0	-1	-2
y	2	-1	-4

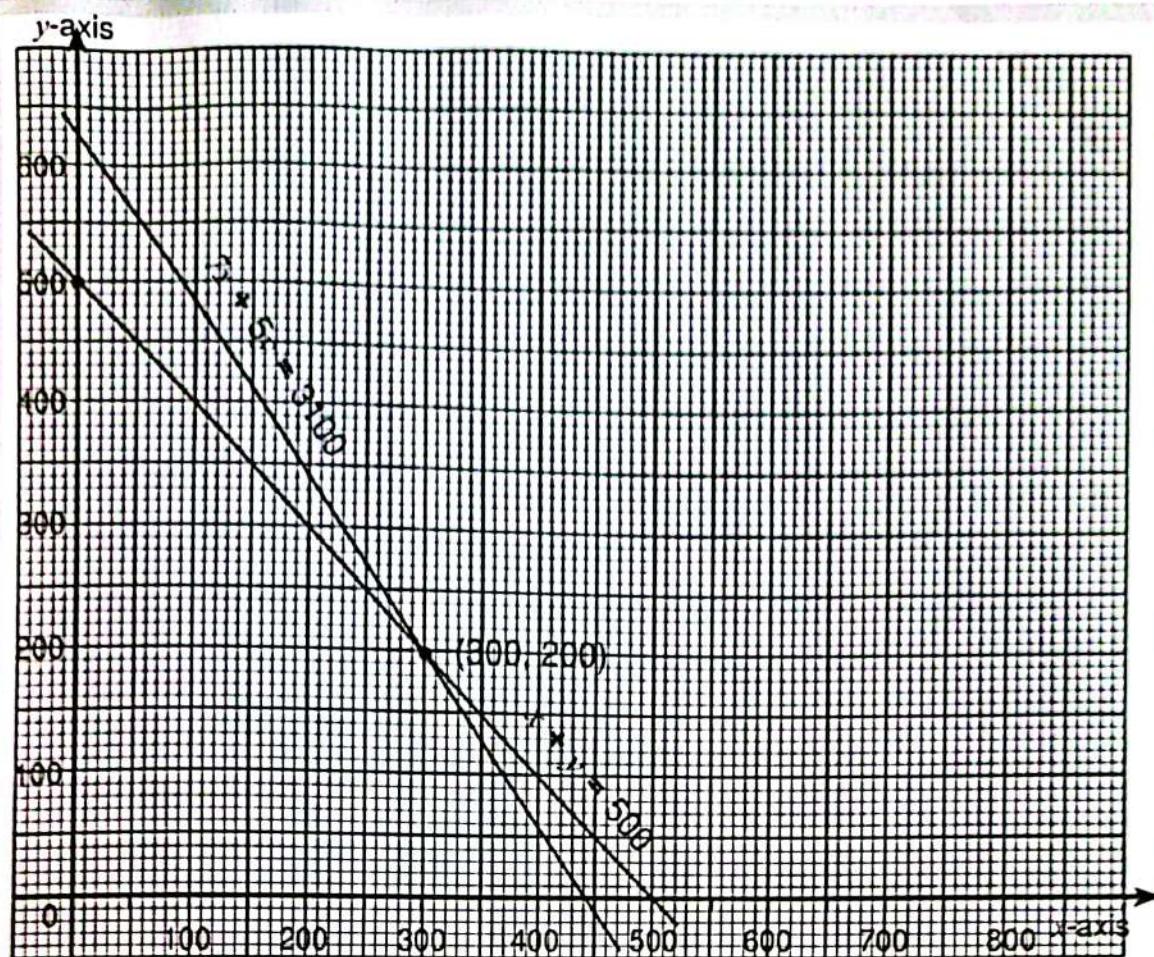
For $y = 2x - 3$

x	0	-2	-3
y	-3	-7	-9

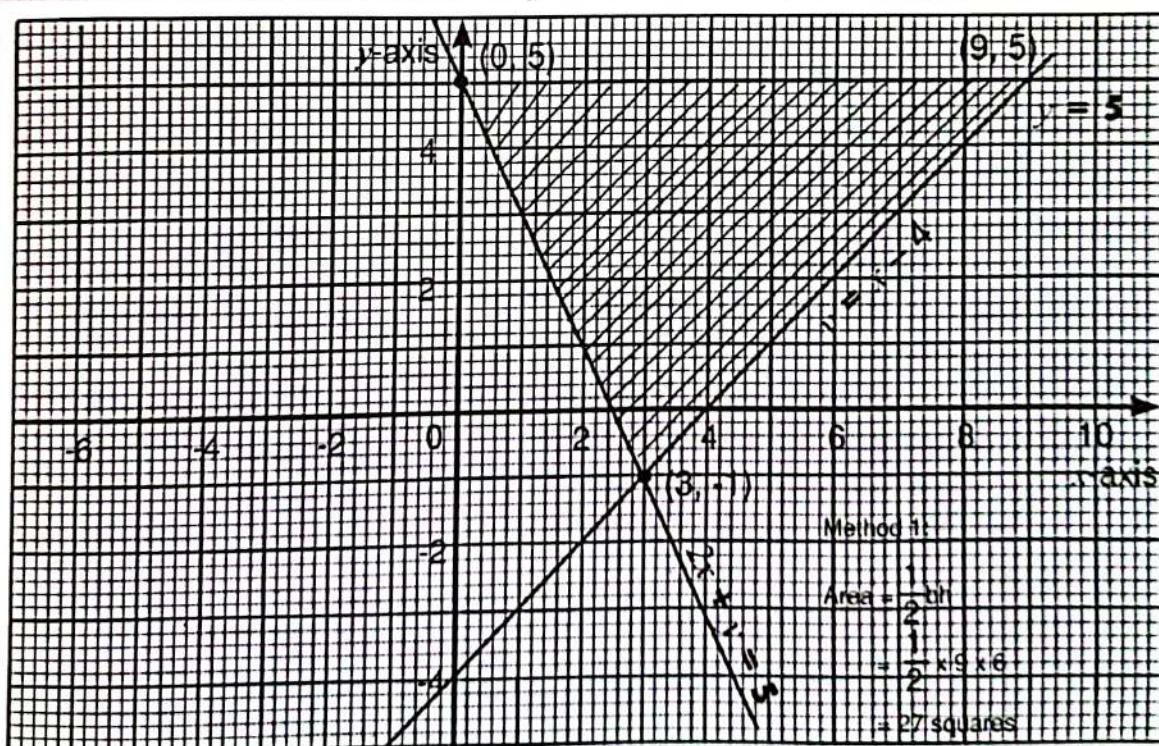


Solution is $(-5, -13)$





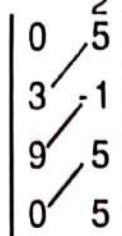
$$x = 300 \text{ and } y = 200$$



Method ii: Coordinates y - intersection are;

(0, 5), (3, -1) and (9, 5)

$$\text{Area} = \frac{1}{2}(\text{Big diagonal} - \text{small diagonal})$$



small diagonal

$$3 \times 5 + 9 \times -1 + 0 \times 5$$

$$15 - 9 + 0$$

$$6$$

big diagonal

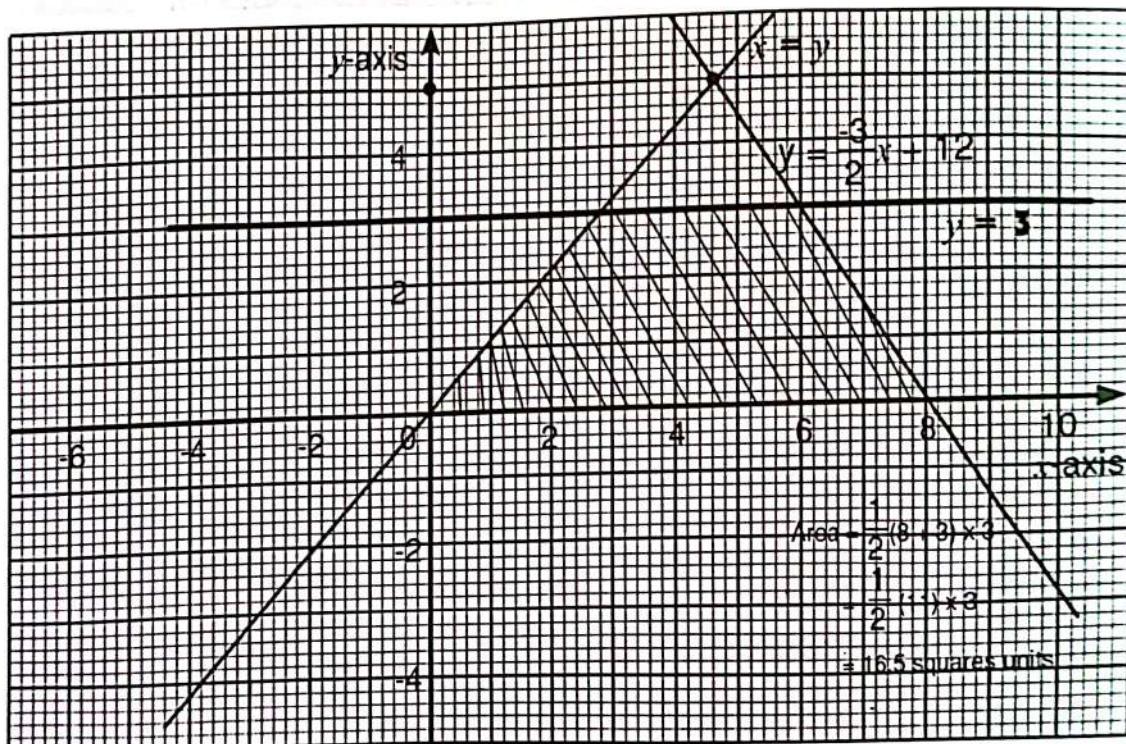
$$0 \times -1 + 3 \times 5 + 9 \times 5$$

$$0 + 15 + 45$$

$$60$$

$$\text{Area} = \frac{1}{2}(60 - 6) = 27 \text{ square units.}$$

6. $y = 0, y = 3, x = y$ and $y = \frac{-3}{2}x + 12$



10.4: Solving Simultaneous Equations Using matrices (Pg 195 LB)

- Review with the learners how to get the inverse of a 2×2 matrix taught in topic
- Let the learner try to multiply several compatible matrices especially a matrix with its inverse.
- Randomly choose one student from the class to work out the inverse of any 2×2 matrix you have written on the chalk board. After which you call another student to use the result of the previous student and multiply it with the original matrix you gave

- Let the class discover the answer he / she gets and mention the type of matrix.

Activity 10.5

- Organise the class into small groups and each group attempts the activity.
- Observe them as they do the activity. Look out for the competencies given in the learners books.
Note down what you have observed from each individual in the respective groups and assist where necessary. Especially in re-arranging the equations above.
- Let each group present their findings as you guide them to the correct approach.
- Make a wrap up of the steps.

Possible answer to activity 10.5

$$2x = 13 + 7y$$

$$x = 3y + 6$$

a) $2x - 7y = 13$

$$x - 3y = 6$$

$$\begin{pmatrix} 2 & -7 \\ 1 & -3 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 13 \\ 6 \end{pmatrix}$$

b) $\begin{pmatrix} -3 & 7 \\ -1 & 2 \end{pmatrix}$

e) put $x = 3$ and $y = -1$

$$2x = 13 + 7y$$

$$2(3) = 13 + 7(-1)$$

$$6 = 13 - 7$$

$$6 = 6 \text{ true}$$

In eqtn 2:

$$x = 3y + 6$$

$$3 = 3(-1) + 6$$

$$3 = 3 \text{ true}$$

- Now explain to the learners what matrix method is all about.

- Guide the learners through example 10.9

Quick Practice

- Let each learner practice in their books and move around to mark.
- Give attention to the area of difficult of re-arranging the equation first.

Possible answer to Quick Practice 10.7

$$x = -1 \text{ and } y = 2$$

Answers to Exercise 10.5 Page 196

1. a) $x + y = 5$

$$3x - 4y = 8$$

$$\begin{pmatrix} 3 & 1 \\ 3 & -4 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 5 \\ 8 \end{pmatrix}$$

b) $5x - 3y = 9$

$$-4x + 2y = 10$$

$$\begin{pmatrix} 5 & 1 \\ -4 & 2 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 9 \\ 10 \end{pmatrix}$$

c) $x = 4 - 8y$

$$4x - 5y = -11$$

$$x + 8y = 4$$

$$4x - 5y = -11$$

$$\begin{pmatrix} 1 & 8 \\ 4 & -5 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 4 \\ -11 \end{pmatrix}$$

d) $a = 2 + 2b$

$$3b - 4 = 5a$$

$$a - 2b = 2$$



$$-5a + 3b = +4$$

$$\begin{pmatrix} 1 & -2 \\ -5 & 3 \end{pmatrix} \begin{pmatrix} a \\ b \end{pmatrix} = \begin{pmatrix} 2 \\ +4 \end{pmatrix}$$

2. $\begin{pmatrix} \frac{+2}{29} + \frac{+3}{29} \\ \frac{+5}{29} + \frac{-7}{29} \end{pmatrix} = A^{-1}$

$$x = 3 \text{ and } y = 2$$

3. a) $x = 3$ and $y = -7$

b) $x = 1$ and $y = -7$

c) $a = -2$ and $b = -2$

d) $p = \frac{1}{2}$ and $q = 2$

4. 14 adults and 16 Children

5. $b = 3$ and $m = 2$

6. a) $x = 3$ and $y = 4$

b) $x = 4$ and $y = 1$

c) $x = 3$ and $y = 4$

d) $x = 2$ and $y = 3$

7. Therefore the rowing speed is 6 km/hr the current speed is 2 km/hr

Sample Assessment Grid of Activity of Integration 10

Output	Basis of evaluation	Relevancy /3	Accuracy /3	Coherence /3	Excellence /1
A report	Finding the number of T-shirts for each type	<p>Score 3: - Identifies the variables and assigns letters to them forming a simultaneous equation and solving the simultaneous equations .</p> <p>Score2: Forms simultaneous equation without defining them and solves them</p> <p>Score1: Identifying the variables correctly but forms atleast one simultaneous equation.</p>	<p>Score3: Accurately Identifies the variables and assigns letters to them forming a simultaneous equation and solving the simultaneous equations .</p> <p>Score2: Accurately forms simultaneous equation without defining them and solves them.</p> <p>Score1: Accurately identifies the variables correctly but forms atleast one simultaneous equation..</p>	<p>Score3: Logically Identifies the variables and assigns letters to them forming a simultaneous equation and solving the simultaneous equations.</p> <p>Score2: Logically forms simultaneous equation without defining them and solves them.</p> <p>Score1: Logically identifies the variables correctly but forms atleast one simultaneous equation</p>	A learner earns 1 point if he/she has added any exceptional feature unsolicited in the instructions.
					MAX = 10

Expected solution to sample activity of integration 10

Let x be number of short sleeved T-shirts and

y be the number of long sleeved T-shirts.

Form two simultaneous equations and solve them.

$$28000x + 35000y = 13,650,000 \dots \dots \dots \text{(i)}$$

$$38500x + 56000y = 20,737,500 \dots \dots \dots \text{(ii)}$$

The above equations are simplified as below;

$$4x + 5y = 1950 \dots \dots \dots \text{(i)}$$

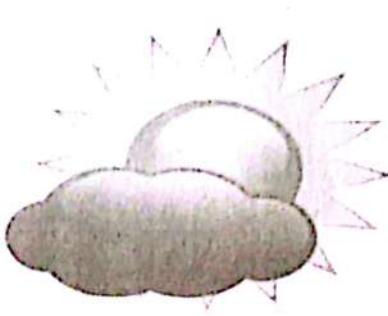
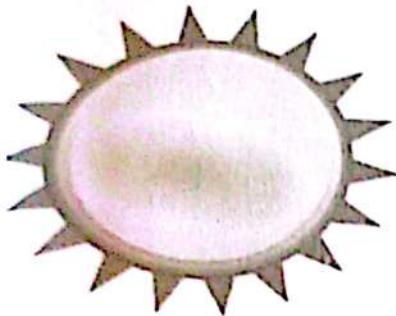
$$11x + 16y = 5925 \dots \dots \dots \text{(ii)}$$

$x = 175$ and $y = 250$ In-order for the intended target to be achieved 175 short sleeved T-shirts and 250 long sleeved T-shirts should be produced and sold.

Topic

11

Probability



Chance of Rain

5%

Chance of Rain

30%

Chance of Rain

80%

Competency: The learner applies their understanding of probability to solve a wide range of problems.

- ❖ Ensure that the contents of this topic are covered within the allocated 15 periods.
- ❖ Emphasize the use of the key words in the leaner's book. Use them continuously for learners to understand their meanings as used in this topic, guide the learner to;

In this topic, guide learners to:

- a) understand the terms random, experiment, outcome, sample space, event and probability.
- b) construct the probability space.
- c) determine probabilities from experiments and real-life data.
- d) differentiate between theoretical and experimental probabilities.
- e) identify and understand mutually exclusive and independent events.
- f) use probability trees to determine the probabilities of mutually exclusive and independent events.
- g) use Venn diagrams to determine probabilities. .

Introduction

Ask learners to focus on the introduction in their guides. You can also use more probing situations which involve probability. For instance, ask learners to state which side of the dice will show on top.

Build from what they know to bring out the idea of probability.

11.1: Experimental Probability 3 periods (Learner's book page 200)

In this section, much emphasis will be put on the use of key words..

Activity 11.1

Instructional procedures.

- ❖ Organise learners into groups to do activity 11.1
- ❖ Circulate around classroom observing competences such as cooperation and leadership skills.
- ❖ Note these down against the individual learners' name.

Possible answers to activity 11.1

The activity to be done practically by the learner and answers will vary.

- ❖ Call for the whole class group discussion and let group leaders represent their findings.
- ❖ Correct any misconception.
- ❖ Conclude the discussion and help the learner to the individual level.

11.2: Impossibilities and Certainties 2 periods (learner's book page 201)

You have always used the word 'impossible' such as being told that the clouds are green or being certain that the sky is blue in colour.

Activity 11.2

Instructional procedures

- ❖ Arrange the learners in pairs.
- ❖ Let learners attempt the activity in pairs.
- ❖ Observe them as they do the activity. Watching out for competences like honesty and communication skills.
- ❖ Record these against the individual learner's name.
- ❖ Discuss with learners the possible answers of the activity as follows
- ❖ Organise learners back into a whole class to discuss their findings.
- ❖ Guide learners in discussing relations in the activity done.
- ❖ Conclude the discussion and give time
- ❖ Exercise 11.1 to practice the skill

Possible answers to Activity 11.2

- a) 1 b) 0
- (i) Mango = $\frac{5}{7}$ (ii) orange = $\frac{2}{7}$
- (iii) Banana = 0
- (iv) A mango or an orange = 1
- d) (i) 0 (ii) = $\frac{10}{12}$
- e) 0 to 1

Answers to Q.P. 1

- a) $\frac{10}{20}$ or $\frac{1}{2}$ b) $\frac{10}{20}$ or $\frac{1}{2}$
 c) $\frac{7}{20}$ d) 0 e) 1

Answers to Exercise 11.1 (Pg 203 LB)

1. $\frac{43}{45}$ 2. 1 3. Practical
 4. a) 0 b) $\frac{3}{5}$ c) $\frac{2}{5}$
 d) $\frac{3}{10}$ e) 0 f) $\frac{7}{10}$ g) 1
 5. open
 6. 1
 7. Practical
 8. Practical

**11.3: Theoretical Probability
2 periods (Pg 204 LB)****Activity 11.3**

Finding the theoretical probability

Instructional procedures.

- ❖ Organise the learners into groups to do the activity 11.3.
- ❖ Observe them as they do the activity watching out for the competencies like leadership skills and respect.
- ❖ Record against the individual learner's name.

Possible answers for activity 11.3

- a) H, T b) (i) $\frac{1}{2}$ (ii) $\frac{1}{2}$ b) (i) $\frac{5}{16}$
 (ii) $\frac{11}{16}$ (iii) 0

Quick Practice 2 Answers

- a) $\frac{3}{5}$ b) $\frac{4}{15}$ (c) $\frac{3}{5}$

To be done by the learners practically .

Call for the whole class groups discussion and allow each group to present their finding.

Guide them and discussion and give them the exercise 11.2 for practice.

Answers to Exercise 11.2

(Pg 205 LB)

1. $\frac{22}{47}$
 2. (i) $\frac{5}{9}$ (ii) $\frac{5}{9}$
 3. a) $\frac{1}{6}$ b) $\frac{1}{6}$
 c) 0 d) $\frac{3}{6}$ or $\frac{1}{2}$
 e) 1 f) 0 g) $\frac{1}{2}$
 h) $\frac{1}{3}$ i) $\frac{4}{6}$ j) $\frac{5}{6}$
 k) $\frac{1}{3}$
 4. a) $\frac{1}{5}$ b) $\frac{2}{5}$ c) $\frac{2}{5}$ d)
 0 e) $\frac{3}{5}$
 5. a) 368, 386, 638, 683, 836, 863
 b) $\frac{1}{3}$ c) $\frac{1}{3}$ d) $\frac{2}{3}$ e) 1

**11.4: Mutually Exclusive and Independent Events
2 periods (Learner's book page 206)****Activity 11.4****Instructional procedures.**

- ❖ Organise the learners into groups to do the activity 1.4

- ❖ Move around the classroom observing the competences such as communication skills.
- ❖ Record against individual learners' name.
- ❖ Call for the whole class group discussion and guide them to present their findings.
- ❖ Correct any misconception.
- ❖ Conclude the discussion and give them exercise 11.3 to practices

Possible answers for Activity 11.4

a) Practical

b)

		Sh 500 coin	
UGX 200 coin	H	H	T
	H	HH	HT
	T	TH	TT

c) (i) space is HH, HT, TH, TT

$$\text{(ii) probability} = \frac{2}{4} \\ = \frac{1}{2}$$

d)

		Die					
Coin	H	1H	2H	3H	4H	5H	6H
		T	1T	3T	3T	4T	5T

e) space is 1H, 2H, 3H, 4H, 5H, 6H, 1T, 2T, 3T, 4T, 5T, 6T

f) $\{1H, 3H, 5H\}$

$$\frac{3}{12} = \frac{1}{4}$$

Answers to Exercise 11.3 (Pg 209 LB)

1. (a). Mutually exclusive.

- (b). Not mutually exclusive.
- (c). Not mutually exclusive.
- (d). Not mutually exclusive.

2. $\frac{8}{125}$ 3. $\frac{1}{2}$ 4. a) $\frac{27}{125}$
b) $\frac{8}{125}$ 5. a) $\frac{1}{4}$ b) $\frac{3}{4}$ c) $\frac{1}{4}$

6. a)

		1st bag				
2nd bag	R	R	Y	B	B	
	R	(R,R)	(R,I,R)	(R,I,Y)	(R,I,B)	(R,I,B)
	Y	(Y,I,R)	(Y,I,R)	(Y,I,Y)	(Y,I,B)	(Y,I,B)
	Y	(Y,I,R)	(Y,I,R)	(Y,I,Y)	(Y,I,B)	(Y,I,B)
B		(B,R)	(B,I,R)	(B,I,Y)	(B,I,B)	(B,I,B)

b) (i) $\frac{2}{20}$ (ii) $\frac{2}{20}$ (iii) $\frac{5}{20}$
(iv) $\frac{1}{20}$

7. a) $\frac{1}{1000}$, b) $\frac{9}{1000}$ c) $\frac{32}{125}$

11.5: Tree Diagrams (3 periods) (learner's book page 210)

Activity 11.5

Instructional procedures

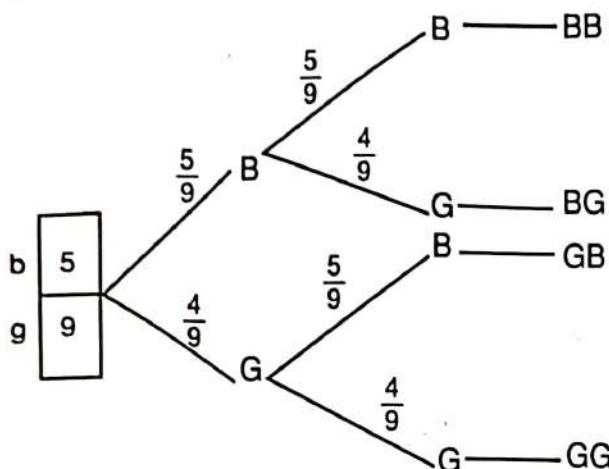
- ❖ Arrange learners in groups to do activities.
- ❖ Circulate around the classroom as they do activity and watch out for competences such as respect leadership and communication skills.
- ❖ Record on individual learners name.

- ❖ Have the whole class group discussion and allow group leaders to present their findings.
- ❖ Guide them and correct them where necessary.

- ❖ Conclude the discussion and give out exercise 11.4 for practice.

Possible answers to Activity 11.5

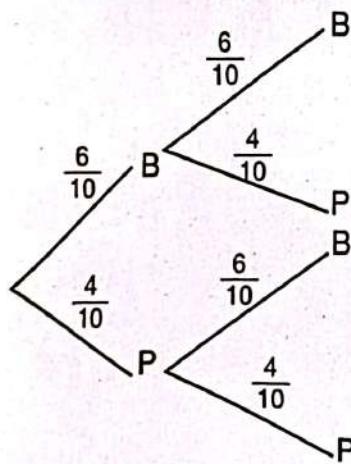
- a) (i) $\frac{5}{9}$ (ii) $\frac{4}{9}$
 b)



- c) (i) $\frac{16}{81}$ (ii) $\frac{40}{81}$

Answers to Exercise 11.4 (Pg 212 LB)

1. a)



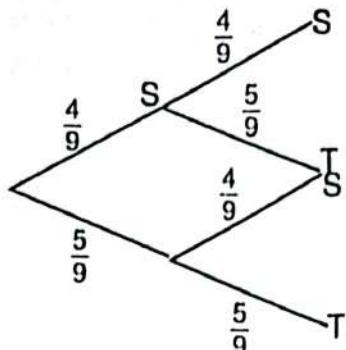
- b) (i) $\frac{16}{100}$ or $\frac{4}{25}$ (ii) $\frac{52}{100}$ or $\frac{13}{25}$

2. a) $\frac{4}{9}$ b) 0

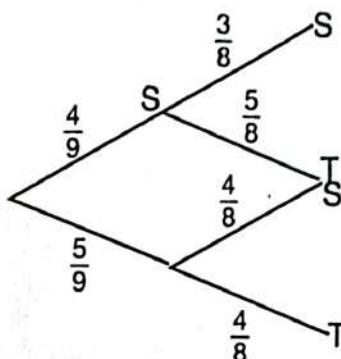
3. a) $\frac{1}{6}$ b) $\frac{5}{18}$

5. a) $\frac{15}{91}$ b) $\frac{15}{91}$ c) $\frac{25}{91}$

6. a) (i) with replacement



(ii) without replacement



- b) (i) $\frac{16}{81}$ or $\frac{12}{72}$ (ii) $\frac{40}{81}$ or $\frac{40}{72}$

11.6: Probability and Sets (2 periods learners book page 213)

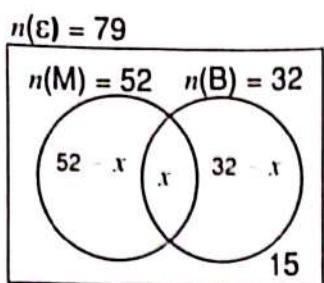
Activity 11.6

Instructional procedures.

- ❖ Arrange learners into groups to do activity 11.6
- ❖ Move around the classroom observing competences such as communication skills and leadership skills.
- ❖ Record on the individual learner's name.

Possible answers for activity 11.6

Let B = bread ; M = milk

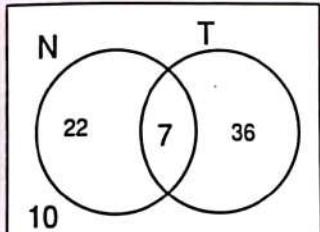


- (i) 20 (ii) 12 (iii) 64

- ❖ Call for the whole class group discussion and let each group present their findings.
- ❖ Guide and correct learners where necessary.
- ❖ Conclude the discussion and help the learner to the individual basis.

Answers to Exercise 11.5 (Pg 215 LB)

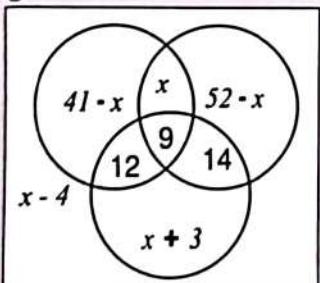
2. a) \mathcal{E}



- b) (i) 22 (ii) 65 (iii) 10

3. a) 10 b) 31 c) 15

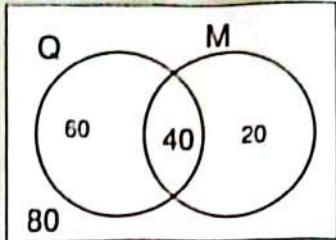
4. a) \mathcal{E}



- b) (i) 18 (ii) 41

c) (i) $\frac{89}{142}$ (ii) $\frac{105}{142}$

5. a) \mathcal{E}



- b) (i) 120 (ii) 80 (iii) 80

Assessment grid for Activity of integration 11

Output	Basis of evaluation	Relevancy	Accuracy	Coherence	Excellence
Extent of wearing seatbelts.	❖ Work out probabilities to determine the level of the use of seat belts	<p>Score 3: Identifies all 5 relevant parts; drawing a probability tree, finding probability that both adult and student wear seatbelt, finding probability that an adult does not but a student wears seatbelt, adds the two found probabilities to find required probability, states line of action basing on the results.</p>	<p>Score 3: Accurately applies all 5 relevant parts; draws a probability tree, finds probability that both adult and student wear seatbelt, finds probability that an adult does not but a student wears seatbelt, adds the two found probabilities to find required probability, states line of action basing on the results.</p>	<p>Score 3: Logical flow in the use of all relevant parts.</p>	<p>Learner earns 1 point if he/she has added any exceptional feature unsolicited in the instructions.</p>
			<p>Score 2: Identifies 3-4 relevant parts from; drawing a probability tree, finding probability that both adult and student wear seatbelt, finding probability that an adult does not but a student wears seatbelt, adds the two found probabilities to find required probability, states line of action basing on the results.</p>	<p>Score 2: Logical flow with distortions in the use of the relevant parts.</p>	

	Score 1: Identifies 1-2 relevant parts from; drawing a probability tree, finding probability that both adult and student wear seatbelt, finding probability that an adult does not but a student wears seatbelt, adds the two found probabilities to find required probability, states line of action basing on the results.	Score 1: Accurately applies 1-2 relevant parts; draws a probability tree, finds probability that both adult and student wear seatbelt, finds probability that an adult does not but a student wears seatbelt, adds the two found probabilities to find required probability, states line of action basing on the results.	Score 1: Limited flow in the use of the relevant parts.
	Total = 10		

Solution to Assessment grid for Activity of integration 11

Let event A be adult wears seatbelt, event B be adult does not wear seatbelt and event C be student wears seatbelt.

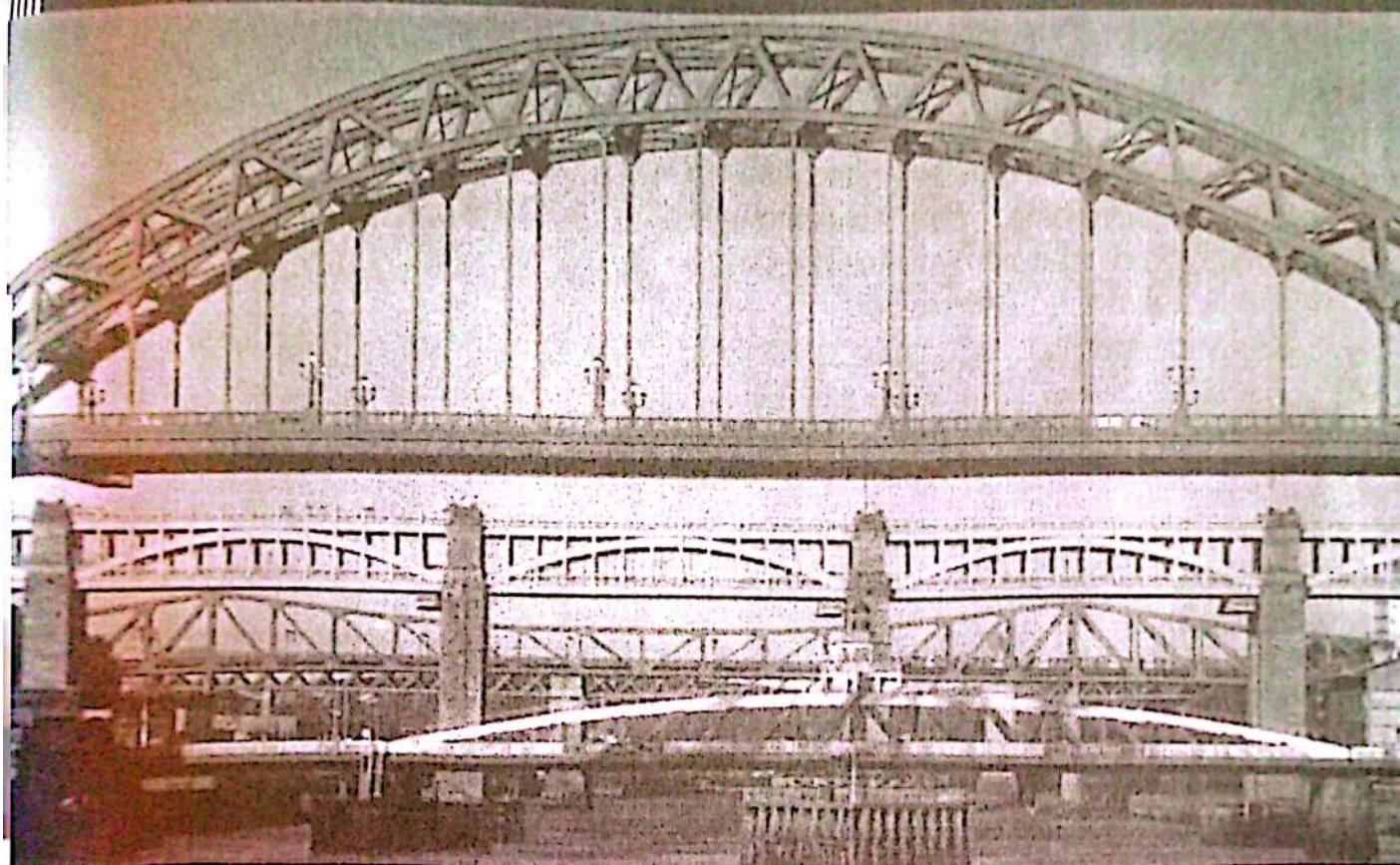
$$P(C) = P(A \text{ and } C) + P(B \text{ and } C) = 0.69 \times 0.65 + 0.31 \times 0.26 = 0.5291.$$

Since almost half the number of times students do not wear seatbelts, it is important to start a campaign to urge students to wear seatbelts irrespective of whether the adult is wearing or not

Topic

12

Quadratic Equations



Competency: The learner understands and solves quadratic equations and relates them to the graphs.

- ❖ Ensure that the contents of this topic are covered within the allocated 15 periods.
- ❖ Emphasize the use of key words in the Learner's book. Use them regularly for the learners to understand their meanings as used in this topic.

In this topic, guide the learners to:

- a) determine the roots of quadratic equations using factorization, completing the square and the formula.
- b) form a quadratic equation given its roots.
- c) make a table of values for a quadratic function and draw the graph.
- d) link the solutions of a quadratic equation with its graphical representation.
- e) solve simultaneous equations involving one quadratic equation and one linear equation.

Introduction

Check for learner's prior knowledge and skills for solving quadratic equation. Remind them about the quadratic equations covered in book 2 topic 6.

12.1: Solving Quadratic Equations by Factorisation (Pg 220 LB)

Some quadratic equations can be solved by factorising. First rearrange the equation so that all the terms are on one side and are equated to zero.

Use the property of zero where;

- If $ab = 0$ then either $a = 0$ or $b = 0$.
- If $(x - 2)(3x + 5) = 0$
- Then either $x - 2 = 0$ or $3x + 5 = 0$

Activity 12.1

- ❖ Have the learners move into groups. Ask them to perform activity 12.1
- ❖ In this activity the learners will be solving quadratic equations by factorization.
- ❖ Observe the learners as they are engaged taking note of competencies like team work and tolerance.

Possible answers to activity 12.1

- $q = 0, p = 0$
 - $x = 0, x = -4$
 - $a = -7$ or $a = 8$
 - $x = \frac{1}{2}$ or $x = \frac{5}{4}$
 - The product is zero only if atleast one of the factors is zero.
- ❖ Let the learners come forth and discuss their group results explaining all the way.

- ❖ Have them study example 12.1

Answers to Quick practice

- '5, '4
- 0, '5
- $\frac{3}{2}, \frac{5}{6}$

Quick Practice 2

- $\frac{9}{5}, 2$
- $\frac{6}{7}, 1$

Activity 12.2

- ❖ Walk around the classroom noticing their behaviour. Do you notice communication among them?

Possible answers to activity 12.2

- $2a(a + 3); a = 0$ or $a = -3$
 - $(k - 3)(k - 6); k = 3$ or $k = 6$
 - $(2y + 1)(3Y - 5); y = \frac{-1}{2}$ or $y = \frac{5}{3}$
- ❖ Challenge the learners to come forward and present their finding to the whole class.
 - ❖ Harmonise the discussion with them
 - ❖ Aid them to study examples 12.1 and 12.3 explaining the challenging sections.
 - ❖ Give them an opportunity to test their skills by giving them an assignment from exercise 12.1

Answers to exercise 12.1 learner's book page 222.

- (a) {3, 4} (b) {-10} (c) {0, 3}
(d) $0, \frac{-5}{2}$ (e) {3, -5} (f) {2}
- 6, 13
- 7 cm, 24 cm
(a) $y = 3$ (b) $y = 3$
- Length = 60m, width = 40m
- (a) $k = 3$, $k = \frac{-5}{3}$ (b) $\frac{-5}{3}$

4. (c) $\frac{-1}{3}, \frac{-3}{2}$ (f) $x = 2$ (g) $a = 3$

7. Width = 3 m

8. Son = 11 years, Mugume is 44 years.

9. 10 cm

12.2: Solving Quadratic Equations by Completing the Square. - 3 periods (Pg 223 LB)

Quadratic equations which cannot be factorized easily can be solved by completing the square.

To write a quadratic expression in completed square form, you write:-

$$x^2 + bx + c \text{ in the form } (x + p)^2 + q$$

$$\text{For example; } x^2 - 6x + 2 = (x - 3)^2 - 7$$

In the topic 6 of book 2, you learnt about perfect squares. That knowledge will be quite useful in this section.

Activity 12.3

Instructional procedures:

- ❖ Let the learners move to groups you have arranged. Ask them to perform activity 12.3.
- ❖ In this activity, the learners will complete the square.
- ❖ Observe the learners in their groups. Listen to their comments about the work. Do you notice communication and problem solving skills?

Possible answers to activity 12.3

(d). (i). $(x + 3)(x + 3)$

(ii). $x^2 + 3x + 3x + 3^2$

1	$(x + 1)^2$
4	$(x + 2)^2$
9	$(x + 3)^2$

f. (i). $\frac{b}{2} = d$ (ii). $c = d^2$

- ❖ Call for a whole class discussion. This concept is challenging to many. So guide them cautiously.
- ❖ Lead the discussion of examples 12.4 and 12.5
- ❖ Ask the learners to work out problems from exercise 12.2

Answers to Exercise 12.2 (Pg 225 LB)

1. (a) $\frac{81}{4}$ (b) 64 (c) 25
(d) $\frac{1}{16}$ (e) $\frac{1}{36}$ (f) $\frac{49}{324}$
2. (a) 9, 3 (b) 16, 4 (c) $\frac{1}{4}, \frac{1}{2}$
(d) $\frac{1}{9}, \frac{1}{3}$ (e) $\frac{9}{4}, \frac{3}{2}$ (f) 1.21, 1.1
3. (a) 3.66 (b) 4.55 (c) 7.3
(d) 2.32
4. (a) 1, -7
(b) 12.08, -0.08
(c) 4.12, -0.12
(d) 0.30, -3.30
(e) 0.81, -0.31
(f) 0.52, -4.52
5. (a) 1.72, -0.12
(b) 2.50, -0.33
(c) 1.40, -1.70
(d) 1.90, -1.90
(e) 0.81, -0.31

12.3: Solving Quadratic Equations using the Quadratic Formula (Pg 226 LB)

In section 12.2, you solved quadratic equations by completing the square for each equation separately. In this section, you will learn how to obtain and use a formula.

Activity 12.4

Instructional procedures:

- ❖ Let the learners move to groups you have arranged. Ask them to perform activity 12.4.
- ❖ In this activity, the learners will complete the square.
- ❖ Observe the learners in their groups. Listen to their comments about the work. Do you notice communication and problem solving skills?

Possible answers to Quick Practice

Solve $4x^2 + 3x = 2$ using the quadratic formula, correct to 2 decimal places.

12.4: Forming Quadratic Equations from its Roots (Pg 227 LB)

You have been finding solutions to quadratic equations. What if you can have the solutions, how do you determine the original quadratic equation?

Activity 12.5

Instructional procedures:

- ❖ Let the learners move to groups you have arranged. Ask them to perform activity 12.4.

- ❖ In this activity, the learners will complete the square.
- ❖ Observe the learners in their groups. Listen to their comments about the work. Do you notice communication and problem solving skills?

Possible answers Quick Practice

Write a quadratic equation with the given solution set:

a) $\{-7, 4\}$ b) $\left\{\frac{-2}{3}, \frac{4}{5}\right\}$

Answers to Exercise 12.3 (Pg 228 LB)

1. a) 2, 7 and 5
b) 1, -3 and 1
c) 5, 1 and 0
d) 3, -5, 0
e) -1, -8 and 5
f) 4, 1 and -10
g) -5, 6 and 0
h) 9, 0 and -8
2. a) 0.56 or -3.56
b) 2.87 or -0.87
c) 0.42 or -0.53
d) 2.11 or 0.095
e) 0.2 or 2
f) 0.44, 0.94
3. t = 5.46 m, w = 1.46 m
4. w = 0.7 and l = 18.6 inches or
w = 1.4 and l = 9.3 inches
5. a) $x^2 - x - 30 = 0$
b) $4x^2 - 45x + 104 = 0$
c) $40x^2 + 3x - 28 = 0$

- d) $20x^2 - 7x - 3 = 0$
 e) $x^2 - 20 = 0$
 f) $y^2 - 48 = 0$
6. a) _____ b) 1.16, -5.16
 c) 2.5, 1 d) 2.41, -0.41
 e) 0.406, -1.47
 f) -1.55, 3.6
7. 2 km/h
 8. 4 m
 9. h = 2.2 cm

12.5: Quadratic Functions and their Graphs (Pg 230 LB)

In this section, you will study quadratic functions and their graphs. By graphing functions that model the paths of the things we throw, you will be able to determine both the maximum height and the distance of these objects.

Activity 12.6

Instructional procedures:

- ❖ Let the learners move to groups you have arranged. Ask them to

perform activity 12.6.

- ❖ In this activity, the learners will complete the square.
- ❖ Observe the learners in their groups. Listen to their comments about the work. Do you notice communication and problem solving skills?

Draw the graph of $f(x) = x^2 - 2x - 4$ for $-2 \leq x \leq 4$. From your graph,

- a) Find the value of x for which $f(x) = 0$.
- b) What is the minimum value of the function?
- c) Find the values of x for which $f(x) = -2$.
- d) State the equation of the line of symmetry.

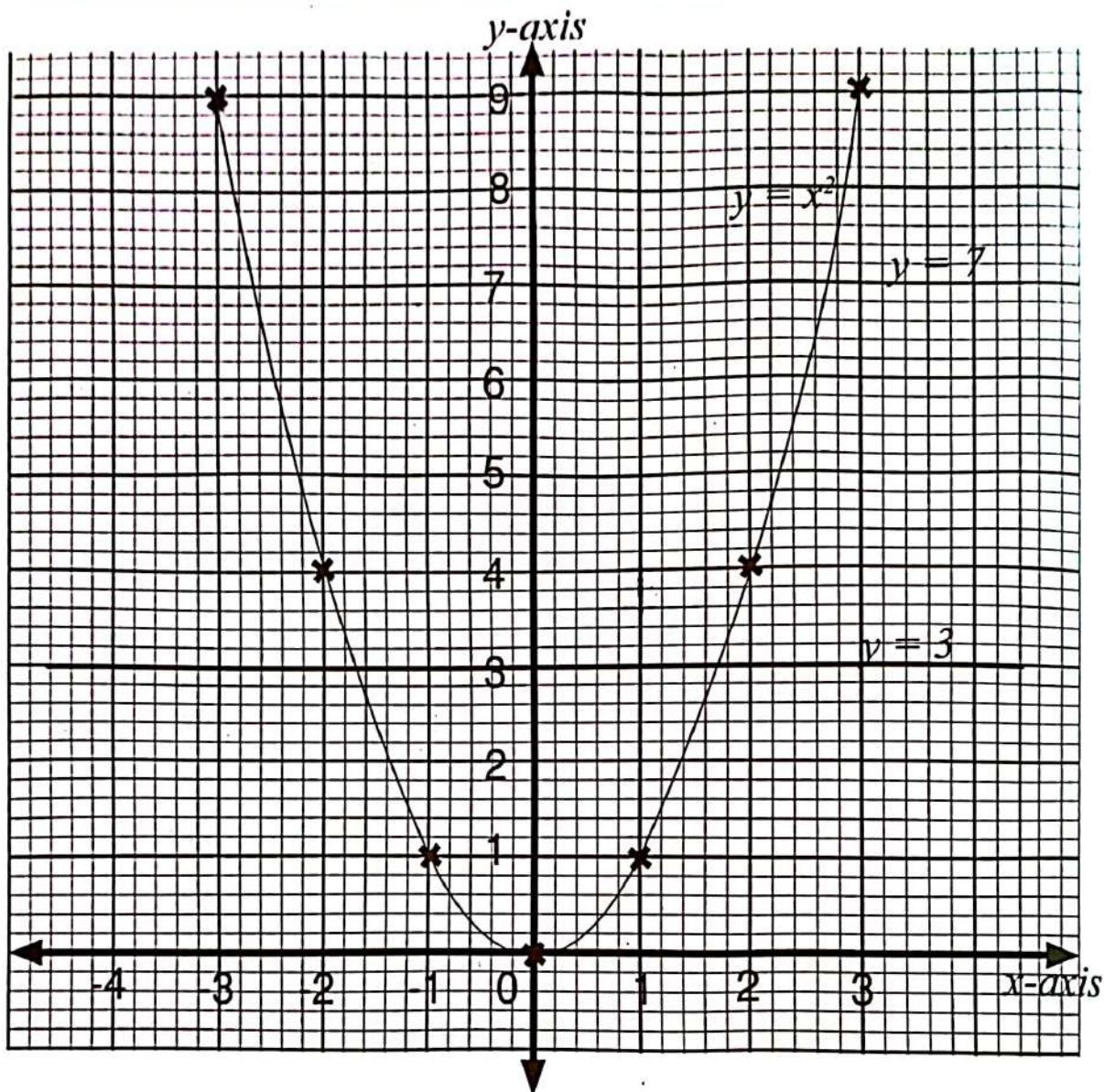
12.6: Simultaneous Equations: One Linear, One Quadratic (Pg 235 LB)

In topic 10, you learnt how to solve simultaneous equations. You are going to see how to solve simultaneous equations involving one quadratic equation and a linear equation.

Answers to Exercise 12.4 (Pg 236 LB)

1. a)

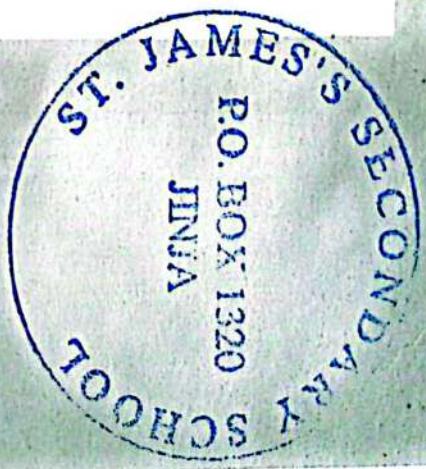
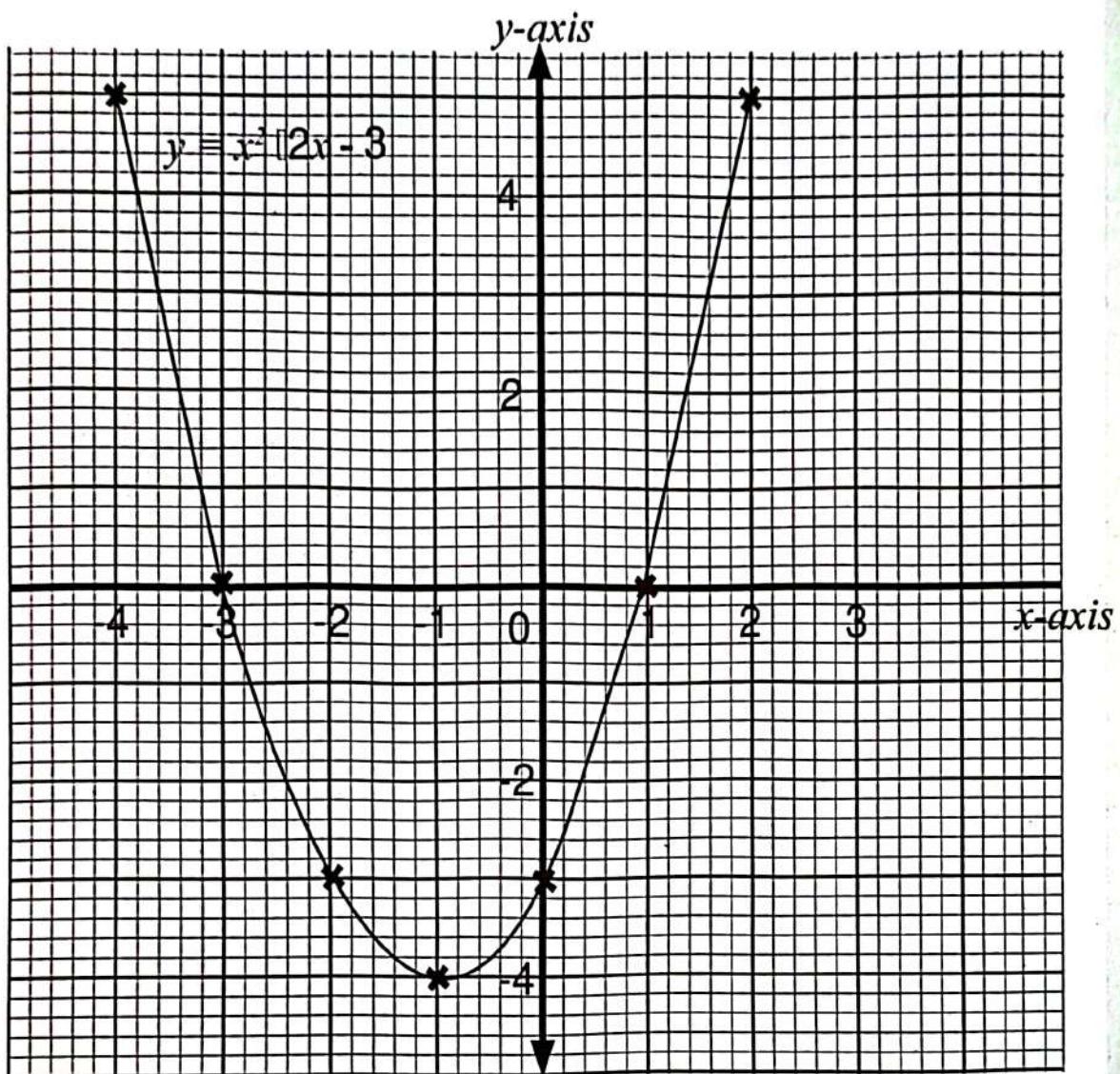
x	-3	-2	-1	0	1	2	3
$y = x^2$	9	4	1	0	1	4	9
(x, y)	(-3, 9)	(-2, 4)	(-1, 1)	(0, 0)	(1, 1)	(2, 4)	(3, 9)



- b) see graph c) (i) 0.8 (ii) 6.2 (iii) 3.2 d) (i) ± 1.7 (ii) ± 2.4
e) (i) 5.6 (ii) 2.7 f) $x = 0$

2. a)

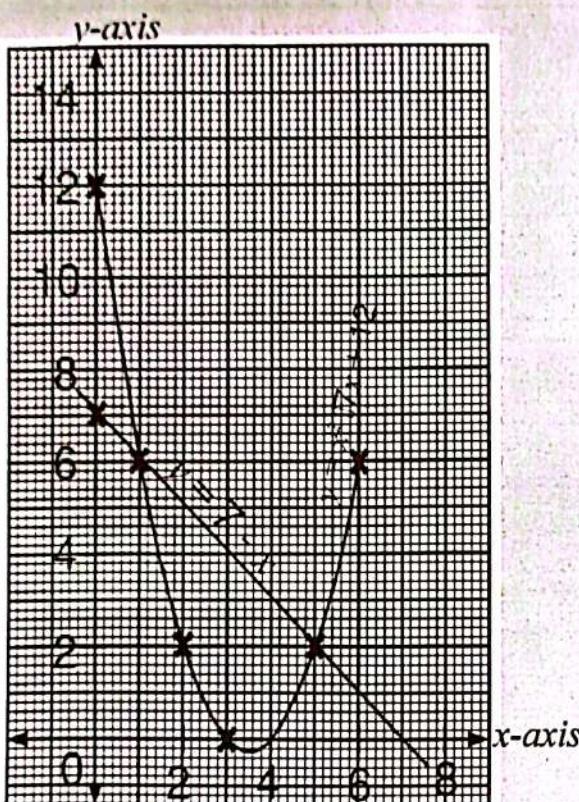
x	-4	-3	-2	-1	0	1	2
x^2	16	9	4	1	0	1	4
$2x$	-8	-6	-4	-2	0	2	4
3	-3	-3	-3	-3	-3	-3	-3
y	5	0	-3	-4	-3	0	5



- a) -1.7 b) (-1, -4) c) $x = -3.5, x = 1.5$ d) $x = -3, x = 1$
 3. a) Yes b) Yes c) Yes d) Yes

4.

x	0	1	2	3	4	5	6
x^2	0	9	4	9	16	25	36
$7x$	0	7	14	21	28	35	42
12	12	12	12	12	12	12	12
y	12	6	2	0	0	2	6

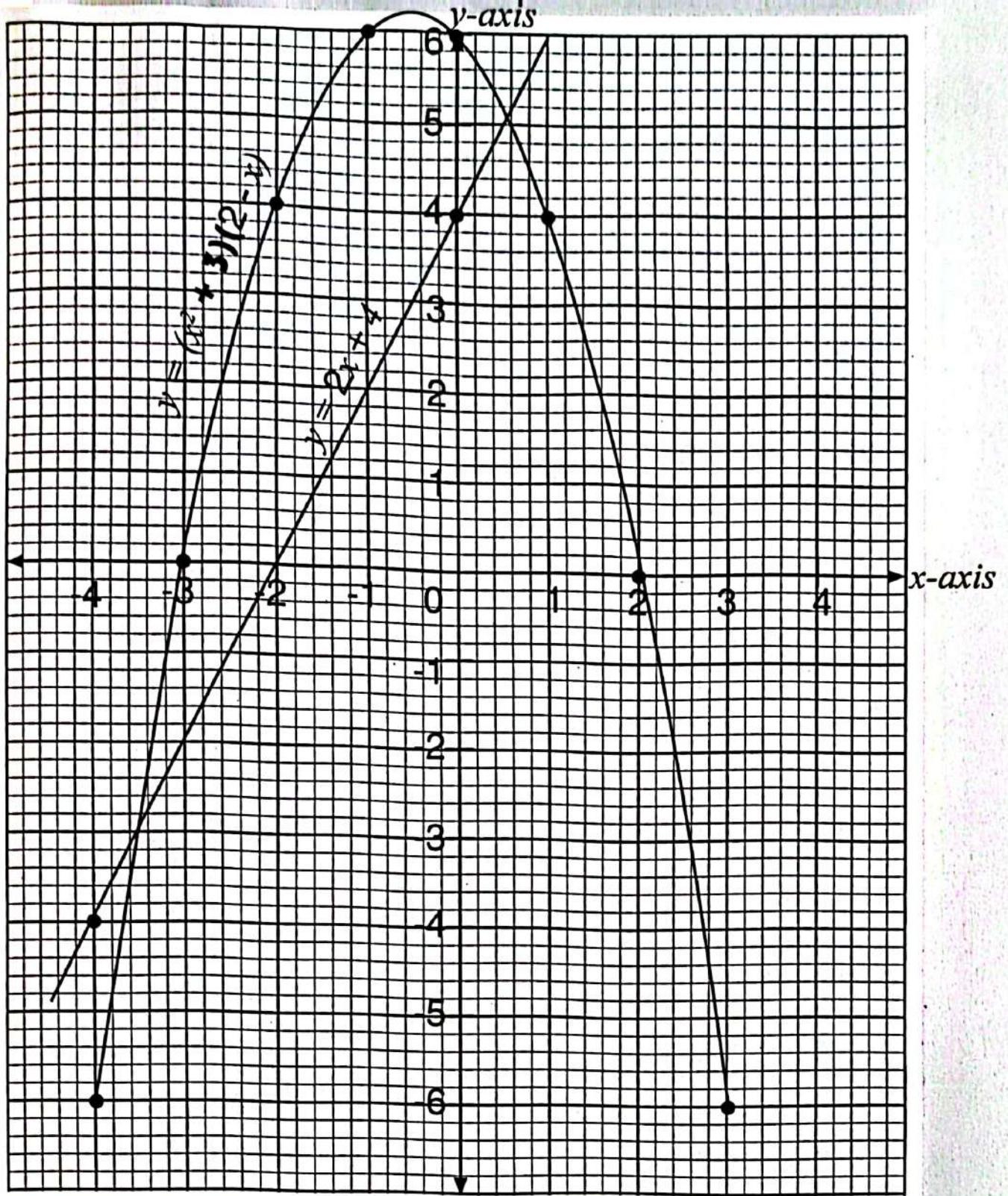


- a) $x = 3.5$
 b) 0.25
 c) see graph
 d) (i) 3 or 4
 (ii) 2 or 5

5. a) (3, -4) or (5, 0) b) (-2, 2) or (-2, -1)

6. a)

x	-4	-3	-2	-1	0	1	2	3
$x + 3$	-1	0	1	2	3	4	5	6
$2 - x$	6	5	4	3	2	1	0	-1
y	-6	0	4	6	6	4	0	-6
$2y + 4$	-4	-2	0	2	4	6	8	10

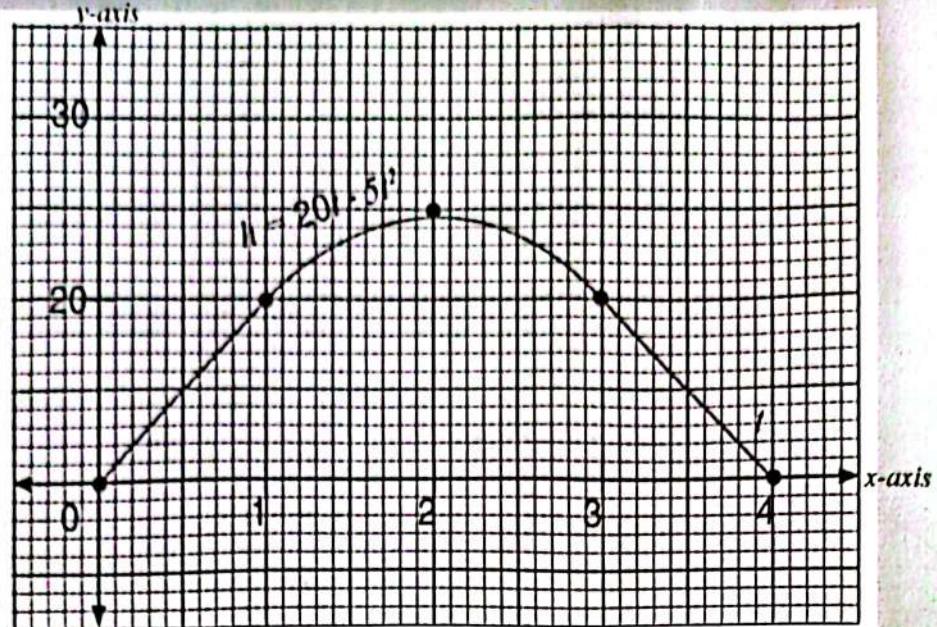


- b) (i) -2.6, 1.5 (ii) -3.6, 0.7 c) 6.2

7. a)

t	0	1	2	3	4
$20t$	0	20	40	60	80
$-5t^2$	0	-5	-20	-45	-80
h	0	15	20	15	0

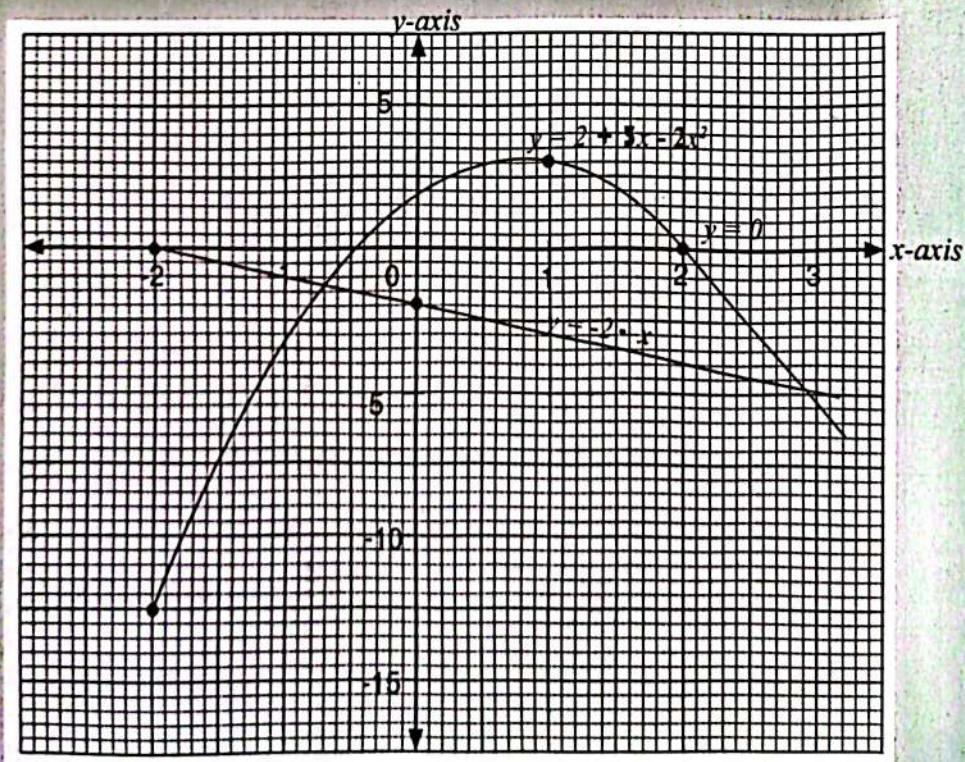
b)



- c) 20 m d) 2.8 seconds

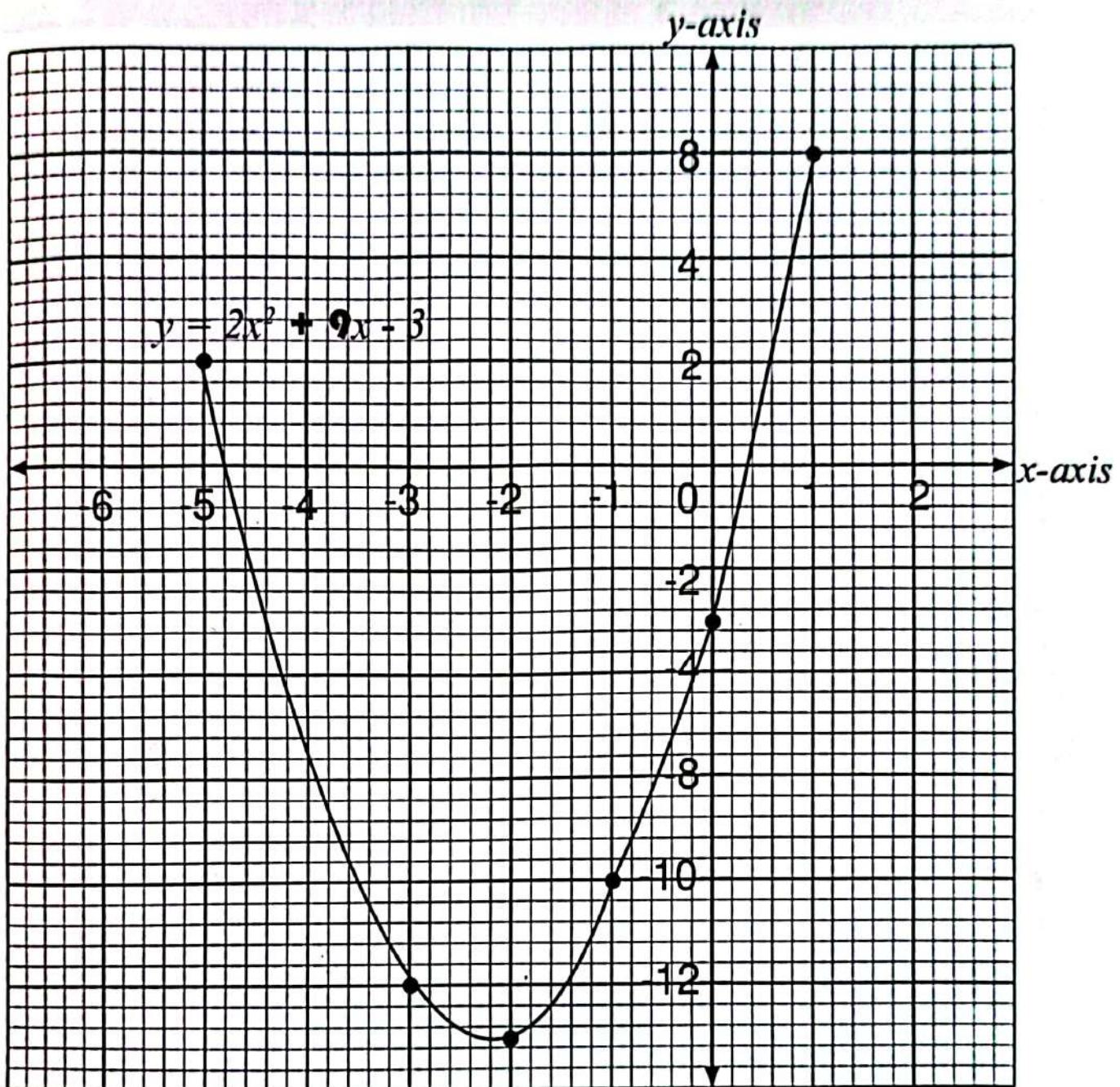
8. a)

x	-2	-1	0	1	2	3
2	2	2	2	2	2	2
$3x$	-6	-3	0	3	6	9
$-2x^2$	-8	-2	0	-2	-8	-18
y	-12	-3	2	3	0	-7



- (i) $-0.7, 2.7$ (ii) $-0.5, 2$ (iii) $-0.3 \leq x \leq 1.7$

<i>x</i>	-5	-4	-3	-2	-1	0	1
$2x^2$	50	32	18	8	2	0	2
$9x$	-45	-36	-27	-18	-9	0	9
-3	-3	-3	-3	-3	-3	-3	-3
<i>y</i>	2	-7	-12	-13	-10	-3	8



- a) (i) -3.8, 0.8 (ii) +0.2, -4 .3
- b) -13.25
- c) There is no line of symmetry

Sample Assessment Grid 12

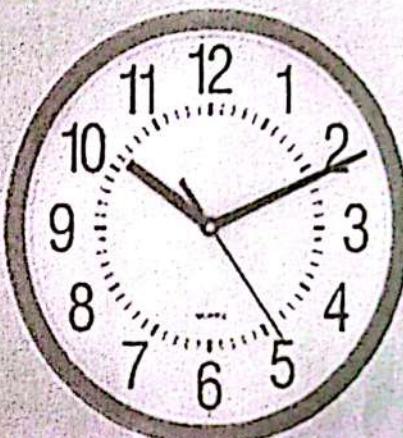
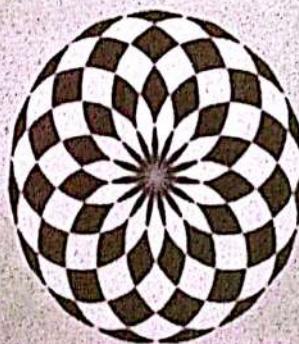
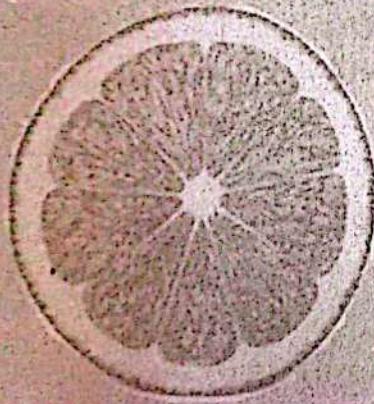
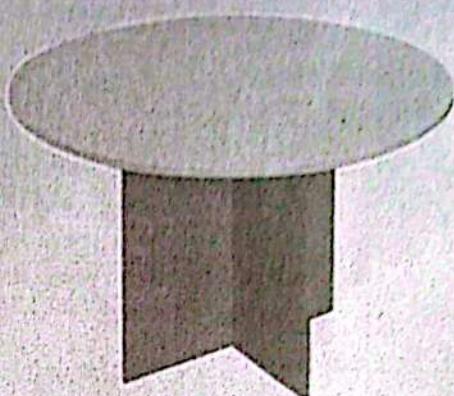
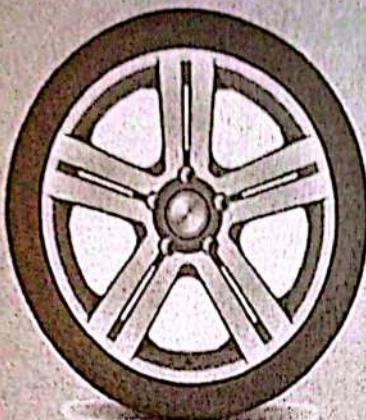
Output	Basis of evaluation	Relevancy /3	Accuracy /3	Coherence /3	Excellence /1
New enclosure dimensions	Sketch diagram of enclosures. Area of current enclosure. Quadratic equation. Same distance stated. New dimensions	Score 3: Identifies all 5 relevant parts; drawing a sketch diagram of enclosures showing dimensions, finding the area of current enclosure, writing the quadratic equation, solving the quadratic equation to find the added distance, using the found distance to work out the new dimensions.	Score 3: Accurately applies all 5 relevant parts; draws a sketch diagram of enclosures showing dimensions, finds the area of current enclosure, writes the quadratic equation, solving the quadratic equation to find the added distance, uses the found distance to work out the new dimensions.	Score 3: Logical flow in the use of all relevant parts.	Learner earns 1 point if he/she has added any exceptional feature unsolicited in the instruction
		Score 2: Identifies 3-4 relevant parts from; drawing a sketch diagram of enclosures showing dimensions, finding the area of current enclosure, writing the quadratic equation, solving the quadratic equation to find the added distance, using the found distance to work out the new dimensions.	Score 2: Accurately applies 3-4 relevant parts; draws a sketch diagram of enclosures showing dimensions, finds the area of current enclosure, writes the quadratic equation, solving the quadratic equation to find the added distance, uses the found distance to work out the new dimensions.	Score 2: Logical flow with distortions in the use of the relevant parts.	
		Score 1: Identifies 1-2 relevant part from; drawing a sketch diagram of enclosures showing dimensions, finding the area of current enclosure, writing the quadratic equation, solving the quadratic equation to find the added distance, using the found distance to work out the new dimensions.	Score 1: Accurately applies 1-2 relevant parts; draws a sketch diagram of enclosures showing dimensions, finds the area of current enclosure, writes the quadratic equation, solving the quadratic equation to find the added distance, uses the found distance to work out the new dimensions.	Score 1: Limited flow in the use of the relevant parts.	
	Total 10 mks				

Let the added distance be x metres. Old area of enclosure is 630 square metres.

It follows that $(x + 35)(x + 18) = 2(630)$

Since $x = 10$ metres, the new enclosure will be 45 metres long and 28 metres wide.

Topic 13 Circle Properties



Competency: Learners should be able to understand and use circle properties to solve problems.

- ❖ Ensure that the contents of this topic are covered within the allocated 15 periods.
- ❖ Emphasize the use of the key words in the learner's book. Use them continuously for learners to understand their meanings as used in this topic, guide the learners to;

In this topic, guide the learners to:

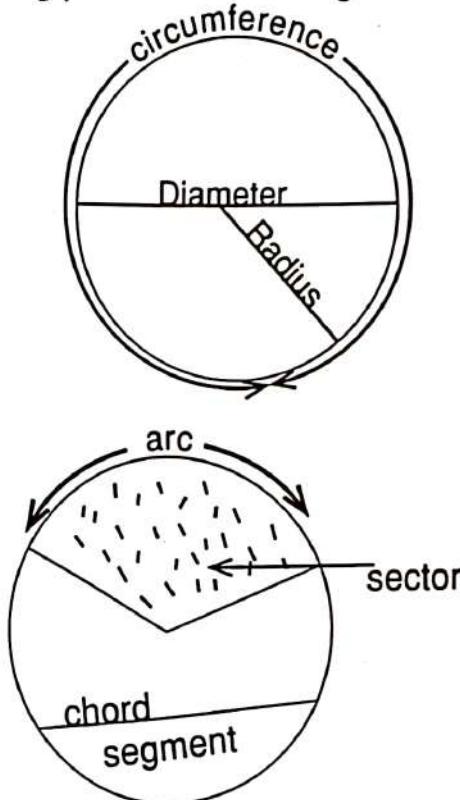
- a) identify arc, chord, sector and segments.
- b) relate angles made by an arc at the circumference and centre.
- c) determine the tangent, chord and angle properties of the circle.
- d) determine and uses the properties of a cyclic quadrilateral.
- e) find the length of the common chord for two intersecting circles.
- f) calculate the area of sectors and segments.

Introduction

Check for learners' prior knowledge about circles. Remind them that it was initially covered in book 2 , topic 8. A brief revision of finding the circumference and area of a circle is crucial for application in this topic.

13.1: Circle Definitions (Revision) 1 Period (LB page 240)

The diagrams below show some of the terms the learners will use when solving problems involving circles.



A chord is a straight line joining two points on the circumference. A segment is the region between a chord and the circumference.

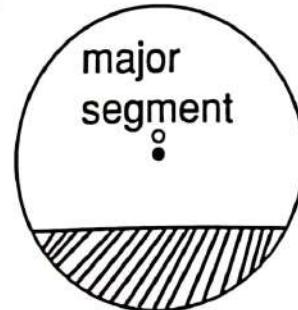
Activity 13.1

Possible Answers to Activity 13.1

- (a) (i) O (ii) \overline{OA} , \overline{OC} , \overline{OD}
- (iii) \overline{CD} (iv) \overline{PQ} , \overline{CD}

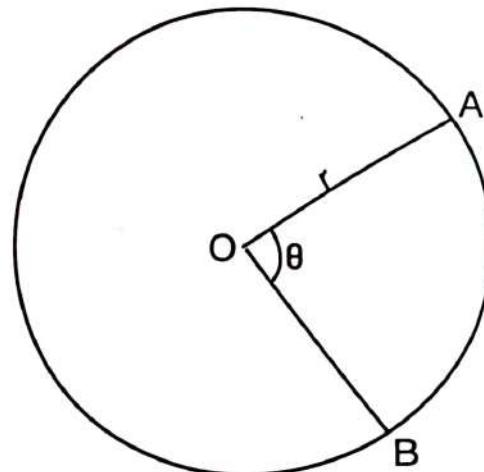
- (b) (i) \overline{PRQ} (ii) \overline{QT} , \overline{TR} , \overline{PR} ,
- (iii) \overline{QPT} (iv) \overline{OQT} , \overline{OPT}
- (v) \overline{QPRT}

(c)



- ❖ Have a discussion involving the whole class to address the parts of circle. Clearly explain the difference.
- ❖ Allow the learners make a few notes.

13.2: Length of an Arc 1 Period (LB page 240)



Length of arc AB

$$= \frac{\theta}{360^\circ} \times 2\pi r$$

Activity 13.2

Possible Answers to Activity 13.2

- (a) 360° (b) 60° , $\frac{1}{6}$
- (c) $2\pi r = 2\pi \times 8 = 50.24 \text{ cm}$
- (d) $\frac{50.24}{6} = 8.37 \text{ cm}$

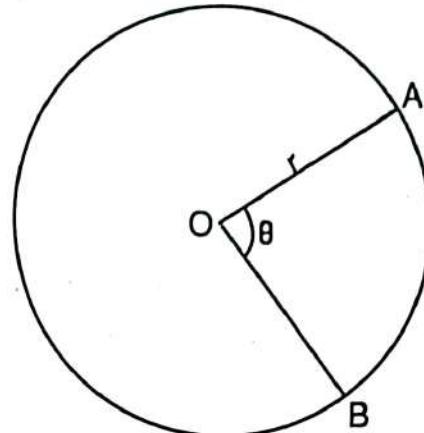
- ❖ Call for class discussion of their results from group representatives.
- ❖ Conclude the discussion by pointing out the formula for finding an arc of a circle.
- ❖ Let them study example 13.1 and work out its quick practice question.
- ❖ Give them an assignment from Exercise 13.1

Answers to Exercise 13.1

(LB page 241)

1. (a) CD (ii) OC, OD
(b) (i) AJ (ii) OJ, OL, OA
(iii) AJ
(c) (i) BC, AD, XW, YZ
(ii) OX, OW, OY, OZ,
(iii) XW, YZ
(d) (i) RT (ii) NP, NQ, NR, NT,
(iii) QT
2. (a) 10 units (b) 4 units
3. (a) minor arc CB, major arc CLB, minor arc BL. Central angles COB, BOL, COL.
(b) minor arcs CD, NM; major arcs CXD, NYM central angles COD, NOM.
(c) minor arcs QR, PQ, PR, major arc PRQ central angle POR, QOR.
4. (a) 12.56 cm, (b) 38.73 cm
(c) 28.13 cm, (d) 64.89 cm
5. 0.84 cm
6. 143.3°
7. (a) 2.18 cm (b) 30°

13.3: Area of a Sector 2 period (LB page 242)



Area of minor sector

$$\text{OAB} = \frac{\theta}{360^\circ} \times \pi r^2$$

Activity 13.3

Possible Answers to Activity 13.3

$$\begin{aligned} \text{(a)} \pi r^2 &= 314 \text{ cm}^2 & \text{(b)} \frac{50^\circ}{360^\circ} \\ \text{(b)} \frac{50^\circ}{360^\circ}, \text{Sector area} &= \frac{314}{314} \\ \text{(d)} \frac{\text{Sector area}}{314} &= \frac{50^\circ}{360^\circ} \end{aligned}$$

$$\begin{aligned} \text{Sector area} &= \frac{50^\circ}{360^\circ} \times 314 \\ &= 43.61 \text{ cm} \end{aligned}$$

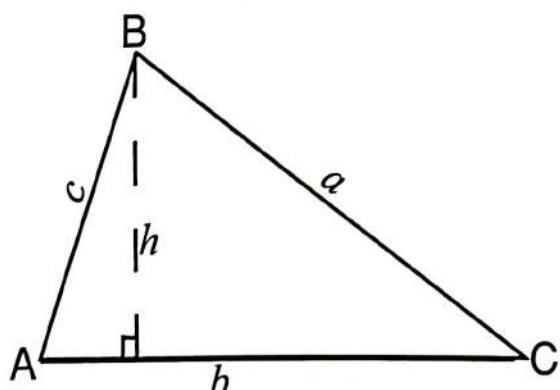
- ❖ Hold a whole class discussion about their activity results. Let them explain their answers.
- ❖ Strengthen further their understanding by concluding with the formula for finding the area of a sector of a circle.
- ❖ Ask them to study examples 13.2 and 13.3. Let them test their skills by working through the quick practice questions.
- ❖ Before the learners move on to the next section, let them work through exercise 13.2.

Answers to Exercise 13.2**(LB page 260)**

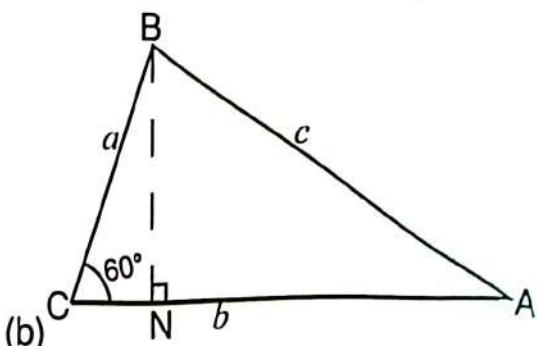
1. (a) 21.7 cm^2
 (b) 148.49 cm^2
 (c) 270 cm^2
 (d) 70.39 cm^2
2. (a) 42 cm (b) 12 m
 (c) 11 m
3. (a) 129.32 cm^2
 (b) 60.72 cm^2
 (c) 601.25 cm^2
 (d) $1,101.8 \text{ m}^2$
4. (a) 78° (b) 246°
 (c) 123°
5. $1,114.67 \text{ cm}^2$.
6. 159 cm^2

13.4: Area of a Triangle Using Trigonometry 2

Period (LB page 244)



The area of a triangle = $\frac{1}{2}bh$. But $a \sin C = h$. This area = $\frac{1}{2}ab \sin C$. Like wise, area of ABC = $\frac{1}{2}ac \sin B$ and area of ABC = $\frac{1}{2}bc \sin A$.

Activity 13.4**Possible Answers to Activity 13.4**

$$(b) \sin 60^\circ = \frac{BN}{a}$$

$$a \sin 60^\circ = BN$$

$$(d) \text{Area} = \frac{1}{2}bh$$

$$= \frac{1}{2} \times b \times a \times \sin 60^\circ$$

$$= \frac{1}{2} ab \sin 60^\circ$$

- ❖ Discuss the learners' results from the activity.
- ❖ Focus the discussion on the mathematics concept of finding the area of a triangle given two sides and the included angle. A formula should therefore result.
- ❖ Have the learners jot down some notes.
- ❖ Ask them to study example 13.4 and do its quick practice question.
- ❖ Enhance further the learners' skills in finding the area of a triangle by asking them attempt exercise 13.3.

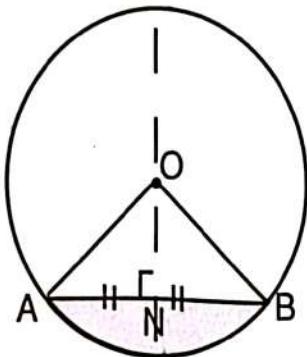
Answers to Exercise 13.3 (page 245)**(LB page 245)**

1. (a) 118.54 cm^2 (b) 144.78 cm^2
 (c) 33.84 cm^2 (d) 13.54 m^2
2. 55 cm^2

3. $49.1^{\circ}, 130.9^{\circ}$
4. 57°
5. (a) 82.68 cm^2 (b) 217.38 cm^2
(c) 144.06 m^2 (d) $1,245.68 \text{ m}^2$
6. 93.44 cm^2

13.5: Chord Properties Of Circles 2 Periods (LB page 246)

- a) If a line is the perpendicular bisector of a chord, it passes through the centre of the circle.

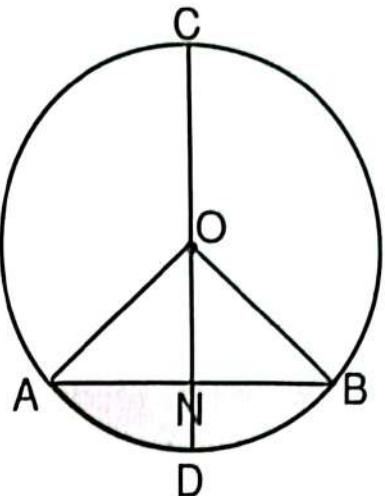


- b) The perpendicular from the centre of a circle to a chord bisects the chord.
c) In the same circle or in equal circles, chords equidistant from the centre are equal.

Activity 13.5

- ❖ Put the learners into groups. Ask them to perform the activity.
- ❖ In this activity, the learners will discover for themselves the chord properties of a circle.
- ❖ Observe the learners as they are engaged and take note of competencies such as tolerance and team work

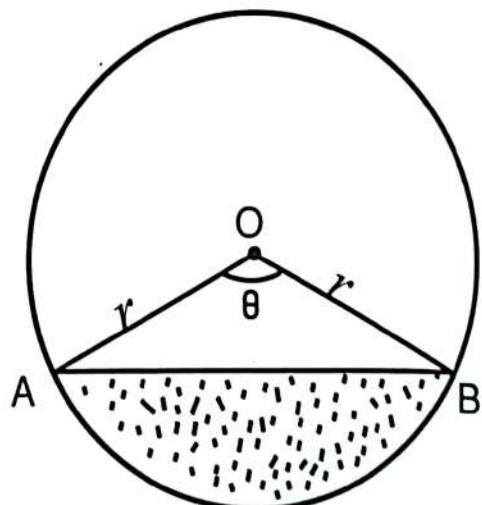
Possible Answers to Activity 13.5



- (d) $\overline{AN} = \overline{NB}$ (e) $\angle AON = \angle BON$
(f) Since CD is perpendicular to AB, each is 90° .

- ❖ Call the attention of the whole class to deliberate on their findings.
- ❖ Allow them to make some notes.
- ❖ They can study examples 13.5 and 13.6 and thereafter work through their quick practice questions.

13.6: Area of a Segment 2 Period (LB 247)



To find the area of shaded segment.

Activity 13.6

- ❖ Have them move into groups. Let them perform activity 13.6

- ❖ In this activity, the learners should find the area of a segment of a circle.
- ❖ As they are engaged, observe them noting their attitude towards group work and whether they are working harmoniously.

Possible Answers to Activity 13.6

(a) Area of segment = Area of sector – area of triangle.

(b) Area of sector

$$\text{OCD} = \frac{76^\circ}{360^\circ} \times 3.14 \times 10^2$$

$$= 66.29 \text{ cm}^2$$

$$\begin{aligned} (\text{c}) \text{ Area of } \Delta \text{ OCD} &= \frac{1}{2} r^2 \sin \theta \\ &= \frac{1}{2} \times 10^2 \times \sin 76^\circ \\ &= 48.51 \text{ cm}^2 \end{aligned}$$

$$\begin{aligned} (\text{d}) \text{ Area of segment} &= 66.29 - 48.51 \\ &= 17.78 \text{ cm}^2 \end{aligned}$$

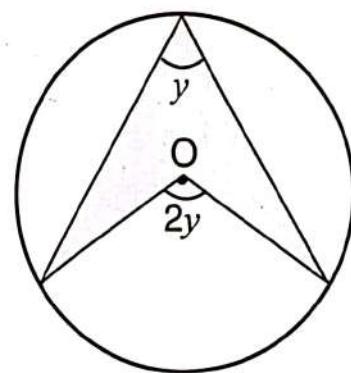
- d) Call the attention of the whole class to address their group work. Let group representatives lead the discussion.
- e) Guide the discussion and give help to the struggling learners.
- f) Study the examples 13.7 and especially 13.8 with them as you guide them. Then let them have an attempt at the quick practice questions.
- g) Next let them connect their responses in the activity by doing an assignment from Exercise 13.4.

Answers to Exercise 13.4 (Pg 249 LB)

1. (a) 11.2 cm (b) 19 cm
(c) 15.59 cm (d) 48 cm
2. (a) 86° (b) 10.91 cm
3. (a) 114 cm^2
(b) 328.32 cm^2
4. 16 cm
5. 72.84 cm
6. $1200, 74.25 \text{ cm}^2$

13.7: Angle Properties of a Circle 3 Period (LB page 250)

- a) The angle subtended by an arc at the centre of a circle is twice the angle that it subtends at the circumference.



- b) The angle inscribed in a semi-circle is a right angle.
- c) Angles in the same segment are equal
- d) Opposite angles of a cyclic quadrilateral are supplementary

13.7.1: Discovering the relation between the angle at the centre and that at the circumference

Activity 13.7

- ❖ Let the learners move into groups. In this activity, they will discover solve angle properties of a circle.
- ❖ Ask them to perform activity 13.7, thinking cheaply.
- ❖ Observe the learners in their groups as they work. Notice any problem solving skills and creativity

Possible Answers to Activity 13.7

- (b) Arc AC
- (c) Angle AOC = twice angle ABC
- (d) Semi circle, $\angle ACB = 90^\circ$.

$$\angle ACB = \frac{1}{2} \angle AOB$$

- ❖ Call upon the learners to come forward and demonstrate their group findings.
- ❖ Harmonise the discussion.
- ❖ Allow them to make some notes. Examples 13.9 and 13.10 should enhance their understanding. The quick practice questions should be then attempted.

Possible solution for quick practice

$$\angle a = 27^\circ, \angle b = 54^\circ$$

Activity 13.8

- ❖ You can ask the learners to work individually or in a group.
- ❖ In activity 13.8, the learners will find the relation between angles in the same segment.
- ❖ Walk around the classroom observing them as they are engaged. Listen to their comments about the work.

Possible Answers to Activity 13.8

The three angles a, b and c are equal in size.

- ❖ Call for the whole class discussion
- ❖ Have them study example 13.11 and do its quick practice question.

Possible Answers to quick practice

$$\angle d = 55^\circ, \angle e = 39^\circ, \angle f = 55^\circ$$

- ❖ 13.7.2: Discovering the angle properties of a cyclic quadrilateral

Activity 13.9

- ❖ Likewise, you can ask the learners to work individually or in a group.
- ❖ In activity 13.9, they will be discovering the angle properties of a cyclic quadrilateral.
- ❖ Observe them as they work. Are they communicating and tolerant of each other?

Possible Answers to Activity 13.9

- (b) $x + y = 180^\circ$
- (c) $a + b = 180^\circ$
- ❖ Ask the learners during the whole class discussion to explain how they arrived at the solution (s) and how they applied the mathematics concepts.
- ❖ Explain the two theorems obtained here.
- ❖ Allow them jot down a few notes and study example 13.12, doing its quick practice question as well.

Answers to Exercise 13.5

(LB page 253)

1. (a) ACB and ADB, DAC and CBD
(b) KJL and KML, JKM and MLJ

- (c) XWY and XZY, WXV and VYW.
2. (a) SQ (b) arc PT
 (c) TQP, TSP (d) QPS
 (e) PTQ, PSQ, PRQ
 (f) TPQ, PTR, PQR, TRQ
 (g) Rectangle
3. (a) $a = 56^\circ$ (b) $y = 262^\circ$
 (c) $x = 117^\circ$ (d) $f = 74^\circ$,
 $h = 53^\circ$ (e) $q = 55^\circ$,
 $p = 70^\circ$, $r = 55^\circ$
4. (a) $x = 20.5^\circ$ (b) $c = 52^\circ$,
 $d = 38^\circ$ (c) $x = 18^\circ$,
 $e = 72^\circ$ (d) $r = 33^\circ$,
 $p = 66^\circ$, $q = 57^\circ$, $w = 45^\circ$

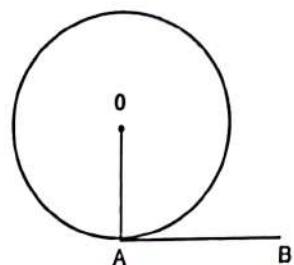
13.8: Tangent Properties of a Circle 2 Periods (LB page 255)

Activity 13.10

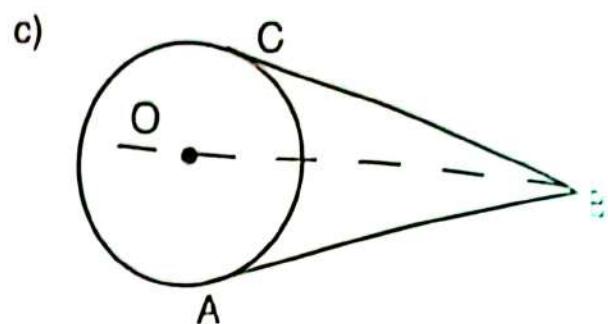
- ❖ Let the learners move into groups. Tell them to perform activity 13.10
- ❖ In this activity, they will be exploring the tangent properties of a circle.
- ❖ Observe them as they work through the activity. Notice any problem solving and communicating skills and record.

Possible Answers to Activity 13.10

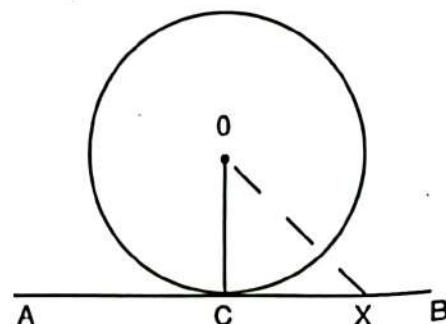
a)



- b) $OAB = 90^\circ$. \overline{OA} is perpendicular to \overline{AB} .

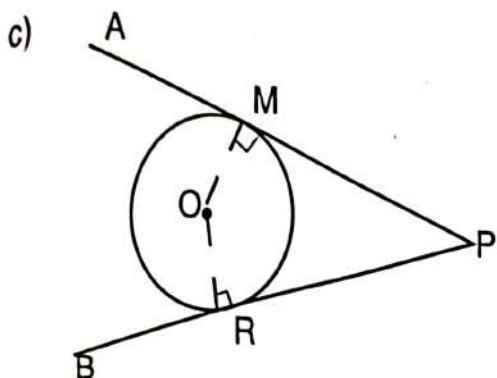


- c)
- d) $\overline{AB} = \overline{BC}$
- e) They are equal. The line OB is a line of symmetry, bisecting angle ABC.
- f) (i) Angle PAC = angle ABC.
 (ii) Angle BAT = angle ACB.
- ❖ Call the attention of the whole class and discuss their results.
 - ❖ Harmonise the discussion, helping struggling learners
 - ❖ Allow them write a few notes.
 - ❖ Discuss examples 13.13 - 13.15 with them.
 - ❖ Give them an opportunity to check their understanding by attempting their quick practice questions.
 - ❖ Discuss the alternate segment theorem and its example 13.16. Allow them work out its quick practice question.
 - ❖ Give them an assignment from exercise 13.6.
- a) A tangent is a line that, even if extended, touches a circle at only one point.

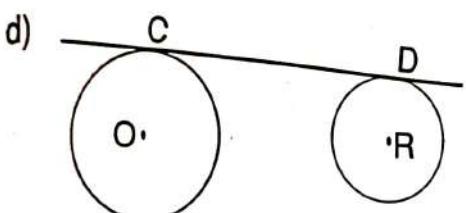


AB is tangent to the circle at C. All other points on AB lie outside the circle. C is called a point of tangency or point of contact.

- b) If a line is perpendicular to a radius at its outer extremity, it is tangent to the circle. AB is perpendicular to the radius OC at C.

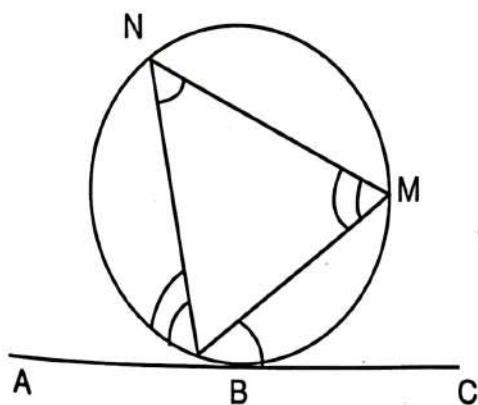


Two tangents to a circle from an outside point are equal. $PM = PR$



A common tangent is a line tangent to two circles. Tangent circles are two circles tangent to the same line at the same point.

- e) The angle between a tangent and a chord through the point of contact is equal to the angle subtended by the chord in the alternate segment.



Thus angle ABN = angle BMN and angle MBC = angle BNM.

Answers to Exercise 13.6

(Pg 258 LB)

(LB page ...)

1. (a) $x = 17^\circ$ (b) $a = 37^\circ$
(c) $c = 45^\circ$ (d) $d = 68^\circ$
2. 9 cm
3. (a) $\angle CPT = 42^\circ$ (b) 63.5°
(c) 46° (d) 34°
4. (a) 7.8 cm (b) 12 cm
5. 26 cm
6. 74 cm
7. (a) $y = 26 \text{ cm}$ (b) $x = 4$
(c) $x = 6 \text{ cm}$ (d) $x = 9 \text{ cm}$
(e) $r = 10 \text{ cm}$ (f) $x = 2 \text{ cm}$
8. 97.9 m
9. $JN = 2.8 \text{ m}$
10. 36.6 cm, 46.85 cm, 59.45 cm
11. $EH = 18 \text{ cm}$
12. (a) 3.4 cm (b) 12.84 cm^2
(c) 1.52 cm^2
13. (a) $d = 81^\circ$, $e = 78^\circ$,
(b) $f = 47^\circ$, $g = 23^\circ$,
(c) $x = 46^\circ$, $y = 67^\circ$,
(d) $n = 58^\circ$, $p = 74^\circ$,
(e) $c = 36^\circ$,
(f) $w = 49^\circ$, $y = 82^\circ$, $u = 49^\circ$, $x = 82^\circ$
(g) $d = 62^\circ$, $n = 56^\circ$
14. 17.4 cm

Assessment Grid for Activity of integration 13

Output	Basis of evaluation	Relevancy /3	Accuracy /3	Coherence /3	Excellence /1
Total amount raised.	Area of each slice of chapatti. Profit on each slice. Total amount gained.	Score 3: Identifies all 3 relevant parts; finding the area of each slice of chapatti, working out the profit on each slice, finding the total profit gained.	Score 3: Accurately applies all 3 relevant parts; finds the area of each slice of chapatti, works out the profit on each slice, finds the total profit gained.	Score 3: Logical flow in the use of all relevant parts.	Learner earns 1 point if he/she has added any exceptional feature unsolicited in the instructions
		Score 2: Identifies 2 relevant parts from; finding the area of each slice of chapatti, working out the profit on each slice, finding the total profit gained.	Score 2: Accurately applies 2 relevant parts; finds the area of each slice of chapatti, works out the profit on each slice, finds the total profit gained.	Score 2: Logical flow with distortions in the use of the relevant parts.	
		Score 1: Identifies 1 relevant part from; finding the area of each slice of chapatti, working out the profit on each slice, finding the total profit gained.	Score 1: Accurately applies 1 relevant part; finds the area of each slice of chapatti, works out the profit on each slice, finds the total profit gained.	Score 1: Limited flow in the use of the relevant parts.	
	Total				

Solution to Assessment Grid for Activity of integration 13

$$\text{Area of slice of chapatti} = \frac{60}{360} \times \frac{22}{7} \times \left(\frac{21}{2}\right)^2 = 57.75 \text{ cm}^2.$$

$$\text{Profit on each slice} = 300 - 120 = \text{UGX. } 180.$$

$$\begin{aligned}\text{Total amount raised} &= 180 \times 6 \times 275 \\ &= \text{UGX. } 297,000.\end{aligned}$$

Glossary

Area: This refers to the amount of space taken by a plane figure.

Accelerate: Beginning to move very quickly.

Cartesian plane: A graph with one x axis and one y axis. The two axes are always perpendicular to each other.

Circle: The set of all points in a plane that are the same distance from a given point called the centre.

Cylinder: A cylinder is a solid figure with two parallel congruent circular bases.

Corresponding: These are sides of similar figures that match.

Corresponding angles: In the figure, there are four pairs of corresponding angles; $\angle 5$ and $\angle 1$, $\angle 8$ and $\angle 4$, $\angle 6$ and $\angle 2$ and $\angle 7$ and $\angle 3$.

Conjugate: Refers to the change of sign between two terms in a binomial. For example, $4x + y$, its conjugate would be $4x - y$. For example, $A = \{1, 2, 3, 4\}$, then its cardinality noted by $n(A) = 4$ **Chord:** It refers to the line segment joining any two points on a circle.

Chord: It refers to the line segment joining any two points on a circle.

Circumference: This is the distance around the circle

Data: Information, often numerical, which is gathered for statistical purposes.

Decelerate: Beginning to reduce or move slowly.

Domain: This is a set of input values.

Equiangular: Equal vertex angles and sides of a polygon.

Factorisation: This refers to writing an algebraic expression in terms of its factors.

Function: This is a relation in which no two ordered pairs have the same first element and different second elements.

Factors: These are numbers you multiply to get another number. A number that divides another number or algebraic expression evenly. For example, consider 12. Any number that divided 12 evenly is its factor, for example, 1, 2, 3, 4 and 6.

Hypotenuse: This is the side opposite to the right angle or the longest side of a right-angled triangle.

Inequality: This is a relation that connects two numbers or other mathematical objects

Identity: Refers to two equivalent expressions.

Image: Corresponding member(s) of an object unto which it is mapped.

Magnitude: Size, amount of.

Mapping: This shows how the elements are paired.

Scalar: A quantity with only magnitude.

Plane figure: A flat, two-dimensional figure.

Prism: A three-dimensional object with two congruent parallel bases that are polygons.

Perimeter: The outside boundary or edges of a shape or the sum of the length of the sides of a polygon

Pyramid: A three-dimensional object with a base that is a polygon and triangular faces that meet at one vertex.

Rationalise: To move a root in a fraction for the bottom (denominator) to the top(numerator). Therefore, we rationalise the denominators.

Radius: This is a line segment with end point at the centre and on the circle.

Relations: The relationship between sets of information.

Solid figure: A three-dimensional figure with height, width and depth.

Sphere: A round, three-dimensional solid.

Scale factor: It is the ratio of the length of the corresponding sides of two similar polygons.

Symmetry: This is whereby a shape looks the same even after a rotation.

Significant figures: These are the figures in a number, apart from any zeros which occur either before the first or after the last figure.

Translation: A slide or shift in a straight such that every point on the figure moves the same distance and in the same direction.

Quadratic: Square of something. An equation expressed in the form $ax^2 + bx + c$ is called a quadratic equation and if it is an algebraic expression, then it is called a quadratic

Volume: The of space occupied by a solid object.

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