

Ministry of Education, Science and Technology

Initial Primary Teacher Education

through

Open and Distance learning (ODL)

Numeracy and Mathematics

Module 2

Department of Teacher Education and Development (DTED)

First Edition 2009



Published by

MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY
DEPARTMENT OF TEACHER EDUCATION AND DEVELOPMENT

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January, 2010

ACKNOWLEDGEMENTS

The Ministry of Education, Science and Technology, through the Department of Teacher Education and Development (DTED) wishes to sincerely thank the following individuals who contributed to the development of the modules for ODL student teachers.

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The Ministry also wishes to sincerely thank all the members of the ODL Planning Committee for giving the impetus in planning all the activities pertaining to the production of the modules.

These members are:

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NUMERACY AND MATHEMATICS MODULE 2

TABLE OF CONTENTS

UNIT 1	Percentages.....	1
UNIT 2	Approximation and Estimation.....	8
UNIT 3	Rate, Ratio and Proportion.....	15
UNIT 4	Profit and Loss.....	24
UNIT 5	Commission and Discount.....	30
UNIT 6	Taxes and Premiums.....	36
UNIT 7	Budgets and Bills.....	44
UNIT 8	Teaching of Money.....	50
UNIT 9	Postal and Bank Services.....	57
UNIT 10	Simple and Compound Interest.....	63
UNIT 11	Simple Accounts.....	72
UNIT 12	3-Dimension and 2-Dimensional Shapes.....	85
UNIT 13	Angles and Triangles.....	92
UNIT 14	Quadrilaterals and Circles.....	102
UNIT 15	Scale Drawing.....	114

UNIT 1 PERCENTAGES

1.1 Introduction

In unit 14 of module 1, you learned about decimal numbers. In this unit, you will learn another way of representing fractions called percentages. The focus will be on converting fraction to percentage and vice versa. You will also solve practical problems on percentages and use appropriate methodologies when teaching percentages. The knowledge and skills gained from this topic will help you understand the topic and teach it effectively to primary school learners.

1.2 Success criteria

By the end of this unit you must be able to:

- convert fractions to percentages.
- convert percentages to fractions
- solve practical problems on percentages
- use appropriate methodologies when teaching percentages

1.3 Key words

The following is a key word in this unit:

Percentage

1.4 Percentages

What is a percent? A percent is a part-to-whole ratio that has 100 as a reference term. Percentages are commonly used in everyday life. For example, goods prices and salaries of workers are increased or decreased by certain percentages. You can also use it in classroom situation when awarding marks and you can easily compare performance of learners in different subjects. Sometimes the term ‘percentage’ is written in short as percent.

1.5 Converting fractions to percentages

Since per means ‘out of’ and ‘cent’ means hundredth, therefore, you can express percentage as something out of 100. A symbol which represents percentages is %. Percentages are presented in different ways. For example 20 percent can be written as 20%, $\frac{20}{100}$, 20 out of 100 and 20 for every 100.

Expressing a fraction as a percentage

When converting a number or a fraction to percentage, you multiply the number or fraction by 100. Study the following examples of converting fractions to percentage.

Example 1: Express $\frac{1}{2}$ in percentage

Solution

$$= \frac{1}{2} \times 100 = 50$$

Therefore $\frac{1}{2} = 50\%$

Example 2: Express $\frac{3}{5}$ in percentage

Solution

$$= \frac{3}{5} \times 100 = 60$$

Therefore $\frac{3}{5} = 60\%$

Example 3: Express 4.25 as a percentage

Solution

$$\begin{aligned} 4.25 &= \frac{425}{100} \times 100 \\ &= 425\% \end{aligned}$$

Example 4: convert $\frac{1}{6}$ to percentage

Solution

$$\begin{aligned} &= \frac{1}{6} \times 100 = \frac{100}{6} = 16\frac{2}{3} \\ \text{Therefore } \frac{1}{6} &= 16\frac{2}{3}\% \end{aligned}$$

Example 4: Change 0.375 to percentage

$$\begin{aligned} 0.375 &= \frac{375}{1000} = \frac{375}{1000} \times 100 = \frac{375}{10} \\ \text{Therefore } 0.375 &= 37.5\% \end{aligned}$$

Self assessment 1

Convert the following to percentages

1. $\frac{3}{4}$
2. $\frac{5}{8}$
3. $\frac{1}{3}$

1.6 Converting percentages to fractions

In previous section, you converted fraction to percentage. In this section, you will convert percentage to fraction. When converting percentage to fraction or mixed number, you should write percent as a fraction with denominator 100. Then, you reduce the fraction to lowest terms.

Example 1: Express 75% as a fraction.

Solution:

$$75\% = \frac{75}{100} = \frac{3}{4}$$

Example 2: change 120% to a mixed number

Solution:

$$\begin{aligned} 120 \% &= \frac{120}{100} \\ &= \frac{6}{5} \\ &= 1 \frac{1}{5} \text{ or } 1.2 \text{ in decimals.} \end{aligned}$$

Self assessment 2

1. Convert 80% to a fraction.
2. Express 87.5 % as a fraction
3. Convert 2 % to decimals.

1.7 Solving practical problems on percentages

So far you have been changing fractions to percentages and percentages to fractions. In this section, you will solve problems on percentage related to your everyday life.

Consider the following examples:

Example 1:

During end of term examination, Mphatso scored 36 marks out of 40. Express this result as percentage.

Solution:

Firstly you should express 36 as a fraction of 40 that is $\frac{36}{40}$

Then multiply the fraction by 100% that is $\frac{36}{40} \times 100\% = 90\%$.

Example 2

In a class of 180 learners, 135 passed Mathematics and the rest failed. What percentage of the learner in this class failed Mathematics?

Solution:

Number of learners failed Mathematics is $180 - 135 = 45$

Therefore, percentage failed mathematics is $\frac{45}{180} \times 100\% = 25\%$

Example 3

Increase 400 by 30%

Solution:

First work out 30 % of 400 and add the result to 400

That is $\frac{30}{100} \times 400 = 120$. Then $400 + 120 = 520$

OR

To show the increase, 30% is added to 100% which is 130%

Then multiply 400 by 130% which is $400 \times \frac{130}{100} = 520$.

Example 4

During Christmas, price of sugar was reduced by 20 %. If a packet of sugar was K140 before Christmas, calculate the cost of packet of sugar during Christmas.

Solution:

First workout 20% of K140 which is $\frac{20}{100} \times \text{K}140 = \text{K} 28$.

Then subtract K28 from K140 which is K112.

As you can see from example 3, when increasing quantities by given percentage, you can calculate the actual increase first, then add to the original quantity or add the given percentage first to 100% then multiply by the original quantity. You follow the same process when decreasing quantities by given %, but instead of adding you subtract.

Self assessment 3

1. In a meeting of 60 participants, 40 are women and the rest are men.
 - a) Express the number of men as a percentage of the number of women.
 - b) What percentage of participants are women?
2. Decrease the following by the given percentages:
 - a) 95 by 80%
 - b) K4,000 by 0.5 %
3. Increase the following numbers by the given percentages:
 - a) 150 by 18%
 - b) 360 by $12\frac{1}{2}$ %
4. In an aptitude test, 45% of candidates failed. If there were two more candidates who passed the test than those who failed, calculate the number of candidates who passed the test.

1.8 The teaching of percentage

You can introduce percentage to learners using various ways. Knowledge of fractions will help learners understand the concepts of percentages without many problems. In the following activity, you will introduce percentage as a fraction with denominator 100.

Activity 1

1. First draw a chart with 100 boxes as shown below.

2. Shade 5 boxes and ask learners to name the fraction modelled on the chart. Help learners to name the fraction as $\frac{5}{100}$.
3. Explain to the learners that $\frac{5}{100}$ means 5 out of 100 and then tell them that 5 out of 100 is also known as 5 per cent.
4. Explain that percent is a short form of writing percentage and % is the symbol used to represent percent. Therefore 5 percent is written 5% in short. Let learners practice reading and writing percentage of different numbers using the symbol.
5. Show learners charts with different number of shaded boxes and ask them to write the correct percentage modelled in each case.
6. You may also use other resources such as 100 bottle tops and any object which can easily be divided into 100 equal parts.
7. Explain to learners how to express one quantity as a percentage of another quantity. Give learners many questions on practical problems involving percentages.
8. Assess learners' progress on percentages using appropriate methodologies such as class exercises and homework.

Self assessment 4

Briefly explain how you would use bottle tops when introducing the concept of percentage.

1.9 Summary

In this unit, you have learnt about percentages. You noted that a percentage is a way of writing fraction with denominator 100. % is a symbol used to represent percentage. You can express one quantity as a percentage of another quantity by writing the two quantities as a fraction and multiply by 100.

You can introduce percentage by drawing a rectangle and divide it into 100 equal boxes then shade some boxes.

1.10 Unit assessment 1

1. An employee receives a salary of K15, 000 per month. If the salary increases by 12%, calculate the new monthly salary.
2. A company produces white and brown sugar. Each week it makes 45,360 tonnes of white sugar which represent 64% of the total production of sugar made in a week.
 - a) What is the total number of tonnes of sugar produced in a week?
 - b) How many tonnes of brown sugar are produced in a week?
3. During month end promotion, a shop reduced the cost of mattresses by 20%. If mattresses cost K9,600 during month end, calculate the cost of mattresses during mid month.
4. A person's body mass increases by 15%. He then reduces the new body mass by 15%. Is his final body mass greater or less than the original mass, and by how much?
5. A rubric is one of the assessment tools you could use to assess learners' progress.
 - a) What other assessment tools could you use to assess learners on percentages?
 - b) Explain advantages of using more than one assessment tool in one unit.

1.11 Suggested answers to self assessment

Self assessment 1

1. 75%
2. $62\frac{1}{2}\%$
3. $33\frac{1}{3}\%$

Self assessment 2

1. $\frac{4}{5}$
2. $\frac{7}{8}$
3. 0.02

Self assessment 3

1. a) 50 %
b) $66\frac{2}{3}\%$
2. a) 19
b) 3980
3. a) 177
b) 405
4. 11 candidates passed.

Self assessment 4

You may use the following steps when introducing percentages using bottle tops:

- Let learners be in groups.
- Provide each group with 100 bottle tops.
- Ask learners to remove some bottle tops from the group, for example, 15 bottle tops.
- Help learners to name and write the remaining bottle tops as a fraction of the total number of bottle tops given.
- Tell them that a fraction with denominator 100 is also called percentage because percent means out of 100.
- Let learners practice writing and reading percent using symbol %.

Unit assessment 1

1. K16,800
2. a) 70,875 tonnes
b) 25,515 tonnes
3. K12,000
4. Less by $2\frac{1}{4}\%$
5. a) Other tools used when assessing learners include: checklist, tests, class exercises, home work, learner portfolios and record book.
b) The advantage of using a variety of tools when assessing learners' progress is that a learner may not do well in one part but may perform well in other areas.

GLOSSARY

Percentage: rate or proportion out of 100.

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UNIT 2

APPROXIMATION AND ESTIMATION

2.1 Introduction

In unit 1, you learned about the concept of percentage as a convenient way of writing fractions which have a denominator 100. In this unit, you will learn approximation and estimation. You will also explore suitable methodologies when teaching approximation and estimation. Approximation and estimation will help you predict distances, size of quantities accurately in everyday life.

2.2 Success criteria

By the end of this unit, you must be able to:

- round off numbers to a given unit
- estimate distances, time, size of quantities accurately in everyday life
- use suitable methodologies when teaching approximation and estimation

2.3 Key words

The following are the key words in this unit

- approximation
- estimation
- rounding off
- significant figures

2.4 Approximation

You have heard people expressing the distance from their homes to school or work place by saying “it’s about 9 kilometers.” Sometimes, one could say I walked a distance of about 1 hour. Approximation involves rounding off numbers especially those with recurring decimals. The numbers could be rounded to a whole number or to a given decimal places. Numbers are rounded off to different standards for easy reading and writing.

2.4.1 Rounding off numbers to a whole number

The following activity will help you round off marked prices to the nearest kwacha.

Activity 1

- Visit a nearest shop to your home or school, where you teach.
- Observe the prices of different commodities in the shop.
- Write down prices of few commodities observed.
- If the prices are in kwachas and tambalas, write the prices in the nearest kwacha.

You will observe that most prices are marked in kwacha and tambala. For example, you have noticed commodities with the following marked prices K10.50, K45.99, K200.05 etc. In this case, you can convert the prices listed above to the nearest Kwacha as follows: K11.00, K46.00, and K200.00. Sometimes, this could also be expressed as rounding off numbers to a whole number and or to the nearest ten, hundred, and thousand.

Example:

(a) Round off the following to the nearest number given in brackets:

- i. 14.5 (nearest ten)
- ii. 547 (nearest ten)
- iii. 241 (nearest hundred)
- iv. 3606 (nearest thousand)

You can remember that when you were in module 1, you learnt about place value of numbers. For example, the number 478 has the following values:

Hundreds	Tens	Ones
4	7	8

This means that 4 represents four hundred, 7 represents seventy (7 tens), and 8 represents eight ones. Considering this explanation, I believe you came up with the following answers for the examples:

- i. 10
- ii. 550
- iii. 200
- iv. 4000

In (i) the value of digit 4 under Ones in this number (14.5) is less than five. Therefore, the value of 1 under Tens will remain unchanged so 14.5 will change to 10.

In (ii) the value of digit 7 under Ones in the number 547 is more than five (half of ten). Therefore, the value of 4 under Tens will change to 5 and the place value for the digit 7 will become zero e.g. 550

In (iii) to the nearest hundred; in this case, 241 become 200; for 41 is less than 50 (half of hundred) hence the answer is 200.

Finally, to the nearest thousand 3,606 changes to 4,000 because 606 is above 500 (half of a thousand).

2.4.2 Rounding off numbers to a given decimal places

Writing numbers to a given number of decimal places uses the same procedures as when converting them to the nearest whole number.

Consider the following examples:

- i. 3.8501 to 1 decimal place
- ii. 84.068 to 2 decimal places
- iii. 135.5744 to 3 decimal places

Solution

- i. 3.8501 becomes 3.9
- ii. 84.068 becomes 84.07
- iii. 135.5744 becomes 135.574

If the digit to be left out is smaller than 5, drop this digit and leave the remaining number unchanged e.g. converting 1.684 to 2 decimal places becomes 1.68

If the digit to be left out is 5 or larger, drop this digit and add 1 to the preceding digit e.g. 1.27 becomes 1.3 to 1 decimal place

Zeros at the end of a decimal number after rounding off are not important, so you can leave them i.e. 60.100 becomes 60.1

Self assessment 1

1. (a) Change K146.90 to the nearest kwacha
(b) Round off 6,090.30 to the nearest thousand
2. (a) Convert the following numbers to nearest whole number
 - i. 2.76
 - ii. 49.57(b) Round off the following numbers to the given number of decimal places
 - i. 4.3498 to 3 decimal places
 - ii. 0.0089 to 2 decimal places

2.4.3 Significant figures

Another way of approximating numbers is to express them to a given number of significant (important) figures. The short form for significant figure is s.f.

For example, express the following numbers to a given significant figure:

(a) 128.4 to 2 s.f.

Solution:

The number 128.4 to 2 significant figures becomes 130.

How did you arrive at this answer?

From the above provided answer, you can see that the digits 1 and 3 are the significant figures. To find significant figures, in this case, count two numbers from your left hand side. Check the third number. Verify whether it is less than five or it's five and above. If it is less than five, then you drop it and become zero; and the two digits counted remain the same. In your case the second number is 2, then 8 is your third number which is more than 5. Therefore, you drop 8, which will change to 1 and that 1 is added to 2 as a second number which becomes 3. Hence, 128.4 gives us 130. as a solution. However, though the significant figures are 1 and 3, we still write the zero. Why don't we just write 13 since for these are the significant figures? What do you think is the reason for doing that?

Well, when converting numbers to given significant figures, place value is of great importance. This is to make sure that digits still holds their place value position, for example, correct 4667 to 2 significant figures. The answer is 4700. The two zeros are retained so that the other numbers 4 and 7 do not lose their place value. In this case, 4 is representing thousands and 7 for hundreds. Writing 47 as significant figures would mean 4 representing tens and 7 representing ones which is not true. If the number was 124.4, the solution would be 120.0 because the digit 4 which is after number 2 is less than 5. But if the third number was 5 or above thus, 5, 6, 7, 8, and 9 then that third number would have been dropped and the digit becomes 1, which is added to the second number.

(b) 0.0070036 to 4 significant figures

Solution:

$0.0070036 = 0.0070040$ to 4 significant figures.

When expressing numbers to a given number of significant figures you should start counting from the 1st non-zero digit from the left to the right of the decimal. Here you can see that the 5th number (start counting from 7 going to the right) is 6. This number 6 is above number 5; then we drop it and become 1. This 1 is added to 3 which will change to 4.

(c) 0.4014 to 3 significant figures

Solution:

$0.4014 = 0.0401$ to 3 significant figures.

A zero in between other numbers is significant. In this case a zero between 4 and 1 is regarded as a significant figure because it is between two digits. Therefore, the number 0.0401 has three significant figures, including the zero between 4 and 2. Look at the other examples below.

i. 24700

ii. 0.001047

The number 24700 has three significant figures while 0.001047 has four significant figures, including the zero in between 1 and 4.

Self assessment 2

Express the following numbers to the given significant figures

1. 0.10245 to 3 s.f.
2. 42.06213 to 2 s.f.
3. 64528 to 4 s.f.

2.5 Estimation

So far, you have learnt how to convert or round off numbers to the nearest whole number, kwacha or to the given decimal places. The next concept to learn is estimation. Estimation is predicting of things before actual measurement. The words associated with estimation include about and almost. The following activity will help you estimate distances.

Activity 2

- Take a close look at any two separate classroom blocks at the school where you teach or any two buildings at your home.
- Predict the distance in meters between the two chosen buildings. How far apart are the two buildings?
- Take a one meter ruler and measure the actual distance. Was your estimation the same?

Estimation can either be over or under actual measurement. However the estimate should be close to the actual measurement.

Self assessment 3

Estimate the following:

1. How many learners are present in your classroom? (do not count before guessing)
2. How far is your school from your home?
3. How much money do you spend buying air time per month?

2.6 Teaching of Approximation and Estimation

In sections 2.4 and 2.5 you learnt how to round off numbers to whole numbers or to a given number of decimal places. You also learnt the concept of estimation. In this section, you will learn how to teach approximation and estimation to learners. To teach the concept of approximation, you need to remind the learners concept of place value that is digits in a number have place values e.g. 462 has 4 hundreds, 6 tens, and 2 ones. You need to use appropriate teaching and learning resources such as place value box, place value chart, abacus.

Remember to explain the concepts of approximation like rounding off to learners for them to understand the topic and involve the learners in the lesson activities. Follow the logical order or sequence when teaching the concepts.

2.7 Summary

In this unit you learnt approximation and estimation. Approximation and estimation involve stating quantities to a certain number of decimal places or significant figures or to the nearest whole number.

Significant figures are digits in a number that retain their place value in a number after rounding off. Significant figures may be written in short as s.f.

2.8 Unit assessment 2

Convert the numbers as stated

- a. 299.08 to 1 decimal place
- b. 341.721 to 2 decimal place
- c. 0.9808 to 1 decimal place
- d. 44.010 to 4 s.f.
- e. 0.08491 to 2 s.f.
- f. 69.998 to 4 s.f.

2.9 Suggested answers

Self assessment 1

- 1. (a) K147
(b) 6,000
- 2. (a) i. 3
ii. 50
(b) i. 4.350
ii. 0.01

Self assessment 2

- (1) 0.102
- (2) 42
- (3) 6453

Self assessment 3

(Subjective)

Unit Assessment 2

- a. 299.1
- b. 341.72
- c. 1.0
- d. 44.01
- e. 0.085
- f. 70.00

Glossary

Approximation:	making measurement to the nearest something depending on level of accuracy of measuring device
Estimation:	guessing amount of quantity according to experience
Round down:	under estimating a figure
Round up:	over estimating a figure
Significant figures:	figures that still hold their place value after rounding down or up

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UNIT 3

RATE, RATIO AND PROPORTION

3.1 Introduction

In unit 2, you learnt about estimation and approximation which are terms commonly used in measuring quantities, distances and telling time. In this unit, you will learn rate, ratio, and proportion. You will examine ways of solving practical problems on rate, ratio and proportion. You will also explore methodologies and techniques in teaching and assessing learners on rate, ratio, and proportion. This unit will help you understand the terms and teach the topic to learners effectively. In addition you will use knowledge of rate, ratio and proportion in solving other mathematical problems.

3.2 Success criteria

By the end of this unit, you must be able to:

- Solve practical problems on rate, ratio, and proportion
- Use appropriate methodologies when teaching concepts on rate, ratio, and proportion

3.3 Key words

The following are the key words in this unit:

- proportion
- rate
- ratio

3.4 Ratio

What is ratio? Ratio is a comparison of two quantities. You can write ratio using colon, fraction and to. You can compare quantities using ratios if they are measured in the same units. Study the following examples:

Example 1

Madalitso has 5 tambala and Chinsisi has 8 tambala. Express the amount of money that Madalitso and Chinsisi have as a ratio. It would be $\frac{5\text{t}}{8\text{t}}$

Example 2

A boy's age is 20 and his father's age is 60. What is the ratio of their ages?

Solution

The ratio of the boy's age to his father's age is 20:60 or $\frac{20}{60}$

You could simplify as follows:

$$20:60$$

$$2:6$$

$$1:3$$

$$\text{Or } \frac{20}{60} = \frac{2}{6} = \frac{1}{3}$$

So, the required ratio is 1 : 3

Example 3

Express $2\frac{1}{2}$ to $1\frac{1}{4}$ as a ratio

Solution

Express each as improper fractions. i.e. $\frac{5}{2} : \frac{5}{4}$

Write fractions using common denominators. That is $\frac{10}{4} : \frac{5}{4}$

Then consider numerators only. So, the required ratio is $10 : 5 = 2 : 1$

Example 4

Decrease 420 in the ratio 5:7

Solution:

Since you are decreasing, the small number of the ratio becomes the numerator. In this case, it will be x

$$\frac{5}{7} \times 420 = 300$$

Example 5

If 8 men build a house in 24 days, how long would 6 men take?

Solution

6 men take more time than 8 men. The number of men is decreased in the ratio of 6:8; hence, the time taken is increased in the ratio of 8:6

Therefore, increase 24 days in the ratio 8:6.

That is $\frac{8}{6} \times 24$ days

This will give the result of 32 days.

Therefore 6 men take 32 days

Self assessment 1

1. In each case, find out which one of the two ratios is greater
 - a. 17:8 or 15:6
 - b. K170 : K200 or K300 : K480
2. The ages of a mother and a son are in the ratio 8:3. If the son's age now is 12, what will be the ratio of their ages in 4 years time?
3. If $a:b:c = 5:2:3$; evaluate
 - a. $\frac{a+b+c}{5a}$
 - b. $4a - b : a + 2b - c$
4. Increase 1050 mangoes in the ratio 7:6

3.5 Rate

In section 3.4, you solved problems involving ratio. What do you think is the reason for starting with ratio? Well, you use ratio when defining rate. So, learners need to understand ratio first before you move on to rate. Now define rate. You can define rate as a ratio of two measurements having different units. In this section you solve problems involving rates. Below is an example on how you could express rate.

Example

A car travels at a steady speed. It covers 200km in 4 hours. At what speed is it travelling?

Solution: $\text{Speed} = \frac{\text{Distance}}{\text{Time}}$

$$= \frac{200\text{km}}{4\text{hours}}$$
$$= 50 \text{ km/hour}$$

You can also express this as 50km/hr or 50km per hour. It means this car was travelling 50 km every one hour.

Some of the examples of rates are kilometres per hour and mass per volume. In these examples, kilometre per hour is speed and mass per volume is density.

Using the table below, match quantities in column A with the correct unit rates in column B

A	B
1. Distance per time	(i) density
2. force per unit	(ii) wages
3. grams per cubic Centimetre	(iii) pressure
4. litre per kilometre	(iv) speed
5. Kwacha per hour	(v) fuel consumption

Solution for the above activity is as follows:

1-(iv); 2-(iii); 3-(i); 4-(v); and 5-(ii)

Self assessment 2

1. Flour is priced at K11.70 for a bag of 3 kilograms. How much would the following amounts cost?
 - a. 6 kg
 - b. 14.1 kg
 - c. 200 grams
2. Maize seeds are planted at the rate of 25 kilograms per hectare. How many kilograms are needed for an area of 13 hectares?
3. A cyclist rides 100m in 2 seconds. Express the speed in km/hr.
4. A farmer applies a field of 4 hectares with 580 kg fertilizer. What is the rate in
 - a. Kg per hectare?
 - b. Grams per hectare?

3.6 Proportion

So far, you have learnt ratio and rate. In this section, you will learn about proportion and how it is related to ratio. Proportion is an equation which states that two ratios are equivalent. It is introduced using ratios.

For example, $\frac{30}{50}$ is proportional to $\frac{24}{40}$ that is $\frac{30}{50} = \frac{24}{40}$ You can check this by cross multiplying

the two ratios, that is $30 \times 40 = 50 \times 24$

$$1200 = 1200$$

There are two types of proportion. These are simple and compound. In simple proportion, you compare two ratios while in compound proportion you compare three or more ratios or quantities.

There are also two types of simple proportion, namely; direct and inverse. What is the difference between these two? In direct proportion, two quantities are related such that when one increases, the other one also increases and when one decreases, the other one also decreases. Look at the following example of direct simple proportion:

1 bag of maize costs K2,000

2 bags of maize cost K4,000

3 bags of maize cost K6,000

Notice that more bags of maize cost more money while fewer bags of maize cost less money. The ratio of number of bags to the cost price remains the same.

In inverse proportion, two quantities are related such that when one increases the other one decreases. For instance, 10 people take 4 hours to complete a piece of work; and 5 people will take 8 hours to complete the same piece of work. As the number of people decreases, time increases.

Now consider the following example:

Example

If 70 notebooks cost K300, what will be the cost of 21 notebooks?

Solution

70 notebooks cost K300

1 notebook costs $\frac{K300}{70}$

So, 21 notebooks cost $\frac{K300 \times 21}{70}$

$$= \frac{K6,300}{70}$$

$$= K90$$

This is called unitary method of solving a simple proportion problem. You can solve the same problem as follows:

Ratio of notebooks is 70: 21

Therefore, cost of 21 notebooks will be less

Therefore, decrease K300 in the ratio $\frac{21}{70}$

That is $K300 \times \frac{21}{70} = K90$

Self assessment 3

1. A sum of money is divided among 3 students, A, B, and C in the ratio 3:5:7. If A gets K450, how much does C receive?
2. 7 people dig a piece of ground in 10 days. How long would 5 people take to dig the same piece of ground?
3. A mother shared K7,700 to her three children Chipiriro, Mweta, and Eunice so that Chipiriro gets twice as much as Mweta and Mweta gets twice as much as Eunice. How much did each child receive?
4. Yohane, Maria and Zione shared K68,000 so that for every K100 that Zione gets, Maria gets K300 and for every K300 that Maria gets Yohane gets K400. How much does each get?

3.7 Teaching of rate, ratio, and proportion

How would you introduce the concepts of rate, ratio, and proportion to learners? For you to teach the concepts of rate, ratio, and proportion, you need to follow appropriate procedures and methodologies. The following are some suggestions on how you would introduce rate, ratio and proportion:

3.7.1 Introducing ratio

The idea of ratio is not easily understood by most learners. Therefore, this activity will assist you explore suitable methodologies you can use when teaching ratio to learners.

- Have 7 stones and two containers or plates labelled A and B
- Put 2 stones on one container or plate and 5 stones in the other container or plate
- Find how many stones are in each plate or container. Notice that 7 stones have been shared to plate A and B such that A has 2 stones and B has 5 stones.
- You can use ratio in relating number of stones in plate A to number of stones in plate B using the colons (:)
- So the number of stones in A to number of stones in B can be written as 2 stones to 5 stones i.e. $A:B = 2:5$
- Establish that 2:5 means for every 2 stones that A receives B receives 5

3.7.2 Introducing rate

You have learnt various ways of calculating rate. Now you will explore different methods of teaching rate to learners. You can do the following activity.

- Firstly, revise measuring distances and time
- Arrange that each one of learners walk a known distance (possibly a football ground) at their own pace. Take note of the starting and finishing time.
- Let each learner find the time taken to cover the distance
- Find the speed in each case. Now discuss as to which one of them walked faster than the other
- Establish the speed as an example of rate
- Repeat using different types of activities and calculate the rate of each activity.

3.7.3 Teaching of direct proportion

In section 3.6, you learnt about various ways you can use to solve proportion problems. In this section you will explore various ways of teaching proportion to learners. You can:

- Revise the sharing activities using three learners A, B, and C
- Share say 30 books to learners A, B, and C as follows: give 5 books to A, 10 books to B and 15 books to C

- Find the ratios of A's to B's, B's to C's share and A's share to C's. This will give them 1:2, 2:3 and 1:3 ratios respectively.
- Establish that if this information is put together then a proportion will be formed. This will be 1:2:3
- Do more activities on proportion

Notice that proportion is simply the equivalence of ratios. You can solve proportion problems using unitary or ratio methods.

3.8 Summary

In this unit you have learnt rate, ratio and proportion. The terms rate, ratio and proportion are related such that it is difficult to talk about proportion without talking about rate and ratio. You have also explored ways of using rate, ratio and proportion. You can express ratio using colon, fraction and statement.

3.9 Unit assessment 3

1. Decrease K73.35 in the ratio 5:9
2. What success criteria would you want to achieve after teaching proportion?
3. If 3 men can do a job in 4 days, working 10 hours a day, how many days will it take 8 men working 6 hours a day?
4. Share 630 mangoes to three learners, Charles, Jane and Chrissie so that Charles gets half as much as Jane and Chrissie gets half as much again as Charles. How much does each one get?

3.10 Suggested answers

Self assessment 1

1. (a) 15:6
(b) K170 : K200
2. Mother = 36 years
Son = 16 years

Therefore, their ratio will be 9 : 4

3. (a) $\frac{2}{5}$
(b) 3:1

4. 1225

Self assessment 2

1. a. K23.40

- b. K54.99
- c. K0.78
- 2. 325 kg
- 3. 180km/ hour
- 4. a. 145kg / hectare
- b. 145,000g / hectare

Self assessment 3

- 1. K1,050
- 2. 14 days
- 3. Chipiliro = K4,400; Mweta = K2,200; Eunice = K1,100
- 4. Zione = K8,500; Maria = K25,500; Yohane = K34,000

Unit assessment 3

- 1. K40.75
- 2. learners must be able to :
 - a. solve practical problems on proportion
 - b. use proportion to calculate quantities
- 3. $2\frac{1}{2}$ days
- 4. Each of them will get as follows:
 - a. Charles = 180 mangoes
 - b. Jane = 90 mangoes
 - c. Chrissie = 360 mangoes

Glossary

Rate:	comparison of quantities of different types
Ratio:	comparison of two quantities of the same kind; and it has no units.
Proportion:	equality of two ratios
Unitary method:	a method of solving a simple proportion problem where 1 is used in the process.

Ratio method: a method of solving simple proportion problem where multiplying factor is used in the process.

Reference

Ministry of Education (2005) *Initial Primary Teacher Education Teaching syllabus for Numeracy and Mathematics*, MIE, Domasi

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UNIT 4

PROFIT AND LOSS

4.1 Introduction

In unit 3, you learnt about ratio, rate and proportion. In this unit you will learn about profit and loss. People do business in order to make profits although sometimes they make losses. It is therefore necessary to equip you with knowledge and skills on how to calculate profit and loss. The knowledge of rate, ratio and proportion will help you solve problems on profit and loss. In addition the knowledge and skills on profit and loss will help you and your learners comfortably run businesses.

4.2 Success criteria

By the end of this unit you must be able to:

- Solve practical problems on profit and loss.

4.3 Key words

The following are key words in this unit:

- cost price
- loss
- profit
- selling price

4.4 Practical problems on profit and loss

Manufacturers produce commodities which they sell to wholesalers in large amounts. These wholesalers then sell the commodities in cartons, units, dozens or pairs to retail shop owners and other traders. Amount of money paid to wholesalers is called wholesale price or cost price (CP). These traders in turn sale the commodities to consumers at high prices called retail prices or selling price (SP).

4.4.1 Calculating loss and profit given cost and selling prices

When does a trader make profit? A trader makes profit if the cost price is less than the selling price. However, a trader makes a loss if a cost price is more than selling price.

Consider the following examples:

Example 1: A shopkeeper bought a one litre bottle of cooking oil at K506 and sold it at K570.

- (a). Identify the wholesale price, retail price, selling price and cost price.
- (b). Find out whether a profit (gain) or a loss was made in the transaction.

Solution:

- a) The wholesale price or cost price is K506 and K570 is retail or selling price.
- b) A trader made a profit since the selling price is more than cost price.

Example 2:

The cost price of a unit of umbrella is K7,500 and the selling price of each umbrella is K820. How much is the profit?

Solution:

Cost price = K7,500 for 1 unit (10 umbrellas)

Selling price = K820 each umbrella

Therefore total SP = K820 x 10

$$= \text{K}8,200$$

Profit = SP - CP = K8200 – K7500

$$= \text{K}700$$

4.4.2 Finding selling price given cost price and profit or loss

The following relationships among selling price, cost price and profit or loss will help you to solve questions involving SP, CP, loss or profit:

When a profit is made, Selling Price = Cost Price + profit.

When a loss is made Selling Price = Cost Price – loss.

Study the following example:

Example 1: James bought a packet of salt at K37.00. He sold it and made a profit of K10.00. Calculate the selling price.

Solution

CP = K37.00 and Profit = K10.00

Therefore SP = CP + Profit

$$= \text{K } 37.00 + \text{K } 10.00$$

$$= \text{K}47.00$$

Example 2: Mary bought a car at K850,000.00. If she sold the car and made a loss of K120000.00, calculate its selling price.

Solution

CP = K850,000.00 and loss = K 120,000.00.

Therefore $SP = CP - \text{Loss}$

$$= K850,000.00 - K 120,000.00$$

$$= K 730,000.00.$$

4.4.3 Finding cost price given selling price and profit or loss

You recall that $\text{Selling Price} = \text{Cost Price} + \text{profit}$ or $\text{Selling Price} = \text{Cost Price} - \text{loss}$. Rearrange these equations so that you start with cost price. You will have:

$\text{Cost Price} = \text{Selling Price} - \text{Profit}$

$\text{Cost Price} = \text{Selling price} + \text{Loss}$

Check how you can use them in the following examples:

Example 1: A bag of maize was sold at K850.00. Calculate its cost price if a profit of K107 was made.

Solution:

Selling price = K850.00 and profit = K107.00

Therefore $CP = SP - \text{profit}$

$$= K850.00 - K 107.00$$

$$= K743.00$$

Example 2: A fish vendor sold a unit of Chambo at K275 per fish. If a total loss of K125 was made after selling the unit, find the total cost of the unit of chambo.

Solution

Total selling price = $K275 \times 10 = K2750$ and total loss = K125

Therefore $\text{Cost price} = SP - \text{loss}$

$$= K2750 - K125$$

$$= K2625.$$

Self assessment 1

1. Chimwemwe sold a pair of shoes at K720 making a profit of K130. Find the cost price of the pair of shoes.
2. Taonga bought 12 mattresses at K7300 each. He sold 10 of them and made a loss of K2400. Find the total selling price of 10 mattresses.

3. A girl bought one tray of eggs at K780. She sold 20 eggs at K30 each and remaining 15 eggs at K28 each. Calculate the total profit.

4.4.4 Profit and loss percent

The knowledge of percent you covered in unit 1 will help you to solve questions in this section. Do you remember how to express one quantity as a percentage of another quantity? If you cannot remember, revise unit 1 before you proceed. Percentages are used to describe the actual profit or loss made. In the following examples, you will discover how profit and loss percentages are calculated. Cost price is always 100% while selling price depends on profit% or loss%.

To find profit % you divide the actual profit by cost price then multiplied by 100.

In short, Profit % = $\frac{\text{actual profit}}{\text{cost price}} \times 100 \%$

Similarly, loss % = $\frac{\text{actual loss}}{\text{cost Price}} \times 100 \%$

As you can see, both profit and loss percentage are based on cost price.

Consider the following examples:

Example 1: Students bought Braille book at K1,600 and then sold it at K1,520. Calculate the loss percentage.

Solution:

CP = K 1600,

SP = K1520 and

loss = CP – SP

= K1600 - K1520

= K80.

Therefore Loss % = $\frac{\text{K80}}{\text{K1600}} \times 100 \%$ = 5 %

Example 2: A chemist's shop bought 25 bottles of perfume for K8,750. To attract customers, the first ten bottles are sold at K315 each and the remaining bottles are sold at the normal price of K490. Calculate the profit percent made.

Solution:

Cost price = K8750

Selling price for 10 bottles = K315 x 10 = K3,150

Selling price for 15 bottles = K490 x 15 = K7,350

Therefore total selling price = K3,150 + K7,350

$$= \text{K}10,500$$

$$\text{Profit} = \text{K}10,500 - \text{K}8,750 = \text{K}1,750$$

$$\begin{aligned} \text{Therefore profit \%} &= \frac{\text{K}1,750 \times 100}{\text{K}8,750} \% \\ &= 20 \% \end{aligned}$$

Self assessment 2

1. A radio is purchased at K4,500.00 and sold for K4,725.00. What is the profit percentage?
2. A bicycle bought for K10,200 was sold at K8,160. Find the loss percent.
3. A trader made a profit of 15 % by selling a bag of cabbage for K3,220. Calculate the cost price of the bag of cabbage.

4.5 Summary

You can calculate profit and loss by finding the difference between cost price and selling price. Profit is made when selling price is more than cost price while a loss is when selling price is less than cost price. Profit percent or loss percent is always based on the cost price. Cost price is always given 100% and selling price % is equal to CP % + Profit % or is equal to CP % – loss % if a loss is made.

When more than one price is involved in the problems, first find the total cost price and selling price. Then find the difference between the two to obtain the overall profit or loss.

4.6 Unit assessment 4

1. A shopkeeper buys crates containing 20 bottles of soft drinks for K880 per crate. The bottles are then sold at K55 each.
 - a) What profit does the shop owner make on each crate of drinks?
 - b) Calculate the profit percentage made.
2. Mr. Masamu buys 50 ball pens at K10.00 each. Thirty five are sold at K12.00 and the remaining ball pens are sold at a reduced price of K8.00. Did he make a profit or loss and calculate its percentage?
3. Miss Takhoza made a loss of 10% after selling a car for K1,440 000. How much would she have sold it in order to make a profit of 10%?

4.7 Suggested answers to self assessment

Self assessment 1

1. K 590
2. K 70,600
3. K 240

Self assessment 2

1. 5 %
2. 20 %
3. K2,800

Unit assessment 4

1. (a) K220
(b) 25 %
2. He made a profit of 8%
3. K 1,760,000.

Glossary

Cost price: amount of money one pays when buying something.

Selling price: amount of money one receives in exchange of something.

Profit: difference between cost price and selling where by selling price is more than the cost price

Loss: difference between cost price and selling price where by selling price is less than the cost price.

References

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UNIT 5

COMMISSION AND DISCOUNT

5.1 Introduction

In unit 4, you learned about profit and loss. In this unit you will learn about commission and discount. The focus will be on calculating commission and discount, expressing commission and discount as percentage and also solving practical problems involving commission and discount. Discounts are common when buying and selling commodities. This unit will help you interpret and calculate commission and discount.

6.1 Success criteria

By the end of this unit you must be able to:

- Solve problems involving commission
- Workout problems on discount

6.2 Key words

The following are key words in this unit:

- agent
- commission
- discount
- marked price

5.4 Commission

What do you understand by the term commission? Commission is amount of money a salesperson or an agent receives for selling items such as newspaper, air time, houses and cars. Commission is usually proportional to goods sold. Firms and companies normally pay their sales persons commission on top of their salaries as an incentive.

5.4.1 Finding commission and commission percentage.

Rate of commission is given in percent or amount of money per certain amount of sales. To find commission, you multiply the rate by total sales. Commission percent is equivalent to actual commission divided by total sales then multiplied by 100%.

Consider the following examples:

Example 1:

A car saleslady gets 3t in every kwacha as commission. How much commission will she get for selling a car at K820,000?

Solution:

Rate of commission is 3t in every kwacha. That is $\frac{3t}{100t}$

$$\begin{aligned}\text{Therefore, total commission} &= \frac{3t \times K820,000}{100t} \\ &= K246.00\end{aligned}$$

Example 2:

A newspaper vendor gets 6 % commission on every paper he sells. If he made total sales of K15,000 how much money did he receive as commission?

Solution

$$\text{Commission} = 6\% \times K15,000$$

$$\begin{aligned}&= \frac{6 \times K15,000}{100} \\ &= K 900.\end{aligned}$$

Example 3: A sales agent sold a television (TV) set for K84,500. The owner of the TV got K78,163 from the sales. Calculate commission percentage the agent received.

Solution

$$\text{Actual commission} = K 84,500 - K 78,163$$

$$= K6,337$$

$$\begin{aligned}\text{Therefore commission \%} &= \frac{K 6,337 \times 100\%}{K 84,500} \\ &= 7.5 \% \text{ (corrected to one decimal place)}\end{aligned}$$

Self assessment 1

1. An agent sold 128 pails of maize at K850 each and received K6,528 as a commission. Express the commission as a percent.
2. An insurance agent's commission is 7t for every kwacha of the value of insurance sold. How much does the agent get for selling insurance worth K9,756,000?

5.4.2 Finding total sales given rate and commission

The knowledge of proportion covered in unit 3 will help you to calculate total sales given commission and its rate. Total sales are normally equivalent to 100%.

Example 4:

An egg sale representative received a commission of K 19,200. If the rate of commission was 12%, calculate the total sales of eggs.

Solution

Rate of commission is 12%

Total commission = K19,200

$$\begin{aligned}\text{Therefore, total sales} &= \frac{K19,200 \times 100\%}{12\%} \\ &= K160,000\end{aligned}$$

Example 5:

An air time vendor received a commission of 9t for every kwacha. If she received a commission of k3600, find the total amount of the recharge vouchers sold.

Solution

Rate is 9t / K1.00 = 9t / 100t

Commission = K3,600

$$\begin{aligned}\text{Therefore total sales} &= \frac{K3,600 \times 100t}{9t} \\ &= K40,000.\end{aligned}$$

Self assessment 2

1. An estate agent is paid 3% commission for selling various items. If she earns K4, 200 as her commission, how much are the total sales?
2. A salesman received 9½ % as commission on sales worth K26, 000. The commission received is part of his monthly salary. Find his monthly salary.

5.5 Discount

Have you ever asked for reduction in price of items when buying a commodity? If yes, what you asked for is a discount. Discount is the amount of money deducted from price of an item. After discount, customers pay less amount of money than the actual marked price. People or companies reduce price of items for various reasons such as to clear out old stock, to attract customers and during celebrations like Christmas and New Year.

Discount is given as a percentage of marked price and sometimes as amount of money per number of items bought. Marked price is the cost of an item before discount is offered and is always equivalent to 100%. Selling price is the actual amount of money paid for an item after discount is subtracted. Selling price is equivalent to marked price minus discount. You can find discount percentage by dividing the actual discount by marked price then multiply by 100%.

Study the following examples:

Example 1:

A dress marked at K1, 300 was sold at a discount of $2\frac{1}{2}\%$. Calculate the amount of money paid for the dress.

Solution

Total discount = $2\frac{1}{2}\% \times \text{K}1, 300$

$$= \frac{5 \times \text{K}1,300}{200}$$

$$= \text{K}32.50$$

Therefore amount of money paid = $\text{K}1,300 - \text{K}32.50$
 $= \text{K}1, 267.50$

Example 2:

A person paid K8, 925 for a radio. If a discount of 15% was offered, calculate the marked price of the radio.

Solution

Discount = 15%

Selling price = $100\% - 15\%$
 $= 85\%$

If 85% represents K8,925,

Therefore 100% represents $\frac{\text{K}8,925 \times 100}{85}$

Marked price of the radio = K10, 500

Self assessment 3

1. A pair of trousers marked K2, 750 was sold for K2, 640. Find the discount percent.
2. A woman is offered a discount of $7\frac{1}{2}\%$ on a bicycle with marked price of K18, 400. How much will the woman pay?

3. A wholesale allowed 8% discount for goods bought in excess of K5, 000. A retailer bought goods for K8, 750 from the wholesaler, how much did the retailer save?

5.6 Summary

Commission is the amount of money paid for a service. It is expressed as a percentage or amount of money per number of items sold or certain amount of tambala per kwacha. You can find commission percentage by dividing the actual commission by total sales then multiply by 100%.

Discount is amount of money subtracted from the cost of an item. You can find discount by subtracting selling price from the marked price. Discount percentage is equivalent to actual discount divided by marked price then multiplied by 100%. Marked price is always equivalent to 100% while selling price % is equivalent to marked price % minus discount %.

5.7 Unit assessment 5

1. An auctioneer is paid 12% commission for selling a refrigerator for K35, 000 and a vehicle for K812000. How much commission does the auctioneer receive?
2. A farmer saved K3, 735 when he was offered a 15% discount for buying bags of fertiliser. Calculate the total price of fertiliser before discount.
3. An ox marked at K47, 200 is sold to a butcher at a discount of 10t for every kwacha. Find the actual amount of money the butcher paid.
4. An agent sold a house for K1, 750,000, the commission arrangement was 4% for the first K900, 000 and 2½ % for any amount over it. What was the total commission on the sales?

5.8 Suggested answers

Self assessment 1

1. 6%
2. K682,920

Self assessment 2

1. K140,000
2. K14,820

Self assessment 3

1. 4%
2. K17,020
3. K300.

Unit assessment 5

1. K101,640

2. K24,900
3. K42,480
4. K57,250

Glossary

Agent: firm or company selling items on behalf of the owner.

Commission: amount of money paid for services.

Discount: amount of money deducted from price of an item

Marked price: price of an item before discount

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UNIT 6

TAXES AND PREMIUMS

6.1 Introduction

In unit 5 you solved problems involving commission and discount. In this unit you will learn about taxes and premiums. You will focus on solving practical problems on taxes and premiums. Government has a very heavy expenditure, and to meet this it raises money by taxes. These taxes are important because they enable the government to raise revenue, which is used for providing the people with essential services, such as road constructions and provision of health services. This unit will help you explore how government and organisations calculate taxes and premiums.

6.2 Success criteria

By the end of this unit, you must be able to:

- solve practical problems on taxes
- solve practical problems on premiums

6.3 Key words

The following are key words in this unit:

- PAYE
- premium
- tax

6.4 Taxes

What do you understand by the term tax? A tax is a compulsory contribution made by the tax payer to the state towards its expenditure. There are several types of taxes that people and organisations pay. Can you suggest some of these taxes? In this section you will learn income tax.

Income tax

Income tax is also called pay as you earn (PAYE) and is the commonest type of tax people pay to government. In order to calculate income tax, you need to have rates.

Below are the rates used for calculating income tax in 2008.

Table 1

Income per month	Rate
First K9, 000	0%
Next K3, 000	15%
In excess of K12, 000	30%

Study the table and answer the following questions:

What does (a) 0% rate on first K9, 000 mean?

(b) Income per month in excess of K12, 000 mean?

When income per month is K9, 000 or less you don't pay tax. Any income less or equal to K3, 000 on top of K9, 000 you pay 15%.

Income per month in excess of K12, 000 means remaining amount after subtracting K12,000 from the monthly income. Example below explains how you can calculate income tax.

Example:

Use the income tax rates given in table 1 to calculate the income tax payable by Ms Thema whose monthly income is MK40, 000.

Solution

Income	Rate	Tax
First MK9, 000	0%	None
Next MK3, 000	15%	$\text{MK3, 000} \times \frac{15}{100} = \text{MK450}$
Remainder MK28, 000	30%	$\text{MK28, 000} \times \frac{30}{100} = \text{MK8, 400}$
Total income MK40, 000		Total tax = MK8, 850

Some portions of the monthly income of some employees in government or private sector are not taxed. These non-taxable portions are called tax-free allowances.

Example

A lady has an income of MK80, 000 per month. She has a husband, three children and a mother who depend on her. Find how much tax she pays per month if she gets the following tax free allowances:

1. personal - MK9, 000
2. marriage - MK3, 000
3. children - MK2, 000 per child
4. dependants - MK1, 000

Tax free allowances

Personal = MK 9, 000

Marriage = MK 3, 000

Children (3 × MK2, 000) = MK 6, 000

Dependants	=	MK 1, 000
Total	=	MK19, 000
Taxable Income	=	MK80, 000 – MK19, 000
	=	MK61, 000

Income	Rate	Tax
Next MK3, 000	15%	$\text{MK3, 000} \times \frac{15}{100} = \text{MK450}$
Remainder MK 58, 000	30%	$\text{MK58, 000} \times \frac{30}{100} = \text{MK17, 900}$
Total taxable income MK 65, 000		Total tax = MK17, 850

Self assessment 1

Using table 1, work out the following problems:

- Mr Zimba's salary is MK35, 000 per month and his wife's salary is MK23, 000 per month. Find the total amount of income tax they pay in one year?
- A certain organisation gives the following tax free allowances to its civil servants.
 - MK3, 000 personal allowance
 - MK2, 500 marriage allowance
 - MK1, 500 child allowance (up to four children)
 - MK1, 000 dependants allowance

How much tax does a civil servant pay if he has a wife, 3 children and one grandson if his gross income is MK75, 000?

- A company pays a man a salary of MK1.5 million per annum.
 - How much tax is deducted every month?
 - Express his annual tax as a percentage of his taxable annual income?

6.5 Premiums

It is common to see people insure various things including their lives. As a result, they pay monthly or yearly contribution towards their insurance policies. The monthly or yearly contributions are called premiums. In this section you will solve practical problems involving premiums. Study the example below:

Example

Mr. Mwafulirwa owns a factory in Blantyre and insured it against fire. The yearly premium is MK100 per MK2, 000. What does he pay yearly to his factory worth MK5 million?

Solution

The premium per year will be:

$$\begin{aligned}
 & \frac{K100 \times K5,000,000}{K200} \\
 = & \frac{K500,000}{2} \\
 = & K250,000
 \end{aligned}$$

Sometimes you calculate premiums using a table. Study the table below

Table 2

Age	Annual premium per MK10, 000 at death or after			
	20 years	25 years	30 years	35 years
20	MK1, 000	MK950	MK900	MK800
25	MK1, 500	MK1, 450	MK1, 400	MK1, 300
30	MK2, 000	MK1, 950	MK1, 900	MK1, 800
35	MK2, 500	MK2, 450	MK2, 406	MK2, 300

Table 2 indicates annual premiums payable at the indicated ages. These premiums are charged by Insurance Company for savings (endowment). These premiums are charged per MK10, 000 of the amount insured and payable by the insurance company at death or after the indicated years. Note that Insurance companies may also charge their premiums in percentages.

Example:

Use table 2 to work out the following problems:

- What annual premium must a 20 year old woman pay for an insurance policy of MK50, 000 payable in 25 years time?
- What must she pay for an insurance policy of MK170, 000 payable after 35 years?

Solution

- Value of the policy is MK50, 000
The monthly premium for 20 a year old woman payable in 25 years is MK950

$$\begin{aligned}
 \text{Therefore her annual premium} &= \frac{MK50,000 \times MK950}{MK10,000} \\
 &= MK4,750
 \end{aligned}$$

- Value of the policy is MK170, 000
Her monthly premium payable in 35 years is MK800

$$\begin{aligned}
 \text{Therefore her annual premium} &= \frac{MK170,000 \times MK800}{MK10,000} \\
 &= MK13,600
 \end{aligned}$$

Self assessment 2

1. Write down any three insurance policies that people have in Malawi.
2. By how much is the annual premium for an insurance policy of MK80, 000 payable in 20 years time for a 20 years old man less than that of a 35 year old man for the same policy and the same period of time?

6.6 Summary

People pay income tax to the government depending on the amount of money they receive. These taxes help the government to provide various services to its citizens.

The amounts of money people pay to the insurance companies are called premiums. This is one way of protecting their properties and even their lives against theft or accidents.

6.7 Unit assessment 6

1. Why are taxes important to the government?
2. Explain why the premium table (table 2) shows that the older the client, the more the premium s/he pays to an insurance company.
3. Express the annual premiums per MK10, 000 at death or after the indicated years in table 2 as percentages.

6.8 Suggested answers

Self assessment1

1. Mr. Zimba's salary = MK35, 000

Income	Rate	Tax
First MK9, 000	0%	None
Next MK3, 000	15%	$\text{MK3, 000} \times \frac{15}{100} = \text{MK450}$
Remainder MK23, 000	30%	$\text{MK23, 000} \times \frac{30}{100} = \text{MK6, 900}$
Total Income MK35, 000		Total tax =MK7, 350

If he pays MK7, 350 in a month, therefore in a year he pays:

$$\begin{aligned} & \text{MK6, 450} \times 12 \\ & = \text{MK88, 200} \end{aligned}$$

- Mrs. Zimba's salary = MK23, 000

Income	Rate	Tax
First MK9, 000	0%	None
Next MK3, 000	15%	$\text{MK3, 000} \times \frac{15}{100} = \text{MK450}$
Remainder MK11, 000	30%	$\text{MK11, 000} \times \frac{30}{100} = \text{MK3, 300}$
Total Income MK23, 000		Total Tax = MK3, 750

If she pays MK3, 750 in a month, therefore in a year she pays:

$$\begin{aligned} & \text{MK3, 750} \times 12 \\ & = \text{MK45, 000} \end{aligned}$$

Therefore in a year both of them pay:

$$\begin{aligned} & \text{MK7, 350} + \text{MK45, 000} \\ & = \text{MK52, 350} \end{aligned}$$

2. The civil servants' salary = MK75, 000

Total allowances:

Personal allowance	=	MK3, 000
Marriage allowance	=	MK2, 500
Child allowance (3 × MK1, 500)	=	MK4, 500
Dependants allowance	=	MK1, 000
Total	=	<u>MK11, 000</u>

$$\begin{aligned} \text{Taxable income} &= \text{MK75, 000} - \text{MK11, 000} \\ &= \text{MK64, 000} \end{aligned}$$

Income	Rate	Tax
First MK9, 000	0%	None
Next MK3, 000	15%	$\text{MK3, 000} \times \frac{15}{100} = \text{MK450}$
Remainder MK52, 000	30%	$\text{MK52, 000} \times \frac{30}{100} = \text{MK15, 600}$
Total taxable Income MK75, 000		Total Tax = MK16, 050

3. The employee's salary = MK1.5 million
Therefore his monthly income = MK1, 500, 000 12
= MK125, 000

His monthly tax is as follows:

Income	Rate	Tax
First MK9, 000	0%	None
Next MK3, 000	15%	$\text{MK3, 000} \times \frac{15}{100} = \text{MK450}$
Remainder MK113, 000	30%	$\text{MK113, 000} \times \frac{30}{100} = \text{MK33, 900}$
Total monthly income MK125, 000		Total Tax = MK34, 350

His annual tax as a percentage of his taxable annual income:

$$\frac{\text{MK}34,350 \times 12 \times 100}{\text{MK}1,500,000}$$
$$= 27.48\%$$

Self assessment 2

1. Life assurance, car insurance, house insurance
2. Value of the policy is MK80, 000
The monthly premium for a 20 year old man payable in 20 years is MK1, 000

$$\begin{aligned}\text{Therefore his annual premium} &= \frac{\text{MK}80,000 \times \text{MK}1,000}{\text{MK}10,000} \\ &= \text{MK}8, 000\end{aligned}$$

The monthly premium for a 35 year old man payable in 20 years is MK2, 500

$$\begin{aligned}\text{Therefore his annual premium} &= \frac{\text{MK}80,000 \times \text{MK}2,600}{\text{MK}10,000} \\ &= \text{MK}20, 000\end{aligned}$$

$$\begin{aligned}\text{The difference between the two premiums} &= \text{MK}20, 000 - \text{MK}8, 000 \\ &= \text{MK}12, 000\end{aligned}$$

The first policy holder is paying MK12, 000 less than the other.

Unit assessment 6

1. Taxes are important to the government because they enable it to raise revenue that is used to provide essential services such as health services and construction of infrastructure to its citizens.
2. The older the client the more premium s/he pays because the older the client the higher the probability of him/her to die sooner than the younger client.

Age	Annual premium as %			
	20 years	25 years	30 years	35 years
20	10%	9.5%	9%	8%
25	15%	14.5%	14%	13%
30	20%	19.5%	19%	18%
35	25%	24.5%	24.06%	23%

Glossary

Income tax: tax one pays according to his/her income

Premium: the monthly or yearly contribution one pays to insurance companies

Tax: a compulsory contribution made by an individual or organisation to the state towards its expenditure

Reference

Malewezi, FR and Mwanjabe, BEJ, (1989). *Secondary School Mathematics Book 1*. Blantyre: Dzuka Publishing Company.

7.1 Introduction

In unit 6, you learned about taxes and premiums. You solved practical problems involving taxes and premiums. In this unit you will learn about budgets and bills. You are aware that people pay for goods and services in their everyday life. Some companies provide public utilities like water, electricity and telephones. These companies prepare bills and issue them to their customers. The knowledge that you will acquire from this unit will help you prepare household budgets and work out bills. You will also use the knowledge to solve practical problems on budgets and bills.

7.2 Success criteria

By the end of this unit you must be able to:

- Prepare household budgets
- Work out bills
- Teach budgets and bills effectively

7.3 Key words

- bill
- budget

7.4 Household budgets and bills

Budgets and bills are usually handled together. Can you explain the difference between budgets and bills? A budget is a general plan of the items one would like to buy. On the other hand, a bill is an invoice that one pays for in return to the services rendered or goods purchased. In the following subsections you will learn how to prepare household budgets and bills.

7.4.1 Preparing a budget

Imagine you are planning to purchase the following items for a birthday party: 3 chickens at K500 each, 5 heaps of tomatoes at K50 per heap, 10 bulbs of onions at K20 each, 2 packets of rice at K980 each. Prepare a budget for these purchases.

Your budget should look like the one below:

3 chickens at K500 each	=	K1,500.00
5 heaps of tomatoes at K50/ heap	=	K 250.00
10 bulbs of onions at K20/ bulb	=	K 200.00
2 packets of rice at K980 each	=	<u>K1,960.00</u>
Total	=	<u>K3,910.00</u>

Self assessment 1

1. Brian was asked to buy 2 kg beef at K600 per kg, 5 heaps of tomatoes at K60 per heap, 8 kg rice at K150 per kg and a chicken for K450. How much money did he spend?
2. A school bought 400 boxes of chalk at K263.45 per box, 32 dusters at K100 each, 6 dictionaries at K2,114.69 each and 8 chalkboard rulers at K120 each. How much did the school spend?

7.4.2 Working out bills

In section 7.4.1, you practised preparing budgets from given information. In this section you will learn how to work out bills from a given price list of items.

Study the price list of items below

Table 1: Price list

ITEMS	PRICE PER ITEM
Sugar	K125.00 per kg
Cooking oil	K560.00 per litre
Palmolive soap	K110.00 per litre
Surf (liquid)	K395.00 per litre
Table salt	K 62.50 per litre
Chambo fish	K165.00 per litre
Flour	K200.00 per each
Yeast	K 95.00 per bottle
Milk	K 96.00 per bottle
Soft drinks	K 50.00 per bottle

Now consider the following question:

A girl went to a grocery store and bought 18 bottles of soft drinks, 13 Kg of flour, 5 bottles of milk and 2 bottles of yeast. How much money did she pay?

Use the price list above, to come up with a working sequence for finding the total bill. Here is what you can do:

18 bottles of soft drinks at K50 each	=	K 900.00
13 kg flour at K200.00 per kg	=	K2, 600.00
5 bottles of milk at K96.00 per bottle	=	K 480.00
2 bottles of yeast at K95. 00 per bottle	=	<u>K 190.00</u>
		<u>K 4,170.00</u>

Self assessment 2

Study the price list below:

Price list

Mangoes K50 per kg

Sauce K480 per bottle

Potato K210 per kg

Chicken K560 each

Soap K115 per tablet

- (a) Find the total bill a man would pay after buying 4kg of mangoes, 6 kg of potatoes, 2 chickens and 3 bottles of sauce.
- (b) How much change would he get after paying K5, 000.00?

7.5. Teaching budget and bills

You are required to have some knowledge on how you can teach budget and bills to your learners. How can you do this? You will need resources like a shopping corner, shopping items and price tags. Then follow the guide lines below:

1. Collect various items or their wrappers for example soap, biscuits pens, from the environment.
2. Attach price tags to the items collected.
3. Put these items on the table either made of sticks and grass or a wooden table. What you have made is a shopping corner. A shopping corner is a place in a classroom where a list of items is put and their prices attached for the learners to practise a shopping activity.
4. You will use the items on this table to demonstrate preparing budgets and working out bills with your learners.

You can also teach concept of budgets and bills by visiting the nearest shop with your learners and collect a list of items and their prices. Using information obtained the learners can prepare budgets and work out bills.

Self assessment 3

Write any two success criteria for teaching budgets and bills in standard 7.

7.6. Summary

In this unit you have learned budgets and bills. A budget is a general plan of the items one would like to buy and a bill is an invoice that one pays for the services rendered or goods bought. A good budget does not go beyond one's financial capacity. You learned how to prepare household budgets and workout bills. You also learnt how to teach budgets and bills using shopping corner.

7.7. Unit assessment 7

A college uses the following food items in the kitchen on weekly basis to feed 350 students.

Table of food items

6 beef meals of 45 Kg each
11 bean meals of 25 Kg each
11 nsima meals of 65 Kg each
2 fruit meals of 50 Kg bananas each
4 rice meals of 125 Kg each
2 egg meals of 24 units each
1 vegetable meal of 50 Kg cabbage daily
20 Kg sugar for porridge and tea per day.
42 Kg kitchen salt
28 Kg table salt
70 litres cooking oil
14 Kg powdered milk
14 500g curry powder
20 500g tea leaves

Price list

Beef	K 600 per kg
Beans	K180 per kg
Maize flour	K75 per kg
Sugar	K125 per kg
Kitchen salt	K 85 per kg
Cooking oil	K450/litre
Milk powder	K 895 per kg
Curry	K115 per kg
Tea leaves	K103.35 per kg
Vegetable (cabbage)	K56 per kg

Eggs	K250 per unit
Rice	K167 per kg
Table salt	K105 per kg
Bananas	K 45 per kg

1(a) Prepare a one week budget for the college using the information provided.

(b) Work out the college bill for a period of four weeks.

2. Prepare three questions you would ask your class using the price list given in section 7.4.2.

7.8 Suggested answers

Self assessment 1

1.	2 Kg beef at K600 per Kg	=	K1,200
	5 heaps of tomatoes at K60 per soap	=	K 300
	8 Kg rice at K150 per Kg	=	K1,200
	1 Chicken at K450	=	<u>K 450</u>
	Total	=	<u>K3,150</u>
2.	400 boxes of chalk at K263.45/box	=	K105,380.00
	32 dusters at K100 each	=	K 3,200.00
	6 dictionaries at K2,114. 69 each	=	K 12,688.14
	8 Chalkboard rulers at k120 each	=	<u>K 960.00</u>
			<u>K121,928.14</u>

Self assessment 2

(a)	4Kg of mangoes at K50 per Kg	=	K 200.00
	6Kg of potatoes at K210 per Kg	=	K1,260.00
	2 Chickens at K560 each	=	K1,120.00
	3 bottles of sauce at K480 per bottle	=	<u>K1,440.00</u>
	Total	=	<u>K4,020.00</u>

(b) Change would be K5,000.00 - K4020.00 = **K 980.00**

Self assessment 3

Learners must be able to:

- Prepare budgets
- Work out bills

Unit assessment 7

1. 6 beef meals of 45 Kg each at K600/Kg	=	6x45 x 1600	=K162,000.00
11 bean meals of 25 Kg each at K180/Kg	=	11x 25 x K180	=K 49,500.00
11 nsima meals of 65 Kg each at K75/Kg	=	11x 65 x K 75	=K 53,625.00
2 fruit meals of 50Kg bananas at K45/Kg	=	2 x 50 x K45	=K 4,500.00
4 rice meals of 125 Kg each at K167/Kg	=	4 x125 x K167	= K 83,500.00
2 egg meals of 24 units each at K250/Kg	=	2 x 24 x K250	= K12,000.00
7 vegetable meals of 50Kg cabbage at K56/Kg	=	7 x 50 x K56	= K19,600.00
20Kg sugar daily at K125 per Kg	=	7 x 20 K125	= K17,500.00
42Kg kitchen salt at K85/Kg	=	1 x 42 x K 85	= K 3,570.00
28Kg table salt at K105/Kg	=	1 x42 x K85	= K 2,940.00
70 litres cooking oil at K450/litre	=	1x70 x K450	= K31,500.00
14 Kg powdered milk at 895/ litre	=	1x14 x K895	= K12,530.00
14 500g curry powder at K115/Kg	=	14 .5 x K115	= K 1,667.50
20 500g tea leaves at K103.35	=	20 .5 x K103.35	= <u>K 2,118.68</u>
Total budget for 1 week			= <u>K456,591.18</u>

b. For a period of 4 weeks the college bill will be K456,591.18

$$\begin{array}{r} \times \quad 4 \\ \hline \mathbf{\underline{K1,826,364.72}} \end{array}$$

2. Subjective

Glossary

Budget: A list of items to be bought showing the quantity and price of each item.

Bill: Invoice that needs to be paid for shopping corner

References

Malawi Institute of Education (2008). Malawi Primary Education Mathematics. Teachers Guide for Standard 7. Domasi. MIE.

UNIT 8

TEACHING OF MONEY

8.1 Introduction

In unit 7, you learned about how you can prepare budgets and work out bills. The work on budgets and bills involved money. In this unit you will explore effective ways of teaching concepts and skills on money. Money plays a very important role in your everyday life activities. It is a medium of exchange. It has value and must be accepted. Teaching money involves assisting learners in recognising, naming, writing and finding values of different forms of money. In this unit, you will acquire skills suitable for teaching of money.

8.2 Success criteria

By the end of this unit, you must be able to:

- use appropriate methodologies and resources when teaching concepts and skills on money
- teach basic operation on money

8.3 Key words

The following are key words in this unit:

- price tag
- shopping scene

8.4 Concepts and skills on money

Money is the medium of exchange. Children come to school with some ideas about money. They have been to places where people buy and sell commodities such as shops, groceries and farm produce markets. However, this does not mean they understand the concepts of money. In this section, you will learn about how to teach concepts and skills such as recognising, naming and values of money.

8.4.1 Teaching recognition of money

Money is in two forms namely coins and bank notes. The following activity will help you acquire the skill of recognising money.

1. Have coins of different values.
2. Pick one coin. Observe and describe the coin in terms of colour, size and features on it.
3. Do the same with other coins
4. State similarities and differences between the coins.
5. Now have different bank notes.
6. Repeat steps 1 to 4 using bank notes.

Note that you can use the same steps when teaching learners recognition of money. In addition you should emphasise on correct pronunciation of each. You can also involve learners in tracing the coins.

8.4.2 Teaching writing of money

In section 8.4.1, you learned about how to teach recognition of money. In this section you will explore how to teach writing of money. How can you teach writing of money? You can:

- Pick a coin or bank note and ask learners to name it.
- Demonstrate how to write it on the chalkboard in full. For example 1 tambala, 5 kwacha and 400 kwacha.
- Demonstrate how to write the money in short form. For example 1t, K5 and K400.
- Ask learners to practice writing money in short form

Sometimes you can write money in kwacha and tambala. For example you can have 1 kwacha and 50 tambala. You can write this as K1.50t. However, when writing in kwacha only you should use decimal notation. Therefore, K1 50t becomes K1.50.

Note that you should give learners enough time to practice writing money in decimal notations.

8.4.3 Teaching values of money

Having known recognition and writing of money, you can now involve learners in expressing money in terms of others. You need a collection of different coins and bank notes in order to teach this effectively. You can use the following points:

- Give learners several 1t coins.
- Ask them to pick 1t coins that make 5t.
- Help learners to establish that five 1t coins make 5t.
- Repeat expressing values of money in terms of others such as K20 in terms of K5, K100 in terms of K10.
- You can summarise this using a chart as follows:

5t 1t, 1t, 1t, 1t, 1t

10t 2t, 2t, 2t, 2t, 2t

K10 K5, K5

K100 K20, K20, K20, K20, K10, K10

Self assessment 1

1. Explain an activity that you can do with your learners on recognition of money.
2. Convert the following to Kwacha and tambala:
 - (a) 84t
 - (b) 2305t

8.5 Teaching basic operation of money.

You can teach basic operations of money effectively by using experiences from everyday situations where the total of two or more prices is calculated. In this section you will investigate different approaches of teaching addition, subtraction, multiplication and division of money. The use of shopping scene will help you teach the operations effectively.

8.5.1 Addition of money

Addition of money involves finding the total amount of prices for two or more items. When introducing addition of money you should organise a shopping scene. What is a shopping scene? It is a role play where by learners practice selling and buying items. These items include real objects, wrappers, packets and tins. You should attach price tags to each item and display them on a shopping corner (mini market) in the classroom.

Do you have any idea on how to use a shopping scene when teaching addition of money? You can:

- Choose one learner to be a shopkeeper.
- Ask another learner to buy two items of different prices. For example a packet of salt at K20 and a box of matches at K5.
- Tell the shopkeeper to find the total cost of the two items.
- Let the customer pay exact amount of money.
- Help learners to establish that $K20 + K5 = K25$.
- Let them continue the buying and selling of different items from the shopping scene using other learners.

Note that you should put much emphasis on finding the total amount for the items bought. After using shopping scene, teach learners how to solve problems involving addition of money using vertical arrangement. Consider the following example:

Thoko bought a pencil at K8.50 and a rubber at K10.70. How much did he pay altogether?

Solution

$$\begin{array}{r} \text{K} \quad \text{T} \\ 8 \quad 50 \\ +10 \quad 70 \\ \hline 19 \quad 20 \end{array}$$

8.5.2 Subtraction of money

Like in addition, you should approach subtraction of money practically using a shopping scene. You can use the following steps:

- Set up a shopping corner where farm produce and grocery items are displayed.
- Ask one learner to be a shopkeeper and ask another learner to be a customer.

- Ask the customer to buy one item say a packet of sugar at K125 and pay K 130.
- Let the shopkeeper give the item and correct change.
- Help learners to establish that $K130 - K125 = K5$.
- Let other learners practice buying and selling items. They should pay money which will need change.

In the process of buying and selling remember to ask learners questions like:

- What did you buy?
- How much did it cost?
- How much did you give the shopkeeper?
- What change did you get?

Then involve learners in solving problems on subtraction of money using vertical arrangement as in the following example:

Example:

Chimwemwe bought an exercise book which cost K60. If she gave the shopkeeper K100, how much change did she get?

Solution

$$\begin{array}{r}
 \text{K} \quad \text{t} \\
 100 \quad 00 \\
 - \quad 60 \quad 00 \\
 \hline
 40 \quad 00
 \end{array}$$

Self assessment 2

When teaching addition using a shopping scene, why is it advisable for learners to use exact amounts of money to buy the items?

8.5.3 Multiplication of money

In sections 8.5 1 and 8.5.2 you learnt about how to teach addition and subtraction of money. In this unit you will explore how to teach multiplication of money. The use of shopping scene is also important in teaching multiplication of money.

You can use the following steps:

1. Ask the customer to buy three or more items of the same kind say four exercise books at K12. 00 each.
2. The shopkeeper should find the total cost using repeated addition as follows:

$$\begin{array}{r}
 \text{K}12.00 \\
 \text{K}12.00 \\
 \text{K}12.00 \\
 + \text{K}12.00 \\
 \hline
 \text{K}48.00
 \end{array}$$

3. Help learners to establish that the total cost can be found by multiplying the cost by the number of items. In this case it will be $\text{K}12.00 \times 4 = \text{K}48.00$.

$$\begin{array}{r}
 \text{Or} \quad \text{K}12.00 \\
 \quad \quad \times \quad 4 \\
 \hline
 \quad \quad \text{K}48.00
 \end{array}$$

4. You should repeat the activity with a wide range of items being sold or bought.

8.5.4 Division of money

Division of money involves calculating the number of items bought at the same cost price when given the total cost. Sometimes you work out the cost of each item given the total cost and total number of items. You should teach the concept by using examples from everyday life. Consider the following situation:

If you have K200 and would like to buy oranges which are selling at K20 each, how many oranges would you buy? How would you work out the number of oranges to be bought? The approach would be as follows:

$$\begin{array}{l}
 \text{K}200 \div \text{K}20 \\
 \text{200} \\
 \text{20} \overline{) 200} = 10 \text{ oranges.}
 \end{array}$$

You should give learners more questions based on calculating the number of items when given the total cost and the price per item.

Self assessment 3

1. Briefly explain how you can teach multiplication of money using the shopping scene.
2. Show how you would carry out division of money in decimals like $\text{K}60.48 \div 9$.

8.6 Summary

In this unit, you have learnt about concepts and skills on money. These include recognition, naming, writing and finding the value of money in terms of others. When teaching expressing value of money in terms of others, you need to have a collection of different coins and bank notes.

You have also explored different ways of teaching basic operation of money. The use of shop scene is very important when teaching these operations.

8.7 Unit assessment 8

1. Give advantages of using a shopping scene when teaching basic operations of money.
2. Write a lesson plan on subtraction of money using the shopping scene.

9.8 Suggested answers

Self assessment 1

1. Activities on recognition include:

- Give learners a 20t coin and let them describe it in terms of colour, size and other features.
- Ask learners to pick a 20t coin from a group of different coins.

3. (a) K0.84 (b) K23.05

Self assessment 2

At this stage learners have not learned subtraction of money therefore they cannot give change.

Self assessment 3

1. Ask learners to buy three or more items of the same price and tell them to find the total cost. The total cost is equal to the price of an item multiplied by the number of items bought.
2. Arrange division sentence in form of long division as follows:

$$\begin{array}{r} \text{K}6.72 \\ 9 \overline{) \text{K } 60.48} \\ \underline{- 54} \\ 64 \\ \underline{- 63} \\ 18 \\ \underline{- 18} \\ 0 \end{array}$$

Unit assessment 8

1. Advantages of using a shopping scene include:

- Learners experience real life situations
- Learners role play adult roles that is a customer and shopkeeper

- Teaching and learning process is participatory

2. Practical

Glossary

Shopping scene: is a role play where by learners practice buying and selling items.

Price tag: label indicating the price of a commodity.

References

Ministry of Education (2005) Initial Primary teacher Education Teaching Syllabus for Numeracy and Mathematics, MIE, Domasi.

Ministry of Education (2006) Initial Primary Teacher Education Numeracy and Mathematics Student Handbook for term 2, MIE, Domasi.

UNIT 9

POSTAL AND BANK SERVICES

9.1 Introduction

In unit 8, you learned about how you can teach money particularly concepts, skills and the basic operations on money. In this unit, you will learn about postal and bank services. The idea about postal and bank services is very important to you since you use these services in your everyday life.

9.2 Success criteria

By the end of this unit, you must be able to:

- solve problems on postal services
- solve problems on bank services

9.3 Key words

The following is the key word in this unit:

- ATM Card

9.4 Postal services

You have been at the post office and know how important it is. Can you suggest the service that the post office offers? The post office offers several postal services some of which are sending letters and parcels, telephones, fax, electronic mail (e-mail) telegram and telex. They also offer monetary services which include money orders, postal orders, telegrams and fast cash.

9.4.1 Calculating charges for sending letters and small parcels by surface mail.

When the post office offers you some services, it charges you some amount of money. The amount of charge depends on the type of service rendered. Below are the postage rates for sending different articles.

Rates of postage in respect of postal articles transmitted by surface in the domestic service

Table 1

POSTAL ARTICLES	POSTAGE RATE PER WEIGHT	
<u>Letters and small packets</u>	Up to 20g	K 40
	Above 20g up to 100g	K 100
	Above 100g up to 250g	K 195
	Above 250g up to 500g	K 370
	Above 500g up to 1000g	K 640
	Above 1000g up to 2000g	K1,030
	Per additional step of 1000g	K 520

<u>Post Cards</u>		K20each
<u>Newspaper</u>	Up to 20g	K25
	Above 20g up to 100g	K45
	Above 100g up to 250g	K80
	Above 250g up to 500g	K145
	Above 500 up to 1000g	K240
	Above 1000g up to 2000g	K340
	Per additional step of 1000g	K170
<u>Literature of the blind</u>	Free up to 7Kgs, additional 1000g	K300
<u>Library books to and from bonafide libraries only</u>		
<u>Parcels</u>	Domestic	
	Up to 1kg	K 240
	Above 1kg up to 3kg	K 395
	Above 3kg up to 5kg	K 475
	Above 5kg up to 10kg	K 660
	Above 10kg up to 15kg	K 915
	Above 15kg up to 20kg	K1,285
	Per additional step of 1000g	K 520

Study the table above. Now, calculate charges for sending a letter of mass 28.09g. This is what you can do. The mass 28.09g is in the section above 20g up to 100g. Therefore a person will pay K100.00.

Now, consider the following example:

Question

What is the total cost of posting the following articles within Malawi:

A letter weighting 110g, a letter weighting 95g and literature for the blind weighting 5Kg.

Solution

A letter weighting 110g : K195.00

A letter weighting 95g : K100.00

Literature for the blind weighting 5Kg : K 00.00

K295.00

Self Assessment 1

1. What would be the total cost of sending the following items: a letter weighing 120g, 3 letters each weighting about 750g, 2 post cards, and newspapers weighing 1.5 kg.
2. What would be the postage charge for sending 2 small packets weighting 1.792kg?

9.4.2 Calculating charges for sending postal articles by air mail.

In subsection 9.4.1, you calculated the charges for sending various items by surface mail. In this subsection, you are going to calculate charges for sending postal articles by air mail.

Now, study the following table:

Table 2

Rates of postage in respect of postal articles transmitted by air mail			
Country of destination	Letter	A letter Aerograms and post cards)	News papers, printed paper, literature for the blind and small packets
All countries in Africa including Malagasy, Mautitius and sychellers	K60 per 10g or part thereof	K60	K55 per 10g or part thereof
Great Britain and Ireland, East of Europe, India, Pakistan and Middle East	K65 per 10g or part	K65	K 60 per 10g or part thereof
North, Central and South America, West Indies, Japan and the far East	K70 per 10g or part thereof	K70	K65 per 10g or part thereof

Using the table above, can you calculate the cost of sending a newspaper weighing 20g and a letter weighing 10g from Malawi to Britain? To calculate the cost, you can do the following:

Cost of sending newspapers weighing 20g = K110.00

Cost of sending a letter weighing 10g = K 60.00

K170.00

Self Assessment 2

Use table 2 to answer the following questions:

1. How much would James pay for sending a 306 g parcel by air from Malawi to Mexico?
2. What is the total cost of sending 5 air letters and an 11g packet by air mail to Japan from Zomba?

9.5 Bank services

Banks offer various services to the general public. Such services include sending and receiving money. In this section, you will focus on sending and receiving money through savings and current accounts. You will also explore how to fill various bank forms for the required bank service.

9.5.1 Savings account

Savings account is an account with the initial deposit for its opening. To open this account, one has to complete a form and the bank requires a specimen of the customer's signature for future transactions. After opening the accounts, a customer gets an Auto Teller Machine (ATM) Card. When depositing money in a savings account, a customer complete two deposit slips. The bank keeps one and the customer keeps the duplicate. The figure below shows a sample of a cash deposit slip for National Bank of Malawi.

Drawing on page 73 of mathematics learners book for standard 7 (PCAR)

Use the cash deposit slip above to answer the questions that follows:

Mary Zulu of Box 54, Salima, wants to deposit ten K500 notes, nine K200 notes, two K100 notes, one K50 note, twenty K20 notes, fifty K10 notes and three K5 coins into her savings account number 0243000456. Complete a deposit slip form for Mary.

Solution

Account number	0	2	4	3	0	0	0	4	5	6
----------------	---	---	---	---	---	---	---	---	---	---

Notes	K5		
	K10	K500	
	K20	K400	
	K50	K50	
	K100	K200	
	K200	K1800	
	K500	K5000	
	Silver	K 15	
	Copper		
Potal/ Money orders			
Total Cash		K 7,965	

Now that you can fill the cash deposit form, how do you think you can withdraw your money from the bank? You will need to fill the cash withdrawal form. Sometimes the bank teller will ask for your identity card such as a passport or driver's licence just to make sure that the bank is paying the right person.

Study the diagram below:

Copy the diagram for Cash withdrawal form on page 74 Mathematics Learners. Book for Standard 7

After filling this form, the bank teller will request you to sign on the reverse side of the form which shows you acknowledge receipt of cash you requested to withdraw.

Self assessment 3

1. Fill a deposit slip to deposit the following money:

Four K500 notes, two K100 notes, five K50 notes, ten K10 coins, five K5 coins, ten K1 coins and fifty 1t coins, suppose you have a savings account number 0454300215 with a bank.
2. Reymond would like to withdraw K5000 from his savings account number 0015433267. Show how he would fill a withdrawal form.

9.5.2 Current account

Opening current account is similar to opening a savings account. As a customer, you get a cheque book and an ATM Card. To deposit money in this account is similar to savings account. To withdraw money, a customer writes a cheque indicating the amount of money to be paid and to whom it is payable. A customer can also use an ATM Card to withdraw money from this account.

When a customer wants to deposit a cheque in the account, he/she completes a cheque deposit slip. See the diagram below:

Copy diagram on page 74 of Mathematics Learners' Book for Standard 7

9.6 Summary

In this unit, you have learned two main services which are postal and bank services. Postal Services include sending letters and parcels among other services. The bank services include the opening of Savings and Current accounts.

9.7 Unit assessment 9

1. Using the table in Section 9.4.1, find the postage charge for sending a parcel of mass 1,700g which was sent from Lilongwe to Mzuzu.
2. How much would you pay the post office to send
 - (a) 40g letter to your friend within Malawi

(b) Newspapers of mass (i) 19 g?

(ii) 50g?

3. Use the information below to complete a cheque deposit form:

A cheque of K5,000 from Matola Company dated 2nd April, 2008 for Mr Banda of Box 127 Namitete (Account number 0041758900). To be deposited at National Bank of Malawi, Namitete Branch.

9.8 Suggested answers

Self assessment 1

1. K2,495

2. K2,060

Self assessment 2

1. K1,989

2. K 480

Self assessment 3

1. Practical

2. Practical

Unit assessment 9

1. K395

2. (a) K100

(b) (i) K25

(ii) K45

3. Practical

Glossary

ATM Card: A card offered at the bank to a customer that can be used to access his/ her account in terms of checking the balance, withdrawing cash, or paying bills.

Reference

Malawi Institute of Education (2007). Initial Primary Teacher Education: Numeracy

and Mathematics: Student Term 1 Domasi : (MIE)

Malawi Institute of Education (2008): Mathematics Learners' Book for Standard 7 Domasi (MIE)

UNIT 10

SIMPLE AND COMPOUND INTEREST

10.1 Introduction

In unit 9, you learnt about how people use postal and bank services in their everyday life. One of the services offered by the banks is to keep peoples' money safe and lending money to individuals and organizations. In this unit, you will learn about how to solve practical problems on simple and compound interest. The knowledge of simple and compound interest will help you understand how banks and other money lending organizations calculate interest.

10.2 Success criteria

By the end of this unit you must be able to:

- Work out practical problems on simple and compound interest
- use suitable methodologies when teaching and assessing concepts of simple and compound interest

10.3 Key words

The following are the key words in this unit:

- amount
- interest
- principal
- rate
- time

11.4 Simple interest and compound interest

You might have heard some people opening an account with one of the banks in Malawi or yourself have an account. Banks in Malawi include National bank, Standard bank, New Building Society bank, Malawi Savings bank, Opportunity International Bank of Malawi, INDE Bank. One requirement to open an account with these banks is to have an initial amount of money to deposit. This initial amount of money you deposit into the bank is called **principal**. If you borrow money, the price paid on top of the money you borrowed is called **interest**. In this case, if you deposit money into the bank, it means that the bank has borrowed money from you. At the end of agreed period (time) the bank pays something for using the money and this is your interest. Additionally, the interest paid to money borrowed by the bank is calculated on agreed percentage, known as **rate**. At the end of the agreed period, say end of year, the interest you earn is added to the principal. The total sum of the principal and the interest is called **amount**.

There are two types of interest namely, simple and compound. At this point in time, you are now familiar with terms used in simple and compound interest. Therefore, you are going to work out practical problems on simple interest first.

10.5 Simple interest

In section 10.4, you learnt the meaning of interest. Now, you will learn how to find simple interest for given problem. Study the following example:

Example

Find the simple interest on K35, 000 for 4 years at 3% per annum?

To solve this problem, you need to analyse the question . In this situation, the question says:

- per year the interest on K35,000 is 3%
- K35, 000 will receive 3% every year for 4 years.

Therefore, you can work out this problem in several ways. You can get 3% of K35, 000 for 1 year then multiply the result by 4 to give interest for 4 years. Remember 3% is the same as 3/100. This is how you can do it:

$$= (3/100 \times 35000) \times 4$$

$$= (3 \times 350) \times 4$$

$$= 1050 \times 4$$

$$= \text{K}4, 200$$

So, your answer is K4, 200

Another way to solve the problem is to think of it as follows:

- In 4 years K35, 000 at 3% will earn you $(3/100 \times 4)$
- This should give 12% of 35,000
- You can translate this to $12/100 \times 35, 000$
- You divide 35,000 by 100. This comes to $12 \times 350 = 4200$

Does this make sense to you? Now you can use a formula to work out this problem. The formula is:

$$\text{Interest (I)} = \frac{\text{Principal (P)} \times \text{Time (T)} \times \text{Rate (R)}}{100}$$

$$\text{You can shorten this to: } I = \frac{PxTxR}{100}$$

In section 10.4, you learnt that principal is money on which you base the calculation of your interest. Time is the period of time which you receive the interest. Finally, rate is that factor for determining the interest and you base it on percentage. This is why you divide the second part of the formula by 100.

Now substitute this formula:

$$I = \frac{PxTxR}{100}$$

With the figures in the problem, this should give you:

$$I = \frac{35,000 \times 4 \times 3}{100}$$

Now consider a different situation where you have the interest, the principal and rate. How can you find the time? Can you suggest? Remember, the formula for finding interest is

$$I = \frac{PxTxR}{100}$$

What you need to find is time. If you substitute, you will see that you have

$$4,200 = \frac{35,000 \times T \times 3}{100}$$

$$4200 = 350 \times 3 \times T$$

$$4200 = 1050T$$

$$420 = 1050T$$

$$4 = T$$

You can use a formula to solve this problem. How? First you make T subject of the formula.

$$I = \frac{PxTxR}{100}$$

- Multiply both sides by 100 ie $(I \times 100) = \frac{PTR \times 100}{100}$
- Cancel the denominator 100 with 100, multiplied to PTR
- This will give you the following result $I \times 100 = PTR$
- Then divide PR on both sides of the equation $\frac{100 \times I}{PR} = \frac{PTR}{PR}$
- Cancel the numerator PR with denominator PR on the right side of the equation
- The result is $\frac{I \times 100}{PR} = T$

$$\text{Therefore, } T = \frac{Ix100}{PR}$$

$$\text{Similarly you can make R or P subject. } R = \frac{100 \times I}{PT} \text{ and } P = \frac{100 \times I}{TR}$$

Example 1

Find the time in which K350 000 will earn K84 00 at 3% per annum

Solution:

$$\begin{aligned} T &= \frac{100xI}{PR} \\ &= \frac{100x8,400}{35,000x3} \end{aligned}$$

Therefore, time is 8 years

Example 2

Find the time which K15 120 will earn K3,969 interest at $3\frac{1}{2}\%$ per annum.

Solution:

$$\begin{aligned} T &= \frac{100xI}{PR} \\ &= \frac{100x3,969}{15,120x3\frac{1}{2}} \\ &= \frac{100x3,969}{15,120x\frac{7}{2}} \\ &= \frac{100x3,969x2}{15,120x7} \\ &= \frac{15}{2} \end{aligned}$$

Therefore time = $7\frac{1}{2}$ years

Example 3

Find the rate per cent per annum at which K60 000 will earn K15 000 in 5 years?

Solution:

Remember, $R = \frac{100xI}{PT}$

Therefore $R = \frac{100x15,000}{60,000x5}$

$$R = 5\%$$

Example 4

Find the principal which earn K740 in 2 years at 5%.

Solution:

Remember, $P = \frac{100xI}{TR}$

$$\begin{aligned}\text{Therefore } P &= \frac{100 \times 740}{2 \times 5} \\ &= \frac{74,000}{10}\end{aligned}$$

Principal = K7,400

Sometimes you have amount and you need to find principal. How will you find the principal? Well, the formula you can use is:

$$P = \frac{100 \times \text{Amount}}{100 + (TR)}$$

Example 6

Find the principal that would amount to K72 000 in 2 years at 10% per annum.

$$\begin{aligned}P &= \frac{100 \times 72,000}{100 + (TR)} \\ &= \frac{7,200,000}{100 + 20} \\ &= \frac{7,200,000}{120}\end{aligned}$$

Therefore, principal = K60 000

To find amount, you need to find the simple interest, and then add it to the principal.

Example 7

A woman borrows K300 000 to help to pay for a car. She agrees to pay the money back over 2 years, paying simple interest at $8\frac{1}{2}\%$ per annum. Calculate the total amount.

$$\begin{aligned}I &= \frac{PxTxR}{100} \\ &= \frac{300,000 \times 2 \times 8\frac{1}{2}}{100} \\ &= \frac{300,000 \times 2 \times \frac{17}{2}}{100} \\ &= \frac{300,000 \times 2 \times 17}{100 \times 2} \\ &= \frac{10,200,000}{200}\end{aligned}$$

$$\text{Interest} = \text{K}51,000$$

$$\begin{aligned}\text{Therefore amount} &= \text{principal} + \text{interest} \\ &= \text{K}300,000 + \text{K}51,000 \\ &= \text{K}351,000\end{aligned}$$

Self assessment 1

1. Calculate time taken for K12 800 to yield an interest of K2 240 at 5% per annum
2. At what rate will K2 872 yield an interest of K359 in 5 years?
3. Find the total amount to be paid back on a loan of K10 000 for 15 years at 8% simple interest.

10.6 Compound interest

In section 10.5, you learnt about how to calculate simple interest. In this section, you will learn how to calculate compound interest. When calculating compound interest, you find interest for year one first. The amount for year one becomes principal for the second year. Then, calculate interest for second year. The process continues up to final year. Consider the following examples:

Example 1

Calculate the compound interest on K10, 000 for 2 years at 20% per annum.

Solution:

$$\begin{aligned}1^{\text{st}} \text{ year interest} &= \frac{PTR}{100} \\ &= \frac{10,000 \times 1 \times 20}{100} \\ &= \frac{200,000}{100}\end{aligned}$$

$$\text{Therefore, interest } 1^{\text{st}} \text{ year} = \text{K}2,000$$

$$\begin{aligned}\text{Principal } 2^{\text{nd}} \text{ year} &= \text{K}10,000 + \text{K}2,000 \\ &= \text{K}12,000\end{aligned}$$

$$\begin{aligned}\text{Interest } 2^{\text{nd}} \text{ year} &= \frac{12,000 \times 1 \times 20}{100} \\ &= \frac{240,000}{100}\end{aligned}$$

$$\begin{aligned}\text{Interest 2}^{\text{nd}} \text{ year} &= \text{K2, 400, Amount} = \text{K12,000} + \text{K2,400} = \text{K14,400} \\ \therefore \text{Compound Interest} &= A - P = \text{K14,400} - \text{K10,000} = \text{K4,400.00}\end{aligned}$$

In some cases, you will find out that the number of years are so many and calculating compound interest using the procedure discussed above, becomes tiresome. What do you think would be the suitable way of calculating compound interest in this case? You use the following formula:

$$A = P \left(1 + \frac{r}{100}\right)^n$$

Whereas A is amount

 P is principal

 R is rate

 n is number of years

To find compound interest, you first calculate the amount. Thereafter, you subtract the principal from the amount in order to find the interest.

Note: You will need to use a calculator in your calculations.

Example 2

Calculate the amount when K484 is saved for 2 years at 5% per annum compound interest.

Solution:

$$A = P (1 + r/100)^n$$

$$A = 484 \left(1 + \frac{5}{100}\right)^2$$

$$A = 484(1+0.05)^2 \quad (\text{change the fraction into decimal number by dividing 5 by 100})$$

$$A = 484(1.05)^2 \quad (\text{add 1 and 0.05 to make 1.05})$$

$$A = 484 \times 1.1025 \quad (\text{square 1.05 or multiply 1.05 by 1.05 which gives you 1.1025})$$

$$A = \text{K533.61}$$

To find interest = Amount – Principal

$$= \text{K533.61} - \text{K484.00}$$

$$= \text{K49.61}$$

Note that $(1.05)^2$ means you multiply 1.05 two times or square it.

Self assessment 2

1. Calculate the compound interest on K10 000 for 3 years at 7% per annum.
2. Find the sum to which K2 750 will amount in 3 years at 7 % per annum.

10.6 Teaching methodologies for simple and compound interest

In sections 11.4 and 11.5, you learnt how to calculate simple and compound interest. In this section, you will explore how to teach simple and compound interest. The following points will help you teach the topic of simple and compound interest effectively.

- Explore learners' experiences on loans that business people get and the price charged for the money borrowed
- Discuss why interest is charged on the money borrowed?
- Explain to learners the relationship between the terms in simple and compound interest such as interest, principal, rate, time, and amount.
- Explain to the learners the origin of denominator 100 in the formula $\frac{PTR}{100}$

For example, to find interest, you multiply the principal by the time. And you multiply the product by the rate, which has a denominator 100. Hence, the formula has a denominator 100.

- Involve learners to solve practical problems on simple and compound interest by using formulas
- Advise learners to use calculators in order to solve difficult problems involving complicated formulas e.g. compound interest

10.7 Summary

In this unit, you learnt how to solve problems on simple and compound interest. Simple interest is

calculated using the formula $I = \frac{PTR}{100}$ where P is principal, R is rate, and T is time for which the money

is borrowed or saved. With compound interest, the interest is added to the principal at the end of each year or interval. You can use the formula $A = P(1 + R/100)^n$ and compound interest = A - P when calculating compound interest where A = amount and n = time. Rate is in percentage, as a result, it is $\frac{R}{100}$

10.8 Unit assessment 10

1. Calculate the simple interest on K2 300.50 for four years at 8% per annum.
2. Find the sum which K5 500 amounts to in 2 years at 20% per annum compound interest.
3. Calculate the difference between the compound interest and simple interest on K6 000 for 2 years at 10% per annum.

10.9 Suggested answers

Self assessment 1

1. Time is $3\frac{1}{2}$ years
2. Rate is $2\frac{1}{2}$ years
3. Amount is K22 000

Self assessment 2

1. K2 250.43
2. K3 416.32 corrected to the nearest tambala

Unit assessment 10

1. K736.16
2. K7 920
3. K60

Glossary

Principal : amount of money saved/borrowed

Interest : money received or given back after saving or borrowing respectively for a certain period of time interval.

Amount: the sum of the principal and interest.

References

Channon J.B. (1970) *New General Mathematics Book 2*, Longman group Ltd

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UNIT 11

SIMPLE ACCOUNTS

11.1 Introduction

In unit 10, you learnt about how to calculate simple and compound interest. In this unit, you will prepare simple accounts such as cash account, bank account, and cash book. People and organizations keep account records for various reasons such as a source of information, a frame of reference for decisions making and to check if they are operating at a profit. The knowledge gained from this unit will help you teach the topic of simple accounts to learners effectively.

11.2 Success criteria

By the end of this unit, you must be able to:

- Prepare cash account
- Prepare bank account
- Prepare cash book

11.3 Key words

The following are key words in this unit:

- account
- balance
- balance brought forward
- balance carried forward
- bank account
- cash account
- cash book
- credit
- debit

11.4 Cash account

Think of a club of which you are a member at your school or home. If you don't belong to any club, identify a friend who belongs to such clubs and find more on him or her concerning the following issues:

- How does that club raise money?
- How is the money spent?
- How does the treasurer keep records of financial activities in the club?

- What do you think are the reasons for keeping records of the money received and the money spent?
- What name is given to the record of cash received and cash paid out?
- What name is given to the money received?
- What name is given to the money paid out?

You will find out that the points discussed above will lead you to a concept of cash account. This is a financial account which shows money or cash in (collected) and money or cash out (spent). A cash account has two main parts. What name is given to the left hand side, where a record of income is entered? What name is given to the right hand side, where payments (money out) are recorded?

You will observe that the left hand side of the cash account where income is entered is called debt and the right hand side which shows payments (money out) is called credit. Now, how can these two terms be abbreviated? Do they mean the same in English language? What are the column headings of a cash account? The following activity will try to answer some of the questions raised above:

11.4.1 Entering transaction in cash account

In this activity, you will learn how to enter transactions in the cash account. First, you identify the columns of cash account as shown below:

Table 1

(Debt)

(Credit)

Date	Income	Amount		Date	Payment	Amount
		K T				K T

From the table 1 presented above, you will see that the two main parts of the cash account are debt and credit. These are abbreviated as Dr. and Cr. respectively. Under debt, there are three columns such as date, income, and amount. Similarly, the credit columns are for the date, payment, and amount. The terms debt and credit are used in cash account differently from English language. Here, debt means income while credit means payment.

Now, think of some transactions made in your school club or a club at home. The following is an example of transactions made by Zangaya club:

January 4, 2009 balance in cash K5000

January 5, 2009 sold cabbage at K85000

January 7, 2009 sold beans at K3000

January 8, 2009 paid wages K2000

January 8, 2009 sold onions at K7600

January 9, 2009 paid transport K1500

January 10, 2009 subscription from members K800

January, 11, 2009 bought fertilizer K5000

January 12, 2009 bought seeds K 600

Can you enter the transactions presented above in a cash account? Your presentation should look like the following:

Table 2

Dr.			Cash Account for Zangaya Club			Cr.		
Date	Income	Amount K T		Date	Payment	Amount K T		
4-01-09	Cash balance	5000 00		8-01-09	paid wages	2000 00		
5-01-09	Sold cabbage	8500 00		9-01-09	Paid transport	1500 00		
7-01-09	Sold beans	3000 00		11-01-09	Bought fertilizer	5000 00		
8-01-09	Sold onions	7600 00		12-01-09	Bought seeds	600 00		
10-01-09	Subscription from members	800 00						

11.4.1 Balancing a cash account

In this activity, you will learn about how to balance a cash account. Consider the cash account for Zangaya club discussed earlier in activity 1. You have noted that in a business, a person is interested in knowing how much cash he/she has in hand. But how would one know the amount of cash which is there at the end of specific period of time? Here, you may realize that the solution is to add income and payment separately and subtract the total payments from the total income. This process is referred to as “balancing a cash account.” The difference is called “balance.” This balance is recorded as balance carried down (c/d) on credit side (payments column on that particular month) and the same amount is recorded as balance brought forward (b/d) on the debt side (income column) in the next month as indicated below:

Table 3

Dr.			Cash Account for Zangaya Club			Cr.		
Date	Income	Amount		Date	Payment	Amount		
		K T				K T		
4-01-09	Cash balance	5000 00		8-01-09	paid wages	2000 00		
5-01-09	Sold cabbage	8500 00		9-01-09	Paid transport	1500 00		
7-01-09	Sold beans	3000 00		11-01-09	Bought fertilizer	5000 00		
8-01-09	Sold onions	7600 00		12-01-09	Bought seeds	600 00		
10-01-09	Subscription from members	800 00		31/01/09	Balance c/d	15800 00		
31/01/09	Total	24,900 00		31/01/09	Total	24,900.00		
1-02-09	Balance b/d	15800 00						

Self assessment 1

Study the following transactions and identify the transaction to be put on either debt or credit side of a cash account. Balance the transactions.

Transactions for Kalumbu Debate Club in the month of February, 2009

February 1 cash in hand K1500

February 3 gate collections K2060

February 5 paid for hire of hall K5000

February 10 sold tickets K1180

February 20 bought batteries K250

11.5 Bank account

In section 11.4, you have learnt how to enter and balance transactions in a cash account. In this section you are going to focus on how to enter transactions in a bank account and how to balance it.

What is a bank account? A record of revenue received and payments made in the bank is called bank account. It has sections similar to those of the cash account only that instead of the term income, we use the term receipts.

In this section, you will learn how to enter transactions in the columns of bank account.

February 1 balance in the account K40000

February 2 he banked K50000

February 3 sold clothes and deposited K8000

February 10 paid rent by cheque K2000

February 11 paid wages by cheque K5000

February 15 bought goods by cheque valued at K3000

February 20 paid salary by cheque K2000

February 25 withdrew K10000 from the account

Enter the transactions above in a bank account. Compare you answer with the one below.

Table 4

Dr.			Mr. Dimba's Bank Account			Cr.		
Date	Receipts	Amount		Date	Payments	Amount		
		K	T			K	T	
1-02-09	Account balance	40000	00	10-02-09	Paid rent by	2000	00	
2-02-09	He banked	50000	00		cheque			
3-02-09	Banked	8000	00	11-02-09	Paid wages by	5000	00	
					cheque			
				15-02-09	Bought goods by	3000	00	
					cheque			
				20-02-09	Paid salary by	2000	00	
					cheque			
				25-02-09	Withdrew cash	10000	00	

Note:

- i. Cash paid into the bank is shown as receipts in the bank account
- ii. All payments of money by cash or cheque through the bank are entered on the debt side of the account
- iii. All withdraws of cash or payments made by cheque are entered on the credit side of the account

11.5.2 Balancing a bank account

Consider the transactions that were entered in the activity 3. what would be the appropriate way of balancing the transactions? Can you try balancing the transactions? I hope your balanced cash account looked like the following:

Table 5

Dr.			Mr. Dimba's Bank Account			Cr.		
Date	Receipts	Amount K T		Date	Payments	Amount K T		
1-02-09	Account balance	40000 00		10-02-09	Paid rent by	2000 00		
2-02-09	He banked	50000 00			cheque			
3-02-09	Sold clothes	8000 00		11-02-09	Paid wages by	5000 00		
					cheque			
				15-02-09	Bought goods by	3000 00		
					cheque			
				20-02-09	Paid salary by	2000 00		
					cheque			
				25-02-09	Withdrew cash	10000 00		
				28/02/09	Balance c/d	76000 00		
28/02/09	Total	98000 00		28/02/09	Total	98000 00		
1-03-09	Balance b/d	76000 00						

Self assessment 2

Enter the following transactions in a bank account and balance it.

June 1 balance in bank K14 200

June 4 bought bicycle by cheque K12 500

June 5 paid by cheque K200

June 12 deposited cash K1 150

June 20 deposited a cheque K51 200

June 30 paid wages by cheque K3 100

11.6 Cash book

By now, you know how to enter and balance transactions in cash and bank accounts. This time, you are going to learn how to develop a cash book. You should take note that a cash book is simply a combination of cash and bank accounts.

Entering transactions and balancing cash books

The following transactions were made by Mrs. Salavuka in the month of December, 2008:

December 3 Mrs. Salavuka began with cash K5800

December 3 cash in bank K2000

December 4 sold eggs cash K3000

December 10 she banked K1500

December 15 she bought layers marsh cash K2400

December 16 she sold eggs cash K4500

December 18 she paid into the bank K5000

December 23 she received cash K9000

December 29 withdrew from the bank K3000

Now study the cash book below from Mrs Salavuka's transactions and make observations.

Table 6

Dr.

Mrs. Salavuka's Cash Book

Cr.

Date	Particulars	Bank K T	Cash K T	Date	Particulars	Bank K T	Cash K T
3/12/08	Cash balance		5800 00	10/12/8	Banked		1500 00
3/12/08	Cash in bank	2000 00		15/12/8	Bought layers cash		2400 00
4/12/08	Sold eggs cash		3000 00	18/12/8	Banked		5000 00
10/12/08	Banked	1500 00		29/12/8	Withdrew cash	3000 00	
16/12/08	Sold eggs cash		4500 00				
18/12/08	Banked	5000 00					
23/12/08	Received cash		9000 00				
29/12/08	Cashed		3000 00				
				31/12/08		5500 00	16400 00
31/12/08	Total	8500 00		31/12/08	Balance c/d	8000 00	25300 00
			25300 00		Total		
1-01-09	Balance c/d	5500 00	16400 00				

How different are cash book columns from cash and bank accounts? You have observed that cash book columns are not different from cash and bank accounts' columns. The two accounts, cash and bank are combined.

Note that the procedure for balancing a cash book is same as that of balancing cash and bank accounts. However, you balance cash and bank accounts separately but the combination of these two accounts makes what is called a cash book.

Self assessment 3

Write up a cash book for May 2008 using the following details, and balance off the transactions. All cheques received are banked immediately.

May 1 Mr. Zikoma started business with capital in cash K2000

May 2 Paid rent K200

May 3 Miss Kalumbu paid him K1000 by cheque

May 4 paid Mr. Tchauya by cheque K600

May 5 Cash sales K980

May 7 Mr. Mphepozina paid his debt K620 by cheque

May 9 paid Mrs. Gowa in cash K220

May 11 Cash sales K530

May 16 banked K500

May 19 paid electricity K100 by cheque

May 22 cash sales K660

May 26 paid motor expenses by cheque K240

May 30 paid wages in cash K970

11.7 Teaching methodologies for simple accounts

In sections 11.4 and 11.5, you have learnt how to enter cash and bank accounts transactions and how to balance them. In addition, you also learnt how to enter and balance transactions in the cash book in section 11.6.

In this section, you are going to learn how to teach the topic of simple accounts to learners. The following hints will help you teach simple accounts effectively:

- identify the main concepts and skills on simple accounts
 - i. identifying two sides of simple accounts (Dr. and Cr.)
 - ii. drawing columns of each type of simple accounts correctly

- iii. entering transactions correctly
 - iv. balancing transactions correctly
 - v. identifying the errors that were made when entering transactions
- arrange the concepts and skills in logical teaching order
 - use proper teaching and learning resources
 - involve learners in the lessons by tapping their experiences

Self Assessment 4

Write any four success criteria which you would formulate when teaching simple accounts

11.8 Summary

In this unit you have learnt about simple accounts such as cash account, bank account and cash book. A cash account is a record of revenue received and expenses made. It has two sections; the income and payments sections with dates and amounts columns indicated in each section. All revenues are recorded under income and expenses under payments.

A bank account is a record of revenue received and payment made in the bank. It has sections similar to those of cash account. The bank account columns contain details of payments made by cheques and money received and paid into the bank account. A cheque received is not regarded as cash until it is banked then it transfers into the bank account

A cash book is simply a combination of cash account and the bank account brought together. The debt column of the cash account is placed alongside the debt column of the bank account, and the credit columns of the cash and bank accounts are also placed alongside each other.

Unit assessment 11

1. What is the difference between cash account and bank account?
2. What are the two main columns in a cash account?
3. Explain the procedure of balancing a bank account.
4. What is a cash book?
5. Identify each of the following cash book transactions whether it is for cash or bank account. Indicate further as either a debt or a credit transaction:
 - a. sold eggs cash K3000
 - b. she banked K1500
 - c. she sold eggs cash K4500
 - d. banked a cheque from a friend K450
 - e. paid rent by cheque K1500

- f. withdrew from the bank K3000
- g. received cash K1000
- h. paid rent by cash K900
- i. paid K5000 wages cash
- j. received cash K9000

11.9 Suggested answers

Self assessment 1

Dr. Cash Account for Kalumbu Debate Club Cr.

Date	Income	Amount K T	Date	Payment	Amount K T
1-02-09	Cash in hand	1500 00	5-02-09	Paid for the hire of hall	500 00
3-02-09	Gate collection	2060 00	20-02-09	Bought batteries	250 00
10-02-09	Sold tickets	1180 00			
				Balance c/d	3990 00
		4740 00			4740 00
1-03-09	Balance b/d	3990 00			

Self assessment 2

Dr. Bank Account for Mr. Banya Cr.

Date	Receipts	Amount K T	Date	Payments	Amount K T
Jun 1	Balance in bank (b/d)	14 200 00	Jun 4	Bought bicycle by cheque	12 500 00
Jun 12	Deposited cash	1 150 00	Jun 5	Paid by cheque	200 00
Jun 20	Deposited a cheque	51 200 00	Jun 30	Paid by cheque	3100 00
				Balance c/d	50 750 00
Jun 30	total	66 550 00	Jun 30	Total	66 550 00
Jul 1	Balance b/d	50 750 00			

Self assessment 3

Dr.

Mr. Zikoma's Cash Book

Cr.

Date	Income/receipts	Bank K T	Cash K T	Date	Payments	Bank K T	Cash K T
1/4/08	Cash in hand		2000 00	2/4/08	Paid rent		200 00
3/4/08	Received cheque a	1000 00		4/4/08	Paid by cheque	600 00	
5/4/08	Cash sales		98000				
7/4/08	Received cheque a	620 00		9/4/08	Paid in cash		220 00
11/4/08	Cash sales		530 00	16/4/08	Banked		500 00
16/4/08	Banked	500 00		19/4/08	Paid by cheque	100 00	
22/4/08	Cash sales		660 00	26/4/08	Paid by cheque	240 00	
				30/4/08	Paid in cash		970 00
					Balance c/d	1180 00	2280 00
		2120 00	4170			2120 00	4170 00
1/5/09	Balance b/d	1180 00	2280				

Self assessment 4

Learners must be able to:

- draw columns of cash, bank accounts and cash book correctly
- enter transactions correctly
- balance transactions correctly
- identify errors made when entering the transactions

Unit assessment 11

1. cash account is a record of revenue received and payments made in cash while bank account is a record of revenue received and payments made in the bank

2. a. debt (date, income, amount)
b. credit (date, payment, amount)
3. First you add the total receipts. Then you add the total payments. The next step is to subtract total sum of payments from total sum of receipts.
4. A cash book is simply the cash account and bank account brought together.
5. The following are the required transactions:

Transaction number	Type of account	Type of transaction
A	Cash	Debt
B	Cash/bank	Credit/debt
C	Cash	Debt
D	Bank	Debt
E	Bank	Credit
F	Bank/cash	Credit/debt
G	Cash	Debt
H	Cash	Credit
I	Cash	Credit
J	Cash	debt

Glossary

Account:	a record in which debts and credits affecting a particular activity are entered
Balance:	the difference between the total debits and the total credits in an account
Balance brought forward:	the money or goods recorded from the previous account
Balance carried forward:	the money or goods that are taken to the next account
Bank account:	a record of revenue received and payment made in the bank
Cash account:	a record of revenue received and payments made
Cash book:	a combination of cash account and the bank account
Debt:	an amount of money paid in
Credit:	an amount of money paid out
Payments:	the money or goods issued out

References

Ministry of Education (2005) *Initial Primary Teacher Education Teaching syllabus for Numeracy and Mathematics*, MIE, Domasi

Ministry of Education (2006) *Initial Primary Teacher Education Numeracy and Mathematics Student Handbook for term two*, MIE, Domasi

Ministry of Education (2008) *Malawi Primary Education, Mathematics Teachers' Guide for standard 7*, MIE, Domasi

UNIT 12

3-DIMENSIONAL AND 2-DIMENSIONAL SHAPES.

12.1 Introduction.

In unit 11 you learnt about simple accounts. In this unit you will learn the differences between 3-D and 2-D shapes and ways of determining lines of symmetry in these shapes. You will also explore various ways of teaching 3-D and 2-D shapes to primary school learners. The knowledge you will get from this unit will help you teach the topic of 3-D and 2-D to learners effectively.

12.2 Success criteria.

By the end of this unit, you must be able to:

- describe 3-dimensional and 2-dimensional shapes.
- draw lines of symmetry in 2-D and 3-D shapes.
- use appropriate methodologies when teaching and assessing 3-D and 2-D shapes

12.3 Key words.

The following are key words in this unit:

- 2-D shape
- 3-D shape
- plane
- symmetry

13.4 3-D and 2-D shapes.

All objects exist in 3 dimensions no matter how small they may be. They take up or occupy space according to their size or shape. Some objects have regular shapes while others have irregular shapes. Children enjoy playing with objects of different shapes.

However, real objects are different from drawings or sketches, because real objects show length, width, and height of an object which some objects can not show. The following activity will help you explore more about real object.

Activity 1

1. Collect objects of different shapes from the environment eg sticks, tins, bricks, boxes, balls, oranges, etc
2. Group your objects according to their shapes. How many groups have you made?
3. Now draw/sketch the objects in each group according to their shapes.

4. Draw a table and fill in the differences between the real objects and their drawings/ sketches.

From activity 1, you will find out that the objects can be classified into three: circular, spherical and rectangular.

Self assessment 1.

1. State the characteristics of circular, triangular and rectangular objects.
2. Draw the following shapes using the appropriate geometrical instruments.
 - a. a circle
 - b. a cube
 - c. a sphere.

12.5 Lines of symmetry.

In section 12.4, you learnt about 3-D and 2-D shapes. In this section, you will learn more about the symmetry of plain shapes. What is symmetry? Symmetry is the exact correspondence of opposite sides of an object to each other. A line of symmetry is a line which divides a shape into two equal parts. The following activity will help you understand the concept of symmetry:

Activity 2

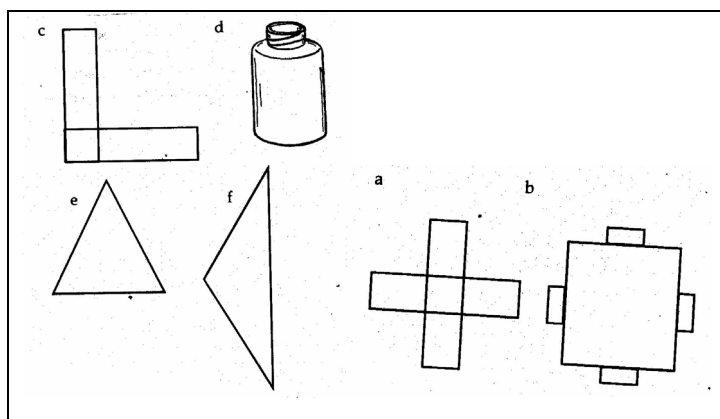
- 1 Collect a variety of plain objects from the environment, eg leaves, pieces of clothes and paper. Fold the objects in between.
- 2 Examine line of symmetry of the plain objects collected.
- 3 Use pieces of paper to form the following: triangles, squares, rectangles, cylinders and circles.
- 4 Fold each formed shapes into two equal parts.
- 5 Identify shapes that form lines of symmetry.

Note that some shapes have no lines of symmetry, others have one or more lines of symmetry.

Self assessment 2.

1. Give two examples of geometrical shapes with:
 - a. line of symmetry
 - b. two lines of symmetry
 - c. one line of symmetry
 - d. many lines of symmetry

2. write the number of lines of symmetry in each of the following shapes:



3. Which capital letters of the alphabet have two lines of symmetry.

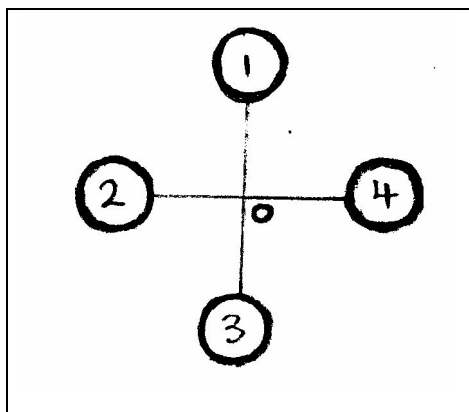
12.6 Rotational symmetry.

In section 12.5, you learnt about lines of symmetry. In this section, you will learn rotational symmetry. What is rotational symmetry? A 2-D shape has rotational symmetry if it fits onto itself two or more times in one turn (i.e. rotation of 360°).

In order to understand the concept of rotational symmetry, do the following activity:

Activity 3

1. Make two copies of the figure below on tracing paper. Number the circles as shown below.



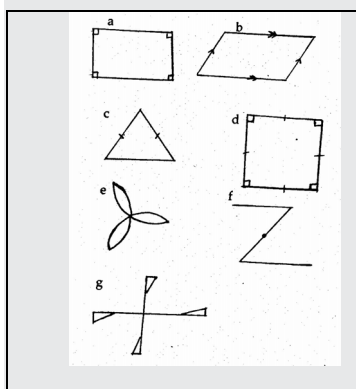
2. Place the two copies such that the two diagrams fit exactly on one another
3. Insert a pointed object through the point O and then rotate the top sheet of tracing paper anticlockwise through an angle of 90° .
4. Rotate the top sheet of paper through another 90° anticlockwise. What do you observe?
5. Again rotate the tracing paper on top through 90° anticlockwise. Through what angle have you rotated the tracing paper so far?

6. Finally, rotate the tracing paper on top through an angle of 90° again, in an anticlockwise direction.
7. Summarise what you have observed.

You must have found that there are 4 positions in which the figure looks as if no rotation has been done as a result of rotating it anticlockwise about the point O. These rotations are at 90° , 180° , 270° and 360° degrees. You could say that the figure has rotational symmetry about O; and because you have 4 positions, then the order of rotational symmetry is 4. Now, can you define order of symmetry? The order of symmetry is the number of times a shape fits into itself in one turn (360°)

Self assessment 3

1. Determine the order of rotational symmetry, if any of these shapes is turned 360 degrees.



2. Draw two geometrical shapes with the following order of rotational symmetry:

- a. 2
- b. 4
- c. 8

12.7 Teaching and assessing 3-D and 2-D shapes

By now you know 3D and 2D shapes and their characteristics. You need skills that will enable you to teach and assess the children effectively.

The following activity will help you introduce 3D and 2D shapes to learners.

Activity 4

- 1) Collect objects of different shapes, colours and sizes from the surrounding.
- 2) Name the objects and group them into circular, rectangular and cylindrical shapes
- 3) Compare sizes of objects of the same shapes.
- 4) Model the shapes using paper.
- 5) Then model the shapes using clay
- 6) Observe what learners have moulded and let them peer assess.

12.8 Summary

All objects exist in 3-dimensions no matter how small they are. Some 3-dimensional shapes are symmetrical others are not. A line of symmetry divides a shape into two equal parts.

Teaching 3-dimensional shapes involve the use of various objects from the local environment.

12.9 Unit assessment 12

- 1) Describe two methods you would use to identify lines of symmetry of a plane shape.
- 2) What problems would your learners face when learning names of solids and plane shapes?

12.10 Suggested answers.

Self assessment 1

1. Characteristics of the following are:
 - a. Circular objects
 - i. Are round in shape
 - ii. All points are equidistant from the center
 - b. Spherical objects
 - i. Have volume
 - ii. All points are equidistant from the center
 - c. Rectangular objects
 - i. Have four sides
 - ii. Have four angles
 - iii. Their angle add up to 360°
2. (Practical)

Self assessment 2

1. Examples of geometrical shapes with:
 - a. One line of symmetry are
 - i. Isosceles triangle
 - ii. Kite
 - b. Two lines of symmetry
 - i. Rectangle
 - ii. Rhombus
 - c. Many lines of symmetry
 - i. Circle
 - ii. Square

2. The answers are:

a. 2

b. 2

c. 1

d. 1

e. 1

f. 1

3. H, I, O, S and X

Self assessment 3

The answers are:

a. 2

b. 1

c. 1

d. 4

e. 4

f. 2

g. 4

Unit assessment 12

1.(a)folding the shapes into two equal parts

(b)measuring the shapes and find out if two sides are exactly the same.

2. these are:

a. pronunciation

b. failing to relate name of shape and actual shape

Glossary

Symmetry: the exact correspondence of opposite sides of an object to each other

3-D shape: a figure that illustrate length, width and height (depth)

2-D shape: a figure that illustrate length and width only.

Plane: a set of points which form a flat surface.

References

MOE (2006) Initial Primary Teacher Education Numeracy and Mathematics handbook for term two, MIE, Domasi.

Hau S (2007) Strides in Mathematics 1, Longman Malawi Ltd, Blantyre.

UNIT 13

ANGLES AND TRIANGLES

13.1 Introduction

In unit 12 you learnt 3-D and 2-D shapes. All objects exist in 3 dimensions, no matter how small they are. In this unit you will learn about types, properties of angles and triangles and how to construct angles and triangles. You will also learn how to use appropriate methodologies and resources when teaching the topic of angles and triangles. Knowledge and skills gained in this unit will help you teach learners the topic of angles and triangles effectively.

13.2 Success criteria

By the end of this unit, you must be able to:

- describe properties of angles and triangles
- construct angles and triangles
- use appropriate methodologies and resources when teaching concepts on angles and triangles.

13.3 Key words

The following are key words:

- Angles
- Triangles
- Vertices

13.4 Types and properties of angles

Angles are of different types and have different properties.

13.4.1 Types and properties of angles.

What is an angle? An angle is the amount of turn from one direction to the other. Can you observe the environment around you and identify objects that have angles? Did you observe any object with an angle? You can find angles in many objects such as clocks, buildings, human bodies, vehicles and furniture.

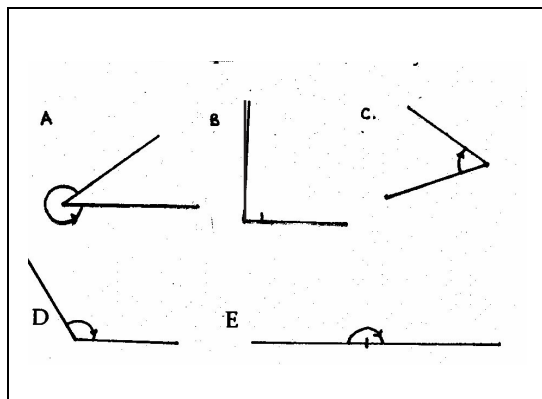
Angles are named in two ways. These are according to sizes and according to positions.

Types of angles according to size.

Examine the following angles:

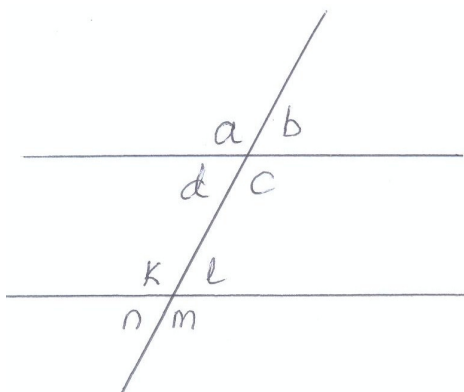
Can you name the type of angles labelled A to E and list the property of each angle.

The table below summarizes the types and properties of each angle.



Angle	Type of angle	Properties
A	Reflex	It is more than 180 but less than 360
B	Right angle	It is equal to 90
C	Acute	It is less than 90
D	Obtuse	It is more than 90 but less than 180
E	Straight line	It is equal to 180

Types of angles according to position.



Do you remember types of angles according to positions from your secondary school mathematics? Can you list some of these angles? Study the diagram below and answer the questions that follow.

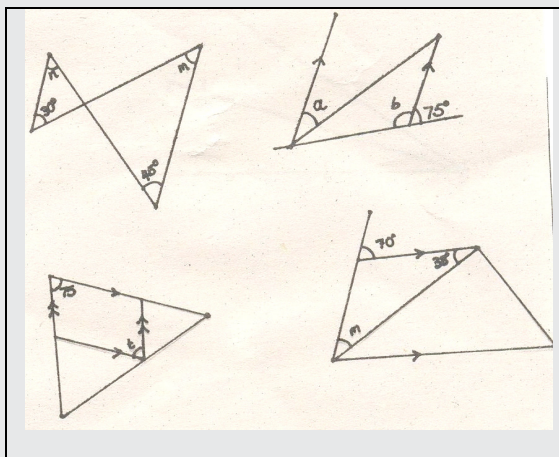
- Name a pair of alternate angles.
- Name one pair of corresponding angles
- Name one pair of adjacent angles.
- Name one pair of Allied angles
- Name one pair of Vertically opposite angles

Compare your answers with the following:

- angle d and l or c and k are alternate angles
- Angle b and l or a and k or c and m or d and n are corresponding angles
- Angle a and b or b and c or d and c or k and l or n and m or k and n are adjacent angles
- Angle c and l or d and k are allied angles
- Angle b and d or a and c or k and m or l and n are vertically opposite angles

Self assessment 1

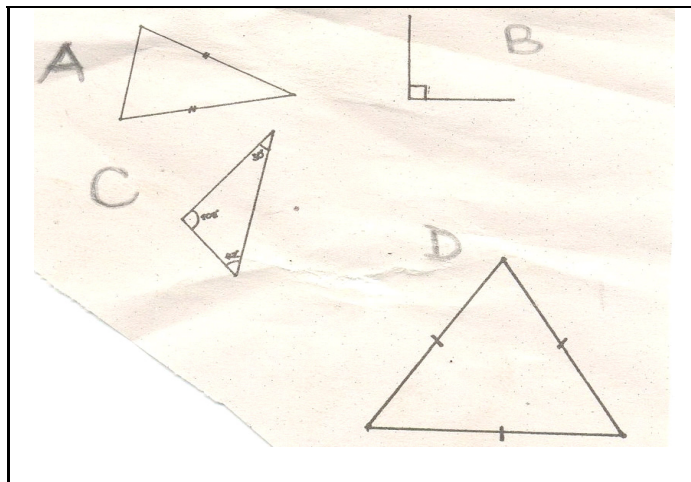
Calculate the angles in the following;



13.5 Types and properties of triangles

What is a triangle? A triangle is a three sided figure which has three angles and three vertices. A triangle has three side, three angles and three vertices. There are various types of triangles. What are these?

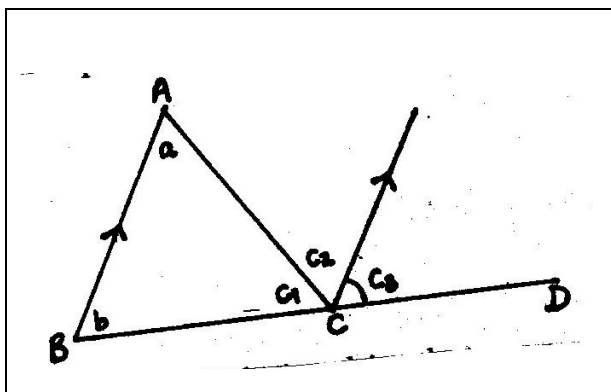
Study the following triangles.



Can you state the type and the properties of each triangle.

Label	Type of triangle	Properties
A	Isosceles	1. Two sides are equal 2. Base angles are equal
B	right angled	3. Has a right angle
C	Scalene	4. All angles and sides are not equal
D	Equilateral	5. All angles and sides are equal

Again study triangle ABC shown below. Line BC is extended to D and the line is drawn from C to E and is parallel to AB.



What is the relationship between

- (i) Angle a and C_2
- (ii) Angle b and C_3
- (iii) Angle C_1 , C_2 and C_3
- (iv) Angle a + angle b + angle C_1

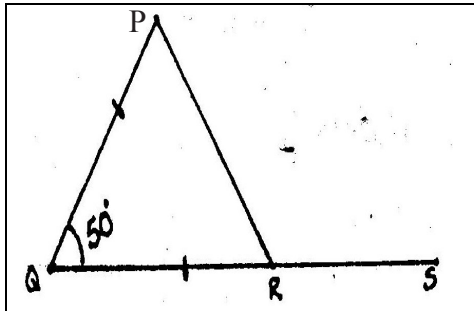
You will find that angle $a+b+C_1=180$.

Thus the angle sum of any triangle is 180.

Now study the example below.

Example

Calculate angle PRS if angle Q=50 and PQ=QR in the figure below



Solution.

Angle QPR + QRP = $180^\circ - 50^\circ$ (angle sum of a triangle add up to 180°)
 $= 130^\circ$

Since PQ = QR (triangle PQR is Isosceles)

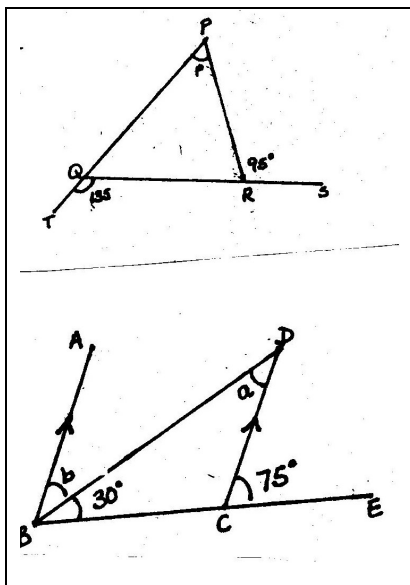
Then angle QPR = 65°

Angle PRS = $50^\circ + 65^\circ$

Therefore angle PRS = 115°

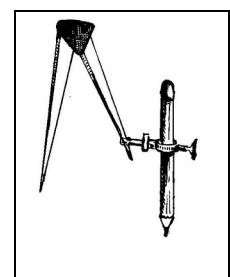
Self assessment 2.

Calculate with reasons the value of the marked angles in the following figures.



13.6 Constructing angles.

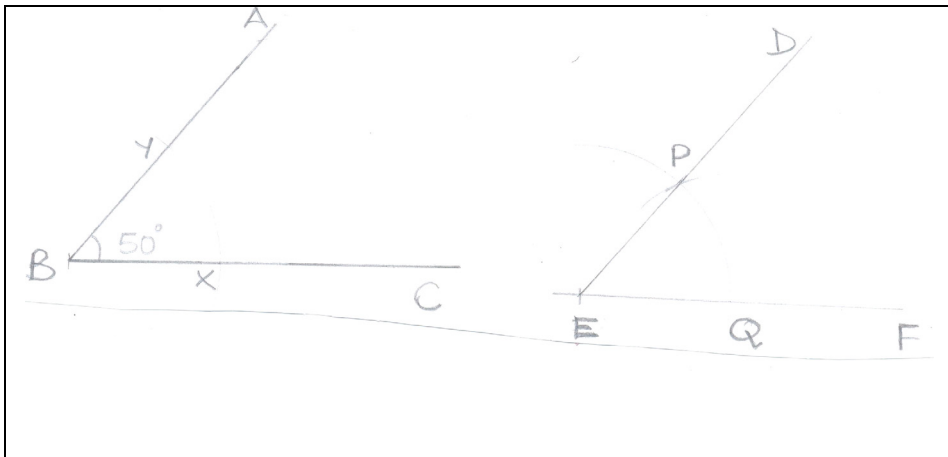
Constructing angles involve copying and bisecting angles. Angles can be constructed using a ruler and a pair of compass. The figure below shows a pair of compass



Copying an angle

The following activity will assist you explore ways of copying a given angle.

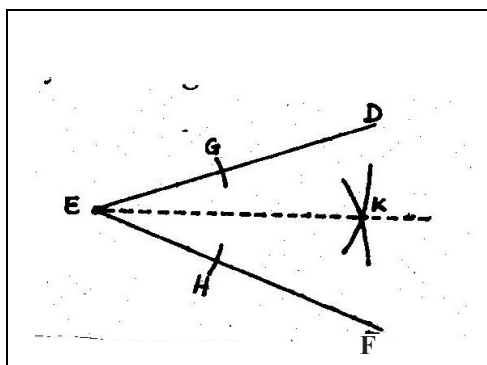
Procedure for copying an angle:



1. Draw line EF
2. Using point B, draw an arc to cut BC at X and BA at Y
3. Using the same radius and E as the centre, draw an arc to cut EF at Q
4. Open your compass from X to Y and using Q as the centre, draw an arc to cut the other arc at P.
5. Join EP and produce it to D.

Therefore, angle PEQ = angle ABC

Bisecting an angle

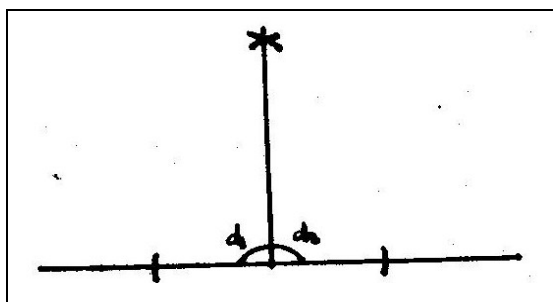


1. Using the same radius, cut EF at H and ED at G using E as the centre.
2. Using the same radius, make another arc at K from point G and H
3. Join EK; and angle DEK is equal to angle FEK

Constructing 90° angles

Do you remember how to construct a 90° degrees angle. The following activity will help you construct a 90° angle:

1. Draw a 180° angle and bisect it as shown below

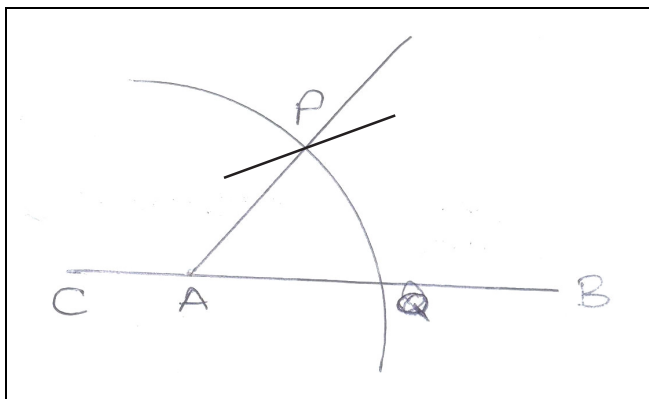


- What is the value of the adjacent angles d_1 and d_2 ? You will find that angle $d_1 = d_2 = 90^\circ$

Constructing 60° and 120° angles.

In the previous sub-section you learnt how to copy a given angle and to bisect an angle. In this sub-section you will learn how to construct 60° , and 120° angles. The following activity will help you construct 60° and 120° degrees angles.

- Draw a straight line CAQB



- Using point A, make an arc of any radius to cut AB at Q
- Use point Q and same radius, draw another arc to cut the first arc at P
- Join AP. Measure angle PAB. You will find $PAB = 60^\circ$ and $PAC = 120^\circ$

Self assessment 3

Construct the following angles.

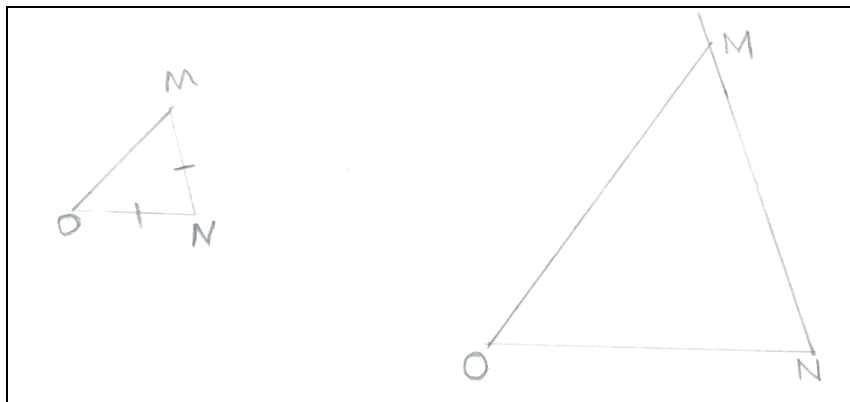
- 15° , b. 135° , c. 105° .

13.7 Constructing triangles.

Constructing triangles also need a ruler, protractor and pair of compass.

How can you construct triangle MNO in which $\angle MON = 55^\circ$ and $MN = ON = 6\text{cm}$.

- Draw a sketch as shown below:



2. Draw the base line $NO = 6\text{ cm}$
3. Using point O, draw a 55° angle using a protractor
4. Join MN
5. Calculate the value of angle MNO. You will find that it is 70° . Now using point N draw a 70° angle
6. Mark M where line NM and OM meet.
7. Make sure that Nm is 6cm

Self assessment 4.

Construct the following triangle using a ruler and pair of compasses only.

Triangle PQR in which $PQ=PR=QR=6.5\text{ cm}$

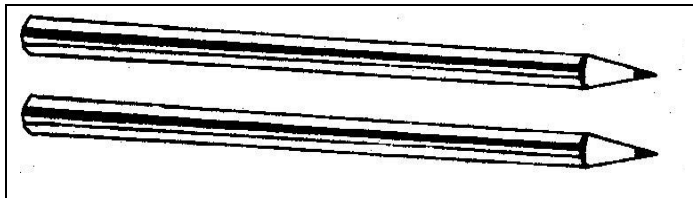
13.8 Teaching of angles and triangles.

Teaching of angles and triangles involves modelling angles and triangles.

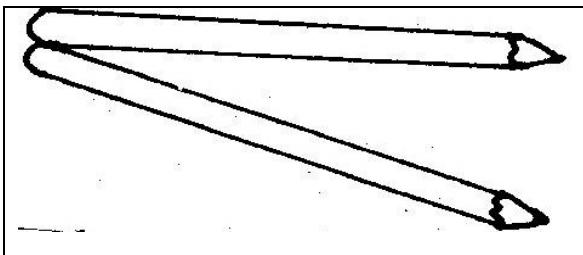
13.8.1 Modelling angles

Remember, an angle is the amount of turn from one direction to the other. You can model angles using different objects. What are some of these objects. The following activity will help you how to model angles using objects:

1. Place two pencils side by side as shown



2. Rotate one pencil away from the other as shown.



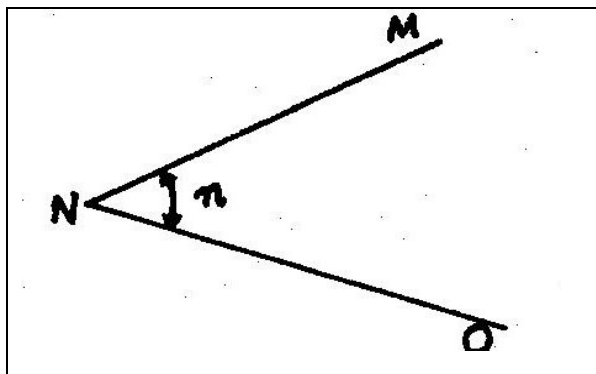
What has been formed at the point where the two pencils meet is an angle.

Self assessment 5.

1. List any three activities which you can do on modelling angles.
2. List any body parts which can form an angle.

13.8.2 Naming angles.

There are many ways of naming angles. Examine the angle drawn below:



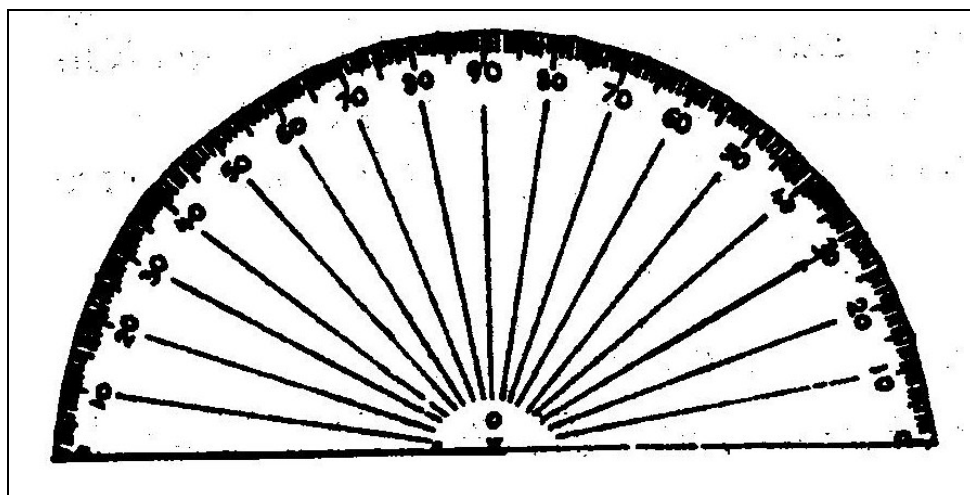
This angle could be named using:

Three letters, ie, angle MNO or ONM.

one small letter (notation) or using one capital letter
i.e. angle N.

13.8.3 Measuring angles.

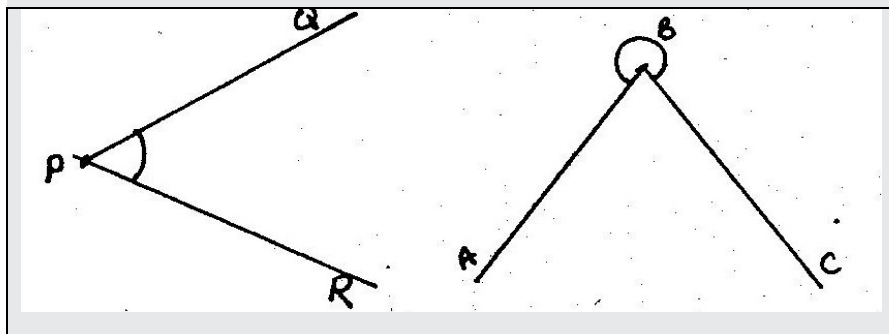
Angles are measured in degrees. The instrument you use to measure angles is called a protractor. A protractor is as shown below.



You can improvise a protractor by using transparent paper or by making one from cardboard.

Self assessment 6.

Measure the following angles.



13.8.4 Introducing triangles.

There are several concepts to teach when introducing triangles. These include

- Meaning of triangles.
- Naming types of triangles.
- Modelling triangles.
- Properties of triangles.

13.8.5 Modelling triangles.

You can model triangles by using resources such as papers and sticks. Can you model triangles using the above resources?

Arrange your models into types of triangles such as

- a. With three equal sides.
- b. With two equal sides
- c. With no equal sides.
- d. With a right angle.

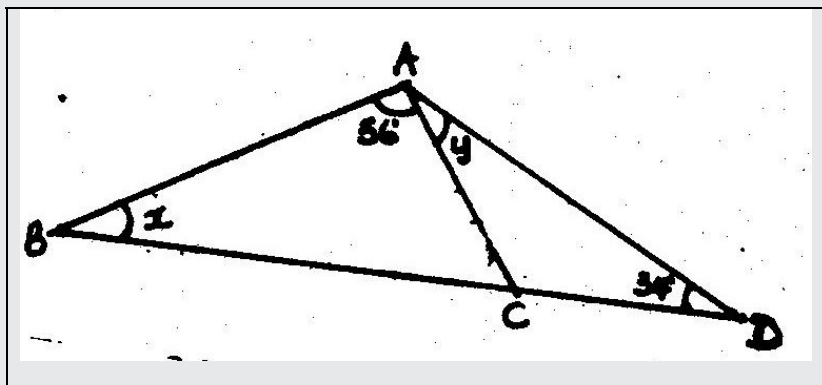
13.9 Summary.

An angle has two sides with a common point. There are several types of angles such as acute, right angled, obtuse, straight and reflex angles. Angles are measured in degrees using an instrument called protractor.

A triangle is a plane figure with three sides and three angles. Types of triangles include right-angled, isosceles, scalene and equilateral. Each triangle has its properties that distinguish it from others.

13.10 Unit assessment 13

1. Calculate the sizes of the marked angles in figure 1 in which $AB=AC$. Angle $BAC=56$ and angle $ADB=34$



2. Using a ruler and a pair of compasses only construct triangle STU in which $ST=6.5\text{cm}$, $TU=7\text{cm}$ and angle $STU=45$.

13.11 Suggested answers

Self assessment 1

- a) $M = 30^\circ$ and $n = 45^\circ$
- b) $T = 75^\circ$
- c) $M = 12^\circ$

Self assessment 2

- 1. $a = 65^\circ$
 $b = 45^\circ$
- 2. $p = 30^\circ$

Self assessment 3

Practical

Self-assessment 4

practical

Self assessment 5

- 1. subjective
- 2. these are
 - a. between figures
 - b. elbow
 - c. knee
 - d. arm pit

Unit assessment

- 1. Angle $x = 60^\circ$
Angle $y = 28^\circ$
- 2. Practical

Glossary

Isosceles: two sides equal

Bisect: cut or divide into two equal parts

Modelling angles: making turns to show angles

Vertex: a point where two lines meet outside an angle

References.

MOE (2006) Initial Primary Teacher Education Numeracy and Mathematics Handbook Term 2. MIE, Domasi.

Hau S (2007) Strides in Mathematics 1. Longman Malawi Ltd. Blantyre.

UNIT 14

QUADRILATERALS AND CIRCLES

14.1 Introduction

In unit 13, you learnt about triangles as one of the geometrical shapes. The other geometrical shapes are quadrilaterals and circles. In this unit, you will learn about quadrilaterals and circles. You will focus on properties and construction of quadrilaterals. You will also solve problems on quadrilaterals and circles. The knowledge you will acquire from this unit will help you to teach learners the topic of circles and quadrilaterals effectively

14.2 Success criteria

By the end of this unit, you must be able to:

- describe properties of quadrilaterals
- construct quadrilaterals
- describe parts of a circle
- model parallel lines
- use appropriate methods and resources when teaching concepts on circles and quadrilaterals

14.3 Key words

The following are the key words in this unit:

- arc
- center
- circle
- circumference
- diagonal
- diameter
- isosceles trapezium
- quadrilateral
- radius
- sector
- segment

14.4 Quadrilaterals

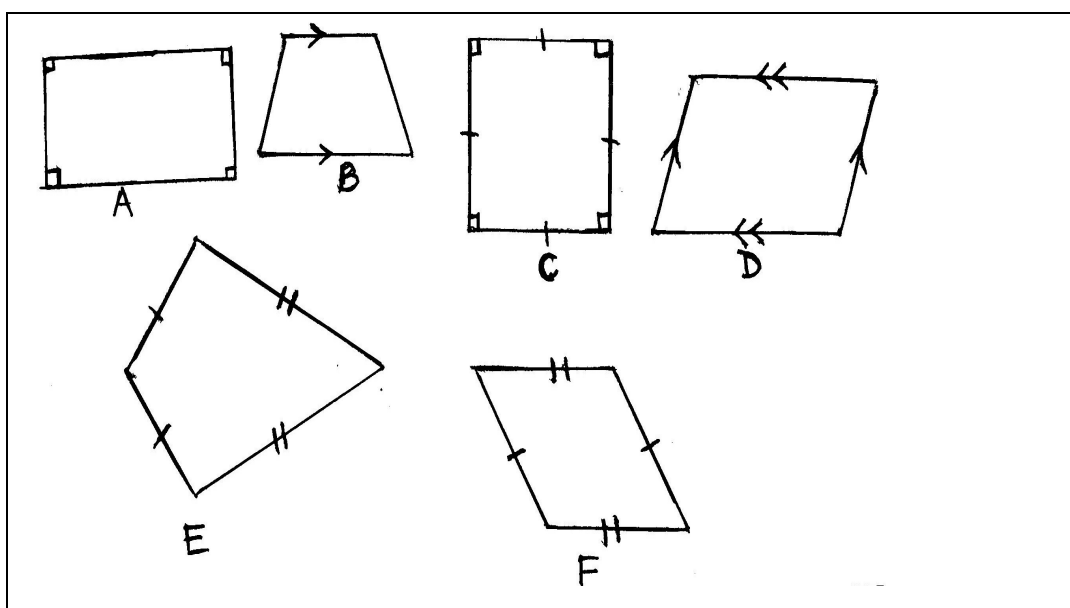
Unlike triangles which are three sided, there also objects which are four sided. The name quadrilateral is derived from the word 'quad' which means four. Therefore all objects with four sides take the name quadrilateral.

Study the following pictures.



What is common among the pictures above in terms of shape? You will find that all the pictures above have four sides. The pictures also have four angles. These objects which have four angles and four sides are called quadrilaterals. The name quadrilateral is derived from the word “quad” which means four. Therefore, all objects with four sides take the name of quadrilateral.

Can you list the different types of quadrilaterals you know? Figures below show different types of quadrilaterals. Name the types of quadrilaterals labeled A to F and give properties of each type.



14.4.1 Properties of quadrilaterals

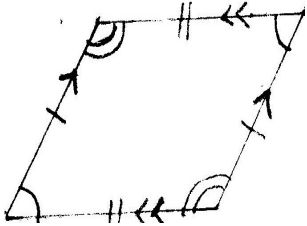
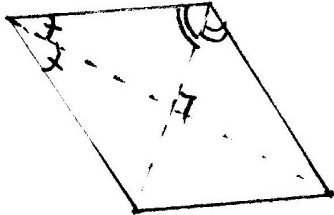
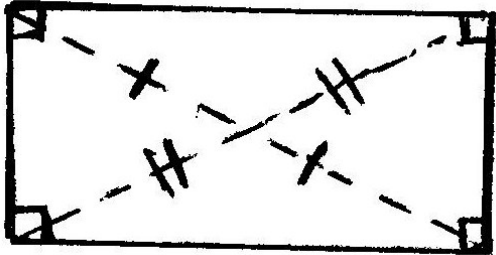
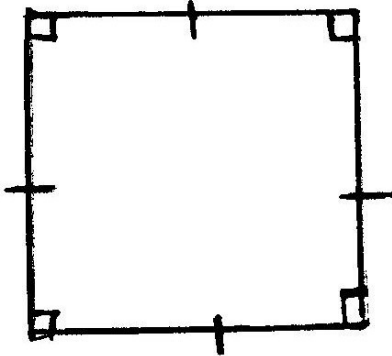
Quadrilaterals are classified according to special properties they have. These special properties are sides, angles and diagonals. You will therefore need knowledge of angles, parallel lines and triangles to successfully do the activity below

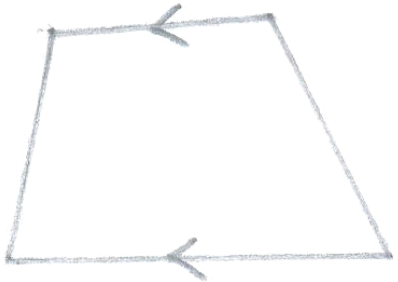
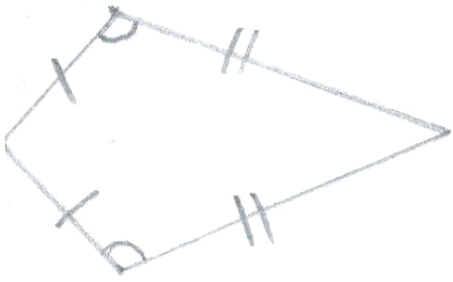
Activity 1

Identifying types and properties of quadrilaterals

In your school or home, identify different types of quadrilaterals. Could you please put them into six categories according to their properties described above? You should come up with the following types: parallelogram,

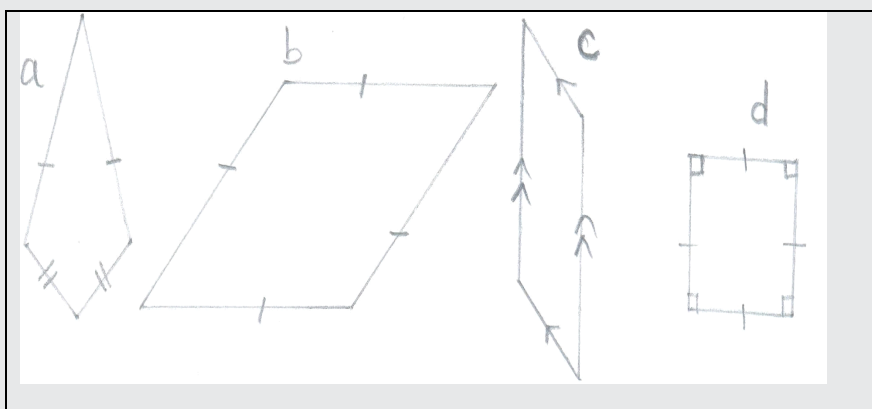
rhombus, square, rectangle, trapezium, and kite. The table below shows details of properties for each type of quadrilateral.

Type	Representation	Properties
Parallelogram		<ul style="list-style-type: none"> • Opposite sides and angles are equal • Diagonals bisect each other • Diagonals bisect the area of parallelogram
Rhombus		<ul style="list-style-type: none"> • Diagonals are perpendicular to each other • Each diagonal bisects a pair of opposite angles • All sides are equal • Has all the properties of a parallelogram
Rectangle		<ul style="list-style-type: none"> • Opposite sides are congruent and parallel • Opposite angles are congruent • Consecutive angles are supplementary • Diagonals are congruent and bisect each other • All four angles are right angles
Square		<ul style="list-style-type: none"> • Has all the properties of a parallelogram • Has all the properties of a rectangles • Has all the properties of a rhombus

Trapezium		<ul style="list-style-type: none"> • Has exactly one pair of parallel side called bases • Isosceles trapezium has both pairs of base angles equal • Diagonals of isosceles trapezium are equal
Kite		<ul style="list-style-type: none"> • Has exactly two distinct pair of adjacent congruent sides • Only one pair of opposite angles are equal

Self assessment 1

Name the type of quadrilaterals drawn below

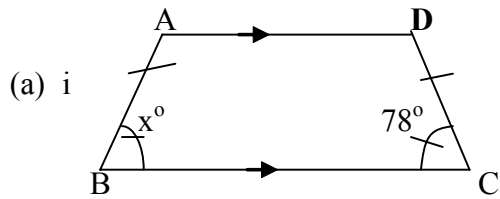


14.4.2 Constructing quadrilaterals

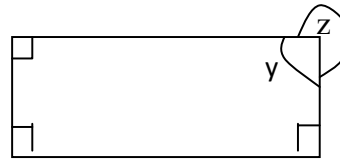
Having known the properties of quadrilaterals, you can now sketch (draw by free hand) or construct quadrilaterals by using appropriate tools such as a ruler and a pair of compass. Before you come to the main activity of constructing quadrilaterals, let us do an exercise of identifying the missing angles in the following examples.

Example 1:

Find the angles marked by letters in the following quadrilaterals. Give reasons



ii.

**Solution**

(a) i.

To calculate x

Since $AB = DC$

Trapezium ABCD is isosceles

Therefore $x = 78^\circ$ (base angles of an iso. Triangle)

ii. To calculate angle y

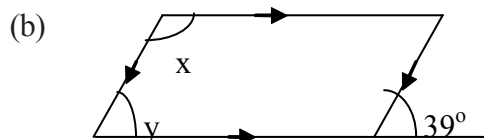
Angle $y = 90^\circ$ (interior angle of a rectangle)

$y + z = 360^\circ$ (angles at a point)

$$90^\circ + z = 360^\circ$$

Therefore, angle $z = 360^\circ - 90^\circ$

$$z = 270^\circ$$



$y = 39^\circ$ (corr. Angles)

$y + x = 180^\circ$ (allied angles)

$$39 + x = 180^\circ$$

$$x = 180^\circ - 39^\circ$$

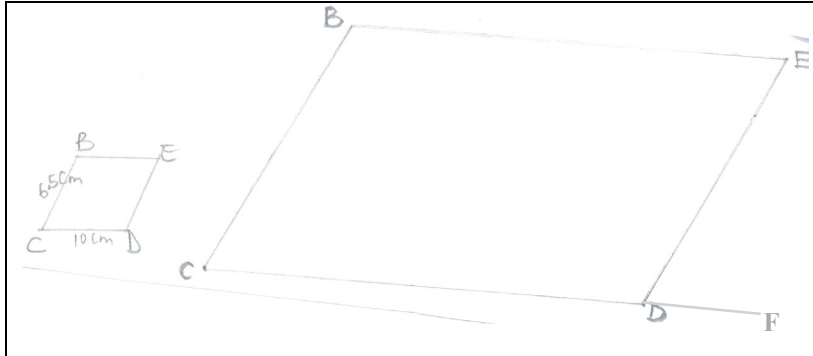
$$x = 141^\circ$$

Now you are going to learn how to construct a quadrilateral. Look at the following example:

Construct a parallelogram BCDE with base BE=10cm, BC=6.5cm and angle BED = 60° .

Procedure:

1. Draw a sketch like the one shown below:



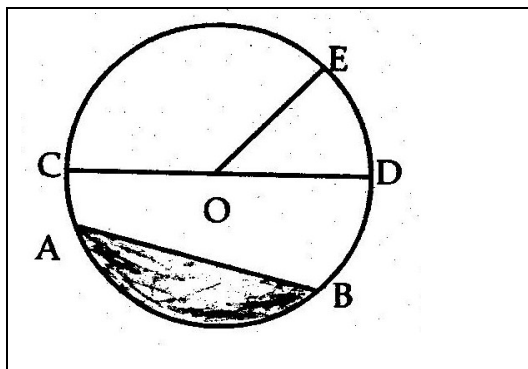
2. Draw the base line CD=10cm
3. Using point C, construct angle BCD= 60° where BC=6.5cm as shown below
4. Extend line CD to F, using point D construct angle EDF= 60° where ED=6.5cm as shown below
5. Join BE; therefore BCDE is a //gram

14.5 Parts of a Circle

Unlike quadrilaterals which are made up of straight lines, a circle is formed by a curved line called the circumference. A circle has a special property that every part of the circumference is the same distance from the middle of the circle. In the activity below, you will explore different parts of a circle and calculate sizes of parts of circles.

Activity 1

Identify and define parts of a circle



From the above figure, you will observe that a circle has different parts. These parts include chord, segment, sector, circumference, diameter, center, and radius. These parts are described as follows:

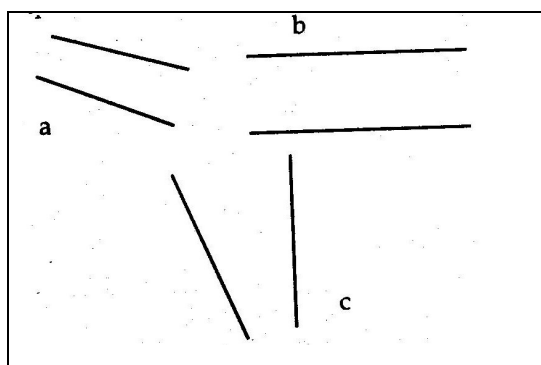
Part of a circle	Representation	Definition
Circumference	ABDEC	Distance around the circle
Diameter	COD	A line from the circumference to circumference through the center of the circle
Center	O	Mid point of a circle
Chord	AB	A line from one end of circumference to another but not through the center
Radius	OE	A line from the center of a circle to the circumference (half diameter)
Sector	EOD	A fraction of a circle
Arc	CE	Part of a circumference of a circle
(segment)	Shaded part	Area bounded by a chord and an arc.

Self Assessment 2

1. Explain the difference between a sector and a segment.
2. Using pencils, pair of compasses and a ruler, draw circles with the following measurement.
 - i. 3 cm radius
 - ii. 8 cm diameter

14.6 Teaching of parallel lines

It is necessary to assist learners to understand the meaning of parallel lines in-order to deal with problems involving parallel lines. Look around your environment and identify objects that depict parallel lines. Which of the following pairs of lines are parallel?

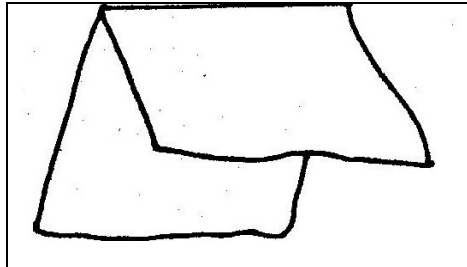


Drawing parallel lines

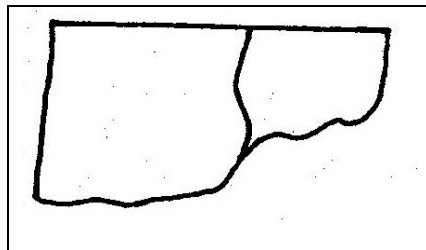
There are several ways of drawing parallel lines. In this activity, you will explore two ways of drawing a line that is parallel to a given lines.

Activity:

1. Fold a paper of any shape into two and in any way as shown below:



2. Fold it the second time such that the folds lie on top of one another as shown below:

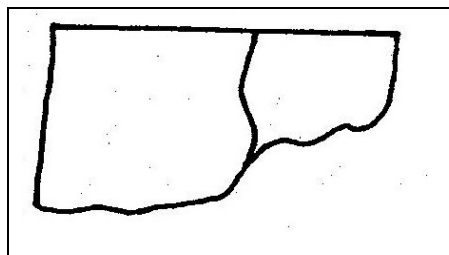


Note that a right angle is formed at the corner.

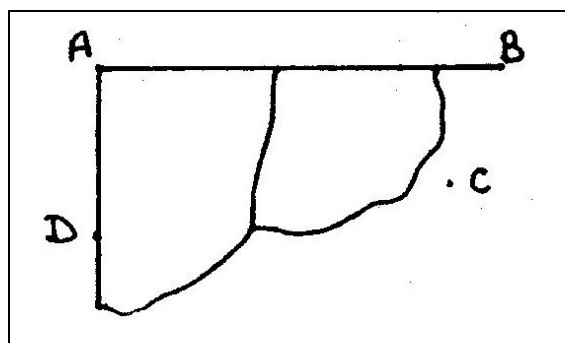
3. Draw a line AB as shown below

A _____ B

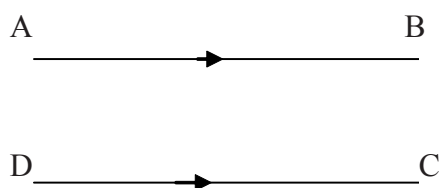
4. Place the foled paper such that the right angled corner is set at point A and the folds lie on line AB. Put a dot 3 cm below point A and name it D as shown below:



5. Remove the folded paper, and place it such that the right angled corner is set at point B and the folds lie on line AB. Put a dot 3 cm below point B and name it D as shown below:



6. Remove a folded paper and join CD as shown below:

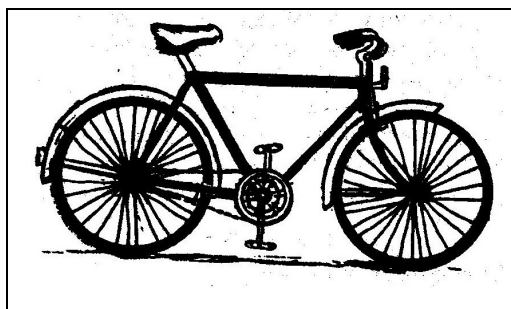


The two lines cannot intersect. They are parallel.

14.7 Teaching of quadrilaterals and circles

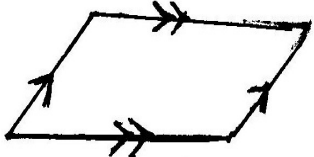
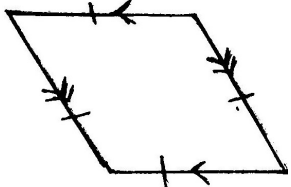
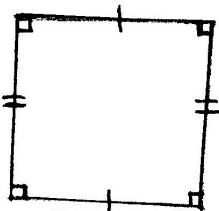

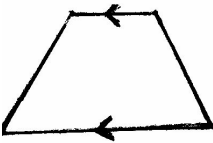
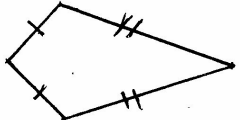
For your learners to understand better the concepts of quadrilaterals and circles, you need to include the following points in your teaching:

- sequence concepts on quadrilaterals and circles
- involve the learners to identify objects which are quadrilateral or circular in shape in class or outside the class
- engage learners with mathematical games when teaching quadrilaterals and circles e.g. forming a circle with bodies while singing a song called “bwalo likule bwalo likule”
- you can include a check list to assess the learners after teaching quadrilaterals
- use talular when teaching quadrilaterals and circles. One good example is the TALULAR bicycle. This is one of the most interesting resources that we can use for the teaching of primary school Numeracy and mathematics. The parts of the bicycle can be used to teach about geometrical shapes.



14.7.1 How to introduce quadrilaterals through modelling

1. identify with learners objects with four sided shapes in your classroom or outside the classroom
2. let learner draw in their notebooks the object with four sided shapes which they have seen
3. model shapes of quadrilaterals using sticks or any appropriate objects
4. let learners know that the four sided objects are called quadrilaterals.
5. ask learner to give more examples of objects at home that are quadrilaterals
6. Show learners models of quadrilaterals made out of paper
7. involve the learner to identify each model of quadrilateral as follows:

Drawing	Name of quadrilateral
	Parallelogram
	Rhombus
	Square
	Rectangle
	Trapezium
	Kite

14.7.2 How to introduce the circle through modelling

1. ask learner to identify objects that are circular in shape
2. draw a circle on a piece of paper
3. cut the circle drawn on the piece of paper
4. fold the circle twice
5. discuss with learners so as to establish the following from the folded circle
 - center
 - radius
 - diameter
 - circumference
6. discuss the meaning of each concept established in the above step
7. let learner practice the activity in their groups

14.8 Unit assessment 14

1. Which quadrilateral is similar to a rhombus?
2. Construct a checklist which you can use to assess learners on quadrilateral

14.9 Suggested answers

Self assessment 1

Types of quadrilaterals
1. Kite
2. Rhombus
3. Parallelogram
4. Square

Self assessment 2

A sector is a part of the circle lying between two straight lines drawn from the centre to the circumference while a segment is part of a circle cut off by a straight line joining any two points on the circumference.

Unit Assessment

1. a square
2. by using the following checklist

Name of learner:

Checklist

How best is the learner able to	Excellent	Good	Average	Needs Support
1. identify drawings of quadrilaterals				
2. name or list type of quadrilaterals				
3. draw quadrilaterals correctly				
4. give example of physical quadrilateral objects				

Glossary

Quadrilateral: four sided figure

Circle: round space enclosed by curved line equidistant from the center

Isosceles trapezium: trapezium with opposite non-parallel sides and base angles equal

Construction: drawing figures using certain materials, given information about sizes of sides and angles

Diagonal: a line that joins two opposite vertices of a quadrilateral

Diameter: a straight line connecting the center of the circle to two points on its sides

Radius: a straight line from the center of the circle to the circumference

Center: a point that is equidistant (equal distant) from the circumference (sides) of the circle

Circumference: distance around the circle

Segment: part of a circle cut off by a straight line joining any two points on the circumference

Sector: part of the circle lying between two straight lines drawn from the center to the circumference

Arc: part of the circumference of the circle

References

Ministry of Education (2005) *Initial Primary Teacher Education Teaching syllabus for Numeracy and Mathematics*, MIE, Domasi

Ministry of Education (2006) *Initial Primary Teacher Education Numeracy and Mathematics Student Handbook for term 2*, MIE, Domasi

Ministry of Education (2008) *Malawi Primary Education, Mathematics Teachers' Guide for standard 7*, MIE, Domasi

UNIT 15

SCALE DRAWING

15.1 Introduction

In unit 14 you learned about properties and construction of triangles, quadrilaterals and circles. Some of these objects are too big or too small to draw on a piece of paper. You need to reduce or enlarge their sizes proportionally. In this unit you will learn about scale drawing. Scale drawing is used in fields such as survey, navigation and carpentry. However in this unit, you will focus on drawing triangles and quadrilaterals to a scale. Knowledge of this unit will help you teach the topic to learners effectively.

15.2 Success criteria

By the end of this unit, you must be able to:

- draw triangles and quadrilaterals to a given scale
- apply the knowledge of scale drawing to real life situations.

15.3 Key words

The following are key words in this unit:

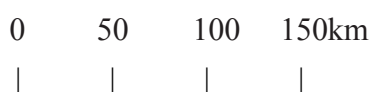
- enlargement
- scale
- scale factor

15.4 Drawing triangles and quadrilaterals to scale

What is a scale? Scale is a proportion which the representation of the object bears to the object itself. It is the ratio of the length in the drawing to the actual length of a real thing. There are three ways of expressing scale namely: simple statement, representative fraction and linear. Can you give examples of these ways?

The examples are:

- Using simple statement such as 1cm to represent 1km. This means that 1cm on the map represents 1km on the actual ground. You can also write the same statement in short as 1cm to 1km.
- Using the representative fraction (RF). The idea of proper fraction is important in this respect. The numerator shows how many parts are being considered while the denominator shows the total number of equal parts into which the whole has been divided. When you see a scale on the map indicating 4cm to 1km, it means that 4cm on the map represents 1km on the actual ground. The RF in this case is $\frac{4}{100\ 000} = \frac{1}{25\ 000}$ sometimes you write it as **1: 25000**. In general, scale = distance on the map/ Distance on actual ground which is the same as any length on the drawing divided by corresponding length of the object.
- Line or linear scale. You have seen on some maps a horizontal line divided into equal portions such as





This means that distance from first mark to second on the map represent 50km on the actual ground. When drawing something to scale, you should start with a rough sketch of the plan. This is necessary because it will give you a clear picture of how the plan will look like. Always you should remember to indicate the title as well as the scale. You should make sure that the chosen scale is suitable otherwise the drawing might be too small or too big to fit on paper. Consider the following examples:

Example 1

A distance on the map is 4.7cm. Using a scale of 1cm to represent 10km, find the actual distance.

Solution.

1cm represents 10km

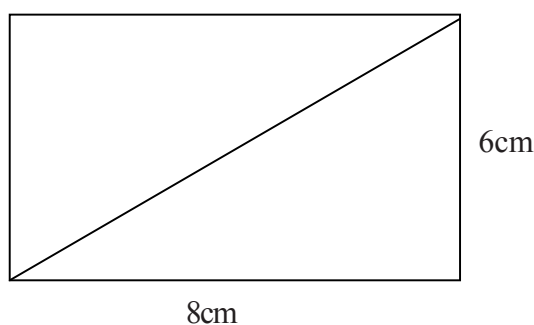
Therefore 4.7cm represent $\frac{4.7\text{cm} \times 10\text{km}}{1\text{cm}}$
 $= 47 \text{ km}.$

Example 2

A rectangular plot measures 80m by 60m. Draw a plan of the plot and find the actual distance between the opposite corners of the plot.

Solution

You should firstly choose a suitable scale to draw the plan such as 1cm represents 10m. You should divide 80m by 10 and also divide 60m by 10. The plan therefore would be drawn 8cm by 6cm as shown below.



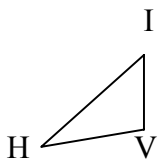
You should calculate the length of the diagonal by measuring the diagonal using a ruler. You will find that it will be 10cm. Then using the scale convert 10cm on the drawing to actual distance on the ground.

If 1cm represents 10m

Therefore 10cm represent $\frac{10\text{cm}}{1\text{cm}} \times 10\text{m}$
 $= 100\text{m}$

Example 3

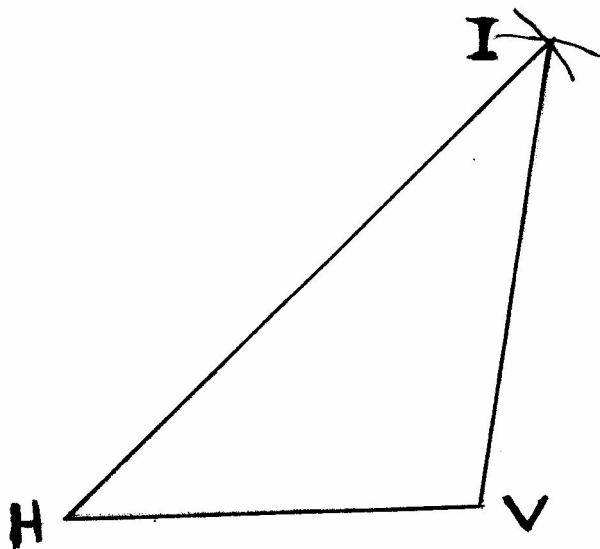
In the figure below, HI and VI are two routes which meet at I.



If H and V are two towns 178 km and 124 km from I respectively and are 108 km apart, use a scale of 1 cm to 20 km make a scale drawing of the routes.

Solution

As 20km on ground represents 1 cm on paper, the town H is $\frac{178}{20}$ cm from I and town V is $\frac{124}{20}$ cm from I and these towns are $\frac{108}{20}$ cm apart on paper. If you simplify these you will get $HI = \frac{178}{20} = 8.9\text{cm}$, $VI = \frac{124}{20} = 6.2\text{cm}$ and $HV = \frac{108}{20} = 5.4\text{cm}$. You should use a ruler, pencil and a pair of compasses to construct the required triangle as shown below:



Self assessment 1

1. Copy and complete the following table:

Actual length	scale	Length on drawing
a. 80m	1 cm to 10cm	
b. 20m	1 cm to 5m	
c. 3km	1cm to 750m	
d. 525km	1 cm to 50km	
e. 2.85km	1cm to 1km	
f. 65m	1 cm to 5m	
g. 56km	1 cm to 8km	

2. Measure the length and width of the top of a rectangular table. Draw its plan and find the length of the diagonal. Check by measuring the actual diagonal.
3. The scale of a map is 1: 100 000. Find in km, the length of the road represented by a line 4.7cm long on the map.
4. A house covers a rectangular ground measuring 15.7m by 12.3m. On the architect's plan the length of the rectangle is 78.5cm. What scale is the architect using?
5. Draw plans of the following rectangles to the given scales and find the actual measurements of the diagonals:
 - a) Rectangular floor 16m by 12m to a scale of 1cm to 2m
 - b) Rectangular hall 40m by 32m to a scale of 1cm to 4m

15.5. Enlargement

What do you understand by the term enlargement? Enlargement is a transformation. It covers both an increase and decrease in the size of an object. When an object is reduced or enlarged, all the corresponding lengths are in the same ratio, that is, they have the same scale factor. You have seen pictures on a screen. They look real. Why is it so? In an enlargement, an object and its image are similar. The corresponding sides are proportional. The scale factor determines the ratio by which an object has been enlarged. How could one determine the scale factor? You need to divide the image length by the object length. So image length = scale factor \times object length and object length = image length \div scale factor. Sometimes you can be asked to calculate the image area. To do this, you should find the area of the object and then multiply that by scale factor squared. In short, area factor = (scale factor)². Area factor is equal to image area \div object area. Therefore, (scale

$$\text{factor})^2 = \text{image area/object area which gives } \textbf{scale factor} = \sqrt{\frac{\text{image area}}{\text{object area}}}$$

Consider the following example:

Example

The length of the church is 15.6m and is represented on the plan by 7.8cm. If the area of the actual church is 312m², find the area of the plan.

Solution

$$\begin{aligned} \text{Scale factor} &= \frac{7.8\text{cm}}{15.6\text{cm}} \\ &= \frac{7.8\text{cm}}{1560\text{cm}} \\ &= \frac{1}{200} \end{aligned}$$

$$\begin{aligned} \text{Then area factor} &= \left(\frac{1}{200}\right)^2 \\ &= \frac{1}{40,000} \end{aligned}$$

If area of the church is 312m^2 ,

Then area of the plan = $312\text{m}^2 \times \frac{1}{40000}$

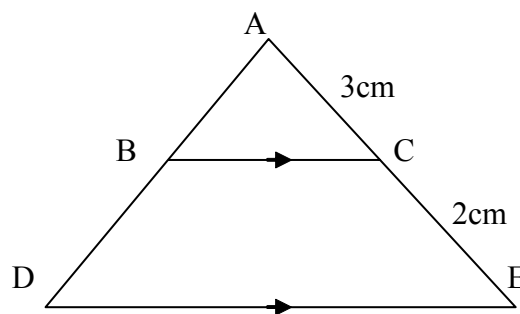
$$= 0.0078\text{m}^2$$

Since $10,000\text{cm}^2 = 1\text{m}^2$

$$\begin{aligned}\text{Area of the plan} &= 0.0078\text{m}^2 \times \frac{10,000\text{cm}^2}{1\text{m}^2} \\ &= 78\text{ cm}^2\end{aligned}$$

Self assessment 2

- 1 A photograph measuring 8cm by 10cm costs K88. What will be the cost of an enlargement measuring 28cm by 35cm?
- 2 A photograph measures 8cm by 5cm. If the scale factor of the enlargement is 3, calculate the area of the photograph.
- 3 In the figure below, BC is parallel to DE. If AC = 3cm, and CE = 2cm, find the ratio of area of “ABC to the area of “ADE.



- 4 The scale on the plan of the school reads as 0.5cm to 1m. If on the plan the room has an area of 20cm^2 , calculate the area of the room in square metres.

15.6 Summary

In this unit you have learned scale drawing and its importance in our daily life. Scale means the proportion which the representation of an object bears to the real object. When a drawing of a plan of the building, car or any other object is required, you should remember to select a suitable scale so that the final drawing and the object will be in proportion. There are three ways of expressing scale. These are by use of a statement, representative fraction and linear or simply line scale. You should rough sketch the plan and indicate the title. Enlargement is a transformation in which the shape of an object remains altered but the size changes. Scale factor determines the extent by which an object has been enlarged.

$$\text{Scale factor} = \frac{\text{image length}}{\text{object length}}$$

15.7 Unit assessment 15

- 1 Using a scale of 1cm to 8 km, what would the following distances be on a drawing: a. 24Km b. 4km
- 2 A map is drawn to a scale of 1: 5 000. On the map a town has an area of 8cm^2 , find the actual area of the town. ($1\text{ha}=10\,000\text{m}^2$)
- 3 A tourist starts from the filling station and walks 300m west and then 400m south and wishes to return to the filling station by the shortest route. Using a scale of 1cm to 50m, draw the routes and find the distance covered on the return journey.

15.8 Suggested answers

Self assessment 1

1

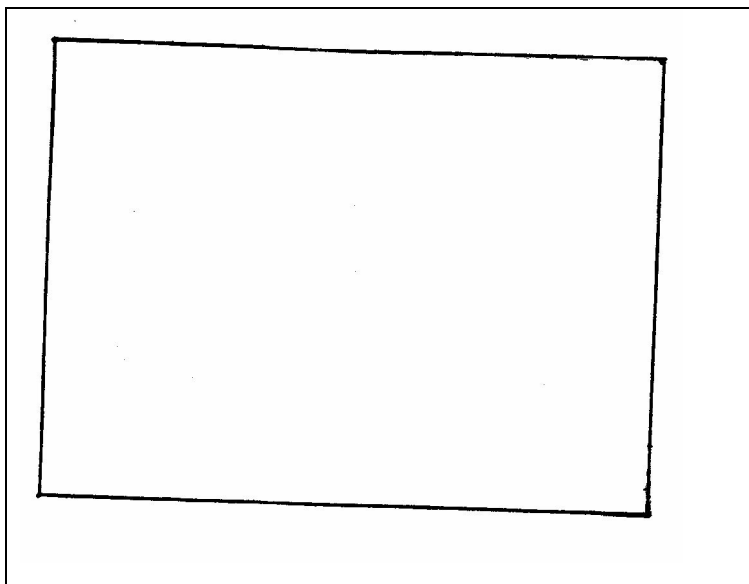
Length of drawing
a. 8cm
b. 4cm
c. 4cm
d. 10.5cm
e. 2.85cm
f. 13cm
g. 7 cm

2. (Practical)

3. 47km

4. 1 to 20

5. a)

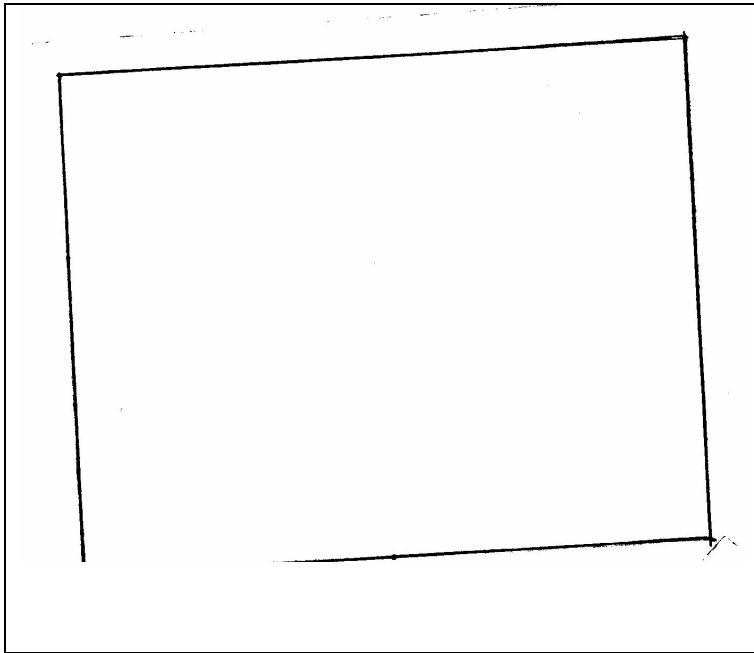


Diagonal is 10cm on the plan, therefore actual measurement is

$$\frac{10\text{cm} \times 2\text{m}}{1\text{cm}}$$

$$= 20\text{m}$$

b)



diagonal is 12.64cm on the plan, therefore actual measurement is

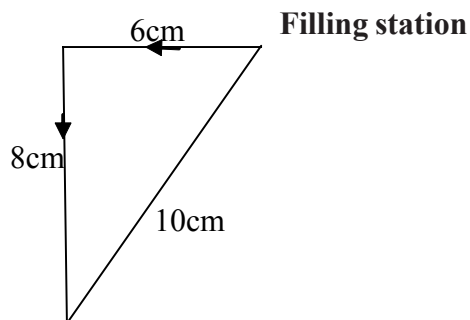
$$\frac{12.64\text{cm} \times 4\text{m}}{1\text{cm}} = 50.56\text{m}$$

Self assessment 2

1. K220
2. 3600cm²
3. 9 to 25
4. 2000 m²

Unit assessment 15

1. a) 3cm b) 0.5cm
2. 20000m² **or** 2 ha.
3. 300m will be 6cm on the drawing and 400m will be 8cm.



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Return journey is 10cm, therefore it will be $\frac{10cm \times 50m}{1cm}$
= 500m.

Glossary

Enlargement: a transformation in which the shape of an object remains unaltered but the size changes.

Scale factor: a number or constant that multiplies to enlarge or reduce the size in a scale drawing.

Scale: ratio of length of the drawing of an object to actual length of the object.

References

Ministry of Education (2005) Initial Primary Teacher Education Teaching Syllabus for Numeracy and Mathematics, MIE, Domasi.

Ministry of Education (2006) Initial Primary Teacher Education Numeracy and Mathematics Student Handbook, MIE, Domasi.

