Study Guide

# Via Afrika Mathematical Literacy

## Grade 11

Via Afrika Publishers

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# Introductory note

The purpose of this study guide is to provide further explanation and consolidation of the concepts explained in the Via Afrika Grade 11 Mathematical Literacy Learner's Book. This guide is not a substitute or a replacement for the Learners' Book and should not be used in isolation of the Learner's Book. Rather, this guide aims to provide further explanation of the key concepts dealt with in each chapter in the Learner's Book and more opportunity for practice and consolidation through the inclusion of additional questions. These questions will still draw on the contexts and resources used in the Learner's Book but focus on different areas of application. This guide will also make more explicit the connection between the contents of each chapter in the Learner's Book and the curriculum as outlined in the CAPS document. In this regard the study guide will help teachers to become more familiar with the contents of the CAPS curriculum document.

The study guide is made up of *two parts*.

- Part 1 provides additional explanation of the concepts, skills and contexts discussed in the teaching/theory component of the Learner's Book. Additional questions and exercises for consolidation of the *selected* concepts, skills and contexts discussed are also included.
- Part 2 provides an analysis of the Paper 1 and Paper 2 practice examinations included on pages 290-297 in the Learner's Book.

# Patterns, relationships and representations

**(LB pages 16-35)**

## Overview

The contents of this chapter form part of the Basic Skills Topics. As such, it is expected that the contents of this chapter will be used throughout the remainder of the curriculum and the chapters in the Learner's Book in order to help in making sense of the contexts encountered in the various Application Topics.

The primary focus in this Basic Skills Topic Grade 11 includes the ability to work with a variety of non-linear graphs, to work with two graphs drawn on a set of axes, identifying the point of intersection of those graphs, and to identify the meaning of the regions on the graph surrounding the point of intersection.

## Contexts and integrated content

- The contexts specified for this topic can include any contexts that are relevant to the Application Topics of Finance, Measurement, Maps and Plans, Data Handling and Probability.
- In working through the contents of this chapter it is essential that learners are able to draw and interpret linear and constant graphs (as taught in Grade 10).

# Section 1: Types of relationships

**(LB pages 18-25)**

## Overview

The content of this section on *Types of relationships*, as part of the Patterns, relationships and representations Basic Skills Topic, is drawn from page 38 in the CAPS document. The specific skills associated with working with these different types of relationships is described on pages 39-43 of the CAPS document.

Primary focus in this section is on introducing learners to a variety of *non-linear* graphs, including:

- graphs showing a constant ratio relationship;
- graphs that are made up of a combination of relationships;
- graphs that represent step-function relationships;
- graphs for which a pattern, relationship or equation is not immediately obvious.

Learners need to be able to draw graphs to represent these types of relationships and interpret and analyse those graphs. Importantly, the motivation for drawing a graph must be to facilitate a deeper understanding of a real-world situation.

## 1. Constant ratio relationships

Consider a scenario where the monthly cost of food purchases in a household is predicted to increase at a rate of 7,4% per year.

*Monthly food cost in 2011* = R3 000,00

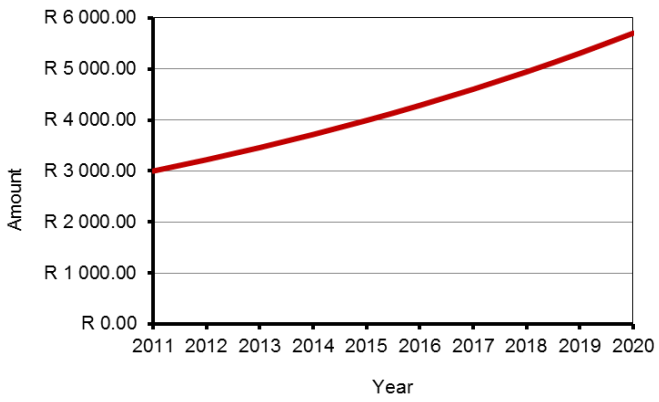
*Monthly food cost in 2012* = R3 000,00 + (7,4% × R3 000,00)
= R3 000,00 + R222,00
= R3 222,00

*Monthly food cost in 2013* = R3 222,00 + (7,4% × R3 222,00)
= R3 222,00 + R238,43
= R3 460,43

By continuing in this way we could construct the following table of values:

| Year | 2011 | 2012 | 2013 | 2014 | 2015 | ... | 2021 |
|---|---|---|---|---|---|---|---|
| Monthly food cost | R3 000,00 | R3 222,00 | R3 460,43 | R3 716,50 | R3 991,52 | ... | R 5 703,74 |

And from this table of values the following graph could be constructed:




A *constant ratio relationship* occurs when a value is increased by a factor (i.e. is multiplied by an amount) or a percentage, and then this new increased value is again increased by the factor or percentage, and so the process is repeated. This happened in the calculations on the previous page where every year a bigger amount was multiplied and increased by the factor of 7,4%.

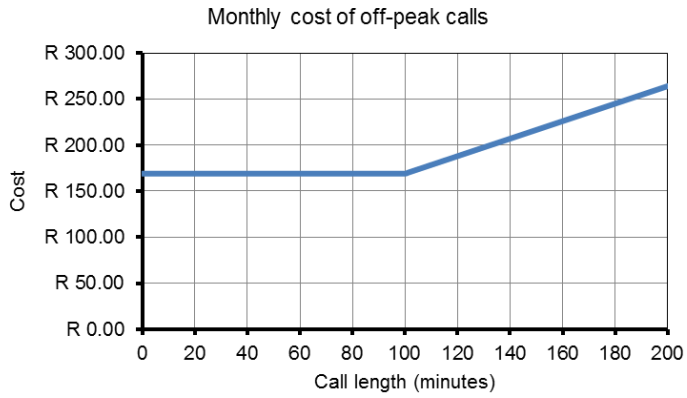
Importantly, notice that this graph of the constant ratio relationship is not a straight line but, rather, is getting steeper at a faster and faster rate. As such, for every time period or every change, the new value is always being calculated on a bigger and bigger value. We say that the graph is *increasing at an increasing rate*.

## 2. Combinations of relationships

The table below shows the cost of making calls on a particular cell phone contract.

| Total off-peak calls (minutes) | 0 | 20 | 40 | 60 | 100 | 101 | 120 | 140 |
|---|---|---|---|---|---|---|---|---|
| Total monthly cost | R169,00 | R169,00 | R169,00 | R169,00 | R169,00 | R169,95 | R188,00 | R207,00 |

The result of plotting these values on a set of axes is the following graph:




Notice that the graph is made up of two very different components:

- a flat linear portion;
- and an increasing portion that is also linear.

In relation to the specific context of the cell phone contract:

- the flat portion represents the fact that there is a fixed monthly subscription fee of R169,00 on this contract but that the contract also comes with 100 free minutes (off-peak). As such, for the first 100 minutes no calls are charged for and only the fixed subscription fee is payable.
- after 100 minutes, however, an additional fee is payable for the calls made. From the table we can see that this additional charge is R0,95 per minute. This additional charge is represented by the increasing portion of the graph. It is increasing because the call costs increased by R0,95 for every minute of talk time that passes; and it is linear because the increase in price is a constant value of R0,95 per minute.

What the discussion above illustrates is that the different portions of the graph, which are different types of graphs/relationships, have different meanings in relation to the cell phone context.

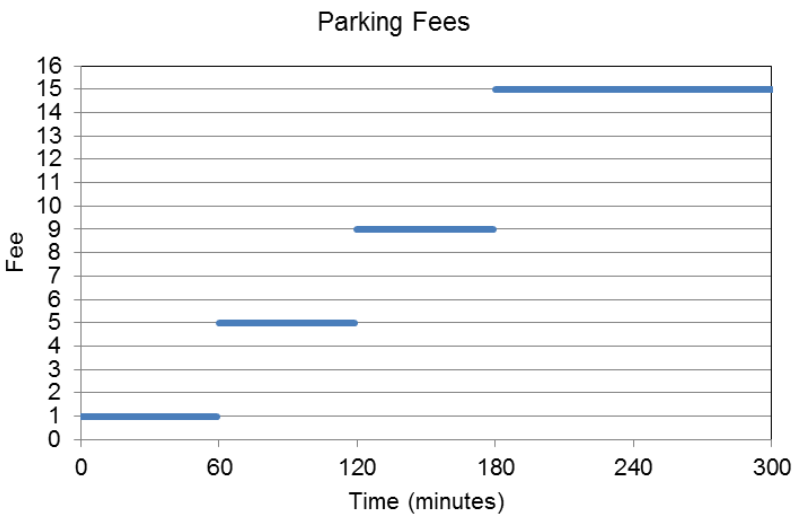
## 3. Step functions

The table below shows the parking fees at a supermarket.

| Time (in minutes) | <1 hour | 1-2 hours | 2-3 hours | 4+ hours |
|---|---|---|---|---|
| Tariff (Rands) | R1,00 | R5,00 | 9,00 | 15,00 |

Notice that for any time value less than 1 hour (e.g. 15 minutes, 35 minutes, 59 minutes, etc) the same fee of R1,00 will be charged. It is only when the time reaches 1 hour that a new fee is charged; and then this new fee applies to any time between 1 hour and 2 hours.

Plotting these values on a set of axes gives the following graph:




- This type of relationship is called a 'step function' because when plotted as a graph the image created looks like a series of steps. The 'steps' or jumps from one portion of the graph to another indicate that different fees are charged for different time intervals, but that within a time interval the same fee is charged for a number of different time values (for example, the cost of parking for 1 hour 10 minutes and 1 hour 50 minutes is the same).
- Also notice that the different 'steps' or segments in the graph are not joined. This indicates that as you move out of one time interval into a different time interval then a completely different fee is charged that is not related to the previous fee.

## 4. Relationships with no obvious pattern or formula

The Learner's Book also contains a discussion that illustrates how sometimes drawing a graph of an unfamiliar situation – even though no specific formula for the situation may be known or no patterns are immediately obvious – makes it possible to make sense of the situation and to see patterns and trends in the situation that were not possible to see without the graph. In other words, it is important to be able to draw and interpret graphs of any situation and not simply of those situations for which formula or patterns are available / visible.

# Section 2: Working with two relationships on a set of axes

**(LB pages 26-31)**

## Overview

The content of this section, as part of the Patterns, relationships and representations Basic Skills Topic, is drawn from page 44 in the CAPS document.

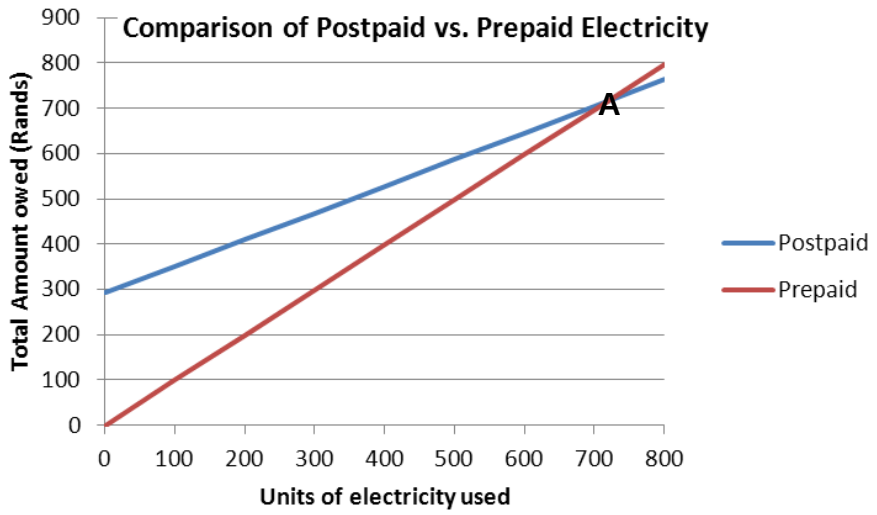
Primary focus in this section is on:

- identifying the point of intersection of two graphs;
- understanding the significance of the point of intersection in specific relation to the context represented in the graphs;
- understanding the significance of the regions on either side of the point of intersection in relation to the context represented in the graphs.

Apart from identifying the point of intersection of two graphs from the graphs, it is also important to be able to estimate the point of intersection of two relationships using the process of trial and improvement (and not accurate algebraic manipulation) with the equations for the relationships.

## 1. Estimating points of intersection of two graphs from a graph

The graph below shows the cost of electricity on two different types of electricity tariff systems.




The place where the two graphs cut (labelled A) is called the 'point of intersection' of the two graphs. At this point the two graphs are exactly equal. As such, in relation to the comparison of the cost of electricity on the different electricity systems, this 'point of intersection' indicates the point at which the cost of electricity on the two different systems is the same.

Importantly, *the point of intersection is always made up of two values*:

- one value is always read from the horizontal axis → in reference to the graph on the previous page, this horizontal value is the number of units of electricity that must be used for the cost to be the same ≈ 720 units;
- one value is always read from the vertical axis → in reference to the graph on the previous page, this vertical value is the amount of money that must be spent on electricity every month for the cost to be the same ≈ R720,00.

## 2. Determining the point of intersection using equations and the process of trial and improvement

Another way to work out the values for which two relationships are equal is to use equations to the relationships and through the process of trial and improvement to substitute values into the equations repeatedly until a value can be found which gives the same answer for both equations.

### Example

The following two equations represent the cost of electricity on the Postpaid and Prepaid systems shown on the graphs on the previous page:

- Postpaid: Total Cost = R291,80 + (R0,589699/unit × units used)
- Prepaid: Total Cost = R9,955025/unit × units used

We see from the graph that the graphs cross at a value *slightly larger* than 700 units of electricity, so let us substitute a value:

*Try* 710 units: Postpaid: Total Cost = R291,80 + (R0,589699 × 710) = R710,49

Prepaid: Total Cost = R9,55025 × 710 = R706,47

*Try* 715 units: Postpaid: Total Cost = R291,80 + (R0,589699 × 715) = R713,43

Prepaid: Total Cost = R9,55025 × 715 = R711,44

*Try*720 units: Postpaid: Total Cost = R291,80 + (R0,589699 × 720) = R716,38

Prepaid: Total Cost = R9,55025 × 720 = R716,72

With more trial and improvement, it is possible to calculate that both options have the same value of *R719,91 for 719,9 units*, but 720 units is accurate enough to make decisions about which option is cheaper.

Importantly, trial-and-improvement is not simply guessing. Rather, it involves substituting a value and then comparing the answer in both equations to inform what value to substitute next, and then doing this again and again until equal values are determined.

## Additional questions

1. Milton runs a car wash business. The monthly expenses for his business include:

- R1 400,00 in salaries
- R5,20 per washed car, for water, soap and electricity.

Milton charges R25,00 per car for a wash and vacuum.

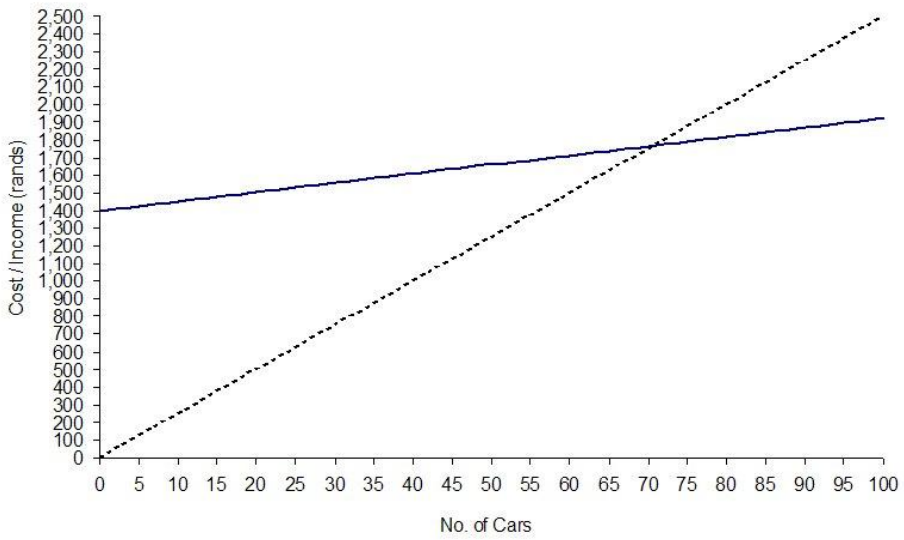
1.1 Write down a formula to represent the total monthly cost that Milton incurs in running his car wash business as dependent on the number of cars washed.

1.2 Write down a formula to represent the total monthly income that Milton generates as dependent on the number of cars washed.

1.3 Use trial and improvement to determine how many cars Milton must wash per month in order to *break even* and cover all business expenses.

1.4 How much must Milton earn in income per month in order to break even?

1.5 The graphs on the next page represent the total monthly cost and total monthly income for Milton's car wash business.

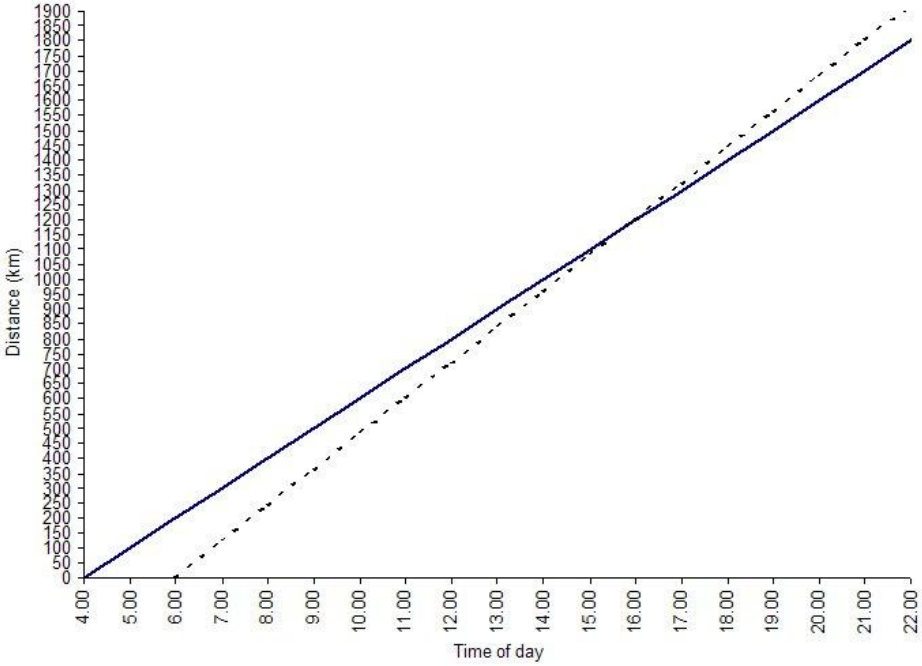



1.5.1 Which graph represents the car wash's total monthly cost and which graph the total monthly income? Explain your answer.

1.5.2 On the graph, identify the break-even point and at this point fill in the number of cars that Milton must wash and the income that he must generate in order to break even.

2. Sandy and Matselidiso are driving from Cape Town to Durban. Sandy leaves at 4:00 am in the morning travel-ling at an average speed of 100 km/h. Matselidiso leaves 2 hours later travelling at an average speed of 120 km/h.

   The graphs below show the distances travelled by Sandy and Matselidiso over the course of the day.




2.1Which graph repr

2.2 At what time of day does Matselidiso leave Cape Town?

2.3 If both Sandy and Matselidiso drive continuously without stopping, use the graph to determine the approximate time at which Matselidiso will overtake Sandy.

2.4 Approximately how far will both Sandy and Matselidiso have travelled when Matselidiso overtakes Sandy?

2.5 The equations below represent the *distance* (in kilometres) travelled by both Sandy and Matselidiso as dependent on the *time of day*.

- Sandy's trip: Distance = 100km/h × time (hours) – 400 km
- Matselidiso's trip: Distance = 120 km/h × time (hours) – 720 km

  Use these equations to determine accurately:

2.5.1 the time of day at which Matselidiso will overtake Mandy

2.5.2 the distance that both Sandy and Matselidiso will have travelled when Matselidiso overtakes Sandy.

2.6 If the actual distance from Cape Town to Durban is 1 753 km (travelling through the Karoo, via Bloemfontein), determine approximately how long (to the nearest hour) it takes both Sandy and Matselidiso to complete the trip.

2.7 If you were to travel from Cape Town to Durban travelling at 120 km/h, do you think that you would complete the trip in the same amount of time as Matselidiso? Explain your answer.

## Answers

1. 1.1 Cost

= R1 400 + R5,20/car × no. of cars

1.2 Income = R25,00/car × no. of cars

1.3 Using trial and improvement (i.e. by substituting repeatedly into the equations), the break even value is 71 cars.

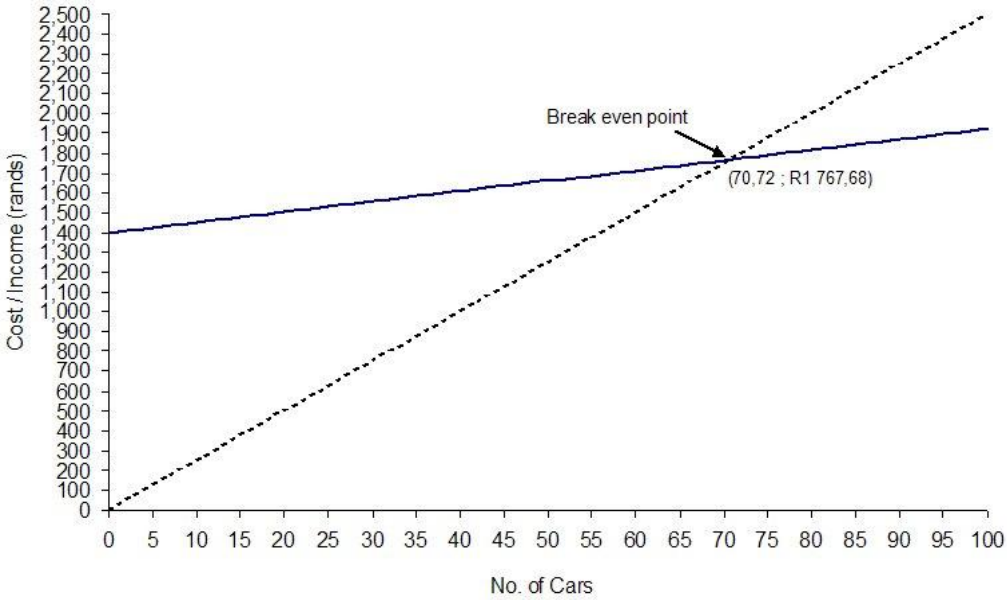
1.4 Income = R25,00/car × no. of cars

For a break-even value of 71 cars: Income = R25,00/car × 71 cars = R1 775,00

1.5 1.5.1 The solid line graph represents the total monthly cost.
Even if Milton does not wash any cars during the month,
he will still have to pay R1 400,00 in salaries. The cost graph for Milton's Car Wash
*y*-axis.

The dotted line represents Milton's monthly income. The income
that Milton earns depends on the number of cars washed. If no cars are washed the

1.5.2 The break-even point is the point of intersection of the two graphs.




2. 2.1 The solid line graph represents Sandy who leaves at 4:00, and the dotted line graph represents Matselidiso who leaves 2 hours later at 6:00.

2.2 6:00 am

2.3 Matselidiso will pass Sandy at approximately 16:00 or 4 pm in the afternoon.

2.4 1 200 km (this is an accurate value)

2.5 Sandy: Distance = 100km/h × time (hours)– 400 km

Matselidiso: Distance = 120 km/h × time (hours)– 720 km

Using trial and improvement and by substituting values into both of the equations, we find they will pass each other when time = 16.

So, Sandy and Matselidiso will pass each other at 16:00.

Substituting *time*= 16 hours into *distance= 100 km/h × time (hours)– 400 km*:

Distance = 100 km/h × 16 hours – 400 km

= 1 600 km– 400 km

= 1 200 km

∴ When Matselidiso overtakes Mandy they both will have travelled 1 200 km.

2.6 *Sandy*: If distance = 1 753 km then:

1 753 km = 100km/h × time (hours) – 400 km

1 753 km + 400 km = 100km/h × time (hours)

2 153 km ÷ 100 km/h = time (hours)

Time = 21,53 hours

So Sandy arrives at ≈ 22:00. If she left at 4:00, then it took her about 18 hours to complete the trip.

*Matselidiso:* If distance = 1 753 km then:

1 753 km = 120 km/h × time (hours) – 720 km

1 753 km + 720 km = 120 km/h × time (hours)

2 473 km÷ 120 km/h = time (hours)

Time = 20,61 hours

So Matselidiso arrives at about 21:00. If he left at 6:00, then it took him about 15 hours to complete the same trip.

2.7 Probably not, as most people do not drive without stopping along the way to fill up with petrol and to take a break. In reality, you would not be able to drive from Cape Town to Durban without stopping to fill up with petrol.

Also, it is also not realistic to think that someone will be able to drive at the same speed the entire journey

# Conversions

**(LB pages 38-51)**

## Overview

The content of this section on *Conversions*, as part of the Measurement Application Topic, is drawn from page 63 in the CAPS document.

As stipulated in the CAPS document, Grade 11 learners need specifically to be able to convert between *different* systems of measurement – for example, from imperial to metric units, from degrees Celsius to degrees Fahrenheit, or from grams to millilitres.

## Contexts and integrated content

- Learners need to be able to work in the context of larger projects that take place in the household, school or wider community. This could include baking or catering projects or construction projects (e.g. making clothes, or building a bicycle ramp).
- Calculations involving conversions, especially between different systems, make use of the concept of *rates* as found in the Basic Skills Topic on Numbers and calculations with numbers.

## Section 1: Conversions

**(LB pages 40-41)**

This section deals with:

1. Conversions between different systems for measurements and lengths, specifically between the imp

- For these types of conversions the *conversion factor* will always be given(for example: 1 kg ≈ 2,206 pounds).
- To solve problems involving conversions the method of working with rates is required:

### Example:

If 1 kg ≈ 2,206 pounds, then 78 kg ≈ 2,206 pounds × 78

≈ 172,1 pounds

(rounded off to 1 decimal place)

Similarly: 1 kg ≈ 2,206 pounds→ 1 pound ≈ 1 kg ÷ 2,206

150 pounds ≈ 1 kg – 2,206 × 150 ≈ 68 kg

2. Conversions from degrees Celsius (°C) to degrees Fahrenheit (°F):

- For these types of conversions the following *conversion formulas* will always be given:
  - °F = (1,8 × °C) + 32°
  - °C = (°F - 32°) ÷ 1,8
- To solve problems involving temperature conversion the method of substitution into equations is required:

### Example:

Converting 35°C to °F gives: °F = (1,8 × 35°) + 32°= 95°

# Section 2: Converting between liquid and solid quantities

**(LB pages 42-43)**

This section demonstrates how to perform conversions between different types of solid and liquid quantities and the units that are required in these conversions. The content and contexts to which the conversions relate include:

- baking projects where items are packages according to weight (kg or g) and need to be measured in ml for a recipe.
- construction projects where volume values are calculated using dimensions given in mm, cm or m but where liquid quantities of materials are needed. These types of conversions involve converting from cubic units ($m^3$, $cm^3$ or $mm^3$) to millilitres or litres.
- A useful conversion is that a box with a volume of 1 $m^3$ will hold 1 litre of water:
- or that a box with a volume of 1 $cm^3$ will hold 1 ml of water.
- construction projects where surface areas are calculated using dimensions given in mm, cm or m but where liquid quantities of materials (e.g. paint) are needed to cover the area. These types of conversions involve converting from square units ($m^2$, $cm^2$ or $mm^2$) to millilitres or litres.

Whenever such conversions are required the necessary conversion factor will be provided.

## Example 1

A person buys a 500 g bag of sugar.

*If a recipe asks for 750 ml of sugar, will this 500 g bag be big enough or will more sugar need to be bought?*

Using the fact that 4 g of sugar is equal to approximately 5 ml, we can answer this question as follows: 4 g → 5 ml

1 g → 5 ml ÷ 4

500 g → 5 ml ÷ 4 × 500 = 625 ml

So the 500 g bag only holds an equivalent of 625 ml of sugar. As such, more sugar will need to be bought.

Note that we could also have solved this problem by working in the other direction:

5 ml → 4 g  so:  1 ml → 4 g ÷ 5

750 ml → 4 g ÷ 5 × 750 = 600 g

So, 750 ml is equivalent to approximately 600 g of sugar. Therefore the 500 g bag will not be big enough.

## Example 2

A wall has dimensions of approximately 6 m by 5 m. The painter thus estimates that the surface area of the wall is approximately 30 $m^2$. The paint that the painter will be using to paint the wall has a conversion factor (spread rate) of 9 $m^2$ per litre. This means that 1 ℓ of paint will cover approximately 9 $m^2$ of wall space.

*How many litres of paint might the painter need to paint this wall?*

Spread rate: 9 $m^2$ → 1 ℓ

1 $m^2$ → 1 ℓ ÷ 9

30 $m^2$ → 1 ℓ ÷ 9 × 30 ≈ 3,3 ℓ

This tells us that the painter will need more than 3 ℓ and so will have to buy at least 4 full litres. However, the actual quantity of paint that he buys may depend on the tin sizes that the paint is available in (e.g. 1 ℓ tin, or 5 ℓ tin, etc).

## Additional questions

1. Various conversions

1.1 Convert the following measurements to the specified units:

1.1.1 530 cm to m

1.1.2 12,5 km to m

1.1.3 1,6 kg to g

1.1.4 3,3 ℓ to ml

1.1.5 550 mℓ to ℓ

1.1.6 3 acres to $m^2$ (if 1 acre = 4 047 $m^2$)

1.1.7 1 $m^3$ to $cm^3$

1.2 1.2.1 At an athletics meeting, Jim runs in the 1 500 m race. How many km does Jim run?

1.2.2 If he later runs the 400 m race, how many km does he run?

1.3 A cake recipe uses 0,8 kg of flour, 1,25 ℓ of milk and 450 g of butter.

1.3.1 How many grams of flour do you need for the cake?

1.3.2 How many millilitres of milk do you need?

1.3.3 If you are measuring the milk using a 250 mℓ cup, how many cups of milk will you need?

1.3.4 If you have a ½ kg block of butter, will you have enough butter for the recipe? Explain your answer.

1.4 1.4.1 A water tank has a volume of 34 $m^3$. How many litres of water does the tank hold?

1.4.2 A cattle trough is able to hold 340 ℓ of water. What is the volume of the tank in $m^3$?

1.5 A piece of land has an area of 6 230 m2.

1.5.1 How big is the land in acres?

1.5.2 How big is the land in hectares? (if 1 acre = 0,4047 hectares)

1.5.3 What is the area (in $m^2$) of a plot of land that is 7,3 acres in extent?

2. Converting grams to ml using a Conversion Table

The table on the next page shows various conversion factors for converting from solid to liquid quantities (i.e. from grams to ml) for different ingredients. Use the table to answer the following questions:

2.1 If a recipe asks for 6 g of *dried peaches*, how many millilitres of dried peaches are needed?

2.2 A recipe asks for 20 g of *baking powder*. How many teaspoons of baking powder are needed?

2.3 A recipe asks for 90 g of *butter*. How many tablespoons of butter are needed?

2.4 A recipe asks for ½ a cup of *margarine*. How many grams of margarine are needed?

2.5 If a recipe asks for 1 cup of *peanuts*, how many grams of peanuts are needed?

2.6 How many grams of *Cheddar cheese* will be needed for a recipe that asks for 50 ml of Cheddar cheese?

2.7 How many grams of *icing sugar* will be needed for a recipe that asks for 45 ml?

2.8 A recipe asks for 350 g of *oats*. How many cups of oats are needed?

2.9 A recipe asks for two teaspoons of *coffee*. How many grams of coffee are needed?

2.10 A cake recipe asks for 7 cups of *flour*. How much flour (in kilograms and grams) must to be bought for the cake?

2.11 A recipe asks for 626 g of *biscuit crumbs*. Approximately how many cups, tablespoons and teaspoons of biscuit crumbs are needed?

| **Measuring instrument** | **ml equivalent** | | | |
|---|---|---|---|---|
| 1 cup | 250 ml | | | |
| 1 tablespoon | 15 ml | | | |
| 1 teaspoon | 5 ml | | | |
| **Ingredients** | **5 ml** | **12,5 ml** | **25 ml** | **100 ml** |
| Almonds (shelled) | 3 g | 8 g | 15 g | 60 g |
| Apricot Jam | 6 g | 15 g | 30 g | 120 g |
| Baking Powder | 4 g | 10 g | 20 g | 80 g |
| Biscuit Crumbs | | 5 g | 10 g | 40 g |

| | | | | |
|---|---|---|---|---|
| Bread Crumbs (fresh) | | 3 g | 6 g | 25 g |
| Bread Crumbs (dry) | | 6 g | 12 g | 50 g |
| Butter | 5 g | 12,5 g | 25 g | 100 g |
| Cheddar Cheese | 2 g | 5 g | 10 g | 40 g |
| Chocolate Chips | 3 g | 8 g | 15 g | 60 g |
| Cottage Cream | 5 g | 12,5 g | 25 g | 100 g |
| Cocoa | 2 g | 5g | 10 g | 40 g |
| Coffee | 1,5 g | 4 g | 7 g | 30 g |
| Curry Powder | 2,5 g | 6,25 g | 12,5 g | 50 g |
| Flour | 3 g | 8 g | 15 g | 60 g |
| Milk Powder | 3 g | 6 g | 13 g | 50 g |
| Margarine | 5 g | 12,5 g | 25 g | 100 g |
| Mealie Meal | 3 g | 6 g | 12 g | 50 g |
| Oats | 2 g | 5 g | 10 g | 40 g |
| Peaches (dried) | 3 g | 8 g | 15 g | 60 g |
| Peanuts | 3 g | 8 g | 15 g | 60 g |
| Rice | 4 g | 10 g | 20 g | 80 g |
| Raisins | 3 g | 8 g | 15 g | 60 g |
| Salt | 5,5 g | 14 g | 28 g | 110 g |
| Samp | | | 20 g | 80 g |
| Samp (instant) | | | 12 g | 50 g |
| Spaghetti | | | 10 g | 40 g |
| Brown & White Sugar | 4 g | 10 g | 20 g | 80 g |
| Icing Sugar | | 7,5 g | 15 g | 60 g |
| Castor Sugar | 4 g | 10 g | 20 g | 85 g |
| Mustard (dried) | 1,6 g | 4 g | 8 g | 32 g |
| Nutmeg (dried) | 2 g | 6 g | 12 g | 48 g |
| Pepper (dried) | 2,4 g | 6 g | 12 g | 48 g |
| Ginger (dried) | 1 g | 4 g | 8 g | 32 g |
| Mixed spices (dried) | 2 g | 5 g | 10 g | 40 g |
| Yeast (dried) | 4 g | 9 g | 18 g | 74 g |

3. Converting from $m^2$ to litres to determine paint quantities

Songi is going to use one coat of undercoat followed by one coat of acrylic paint to paint the walls of his house.

| Paint type | Coverage (per litre) |
|---|---|
| Undercoat | 7 $m^2$ |
| Acrylic | 10 $m^2$ |
| Enamel | 7,5 $m^2$ |

3.1 3.1.1 How many litres of undercoat will he need to paint 1 $m^2$ of wall?

3.1.2 If the surface area of the walls of Songi's house is 51,2 m2, how many litres of undercoat will Songi need to paint the walls of his house?

3.1.3 If the undercoat that Songi is going to use only comes in 5 ℓcans, how many 5 ℓcans will he need to buy?

3.1.4 If the undercoat costs R153,25 for 5 litres, how much will it cost Songi to buy the undercoat to paint the walls?

3.2 3.2.1 How many litres of acrylic paint will he need to paint 1 $m^2$ of wall?

3.2.2 How many litres of acrylic paint will Songi need to paint the outside walls of his house?

3.2.3 The acrylic paint that Songi is going to use comes in 2 ℓand 5 ℓ cans. The 2 ℓcan costs R89,50, the 5 ℓcan costs R149,80.

a. How many of each size can of Acrylic paint should Songi buy? Explain.

b. How much will it cost Songi to buy the Acrylic paint that he needs to paint the walls of his house?

3.3 Determine the total amount that Songi will spend on paint to paint the outside walls of his house.

## Answers

1. Various conversions

1.1 1.1.1 530 cm = 530 ÷ 100 m = 5,3 m

1.1.2 12,5 km = 12,5 × 1 000 m = 12 500 m

1.1.3 1,6 kg = 1,6 × 1 000 g = 1 600 g

1.1.4 3,3ℓ= 3,3 × 1 000 mℓ= 3 300 mℓ

1.1.5 550 mℓ= 550 ÷ 1 000 ℓ= 0,55ℓ

1.1.6 3 acres = 3 × 4 047 $m^2$ = 12 141 $m^2$

1.1.7 1 $m^3$ = 1 m × 1 m × 1 m = 100 cm × 100 cm × 100 cm = 1 000 000 $cm^3$

1.2

1.2.1 1 500 m = 1 500 ÷ 1 000 km = 1,5 km

1.2.2 400 m = 400 ÷ 1 000 km = 0,4 km

1.3 1.3.1 1 000 g = 1 kg ⇢ 0,8 kg of flour = 0,8 × 1 000 g = 800 g

1.3.2 1 000 ml = 1 ℓ⇢ 1,25 ℓof milk = 1,25 × 1 000 mℓ= 1 250 mℓ

1.3.3 Since 1 cup = 250 m*l*, for 1 250 ml of milk
you will need to measure 1 250 m*l* ÷ 250 m*l* = 5 cups.

1.3.4 1 000 g = 1 kg ⇢ 450 g = 450 ÷ 1 000 g = 0,45 kg butter.
Since a ½ kg block = 0,5 kg, if you need 450 g of butter for the recipe then you will have enough butter with ½ a block.

1.4 1.4.1 1 $m^3$ = 1 000 ℓ⇢ 34 $m^3$ = 34 × 1 000 ℓ= 34 000 ℓ

1.4.2 1 $m^3$ = 1 000 ℓ⇢ 340 litres = 340 ÷ 1 000 $m^3$= 0,34 $m^3$

1.5 1.5.1 1 acre = 4 047 $m^2$ ⇢ 6 230 $m^2$ = 6 230 ÷ 4 047 acres
= 1,54 acres (rounded off to 2 decimal places)

1.5.2 1 ha = 10 000 $m^2$ ⇢ 6 230 $m^2$ = 6 230 ÷ 10 000 ha = 0,623 ha

1.5.3 1 acre = 4 0 47 $m^2$ ⇢ 7,3 acres = 7,3 × 4 047 $m^2$= 29 543,1 $m^2$

2. Converting grams to ml using a Conversion Table

2.1 3 g dried peaches = 5 mℓ ⇒ 1 g dried peaches = 5 mℓ ÷ 3
= 1,667 mℓ (rounded off to three decimal places)
⇒ 6 g dried peaches = 1,667 mℓ × 6 = 10 mℓ

2.2 4 g baking powder = 5 mℓ ⇒ 1 g baking powder = 5 mℓ ÷ 4 = 1,25 mℓ
⇒ 20 g baking powder = 1,25 mℓ × 20 = 25 mℓ = 5 teaspoons

2.3 5 g butter = 5 mℓ butter ⇒ 90 g butter = 90 mℓ ⇒ 90 mℓ / 15 mℓ = 6 tablespoons

2.4 ½ cup margarine = 125 mℓ margarine
5 g margarine = 5 mℓ margarine
∴ 125 mℓ margarine = 125 g margarine

2.5 1 cup peanuts = 250 mℓ peanuts and 5 mℓ peanuts = 3 g
⇒ 1 mℓ peanuts = 3 g ÷ 5 = 0,6 g ⇒ 250 mℓ peanuts = 0,6 g × 250 = 150 g

2.6 5 mℓ cheese = 2 g ⇒ 1 mℓ cheese = 2 g ÷ 5 = 0,4 g
⇒ 50 mℓ = 0,4 g × 50 = 20 g

2.7 12,5 mℓ icing sugar = 7,5 g ⇒ 1 mℓ icing sugar = 7,5 g ÷ 12,5 = 0,6 g
⇒ 45 mℓ = 0,6 g × 45 = 27 g

2.8 2 g oats = 5 mℓ ⇒ 1 g oats = 5 mℓ ÷ 2 = 2,5 mℓ
⇒ 350 g oats = 2,5 × 350 = 875 mℓ
⇒ 350 g oats = 875 ÷ 250 cups = 3½ cups

2.9 2 teaspoons of coffee = 10 mℓ
⇒ 5 mℓ coffee = 1,5 g ⇒ 1 mℓ coffee = 1,5 g ÷ 5 = 0,3 g
∴ 10 mℓ coffee = 0,3 g × 10 = 3 g

2.10 7 cups flour = 7 × 250 mℓ = 1 750 mℓ
⇒ 5 mℓ flour = 3 g ⇒ 1 mℓ flour = 3 g ÷ 5 = 0,6 g
∴ 1 750 mℓ flour = 0,6 g × 1 750 = 1 050 g = 1 kg and 50 grams

2.11 5 g biscuit crumbs = 12,5 mℓ ⇒ 1 g biscuit crumbs = 12,5 mℓ ÷ 5 = 2,5 mℓ

⇒ 626 g biscuit crumbs = 2,5 mℓ × 626 = 1 565 mℓ

*Cups:* 1 565 mℓ = 1 500mℓ + 65 mℓ = 6 cup and 65 mℓ

*Tablespoons:* 65 mℓ = 60 mℓ + 5 mℓ = 4 tablespoons + 5 mℓ

*Teaspoons* = 1

3. Converting from m² to litres to determine paint quantities

3.1 3.1.1 To paint 7 m² of wall you need 1 ℓ of undercoat.

⇒ For 1 m² of wall you will need: $\frac{1}{7} \times 1\ell \approx 0{,}143\ \ell$ of undercoat.

3.1.2 Total surface area of the walls of Songi's house = 51,2 m².

⇒ For 51,2 m² of wall space Songi will need:

51,2 × 0,143 ≈ 7,32 ℓ of undercoat (rounded off to two decimal places).

3.1.3 Songi will need to buy two 5 ℓ cans of undercoat.

3.1.4 Total cost of the undercoat = R153,25 × 2 = R306,50

3.2 3.2.1 For 10 m² of wall space you need 1 ℓ of Acrylic paint.

∴ For 1 m² of wall space you will need: $\frac{1}{10} \times 1\ell = 0{,}1\ \ell$ of Acrylic paint.

3.2.2 For 51,2 m² of wall space Songi will need: 51,2 × 0,1 = 5,12 ℓ of Acrylic paint.

3.2.3 a. Songi needs 5,12 ℓ of Acrylic paint. So, the cheapest option for Songi would be to buy one 2 ℓ tin and one 5 ℓ tin of Acrylic.

b. Cost of Acrylic paint = R89,50 + R149,80 = R239,30

3.3 Total amount that Songi will spend on paint = cost of undercoat + cost of Acrylic = R306,50 + R239,30 = R545,80

# Time

## Overview

The content of this section on *Time*, as part of the Measurement Application Topic, is drawn from page 70 in the CAPS document.

As stipulated in the CAPS document, Grade 11 learners need specifically to be able to:

- work with time recording values containing a record of hours, minutes and seconds;
- use study and examination timetables in order to plan and complete activities successfully.

## Contexts and integrated content

- Learners need to be able to work in the context of larger projects that take place in the household, school or wider community. This could include an athletics meeting at a school, or a cycling race in the community.
- It is important that learners are already familiar with different time formats (e.g. digital and analogue) and calculations involving elapsed time. These were covered in Grade 10.

## Section 3: Time

**(LB pages 44-47)**

In the section on time the following three concepts are dealt with:

- interpreting time recording values;
- performing calculations involving time recording values;
- designing and making sense of study, lesson and exam timetables.

### 1. Interpreting time recording values (Time values expressed in hours, minutes and seconds)

A time recording value is a time value that has been recorded on a stopwatch or some other time recording instrument.

For example, the picture given alongside appears on page 44 in the Learner's Book. The stopwatch shown in the picture includes a recorded time value of 1:09:26. This time value can be expressed as

1 hour, 9 minutes and 26 seconds.

It is important to be able to convert this time value into a single unit of time.

### Example 1

Converting 1 hour 9 min 26 sec into seconds only:

- 9 min = 9 min × 60 sec/min = 540 sec
- 1 hour = 60 min = 60 min × 60 sec/min = 3 600 sec
  So, 1 hour 9 min 26 sec becomes 3 600 sec + 540 sec + 26 sec
  = 4 166 sec

  Similarly, but now converting to hours only: 1 hour 9 min 26 sec
- 9 min = 9 min ÷ 60 min/hour = 0,15 hours
- 26 sec = 26 sec ÷ 60 sec/min ≈ 0,433 min
  = 0,433 min ÷ 60 min/hour ≈ 0,0072 hours
  So, 1 hour 9 min 26 sec becomes 1 hour + 0,15 hours + 0,0072 hours
  ≈ 1,1572 hours

## 2. Performing calculations involving time recording values (*Working with differences in time*)

- This sub-section in the Learner's Book explains how to determine differences in time between different time recording values.
- Since the time values can potentially include hour, minute and second values, any calculations performed will need to consider how the time values have changes with respect to all three components.

## Example 2

Consider an athlete who runs through a marker at 1:27:48 and then through another marker at 2:06:13. To determine the time taken to run between these markers the following method can be used:

Time from 1 h 27 min 48 sec to 2 hours:

- 12 seconds takes the time to 28 minutes
- From 28 minutes to 1 hour = 32 minutes
  So, the time taken from 1 h 27 min 48 sec to 2 hours = 32 min 28 seconds

Time taken from 2 hours to 2 h 6 min 13 sec = 6 min 13 sec

So, total time from 1 h 27 min 48 sec to 2 h 6 min 13 sec

= 32 min 28 sec + 6 min 13 sec

= 38 min 41 sec

Notice that the method used here is to first work out the amount of time that has passed to the next minute, then to the next hour, and finally to the required time.

## 3. Timetables

The following timetable appears on page 47 in the Learner's Book.

In making sense of this timetable it is important for learners who are using this timetable to be able to identify the following information:

- the week in which an exam is being written;
- the dates on which the exams applicable to the learner are taking place;
- the time of day and the venue in which the applicable exams are taking place.

| Date | | Time | Examination | Length duration of exam (hours) |
|---|---|---|---|---|
| Week 1 | Wed, 17 Nov | 08h00 | English P1 | 2,5 |
| | | 11h30 | Physical Science P1 | 2 |
| | Thurs, 18 Nov | 08h00 | History P1 | 2,5 |
| | | | Consumer Studies Prac | 2,5 |
| | | 11h30 | French Orals | |
| | | 14h15 | Drama Prac | |
| | Fri, 19 Nov | 08h00 | Maths/Maths Lit P1 | 2 |
| | | 11h30 | Life Science Theory | 2 |
| | Sat, 20th Nov | 08h00 | Afrikaans P2 | 2 |
| Week 2 | Thurs, 25 Nov | 08h00 | IT Theory | 2,5 |
| | | | Consumer Studies Theory | |
| | | 11h30 | Afrikaans P1 | 2 |
| | Fri, 26 Nov | 08h00 | Drama Theory | 2,5 |
| | | 11h30 | French P2 | 2 |
| | Sat, 27 Nov | 07h30 | English P2 | 2,5 |
| Week 3 | Tues, 30 Nov | 08h00 | History P2 | 2 |
| | | 11h30 | Life Science Prac | 1,5 |
| | Wed, 1 Dec | 08h00 | Maths/Maths Lit P2 | 2 |

The teachers in the school could also be given a similar timetable, but with additional information relating specifically to the roles of the teachers in the examinations (see below):

The teachers in the school would have to use this alternative timetable to identify for which subject and on which date they are on invigilation duty and to which teacher in charge they would need to report.

| Date | | Time | Examination | Length | Teacher in Charge | Invigilation Duty (Teacher's Initials) |
|---|---|---|---|---|---|---|
| Week 1 | Wed, 17 Nov | 08h00 | English P1 | 2,5h | Mrs. Fourie | MN; VM; TK; ADG |
| | | 11h30 | Physical Science P1 | 2h | Mr. Ndlovu | STP; OP; AG |
| | Thurs, 18 Nov | 08h00 | History P1 | 2,5h | Miss Vilikazi | SMP; LG; KC; ADG |
| | | | Consumer Studies Prac | 2,5h | Mrs. Taylor | MN; CB; NN; NM |
| | | 11h30 | French Orals | | Mr. Sumbula | JB; AT; MK; TK |
| | | 14h15 | Drama Prac | | Mrs. Bartho | VM; OP; CB; NN |
| | Fri, 19 Nov | 08h00 | Maths/Maths Lit P1 | 2h | Mr. Naidoo | NM; STP; AG; JB |
| | | 11h30 | Life Science Theory | 2h | Mr. Ndlovu | FF; AB; KC; ADG |
| | Sat, 20th Nov | 08h00 | Afrikaans P2 | 2h | Mr. Minaar | MK; NN; LG; TK |
| Week 2 | Thurs, 25 Nov | 08h00 | IT Theory | 2,5h | Mrs. Ndlela | MN; VM; AT; FF |
| | | | Consumer Studies Theory | | Mrs. Taylor | AB; STP; SMP; OP |
| | | 11h30 | Afrikaans P1 | 2h | Mr. Minaar | KP; TM; JA |
| | Fri, 26 Nov | 08h00 | Drama Theory | 2,5h | Mrs. Bartho | VM; OP; CB; NN |
| | | 11h30 | French P2 | 2h | Mr. Sumbula | JB; AT; MK; TK |
| | Sat, 27 Nov | 07h30 | English P2 | 2,5h | Mrs. Fourie | KP; TM; JA |
| Week 3 | Tues, 30 Nov | 08h00 | History P2 | 2h | Miss Vilikazi | SMP; LG; KC; ADG |
| | | 11h30 | Life Science Prac | 1,5h | Mr. Ndlovu | FF; AB; KC; ADG |
| | Wed, 1 Dec | 08h00 | Maths/Maths Lit P2 | 2h | Mr. Naidoo | NM; STP; AG; JB |

In summary, both the learners and the teachers would need to be able to use the timetables in order to plan their lives and in order to complete tasks successfully.

# Section 1: Financial documents

## (LB pages 54-59)

**(LB pages 52-81)**

### Overview

The content of this section on *Financial documents*, as part of the Finance Application Topic, is drawn from pages 49-50 in the CAPS document.

As stipulated in the CAPS document, Grade 11 learners need specifically to be able to:

- make sense of the terminology used in various financial documents;
- be able to explain and/or demonstrate how the values in the financial documents have been determined.

### Contexts and integrated content

- The scope of the financial documents relates primarily to business and/or workplace documents, including payslips, invoices, quotations, etc.
- Some of the documents will contain references to VAT, Tax and UIF – which are drawn from the section on Taxation in the Finance topic.

The table below provides descriptions of some of the key features of different types of documents dealt with in the Learner's Book:

| Payslip | Quotation, Invoice and Receipt |
|---|---|
| Issued by a business to an employee. | Issues by a business to a customer who is thinking of buying or who has bought an item/service from the business. |
| Provides information on the amount of money the employee earns from the business together with any deductions made from the salary. | Quotation ⇢ provides a guideline of all of the costs that a customer will have to pay if they choose to buy an item/service.<br>Invoice ⇢ provides a summary of all of the costs that a customer must now pay because they have chosen to buy an item/service.<br>Receipt ⇢ provides proof that a customer has paid for an item/service and gives a summary of the costs for buying the item/service and the payment details for the customer. |
| **Important terminology:**<br>• Basic salary → the employee's salary excluding any additional income or deductions.<br>• Gross salary → the total of all the income sources of the employee.<br>• Taxable income → the portion of an employee's salary on which tax is calculated.<br>• Deductions → items such as Medical Aid and Pension for which a payment is required from the employee and, so, money is deducted from the employee's salary to pay for these items.<br>• Net Pay → the difference between the gross salary and the total deductions and reflects the actual amount of money that the employee will receive at the end of the month. | **Important terminology:**<br>• Quantity → the number of items being bought.<br>• Unit price → the price of each individual item. |

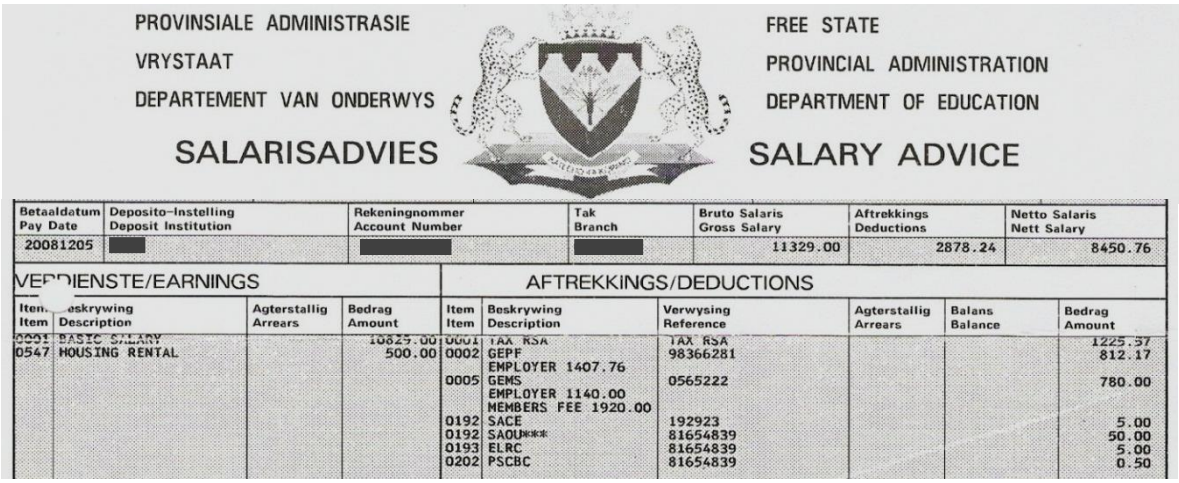
In working with financial documents the following skills are required:

- Being able to understand and explain the different terms used in the documents.
- Being able to explain and demonstrate how different values in the documents have been determined.

The example on the next page will demonstrate how these two skills can be employed when working with a document.

## Example

The following payslip appears on page 58 in the Learner's Book.



PROVINSIALE ADMINISTRASIE
VRYSTAAT
DEPARTEMENT VAN ONDERWYS
SALARISADVIES

FREE STATE
PROVINCIAL ADMINISTRATION
DEPARTMENT OF EDUCATION
SALARY ADVICE

| Betaaldatum Pay Date | Deposito-Instelling Deposit Institution | Rekeningnommer Account Number | Tak Branch | Bruto Salaris Gross Salary | Aftrekkings Deductions | Netto Salaris Nett Salary |
|---|---|---|---|---|---|---|
| 20081205 | [redacted] | [redacted] | [redacted] | 11329.00 | 2878.24 | 8450.76 |

VERDIENSTE/EARNINGS

| Item Item | Beskrywing Description | Agterstallig Arrears | Bedrag Amount |
|---|---|---|---|
| 0001 | BASIC SALARY | | 10829.00 |
| 0547 | HOUSING RENTAL | | 500.00 |

AFTREKKINGS/DEDUCTIONS

| Item Item | Beskrywing Description | Verwysing Reference | Agterstallig Arrears | Balans Balance | Bedrag Amount |
|---|---|---|---|---|---|
| 0001 | TAX RSA | TAX RSA | | | 1225.57 |
| 0002 | GEPF | 98366281 | | | 812.17 |
| | EMPLOYER 1407.76 | | | | |
| 0005 | GEMS | 0565222 | | | 780.00 |
| | EMPLOYER 1140.00 | | | | |
| | MEMBERS FEE 1920.00 | | | | |
| 0192 | SACE | 192923 | | | 5.00 |
| 0192 | SAOU*** | 81654839 | | | 50.00 |
| 0193 | ELRC | 81654839 | | | 5.00 |
| 0202 | PSCBC | 81654839 | | | 0.50 |

## 1. Understanding terms used in the document

The following questions and answers would draw on this skill:

1. *How much does the employee earn as a Basic Salary?*

   Answer: R10 829,00

2. *How much does the employee pay in Deductions?*

   Answer: 2 878,24

3. *Describe what a Gross Salary is and identify the Gross Salary for this employee.*

   Answer: Gross salary is the total of all of the income sources for an employee. This employee's Gross Salary is R11 329,00.

4. *Describe what a Net Salary is and identify the Net Salary for this employee.*

   Answer: Net Salary is the difference between the employee's gross salary and the deductions that they have to pay. As such, the Net Salary is the total amount of money that the employee will actually receive in their bank account at the end of the month. This employee's Net Salary is R8 450,76.

## 2. Demonstrate how values in the document have been determined:

The following questions and answers would draw on this skill:

1. *Use the values on the payslip to show how the Gross Salary value of R11 329,00 for this employee has been determined.*

   Answer: Gross Salary = Basic Salary + Housing Rental

   = R10 829,00 + R500,00 = R11 329

2. *Use the values on the payslip to show how the Deductions value of R2 878,00 for this employee has been determined.*

   Answer: Deductions = sum of all of the Deduction values

   = R1 225,57 + R812,17 + R780,00 + R5,00 + R50,00 + R5,00 + R0,50

   = R2 878,24

3. *Use the values on the payslip to show how the Net Salary value of R8 450,00 for this employee has been determined.*

   Answer: Nett Salary = Gross Salary – Deductions

   = R11 329,00 – R2 878,24 = R8 450,76

# Section 2: Budgets and statements of income-and-expenditure

**(LB pages 54-59)**

## Overview

The content of this section on *Statements of income-and-expenditure and budgets*, as part of the Finance Application Topic, is drawn from pages 51-52 in the CAPS document.

As stipulated in the CAPS document, Grade 11 learners need specifically to be able to:

- work with income-and-expenditure statements showing a comparison of income-and-expenditure for two time periods;
- work with budgets showing a comparison of predicted versus actual values.

## Contexts and integrated content

- The scope of the income-and-expenditure statements and budgets relates primarily to business and/or workplace contexts.

## 1. Budgets

- A budget shows *predicted* income and expenditure items for an event, business or organisation → i.e. the budget describes what the business, organisation or organisers of an event predict the income and expenditure for the business, organisation or event will be *in the future*.
- As such, budgets are important tools for planning the *future finances* of an event, business or organisation.

The following budget appears on page 60 in the Learner's Book:

**Laddswood Primary School**

**2011 Budget**

| SUMMARY | Actual (2010) | Budgeted (2011) | Actual (2011) |
|---|---|---|---|
| Total Income | R 188 100.00 | R 211 000.00 | R 184 805.00 |
| Total Expenses | R 188 575.00 | R 208 000.00 | R 183 595.00 |
| **Net Income** | **-R 475.00** | **R 3 000.00** | **R 1 210.00** |

| INCOME DETAILS | Actual (2010) | Budgeted (2011) | Actual (2011) |
|---|---|---|---|
| School fees | R 131 100.00 | R 144 000.00 | R 133 200.00 |
| Donations & fundraising | R 12 000.00 | R 12 000.00 | R 5 500.00 |
| Grants (from National Dept). | R 40 000.00 | R 50 000.00 | R 42 250.00 |
| Other | R 5 000.00 | R 5 000.00 | R 3 855.00 |
| **Total** | **R 188 100.00** | **R 211 000.00** | **R 184 805.00** |

| EXPENSE DETAILS | Actual (2010) | Budgeted (2011) | Actual (2011) |
|---|---|---|---|
| Administration | R 27 950.00 | R 32 000.00 | R 38 525.00 |
| Teaching resources | R 18 225.00 | R 22 000.00 | R 19 570.00 |
| Maintenance | R 7 150.00 | R 8 000.00 | R 5 500.00 |
| Salaries and wages | R 80 000.00 | R 88 000.00 | R 75 000.00 |
| Feeding scheme | R 55 250.00 | R 58 000.00 | R 45 000.00 |
| **Total** | **R 188 575.00** | **R 208 000.00** | **R 183 595.00** |

| NET INCOME | Budgeted | Actual |
|---|---|---|
| | **R 3 000.00** | **R 1 210.00** |

In accordance with the requirement for Grade 11, notice the following:

- The budget shows both predicted income and expenditure values as well as a summary of actual income and expenditure values.
- This inclusion of both predicted versus actual makes it possible to see how the business actually performed compared to how it was planned or predicted the business would perform.
- The inclusion of actual for 2010 and predicted for 2011 also makes it possible to see how the predictions for 2011 were not simply 'guesses'. Rather, the predictions were based on observation of what actually happened in 2010.

## 2. Statements of income-and-expenditure

- A statement of income-and-expenditure shows a summary of *actual* income and expenditure items for an event, business or organisation → i.e. the statement of income-and-expenditure describes what the business, organisation or organisers of an event have actually spent / earned in a business, organisation or event that has *already taken place*.
- As such, budgets are important tools for describing the *current finances* of an event, business or organisation.

The following statement of income-and-expenditure appears on page 61 in the Learner's Book:

**Kubelo's General Dealer**

Income Statement
*For the Period March to April 2012*

| | March | April | Change |
|---|---|---|---|
| **INCOME** | **R 28 440.00** | **R 30 440.00** | **R 2 000.00** |
| Grocery Sales | R 13 875.00 | R 15 435.00 | R 1 560.00 |
| Sales of Fruit & Vegetables | R 9 450.00 | R 10 060.00 | R 610.00 |
| Sales from Bakery | R 5 115.00 | R 4 945.00 | -R 170.00 |
| **OPERATING EXPENSES** | **R 21 935.00** | **R 24 115.00** | **R 2 180.00** |
| Cost of Goods Sold | R 10 285.00 | R 11 165.00 | R 880.00 |
| Groceries | R 5 150.00 | R 5 890.00 | R 740.00 |
| Fruit & Vegetables | R 3 700.00 | R 4 120.00 | R 420.00 |
| Bakery | R 1 435.00 | R 1 155.00 | -R 280.00 |
| Salaries & Wages | R 3 800.00 | R 3 800.00 | R 0.00 |
| Administration Expenses | R 1 200.00 | R 1 600.00 | R 400.00 |
| Rent Expense | R 5 500.00 | R 6 000.00 | R 500.00 |
| Maintenance Expenses | R 850.00 | R 1 550.00 | R 700.00 |
| Advertising Expenses | R 300.00 | R 0.00 | -R 300.00 |
| **Net Income** | **R 6 505.00** | **R 6 325.00** | **-R 180.00** |

In accordance with the requirement for Grade 11, notice the following:

- The budget shows a summary of income and expenditure values for two different time periods, together with a comparison of the performance over these time periods (shown in the 'Change' values).
- This inclusion of values for two different time periods makes it possible to see how the income and expenditure of the business has changed and whether there has been an improvement or decline in the performance of the business.

# Section 3: Cost price and selling price

**(LB pages 64-67)**

## Overview

The content of this section on *Cost price and selling price*, as part of the Finance Application Topic, is drawn from page 52 in the CAPS document.

As stipulated in the CAPS document, Grade 11 learners need specifically to be able to:

- identify the costs involved in manufacturing an item or providing a service for a small business or organisation or home industry;
- determine the cost price for manufacturing an item or providing a service;
- determine an appropriate selling price for an item or service.

## Contexts and integrated content

- Determination of cost and selling prices is limite
- d to contexts involving small businesses or organisations (e.g. home industry).

## 1. Cost price

The 'cost price' of an item/service refers to the total cost involved in making the item or providing the service.

Understanding the cost price is essential in order to determine how much the item must be sold for or how much must be charged for the service in order to cover the costs involved in making the item / service.

## Example

The following table appears on page 65 in the Learner's Book and shows the following information:

- Column 2 → the quantity of ingredients needed for a batch of 24 doughnuts.
- Column 3 → the available packet size and price of these ingredients in the shops.
- Column 4 → the cost of the specific quantity of each ingredient needed for the batch of doughnuts.

**Table 9 Doughnut costs**

| Ingredient | Quantity needed for 1 batch | Available size & price in shops | Cost per batch |
|---|---|---|---|
| Flour | 960 g (1 600 ml) | 1 kg – R10,50 | R10,08 |
| Salt | 16,5 g (15 ml) | 500 g – R3,29 | R0,11 |
| Sugar | 100 g (125 ml) | 1 kg – R9,69 | R0,97 |
| 1 packet yeast | 1 packet | 1 packet – R2,19 | R2,19 |
| Margarine | 60 g | 500 g – R13,89 | R1,67 |
| Milk | 400 ml | 1 litre – R6,59 | R2,64 |
| Eggs | 2 | Box of 6 – R10,99 | R3,66 |
| Apricot jam | 110 g (90 ml) | 900 g – R15,99 | R1,95 |
| Oil | 250 ml | 750 ml – R13,59 | R4,53 |
| | | **Total cost of ingredients for 1 batch** | **R 27,80** |

The 'cost per batch' values in the last column are the important values with respect to determining the cost price of the ingredients of the doughnuts since they reflect the cost of the required quantity of each ingredient needed for one whole batch.

These values have been determined as follows:

*Flour*

Quantity needed for one batch = 960 g  Available size in shops = 1 kg at R10,50

i.e. 1 000 g = R10,50

1 g = R10,50 ÷ 1 000 → 960 g = R10,50 ÷ 1 000 × 960 = R10,08

The same method can be used to determine the cost of the quantity of each ingredient required for one batch.

Totalling the cost of the ingredients for one batch gives R27,80.

And since there are 24 doughnuts in a batch, the cost price of each doughnut can be worked out easily as:  Cost price per doughnut = R27,80 ÷ 24 ≈ R1,16

Importantly, this cost price only includes consideration of the cost of the ingredients. It does not include electricity and water costs, or possible rental costs. It also only considers the cost of the ingredients bought in specific quantity bags/containers.This cost price could change if different sized quantities of ingredients (at different prices) were bought.

It is for this reason that in the Learner's Book this cost price of R1,16 is increased to an approximate cost of R1,30 per doughnut to account for other costs that have not been considered.

## 2. Selling price

- The 'selling price' is the price at which an item will be sold or a service provided.
- This selling price needs to be higher than the cost price if all of the costs involved in making the item or supplying the service are to be covered and a loss is to be avoided.

The Learner's Book makes the point that an appropriate selling price is not simply determined by 'guessing' or by choosing a much higher price than the cost price in order to make as big a profit as possible. Rather, the selling price must be guided by the cost price, and must also be informed by how much a similar item sells for at other shops.

For example, if a doughnut sells for an average price of R5,00 at several other shops, then it does not make sense to sell the doughnut for R15,00 because the buyers will feel that this is very expensive. A more appropriate selling price might be R5,00 or even R7,50, or something similar that is not significantly different from the prices in other shops.

# Section 4: Break-even analysis

**(LB pages 68-73)**

## Overview

The content of this section on *Break-even analysis*, as part of the Finance Application Topic, is drawn from page 53 in the CAPS document.

As stipulated in the CAPS document, Grade 11 learners need specifically to be able to:

- determine the break-even value for a business by:
  - drawing two graphs and identifying the point of intersection of the graphs;
  - using trial and improvement with appropriate equations.
- make sense of the break-even value with respect to the context for which the break-even value has been determined.

## Contexts and integrated content

- Determination of break-even analysis is limited to contexts involving small businesses or organisations (e.g. home industry).
- There is integration of content from the Basic Skills Topic of *Patterns, relationships and representations* with respect to drawing and interpreting graphs and using equations.

## 1. What is break even?

The break-even value in a business or organisation refers to the amount of income that the business/organisation must make in order to cover all expenses incurred in the running of the business.

In other words, the break-even point gives an indication of how much money a business/organisation must make in order to make a profit.

Outside of a business context, the term ‘break-even’ is used to refer to the values for which two things are equal: for example, the number of minutes of talk time for which the cost of talking on two different cell phone contracts is equal; or the number of units of electricity that must be used on two different systems for the cost of that usage to be equal.

## 2. Break-even has two values

The following graph appears on page 69 in the Learner's Book and shows the costs involved in making doughnuts (at a cost price of ≈ R1,30 per doughnut) and the income generated from the sale of those doughnuts (at a sale price of R5,00 per doughnut).

On the graph the break-even point is indicated as the point at which the two graphs cut each other (i.e. the point at which the cost and income are equal).

Importantly, notice that the break-even value is made up of two values:

1. *Number of doughnuts* ⇢ costs are equal to income when ≈ 67 doughnuts are made and sold.
2. *Amount of income / cost* ⇢ when 67 doughnuts are made then both the cost and the income are equal at ≈ R340,00.

*In any situation, the break-even value will always be made up of <u>two values</u>: one value is read from the <u>horizontal axis</u> on the graph (e.g. number of doughnuts) and the other from the <u>vertical axis</u> of the graph (e.g. income/cost amount).*

## 3. Determining break-even values

There are two methods for determining the break-even value:

1. Drawing graphs of the two scenarios and estimating the point of intersection of the graphs.
2. Using the method of trial and improvement to determine the break-even value.

   The first method has already been shown in the graph on the previous page. The second method of trial and improvement is as follows:

   From previous calculations we know that:

- Income = R5,00 per doughnut
- Cost = R250,00 + R1,30 per doughnut (the R250,00 is a fixed cost for renting a stall at a local market → see page 69-70 in the Learner's Book).

By substituting values into both of these equations and calculating we can try to determine how many doughnuts must be sold in order for the cost and income to be the same:

- Try 100 doughnuts:
  - Income = R500,00
  - Cost = R380,00
- Try 50 doughnuts:
  - Income = R250,00
  - Cost = R315,00

Notice how with 100 doughnuts the income is higher than cost; but for 50 doughnuts the cost is higher than income. This means that the number of doughnuts for which cost equals income is somewhere between 50 and 100 doughnuts.

By continuing to use this method of 'intelligent guessing' or trial and improvement we can determine accurately that making and selling *68 doughnuts* will enable the person to make just enough money to break even and cover all costs involved in making and selling the doughnuts.

## Additional Questions :

### (Cost price, selling price and break-even analysis)

1. Refi runs a shoe-shine business at the local supermarket. The table below contains the monthly list of expenses that Refi encounters in running his business.

| Expense | Quantity used per month | Cost |
|---|---|---|
| Rent for stall space | ---- | R80,00 |
| Rent for chair | ---- | R35,00 |
| Polish | 7 tins | R12,20 per tin |
| Shoe-Shine Brushes | 2 | R8,50 per brush |
| Cloths | 10 | R0,85 per cloth |

1.1 Calculate Refi's total monthly expenditure for his shoe-shine business.

1.2 If Refi decides to charge R5,00 per shoe-shine and manages to shine 36 peoples' shoes, will he make enough money to cover all expenses and break even?

1.3 At R5,00 a shoe-shine, how many customers' shoes will Refi need to shine in order to break even?

1.4 If Refi shines 133 shoes in a particular month, how much profit will he make?

2. Martinus operates a hot-dog stand outside the Moses Mabhida Stadium in Durban before and after soccer matches. The table below outlines the costs involved in Martinus' hot-dog business:

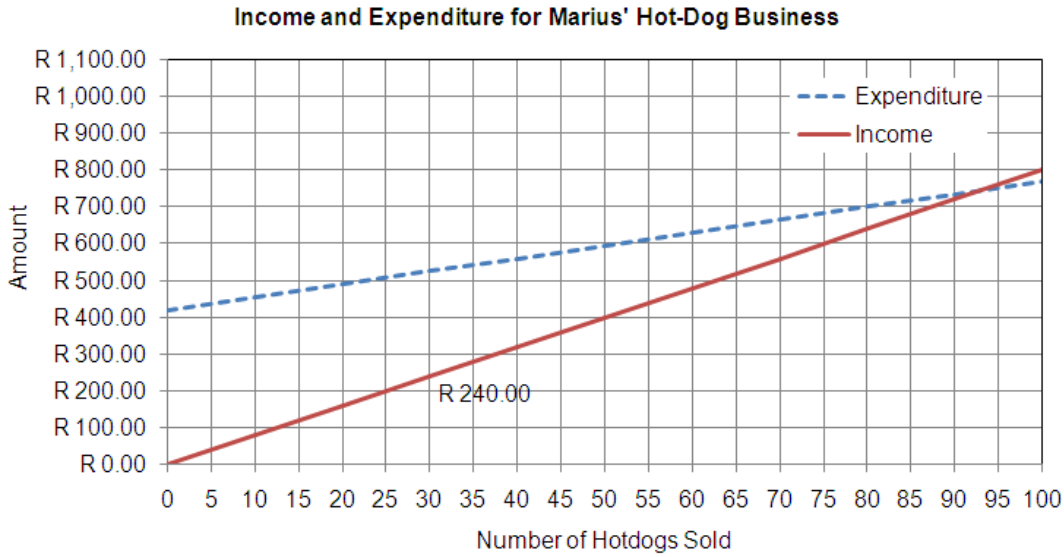
| Fixed Costs | |
|---|---|
| Rental of Hot-Dog Cart (including gas cooker) | R420,00 per day |
| | |
| **Production Costs** | |
| Rolls | R5,70 for 6 rolls |
| Vienna Sausages | R47,00 for 20 sausages |
| Tomato Sauce | R20,00 for a 2 litre bottle:<br>≈ 20 ml for needed each hotdog |

2.1 Calculate the production cost for each hot-dog that Marius makes.

*(Assume that each hot-dog is made up of a roll, a Vienna sausage, and tomato sauce)*

2.2 Based on your answer in 2.1, how much do you think Marius should sell each hot-dog for? Explain your reasoning.

2.3 The graph below shows the expenditure and income for Marius' hot-dog selling business.




2.3.1 Use the graph to determine accurately for how much Marius sells each hot-dog .

2.3.2 Why does the "Expenditure" graph not start at R0,00?

2.3.3 Why are both graph straight lines?

2.3.4 By reading from the graph, estimate the number of hot-dogs that Marius must sell each day in order to break even.

2.3.5 Approximately how much money must Marius' make each day in order to break even?

2.3.6 a. Check whether your estimation in 2.3.4 and 2.3.5 is correct by calculating the cost incurred and income generated from selling the number of hot-dogs that you estimated in 2.3.4.

b. If you did not estimate properly in 2.3.4 and 2.3.5, continue calculating using the method from 2.3.4 until you find the accurate break-even point for Marius' business.

2.4 2.4.1 Do you think Marius is selling each hot-dog for a reasonable price? Explain your reasoning.

2.4.2 Do you think this is a viable business? i.e. do you think it is reasonable to expect that Marius will sell enough hot-dogs to break even? Explain your reasoning.

## Answers

1.1 Total monthly expenditure

= R80,00 + R35,00 + (7 × R12,20) + (2 × R8,50) + (10 × R0,85)

= R80,00 + R35,00 + R85,40 + R17,00 + R8,50

= R225,90

1.2 Income from shining 36 shoes = R5,00/shoe× 36 shoes = R180,00.

⇒ Refi will not manage to break even if he only shines 36 shoes during the month.

1.3 At R5,00 a shine, to break even, Refi will need to shine: R225,90 ÷ R5,00/shoe = 45,18 shoes.

Since it is not feasible to take about polishing 0,18$^{th}$ of a shoe, Refi will need to shine 46 shoes per month to break-even.

1.4 Income from shining 133 shoes = R5,00/shoe× 133 shoes = R665,00

Total monthly expenditure = R225,90.

⇒ Monthly profit if Refi shines 133 shoes = R665,00– R335,90 = R439,10

2.1 Cost per hot-dog of: Roll = R5,70 / 6 = R0,95

Vienna sausage = R47,00 / 20 = R2,35

Tomato Sauce = R20,00 / 2 litre = R20,00 / 2 000 ml

= R0,01 per 1 ml = R0,20 per 20 ml

⇒ Total cost of production per hot-dog = R0,95 + R2,35 + R0,20 = R3,50

2.2 Marius will have to sell the hot-dogs for above R3,50 in order to cover the cost of making each hot-dog. Remember that he won't make a pure profit until he has also covered the cost of the R420,00 rental that he pays for his stall.

2.3 2.3.1 According to the graph: Income from 30 hotdogs = R240,00

⇒ Income from 1 hot-dog = R240,00 ÷ 30 = R8,00

2.3.2 Marius has to pay a fixed cost of R420,00 for the rental of his stall, even if he does not sell any hot-dogs. As such, the graph starts at R420,00.

2.3.3 For every hot-dog sold, Marius' income increases by a *fixed* (constant) rate of R8,00.

For every hot-dog made and sold, Marius' expenditure increases by a *fixed* (constant) rate of R3,50 (i.e. the cost of production of each hot-dog).

As such, both graphs increase at a constant rate and are straight lines.

2.3.4 ≈ 93 hot-dogs

2.3.5 ≈ R750,00

2.3.6 Using trial and improvement:

Income from 93 hot-dogs = R8,00 per hot-dog × 93 hot-dogs = R744,00

Expenditure from 93 hot-dogs = R420,00 + R3,50 per hot-dog × 93 hot-dogs

= R420,00 + R325,50 = R745,50

⇒ Expenditure is still bigger than income. So, try 94 hot-dogs.

Try 94 hot-dogs:

Income from 93 hot-dogs = R8,00 per hot-dog × 94 hot-dogs = R752,00

Expenditure from 94 hot-dogs = R420,00 + R3,50 per hot-dog × 94 hot-dogs

= R420,00 + R325,50 = R749,00

So, Marius needs to sell at least 94 hot-dogs and make R752,00 to break-even and cover all of his costs.

2.4 2.4.1 Yes – R8,00 for a hotdog at a soccer match is a relatively common and reasonable price.

2.4.2 Possibly, but his success also depends on how many other food stalls there are, especially how many other hot-dog stalls there are, and how many people attend the soccer match.

# Section 5: Tariff systems (LB pages 74-79)

## Overview

The content of this section on *Tariff systems*, as part of the Finance Application Topic, is drawn from page 50 in the CAPS document.

As stipulated in the CAPS document, Grade 11 learners need specifically to be able to:

- compare the costs associated with two tariff systems, using graphs if necessary.
- determine costs on water tariff systems and interpret graphs of these types of tariff systems.

## Contexts and integrated content

- There is integration of content from the Basic Skills Topic of *Patterns, relationships and representations* with respect to drawing and interpreting graphs and using equations.

## 1. Water tariffs

Water tariff systems are an example of an 'incremental' tariff system.

This means that different portions of a quantity of water used are charged at different rates rather than the whole quantity being charged at the same rate.

## Example

The following table of water tariffs for Cape Town appears in the Learner's Book on page 74.

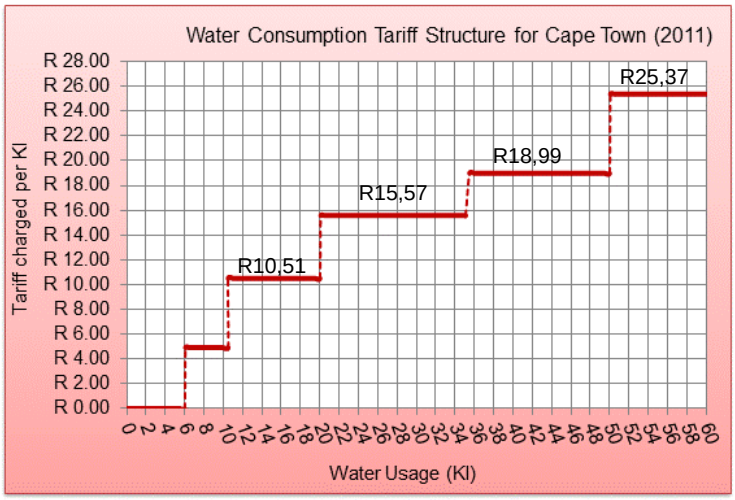
| New water rate for 2011 | | | |
|---|---|---|---|
| | | 2010 | 2011 |
| From | To | R per kl | R per kl |
| 0 | 6 | 0.00 | 0.00 |
| 6 | 10.5 | 4.55 | 4.92 |
| 10.5 | 20 | 9.70 | 10.51 |
| 20 | 35 | 14.38 | 15.57 |
| 35 | 50 | 17.76 | 18.99 |
| 50 | + | 23.42 | 25.37 |

The following method is used to determine the cost of using 25 litres of water (using the 2011 rates):

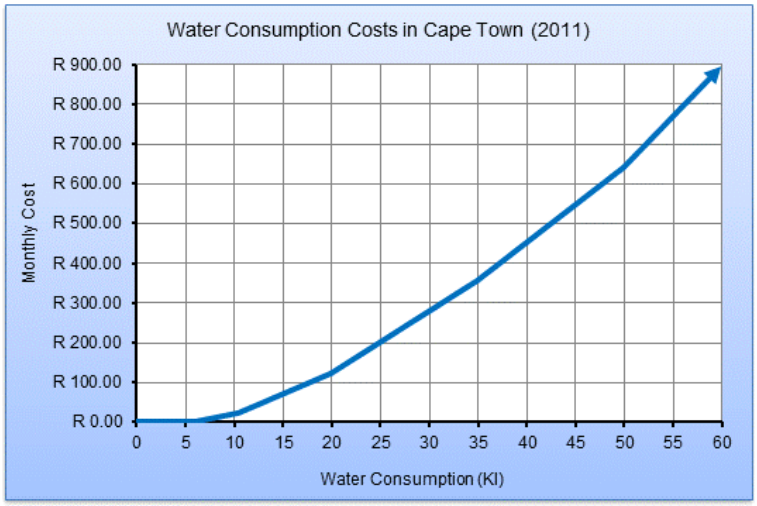
- Cost of using first 6 ℓ = R0,00
- Cost of using next 4,5 ℓ (from 6 to 10,5 ℓ) = R4,92/ℓ × 4,5 ℓ = R22,14
- Cost of using next 9,5 ℓ (from 10,5 to 20 ℓ) = R10,51/ℓ × 9,5 ℓ = R99,85
- Cost of using the last 5 ℓ (from 20 to 25 ℓ) = R15,57/ℓ × 5 ℓ = R77,85

  Total cost of using 25 ℓ = R0,00 (6 ℓ) + R22,14 (4,5 ℓ) + R99,85 (9,5 ℓ) + R77,85 (5 ℓ)
  = R199,84

Notice that when we draw a graph to show the tariff structure (alongside) we get a 'step-function'. This is because the same tariff is charged for water consumption within a certain bracket and then a new tariff is charged as the consumption shifts to a new bracket.




The graph showing the cost of water consumption for varying consumption values (alongside) is a graph that increases and becomes steeper and steeper. This indicates that the more water that is used, the higher the tariff that is charged and, so, the higher the cost.

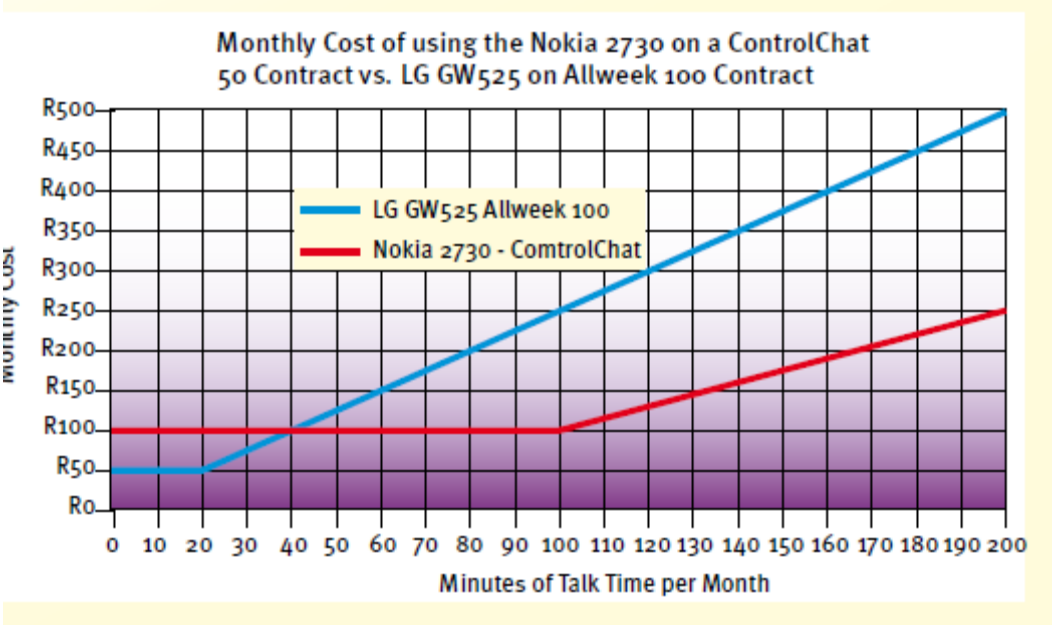


## 2. Comparing tariffs

The second thing that is required when working with tariff systems in Grade 11 is to be able to compare tariffs on different tariff systems. The easiest way to do this is to draw a graph to represent the different tariff system and then to see whether the graphs intersect and what this intersection (or lack thereof) says about the costs involved on the tariff system under different conditions.

## Example

The graph below, which appears on page 73 in the Learner's Book, shows a comparison of the costs involved in making calls on two different cell-phone contracts.




The break-even value for the contracts is 40 minutes of talk time at a cost of R100,00. What this means is that for a person who uses less than 40 minutes of talk time per week, it is cheaper to be on the LG Allweek 100 contact. However, for a talk time usage of more than 40 minutes per week, it becomes much cheaper to be on the Nokia ControlChat contract.

# Additional questions

## Ms.Shabalala's Electricity and Water Rates

Ms.Shabalala has a pre-paid meter in her house. A pre-paid meter works on a similar system to a pre-paid cell phone in that to use the meter the owner must buy electricity credits at a shop and punch in a code on the meter that they are given when they buy the electricity. The electricity meter is then credited with a certain number of units of electricity.

(Picture source: Prepaid Meters Website – http://www.prepaidmeters.co.za).

The table below shows the non-seasonal electricity tariffs for households (domestic users) in the Johannesburg Municipality. The table contains the tariffs for both pre-paid and non-prepaid (billed) electricity systems.

(Source: Johannesburg City Power website – http://www.citypower.co.za/customer_tariff.html. Sourced 12 April 2010)

| CURRENT TARIFFS | 01-Jul-09 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| SEGMENT | Supply Position | Service Charge | Network Charge | Maximum Demand Summer | Maximum Demand Winter | Energy Charge | | | |
| | | R/Month | R/Month | R/kVA | R/kVA | TOU | c/kWh | | |
| | | | | | | | Non seasonal | Low Season | High Season |
| **Domestic 3 Ø 60A** | 230 V | 198.03 | 62.70 | | | | | | |
| **80 A** | | 208.16 | 70.12 | | | | | | |
| 0 to 500 kwh | | | | | | | 47.38 | | |
| 501 to 1000 kwh | | | | | | | 48.18 | | |
| 1001 to 2000 kwh | | | | | | | 48.98 | | |
| 2001 to 3000 kwh | | | | | | | 50.17 | | |
| above 3000 kwh | | | | | | | 50.77 | | |
| **Domestic 1 Ø 60A** | 230 V | 180.76 | 45.80 | | | | | | |
| **80 A** | | 186.84 | 50.20 | | | | | | |
| 0 to 500 kwh | | | | | | | 47.38 | | |
| 501 to 1000 kwh | | | | | | | 48.18 | | |
| 1001 to 2000 kwh | | | | | | | 48.98 | | |
| 2001 to 3000 kwh | | | | | | | 50.17 | | |
| above 3000 kwh | | | | | | | 50.77 | | |
| **Prepaid** | | | | | | | | | |
| 501 to 1000 kwh | | | | | | | 78.52 | | |
| 1001 to 2000 kwh | | | | | | | 80.12 | | |
| 2001 to 3000 kwh | | | | | | | 82.06 | | |
| above 3000 kwh | | | | | | | 83.05 | | |

Use the table to answer the following questions:

1. The example below shows how electricity costs are calculated on the prepaid system:

**Example – Calculating Electricity Costs on the Prepaid system**

Electricity consumption = 725 kWh

Electricity tariff = 78,52c/kWh (R0,7852 per every whole unit of electricity)

Monthly cost = R0,7852/kWh × 725 kWh= R569,27

Use the example to calculate the monthly cost of using the following amounts of electricity on a pre-paid system during the month:

1.1 550 kWh

1.2 1 472 kWh

1.3 2 827,3 kWh

2. The example below shows how electricity costs are calculated on the non-prepaid (billing or flat rate) system:

**Example – Calculating Electricity Costs on the Flat-rate System**

Electricity system: Domestic 3 (3 phase) 60 A (AMP)

Electricity consumption = 725 kWh

Fixed charges:

⇢ Service charge = R198,03 ⇢ Network charge = R62, 70

Consumption charge:

⇢ Electricity tariff = 47,38c/kWh (R0,4738/every unit of electricity)

Monthly cost = R198,03 + R62,70 + (R0,4738/kWh × 725 kWh)

= R198,03 + R62,70 + R343,51= R604,24

Use the example to calculate the monthly cost of using the following amounts of electricity during the month on a Domestic 3 60 A system:

2.1 550 kWh 2.2 1 472 kWh

2.3 782,2 kWh

3. 3.1 Write down a general formula that can be used to represent the monthly cost of electricity on 1000 kWh of electricity.

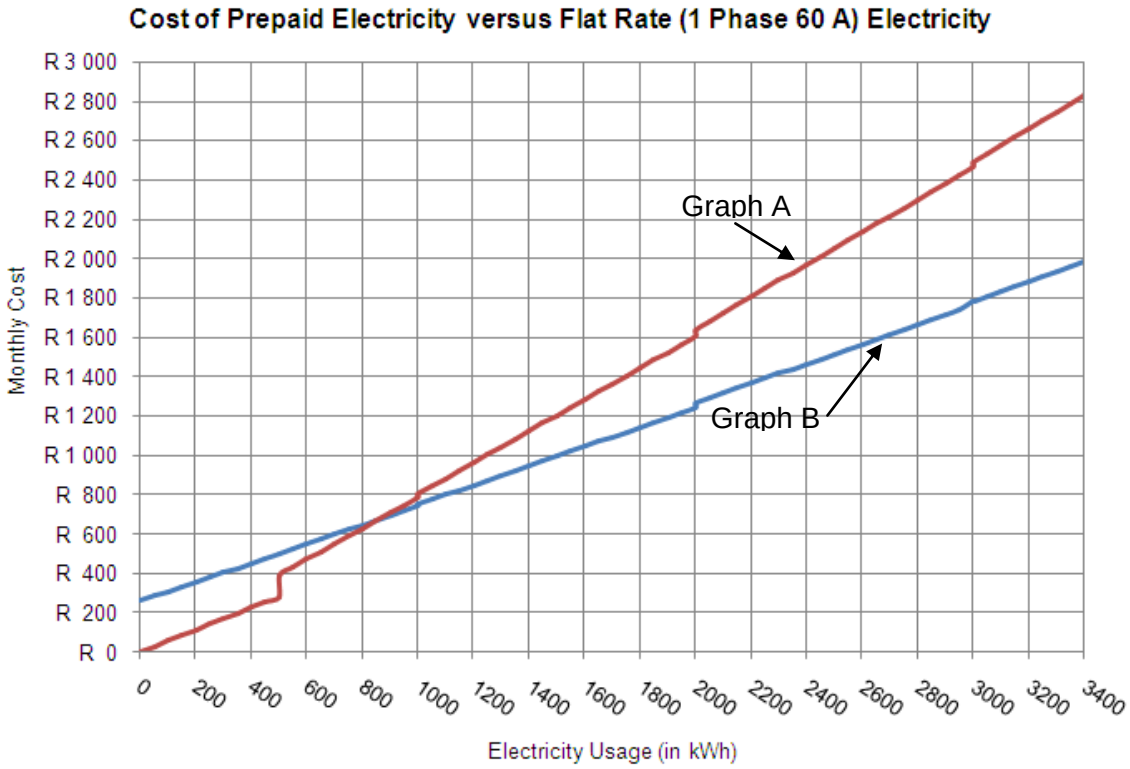
   3.2 Write down a general formula that can be used to represent the monthly cost of electricity on the 60A Domestic 1 phase electricity system.

4. Ms.Shabalala estimates that her average monthly electricity consumption is approximately 600 kWh per month.

   Is the prepaid system the most cost effective option for her, or would it be cheaper for her to be on the Domestic 1 phase 60 A electricity system?

   You must explain your answer and show all working.

5. The graphs below show the cost of electricity on the prepaid and the Domestic 1 phase 60 A systems.




   5.1 Explain why Graph A represents the cost of electricity on the Prepaid system and Graph B the cost of electricity on the Flat Rate (Domestic 1 phase 60 A) system.

   5.2 According to the graphs, what is the approximate cost of using:

      5.2.1 1 800 kWh on the prepaid system?;

      5.2.2 2 450 kWh on the flat rate system?

5.3 Why are the graphs not perfectly straight, but have "steps" in the graphs?

5.4 Write down the break-even point for these two electricity systems. You must give an indication of both electricity usage and cost.

5.5 Ms.Shabalala is giving advice to a neighbour about when it is better to be on the flat rate system compared to the prepaid system. What advice do you think she should give to the neighbour?

6. Ms.Shabalala also has a prepaid water meter in her house. The table alongside shows the water tariffs for her area.

(Source: City of Johannesburg website – www.joburg.org.za. Sourced 12 April 2010)

| Kilolitres per connection per month | 2010/11 Tariff Subsidised measured (R/kl) |
|---|---|
| 0-6 | Free |
| >6-10 | R2.13 |
| >10-15 | R2.56 |
| >15-20 | R4.49 |
| >20-30 | R6.61 |
| >30-40 | R6.82 |
| >40-50 | R8.40 |
| >50 | R11.12 |

6.1 Use the table of water tariffs and the example given above to calculate the total monthly cost of using the following quantities of water:

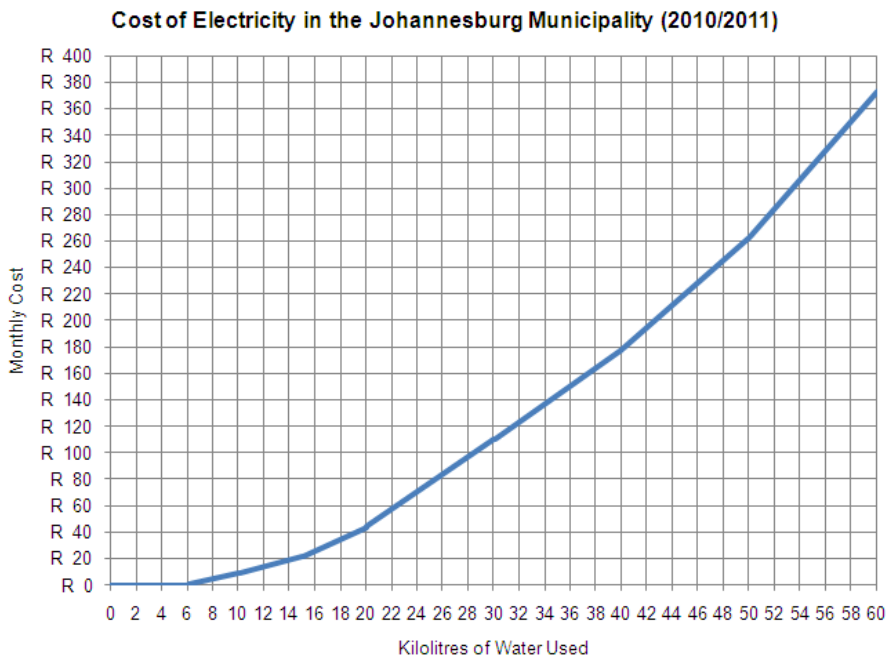
6.1.1 5,5 kℓ

6.1.2 8 kℓ

6.1.3 23 kℓ

6.2 Ms.Shabalala's average monthly water consumption is 12,5 kℓ Calculate the approximate amount that she will pay in water costs every month.

6.3 The graph below shows the monthly water costs as dependent on the quantity of water used during the month.




6.3.1 Approximately how much will it cost to use 25 kℓ of water during the month?

6.3.2 If Ms.Shabalala buys a R50,00 water voucher, approximately how many kℓ of water will she be able to use in one month with this voucher?

6.3.3 Why is the graph a flat line from 0 to 6 kℓ?

6.3.4 Why do different sections of the graph have different gradients (steepness)?

6.3.5 The general approach towards water usage is that "the more you use the more you pay". Would you say that the graph supports this argument? Explain your answer by referring to the graph.

6.4 The table below shows a comparison of the water tariffs in 2009/2010 and 2010/2011.(Source: City of Johannesburg website – www.joburg.org.za. Sourced 12 April 2010)

| Kilolitres per connection per month | 2009/10 Tariff Subsidised measured (R/kl) | 2010/11 Tariff Subsidised measured (R/kl) |
|---|---|---|
| 0-6 | Free | Free |
| >6-10 | R2.01 | R2.13 |
| >10-15 | R2.39 | R2.56 |
| >15-20 | R4.12 | R4.49 |
| >20-30 | R5.87 | R6.61 |
| >30-40 | R5.98 | R6.82 |
| >40-50 | R7.33 | R8.40 |
| >50 | R9.70 | R11.12 |

6.4.1 Johannesburg Water claim that the tariff for people who use between 6 and 10 kℓof water increased by 6% from 2009/2010 to 2010/2011. Is this correct? Show all working.

6.4.2 Calculate the percentage increase in the tariff for the ">20–30" bracket from 2009/2010 to 2010/2011.

6.4.3 Why is it useful to calculate percentage increase values rather than simply working with actual increase values?

6.4.4 Complete the following table:

| Kilolitres used per month | Price increase from 2009/2010 to 2010/2011 | % Increase in price from 2009/2010 to 2010/2011 |
|---|---|---|
| 0-6 | | |
| >6-10 | | |
| >10-15 | | |
| >15-20 | | |
| >20-30 | | |
| >30-40 | | |
| >40-50 | | |
| >50 | | |

6.4.5 Do the values in the table support the principle that "the more you use the more you pay"? Explain your answer.

# Answers

## Ms.Shabalala's Electricity and Water Rates

1.1 R0,7852/kWh × 550 kWh = R431,86

1.2 R0,7852 /kWh × 1472kWh = R1 155,81

1.3 2 827,3 kWh = 2 828 kWh (whole units)

Cost = R0,7852/ kWh × 2 828 kWh = R2 220,55

2.1 Monthly cost = R198,03 + R62,70 + (R0,4738/kWh × 550 kWh)= R521,32

2.2 Monthly cost = R198,03 + R62,70 + (R0,4738/kWh × 1472 kWh)= R958,16

2.3 782,2 kWh = 783 kWh (whole units)

Monthly cost = R198,03 + R62,70 + (R0,4738/kWh × 783 kWh)= R631,72

3.1 Cost = 0,7852 × Electricity Used

3.2 Cost = R260,73 + 0,4738 × Electricity Used

4. Prepaid Cost = R0,7852/kWh × 600 kWh = R471,12

Flat Rate Cost = R180,76 + R 45,80 + R0,4738/kWh × 600 kWh= R545,01

Therefore it is cheaper to be on the prepaid system for her.

5.1 Graph A has a steeper slope. This is due to the higher rate being charged for electricity (Rate determines the slope) OR:

Graph A starts at a cost of R0,00, whereas Graph B starts at a cost of R260,73. The Flat Rate system has a fixed cost that will have to be paid regardless of the amount of electricity used.

5.2 5.2.1 ≈ R1 450 5.2.2 ≈ R1 500

5.3 At certain intervals the rate changes to a higher rate.

5.4 ≈ 840kWh costing ≈ R650

5.5 Based on the answer to question 5.4, when a user uses less than 840kWh of electricity per month, it is cheaper to use the Prepaid system.However, there is also the consideration of convenience and it is certainly less convenient to have to purchase the prepaid electricity (as opposed to a monthly bill for the flat rate).

6.1 6.1.1 No cost (less than 6 kℓ)

6.1.2 Monthly cost = (6 kℓ× R0,00) + (2 kℓ× R2,13) = R0,00 + R4,26

= R4,26

6.1.3 Monthly cost = (6 kℓ× R0,00) + (4 kℓ× R2,13) + (5 kℓ× R2,56) + (5 kℓ× R4,49) + (3 kℓ× R6,61)

= R0,00 + R8,52 + R12,80 + R22,45 + R19,83 = R63,60

6.2 Monthly cost = (6 kℓ× R0,00) + (4 kℓ× R2,13) +(2,5 kℓ× R2,56)

= R0,00 + R8,52 + R6,40 =R14,92

6.3 6.3.1 Just less than R80,00 (Approx R78,00)

6.3.2 In one month she would be able to use 21kℓ

6.3.3 There is no cost for water usage below 6kℓ

6.3.4 There are different (increasing) rates for those sections

6.3.5 Yes, this statement is true. In relation to the graph, this statement is proved by the fact that the graph is increasing at a faster and faster rate as electricity consumption increases.

6.4 6.4.1 Increase = R2,13 – R2,01 = R0,12

% Increase = Increase ÷ Original amount x 100

= R0,12 ÷ R2,01 × 100= 6 % ⇨ Yes, this is correct.

6.4.2 Increase = R6,61 - R5,87 = R0,74

% Increase = Increase ÷ Original amount × 100

= R0,74 ÷ R5,87 × 100= 12,6 %

6.4.3 Percentage allows us to compare to a common base (they are all out of 100) as opposed to comparing the raw increases to each other (e.g. comparing 12c increase to 74c increase)

6.4.4

| Kilolitres used per month | Price increase from2009/2010 to 2010/2011 | % Increase in price from 2009/2010 to 2010/2011 |
|---|---|---|
| 0-6 | 0 | 0% |
| >6-10 | *R0,12* | *6%* |
| >10-15 | R0,17 | 7,1% |
| >15-20 | R0,37 | 9,0% |
| >20-30 | *R0,74* | *12,6%* |
| >30-40 | R0,84 | 14,0% |
| >40-50 | R1,07 | 14,6% |
| >50 | R1,42 | 14,6% |

6.4.5 Yes, because the greater percentage increases were applied to the heavier users.

**(LB pages 86-111)**

# Section 1: Interest

**(LB pages 88-93)**

## Overview

The content of this section on *Interest*, as part of the Finance Application Topic, is drawn from page 54 in the CAPS document.

As stipulated in the CAPS document, Grade 11 learners need specifically to be able to:

- understand the difference between simple and compound interest;
- perform simple and compound interest calculations manually and *without the use of formula*;
- make sense of graphs drawn to represent simple and compound interest scenarios.

In other words, the focus in this section is on helping learners to develop an understanding of the concepts of simple and compound interest and how the calculation of each type of interest differs, rather than the ability to use formula.

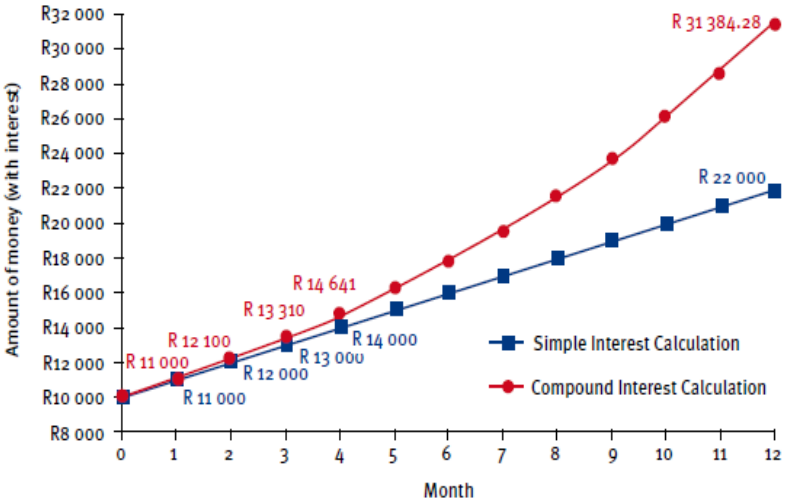
## Contexts and integrated content

Learners need to be able to work in the context relating to banking and small loan agreements.

| Simple interest | Compound interest |
|---|---|
| Always calculated on the original amount of money. | Calculated on a changing value that is made up of the original value plus any interest which has already been calculated. |
| Amount of interest added is always the same because interest is always calculated on the same value | Amount of interest added is always changing because the interest is always calculated on a different value. |

| | |
|---|---|
| **Example:**<br>*R500,00 growing at a simple interest rate of 10% for 3 years.*<br>Interest added each year = 10% × R500,00<br>= R50,00<br>⇒ Total interest added over 3 years<br>= R50,00 × 3 = R150,00<br>⇒ Total money after 3 years = original amount + interest | **Example:**<br>*R500,00 growing at a compound interest rate of 10% for 3 years.*<br>Year 1: Money = original + interest<br>= R500,00 + 10% × R500,00<br>= R500,00 + R50,00 = R550,00<br><br>Year 2: Money = Year 1 money + interest |
| **Observation:**<br>Notice how with simple interest the same interest amount of R50,00 was added every year. | **Observation:**<br>Notice how with compound interest a different (and bigger) interest amount was added every year. This different interest amount was due to the fact that every year the interest was calculated on a different (and bigger) amount of money that is made up of the previous year's money and previous year's interest. |

The graphs alongside (from page 90 in the Learner's Book) show a graphical representation of simple and compound interest scenarios.




- A graph drawn to represent simple interest will always be a linear (straight line) graph. This is because the interest added is always the same amount and so the money will increase by a constant increase.
- A graph drawn to represent compound interest will always increase at an increasing rate. This is because the interest added is always changing and growing bigger, and so the money will increase at an ever increasing rate.

## Additional questions

1. *Without using any formula*, determine the amount of money in the following investments:
   1.1 R2 000,00 is invested at 5% simple interest per month for 18 months.
   1.2 R10 000,00 is invested at 2,5% compound interest per month for 3 months.

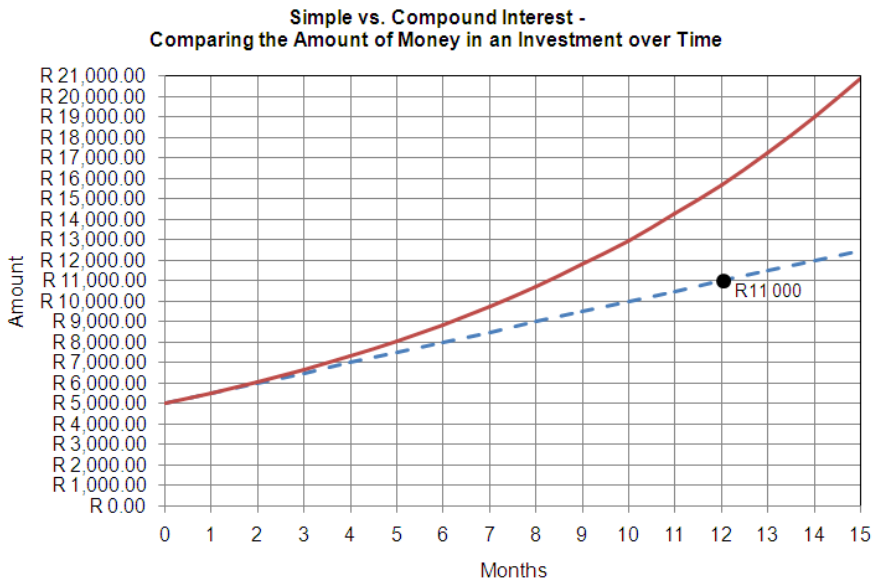
2. R3 500,00 is invested in a fixed deposit account. Interest on the account is calculated at a rate of 7,5% per year, compounded monthly. The life of the fixed deposit is 2 years.
   2.1 If interest is calculated monthly, calculate the monthly rate of interest.
   2.2 How many times will interest be calculated on the investment?
   2.3 Use the formula below to calculate how much money there will be in the account at the end of the 2 years.

   $A = P(1 + i)^n$

   Where: $A$ = money in the account at the end of a time period
   $P$ = initial amount of money invested in the account
   $i$ = monthly rate of interest
   $n$ = number of times interest is calculated

   2.4 If at the end of the 2 years the money were to be left in the account for another 1 month, calculate *without the use of a formula* how much money there will be in the account.

3. The graph below shows a comparison of the amount of money in an investment over time if simple interest and compound interest are calculated on the money.




3.1 Which graph represents the scenario where simple interest has been calculated on the investment and which graph the scenario where compound interest has been calculated? Explain your choices.

3.2 According to the graph, how much money was originally invested?

3.3 For how many months is the money being left in the investment?

3.4 Use the information on the graph of the *simple interest* scenario to calculate:

3.4.1 the amount of interest added on to the investment every month if simple interest is calculated;

3.4.2 the rate at which interest is being calculated on the investment.

3.5 Use your answers in 3.2, 3.3 and 3.4.2 and the formula below to calculate accurately how much money there will be in the investment at the end of the investment if compound interest is calculated.

$$A = P(1 + i)^n$$

Where: $A$ = money in the account at the end of a time period

$P$ = initial amount of money invested in the account

$i$ = monthly rate of interest

$n$ = number of times interest is calculated

*Note:* *Assume that:*

- the rate at which interest is calculated on the simple interest scenario and the compound interest scenario is the same;
- interest is calculated every month.

3.6 Based on what you can see in the graph, why do you think very few banks or other financial institutions make use of simple interest?

## Answers

1. 1.1 Simple interest earned every month = 5% × R2 000,00= R100,00

⇒ Total simple interest over 18 months = R100,00 per month × 18 months

= R1 800,00

⇒ Total amount in the investment after 18 months = R2 000,00 + R1 800,00

= R3 800,00

1.2 Month 1: Money in the investment = R10 000,00 + (2,5% × R10 000,00)

= R10 000,00 + R250,00= R10 250,00

Month 2: Money in the investment = R10 250,00 + (2,5% × R10 250,00)

2. 2.1 Monthly interest rate = 7,5% / 12 = 0,625%

2.2 24 times

2.3 $A = P(1 + i)^n$

$A$ = R3 500,00 $(1 + 0{,}625\%)^{24}$= R3 500,00$(1+ 0{,}00625)^{24}$

= R3 500,00$(1{,}00625)^{24}$= R3 500,00 × 1,16129

= R4 064,52 (rounded off to two decimal places)

2.4 Money in the account = R4 064,52 + (R4 064,52 × 0,625%)

= R4 064,52 + R25,40= R4 089,92

3. 3.1 The curved line represents the compound interest. The money in the account is growing at an increasing (exponential) rate as interest is always calculated on an increasing balance.

The straight line represents simple interest as the amount of money in the account always increases by the same (fixed) amount of interest every month.

3.2 R5 000,00

3.3 15 months

3.4 3.4.1 According to the graph, after 12 months, the money in the account has increased from R5 000,00 to R11 000,00. This is an increase of R6 000,00.

⇒ Interest added each month = R6 000,00 ÷ 12 = R500,00

*Notice here that you cannot simply calculate R11 000,00 ÷ 12 to get the correct answer. This is because the graph does not start at 0 but at R5 000,00, and so the increase over the 12 months is R6 000,00 and not R11 000,00.*

3.4.2 Simple interest per month = R500,00

⇒ R500,00 = ?% × R5 000,00

?% = R500 ÷ R5 000 = 0,1 = 10%

3.5 A = R5 000,00 $(1 + 10\%)^{15}$ = R5 000,00$(1,1)^{15}$ = R20 886,24

3.6 Simple interest guarantees a much higher return on an investment. This means that when banks charge compound interest on loans, they make much more interest than if they were to charge simple interest.

# Section 2: Banking

**(LB pages 94-103)**

## Overview

The content of this section on *Banking*, as part of the Finance Application Topic, is drawn from pages 55-57 in the CAPS document.

As stipulated in the CAPS document, Grade 11 learners need specifically to be able to:

- understand how interest is calculated on different types of bank accounts;
- understand how small loan and hire purchase agreements work;
- compare bank charges for different types of accounts.

## Contexts and integrated content

Learners need to be able to work in contexts relating to banking, bank accounts, and small loan and hire-purchase agreements.

## 1. Investigating how interest is calculated on money in different types of accounts

| Transactional account | Fixed deposit account |
|---|---|
| **Description**<br>This is an account where transactions (i.e. withdrawals, payments and deposits) occur on the account on a regular basis. As such, the balance in the account can change regularly. | **Description**<br>In this type of account money is invested in the account and then left to grow with interest over a period of time. As such, the balance of money in these accounts does not change during the month. |
| **How interest is calculated**<br>Interest is calculated at the end of every day to account for the fact that the balance in the account may change on a daily basis. | **How interest is calculated**<br>Since the balance does not change during the month, interest is calculated on the balance at the beginning of the month and then multiplied by the number of days in the month to give the total monthly interest. This interest is added to money in the account at the end of the month. |
| Refer to pages 95 and 96 of the Learner's Book for illustrations of how to determine interest in both transactional and fixed deposit accounts. | |

2. Hire purchase and loans

The following terms must be understood with respect to hire-purchase and loan agreements:

- Buying on credit
- Deposit
- Monthly payment or monthly repayment
- Interest
- Total cost (including the deposit and any interest paid)
- Length or life of the loan or agreement

| Hire purchase | Loan |
|---|---|
| With a hire purchase agreement, an item is purchased and paid for through *monthly payments* (rather than through buying the item for cash where the whole purchase amount has to be paid upfront).<br>Buying on hire purchase is sometimes referred to as "buying on credit" or a "credit purchase". | With a loan agreement, an amount of money is borrowed and then paid back with interest through *monthly payments*. |
| The final amount paid for the item on hire purchase is always higher than the original purchase price. | The final amount paid back for a loan is always higher than the original loan amount. |
| A *deposit* will sometimes have to be paid for both a hire purchase and/or a loan agreement. A deposit is a percentage of the purchase price or loan amount that represents a 'promise' to buy or to pay back the loan. | |
| *Total cost* ⇢ this is the total amount that will be paid for an item bought on hire purchase or for a loan, including the deposit, all of the payments, and any service or administration fees. | |
| *Interest* ⇢ this is the difference between the total amount paid for an item or the total amount paid back for the loan and the original price for the item or the original loan amount. | |

## 3. Comparing bank charges

The intention of this component in the Learner's Book is the following:

- To use different bank fee formulae to compare bank charges on different types of transactions.
- To make sense of graphs drawn to represent different types of bank charges.
- To make decisions regarding the cost of different types of transactions at different banks.

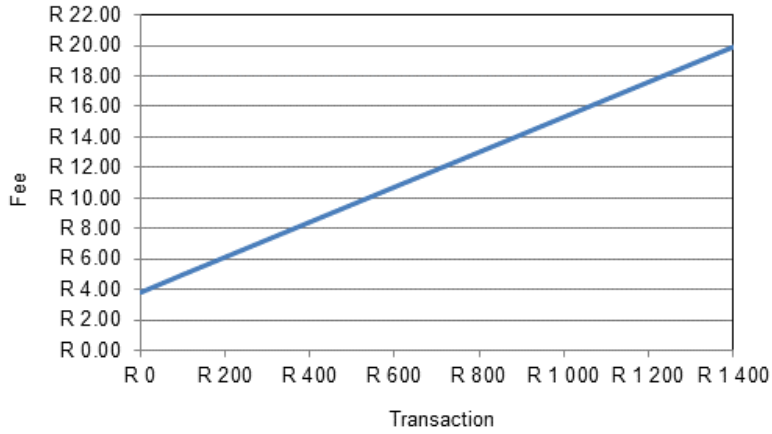
Three different types/structures of bank fee formula are shown in the table of bank fees provided in the Learner's Book:

| Structure 1 | Structure 2 | Structure 3 |
|---|---|---|
| **Fixed cost plus an additional cost that is calculated as a % of the transaction value** | **Same as Structure 1, but with a maximum fee stated.** | **Variable fee that is charged per R100,00 of the transaction value** |
| **Example:**<br>Fee = R3,90 + 1,15% of deposit value | **Example:**<br>Fee = R3,75 + 0,75% of payment value (with a maximum fee of R17,00) | **Example:**<br>Fee = R1,05 per R100,00 |
| **Method:**<br>1,15% of the transaction value is calculated and added to the fixed cost of R3,90.<br><br>**e.g.**<br>Fee on R500,00 deposit<br>= R3,90 + 1,15% × R500<br>= R3,90 + R5,75<br>= R9,65 | **Method:**<br>• 0,75% of the transaction value is calculated and added to the fixed cost of R3,90.<br>• Check the solution to see if it is less than the maximum fee of R17,00.<br>• If the fee is more than the maximum fee, then it is replaced by the maximum.<br><br>**e.g.**<br>Fee on R20 000,00 pay<br>= R3,75 + 0,75% × R20 000<br>= R3,75 + R150,00<br>= R153,75<br>→ This is much higher than the maximum fee of R17,00, so the maximum fee is charged. | **Method:**<br>Work out how many R100,00's make up the transaction value and then multiply this number of hundreds by R1,05.<br><br>**e.g.**<br>Fee on R2 350,00 deposit:<br>There are 24 full R100's in R2 350,00.<br>As such, fee = R1,05 × 24<br>= R25,20 |

**Graphical representation**

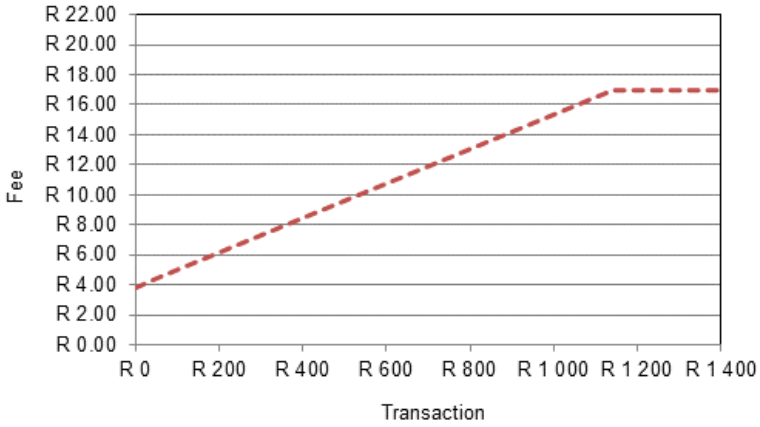
Structure 1: Fee R3,90 + 1,15% × transaction value

A linear graph, increasing at a rate of 1,15% or R1,15 for every R100,00 deposited and starting at R3,90 on the vertical axis.



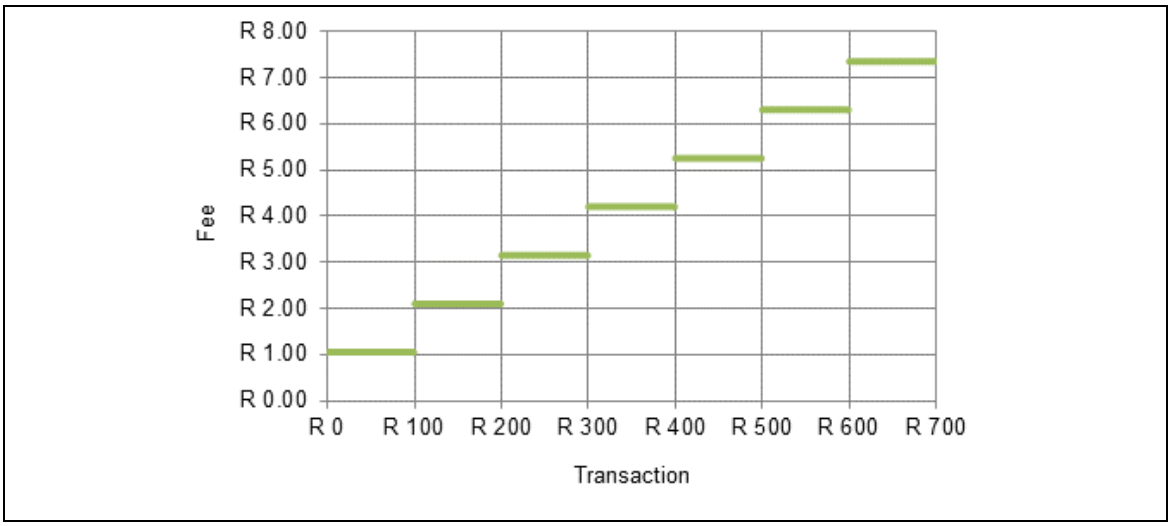

Structure 2: Fee R3,75 + 0,75% × transaction value (max fee of R17,00)

- Will give a linear graph, increasing at a rate of 0,75% or R0,75 for every R100,00 on the horizontal axis and starting at R3,75 on the vertical axis.
- Also, the graph will become a flat (horizontal line) when the maximum fee of R17,00 is reached.




Structure 3: Fee R1,05 per R100,00 transaction value

- A 'step function'.
- A new step will start every time the transaction value passes into a new hundred category and every new step will increase by R1,05 from the previous step.


R 8.00
R 7.00
R 6.00
R 5.00
R 4.00
R 3.00
R 2.00
R 1.00
R 0.00
Fee
R 0
R 100
R 200
R 300
R 400
R 500
R 600
R 700
Transaction

## Section 3: Inflation

**(LB pages 104-109)**

- Inflation is the general increase in the price of goods and services over a period of time.
- The *rate of inflation* is expressed as a percentage and represents the average increase in the cost of goods and services from onetime period to another.
- Because inflation represents the increase in prices, the impact of an increase in inflation is a reduction in buying power: i.e. if things become more expensive then you can buy less with the money that you have – unless your money increases at the rate of inflation.

When determining how prices will change when affected by inflation, the calculation used is a *compound calculation* that involves *increasing a value by a percentage*.

### Example

Car prices will often increase in value as a new model of car is released. Consider a model of a particular type of car priced at R80 000,00 that increases by 5,5% in one year and by 8,2% in the next year. We can predict what the value of a new model of the same car will be after two years as follows:

Value after 1 year = R80 000,00 + 5,5% × R80 000,00

= R80 000,00 + R4 400,00

= R84 400,00

Value after 2 years = value after 1 year + 8,2% increase

= R84 400,00 + 8,2% × R84 400,00

= R84 400,00 + R6920,80

= R91320,80

Notice how the inflation calculation above involves:

- A compounding calculation → i.e. the value for year 2 is dependent on the value for year 1; and the value for year 1 is dependent on the original value.
- A calculation that involves increasing a value by a percentage → i.e. for every calculation, a percentage is calculated of a value and then the answer to this calculation is added to the value.

## Additional Questions

1. Calculate the new prices of the following items if the prices of the items increase at the given inflation rates.
   1.1 Chicken: R29,50; inflation rate = 5%
   1.2 Coke-a-Cola: R6,20; inflation rate = 7%
   1.3 House Price: R730 000,00; inflation rate = 11,3%
   1.4 Electricity tariff: R0,0782 per unit; inflation rate = 32,8%

2. The following extract appeared in The Witness newspaper on 27 March 2008.

**AVERAGE PRICE OF PACSA FOOD BASKET**

| Commodities | Jan-08 | Feb-08 |
|---|---|---|
| Maize Meal 50 kg | 162,23 | 212,65 |
| Flour 12,5 kg | 64,72 | 72,24 |
| Rice 10kg | 40,47 | 44,47 |
| Chicken 2kg | 28,23 | 24,92 |
| Potatoes 10kg | 27,73 | 20,23 |
| Cooking oil 5L | 59,48 | 71,48 |
| Beans 5kg | 54,48 | 48,22 |
| Tomatoes 1kg | 6,28 | 7,77 |
| Onions 1kg | 6,72 | 6,64 |
| Sugar 12,5kg | 68,72 | 68,48 |
| Tea bags 250 gms | 8,48 | 9,11 |
| Coffee 500g | 30,23 | 31,22 |
| Milk 2L | 18,11 | 16,84 |
| Bread 600g (x 20 loaves) | 126,5 | 117,65 |
| Salt 500g | 1,98 | 3,17 |
| Eggs 30 tray | 25,73 | 23,28 |
| Cabbage 5pcs | 23,68 | 27,46 |
| Margarine 500g | 8,96 | 9,86 |
| Soup (NO1) 400g | 9,64 | 9,30 |
| Yeast p/sachet 10g | 1,72 | 1,42 |
| Stock 500g | 7,93 | 6,73 |
| TOTAL | 782,02 | 833,14 |

Study the extract carefully and then try to answer the following questions:

2.1. 2.1.1 By how much has the price of a 50 kg bag of Maize Meal increased from January 2008 to February 2008?

2.1.2 By how much has a block of Margarine increased from January 2008 to February 2008?

2.2 Which items of food decreased in price from January 2008 to February 2008?

2.3 Which item of food increased the most from January 2008 to February 2008?

2.4 The table below shows the difference in price of the various items from January to February 2008 and the percentage increase or decrease in price.

| Food Item | Jan 08 | Feb 08 | Price Difference | % Change | Food Item | Jan 08 | Feb 08 | Price Difference | % Change |
|---|---|---|---|---|---|---|---|---|---|
| Maize | R 162.23 | R 212.65 | R 50.42 | 31.1% | Coffee | R 30.23 | R 31.22 | R 0.99 | 3.3% |
| Flour | R 64.72 | R 72.24 | R 7.52 | 11.6% | Milk | R 18.11 | R 16.84 | -R 1.27 | -7.0% |
| Rice | R 40.47 | R 44.47 | R 4.00 | 9.9% | Bread | R 126.50 | R 117.65 | -R 8.85 | -7.0% |
| Chicken | R 28.23 | R 24.92 | -R 3.31 | -11.7% | Salt | R 1.98 | R 3.17 | R 1.19 | 60.1% |
| Potatoes | R 27.73 | R 20.23 | -R 7.50 | -27.0% | Eggs | R 25.73 | R 23.28 | -R 2.45 | -9.5% |
| Oil | R 59.48 | R 71.48 | R 12.00 | 20.2% | Cabbage | R 23.68 | R 27.46 | R 3.78 | 16.0% |
| Beans | R 54.48 | R 48.22 | -R 6.26 | -11.5% | Margarine | R 8.96 | R 9.86 | R 0.90 | 10.0% |
| Tomatoes | R 6.28 | R 7.77 | R 1.49 | 23.7% | Soup | R 9.64 | R 9.30 | -R 0.34 | -3.5% |
| Onions | R 6.72 | R 6.64 | -R 0.08 | -1.2% | Yeast | R 1.72 | R 1.42 | -R 0.30 | -17.4% |
| Sugar | R 68.72 | R 68.48 | -R 0.24 | -0.3% | Stock | R 7.93 | R 6.73 | -R 1.20 | -15.1% |
| Tea Bags | R 8.48 | R 9.11 | R 0.63 | 7.4% | | | | | |
| | | | | Whole Basket | | R 782.02 | R 833.14 | | |

2.4.1 a. Show how the price difference value of R12,00 for "Oil" was calculated.

b. Show how the price difference value for "Soup" was calculated.

2.4.2 a. Show how the percentage value of 20,2% for "Oil" was calculated.

b. Show how the percentage change value for "Soup" was calculated.

2.4.3 Complete the table by calculating the missing price difference value and the missing percentage increase / decrease value for the "Whole Basket".

2.4.4 Is the item that experienced the greatest increase in price the same as the item that experienced the greatest *percentage* increase in price? Explain.

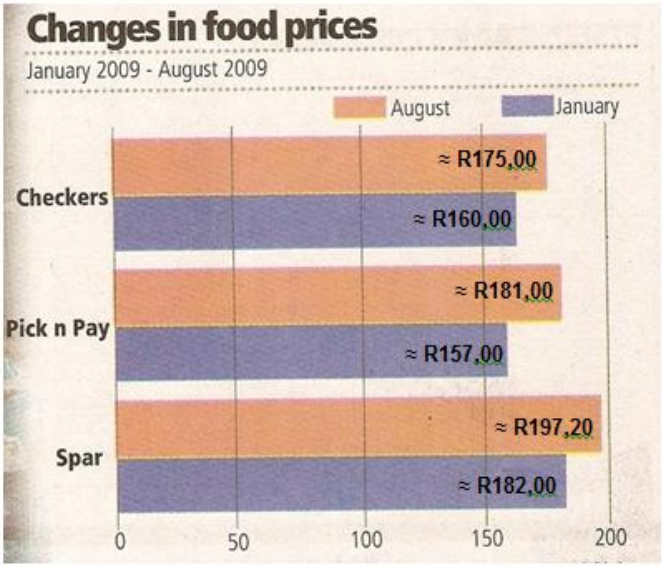
3. The table below show the rate of inflation for a Toyota Avanza vehicle over the period 2006 to 2009.

| Year | 2006 to 2007 | 2007 to 2008 | 2008 to 2009 |
|---|---|---|---|
| Rate of Inflation | 8,2% | 7,7% | 15,2% |

3.1 If the price of a new Toyota Avanza in 2006 was R99 900,00, how much could you expect to pay for a new one in 2009?

3.2 The price of a vehicle depreciates (decreases) by approximately 20% during the first year of ownership. If a Toyota Avanza cost R99 900,00 in 2006, how much would it have been worth after 1 year?

4. The graph alongside shows changes in food prices for the same basket of groceries at three different South African stores in January 2009 and August 2009. (Source: Business Report, 25 August 2009; price labels added to the graph)




4.1 Calculate the rate of inflation for food from January to August 2009 at:

4.1.1 Checkers

4.1.2 Pick n' Pay

4.1.3 Spar

Round all answers off to one decimal place.

4.2 If you were trying to save money and had to pick one of these three shops to shop at, which one would you choose? Give a reason to explain your choice.

## Answers

1.1 Chicken: New price = R29,50 + (5% × R29,50)
= R29,50 + R1,48 (rounded off to two decimal places)
= R30,98

1.2 Coke-a-Cola: New price = R6,20 + (7% × R6,20)
= R6,20 + R0,43 (rounded off to two decimal places)
= R6,63

1.3 House Price: New price = R730 000,00 + (11,3% × R730 000,00)
= R730 000,00 + R82 490,00
= R812 490,00

1.4 Electricity tariff: New price = R0,0782 + (32,8% × R0,0782)
= R0,0782 + R0,0257 (rounded off to four decimal places)
= R0,1039

2. 2.1 2.1.1 Maize increase = R212,65 – R162,23 = R50,40

2.1.2 Margarine increase = R9,86 – R8,96 = R0,90

2.2 Chicken; Potatoes; Beans; Onions; Sugar; Milk; Bread; Eggs; Sup; Yeast; Stock

2.3 Maize Meal: Increased by R50,40

2.4 2.4.1 a. Price increase for oil = R59,48 – R71,48 = R12,00

b. Price change for soup = R9,30 – R9,64 = –R0,34

2.4.2 a. Cooking oil: % increase = (R71,48 – R59,48) ÷ R59,48 × 100 ≈ 20,2%

b. Soup: % change = (R9,30 – R9,64) ÷ R9,64 × 100 ≈ –3,5% (i.e. the price decreased)

2.4.3 Price difference in whole basket = R833,14 – R782,02 = R51,12

% change in whole basket of goods = (R833,14 – R782,02) / R782,02 × 100

≈ 6,5% (i.e. the price decreased)

2.4.4 No – margarine had the greatest increase in price, but salt had the greatest percentage increase in price.

3.

3.1 Inflation from 2006 to 2007 = 8,2%

⇒ Price in 2007 = R99 900,00 + 8,2% increase

= R99 900,00 + (8,2% × R99 900,00)= R99 900,00 + R8 191,80

= R108 091,80

Inflation from 2007 to 2008 = 7,7%

⇒ Price in 2008 = R108 091,80 + 7,7% increase

= R108 091,80 + (7,7% × R108 091,80)

= R108 091,80 + R8 323,07 (rounded off to two decimal places)

= R116 414,87

Inflation from 2008 to 2009 = 15,2%

⇒ Price in 2009 = R116 414,87 + 15,2% increase

= R116 414,87 + (15,2% × R116 414,87)

= R116 414,87 + R17 695,06 = R134 109,93

3.2 Price after 1 year at 20% decrease = R99 900,00 – 20% in value

= R99 900,00 – (20% × R99 900,00) = R99 900,00 – R19 980,00

= R79 920,00

4. 4.1 4.1.1 *Checkers:* Inflation rate =

$$\frac{\text{New Price - Old Price}}{\text{Old Price}} \times 100$$

$$= \frac{R175,00 - R160,00}{R160,00} \times 100 = \frac{R15,00}{R160,00} \times 100$$

≈ 9,4% (rounded off to one decimal place)

4.1.2 *Pick n' Pay:*

Inflation rate = $\frac{R181,00 - R157,00}{R157,00} \times 100 = \frac{R24,00}{R157,00} \times 100$

≈ 15,3% (rounded off to one decimal place)

4.1.3 *Spar:*

Inflation rate = $\frac{R197,00 - R182,00}{R182,00} \times 100 =$

$= \frac{R15,00}{R182,00} \times 100$

$\approx 8,2\%$ (rounded off to one decimal place)

4.2 The prices at Spar are higher than at the other two shops, but the prices at Spar have increased at a lower rate than at the other two shops.

So, while the other two shops have lower prices, they have a higher rate of inflation on the prices. If this trend in food inflation continues at the three stores then there may come a time where Checkers and Pick n' Pay become more expensive than Spar.

But for now, based on the prices shown in the graph, Checkers is probably the best or most affordable place to shop.

**(LB pages 112-127)**

There is very little new content relating to *Measuring length and distance* and *Measuring volume* in Grade 11 compared to the Grade 10 curriculum. The main difference in these sections is that in Grade 11 the skills of being able to work with measuring lengths and distances in contexts that require substantial lengths/distances must be developed. Measuring the dimensions of a field would be an example. Similarly for volume, it is expected that larger volumes of quantities will be determined – for example, measuring the volume of concrete needed using a wheelbarrow as a measuring instrument. Sections 1 and 3 in the Learner's Book) will not be revisited in this study guide.

By contrast, in the sections on *Measuring weight* and *Measuring temperature* there is new content. The new content of these sections will be explored below.

# Section 2: Working with weight

**(LB pages 120-121)**

## Overview

The content of this section on *Measuring weight*, as part of the Measurement Application Topic, is drawn from pages 65-66 in the CAPS document.

As stipulated in the CAPS document, Grade 11 learners need specifically to be able to:

- use recorded weight and height values together with a given formula to determine the Body Mass Index values and corresponding weight category status of an adult.

## Contexts and integrated content

There is integration of content from the Basic Skills Topic of *Patterns, relationships and representations* with respect to interpreting graphs and using equations.

Body Mass Index (BMI) is a calculated value that takes into account the height and weight of an adult and can be used to determine the weight status of the adult. The formula for calculating BMI is:

$$\text{BMI (kg/m}^2) = \frac{\text{weight (kg)}}{[\text{hight (m)}]^2}$$

Notice that the units for a BMI value are kg/m$^2$ → "kilograms per square metres". In other words, BMI represents a comparison of an adult's weight to the surface area (i.e. m$^2$) of their body.

The following table of BMI intervals and corresponding weight status categories can then be used to determine the weight status of an adult with a particular BMI value:

| BMI range (kg/m²) | Weight status |
|---|---|
| less than 18,5 (kg/m²) | underweight |
| from18,5 to 24,9 (kg/m²) | of normal weight |
| from 25 to 30 (kg/m²) | overweight |
| more than 30 (kg/m²) | obese |

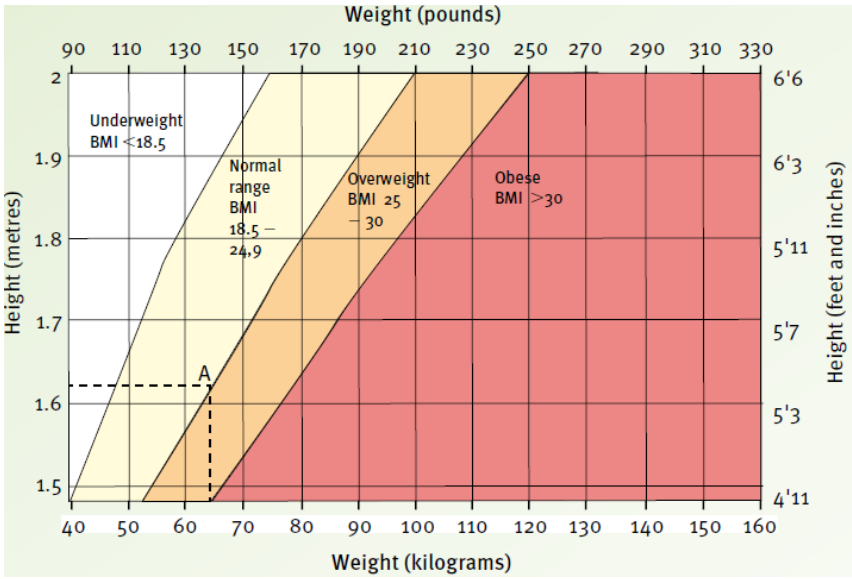
## Example

Consider an adult with a height of 1,75 m and a weight of 82 kg.

BMI = $\frac{82\text{ kg}}{[1{,}75\text{ m}]^2} = \frac{82\text{ kg}}{3{,}0625\text{ m}^2}$ ≈ 26,8 kg/m$^2$ (rounded off to one decimal place).

According to the table of BMI intervals and weight status categories above, this adult would be classified as being *overweight.*

Charts can also be used to determine the weight status of an adult, where plotting the height and weight of an adult on the chart provides an indication of the possible weight status of the adult. Using such charts eliminates the need to calculate a BMI value for the adult.



# Section 4: Measuring temperature

**(LB pages 124-125)**

## Overview

The content of this section on *Measuring temperature*, as part of the Measurement Application Topic, is drawn from pages 67-68 in the CAPS document.

As stipulated in the CAPS document, Grade 11 learners need specifically to be able to:

- convert from degrees Celsius to degrees Fahrenheit using given formula.
- interpret temperature values to plan trips.

## Contexts and integrated content

There is integration of content from:

- Basic Skills Topic of *Patterns, relationships and representations* with respect to using equations;
- Application topic of *Measurement* with respect to converting units between different systems.

## 1. Converting temperature values

The following formulas make it possible to convert from degrees Celsius to degrees Fahrenheit, and vice-versa.

| °F = (°C × 1,8) + 32° | °C = (°F – 32°) ÷ 1,8 |
|---|---|
| **Example:**<br>Converting 30°C to °F gives:<br>°F = (°C × 1,8) + 32°<br>= (30° × 1,8) + 32°<br>= 54° + 32°<br>= 86° | **Example:**<br>Converting 50°F to °C gives:<br>°C = (°F – 32°) ÷ 1,8<br>= (50° – 32°) ÷ 1,8<br>= 18° ÷ 1,8<br>= 10° |

Note that an equivalent temperature in degrees Fahrenheit will always be a much bigger value that a temperature value in degrees Celsius.

## 2. Using temperature values to plan trips

One of the ways in which this type of calculation is useful is for planning a trip, especially when the trip is to another country where temperatures are given in a different unit.

## Example

The chart below shows a weather report for New York in the United States of America. Notice that the temperatures are all given in degrees Fahrenheit.

| | | | | | |
|---|---|---|---|---|---|
| **September 17** | | | | | |
| | **69°F** T-Storms | **69°F** | **90%** | 87% | From SW 12 mph |
| **September 18** | | | | | |
| | **69°F** T-Storms | **69°F** | **80%** | 84% | From SW 11 mph |
| **September 19** | | | | | |
| | **69°F** T-Storms | **69°F** | **70%** | 84% | From SW 11 mph |
| **September 20** | | | | | |
| | **68°F** T-Storms | **68°F** | **70%** | 87% | From SW 10 mph |
| **September 21** | | | | | |
| | **68°F** Scattered T-Storms | **68°F** | **60%** | 84% | From SW 9 mph |

Consider a person travelling from South Africa – where temperature is given in degrees Celsius – to New York. In order to plan their trip and to know what type of clothes to pack, whether to organise outdoor trips, etc., the person would need to make sense of the temperature values on this weather report. One way to do this is to convert the temperature values into degrees Celsius since this is the measurement system that they are possibly more familiar with.

| °C = (°F – 32°) ÷ 1,8 | |
|---|---|
| **Converting 69°F to °C gives:** | **Converting 68°F to °C gives:** |
| °C = (°F – 32°) ÷ 1,8 | °C = (°F – 32°) ÷ 1,8 |
| = (69° – 32°) ÷ 1,8 | = (68° – 32°) ÷ 1,8 |
| = 37° ÷ 1,8 | = 36° ÷ 1,8 |
| ≈ 21° | = 20° |

Based on these conversions, the maximum temperature will be fairly cool and so the traveller should probably pack warm clothes as well as clothes that can cope with the rain (from the indication given about thunderstorms).

# (Scale and Map-work)

**(LB pages 128-155)**

This chapter in the Learner's Book is divided into two sections:

- Section 1 deals with *maps that help you to find your way*. This includes:
  - National road maps
  - Strip charts
  - Street maps
  - Housing complex maps
- Section 2 deals with maps that provide information about an event. This includes:
  - Route maps
  - Elevation maps

It is important to notice that the maps in Section 1 all relate to the types of maps that are be used when travelling and/or navigating to a destination. The maps in Section 2, on the other hand, are maps that provide information about an event, particularly a description of  what the route for an event looks like as shown from two different perspectives: from above – a route map; and from the side – an elevation map.

It is important to see and understand the different functions of the maps included in Sections 1 and 2.

# Section 1: Maps that help you to find your way

**(LB pages 130-149)**

## Overview

The content of this section, as part of the *Maps, plans and other representations of the physical world* Application Topic, is drawn from pages 73-74 in the CAPS document.

As stipulated in the CAPS document, Grade 11 learners need specifically to be able to:

- make sense of the information shown on various maps
- follow and describe directions
- Use grid reference systems
- use scales (number and bar) to estimate distances
- plan trips, including estimating travelling times, travelling costs and travelling speeds.

## Contexts and integrated content

- The maps in this section are limited to:
  - National road maps; Strip charts; Street maps; Housing complex maps
- There is integration of content from the Application topic of *Measurement* with respect to measuring lengths and distances.

It is not the intention and purpose of this study guide to simply recap the same content as is included in the Learner's Book. Rather, the study guide is meant to provide additional information or clarity regarding the content included in the Learner's Book. As such, the discussion below will highlight key concepts covered in working with the different types of maps rather than revisiting the specific maps that appear in the Learner's Book.

Before summarising the key concepts dealt with in the context of exploring each map it is essential to see that there is a deliberate and specific progression that occurs with the different maps used in the section. Namely:

- The first map dealt with – the National Road map – shows a very large area of land but only includes limited detail.
- The next map – the Strip Chart – shows information on a smaller area of land (i.e. a specific section of road between two towns). It includes much more detail about the route than is visible on the National Road map.
- The next map – the Street Map – shows information on a much smaller area of land but with significantly more detail, detail that is not visible on any of the other maps.
  - Finally, the Housing Complex map shows information about a very small area of land and shows detail that is not visible on any of the other maps.

This progression between the maps is intentional in the sense that it is intended to illustrate how people will often make use of maps when travelling. Namely, they will start with a map that shows the total route they have to travel, and then navigate using smaller and smaller maps as they require more detail about specific sections of the route and about the place that they are travelling to.

The key concepts dealt with when working with each map are summarised in the following table.

| Map | Information provided | Content / skills covered | Question example |
|---|---|---|---|
| **1. National road map**<br><br>(LB pages 130-135) | Major routes / roads and distances between major cities and towns in South Africa. | • Deciding on the most appropriate route to travel between two or more destinations and the total distance to be travelled. | *Write down a possible route that can be used to travel from Cape Town to Durban. Include in your description the name(s) of the roads to be travelled on and the towns that the route will pass through.* |
| | | • Estimating travelling costs and travelling times. | *Assume that the driver is travelling at an average speed of 100 km. Determine the approximate amount of time that it will take to complete this journey.Then explain why this travelling time is only an approximate travelling time.* |
| | | • Planning possible stopping points over the whole journey for accommodation or for breaks/petrol. | *If we assume that this car can travel 500 km on a full tank of petrol, identify towns on the route where the driver might decide to stop for petrol.* |
| | | • Making use of a distance table. | *Use the distance table provided to determine the distance from Durban to Cape Town.*<br>*Now explain why this distance only provides a guideline as to the distance between these two cities.* |

| Map | Information provided | Content / skills covered | Question example |
|---|---|---|---|
| **2. Strip-charts**<br><br>(LB pages 135-139) | Locations of towns, other roads, and points of interest on a *specific route* that will be travelled. | • Determining more accurate travelling distances on a section of a specific route to be travelled. | *See above* |
| | | • Deciding on appropriate stopping points to fill up with petrol or to stop for accommodation or to take a break. | |
| | | • Estimating travelling costs and travelling times. | |
| | | • Making use of distance markers given in the margins of the charts as well as distance indicators given on the roads shown on the chart. | *Using the distance markers given in the margin, determine the distance between Kimberley and Bloemfontein.*<br>*Now use the distance markers given on the road to determine the distance between Swinburne and Paul Roux.* |

| Map | Information provided | Content / skills covered | Question example |
|---|---|---|---|
| **3. Street map**<br><br>(LB pages 140-144) | Positions and names of streets and other locations (e.g. hospitals) within a city. | • Being able to identify locations on the map by referring to symbols used. | A school is located in Princess Margaret Street. Describe what symbol is used to represent a school and write down the name of the school. |
| | | • Being able to follow and provide directions that draw on street names and directional indicators (e.g. left, right) to travel to a destination shown on the map. | Provide a set of directions that a person can use to travel from the school in Princess Margaret Street to the Hospital in Masukwana Street. |
| | | • Being able to use a grid reference system together with the street index pages given at the back of a map book to find the location of a specific street both in the map book and on the page in which the relevant map is located. | Identify the school(s) and hospital(s) that appear in block AS20. |
| **4. Housing complex map**<br>(LB pages 145-146) | A map showing the positions of houses within a small housing complex | • Being able to work with a map that shows a small area but without too much detail about that area being provided.<br>• Being able to follow and describe directions to travel to a specific location within a housing complex. | The person that you are looking for lives in house 20 in the complex. Give a set of directions that will enable a person to travel to house 20. In your directions you must make use of directional indicators (e.g. left, right, etc) and must refer to landmarks. |

## 5. Scales

For all of the maps above there is an expectation that the user of a map must be able to use a given scale to estimate travelling distances (when a distance table or distance markers are not provided).

It is essential to understand that in most cases it is only possible to *estimate* distances on a map using a scale and not to determine distances accurately. This is because there are many factors – including accurate measurement, where in the city/town a person is travelling to, etc. – that can affect the accuracy of a distance calculation on a map.

There are two types of scale calculations required in Grade 11:

- Calculation type 1 → measure a distance on a map and use a given scale to determine what this measurement translates to in actual distance.
- Calculation type 2 → use a known actual distance value and a given scale to determine how long a distance must be drawn on a map.

## Example

The following example illustrates the two different types of calculations involving scale required in Grade 11.

Calculation type 1:

A measurement of 13,7 cm is made on a map. If the scale of the map is 1 : 50 000, how much does this distance amount to in actual distance (in kilometres)?

<u>Answer</u>: Scale → 1 : 50 000

This means that the actual distance is 50 000 times bigger than the measurement on the map: Actual distance = 13,7 cm × 50 000 = 685 000 cm

= 6 850 m = 6,85 km

Notice how the actual distance value is expressed in km or in m, while the measured value is expressed in cm or mm.

Calculation type 2:

The distance between two towns along a road is 12 km. If the road between these two towns is shown on a map with a scale of 1 : 50 000, how long will the road measure on the map (in cm)?

Answer: Scale → 1 : 50 000

This means that the measured length on the map is 50 000 times smaller than the actual distance: Measured length = 12 km ÷ 50 000 = 0,00024 km

= 0,24 m

= 24 cm

There are two different types of scales that can be included on maps: Number scales and Bar scales

**Number scale**

- A number scale is expressed in the format 1 : 50 000 (i.e. the scale contains only numbers).As was shown in the example above, this scale shows a specific relationship between the size of the area of land as drawn on the map and the actual size of that area of land.
- The approach taken in the Learner's Book is to express this relationship as one of *enlargement* or *reduction*: i.e. the scale of 1 : 50 000 means that the plan is 50 000 times smaller than the actual size; or that the actual size is 50 000 times bigger than the plan.
- Thinking about the scale in this way makes any calculations using the number scale relatively straight-forward. When converting from a plan measure to an actual distance, the value must be enlarged by a factor of 50 000 (or by whatever the scale is).When converting from an actual distance to a plan measure, the value must be reduced by a factor of 50 000 (or whatever the scale is).

Refer back to the example above for an illustration of how to use a number scale to determine actual distances or plan measurements.

Notice that because a number scale shows a very specific relationship in size between an area of land and the size of the picture drawn to represent that area of land, as soon as a map is resized then the original number scale is no longer valid and a new number scale must be determined.

For example, is a map has a scale of 1 : 50 000 (and, so, the map is 50 000 times smaller than the actual area of land), then if the map is resized is will no longer be 50 000 times smaller than the actual area of land. Rather, it will not be even smaller (perhaps 60 000 times, or 100 000 times smaller).

### Bar scale

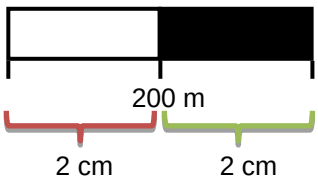
A bar scale is different to a number scale in that the number on the bar show the relationship between measured length and actual distance.

Measuring with a ruler on the bar scale shows how many measured units are equal to actual distance.

This is different to a number scale in that it does not state how many times smaller the map is from the actual. Rather, it states how many measured units are equal to a specific number of actual units.

## Example

As an example, consider the bar scale below.




- The white rectangle (from 0 m to 200 m) is exactly 2 cm long.
- The black rectangle (from 200 m to 400 m) is also 2 cm long.
- This means that the whole length (from 0 m to 400 m) is 4 cm long.

In other words, the bar scale is telling us that:

- 2 cm measured on the map is equivalent to 200 m in actual distance;
- or that 4 cm measured on the map is equivalent to 400 m in actual distance.

Once we know this relationship between measured length and actual distance we can determine distances on the map as follows:

*Question*:

Using this bar scale, how long will a measured length of 15,5 cm amount to in actual distance?

*Answer*:

Measuring on the bar scale shows that 2 cm = 200 m → so 1 cm = 100 m.

Therefore 15,5 cm is equivalent to 100 m × 15,5 = 1 550 m

= 1,55 km

Note that the bar scale does not become inaccurate if the size of the map is changed (as happens with a number scale). This is because the bar scale already shows a specific relationship between a measured length and an actual distance and if the map is resized, then the bar scale is also resized by the same proportion and so the relationship between measured length and actual size also changes proportionately.

## Additional Questions

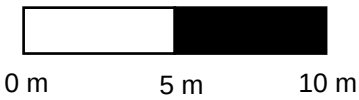
1. The table below shows the dimensions of different parts of a house as measured on a plan. If the plan is drawn on the scale 1 : 50, use the scale to determine the actual length of each feature of the house.

| Feature | Measure on the Plan | Actual Real-World Measure (metres) |
|---|---|---|
| House Length | 14 cm | |
| House Width | 10,5 cm | |
| Height of the walls | 4,4 cm | |
| Height of the roof | 3 cm | |
| Height of the doors | 4 cm | |
| Width of the doors | 1,6 cm | |
| Height of big windows | 2,4 cm | |
| Width of big windows | 3,6 cm | |
| Height of small windows | 1,2 cm | |
| Width of small windows | 2,5 cm | |

2. An architect draws a plan of a building on the scale 1 : 20. The table below shows the actual real-world measurements of some of the dimensions of the building. You need to use the scale to determine how long the architect will need to draw these dimensions on the plan.

| Feature | Measure on the Plan (cm) | Actual Real-World Measure |
|---|---|---|
| Wall Length | | 8 m |
| Wall Width | | 4,5 m |
| Wall Height | | 2,2 m |
| Roof Height | | 1,2 m |
| Door Height | | 1,8 m |

3. If the following bar scale appeared on a plan, work out:




   3.1 the actual distance of a measure of 100 mm on the plan;

   3.2 the actual distance of a measure of 5,35 cm on the plan;

   3.3 what length to draw an actual dimension of 2,5 m on the plan;

   3.4 a number scale to represent this bar scale.

## Answers

1.

| Feature | Measure on the Plan | Actual Real-World Measure (metres) |
|---|---|---|
| House Length | 14 cm | 7 m |
| House Width | 10,5 cm | 5,25 m |
| Height of the walls | 4,4 cm | 2,2 m |
| Height of the roof | 3 cm | 1,5 m |
| Height of the doors | 4 cm | 2 m |
| Width of the doors | 1,6 cm | 0,8 m |
| Height of big windows | 2,4 cm | 1,2 m |
| Width of big windows | 3,6 cm | 1,8 m |
| Height of small windows | 1,2 cm | 0,6 m |
| Width of small windows | 2,5 cm | 1,25 m |

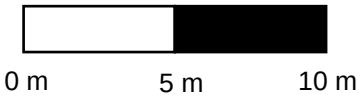
Example of method used to determine the values in the table:

Scale:1 : 50 ⇢ this means that the actual measure is 50 times bigger than the measure on the plan.
House length on plan = 14 cm
Actual house length = 50 times bigger than house length on plan= 14 cm × 50 = 700 cm = 7 m

2.

| Feature | Measure on the Plan (cm) | Actual Real-World Measure |
|---|---|---|
| Wall Length | 40 cm | 8 m |
| Wall Width | 22,5 cm | 4,5 m |
| Wall Height | 11 cm | 2,2 m |
| Roof Height | 6 cm | 1,2 m |
| Door Height | 9 cm | 1,8 m |

Example of method used to determine the values in the table:
Scale: 1 : 20 → this means that the measure on the plan is 20 times smaller than the actual measure.
Actual wall length = 8 m
Wall length on plan = 20 times smaller = 8 m ÷ 20 = 0,4 m = 40 cm




3. 3.1 Measuring on the bar scale gives 2 cm = 5 m
⇢ 1 cm (or 10 mm) = 2,5 m
So, a measure of 100 mm on the plan is an actual length of 2,5 m × 10 = 25 m

3.2 A measure of 5,35 cm on the plan is an actual length of 2,5 m × 5,35 = 13,375 m

3.3 1 cm = 2,5 m ⇢ 1 m = 0,4 cm
So, an actual length of 2,5 m drawn on the plan will be: 1 m = 0,4 cm
⇢ 2,5 m = 0,4 cm × 2,5 = 1 cm

3.4 1 cm = 2,5 m ⇢ 1 cm = 250 cm
So, the number scale is 1 : 250

# Section 2: Maps that provide information about an event: route and elevation maps

**(LB pages 150-153)**

## Overview

The content of this section, as part of the *Maps, plans and other representations of the physical world* Application Topic, is drawn from page 73 in the CAPS document.

As stipulated in the CAPS document, Grade 11 learners need specifically to be able to:

- interpret elevation and route maps of an event in order to plan for and complete an event.

## Contexts and integrated content

The contexts in this section are limited to maps showing route and elevation profiles for different cycling, running and/or other sporting events.

The key differences between route and elevation maps, together with concepts dealt with when working with each type of map, are described below.

| Route map | Elevation map |
|---|---|
| **Perspective:**<br>Provides a *top-view perspective* of the route that a participant will have to travel in an event. | **Perspective:**<br>Provides a *side-view perspective* of the route for an event. |
| **Information shown:**<br>Shows the outline of the route, including the positions of corners, straight sections, and possibly also distances. In the case of a route map for a marathon running race (e.g. the route map of the Comrades Marathon shown on page 150 in the Learner's Book), the route map might also show the position of additional features such as watering stations, first aid stations. | **Information shown:**<br>Shows the elevation profile of a route ⇢ i.e. shows the heights of different portions of the route, including where there will be up-hills, down-hills and flats on the route.<br>Elevation maps can also show distances on a route. |

The key concepts dealt with in working with the different maps, plus examples of questions that address these key concepts, are as follows:

1. Being able to explain how route maps and elevation maps are different and the uses of each type of map.

   Question example:

   What information does the route map tell you about the event and what different information does the elevation map tell you about the event? And how could an athlete use each type of map to help them to plan their run?

2. Being able to describe the information shown on the maps.

   Question example:

   Explain what event / information the elevation and route maps are describing.

3. Being able to identify specific information on the maps.

   Question example:

   Where in the route will the runners reach the highest point in the race?

4. Being able to match the information shown on a route map with the information shown on an elevation map of the same route.

   Question example:

   Identify on both the route map and the elevation map where the half-way point in the race is. OR: Use the elevation map to indicate on the route map where the highest point on the route will be.

5. Being able to use the route and elevation maps to plan for an event

   Use the elevation map to identify what you believe will be the most difficult/challenging portions of the route and then explain how you would use this information to plan your race in this event.

## Additional Questions

In March of every year the Cape Argus Cycle Race takes place in Cape Town.
An elevation map of the route of the Cape Argus Cycle Tour is given on the next page.
The elevation map shows the height above sea level of certain places on the route of the cycle race.

1. Use the elevation map to answer the following questions:
   - 1.1 What is the height of the highest point in the race?
   - 1.2 At what point in the race do the cyclists ride very close to the sea?
   - 1.3 How long (in kilometres) is the longest downhill in the race?
   - 1.4 1.4.1 Approximately how many metres do the riders drop in elevation from the top to the bottom of Smitswinkel Hill (from point A to point B)? You must show all of your working.
     - 1.4.2 What is the distance (in kilometres) from the top to the bottom of Smitswinkel Hill (from point A to point B)?
   - 1.5 Based on what you can see from the elevation map, if you were cycling the Cape Argus Cycle Race, do you think the race would be easy? Explain your answer by referring to the elevation map.

2. Robbie Hunter won the 2008 Cape Argus Cycle Race in a winning time of 2 hours 27 minutes and 30 seconds.

   If the race was 109 km long, calculate his average speed for the race in km/h (kilometres per hour). Round off your final answer to one decimal place.

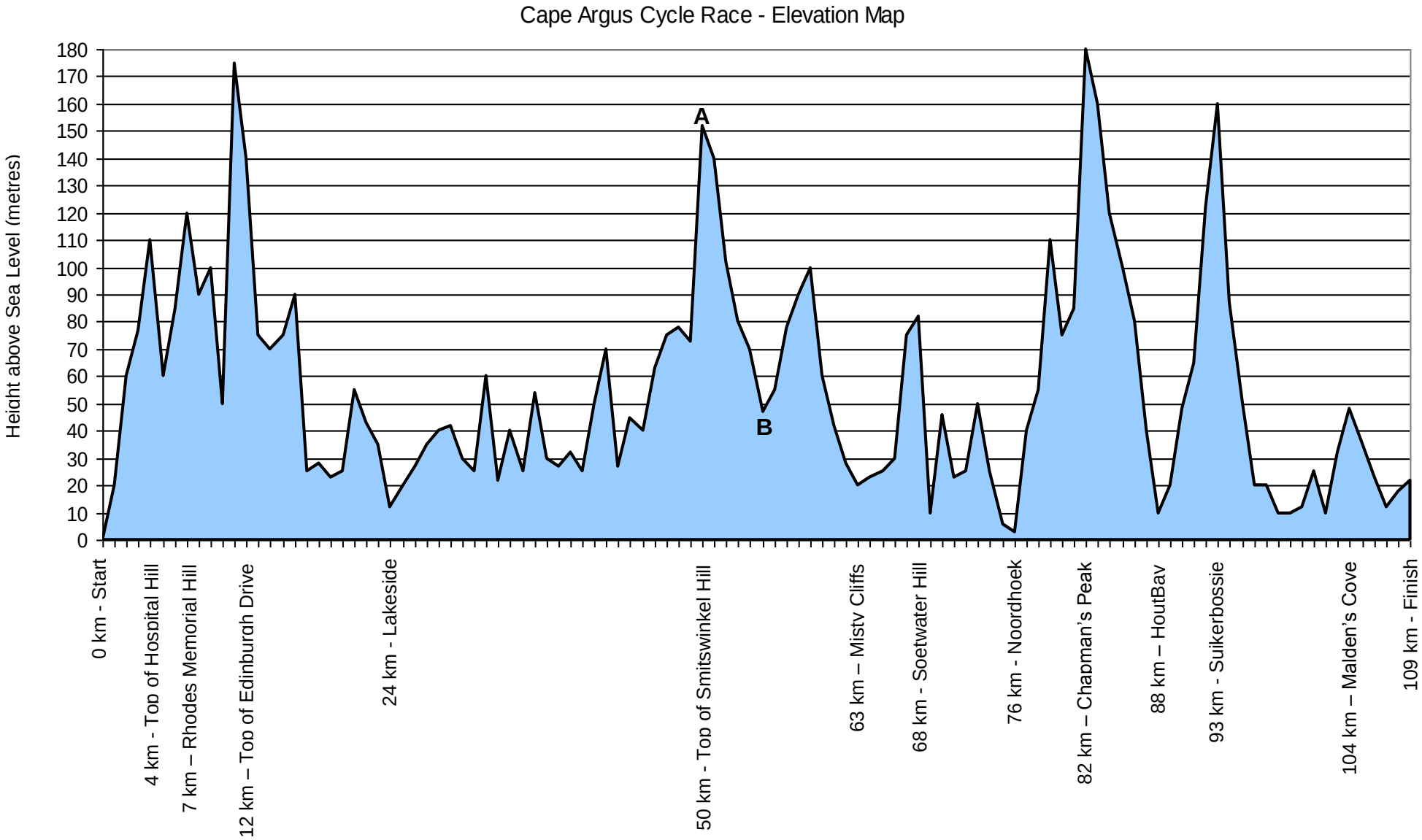
3. The table on the next page shows some statistics relating to the Cape Argus Cycle Race.

| | 2005 | 2006 | 2007 |
|---|---|---|---|
| Entries | 39 699 | 40 064 | 41 279 |
| Finishers | 27 948 | 27 996 | 30 095 |
| | | | |
| **Finishers by time:** | | | |
| Under 3 h: | 317 | 860 | 1 370 |
| Under 3 h 30 min | 4 187 | 5 142 | 6 239 |
| Under 4 h | 9 858 | 11 094 | 12 847 |
| Under 4 h 30 min | 15 408 | 16 970 | 18 203 |
| Under 5 h | 19 936 | 21 270 | 22 497 |
| | | | |
| **Provincial Breakdown:** | | | |
| Western Cape | 15554 | 15868 | 18 213 |
| Eastern Cape | 1833 | 1775 | 1 814 |
| Free State | 1821 | 1629 | 1 519 |
| Gauteng | 13413 | 13833 | 12 920 |
| Kwazulu-Natal | 2321 | 2455 | 2 279 |
| Limpopo | 447 | 374 | 417 |
| Mpumalanga | 906 | 585 | 819 |
| North West | 983 | 695 | 791 |
| Northern Cape | 932 | 814 | 829 |

3.1 How many cyclists who finished the Cape Argus Cycle Race in 2007 finished with a finishing time of between 4 hours and 4½ hours?

3.2 How many cyclists who finished the Cape Argus Cycle Race in 2007 finished with a finishing time of more than 5 hours?

3.3 What percentage of the people who entered the 2007 Cape Argus Cycle Race *did not* finish the race? If necessary, round off your answer to one decimal place.


Cape Argus Cycle Race - Elevation Map
Height above Sea Level (metres)
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
A
B
0 km - Start
4 km - Top of Hospital Hill
7 km – Rhodes Memorial Hill
12 km – Top of Edinburgh Drive
24 km - Lakeside
50 km - Top of Smitswinkel Hill
63 km – Misty Cliffs
68 km - Soetwater Hill
76 km - Noordhoek
82 km – Chapman's Peak
88 km – HoutBay
93 km - Suikerbossie
104 km – Malden's Cove
109 km - Finish

## Answers

1. 1.1 Noordhoek

   1.2 Top of Smitswinkel ≈ 150 m Bottom of Smitswinkel ≈ 50 m

   ⇒ Decrease in elevation = 100 m

   1.3 Top of Smitswinkel = 50 kmBottom of Smitswinkel ≈ 55 km

   ⇒ Distance from top to bottom = 5 km

   1.4 The race appears to be a very hard race as there are numerous uphills, several of which are long and steep.

2. Distance = 109 km

   Time = 2 h 27 min 30 sec = 2 h 27,5 min

   = 2,458 h (rounded off to three decimal places)

   2,458 h = 109 km ⇒ 1 h = 44,345 km

   So, his average speed was 44,3 km/h

3. 3.1 Finishers under 4 hours = 12 847 Finishers under 4½ hours = 18 203

   ⇒ Finishers between 4 and 4½ hours = 18 203 – 12 847= 5 356

   3.2 Total finishers = 30 095 Finished under 5 h = 22 497

   Finishers over 5 h = 30 095 – 22 497 = 7 598

   3.3 No. entered = 41 279 No. finished = 30 095

   ⇒ No. not finished = 11 184

   % Not finished = $\frac{11184}{41279} \times 100 = 27{,}1\%$

# Measurement (Calculating Area and Volume)

**(LB pages 170-183)**

## Overview

The content of this chapter, as part of the *Measurement* Application Topic, is drawn from pages 68-69 in the CAPS document.

As stipulated in the CAPS document, Grade 11 learners need specifically to be able to:

- calculate surface areas and volumes of 3-dimensional objects.
- use surface area and volume calculations to complete tasks (e.g. to determine costs in a building process).

## Contexts and integrated content

The contexts in this section are limited to larger projects situated in familiar contexts (e.g. school or classroom).

Chapter 5 also dealt with area and volume, but with a specific focus on measuring areas and volumes using appropriate measuring instruments. This chapter shifts focus to the calculation of area and volume.

Furthermore, primary focus in Grade 11 is on the calculation of area and volume for 3-dimensional objects (as opposed to the 2-dimensional object dealt with in Grade 10). As such, area calculations involve primarily considerations of surface area.

This chapter is divided into two sections:

- Section 1 deals with calculating the surface area of 3-dimensional objects
- Section 2 deals with calculating the volumes of 3-dimensional objects

The following table shows a summary of the key concepts covered in each of these sections:

| Section 1 | Section 2 |
|---|---|
| **Surface area** | **Volume** |
| **Refers to:**<br>• the total area of all of the surfaces of an object.<br>Note that while you can calculate the area of a 2-dimensional object, you cannot calculate the area of a 3-dimensional object. You can, however, determine the area of all of the surfaces (i.e. surface area) of a 3-dimensional object. | **Refers to:**<br>• the amount of space inside a hollow 3-dimensional object (or the amount that can fit inside a 3-dimensional hollow object);<br>• the amount of space that a solid 3-dimensional object takes up. |
| **Relevant formula:**<br>Surface area of rectangular box<br>= sum of the areas of each side<br><br>Surface area of cylinder (with lid and base)<br>= 2 x π × (radius of lid)² + (2 × π × radius of lid × height of cylindero<br>OR:<br>SA = 2 x (π × r²) + (2 × π × r × h) | **Relevant formula:**<br>General formula for volume of rectangular based container<br>= area of base × height<br><br>Volume of rectangular box<br>= length × width × height<br><br>Volume of cylindrical container<br>= π × (radius of lid)² × height |
| **Appropriate units:**<br>Surface area is always expressed in square units ⇝ i.e. mm², cm² or m² | **Appropriate units:**<br>Volume is always expressed in cubic units ⇝ i.e. mm³, cm³ or m³ |

Importantly, often when performing surface area and volume calculations, the values used in the calculations have been measured in cm, mm or m. As such, surface area values often end up being expressed in square units such as $mm^2$, $cm^2$ or $m^2$. However, when needing to paint a wall, paint is sold in litres and not in square units. As such, there must be a way to convert from square units to litres.

Similarly, volume values are most commonly calculated in cubic units such as $mm^3$, $cm^3$ or $m^3$, but volume values are more commonly measured in liquid measures of millilitres or litres. As such, a method for converting from cubic units to liquid measures is also required for volume.

The table below shows some common conversion ratios for surface area and volume:

| Surface area | Volume |
|---|---|
| Example of a paint conversion ratio:<br><br>Spread rate of a particular type of paint is 10 m² per litre.<br>This spread rate specifies that 1 litre of paint will cover approximately 10 m² of wall space or wall surface area.<br><br>Note: There is no single conversion rate for converting from square units to a liquid quantity for surface area. This is because the conversion depends entirely on the consistency and thickness of the liquid being applied to the surface area space. | • 1 $m^3$ can hold 1 000 ℓ<br>(i.e. a square hole with dimensions 1 m × 1 m × 1 m will hold 1 000 ℓ of water.)<br><br>• 1 $cm^3$ = 1 mℓ<br>(i.e. a square hole with dimensions 1 cm × 1 cm × 1 cm will hold 1 mℓ of water.) |

As a final comment with respect to the units of area and volume values in square and cubic units, even though 1 m = 100 cm, this does not mean that 1 $m^2$ = 100 $cm^2$ or that 1 $m^3$ = 100 $cm^3$ (or that 1 $cm^2$ = 10 $mm^2$, and so on).

To understand why, consider the following:

1 $m^3$ means 1 m × 1 m × 1 m = 100 cm × 100 cm × 100 cm

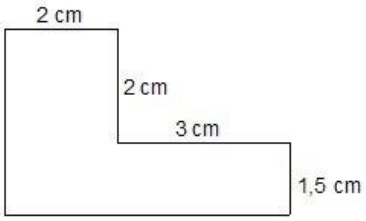
= 1 000 000 $cm^3$

Similarly, 1 $cm^2$ means 1 cm × 1 cm = 10 mm × 10 mm = 100 $mm^2$

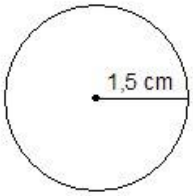
## Additional Questions

1. Determine the perimeter of the shapes given below. The pictures have not been drawn to scale.

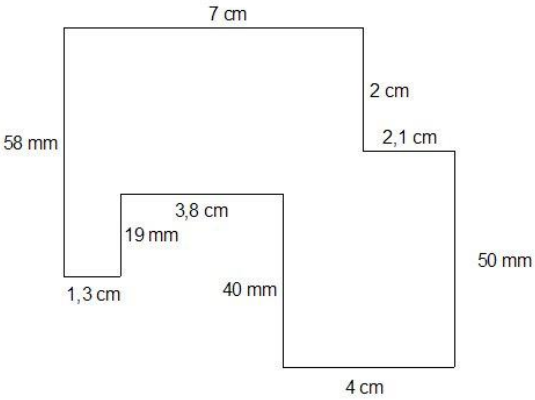
1.1



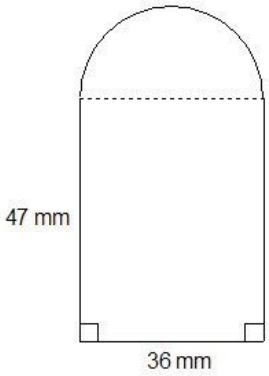

1.2




1.3

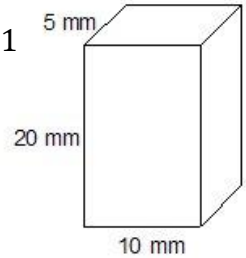



1.4

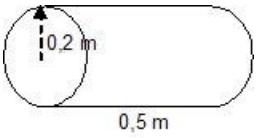



2 2.1 Calculate the surface area of the following containers (not drawn to scale):

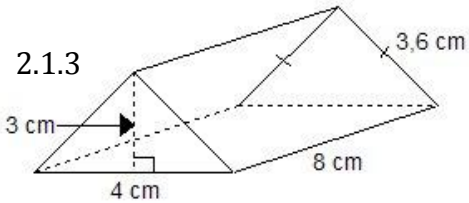
2.1.1




2.1.2



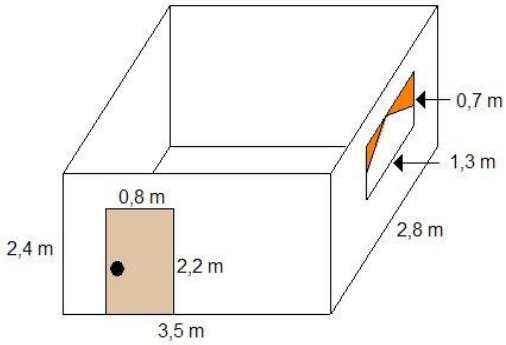

2.1.3



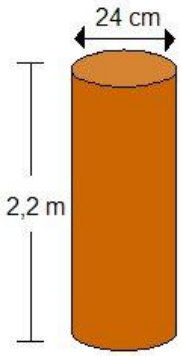

2.2 The 3-D picture alongside shows the dimensions of a bedroom in a house.

The owners of the house want to paint the room, but are not sure how many m² of wall they will need to cover.

Calculate the total surface area of wall space that will be painted.



2.3 Sinilizwe is waterproofing the wooden poles that hold up his carport with creosote.

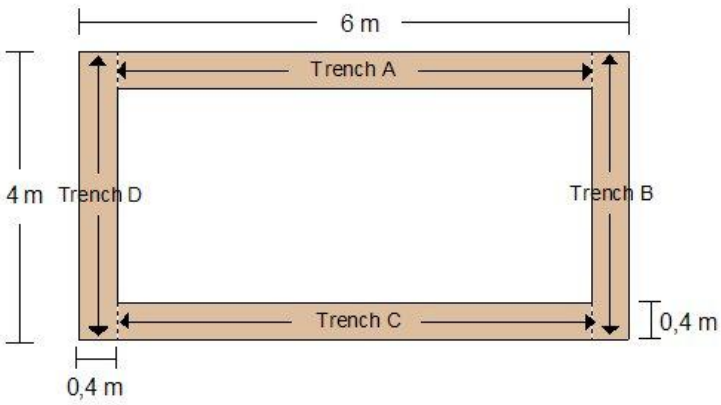



2.3.1 If we want to determine the total m² of wood that Sinilizwe will need to creosote, will we need to include the bottom of the poles in our calculations? Explain.

2.3.2 Calculate the surface area of the pole in the picture to two decimal places.

2.3.3 If there are 4 poles that need to be waterproofed, what is the total m² of wood that Sinilizwe will need to creosote?

3. 3.1 The picture below, not drawn to scale, shows a top view of the foundation trenches for a house.




3.1.1 What is the length of trench A and trench C? Show how you arrived at your answer.

3.1.2 Calculate the volume of concrete needed to fill trenches A and C to two decimal places.

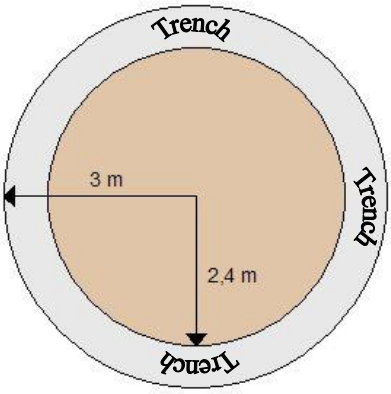
3.1.3 Calculate the volume of concrete needed to fill trenches B and D to two decimal places.

3.1.4 Now calculate the total volume of concrete needed for the foundations of Songi's House to two decimal places.

3.1.5 If the builder decides he needs 10% more concrete to allow for wastage, how much concrete will he need to mix? (Round off your answer to one decimal place).

3.2 The drawing on the next page, not drawn to scale, shows a 2-D top view of the foundations of a rondavel that Sibusiso is building.

- The distance from the middle of the rondavel to the outside of the foundation trench is 3 m.
- The distance from the middle of the rondavel to the inside of the foundation trench is 2,4 m.
- The foundation trench is 0,5 m deep.




To calculate the volume of concrete needed for the foundations of this house, you need to subtract the volume of the small cylinder (i.e. with radius 2,4 m) from the volume of the large cylinder (i.e. with radius 3 m). This will give the volume of the trench.

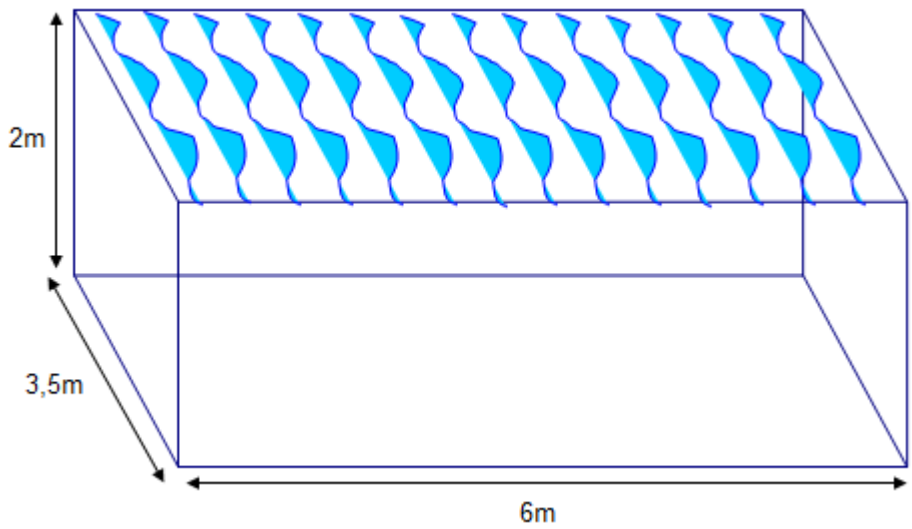
3.2.1 Calculate the volume of the large cylinder with radius 3 m and depth 0,5 m to three decimal places.

3.2.2 Calculate the volume of the small cylinder with radius 2,4 m and depth 0,5 m to three decimal places.

3.2.3 Now calculate the volume of concrete needed for the foundation trench of this rondavel to two decimal places.

3.2.4 If the builder decides to mix 10% more concrete than the required amount, how much concrete must he mix? (Round off your answer to one decimal place).

4. 4.1 The drawing on the next page shows the dimensions of a rectangular swimming pool.



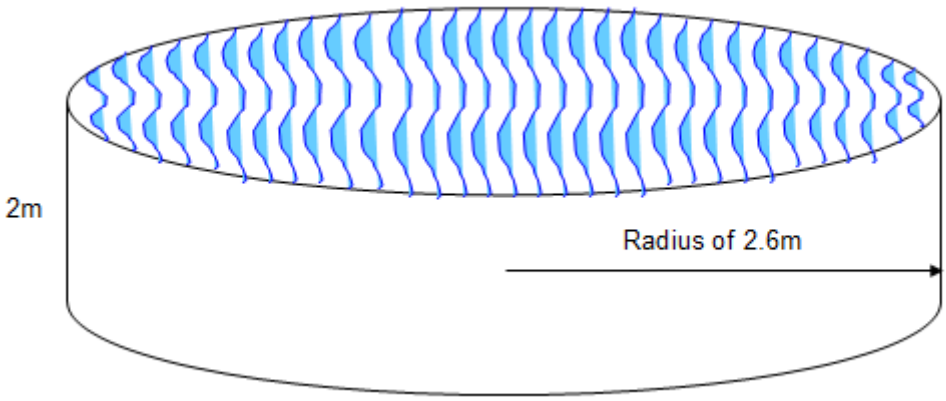

4.1.1 Determine how much space (area) the pool will take up in Tim and Mary's garden.

4.1.2 Determine the volume of the pool (in metres).

4.1.3 How many *litres* of water will it take to fill up the pool?

4.1.4 Can you think of any problems / impracticalities of this particular pool?

4.2 The picture below shows the dimensions of a cylindrical shaped pool.




4.2.1 How much space (area) will the circular pool take up in Tim and Mary's garden?

4.2.2 Write down the formula for determining the volume of a cylinder.

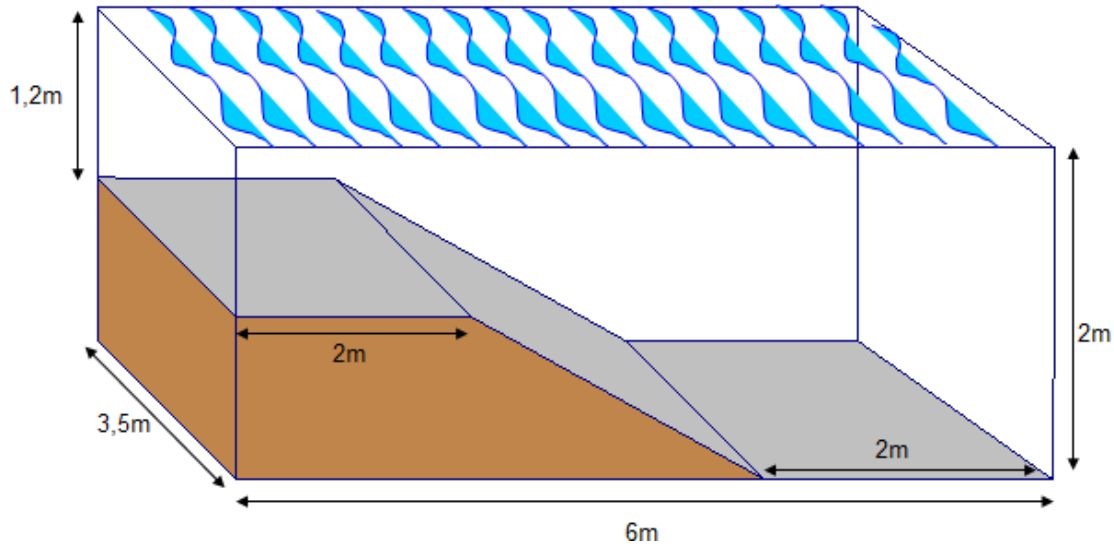
4.2.3 Now use this formula to determine the volume of the circular pool (in cubic metres).

4.2.4 How many *litres* of water will it take to fill up the circular pool?

(use the fact that 1 $m^3$ = 1 000 ℓ).

4.2.5 Can you think of any problems / impracticalities of this particular pool?

4.3 The drawing below is a plan of a pool that has a sloping floor from a shallow end to a deep end. Study the plan carefully and then answer the questions that follow.

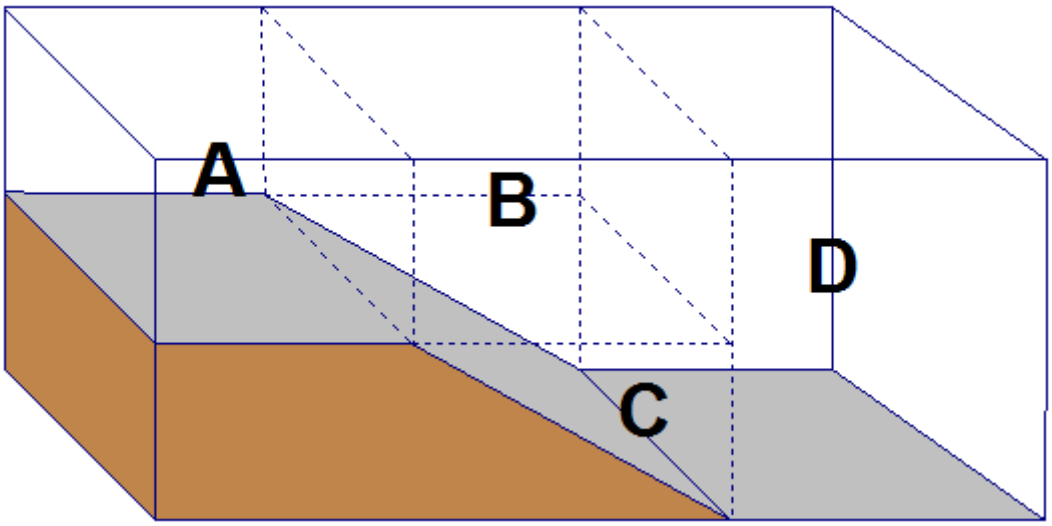



4.3.1 Does the fact that the floor of the pool slopes, affect how much space (area) the pool is going to cover in Tim and Mary's garden? Explain.

4.3.2 Calculate the area of the pool.

4.4 Calculating the volume of this sloping pool is slightly more complicated than the rectangular or circular pools shown previously because of the fact that the depth of this pool varies. To calculate the volume of this sloping pool we are going to divide the pool up into different segments and calculate the volume of each of these segments separately. We will add all of these individual volumes together to determine the total volume of water in the pool.

On the next page you will find a revised plan of the sloping pool where the pool has been divided up into segments. Take careful notee of how the pool has been divided up into *rectangles* and a *triangle*.

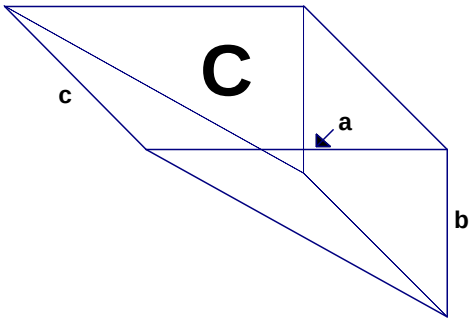



4.4.1 Draw separate 3D pictures of segments A, B and D, filling in all necessary measurements /dimensions.

4.4.2 Determine the volume of segments A, B and D (in cubic metres).

4.4.3 The picture below is a 3D representation of segment C.

Study the picture carefully and then answer the questions that follow:




a.

b. Write down the formula for calculating the volume of *any* rectangular prism.

c. In the triangle that makes up the front face of segment C, write down which side of the triangle is a *height* and which side is a *base*.

d. Use this *height* and *base* to calculate the area of the triangle.

e. Now use the volume formula for a triangular prism to calculate

th

4.5 Calculate the *total volume* of the sloping pool (in cubic metres).

4.6 How many *litres* of water will it take to fill this pool?

4.7 Complete the table below:

| AREA OF POOLS | | | VOLUME OF POOLS | | |
|---|---|---|---|---|---|
| Rectangular | Circular | Sloping | Rectangular | Circular | Sloping |
| | | | | | |

4.8 What do you notice about the areas of the 3 different pools? What does this tell you about the amount of space that the various pools will take up in Tim and Mary's garc

4.9 What do you notice about the amount of water that it takes to fill the rectangular pool and the circular pool?

4.10 How does the volume of water in this sloping pool compare to the volumes of water in the rectangular and circular pools? Why do you think this is the case?

## Answers

1. 1.1 Perimeter = 2 cm + 2 cm + 3 cm + 1,5 cm + 5 cm + 3,5 cm = 17 cm

1.2 Circumference = $\pi \times$ diameter = $\pi \times 3$ cm $\approx$ 9,43 cm (to two decimal places)

1.3 Perimeter = 7 cm + 2 cm + 2,1 cm + 5 cm + 4 cm + 4 cm + 3,8 cm + 1,9 cm + 1,3 cm + 5,8 cm = 36,9 cm

1.4 Perimeter of rectangle = (2 × 47 mm) + 36 mm = 94 mm + 36 mm = 130 mm

Perimeter of semi-circle = $\frac{\pi \times diameter}{2} = \frac{\pi \times 36}{2}$ = 56,57 mm

(rounded off to two decimal places)

⇒ Total perimeter = 130 mm + 56,57 mm = 186,57 mm

2.1 2.1.1 Surface area = (2 × 10 mm × 20 mm) + (2 × 5 mm × 20 mm) + (2 × 5 mm × 10 mm)

= 400 $mm^2$ + 200 $mm^2$ + 100 $mm^2$ = 700 $mm^2$

2.1.2 Surface area of cylinder = [2 ×π× (radius)²] + [π× diameter × height]

= (2 × π × (0,2 m)²) + (π × 0,4 m × 0,5 m)

= 0,251 $m^2$ + 0,628 $m^2$ (rounded off to three decimal places)

= 0,879 $m^2$

2.1.3 Area of triangle = $\frac{1}{2}$ × base × height = $\frac{1}{2}$ × 4 cm × 3 cm = 6 $cm^2$

Area of side = 8 cm × 3,6 cm = 28,8 $cm^2$

Area of base = 4 cm × 8 cm = 32 $cm^2$

⇒ Total surface area = (2 × triangles) + (2 × sides) + base

= (2 × 6 $cm^2$) + (2 × 28,8 $cm^2$) + 32 $cm^2$

= 12 $cm^2$ + 57,6 $cm^2$ + 32 $cm^2$ = 101,6 $cm^2$

2.2 Area of back wall = 3,5 m × 2,4 m = 8,4 $m^2$

Area of side wall without a window = 2,4 m × 2,8 m = 6,72 $m^2$

Area of side wall with window = total area of the wall – area of the window
= (2,8 m × 2,4 m) – (0,7 m – 1,3 m)
= 6,72 $m^2$– 0,91 $m^2$ = 5,81 $m^2$

Area of front wall with door = total area of the wall – area of the door
= (3,5 m × 2,4 m) – (2,2 m × 0,8 m)
= 8,4 $m^2$– 1,76 $m^2$ = 6,64 $m^2$

Total surface of wall space to be painted = 8,4 $m^2$ + 6,72 $m^2$ + 5,81 $m^2$ + 6,64 $m^2$
= 27,57 $m^2$

2.3 2.3.1 No, because the bottom of the poles will be on or in the ground.

2.3.2 Surface area of a cylinder = (2 ×π× (radius)$^2$) + (π× diameter × height)
Diameter of pole = 24 cm = 0,24 m
Radius of pole = 12 cm = 0,12 m

⇒ Surface area of the pole = (2 × π × (0,12 m)$^2$) + (π × 0,24 m × 2,2 m)
= 0,091 $m^2$ + 1,659 $m^2$ (rounded off to three decimal places)
= 1,75 $m^2$ (rounded off to two decimal places)

2.3.3 Total $m^2$ of wood to be creosoted = 4 × 1,75 $m^2$ = 7 $m^2$

3.1 3.1.1 Trench A and C: length = 6 m – 0,4 m – 0,4 m = 6 m – 0,8 m = 5,2 m

3.1.2 Volume of rectangular prism = length × breadth × height
Length of trench A = 5,2 m Width/breadth of trench A = 0,4 m
Height of trench A = 0,6 m

⇒ Volume of trench A = 5,2 m × 0,4 m × 0,6 m = 1,25 $m^3$(to two decimal places)

⇒ Volume of trench C = 1,25 $m^3$

3.1.3 Volume of rectangular prism = length × breadth × height

Length of trench B = 4 m

Width/breadth of trench B = 0,4 m

Height of trench B = 0,6 m

⇒ Volume of trench B = 4 m × 0,4 m × 0,6 m = 0,96 $m^3$

⇒ Volume of trench D = 0,96 $m^3$

3.1.4 Total volume of concrete needed = (2 × 1,25 $m^3$) + (2 × 0,96 $m^3$) = 2,5 $m^3$ + 1,92 $m^3$= 4,42 $m^3$

3.1.5 10% more concrete = 10% of 4,42 $m^3$= $\frac{10}{100}$ × 4,42 $m^3$= 0,442 $m^3$

⇒ Songi will need to mix 4,42 $m^3$ + 0,442 $m^3$ = 4,9 $m^3$ of concrete (rounded off to one decimal place) for the foundations of his house.

3.2 3.2.1 Volume of large cylinder = π × (radius)² × height

= π × (3 m)² × 0,5 m = π × 9 $m^2$× 0,5 m

= 14,137 $m^3$ (rounded off to three decimal places)

3.2.2 Volume of small cylinder = π × (radius)² × height

= π × (2,4 m)² × 0,5 m= π × 5,76 $m^2$× 0,5 m

= 9,048 $m^3$ (rounded off to 3 decimal places)

3.2.3 Volume of foundation trench = volume of large cylinder – volume of small cylinder = 14,137 $m^3$ – 9,048 $m^3$

= 5,09 $m^3$ (rounded off to two decimal places)

3.2.4 10% more concrete = 10% of 5,09 $m^3$

= $\frac{10}{100}$ × 5,09 $m^3$= 0,509 $m^3$

⇒ Total volume of concrete needed

= 5,09 $m^3$ + 0,509 $m^3$= 5,6 $m^3$ (rounded off to one decimal place).

4.1 4.1.1 Area of pool = length × breadth = 6 m × 3,5 m = 21 $m^2$

4.1.2 Volume of pool = length × breadth × height= 6 m × 3,5 m × 2 m= 42 $m^3$

4.1.3 To convert from $m^3$ to litres, multiply by ≈ 1 000

⇒ $42\ m^3 \times 1\ 000 = 42\ 000\ \ell$

4.1.4 The pool is one depth throughout. This means that it will probably be quite difficult for small children to swim in the pool, unless the pool is very shallow. If it is very shallow, it will be quite awkward for adults to use the pool.

4.2 4.2.1 Area of pool = $\pi \times \text{radius}^2 = \pi \times (2{,}6\ m)^2 = \pi \times 6{,}76\ m^2$

$= 21{,}24\ m^2$ (rounded off to two decimal places.)

4.2.2 Volume of cylinder = $\pi \times \text{radius}^2 \times \text{height}$

4.2.3 Volume of pool = $\pi \times (2{,}6\ m)^2 \times 2 = \pi \times 6{,}76\ m^2 \times 2 = 42{,}47\ m^3$

4.2.4 To convert from $m^3$ to litres, multiply by 1 000

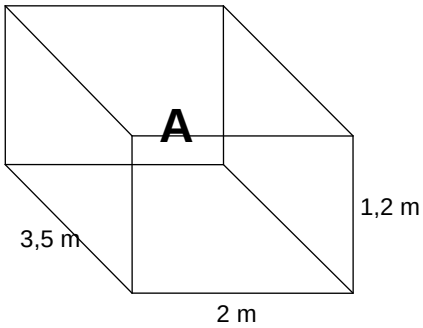
$= 42{,}47\ m^3 \times 1\ 000 = 42\ 470\ \ell$

4.2.5 As with the rectangular pool, this pool has one depth only. This means that it will probably be quite difficult for small children to swim in the pool, unless the pool is very shallow. And if it is very shallow it will also be quite awkward for adults to use the pool.

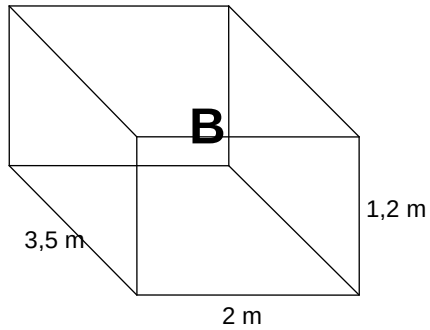
4.3 4.3.1 No – the fact that the floor of the pool slopes will affect the volume of the pool, but it will not affect the area of the pool.

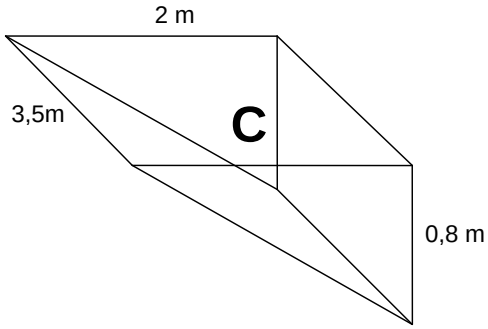
4.3.2 Area of pool = length × breadth = $6\ m \times 3{,}5\ m = 21\ m^2$

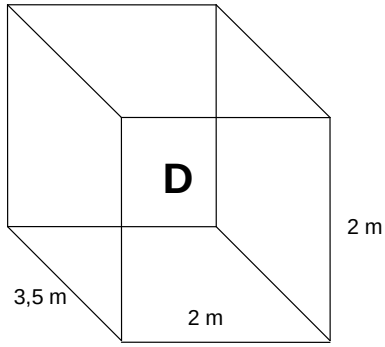
4.4




4.4.1




4.4.2 *Volume of A* = length × breadth × height = 2 m × 3,5 m × 1,2 m = 8,4 $m^3$

*Volume of B* = length × breadth × height = 2 m × 3,5 m × 1,2 m = 8,4 $m^3$ *Volume of D* = length × breadth × height = 2 m × 3,5 m × 2 m = 14 $m^3$

4.4.3 a. a = 2 m b = 0,8 m c = 3,5 m

b. Volume of rectangular prism = area of base × height

c .Since the triangle is right angled, either *a* or *b* could be considered to be the h

d. Area of triangle = $\frac{1}{2}$ × base × height = $\frac{1}{2} \times a \times b$

= $\frac{1}{2}$ × 2 m × 0,8 m = 0,8 $m^2$

e. Volume of segment C = area of base × height = 0,8 $m^2$× 3,5 m

= 2,8 $m^3$

4.5 Total volume = volume of segments A + B + C + D

= 8,4 $m^3$ + 8,4 $m^3$ + 14 $m^3$ + 2,8 $m^3$= 33,6 $m^3$

4.6 To convert from $m^3$ to litres, multiply by ≈ 1 000 (accurate value is 999,984)
⇒ 33,6 $m^3$ × 1 000 = 33 600 ℓ

4.7

| Area of pools | | | Volume of pools | | |
|---|---|---|---|---|---|
| Rectangular | Circular | Sloping | Rectangular | Circular | Sloping |
| 21 $m^2$ | 21,24 $m^2$ | 21 $m^2$ | 42 000 ℓ | 42 470 ℓ | 33 600 ℓ |

4.8 The areas of all three of the pools are almost the exactly the same. The circular pool is slightly bigger than the others, but only by 0,24 $m^2$ or ≈ $\frac{1}{4}$ of a metre$^2$.

This means that each pool will take up almost the same amount of surface space in Tim and Mary's garden.

4.9 The volumes of the rectangular pool and circular pool are also almost the same. The circular pool does hold slightly more water – 470 ℓ more in fact.

4.10 Despite the fact that the sloping pool has the same area as the other two pools, it holds significantly less water than the other two – approximately 8 400 ℓ less.

This has to do with the fact that the floor of the sloping pool slopes and, therefore, rather than there being only one depth in the pool the depth of the pool varies. In some places it is very shallow while in other places it is very deep. This varying depth is the reason for the fact that the volume of the sloping pool is less than the other two pools, where the depth does not vary.

# Maps, plans and other representations of the physical world (Plans and Models)

**(LB pages 184-211)**

This chapter in the Learner's Book is divided into four sections:

- Section 1 deals with floor and elevation plans.
- Section 2 deals with design drawings.
- Section 3 deals with drawing scaled plans.
- Section 4 deals with constructing models.

It is important to understand that although Sections 1 and 2 deal with different types of plans, the common skill underpinning engagement with each type of plan involves making sense of 2-dimensional pictures drawn of 3-dimensional objects. In other words, in each of these sections there is the expectation that you will be able to interpret and analyse 2-dimensional pictures/plans and use these plans to describe, understand and make sense of 3-dimensional structures. For this reason, Sections 1 and 2 will be dealt with together in the discussion below.

Section 3, by comparison, explores the process of drawing scaled plans and Section 4 deals with the construction of 3-dimensional models from 2-dimensional nets or plans of those models.

## Section 1: Floor and elevation plans

**(LB pages 186-195)**

## &Section 2: Design drawings

**(LB pages 196-199)**

### Overview

The content of these sections on floor, elevation and design plans, as part of the *Maps, plans and other representations of the physical world* Application Topic, are drawn from pages 77-78 in the CAPS document.

As stipulated in the CAPS document, Grade 11 learners need specifically to be able to:

- work with elevation, floor and design plans.
- make sense of the information shown on the plans.
- make connections between different plan views of an object.
- use given scale to determine dimensions and lengths on the plan.

### Contexts and integrated content

- The plans in these sections are limited to:
  - Floor and elevation plans of small structures such as classroom, office space, tool shed.
  - Design drawings of furniture, clothing, etc.
- There is integration of content from the section on Scale in the topic *Maps, plans and other representations of the physical world* and Measuring lengths and distances in the topic *Measurement*.

The table below shows a comparison of the different types of plans dealt with in Sections 1 and 2 in the Learner's Book:

| Floor plan | Elevation plan | Design drawing |
|---|---|---|
| **Function:**<br>Shows a 2-dimensional perspective of a building or structure *as seen from above* (and without the roof). | **Function:**<br>Shows a 2-dimensional perspective of a building or structure *as seen from the side*. | **Function:**<br>Shows the design/layout/components of an item to be constructed or manufactured. |
| **Purpose:**<br>To see what the design and/or dimensions of the inside of a building or structure looks like. | **Purpose:**<br>To see what the design and/or dimensions of the outside of a building or structure looks like. | **Purpose:**<br>To see what a completed manufactured/constructed item will look like and the dimensions of the parts of the item. |
| **Visible features:**<br>The floor plan shows the dimensions and layout of the inside of the building.<br>Dimensions such as lengths and widths of the building, lengths of windows and doors are also visible. | **Visible features:**<br>An elevation plan shows the dimensions and layout of the outside of the building, including the design of the roof and the design of walls, windows and doors in the walls.<br>Dimensions such as heights of walls, doors, windows, roof and other external features are visible. | **Visible features:**<br>A design plan commonly shows what an item will look like once it has been manufactured or assembled as well as the different component parts that make up the item.<br>Dimensions of the different parts as well as specific instructions on how the parts must look can also be included. |

When dealing with **floor and elevation plans** the following key concepts are essential:

1. *Describe features of a building / structure shown on the plan.*

   *Question example:*

   Identify how many rooms, windows and doors there are in the house.

2. *Match features shown on a floor plan with those shown on elevation plans of the same building / structure.*

   Question example:

   Which room will you be looking into (as shown on the floor plan) when you are

looking at the North Elevation plan?

3. *Understand the terms North, South, East and West Elevation and the position of* the sides of the house shown on these different elevations.

   Question example:

   The distinction between different types of elevation plans in terms of the position of the side of the building shown on each plan in relation to the sun (or to various compass directions) often causes confusion.

The following basic principles apply to different types of elevation plans.

- The side of a building shown on a North-Elevation plan is the side of the building that is facing North.
- In other words, if you are standing outside the house and looking at the side that is labelled North-Elevation on the plan then you are actually facing South; or if you are standing inside the house and looking outside through a window on the side of the house shown on the North-Elevation plan then you will be looking North. The same principle applies to all other sides of the house shown on the other elevation plans.
- Many houses are built facing North in order to maximise the amount of sun that the house receives in winter.

Question example:

If you are standing outside the building and facing the side of the house that is shown as the North-Elevation on the plan, in which compass direction will you be facing and in which compass direction will this side of the house be facing?

4. *Use a given scale and accurate measurement to determine actual dimensions of features shown on the plan.*

   Question example:

   The plan is drawn on the scale of 1 : 100. Use this scale to determine the dimensions of Room 1 shown on the floor plan.

When dealing with **design drawings/plans** the following key concepts are essential:

1. *Describe the item/object shown on the design plan.*

   Question example:

Describe the item that is represented in the design plan.

2. *Identify the dimensions of the item/object shown on the design plan.*

   Question example:

   Use the design plan to construct a table showing the dimensions of the different components of the item/object shown on the plan.

3. *Describe the different component parts that are required to make the item/object shown on the design plan.*

   Question example:

   Write a description of the different parts that will need to be assembled in order to construct the item/object.

4. *If necessary, identify a cutting list of the parts needed to make the item/object.*

   Question example:

   Draw rough pictures showing the different parts that will be needed to make up the whole object and demonstrate a possible way in which these parts can be cut from a larger piece of board.

# Section 3: Drawing scaled plans

**(LB pages 200 – 205)**

## Overview

The content of this section on drawing plans is drawn from page 78 in the CAPS document.

As stipulated in the CAPS document, Grade 11 learners need specifically to be able to:

- use a given scale to determine lengths in which a plan must be drawn and then
- to draw an accurate scaled plan using these lengths.

## Contexts and integrated content

- The plans in these sections are limited to:
  - Floor and elevation plans of small structures such as classroom, office space, tool shed.
  - Design drawings of furniture, clothing, etc.
- There is integration of content from the section on Scale in the topic *Maps, plans and other representations of the physical world* and Measuring lengths and distances in the topic *Measurement*.

In the previous sections, when working with scale, the primary focus was on using a given scale and measurement on the plan to determine actual dimensions of objects shown on the plan. For example: *measure the length of the window on the plan and use the given scale to determine the actual dimension of the window.* In other words, in this type of calculation the movement is from plan measure to actual dimension. This is the type of calculation that a homeowner or builder using a plan would do to make sense of features of the building shown on the plan.

In this section, focus shifts to a second type of calculation involving scale, namely: using a given scale and a known actual dimension to determine the length on which to draw an object on a plan. In other words, in this type of calculation the movement is from actual dimension to plan measure.

This is the type of calculation that an architect or draftsman would do when designing a house/object and/or drawing the plans for the house/object.

**Actual dimension** → **Scale** = **Plan measurement**

## Example

The height of a door is 2,1 m. To represent the height of this door on a plan that is to be drawn on the scale 1 : 75 the following calculation can be performed:

Actual door height = 2,1 m

Scale: 1 : 75 → this means that the actual door height is 75 times larger than the length that the door must be drawn on the plan; or that the plan measure must be 75 times smaller than this actual height.

i.e. Plan measure = 2,1 m ÷ 75 = 0,028 m

= 2,8 cm or 28 mm

## Section 4:Working with 'Models'

**(LB pages 206 – 209)**

### Overview

The content of this section on models, as part of the *Maps, plans and other representations of the physical world* Application Topic, is drawn from pages79-80 in the CAPS document.

As stipulated in the CAPS document, Grade 11 learners need specifically to be able to:

- build 3-dimensional models from 2-dimensional plans/nets.
- draw 2-dimensional plans/nets of 3-dimensional models.
- use models to investigate various problems involving packaging, perimeter, area and volume.

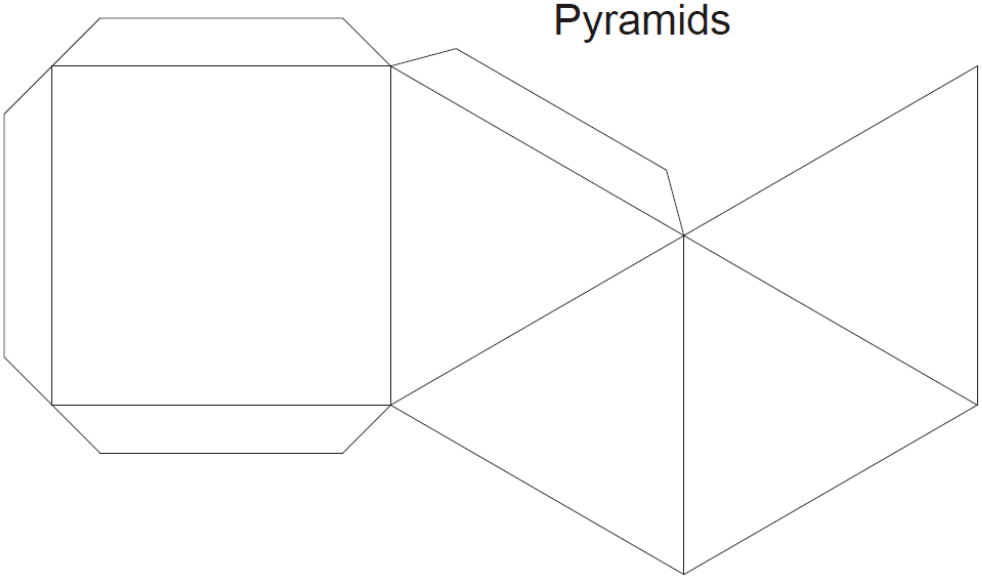
### Contexts and integrated content

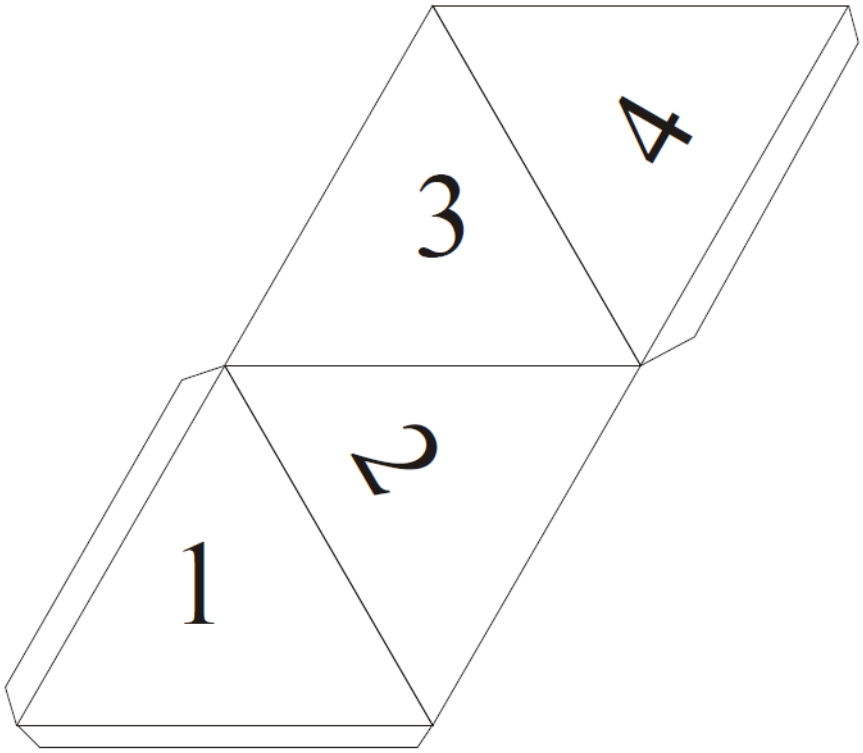
- There is integration of content from the section on Calculating perimeter, area and volume in the topic *Measurement*.

The primary purpose of this section is to provide an opportunity to move between 2- and 3-dimensional representations of objects. i.e. to move from a 2-dimensional drawing to a 3-dimensional construction of the object; and to move from a 3-dimensional model to a 2-dimensional drawings/nets/plans of the model.

The drawings on the next page show a variety of different 'nets' from those provided in the Learner's Book which can be used to explore this movement from 2-dimensional plans/nets to 3-dimensional models. Cut out the shapes and then figure out how to fold them to make the 3-dimensional shapes.

Pyramids

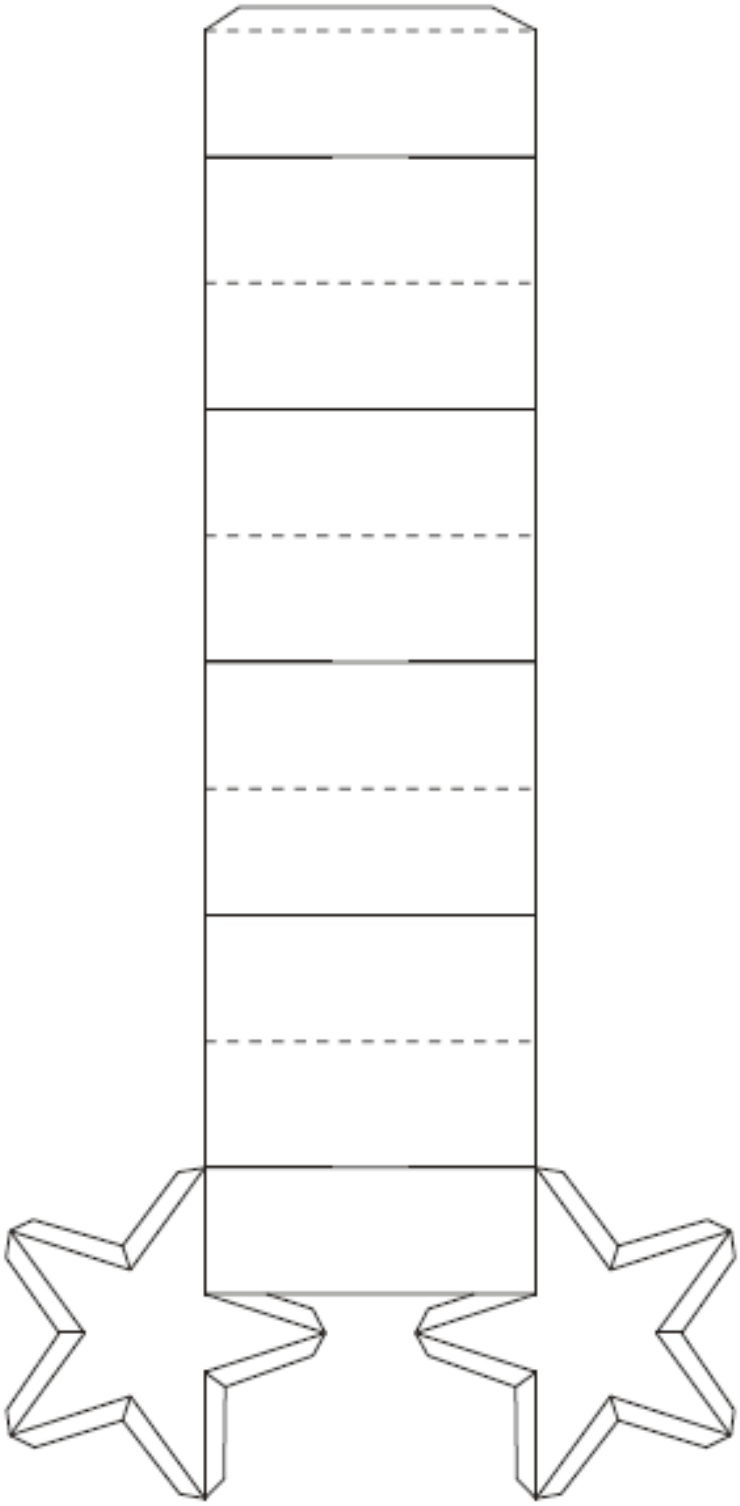





Tetrahedron

# Pentagrammic Prism

Fold the dotted lines forwards
Fold the other lines backwards



**(LB pages 212-219)**

## Overview

The content of this section on Taxation, as part of the Finance Application Topic, is drawn from page 58 in the CAPS document.

As stipulated in the CAPS document, Grade 11 learners need to be able to do the following with respect specifically to the Unemployment Insurance Fund (UIF):

- understand what UIF is and why it is important.
- understand how UIF is calculated.

## Contexts and integrated content

- Learners need to be able to work in the contexts of *payslips*. This requires revision or integration with the contents of Section 1: Financial Documents in Chapter 3 in the Learners' Book(see page 54 in the LB).

- The ability to perform calculations involving percentages and to interpret graphs from the Basic Skills Topics of Numbers and Patterns will also be utilised.

## Section 1: Understanding UIF

**(LB pages 214-215)**

- UIF stands for Unemployment Insurance Fund
- UIF is an insurance that is deducted from an employee's salary or wages in case the employee loses his/her job. If this happens, then the employee can claim an allowance from the Unemployment Insurance Fund for a certain period or until they find another job.

## Section 2: Calculating UIF

*Reminder:*
Gross salary is the total amount of income that an individual earns before any deductions are made on the income.

**(LB pages 216-217)**

The amount of money that must be deducted from an employee's salary or wages is calculated as a percentage of their *gross salary* → i.e. 1% of gross salary.

But, the employer must also contribute a further 1% to the fund on behalf of each employee. So employers must pay a total contribution of 2% of each worker's pay per month to the unemployment insurance fund (UIF).

**Summary:**

⇒ Employee's contribution = 1% × gross salary

⇒ Total contribution (from both employee and employer) = 2% × gross salary

## Example:

Consider a person who earns a gross salary of R10 000,00 per month.
Amount to be deducted from the employee's salary = 1% × gross salary

= 1% × R10 000,00 = R100,00

This is the amount that the *employee* will have to pay. The employer will also have to match this amount and pay an additional R100,00.

So the total amount paid to the Unemployment Insurance Fund on behalf of this employee is R200.

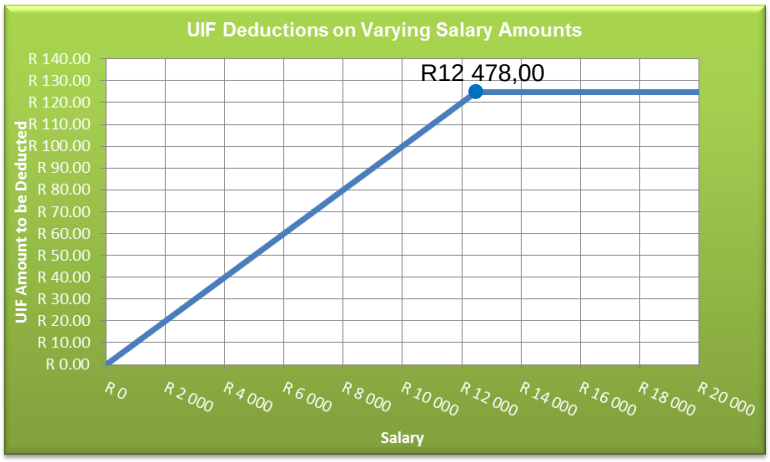
## Ceiling salary?

There is a salary ceiling of R12 478,00 per month when calculating UIF. This means that for a salary which is higher than R12 478,00 per month, UIF will only be calculated on the first R12 478,00 of that salary. As such, the maximum UIF amount that can be deducted from an employee's salary is 1% × R12 478,00=R124,78

irrespective of how much higher than R12 478,00 per month the salary is.

We can illustrate this condition on the following graph

The flat (horizontal) portion of the graph represents the situation where the same (maximum) UIF amount is charged for any salary higher than R12 478,00.



# Probability

(LB pages 222-233)

## Overview

The content of this Application Topic on Probability is drawn from pages 90-95 in the CAPS document.

There are three sections in the Probability topic that are relevant to Grade 11 learners:

- Section 1: Expressions of probability → this section requires that learners understand and can make sense of the different ways (notation) in which probability values are expressed.
- Section 2: Determining possible outcomes → this section requires that learners understand how to use tree diagrams and two-way tables in order to determine possible outcomes for multiple events.
- Section 3: Prediction → this section requires that learners understand the different ways in which probability values are determined and how probability values are used to describe the prediction for an event.

## Contexts

The following contexts are applicable for the exploration of probability in Grade 11:

- Tests where there is the chance of inaccurate results (e.g. *pregnancy test; drug test*);
- Products making statements regarding probability (e.g. *a cosmetic products*);
- Tables and graphs containing data and statistics.

## Integrated content

An understanding of the concepts of ratio, decimal notation, and percentage calculations from the Basic Skills Topic of Numbers and calculations with numbers is important.

## Section 1:Expressions of probability

**(LB pages 222-225)**

Page 93 in the CAPS document reflects the contents of this section.

The probability value for an event is simply a value that describes the likelihood that an event may occur. It is essential to understand that this probability value is simply a prediction of what might or could happen, but that there is no guarantee or certainty that this is precisely what will happen.

So, just because a weather report states that there is a 30% chance of rain does not mean that it will definitely rain. However, what this probability value does tell us is that there is a chance that it might rain and although the chance it not too high, there is still the possibility. This statement of '30% chance of rain', then, is a *prediction*.

The following method is used to describe the probability of an event:

$$P(event) = \frac{number\ of\ ways\ in\ which\ an\ event\ can\ happen}{total\ number\ of\ possible\ outcomes\ for\ an\ event}$$

From this method we can choose to express probability values in three different formats:

1. Fraction format 2. Percentage format 3. Decimal format

- The fraction format is always the original format for a probability value. This is because the method shown above always results in a fraction that compares the ways in which a specific event can occur to the total possible outcomes for the event.
- By dividing the values in the fraction a decimal format can be determined. This decimal will always be smaller than 1, because the probability of an event must lie between 0 (0%) and 1 (100%).
- The fraction value can also be converted to a percentage by multiplying the computed fraction by 100.

Let us apply this understanding to the contents of the Learner's Book where three different contexts/resources are shown.

- Resource 1 is a newspaper article referring to the likelihood of a false positive or false negative in a pregnancy test → notice how in this resource the probability value is expressed as a percentage.
- Resource 2 is an advert showing the details for a beauty product → notice how in this resource a probability value is used to describe the likelihood of using the beauty product and experiencing improved skin quality. In this context the probability value is expressed through a statement in the form "8 in 10" which could be written as a fraction $\frac{8}{10}$ or as a percentage of 80%. It is important to see that this statement of 8 in 10 is not the original probability value but, rather, is a simplified statement of an unspecified number of woman (and not 8) out of a total of 32 women (and not 10).
- Resource 3 is a table of statistics or data showing information on the number of crashes involving different types of vehicles in each of the different provinces in South Africa. What is important to notice is that this table contains *actual values*, unlike in the previous two resources in which the computed probability values were given. As such, when working with this resource it is necessary to use the given actual values to first construct probability values, and then to use those values in order to make predictions.

# Section 2: Representations for determining possible outcomes

**(LB pages 226-229)**

Page 93 in the CAPS document reflects the contents of this section. In particular, learners need to be able to do the following:

1. Construct and interpret tree diagrams
2. Construct and interpret two-way tables.

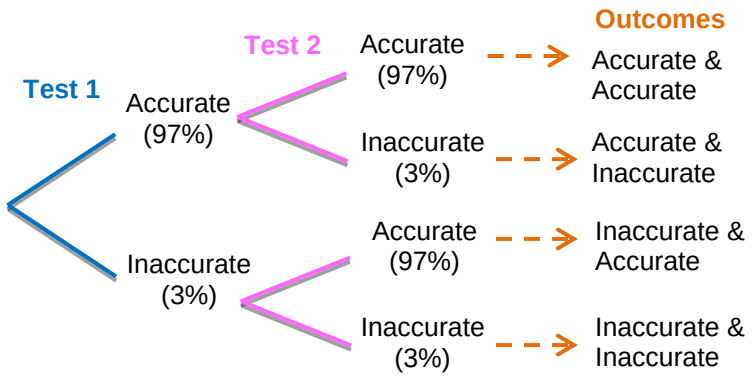
It is important to understand that both tree-diagrams and two-way (contingency) tables are simply tools that can be used to develop a better understanding of a situation involving probabilities where more than one event is occurring and, so, for determining all of the possible outcomes for these events. In other words, it is not enough to simply learn how to draw tree-diagrams and two-way tables; what is more important is to be able to use these tools in order to make sense of real-world situations (like the pregnancy test).

In light of this, the approach adopted in the Learner's Book is to show how tree diagrams and two-way tables can be used to make sense of some of the resources that were introduced in Section 1.

## 1. Tree diagrams

**(LB pages 226-227)**

The following tree diagram is provided in the Learners' Book:




Note the following:

- The tree diagram gives us a visual tool – a picture or diagram – that can help us to make sense of a situation involving more than one event and where it is difficult to know what all of the possible outcomes for the event will be.
- There are two sets of branches because the pregnancy test was conducted twice. If the test had been conducted three times then there would have been three branches.
- Each branch is made up of two lines, with each line representing a different possible outcome for the event. In the case of the pregnancy test, the test could be either positive or negative → and, so, there is a sub-branch for positive and negative.
- Not only is each sub-branch given a label (e.g. Accurate), but the probability value for the event is also included (e.g. 97%). This makes it easy to see precisely what the probability values are for each event.
- Finally, also notice that all possible outcomes for the two events are then listed at the end of the diagram. In doing so we have now used the diagram to determine every possible thing that could possibly occur. We could then use this information further to start to work out the probabilities of each outcome (as is shown in the Learner's Book).

## 2. Two-way tables

A two-way table is simply a table of data that contains a comparison of two different variables and can therefore be read in two different directions. For example, the two-way table in the Learner's Book shows information on the variables of 'Vehicle Type' and 'Provinces' and allows us to see information not only on the different types of vehicles involved in crashes, but also to see how vehicle crashes differ across the provinces in South Africa.

Note that you probably worked with two-way tables frequently in Chapter 12: Data Handling. The difference here is that we intend to use these tables in order to determine probability values and therefore be able to make predictions about the likelihood of certain events occurring. If you intend to use a two-way table to determine probability values, then the recommended approach shown in the Learner's Book is to convert all of the values in the table into percentage probability values so that it is easier to work with the table without having to first perform a calculation.

**Actual Values**

Table 11 Crash statistics

| 2009 | Number of vehicles per type and province involved in fatal crashes | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Vehicle Type | EC | FS | GP | KZN | Li | MP | NC | NW | WC | RSA |
| Motorcars | 969 | 585 | 2 190 | 1 768 | 1 028 | 1 382 | 266 | 795 | 1292 | **10 275** |
| Minibuses | 163 | 92 | 278 | 376 | 139 | 173 | 19 | 102 | 145 | **1 487** |
| Buses | 66 | 9 | 61 | 37 | 31 | 69 | 6 | 23 | 52 | **354** |
| Motorcycles | 16 | 14 | 118 | 43 | 10 | 26 | 8 | 23 | 86 | **344** |
| Trucks | 111 | 102 | 182 | 275 | 132 | 313 | 25 | 88 | 159 | **1 387** |
| Other and unknown | 95 | 49 | 326 | 393 | 143 | 155 | 19 | 88 | 203 | **1 471** |
| Total Motorised | **1 420** | **851** | **3 155** | **2 892** | **1 483** | **2 118** | **343** | **1 119** | **1 937** | **15 318** |

**Probability values**

Table 14 Percentage crash statisics

| 2009 | Number of vehicles per type and Province involved in fatal crashes | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Vehicle type | EC | FS | GP | KZN | Li | MP | NC | NW | WC | RSA |
| Motorcars | 6.3% | 3.8% | 14.3% | 11.5% | 6.7% | 9.0% | 1.7% | 5.2% | 8.4% | 67.1% |
| Minibuses | 1.1% | 0.6% | 1.8% | 2.5% | 0.9% | 1.1% | 0.1% | 0.7% | 0.9% | 9.7% |
| Buses | 0.4% | 0.1% | 0.4% | 0.2% | 0.2% | 0.5% | 0.0% | 0.2% | 0.3% | 2.3% |
| Motorcycles | 0.1% | 0.1% | 0.8% | 0.3% | 0.1% | 0.2% | 0.1% | 0.2% | 0.6% | 2.2% |
| Trucks | 0.7% | 0.7% | 1.2% | 1.8% | 0.9% | 2.0% | 0.2% | 0.6% | 1.0% | 9.1% |
| Other and unknown | 0.6% | 0.3% | 2.1% | 2.6% | 0.9% | 1.0% | 0.1% | 0.6% | 1.3% | 9.6% |
| Total motorised | 9.3% | 5.6% | 20.6% | 18.9% | 9.7% | 13.8% | 2.2% | 7.3% | 12.6% | 100.0% |

Converting actual values into percentage probability values to be included in a two-way table, simply involves a calculation involving *expressing a value as a percentage*. For example, converting the value of 969 for Motorcars in the Eastern Cape into a probability value involves the following calculation: $\frac{969}{15\,318} \times 100 =$ 6,3%.

Here is something to look out for when converting a two-way table into percentage probability values:

- The table of percentage values on the previous page represents percentages out of the total value of 15 318 vehicles.
- It would be possible for the values in each column to be expressed as percentages of the total of each column, but this would change what the values in the table represent completely (see below):

| 2009 | Number of Vehicles per Type and Province involved in Fatal Crashes | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Vehicle Type** | EC | FS | GA | KZ | LI | MP | NC | NW | WC | RSA |
| **Motorcars** | 68.2% | 68.7% | 69.4% | 61.1% | 69.3% | 65.3% | 77.6% | 71.0% | 66.7% | 67.1% |
| **Minibuses** | 11.5% | 10.8% | 8.8% | 13.0% | 9.4% | 8.2% | 5.5% | 9.1% | 7.5% | 9.7% |
| **Buses** | 4.6% | 1.1% | 1.9% | 1.3% | 2.1% | 3.3% | 1.7% | 2.1% | 2.7% | 2.3% |
| **Motorcycles** | 1.1% | 1.6% | 3.7% | 1.5% | 0.7% | 1.2% | 2.3% | 2.1% | 4.4% | 2.2% |
| **Trucks** | 7.8% | 12.0% | 5.8% | 9.5% | 8.9% | 14.8% | 7.3% | 7.9% | 8.2% | 9.1% |
| **Other and unknown** | 6.7% | 5.8% | 10.3% | 13.6% | 9.6% | 7.3% | 5.5% | 7.9% | 10.5% | 9.6% |
| **Total Motorised** | 100% | 100% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |

- In other words, always make sure that you know precisely out of which total value you will be expressing the probability values, since this will affect what the values in the table represent and how they can be used for purposes of prediction.

## Section 3: Prediction

**(LB pages 230-231)**

Page 92 in the CAPS document reflects the contents of this section. According to this page, Grade 11 learners specifically need to be able to recognise that probability values:

- are determined by observing and identifying trends in events that have happened in the past. The evidence from these past events then makes it possible to predict what might happen in the future.
- describe the likelihood of a prediction over a period of time and not necessarily for each individual event. For example, we could toss a coin 10 times and the coin could land on heads every time. However, if we were to toss the coin thousands of times, then we would probably find that the probability of the coin landing on heads is closer to 50% (which is what is commonly known as the probability values for a tossed coin landing on heads).

In light of this, the approach adopted in the Learner's Book uses an advert showing car insurance rates for females and males. The important thing to notice is that although the profiles of the females and males are the same, the insurance rate for the females is lower than for the males. This is because males in certain age groups are considered to be a higher risk (of having an accident) than females in the same age group. And this is information determined by insurance companies keeping track of the number of accidents involving females and males in different age groups over time and then using these statistics to predict what might happen in the future. Based on these future predictions, the insurance companies charge higher rates for males than for females because there is a higher likelihood of the males being involved in an accident.

Importantly, there is no guarantee that if a male driver falls in a certain age group then he will definitely have an accident. But, based on historical statistical information from the past, the male is more likely to have an accident. In other words, probability is a prediction and not a certainty. And people like insurance companies use prediction to inform how people might act in certain situations.

The example and discussion in the Learner's Book is an example of how historical events are used to predict future events and how although probability values are used for prediction, they do not guarantee certainty.

## Additional questions

1. In a large herd of sheep, 30% have black wool and 70% have white wool; 40% are male and 60% are female.

   1.1 Draw a tree diagram to illustrate the possible outcomes if a sheep is drawn at random from the herd.

   1.2 What is the probability that if a sheep is drawn at random from the herd it will be black and male?

   1.3 What percentage of the sheep are female with white wool?

2. John and Samantha are playing a game with two dice. The game has the following rules:

- If the numbers on the two dice add up to an even number John wins;
- If the two numbers are the same Samantha wins.

   2.1 Construct a tree diagram to show all the possible outcomes of this compound event.

   2.2 Use the tree diagram to calculate the probability that the sum of the two numbers on the dice is an even number.

   2.3 Use the tree diagram to calculate the probability that the two numbers on the dice are the same.

   2.4 Who has the bigger chance of winning the game – John or Samantha? Explain.

3. In a study on the number of accidents in 1 year and the age of the driver, 500 drivers between the ages of 18 and 50 were questioned. The following contingency table shows the information that was collected in the study.

| Number of Accidents | Age of Driver | | | Row Totals |
|---|---|---|---|---|
| | 18–25 | 26–40 | 41–50 | |
| 0 | 75 | 115 | 110 | 300 |
| 1 | 50 | 65 | 35 | 150 |
| 2 | 25 | 20 | 5 | 50 |
| Column totals | 150 | 200 | 150 | 500 |

If one driver is selected at random from the sample, what is the probability that the driver will:

3.1 be aged 18-25?

3.2 have had 2 accidents in the past year?

3.3 be aged 18-25 and will have had no accidents during the past year?

3.4 be aged over 25?

3.5 be aged over 25 and will have had no accidents during the past year?

4. The following statistics were collected during a recent local government municipal election in Bothasville:

- Of the total 8 050 people who live in the town, 5 225 people voted.
- Of the people who voted, 3720 were black voters, 420 were Indian voters, and the remainder were white voters.
- Of the black voters, 1973 voted for partyA, 745 voted for party B, and the remainder voted for party C.
- Of the Indian voters, 112 voted for partyA, 278 voted for party C, and the remainder voted for party B.
- Of the white voters, 450 voted for party B, 80 voted for party C, and the remainder voted for party A.

4.1 Use the given information to complete the following contingency table.

| Party | Race of Voter | | | |
|---|---|---|---|---|
| | Black | Indian | White | Row Totals |
| A | | | | |
| B | | | | |
| C | | | | |
| Column totals | | | | |

4.2 Now use the contingency table to calculate the probability, as a percentage, that:

4.2.1. A person chosen at random in the town voted in the local government municipal elections?

4.2.2 A voter chosen at random is black?

4.2.3 A voter chosen at random voted for party A?

4.2.4 A voter chosen at random is Indian and voted for party B?

4.2.5. A person chosen at random in the town voted for party C.

4.2.6. Party C will win the local government municipal elections?

(If necessary, round off your answers to one decimal place.)

5. A die and a coin are tossed.

5.1 Construct a contingency table for the two actions.

5.2 What is the probability of getting:

5.2.1 the number 3 on the dice?

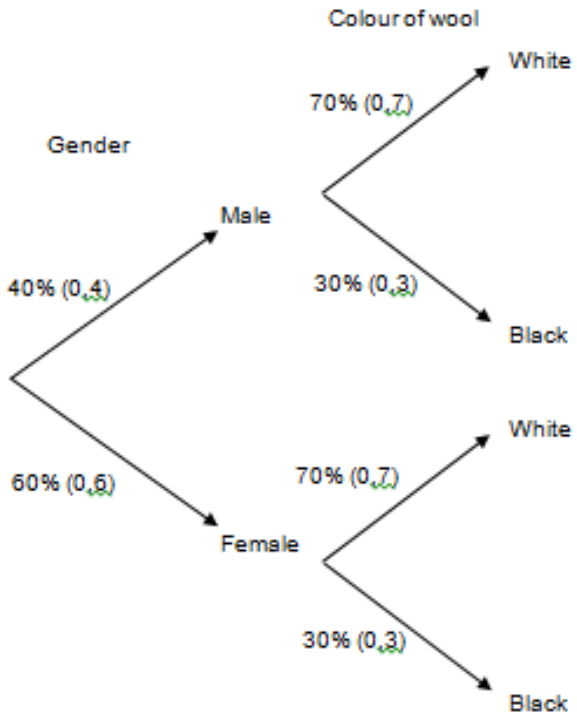
5.2.2 the number 3 on the dice and heads on the coin?

5.2.3 an even number on the dice and heads on the coin?

5.2.4 an even number or the number 3 on the dice?

## Answers

1.1




1.2 P(sheep is male and black) = 0,4 × 0,3 = 0,12 (12%)

1.3 % of the sheep that are female with white wool = (0,6 × 0,7) × 100 = 42%

2.1 (see next page for the tree diagram)

2.2 Total number of possible outcomes = 36

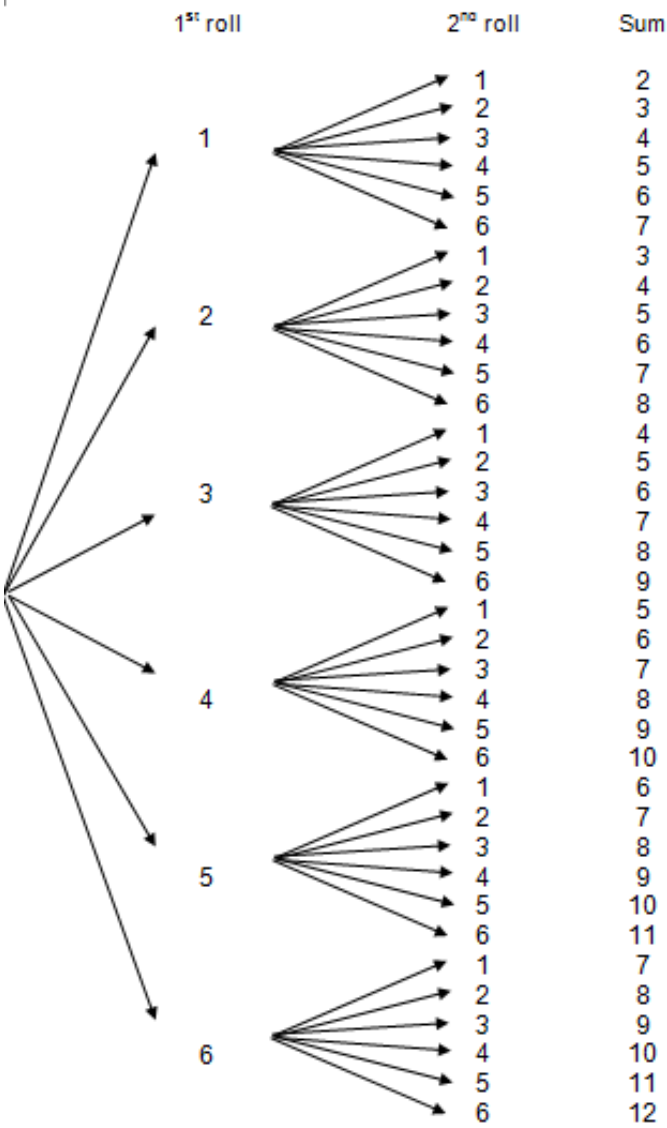
Number of ways in which sum can add up to an even number = 18

⇒ P(the sum of the numbers on the dice is even) = $\frac{18}{36} = \frac{1}{2}$ (50%)

2.3 Number of ways in which the two numbers on the dice can be the same = 6

⇒ P(The two numbers on the dice are the same) = $\frac{6}{36} = \frac{1}{6}$ (≈ 16,7%)

2.4 John has the bigger chance of winning the game because the probability that the numbers on the two dice will add up to an even number is approximately 33% greater than the probability that they will be the same.




3.1 P(aged 18-25) = $\frac{150}{500}$ (30%)

3.2 P(2 accidents in the past year) = $\frac{50}{500}$ (10%)

3.3 P(driver 18-25 and with no accidents during the past year) = $\frac{75}{500}$ (15%)

3.4 P(aged over 25) = $\frac{200}{500} + \frac{150}{500} = \frac{350}{500}$ (70%)

3.5 P(over 25 and no accidents during the past year) = $\frac{115+110}{500} = \frac{225}{500}$ (45%)

4.1

| Party | Race of Voter | | | |
|---|---|---|---|---|
| | Black | Indian | White | Row Totals |
| A | 1 973 | 112 | 555 | 2 640 |
| B | 745 | 30 | 450 | 1 225 |
| C | 1 002 | 278 | 80 | 1 360 |
| Column totals | 3 720 | 420 | 1 085 | 5 225 |

4.2.1 P(person voted) = $\frac{5\ 225}{8\ 050} \times 100 \approx 64{,}9\ \%$

4.2.2 P(Black voter) = $\frac{3\ 720}{5\ 225} \times 100 \approx 71{,}2\ \%$

4.2.3 P(voted for party A = $\frac{2\ 640}{5\ 225} \times 100 \approx 50{,}5\ \%$

4.2.4 P(Indian and voted for the party B) = $\frac{30}{5\ 225} \times 100 \approx 0{,}6\ \%$

4.2.5 P(person in the town voted for party C)

= $\frac{1\ 360}{8\ 050} \times 100 \approx 16{,}9\ \%$

4.2.6 P(Party C will win) = $\frac{1\ 360}{5\ 225} \times 100 \approx 26\ \%$

5.

| Die | Coin | | Row totals |
|---|---|---|---|
| | Head | Tail | |
| 1 | $\frac{1}{6} \times \frac{1}{2} = \frac{1}{12}$ | $\frac{1}{6} \times \frac{1}{2} = \frac{1}{12}$ | $\frac{2}{12}$ |
| 2 | $\frac{1}{12}$ | $\frac{1}{12}$ | $\frac{2}{12}$ |
| 3 | $\frac{1}{12}$ | $\frac{1}{12}$ | $\frac{2}{12}$ |
| 4 | $\frac{1}{12}$ | $\frac{1}{12}$ | $\frac{2}{12}$ |
| 5 | $\frac{1}{12}$ | $\frac{1}{12}$ | $\frac{2}{12}$ |
| 6 | $\frac{1}{12}$ | $\frac{1}{12}$ | $\frac{2}{12}$ |
| Column totals | $\frac{6}{12}$ | $\frac{6}{12}$ | $\frac{12}{12} = 1$ |

5.1 P(the number 3 on the dice) = $\frac{1}{6}$

5.2 P(the number 3 on the dice and heads on the coin) = $\frac{1}{12}$

5.3 Even numbers on the dice = 2; 4; 6

$\therefore$ P(even number dice and heads on the coin) = $\frac{1}{12} + \frac{1}{12} + \frac{1}{12} = \frac{3}{12} = \frac{1}{4}$

(25%)

5.4 P(even number or the number 3 on the dice) = $\frac{3}{12} + \frac{1}{12} = \frac{4}{12} = \frac{1}{3}$ ($\approx$ 33,3%)

# Finance (Exchange Rates)

**(LB pages 238-247)**

## Overview

The content of this section on Exchange Rates, as part of the Finance Application Topic, is drawn from page 60 in the CAPS document.

As stipulated in the CAPS document, Grade 11 learners need to be able to do the following with respect to Exchange Rates:

- estimate conversions between different currencies.
- understand the terms ‘strong’ and ‘weak’ when comparing currencies.
- understand the ‘buying power’ of a currency.

## Integrated content

In working with exchange rates, learners will be required to draw on their knowledge of rates and proportion from the Basic Skills Topic of Numbers and calculations with numbers.

## Section 1: What are exchange rates?

**(LB pages 240-241)**

An exchange rate is a rate that is used to show a comparison of the value of one currency in relation to another currency. The exchange rate is most commonly expressed by showing how many units of one currency is equal to a certain number of units of another currency.

For example:

The exchange rate between the Rand and the American Dollar was R7,00 to $1,00.

This could also be expressed as a rate between the Dollar and Rand as $0,14 to R1,00.

Importantly, the exchange rates between different currencies will change on a daily basis and sometimes even several times during the course of a day.

The most common usage of exchange rates is for people who are travelling to another country and who need to 'buy' the currency of that other country so that they can buy things when they are in the country. Companies who import and export goods from other countries also make use of exchange rates.

# Section 2: Working with exchange rate values

**(LB pages 242-243)**

A currency conversion involves converting a certain amount of one type of currency into another type of currency. The exchange rate between the two currencies gives an indication of how this conversion should take place.

There are two ways of converting currencies that are dealt with in the Learner's Book:

- Estimation
- Accurate calculation

## 1. Doing currency conversion using estimation

Estimating currency conversions is the method commonly employed by many people who travel to different countries.They only need a general idea of the amount of currency that will be exchanged.

## Example:

Consider a person who wants to exchange R1 000,00 into American Dollars ($) at an exchange rate of R7,9050 : $1,00.This exchange rate tells us that *approximately* R8,00 is needed for $1,00.

So:R80,00 will give ≈ $10,00 → R800,00 will give ≈ $100,00

So, R1 000,00 will give approximately $125,00.

Importantly, since the exchange rate is just less than R8,00 for $1,00, we might need to readjust this estimate slightly in our own heads to understand that R1 000,00 will give us just more than $1250,00.

## 2. Currency conversions requiring accuracy

However, if a person is running a business where they import or export goods into / out of the country, then they may need to be able to perform currency conversions accurately since this will impact on precisely how much they will have to pay or charge for the goods.

## Example:

Consider a person from South Africa who wants to buy something from America that is selling for $245,00. Using the exchange rate of R7,9050 : $1,00 we can work out the exact amount that this item will cost in Rands in the following way:

$1,00 : R7,9050→ $245,00 = R7,9050 × 245

= R1 936,73(rounded off to two decimal places)

Although this is how much the item costs when converted to Rands, there may be extra fees payable for delivery or for having to convert currency from Rand into Dollars when paying for the item. In reality, the person will probably end up paying more than this amount of R1 936,73 for the item.

# Section 3: Understanding the value of a currency in relation to other currencies

**(LB pages 244-245)**

There are two things that need to be understood when comparing the values of two different currencies:

- The 'strength' of a currency
- The 'buying power' of a currency

## 1. Strong and weak currencies

We can determine the 'strength' of a currency in relation to another currency by looking at the exchange rate between the two currencies. For example, consider the exchange rate of R7,9050 : $1,00.

- Here, approximately 8 units of South African currency (Rands) are needed to exchange for one unit of American Currency (Dollars).
- Since so many more units of Rands are needed for one unit of Dollars, we say that the Dollar currency is *stronger* than the Rand.

Now consider the exchange rate value of the Rand to the Zambian Kwacha of R1,00 : R395,3663.

- Here, approximately 400 Kwacha are needed for one unit of Rand → so, the Rand is *stronger* than the Kwacha.

**Summary:**

- Stronger currency → if one unit of a currency exchanges for more than one unit of another currency.
- Weaker currency → if one unit of a currency exchanges for less than one unit of another currency.

## 2. Buying Power of a currency

Consider the exchange rate of the Rand to the Dollar of R7,9050 : $1,00. Because approximately R8,00 is needed for every $1,00, it might appear that when a South African travels to America they will have to have lots of money to spend because everything will be so 'expensive' because when converting to a Rand value it will

always be 8 times more. So, a can of cool drink that costs $2,00 would be equivalent to a can of cool drink costing R16,00 in South Africa – which is really expensive.

But it is actually not correct to say that things are more expensive in another country simply because a person has to buy things with a weaker currency. The only way to determine how expensive things are in a particular country is to compare the cost of an item to the amount of money that a person earns in that country.

### Example:

Consider a teacher in South Africa who earns a monthly salary of R12 500,00 and who buys a television priced at R5 000,00. The ratio of the price of the television to the person's salary (as a percentage) is: R5 000,00 ÷ R12 500,00 × 100 ≈ 40%

So the teacher has to pay 40% of his/her monthly salary to buy the television.
Now consider a teacher in America who earns a monthly salary of $2 000,00 and buys the same television priced at $750,00 (R5 928,75,00 in Rand value).

The ratio of the price of the television to the person's salary (as a percentage) is:

$750,00 ÷ $2 000,00 × 100 ≈ 37,5%

So, even though it appears that the television is more expensive in Dollar currency (only because the person is converting the price into the weaker Rand currency), when compared to the amount of money people earn, the price actually amounts to a smaller percentage of the teacher's salary.

## Additional questions

1. If the current exchange rate for the Rand to US Dollar is R7,4768 = $1,00:
   - 1.1 how many Rand is equivalent to $500,00?
   - 1.2 how many Rand is equivalent to $2 350,00?
   - 1.3 how many US Dollars are equivalent to R500,00?
   - 1.4 how many US Dollars are equivalent to R2 350,00?

2. Use the exchange rate table from the Independent on Saturday newspaper given below to answer the following questions:

**EXCHANGE RATES TO 19/02/2010**

| COUNTRY | BUYING RATES | | | SELLING |
|---|---|---|---|---|
| | Telegraphic transfer | Traveller's cheques | Bank notes | |
| USA | 7.5000 | 7.4835 | 7.4768 | 7.8500 |
| UK | 11.5215 | 11.4973 | 11.4858 | 12.1667 |
| Euro | 10.0658 | 10.0426 | 10.0336 | 10.6360 |
| Australia | 6.6445 | 6.6225 | 6.5963 | 7.0472 |
| Botswana | 1.0288 | 1.0175 | 1.0128 | 1.2165 |
| Canada | 7.0972 | 7.0822 | 7.0771 | 7.5358 |
| Denmark | 1.3504 | 1.3461 | 1.3441 | 1.4308 |
| Hong Kong | 0.9621 | 0.9605 | 0.9588 | 1.0146 |
| India | 0.1600 | 0.1584 | 0.1577 | 0.1711 |
| Israel | 1.9897 | 1.9857 | 1.9810 | 2.1155 |
| Japan | 0.0813 | 0.0812 | 0.0810 | 0.0862 |
| Malawi | 0.0495 | 0.0482 | 0.0476 | 0.0535 |
| Mauritius | 0.2439 | 0.2414 | 0.2404 | 0.2632 |
| New Zealand | 5.1894 | 5.1706 | 5.1493 | 5.5157 |
| Norway | 1.2449 | 1.2408 | 1.2393 | 1.3182 |
| Seychelles | 0.0000 | 0.0000 | 0.0000 | 0.6944 |
| Singapore | 5.2604 | 5.2521 | 5.2411 | 5.6117 |
| Sweden | 1.0246 | 1.0225 | 1.0216 | 1.0837 |
| Switzerland | 6.8634 | 6.8493 | 6.8446 | 7.2674 |

2.1 How many Rand will you need to buy £00,00 (UK) *bank notes*?

2.2 How many Rand will you need to buy P2 500,00 (Botswana) *Traveller's Cheques*?

2.3 If you were to exchange R7 000,00 into Euro (€) *bank notes*, how many Euro would you receive?

2.4 If you were to exchange R1 300,00 into Mauritian Rupees (₨) through a *telegraphic transfer*, how many Rupees would you receive?

2.5 On returning from a trip to America, Kennedy decided to exchange his left over US Dollars ($) back into Rand. If he "sells" his $830,00 back to the bank, how many Rand will he receive?

2.6 Identify which countries in the exchange rate table have currencies that are weaker than the Rand. You must give a reason for your choice(s).

3. A cross currency exchange rate is a particular type of exchange rate table that is useful for converting between different foreign currencies, and not just between the Rand currency and other currencies.

The table below shows a cross currency exchange rate table dated 20 February 2010.

(Source: www.oanda.com. 20 February 2010, 4:12 pm)

| Currency codes | Botswana Pula | Euro | New Zealand Dollar | South African Rand | Swaziland Lilangeni | Great Britain Pound | US Dollar |
|---|---|---|---|---|---|---|---|
| BWP | 1 | 9.5525 | 4.9165 | 0.9211 | 0.9331 | 10.8913 | 7.0633 |
| EUR | 0.1083 | 1 | 0.5148 | 0.0964 | 0.09769 | 1.1404 | 0.7395 |
| NZD | 0.2106 | 1.9442 | 1 | 0.1875 | 0.1899 | 2.2167 | 1.4376 |
| ZAR | 1.1268 | 10.3995 | 5.3543 | 1 | 1.0162 | 11.8611 | 7.6923 |
| SZL | 1.1523 | 10.6382 | 5.4753 | 1.0257 | 1 | 12.1292 | 7.8661 |
| GBP | 0.09503 | 0.8774 | 0.4515 | 0.08459 | 0.08569 | 1 | 0.6487 |
| USD | 0.1465 | 1.3524 | 0.6961 | 0.1304 | 0.1321 | 1.5419 | 1 |

3.1 3.1.1 The exchange rate of the Rand to the Euro (EUR) is R10,3995 : €1,00.

Now write down the exchange rate of the Rand to the New Zealand Dollar (NZ$) in relation to NZ$1,00.

3.1.2 The exchange rate of the Rand to the Euro (EUR) in relation to R1,00 is R1,00 : €0,0964.

Now write down the exchange rate of the Rand to the New Zealand Dollar (NZ$) in relation to R1,00.

3.2 What does the diagonal of "1's" running from the top left to the bottom right of the table represent?

3.3 3.3.1 How many Botswana Pula (BWP) are equivalent to R100,00?

3.3.2 How many Great Britain Pound (GBP) (£) are equivalent to €500,00 (Euro)?

3.3.3 How many Euro (€) are equivalent to £500,00 (Great Britain Pound (GBP))?

## Answers

1.1 1.1.1 $1,00 = R7,4768
$ 500,00 = R7,4768 × 500 = R3 738,40

1.1.2 $1,00 = R7,4768
$ 2 350,00 = R7,4768 × 2 350,00 = R17 570,48

1.2 1.2.1 R7,4768 = $1,00 ⇢ R1,00 = $1,00 ÷ 7,4768
→ R500,00 = $1,00 ÷ 7,4768 × 500
≈ $66,87 (rounded off to two decimal places)

1.2.2 R7,4768 = $1,00 ⇢ R1,00 = $1,00 ÷ 7,4768
⇢ R2 350,00 = $1,00 ÷ 7,4768 × 2 350
≈ $314,31 (rounded off to two decimal places)

2.1 Pound to Rand "bank notes" exchange rate:
£,00 = R11,4858 ⇢ £800,00 = R11,4858 × 800 = R9 188,64

2.2 Pula to Rand "traveller's cheques" exchange rate:
P1,00 = R1,0175 ⇢ £ 500,00 = R1,0175 × 2 500 = R2 543,75

2.3 Rand to Euro "bank notes" exchange rate:
R10,0336 = €1,00 ⇢ R1,00 = €1,00 ÷ 10,0336
R7 000,00 = €1,00 ÷ 10,0336 × 7 000 = €697,66 (to two decimal places)

2.4 Rand to Rupees "telegraphic transfer" exchange rate:
R0,2439 = ₨1,00 ⇢ R1,00 = ₨ ,00 ÷ 0,2439
R1 300,00 = ₨ ,00 ÷ 0,2439 × 1 300 = ₨5330,05 (to two decimal places)

2.5 Dollar to Rand "selling" exchange rate:
$1,00 = R7,8500 ⇢ $830,00 = R7,8500 × 830 = R6 515,50

2.6 Hong Kong; India; Japan; Malawi; Mauritius; Seychelles.
These are all of the currencies for which less that R1,00 is needed to buy one unit of foreign currency.

3.1 3.1.1 R5,3543 = NZ$1,00

3.1.2 R1,00 = NZ$0,1875

3.2 The "1's" represent the exchange rate of a currency listed in the first column in relation to the same currency listed in the top row. i.e. the exchange rate of a currency to itself is 1 : 1.

3.3 3.3.1 R1,00 = P0,9211 ⇒ R100,00 = P92,11

3.3.2 €1,00 = £0,8774 ⇒ €500,00 = £0,8774 × 500 = £438,7

3.3.3 £1,00 = €1,1404 ⇒ £500,00 = €1,1404 × 500 = €570,20

# Data Handling

**(LB pages 248-273)**

## Overview

In working with data handling, the following processes of the statistical cycle need to be understood and engaged with:

- Stage 1 → Posing questions
- Stage 2 → Collecting data
- Stage 3 → Organising the data
- 
- Stage 4 → Representing the organised data graphically
- Stage 5 → Measuring the data
- Stage 6 → Analysing the var ous representations of the data in order to find answers to the questions posed at the beginning of the statistical process

In Grade 11 the following specifications apply:

- Two sets of data or data with two different categories, and comparisons of the data / categories, must be dealt with.
- Data must be collected on contexts relating to the wider community (as opposed to the personal lives of the learners which was the scope in Grade 10).

In light of the above, the approach taken in the Learner's Book is to engage with a table of data relating to the weights and heights of a group of adults. The Body Mass Index (BMI) values of these adults are also determined. This approach has been taken for two reasons:

- Firstly, the data relates to concepts that the learners can relate to – i.e. height and weight − and which they can work with and experience in the context of their classroom.
- Secondly, the context of BMI overlaps with the contents of the section on Measuring Weight in the Measurement Application Topic.

In meeting the specification that two sets of data or data with two categories must be dealt with, the approach taken in the Learner's Book is to collect, organise, represent and analyse data relating to a comparison of the heights and weights of the female and male patients. In other words, the Learner's Book illustrates how to compare and analyse two different categories (females and males) within a single set of collected data.

# Interpreting and Analysing Data

## Overview

The content of this section on Collecting data, as part of the Data Handling Application Topic, is drawn from page 87 in the CAPS document.

Importantly, interpreting and analysing data is not something that occurs as a separate stage in the statistics process. Rather, data must be constantly analysed and interpreted throughout every stage of the statistical process. Analysing and interpreting data involves asking questions about:

- what types of questions should be included on a data collection instrument;
- the most appropriate type of data collection instrument for a particular set of data;
- the most suitable sample if bias is to be minimised;
- the best way in which to sort/arrange data;
- the types of intervals that must be used when constructing a frequency table;
- whether percentage values must be included in a frequency table;
- the most appropriate graph to use to represent data;
- the most appropriate measure of central tendency and measure of spread to use to generate a reliable measure of the data;
- what the specific values of the measures of central tendency and spread indicate about the data;
- any trends that are identifiable within the data as shown in the frequency tables, graphs and/or measures;
- what information the tables, graphs and measures tell us regarding the questions that were posed at the beginning of the data collection process.

In light of the above, it is essential that analysis and interpretation must occur whenever the data is transformed in any way and the analysis and interpretation must always be directed backwards towards trying to understand what the data tells us about the original questions that guided the data collection process.

# Section 1: Collecting data to answer questions

**(LB pages 250-251)**

## Overview

The content of this section on Collecting data, as part of the Data Handling Application Topic, is drawn from page 83 in the CAPS document.

As stipulated in the CAPS document, Grade 11 learners need to be able to:

- pose questions that require the collection of two sets of data or data that contains two categories.
- use a variety of data collection instruments (e.g. questionnaires, surveys, interviews, etc) to collect the required data.

There is no new content in this section from the Grade 10 curriculum. Rather, it is expected that the skills and knowledge taught in Grade 10 must now be used in order to collect either two sets of data or a single set of data that comprises of two categories, drawn from potentially less familiar contexts relating to the wider community.

## 1. Posing questions

The first stage in any statistical process is to pose questions. These questions will provide a reason for collecting the data, will affect the type of data that needs to be collected, and will inform the way in which the data is collected, organised, represented and measured.

## Example 1

Consider a teacher who wants to make sense of the results in his class. To do this he could pose the following questions relating to their marks:

- How did the class perform as a whole?
- Did the female students perform better than the male students?
- Did the class perform better than the other classes in the same grade?

These questions will inform the way in which the teacher collects information on the marks of his students, the way he organises those marks, and the best types of graphs and measures that he can use to make sense of the marks

## Example 2

A house owner wants to reduce the amount of electricity that is used in the home and the amount of money that has to be paid for that electricity. The home owner may pose the following questions to help decide how to reduce the electricity consumption:

- How many units of electricity am I using, on average, per month?
- How much am I paying for electricity, on average, per month?
- Which appliances in my household use the most electricity?
- Which appliances can I use less often in order to reduce my electricity consumption and cost?

As with the teacher, these questions will inform the type of information that the homeowner collects with respect to electricity usage and the types of tools that they make use of in collecting, organising and making sense of the information.

## 2. Developing a data collection instrument

In collecting data it is important to consider:

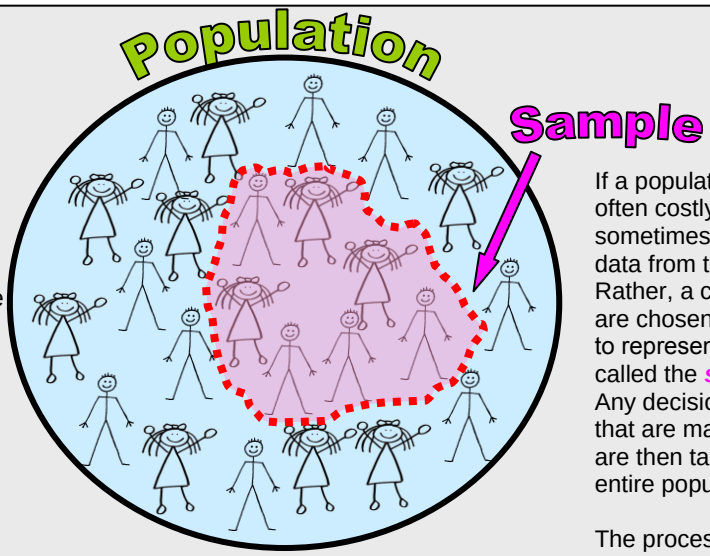
- The type of data collection tool that will be the most effective for collecting the data.
- The nature of the group of people / objects from which the data will be collected.

### Populations and samples

Data may be obtained from a number of sources, including people, animals, plants, databases, etc. When collecting data from any of these sources it is important to distinguish between the ***population*** and the ***sample***. The diagram on the next page provides an explanation of the difference between these two groups:

The ***population*** is the entire group about which data is being collected.

A population may be big or it may also be small, depending on the situation for which data is being collected and the size of the group being dealt with.400 m




If a population is very large, it is often costly, impractical, and sometimes impossible to collect data from the entire population. Rather, a collection of people are chosen from this population to represent the population – called the ***sample***.
Any decisions or conclusions that are made about the sample are then taken to apply for the entire population.

The process of collecting data from a sample (or a population) is called a **survey**.0 m

## Example 3

If data is being collected on the most popular mode of transport used by learners of a school:

- "**population**" = the entire student body of the school;
- "**sample**" = a smaller number of students comprising students from the different grades in the school and both male and female students who can be interviewed about the mode of transport that they use to travel to school.

If data is being collected on the number of people in South Africa who have/have had Malaria:

- "**population**" = the entire population of South Africa;
- "**sample**" = collection of female and male South African citizens from each of the different provinces and different racial groups who could be interviewed about Malaria.

### Considerations of bias

When collecting data it is also important to ensure that the collected data is free of 'bias'. One of the ways in which this is achieved is by ensuring that a sample selected is *representative* of the population so that any decisions or conclusions made about the sample will accurately apply to the whole population:

- The sample must reflect the same features and characteristics of the population.
- The sample chosen must also be large enough. If the sample is too small then there is the possibility that the information gathered from the sample will not provide an accurate enough reflection of the population.

If a sample is not accurately representative of the population, then that sample will provide a *skewed* or *biased* impression of the features or characteristics of the population.

## Example 4

Consider a scenario where data is being collected on alcohol abuse amongst high school learners at a school.

The **population** of the data is ALL of the learners in the school.

A representative **sample** of this population will have to include:

- both female and male students;
- students from every grade in the school;
- students from all of the different racial backgrounds in the school;
- correct proportions in relation to the whole population → i.e. if the school consists primarily of black students then interviewing mostly white students will result in a skewed impression of the population.

The sample will also need to be big enough so that the information that is gathered is reliable and can be applied to the larger population. For example, in a school of 980 students, a sample of 150 or 200 students should be a big enough sample.

If the sample does not include all of these different criteria/characteristics, then there is the risk that any conclusions that are made about the sample will not accurately reflect the reality of alcohol abuse amongst the students at this school.

### Data collection instruments

Having considered issues regarding who the data will be collected from and how to ensure that the collected data is free of bias, it then becomes possible to design an appropriate data collection tool. The two most common tools are:

- *Questionnaire* → a document containing a list of questions submitted to a group of people (to fill in by themselves or to be filled in by an interviewer) to gather information about the group or the opinions of the group on a particular topic or issue.
- *Recording sheet* → a document that is used to record how often aparticular event occurs, how long different events take, or the particularfeatures of different events. A recording sheet is almost always filled outonly by the person conducting the research.

## Example 5

The following document is provided on page 251 in the Learner's Book and illustrates a type of questionnaire that could be used to collect information on patients who visit a clinic.

| | | | | |
|---|---|---|---|---|
| Patient surname: ..... | | Patient first names:..... | | |
| Age:..... | Gender:..... | Urban/Rural:..... | Height:..... | Weight:..... |
| Reason for visit:..... | | Treatment and medication:..... | | |

Note that:

- this questionnaire can be completed either by a nurse or by the patient themselves.
- there are multiple categories of information on the questionnaire, including age, gender, height and weight, and so on. This will enable the person collecting the data to do comparisons across different categories, most especially between the female and male patients.

## Example 6

The chart below shows an example of a recording sheet used by an employee at a Post Office to keep track of the number of visitors to the post office at different times of the day.

**Hilton Post Office - Visitor Recording/Monitoring Sheet**

| Time of day | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |
|---|---|---|---|---|---|---|
| 08:00 am - 8:30 am | √ √ √ | √ | | | | |
| 08:30 am - 9:00 am | √ √ √ √ √ √ | √ √ √ √ | | | | |
| 09:00 am - 9:30 am | √ | | | | | |
| 09:30 am - 10:00 am | | √ √ | | | | |
| 10:00 am - 10:30 am | √ √ √ √ | √ √ √ √ √ √ √ √ √ √ √ | | | | |
| 10:30 am - 11:00 am | √ √ √ √ √ √ √ √ √ √ | √ √ √ | | | | |
| 11:00 am - 11:30 am | √ √ √ √ √ | √ √ | | | | |
| 11:30 am - 12:00 pm | √ √ √ √ | √ √ √ √ √ √ | | | | |
| 12:00 pm - 12:30 pm | √ √ √ √ √ √ √ √ √ √ √ √ √ | √ √ √ √ √ √ √ √ √ √ √ | | | | |
| 12:30 pm - 1:00 pm | √ √ √ √ √ √ √ √ √ √ √ | √ √ √ √ √ √ √ √ √ √ √ √ √ | | | | |
| 1:00 pm - 1:30 pm | √ √ √ √ √ √ √ √ √ | √ √ √ √ √ √ √ | | | | |
| 1:30 pm - 2:00 pm | √ √ √ √ √ √ | √ √ √ √ | | | | |
| 2:00 pm - 2:30 pm | √ √ √ | √ | | | | |
| 2:30 pm - 3:00 pm | √ | | | | | |
| 3:00 pm - 3:30 pm | √ √ √ √ √ √ | √ √ √ √ | | | | |
| 3:30 pm - 4:00 pm | √ √ √ √ √ √ √ √ | √ √ √ √ √ √ √ √ √ | | | | |
| 4:00 pm - 4:30 pm | √ √ √ √ √ √ √ √ √ √ √ | √ √ √ √ √ √ √ √ √ √ √ √ √ | | | | |

Note that:

- the post office employee will complete this recording sheet himself and the visitors to the post office may not even be aware that such a sheet is being kept.
- the information on the sheet can then be used to inform decisions regarding how many employees must be on duty at a particular time of the day, when the most appropriate time would be for the employees to take breaks for lunch and tea, and other decisions which affect the functioning of the post office.

## Additional Questions

1. Philemon, a Grade 8 learner, is conducting a survey in his school on the number of learners that smoke. In collecting information, Philemon interviews 20 learners, all of whom are in Grade 8.

   1.1 What is the population of these data?

   1.2 What is the sample of these data?

   1.3 Why would this sample be considered biased?

   1.4 How could Philemon improve his sample to remove bias?

2. Zipho and her friends are given a project in which they are asked to collect data and investigate which is the most popular make of car in their town. To do this, they walk to *Pick n' Pay* and spend an hour counting the various makes of cars parked in the parking lot.

   The table below contains the data that they collected and the deduction that they reached.

| Make of car | Number of cars |
|---|---|
| Ford | 38 |
| Mazda | 59 |
| BMW | 25 |
| Toyota | 66 |
| Mercedes | 8 |
| Peugeot | 1 |
| Hyundai | 7 |
| Nissan | 52 |
| **Deduction:** *From the data that we have collected we concluded that Toyota is the most popular car in our town.* | |

   2.1 What is the population of the data?

   2.2 What is the sample of the data?

   2.3 Do you think the deduction that Zipho and her friends have made is correct, or do you think it is biased? Explain your answer.

   2.4 How could Zipho and her friends improve their sample to reduce any bias?

3. Martin wants to operate a tearoom in his neighbourhood, but he first wants to find out whether the people in his neighbourhood will support his tearoom. Martin visits 60 households in his neighbourhood and conducts a survey.

   The table below contains a summary of statistics of the people who completed Martin's survey.

| TEAROOM FEASIBILITY SURVEY | |
|---|---|
| Approximate number of people in the neighbourhood | 300 |
| Number of children/teenagers surveyed | 18 |
| Number of women surveyed | 56 |
| Number of men surveyed | 33 |

   3.1 *Estimate* the fraction of people surveyed of the total number of people who live in the neighbourhood.

   3.2 Do you think that the data that Martin has collected is biased, or will it give him a good idea of whether operating a tearoom in his neighbourhood will be successful? Explain..

4. Xolani reads in the newspaper that 21,1% of high school learners smoke cigarettes regularly. He is sceptical about this statistic and decides to conduct his own survey at his school. The table below contains the results of his survey:

| Smoking Survey | | | | | |
|---|---|---|---|---|---|
| Number of people surveyed | 200 | Males | 100 | Black | 50 |
| | | Females | 100 | Coloured | 50 |
| | | | | Asian | 50 |
| | | | | White | 50 |
| Total number of smokers | 26 | | Percentage of smokers | | 13% |
| Total number of non-smokers | 174 | | Percentage of non-smokers | | 87% |
| **Conclusion:** *Based on the information collected in my survey, I have concluded that the statistic given in the newspaper is unrealistically high and that only about 13% of high school learners smoke cigarettes regularly.* | | | | | |

   Is Xolani's conclusion valid, or did he collect a biased sample? Explain..

## Answers

1.1 Population = All of the learners in Philemon's school.

1.2 Sample = Twenty Grade 8 learners interviewed by Philemon.

1.3 The sample is biased as Philemon only surveyed students who are in Grade 8. It would be impossible for Philemon to make a deduction about the number of learners in the whole school who smoke because he has not interviewed students from every age group or grade.

1.4 Philemon could improve his sample by interviewing students from each grade.

2.1 Population = All the cars in Zipho's town.

2.2 Sample = Cars parked in the parking lot of *Pick n' Pay.*

2.3 The deduction made by Zipho and her friends is biased. By only counting the number of cars parked at one shopping centre, the data is limited to people who shop at Pick n' Pay. At a different shopping centre in the town, the makes of the cars parked in the parking lot may be completely different.

2.4 Zipho and her friends could improve their data by collecting data on cars parked at several shops in the town, or they could count the various makes of cars driving along particular stretches of roads in the town.

3.1 Number of people surveyed = 25 + 88 + 42 = 155.

Total number of people in the neighbourhood = 300.

$\Rightarrow$ Fraction of people surveyed $\approx \frac{1}{2}$ =50% The accurate value is 51,7%.

3.2 Martin has surveyed more than half of the people in the neighourbhood and he has interviewed men, women and children. The data that he has collected should give him a fairly accurate indication of whether he should open up a tearoom.

4. Xolani's conclusion is valid and does not appear to be biased as Xolani has interviewed a fairly large number of people from various racial and gender groups. The data that he has collected is representative of a wide variety of people and should be accurate. BUT Xolani should have tried to proportion the races better. To represent the population of high school students in South Africa, Xolani should have collected data from a higher proportion of black students, and fewer of the other races. This could affect his findings since race could be a factor in whether a student will smoke.

# Section 2: Organising Data

**(LB pages 252-255)**

## Overview

The content of this section on Collecting data, as part of the Data Handling Application Topic, is drawn from page 83 in the CAPS document.

As stipulated in the CAPS document, Grade 11 learners need to be able to:

- sort data according to two conditions.
- group two sets of collected data or two categories of data using appropriate intervals.
- organise two sets of data or two categories of data in frequency tables; and include percentage values in the frequency tables in order to make comparisons of the data/categories possible.

Data can be organised in two different ways:

- sorting the data in a particular order;
- organising the data into frequency tables often containing class intervals.

## 1. Sorting and arranging data

Sorting data involves putting the data in a particular order. When dealing with numbers, this could involve putting the data in order from smallest to biggest (or biggest to smallest); when dealing with categorical data (e.g. different types of fruit) this could involve arranging the data in alphabetical order.

We sort data because by putting it in a particular order. It then makes it easier to make sense of the data.

The primary focus in Grade 11 is on sorting data according to *two criteria*.

For example, one way in which the height-weight data shown in the Learner's Book (page 252) could be sorted according to two criteria `is to separate the height values for the females and the males and then to sort the height values for each gender group separately. As such, the height values are being sorted according to two criteria → gender and height.

The table below shows how the data for the females and males have been separated and then sorted separately for each group according to height.

| Patient no. | Age | Gender | Race | Residence | Height (m) | Weight (kg) | Patient no. | Age | Gender | Race | Residence | Height (m) | Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 46 | F | Black | Rural | 1.45 | 103.7 | 25 | 24 | M | Black | Rural | 1.2 | 60 |
| 8 | 31 | F | Black | Urban | 1.48 | 90 | 38 | 34 | M | White | Urban | 1.65 | 73 |
| 23 | 61 | F | White | Urban | 1.53 | 73.5 | 1 | 35 | M | Black | Rural | 1.72 | 54 |
| 9 | 29 | F | Black | Rural | 1.55 | 55 | 5 | 35 | M | White | Urban | 1.72 | 98 |
| 14 | 42 | F | Black | Rural | 1.57 | 109 | 10 | 45 | M | Coloured | Urban | 1.73 | 67 |
| 3 | 31 | F | Black | Urban | 1.58 | 60 | 21 | 31 | M | Indian | Rural | 1.74 | 72.5 |
| 15 | 38 | F | Black | Rural | 1.59 | 85 | 2 | 32 | M | Black | Rural | 1.75 | 70.5 |
| 29 | 39 | F | Coloured | Urban | 1.61 | 92 | 32 | 37 | M | White | Urban | 1.77 | 72 |
| 20 | 38 | F | White | Urban | 1.61 | 156 | 39 | 31 | M | White | Urban | 1.78 | 72.5 |
| 22 | 43 | F | Black | Urban | 1.62 | 85 | 12 | 30 | M | Coloured | Urban | 1.8 | 71 |
| 36 | 21 | F | Black | Rural | 1.64 | 68 | 33 | 24 | M | Black | Rural | 1.82 | 60 |
| 16 | 38 | F | Black | Rural | 1.64 | 88.5 | 19 | 33 | M | Indian | Rural | 1.83 | 73.5 |
| 26 | 39 | F | Indian | Urban | 1.64 | 132 | 4 | 32 | M | White | Urban | 1.88 | 74 |
| 13 | 35 | F | Black | Urban | 1.66 | 80 | 6 | 31 | M | Indian | Rural | 1.95 | 82 |
| 11 | 48 | F | White | Urban | 1.66 | 87 | 31 | 49 | M | White | Urban | 2.15 | 86 |
| 28 | 27 | F | Black | Urban | 1.67 | 81 | | | | | | | |
| 27 | 42 | F | Indian | Urban | 1.67 | 96.5 | | | | | | | |
| 37 | 28 | F | Black | Rural | 1.68 | 67 | | | | | | | |
| 35 | 27 | F | Black | Rural | 1.69 | 83 | | | | | | | |
| 18 | 41 | F | Black | Urban | 1.74 | 70 | | | | | | | |
| 7 | 55 | F | White | Urban | 1.75 | 71 | | | | | | | |
| 17 | 55 | F | White | Urban | 1.75 | 73 | | | | | | | |
| 34 | 25 | F | Black | Rural | 1.78 | 86 | | | | | | | |
| 24 | 36 | F | Black | Urban | 1.82 | 82 | | | | | | | |

## 2. Frequency tables and tallies

- A frequency value is a value that indicates how often a particular piece of data appears in a data set.
- We make use of frequency tables to summarise how often different values appear in a data set. This allows us to compare the frequency of different components of the data.
- In order to make it easier to organise sets of data that contain large numbers of very different values, class intervals are often used as a way to 'group' the data into more manageable categories.

## Example 7

The table below shows a frequency table (similar to the one on page 254 in the Learner's Book) showing the number (frequency) of females and males with heights that fall in different height categories.

These class interval categories have been used to make the height data easier to organise.

Notice how separate columns have been included for the females and males. This is because the height data was sorted separately for the males and females and we want to be able to compare the heights of the females and males.

| Height Category / Interval | Number (frequency) | |
|---|---|---|
| | Female | Male |
| < 1.5 m | 2 | 1 |
| 1.5 - 1.59 m | 5 | 0 |
| 1.6 - 1.69 m | 12 | 1 |
| 1.7 - 1.79 m | 4 | 7 |
| 1.8 - 1.89 m | 1 | 4 |
| 1.9 - 1.99 m | 0 | 1 |
| > 2 m | 0 | 1 |

These values are the 'frequency' values that represent the number of females and males with heights that fall in each of the height interval categories.

When constructing frequency tables to summarise and organise data that shows a comparison of <u>two different categories,</u> it is often necessary to include columns in the table that contain *percentage values* to represent the frequency values.

This is particularly important when the two categories of data contain a different number of data values, which makes it difficult to compare the frequency values. Converting the frequency values to percentage values is effectively converting every value to the same unit of measurement (since every value is now out of a total of 100 and no longer out of different totals), which then makes comparison of the values more accurate and reliable.

## Example 8

For example, the table below (which is based on the table on page 254 in the Learner's Book) now also contains percentage values.

| Height Category / Interval | Number (frequency) | | % Distribution | |
|---|---|---|---|---|
| | Female | Male | % Female | % Male |
| < 1.5 m | 2 | 1 | 8,3% | 6,7% |
| 1.5 - 1.59 m | 5 | 0 | 20,8% | 0,0% |
| 1.6 - 1.69 m | 12 | 1 | 50% | 6,7% |
| 1.7 - 1.79 m | 4 | 7 | 16,7% | 46,7% |
| 1.8 - 1.89 m | 1 | 4 | 4,2% | 26,7% |
| 1.9 - 1.99 m | 0 | 1 | 0% | 6,7% |
| > 2 m | 0 | 1 | 0% | 6,7% |

The percentage values represent a comparison of the number of females and males with heights in each height interval to the total number of females and males.

The percentage value of 8,3% is determined as follows:

- Total number of females = 24
- Number of females with heights in the '<1.5 m category' = 2
  → % of females who fall in this category = $\frac{2}{24} \times 100 \approx 8{,}3\%$

Including the percentage values in the table now makes it possible to compare the height distribution of the females and males more easily and accurately.

## Additional Questions

The table below contains data showing heights and weights of females and males.

| Gender | Height (m) | Weight (kg) |
|---|---|---|
| Female | 1.61 | 58 |
| Female | 1.75 | 50 |
| Male | 1.78 | 89 |
| Male | 1.67 | 68 |
| Male | 1.95 | 97 |
| Male | 1.7 | 73 |
| Male | 1.62 | 75 |
| Male | 1.78 | 70 |
| Female | 1.83 | 70 |
| Female | 1.69 | 69 |
| Female | 1.61 | 96 |
| Male | 1.58 | 73 |
| Male | 1.85 | 71 |
| Male | 1.85 | 73 |
| Male | 1.81 | 81 |
| Male | 1.92 | 94 |
| Male | 2.2 | 110 |
| Male | 1.78 | 137 |
| Male | 1.81 | 89 |
| Male | 1.68 | 76 |
| Male | 1.7 | 78 |
| Male | 1.79 | 73 |
| Male | 1.78 | 71 |
| Male | 1.75 | 70 |
| Female | 1.88 | 74 |
| Female | 1.77 | 88 |
| Female | 1.56 | 58 |
| Female | 1.65 | 64 |
| Female | 1.7 | 68 |
| Female | 1.75 | 67 |
| Female | 1.68 | 68 |
| Female | 1.67 | 86 |
| Female | 1.61 | 53 |

| Gender | Height (m) | Weight (kg) |
|---|---|---|
| Male | 1.76 | 89 |
| Male | 1.9 | 90 |
| Male | 1.76 | 95 |
| Male | 1.87 | 98 |
| Male | 1.86 | 115 |
| Female | 1.57 | 58 |
| Male | 1.88 | 126 |

1. 1.1 Sort the data according to gender and height.

   1.2 In a different table, sort the data according to gender and weight.

2 Organise the height and weight data into the following frequency tables:

| Height Category | Females | | Males | |
|---|---|---|---|---|
| | No. of People (Frequency) | % of gender group | No. of People (Frequency) | % of gender group |
| 1.5 - 1.59 m | | | | |
| 1.6 - 1.69 m | | | | |
| 1.7 - 1.79 m | | | | |
| 1.8 - 1.89 m | | | | |
| 1.9 - 1.99 m | | | | |
| › 2 m | | | | |

| Weight Category | Females | | Males | |
|---|---|---|---|---|
| | No. of People (Frequency) | % of gender group | No. of People (Frequency) | % of gender group |
| 50-59 kg | | | | |
| 60-69 kg | | | | |
| 70-79 kg | | | | |
| 80-89 kg | | | | |
| 90-99 kg | | | | |
| 100-109 kg | | | | |
| 110-119 kg | | | | |
| ›120 kg | | | | |

## Answers

1.1 & 1.2

**Table 1 – Sorted According to Gender&Height**

| Gender | Height (m) | Weight (kg) |
|---|---|---|
| Female | 1.56 | 58 |
| Female | 1.57 | 58 |
| Female | 1.61 | 58 |
| Female | 1.61 | 96 |
| Female | 1.61 | 53 |
| Female | 1.65 | 64 |
| Female | 1.67 | 86 |
| Female | 1.68 | 68 |
| Female | 1.69 | 69 |
| Female | 1.7 | 68 |
| Female | 1.75 | 50 |
| Female | 1.75 | 67 |
| Female | 1.77 | 88 |
| Female | 1.83 | 70 |
| Female | 1.88 | 74 |
| Male | 1.58 | 73 |
| Male | 1.62 | 75 |
| Male | 1.67 | 68 |
| Male | 1.68 | 76 |
| Male | 1.7 | 73 |
| Male | 1.7 | 78 |
| Male | 1.75 | 70 |
| Male | 1.76 | 89 |
| Male | 1.76 | 95 |
| Male | 1.78 | 89 |
| Male | 1.78 | 70 |
| Male | 1.78 | 137 |
| Male | 1.78 | 71 |
| Male | 1.79 | 73 |
| Male | 1.81 | 81 |

…

**Table 2 – Sorted According to Gender&Weight**

| Gender | Height (m) | Weight (kg) |
|---|---|---|
| Female | 1.75 | 50 |
| Female | 1.61 | 53 |
| Female | 1.56 | 58 |
| Female | 1.57 | 58 |
| Female | 1.61 | 58 |
| Female | 1.65 | 64 |
| Female | 1.75 | 67 |
| Female | 1.68 | 68 |
| Female | 1.7 | 68 |
| Female | 1.69 | 69 |
| Female | 1.83 | 70 |
| Female | 1.88 | 74 |
| Female | 1.67 | 86 |
| Female | 1.77 | 88 |
| Female | 1.61 | 96 |
| Male | 1.67 | 68 |
| Male | 1.75 | 70 |
| Male | 1.78 | 70 |
| Male | 1.78 | 71 |
| Male | 1.85 | 71 |
| Male | 1.58 | 73 |
| Male | 1.7 | 73 |
| Male | 1.79 | 73 |
| Male | 1.85 | 73 |
| Male | 1.62 | 75 |
| Male | 1.68 | 76 |
| Male | 1.7 | 78 |
| Male | 1.81 | 81 |
| Male | 1.76 | 89 |
| Male | 1.78 | 89 |

| | | |
|---|---|---|
| Male | 1.81 | 89 |
| Male | 1.85 | 71 |
| Male | 1.85 | 73 |
| Male | 1.86 | 115 |
| Male | 1.87 | 98 |
| Male | 1.88 | 126 |
| Male | 1.9 | 90 |
| Male | 1.92 | 94 |
| Male | 1.95 | 97 |
| Male | 2.2 | 110 |

| | | |
|---|---|---|
| Male | 1.81 | 89 |
| Male | 1.9 | 90 |
| Male | 1.92 | 94 |
| Male | 1.76 | 95 |
| Male | 1.95 | 97 |
| Male | 1.87 | 98 |
| Male | 2.2 | 110 |
| Male | 1.86 | 115 |
| Male | 1.88 | 126 |
| Male | 1.78 | 137 |

2.1

| Height Category | Females | | Males | |
|---|---|---|---|---|
| | No. of people (Frequency) | % of gender group | No. of people (Frequency) | % of gender group |
| 1.5 - 1.59 m | 2 | 13.3% | 1 | 4.0% |
| 1.6 - 1.69 m | 7 | 46.7% | 3 | 12.0% |
| 1.7 - 1.79 m | 4 | 26.7% | 10 | 40.0% |
| 1.8 - 1.89 m | 2 | 13.3% | 7 | 28.0% |
| 1.9 - 1.99 m | 0 | 0.0% | 3 | 12.0% |
| › 2 m | 0 | 0.0% | 1 | 4.0% |

2.2

| Weight Category | Females | | Males | |
|---|---|---|---|---|
| | No. of people (Frequency) | % of gender group | No. of people (Frequency) | % of gender group |
| 50-59 kg | 5 | 33.3% | 0 | 0.0% |
| 60-69 kg | 5 | 33.3% | 1 | 4.0% |
| 70-79 kg | 2 | 13.3% | 11 | 44.0% |
| 80-89 kg | 2 | 13.3% | 4 | 16.0% |
| 90-99 kg | 1 | 6.7% | 5 | 20.0% |
| 100-109 kg | 0 | 0.0% | 0 | 0.0% |
| 110-119 kg | 0 | 0.0% | 2 | 8.0% |
| ›120 kg | 0 | 0.0% | 2 | 8.0% |

## Section 3: Displaying Data (LB pages 256-265)

### Overview

The content of this section is drawn from page 86 in the CAPS document.

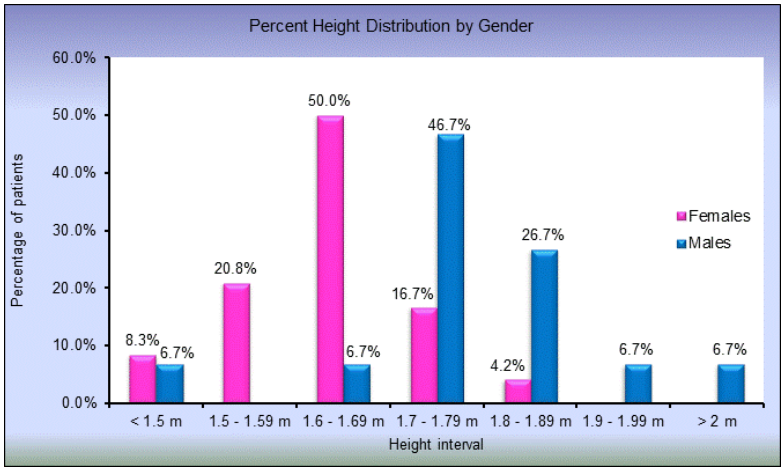
As stipulated in the CAPS document, Grade 11 learners need to be able to draw and interpret a variety of graphs suitable for showing a comparison of two different categories of data or of two different sets of data. These graphs include:

- Compound bar graphs, including:
  - Double bar graphs
  - Vertical stack graphs
- Pie-of-pie and bar-of-pie graphs
- Two line graphs on the same set of axes
- Scatter plot graphs

The scope of the contexts from which the data is drawn must relate to issues involving the wider community.

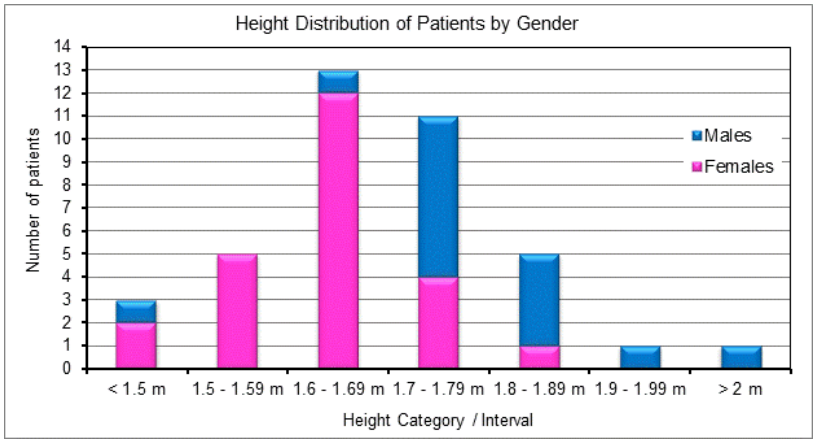
All of the graphs that are discussed in the Learner's Book are specifically directed towards representing either two categories of data or two sets of data and facilitating a comparison between the categories or sets.

### Double bar graphs




- Contain two bars for each interval, with each bar representing a separate category of the data.
- The height of each bar represents the frequency of a category, as summarised in the frequency table.
- These graphs are useful for showing a comparison between the frequency values for different categories over different intervals.

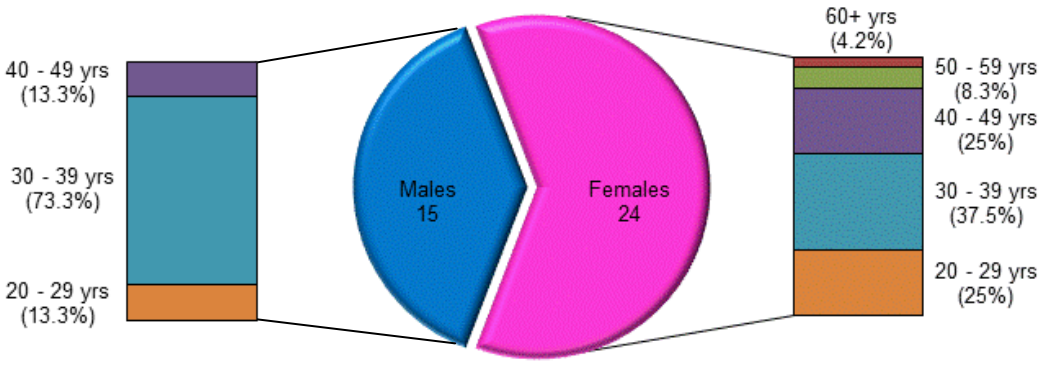
## Vertical stack bar graphs




- Contains two bars for each interval that are stacked on top of each other (i.e. stacked vertically).
- The two parts of each bar represent a different category within the data (e.g. males and females).
- Importantly, the height of the bars does not represent the frequency of each interval → rather, height of each of the two sections of the bar must be equal to the frequency values that were recorded in the frequency table.
- These graphs are useful when it is necessary to show the total frequency of two categories combined as well as an illustration of the different components that make up this total frequency.
- For example, the vertical stack graph above shows the total number of patients with heights <1.5 m as well as the number of females and males that make up the total for this interval.

## Pie-of-pie and Bar-of-pie

The graph below shows an example of a bar-of-pie chart.




- A bar-of-pie chart is made up of a pie chart that shows a comparison between two different categories of data and then stacked bars that show the different components of each of the categories.
- A pie-of-pie chart would simply have pie-charts showing the components of the main categories shown in a bigger pie chart.

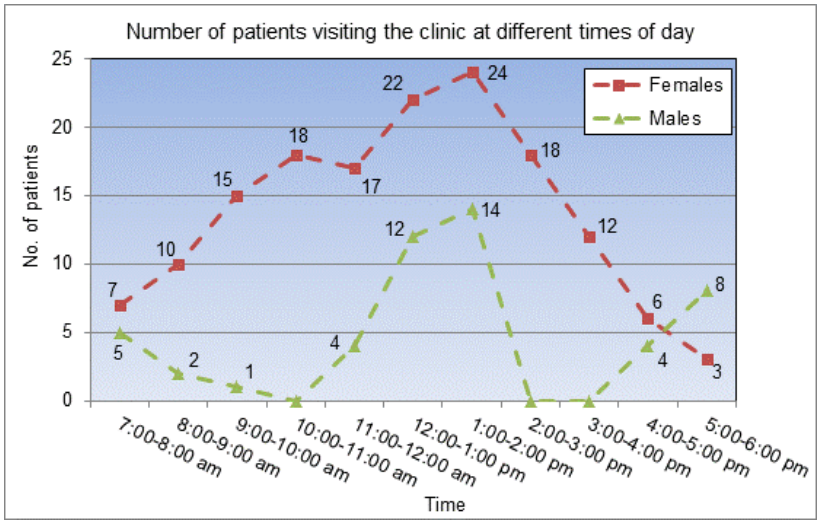
Importantly, the bars represent a portion or percentage of a specific category within the data and do not represent a portion or percentage of the whole of the data.

These graphs are useful when it is necessary to show a comparison between different components of data and when each component is made up of more categories.

For example, the bar-of-pie chart shown on the previous page shows – firstly – a comparison of the number of the female patients to male patients, and – secondly – a comparison of the number of females and males in each of the height intervals that make up the bigger female and male groups.

## Two line graphs

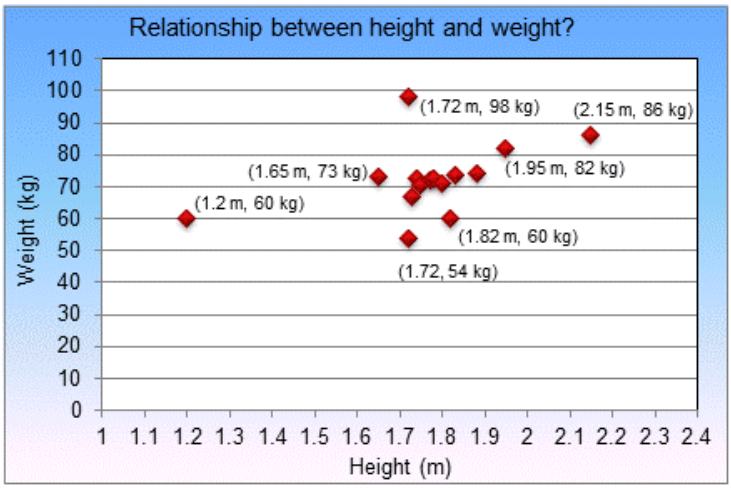
Line graphs are most effective for showing how changes occur in a data set over time and therefore for identifying trends in the data.




Placing two line graphs on a single set of axes thus makes it possible to compare how changes in different data sets will change over time and will change differently to each other.

For example, the line graphs above show a comparison of the trends in the numbers of females and males visiting the clinic at different times of day. From the graph we can see how the number of visitors for each gender group changes during the course of the day, together with maximum and minimum visitors for each group.

## Scatter Plot Graphs




These types of graphs are useful for comparing the type of relationship that exists between two different variables or quantities for which no obvious pattern is visible.

These graphs are constructed by plotting points on a set of axes, with each point made up of two different values for the two different variables or quantities.

For example, on the graph above, the point (1.2 m, 60 kg) contains both a height value (shown on the horizontal axis) and a weight value (shown on the vertical axis).

By looking at how the points are scattered on the graph we can then get a sense of whether there is a pattern in the way in which the different variables or quantities are related, and whether this pattern shows a close relationship, or a weak relationship, or even no relationship.

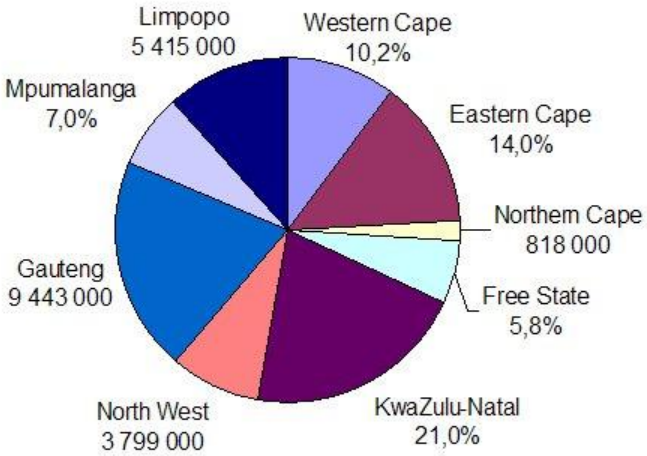
The word '*correlation*' is the word that is used to describe whether there is a relationship or patterns between the variables:

- weak correlation indicates that there is only a weak pattern;
- strong correlation indicates a strong pattern/relationship.

For example, in the graph above most of the points are clustered fairly closely together. Also, the taller the height the heavier the weight. This suggests that there is a reasonably strong correlation between an individual's height and weight. However, there are also some points that do not fit in this general patterns → these points are called '*outliers*'. The outliers signal that although a general pattern does exist, there are also instances where the pattern is not valid.

## Additional Questions

1. The pie chart below shows the number of people living in certain provinces in South Africa, as well as the size of the populations of other provinces in relation to the total South African population (expressed as a percentage).




1.1 If the total population of South Africa is 46 495 000, use the pie chart to complete the following table:

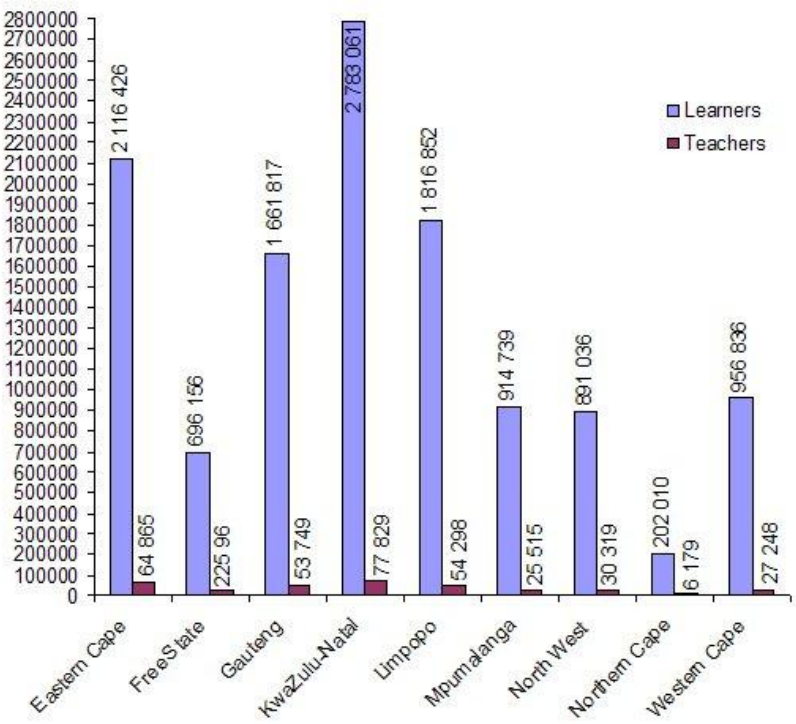
| | Number of people | Percentage of the total South African population |
|---|---|---|
| Eastern Cape | | 14,0% |
| Free State | | 5,8% |
| Gauteng | 9 443 000 | |
| KwaZulu-Natal | | 21,0% |
| Limpopo | 5 415 000 | |
| Mpumalanga | | 7,0% |
| North West | 3 799 000 | |
| Northern Cape | 818 000 | |
| Western Cape | | 10,2% |

1.2 1.2.1 Which province has the largest population?

1.2.2 Which province has the smallest population?

1.2.3 Which provinces have similar sized populations?

2. The bar chart on the next page shows a comparison between the number of learners and teachers in each province of South Africa.




2.1 Which province has the greatest number of learners?

2.2 Which province has the smallest number of learners?

2.3 Which province has the greatest number of learners and teachers?

2.4 The *pupil-teacher ratio* describes the number of pupils per one teacher. Calculate the pupil-teacher ratio for each province. If necessary, round all answers off to the nearest unit.

2.5 Which province has the largest pupil-teacher ratio?

3. The table below contains data on the prevalence of HIV (as a percentage) by sex and age in South Africa.

| Age (years) | Male | Female |
|---|---|---|
| 2–14 | 5% | 6% |
| 15–19 | 4% | 7% |
| 20–24 | 8% | 17% |
| 25–29 | 22% | 32% |
| 30–34 | 24% | 24% |

| | | |
|---|---|---|
| 35–39 | 18% | 14% |
| 40–44 | 12% | 19% |
| 45–49 | 12% | 11% |
| 50–54 | 5% | 8% |
| 55+ | 7% | 7% |

3.1 Draw a double bar chart to illustrate the percentage of HIV+ males and females in each age group in South Africa.

3.2 Use the graph to answer the following questions:

3.2.1 In which age group is the highest percentage of HIV+ males?

3.2.2 In which age group is the highest percentage of HIV+ females?

3.2.3 On average, are more males or females in South Africa HIV+? Explain how you arrived at your answer.

4. The table below contains the national pass rate for the Matriculation Exam from 1994 to 2004.

| Year | Pass Rate |
|---|---|
| 1994 | 58,0% |
| 1995 | 53,4% |
| 1996 | 54,4% |
| 1997 | 47,4% |
| 1998 | 49,3% |
| 1999 | 48,9% |
| 2000 | 57,9% |
| 2001 | 61,7% |
| 2002 | 68,9% |
| 2003 | 73,3% |
| 2004 | 70,4% |

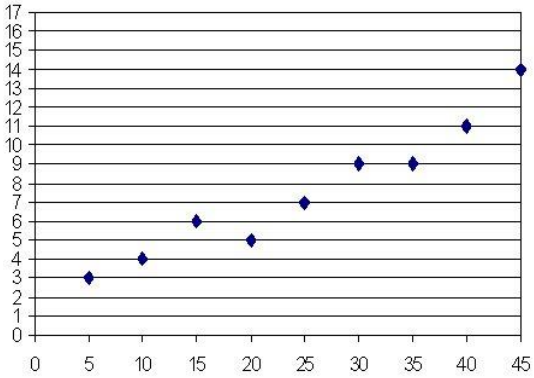
4.1 Determine the *mean* pass rate for the Matriculation Exam over the past 9 years.

4.2 Use the data provided in the table to draw a *line graph* to show the changes in the pass rate in the Matriculation Exam from 1994 to 2004.

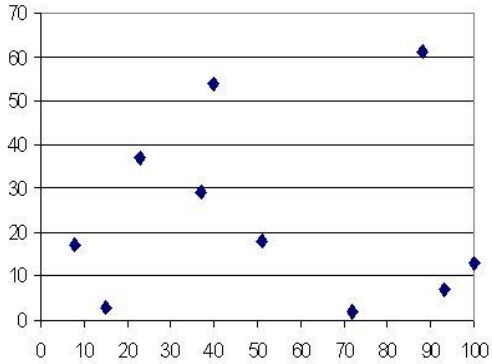
4.3 Use the line graph to describe any trends in the matriculation pass rate over the period 1994 to 2003.

5. Three different scatter plots are given below. For each scatter plot you need to decide if there is a *positive*, *negative* or *no* association between the variables.

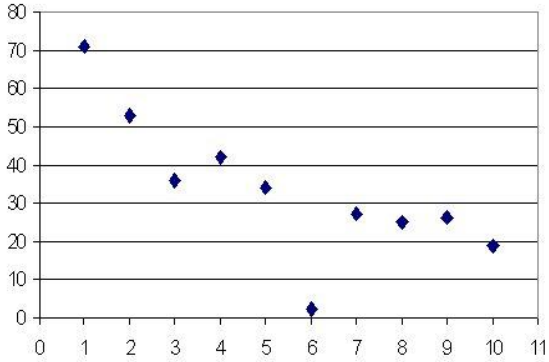
5.1




5.2



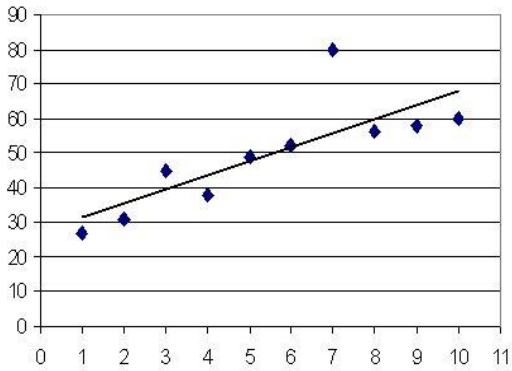

5.3



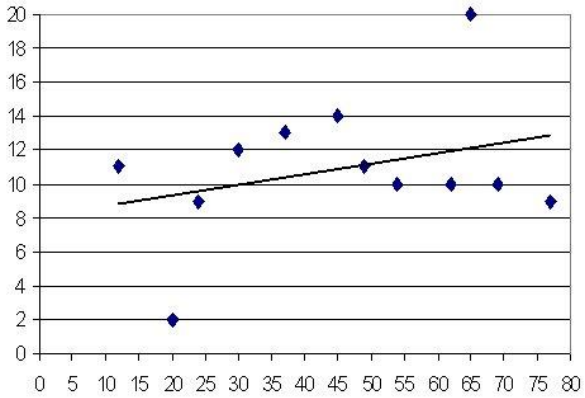

6. Three scatter plot graphs are given below. For each scatter plot you need to write down:

- the coordinates of the *outliers*;
- whether there is a *positive*, *negative* or *no association* between the variables
- whether the association between the variables is *weak* or *strong*.

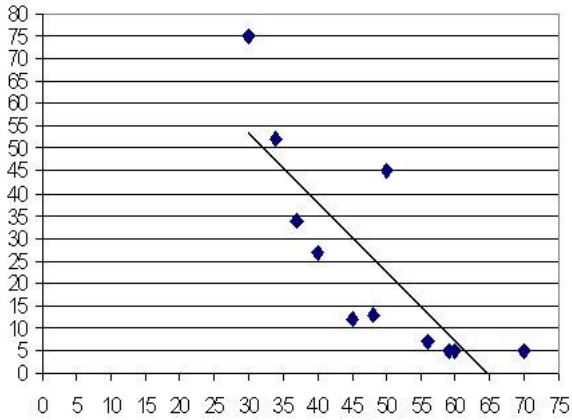
6.1




6.2



6.3




7. The table below shows the distance that it takes a car, travelling at various speeds, to come to a complete stop once the brakes are applied.

| **Speed (km/h)** | 30 | 40 | 50 | 60 | 70 | 80 | 90 |
|---|---|---|---|---|---|---|---|
| **Distance (m)** | 16 | 27 | 40 | 65 | 66 | 105 | 155 |

7.1 If you were to draw a scatter plot of the data, on which axis must the variable *Speed* appear and on which axis the variable *Distance*? Explain.

7.2 Draw a scatter plot of the speed–stopping distance data. You must construct your own set of axes and use a scale of 10 units on the horizontal axis and 5 units on the vertical axis.

7.3 Draw in the line of best fit on the scatter plot.

8. The table below contains the *Olympic Men's Marathon Winning Times* from 1948 to 2004 (Source: www.athletics-heros.net(8 March 2006).

| Year | Time (Hours & Minutes) |
|---|---|
| 1948 | 2,34 |
| 1952 | 2,23 |
| 1956 | 2,25 |
| 1960 | 2,15 |
| 1964 | 2,12 |
| 1968 | 2,20 |
| 1972 | 2,12 |
| 1976 | 2,10 |
| 1980 | 2,11 |
| 1984 | 2,09 |
| 1992 | 2,13 |

| | |
|---|---|
| 1996 | 2,12 |
| 2000 | 2,10 |
| 2004 | 2,11 |

8.1 Draw a scatter plot of the marathon winning times data. You must construct your own set of axes, decide which variable goes on which axis, and use an appropriate scale on each of the axes.

8.2 Draw in the line of best fit on the scatter plot.

8.3 The winning time for the year 1988 has been left off the table. Use the line of best fit to approximate what the winning time would have been in 1988.

## Answers

1.1

| | Number of people | Percentage of the total population of South Africa |
|---|---|---|
| Eastern Cape | 6 509 300 | 14,0% |
| Free State | 2 696 710 | 5,8% |
| Gauteng | 9 443 000 | 20,3% |
| KwaZulu-Natal | 9 763 950 | 21,0% |
| Limpopo | 5 415 000 | 11,6% |
| Mpumalanga | 3 254 650 | 7,0% |
| North West | 3 799 000 | 8,2% |
| Northern Cape | 818 000 | 1,6% |
| Western Cape | 4 742 490 | 10,2% |

1.2 1.2.1 KwaZulu-Natal

1.2.2 Northern Cape

1.2.3 Mpumalanga and North West; KwaZulu-Natal and Gauteng

2.1 KwaZulu-Natal

2.2 Northern Cape

2.3 KwaZulu-Natal

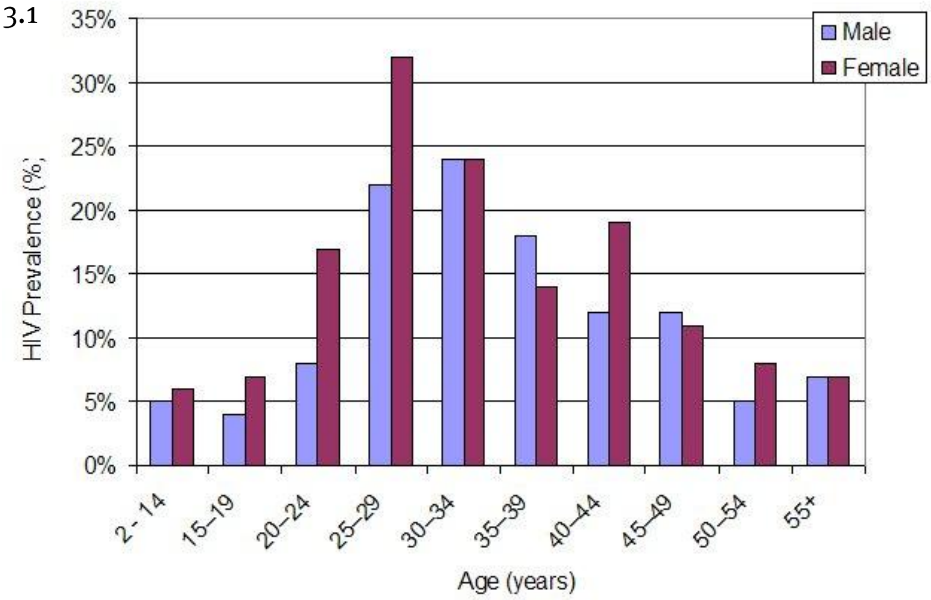
2.4 Pupil Teacher Ratio $= \frac{Pupils}{Teachers}$

| Province | Pupil : Teacher Ratio |
|---|---|
| Eastern Cape | 33 : 1 |
| Free State | 31 : 1 |
| Gauteng | 31 : 1 |
| KwaZulu-Natal | 36 : 1 |
| Limpopo | 34 : 1 |
| Mpumalanga | 36 : 1 |

| | |
|---|---|
| North West | 29 : 1 |
| Northern Cape | 33 : 1 |
| Western Cape | 35 : 1 |

2.5 Mpumalanga has the largest pupil teacher ratio as there are ≈ 36 pupils per teacher.

3.1




3.2 3.2.1 30-34 years

3.2.2 25-29 years

3.2.3 On average, there are more females that are HIV+ than males. If you analyse the graph you can see that in 6 of the 10 age categories more females are HIV+ than males; in two age categories the number of HIV+ females is equal to HIV+ males; in only 2 age categories is the number of HIV+ females less than the number of HIV+ males.

4.1

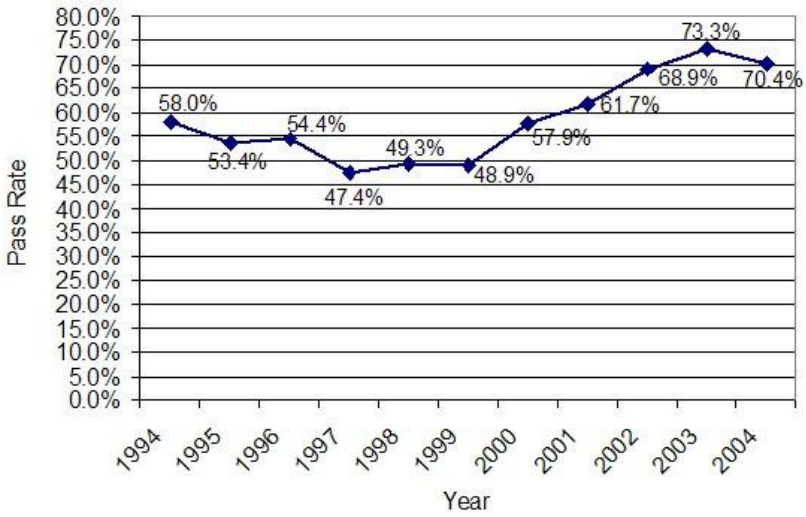
Mean pass rate

$$= \frac{58\% + 53{,}4\% + 54{,}4\% + 47{,}4\% + 49{,}3\% + 48{,}9\% + 57{,}9\% + 61{,}7\% + 68{,}9\% + 73{,}3\% + 70{,}4\%}{11}$$

$$= \frac{643{,}6\%}{11}$$

$= 58{,}51\%$

4.2




4.3 Although the pass rate decreased over the period 1994 to 1997, from 1997 to 2004 the pass rate increased steadily. The general trend in the pass rate over the period 1994 to 2004 has been an increase in the pass rate.

The pass rate reached a minimum in 1997 and a maximum in 2003.

5.1 Positive association – the values on the vertical axis tend to increase as the values on the horizontal axis increase.

5.2 No association – there is no discernable pattern in the points.

5.3 Negative association – the values on the vertical axis tend to decrease as the values on the horizontal axis increase.

*6.1* *Coordinates of the outlier:* *(7; 80)*

*Association between variables:*

As the majority of points are close to the line of best fit and the line has an upward slope, there is a strong positive association between the two variables.

*6.2* *Coordinates of the outliers:* *(20; 2) and (65; 20).*

Association between variables:

As the line has an upward slope, but the majority of points are not close to the line of best fit, there is a weak positive association between the two variables.

Note that if the two outliers should be removed from the data set the line of best fit will no longer have an upward slope, but will be horizontal, indicating that in such a case there is no association between the two variables.

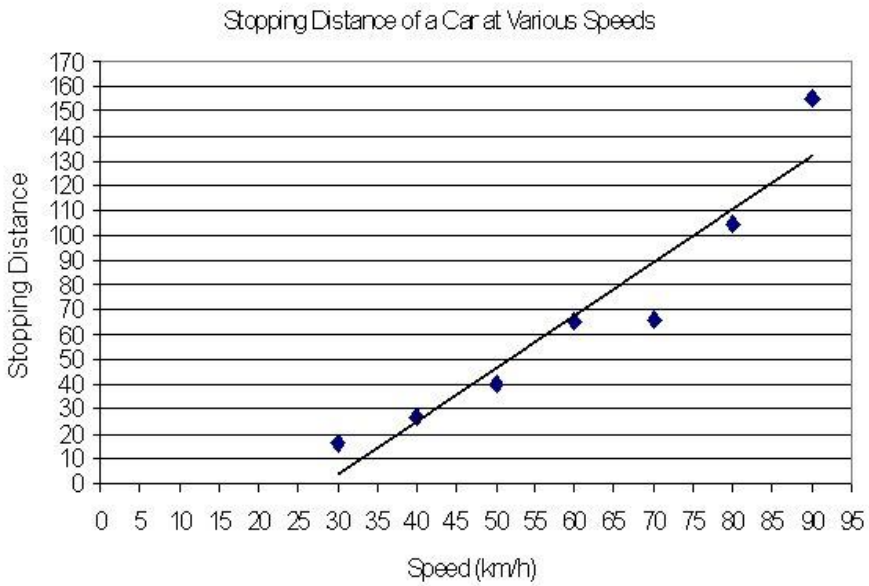
6.3 *Coordinates of the outliers:* *(30; 75) and (50: 45).*

*Association between variables:*

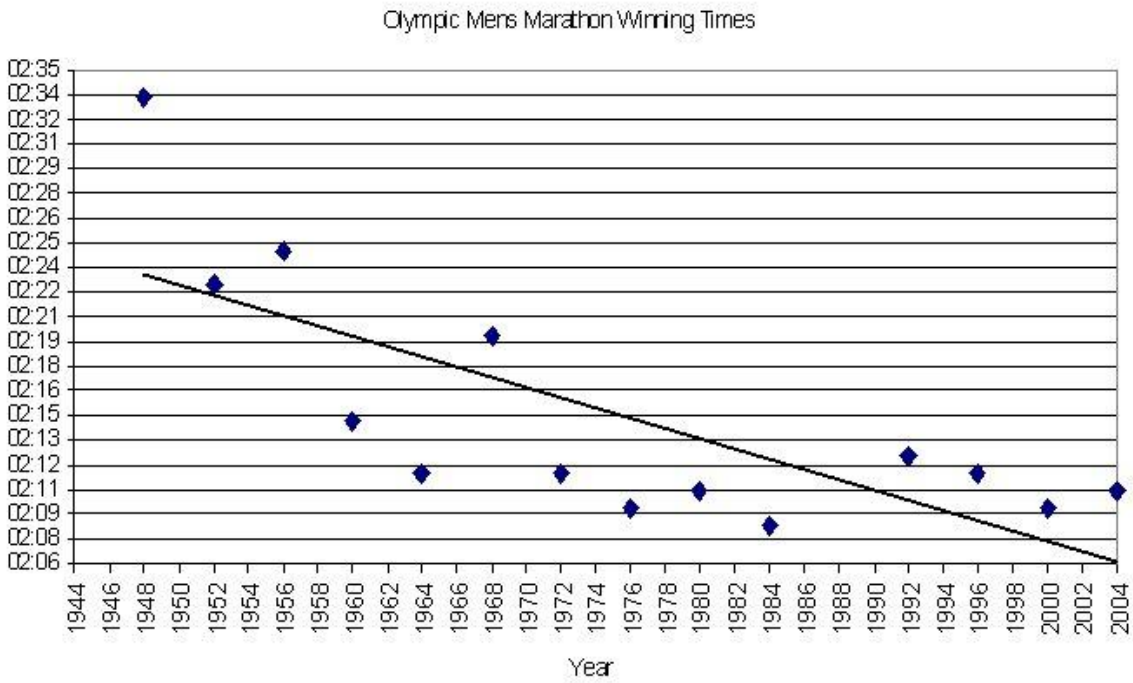
As the majority of points are fairly close to the line of best fit and the line has a downward slope, there is a fairly strong negative association between the two variables.

7.1 Speed should appear on the horizontal axis, as it is likely that the distance that it takes for a car to stop will be dependent on the speed at which it is travelling.

7.2 & 7.3




8.1 & 8.2 Year goes on the horizontal axis as the graph will then reflect the trend in winning ti
responsible for the changes in the winning times, it represents
the effect of the improvement in equipment, techniques and training
over the years on the winning time.
The scales should not start at 0 (which would make the graph too large), but should




8.3 The winning time predicted for 1988 ≈ 2 hours12 minutes.

# Section 4: Summarising Data

**(LB pages 266-269)**

## Overview

The content of this section on Displaying Data, as part of the Data Handling Application Topic, is drawn from page 84 in the CAPS document.

As stipulated in the CAPS document, Grade 11 learners need to be able to:

- calculate measures of central tendency (mean, median and mode) for two sets of data and compare the measures to explain differences between the data sets.
- calculate measures of spread (range) for two sets of data and compare the measures to explain differences between the data sets.
- decide which measure of central tendency is the most appropriate under a given set of circumstances.
- understand the impact of outliers on the accuracy of a measure of central tendency and/or spread.

Primary focus in Grade 10 was on learning how to calculate the measures of central tendency and spread. Primary focus in Grade 11 is now on using measures of central tendency and spread to compare different data sets or different components within a data set and to make deductions about the data.

## 1. Measures of central tendency: mean, median and mode

- Reminder: mean, median and mode provide an indication of the 'centre' of a data set, or an indication of the 'average' value in a data set – namely, a value in the data set that can be seen to be representative and stand for the majority of the values in the data set.

- Depending on the type of data being dealt with and the nature of the data, sometimes the mean is more appropriate than the others, but sometimes one of the others is more appropriate than the mean.

## 2. Measures of spread – Range

The Range of a data set provides an indication of how spread out the values in a data set are.

- However, it only becomes possible to see if the values in a data set are widely spread out when it becomes possible to compare the range for that data set to another data set. The spread of the values in a data set can provide important information about trends that exist within the data set – particularly about whether the values in the data set are quite similar or whether they are vastly different.

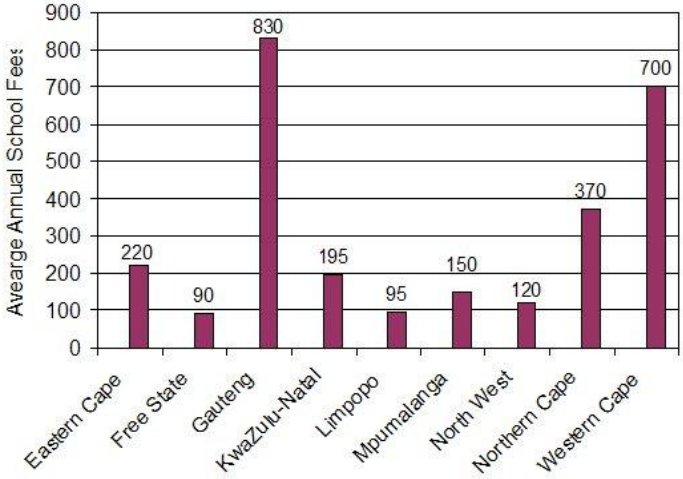
- The table on the next page shows some things to consider when trying to determine which measure – the mean, median or mode – provides the most accurate representation of the 'average' of a set of data:

| Measure | Method | Most accurate when ... | Influenced negatively by ... |
|---|---|---|---|
| Mean | $\frac{\text{sum of all values in a data set}}{\text{number of values in the data set}}$ | The mean is not affected by the data being grouped closely together or spread widely apart, but the mean is most accurate when there are no outliers in the data. | If there is an outlier on one end of the data set that is much higher or much lower than the other values, then the mean can become skewed (unrealistically high or low) and provide an inaccurate indication of the average value. |
| Median | Middle most value in a sorted data set:<br>• If there is an *odd* number of values in the data set then the median will be one of the values in the data.<br>• If there is an *even* number of values in the data set, then the median will lie between the two values that appear in the middle of the data. | The data is grouped closely together ⇢ then the middle most value still provides an accurate indication of the average value.<br><br>As the middle most value the median is also not affected by outliers (and so is more effective than the mean when there are outliers) | The median can become unrealistic if the data values are widely spread apart, because then the middle most value might not provide a realistic average for the values that lie far away from this middle value. |
| Mode | Value that occurs most often or frequently in a data set. | The mode is especially useful when it is important to know the object that occurs most often – for example, in the context of sales figures; or the dominant age group of people entering a shopping centre. | It is important to realise that just because a value occurs more often than other values does not mean that the value is representative of the majority of the values in the data.<br>For example, a modal height of 1,75 m does not account for the very many vastly different heights that occur amongst the patients. |
| Range | Highest value – lowest value | There are no outliers in the data set | If there are outliers in the data set then the range can appear to be unrealistically big or small. This can create an unrealistic impression of how spread-out/grouped or how similar/unlike the values in the data set are. |

As a general rule of thumb: calculate– the mean, median and mode – and then compare each measure to the other values in the data set to see which measure provides the best or most reflective indication of the majority of the values in the data set.

## Additional Questions

1. The graph below shows the average annual school fees for government schools per province in South Africa.




Determine the mean annual school fees in South Africa. (Assume for the purposes of this exercise that all the provinces have an equal number of schools.)

2. The table below contains the test scores of two Grade 11 classes in a recent mathematics test. The test was out of a total of 50 marks.

| Class 1 | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 44 | 25 | 18 | 37 | 48 | 22 | 15 | 33 | 38 | 36 | 29 | 30 | 42 | 24 | 35 |
| 26 | 29 | 41 | 32 | 19 | 15 | 38 | 43 | 20 | 26 | 25 | 33 | 38 | 40 | 36 |

| Class 2 | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 17 | 15 | 38 | 45 | 41 | 29 | 37 | 36 | 28 | 47 | 49 | 25 | 19 | 47 | 22 |
| 13 | 42 | 28 | 37 | 31 | 45 | 29 | 40 | 35 | 32 | 28 | 25 | 27 | 30 | 43 |

2.1 Calculate the mean of the test scores for both classes as a *mark out of 50* (if necessary, round answers off to two decimal places).

2.2 Calculate the mean of the test scores for both classes as a *percentage*.

2.3 Which class performed the best in the test?

3. Zandile employs 10 workers on his construction site. Below are the weekly wages of the 10 workers.

R250 ; R275 ; R200 ; R520 ; R260 ; R250 ; R250 ; R260 ; R200 ; R240

3.1 Calculate the mean, median and modal weekly wage of the workers.

3.2 Which indicator(s) provides the most realistic average weekly income of the workers? Explain.

3.3 Which indicator(s) provides an unrealistic average weekly income of the workers? Explain your answer.

In preparation for a party, Mrs.Ntuli asks her family and friends what their favourite food is. This will give Mrs.Ntuli an idea of what she should cook. The table below contains the responses of Mrs.Ntuli's family and friends.

| | | | |
|---|---|---|---|
| Themba | Putu | Molly | Chicken |
| Thandi | Ham | Sipho | Putu |
| Khosi | Vegetables | Gugu | Chicken |
| Mrs.Dlamini | Samp& Beans | Mr. Dlamini | Putu |
| Thandeka | Chicken | Musa | Samp and Beans |
| Bongani | Putu | Elizabeth | Beef |
| Rachel | Chicken | Philemon | Putu |
| Wiseman | Samp& Beans | Zuma | Beef |
| Jabulani | Putu | Moira | Chicken |
| Kagiso | Rice | Margaret | Ice-cream |

4.1 Which indicator should Mrs.Ntuli use to determine which food is the most popular?

4.2 Use this indicator to determine the 3 most popular food choices.

5. The table below contains data on the number of teachers in each province in South Africa.

| Province | Teachers |
|---|---|
| Eastern Cape | 2 116 426 |
| Free State | 686 155 |
| Gauteng | 1 661 817 |
| KwaZulu-Natal | 2 783 051 |
| Limpopo | 1 816 852 |
| Mpumalanga | 914 739 |

| | |
|---|---|
| North West | 891 036 |
| Northern Cape | 202 010 |
| Western Cape | 956 836 |

5.1 Calculate the mean number of teachers per province for all the provinces.

5.2 Calculate the median number of teachers per province for all the provinces.

5.3 Which indicator provides the best indication of the general distribution of teachers per province? Explain your answer.

6. Determine the range of the following sets of numbers:

6.1 5, 12, 7, 2, 4, 19, 8

6.2 103, 67, 92, 54, 18, 125, 36, 80

7. The list below contains the salaries of 20 employees at a local supermarket.

| | | | | |
|---|---|---|---|---|
| R3 256,40 | R2 894,12 | R2 543,20 | R3 412,55 | R3 010,15 |
| R2 900,00 | R2 245,78 | R3 127,50 | R2 780,90 | R3 354,60 |
| R2 651,20 | R2 748,50 | R3 400,20 | R3 005,18 | R2 432,90 |
| R2 780,60 | R2 856,45 | R3 010,30 | R2 105,20 | R2 908,26 |

7.1 Calculate the range of the salaries.

7.2 What does the range tell you about the difference in salaries between the employees – i.e. are some employees earning significantly more than others, or are all the employees earning similar salaries?

8. The tables below contain daily maximum temperatures for Durban and Cape Town for the same month.

| DURBAN | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 31°C | 28°C | 29°C | 33°C | 32°C | 27°C | 26°C | 29°C | 28°C | 31°C |
| 32°C | 30°C | 27°C | 32°C | 31°C | 28°C | 26°C | 26°C | 29°C | 27°C |
| 30°C | 32°C | 31°C | 33°C | 35°C | 32°C | 33°C | 31°C | 26°C | 28°C |
| **CAPE TOWN** | | | | | | | | | |
| 27°C | 29°C | 30°C | 29°C | 31°C | 32°C | 25°C | 22°C | 18°C | 20°C |
| 28°C | 30°C | 26°C | 29°C | 30°C | 32°C | 26°C | 25°C | 20°C | 16°C |
| 18°C | 18°C | 27°C | 28°C | 32°C | 30°C | 31°C | 31°C | 30°C | 29°C |

8.1 Determine the range of the temperatures for Durban and Cape Town for this month.

8.2 By referring to the ranges of the temperatures that you calculated for each city, make a deduction about which city experienced fairly stable temperatures and which city experienced large changes in temperature during the month.

## Answers

1. Mean school fees $= \frac{220+90+830+195+95+150+120+370+700}{9} = \frac{2770}{9}$

$= R307,78$

2.1 Class 1:

Mean test score $= \frac{44+25+18+37+48+22+15+...+38+40+36}{30}$

$= \frac{937}{30} = 31,23$ rounded off to two decimal places)

Class 2:

Mean test score $= \frac{17+15+38+45+41+29+37+...+27+30+43}{30}$

$= \frac{980}{30} = 32,67$ (rounded off to two decimal places)

2.2 *Class 1:* $\frac{31,23}{50} \times 100\% = 0,625 \times 100\% = 62,5\%$

*Class 2:* $\frac{32,67}{50} \times 100\% = 0,653 \times 100\% = 65,3\%$

2.3 Class 2 performed better, since their average mark was higher.

3.1 Mean weekly wage $= \frac{250+275+200+520+260+250+250+260+200+240}{10}$

$= \frac{2\ 705}{10} = R270,50$

Median: Data arranged in ascending order:

R200 ; R200 ; R240 ; R250 ; R250 ; R250 ; R260 ; R260 ; R275 ; R520

⇒ Median salary = half way between R250,00 and R250,00= R250,00

333Modal salary = salary that occurs most often = R250,00

3.2 The most useful indications of the average weekly wage are given by both the median and modal wage, each being R250,00. This is the salary that is earned by the majority of the workers and most of the rest of the workers earn wages that are similar to this figure. O3nly one worker earns a salary that is significantly different from this value.

3.3 The mean weekly wage provides an unrealistic indication of the average wage as the mean wage is R270,50 but only 2 people of the workers earned more than R270,00 while the remaining 8 workers earned less than R270,00. The mean average is distorted by the fact that one of the workers earns R520,00 which is significantly more than the other workers.

4.1 Mrs.Ntuli should use the modal average as this will show the most popular choice of food. It is actually impossible to use the mean or median average in this scenario.

4.2

| Food Choice | No. of people who chose this food |
|---|---|
| Putu | 6 |
| Ham | 1 |
| Vegetables | 1 |
| Samp& Beans | 3 |
| Chicken | 5 |
| Rice | 1 |
| Beef | 2 |
| Ice-cream | 1 |

The 3 most popular food choices are: Putu (6); Chicken (5); Samp& Bean (3)

5.1 Mean = (2 116 426 + 686 155 + 1 661 817 + 2 738 051 + 1 816 852 + 914 739 + 891 036 + 202 010 + 956 836) ÷ 9= $\frac{12\ 028\ 922}{9}$ = 1 336 547

5.2 Data arranged in ascending order:

| Province | Teachers |
|---|---|
| Northern Cape | 202 010 |
| Free State | 686 155 |
| North West | 891 036 |
| Mpumalanga | 914 739 |
| Western Cape | 956 836 |
| Gauteng | 1 661 817 |
| Limpopo | 1 816 852 |
| Eastern Cape | 2 116 426 |
| KwaZulu-Natal | 2 783 051 |

→ The median number of teachers is 956 836.

5.3 The mean average would be better, since it takes into account the extreme values of KwaZulu-Natal and Northern Cape.

6.1 Range = 19 – 2 = 17

6.2 Range = 125 – 18 = 107

7.1 Range = R3 412,55 – R2 245,78 = R1 166,77

7.2 The range is very high. This indicates that some workers are earning much more than other workers.

8.1 Durban Range = 35°C – 26°C = 9°C

Cape Town Range = 32°C – 16°C = 16°C

8.2 Durban had more stable temperatures since the range between the highest and lowest temperatures was only 9°C. This means that there was not much change in temperature over this one month period.

Cape Town had much less stable weather, with a range of 16°C indicating that the temperature changed by 16°C during the course of the month.

# Introduction

In this part of the study guide you will be provided with an analysis of the Paper 1 and Paper 2 practice examination papers provided on pages 290-297 in the Learner's Book. The intention of this exam analysis is to provide you with insight into

- how the examination papers for this subject are structured,
- how the different levels of the Mathematical Literacy taxonomy are used to inform the structure of the examinations, and
- how to determine the intention of each question and the content and method needed to complete each question.

Before the exam analysis is provided, the discussion below will first highlight the structure of the examination papers in Mathematical Literacy.

# Required structure of the examinations

## 1. Difficulty level of each examination paper

There are two examination papers in Grade 11 in Mathematical Literacy. These two examinations are differentiated according to difficulty (i.e. cognitive demand):

- Paper 1 is a 'basic skills' paper and the intention of this paper is to assess whether learners understand basic concepts and skills. The contexts used in this paper must be drawn from the contexts described in the CAPS curriculum document.
- The Paper 1 examination paper in the Learner's Book appears on pages 290-293.
- Paper 2 is an 'applications' paper and the intention of this paper is to assess whether learners can use their knowledge and skills in order to make sense of a variety of real-world contexts. The contexts used in this paper can be drawn from any scenario, including those listed in the CAPS curriculum document.
- The Paper 2 examination paper in the Learner's Book appears on pages 294-297.

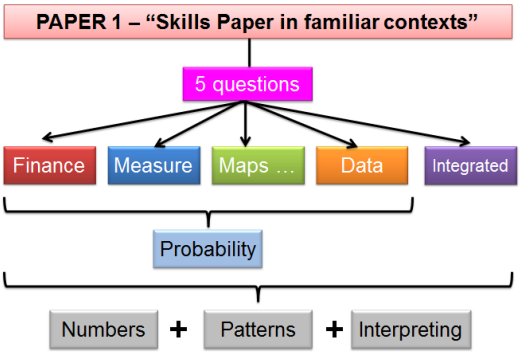
In Mathematical Literacy there is a four-level taxonomy that determines the level of cognitive demand of a question in an examination. The table on the next page shows the percentage of marks in the Paper 1 and Paper 2 examination papers that must be allocated to each of levels of the taxonomy.

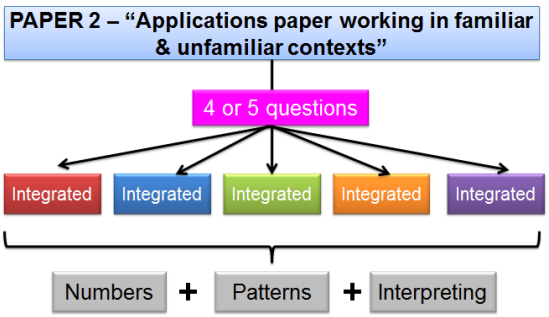
| | Grades 11 and 12 | | |
|---|---|---|---|
| | Paper 1 | Paper 2 | Overall allocation |
| Level 1: Knowing | 60% (± 5%) | | 30% (± 5%) |
| Level 2: Applying routine procedures in familiar contexts | 35% (± 5%) | 25% (± 5%) | 30% (± 5%) |
| Level 3: Applying multi-step procedures in a variety of contexts | 5% | 35% (± 5%) | 20% (± 5%) |
| Level 4: Reasoning and reflecting | | 40% (± 5%) | 20% (± 5%) |

Notice that Paper 1 contains questions positioned primarily at the two lowest levels (Level 1 and Level 2) of the taxonomy. This is why the paper is classified as a basic skills paper. Paper 2 contains questions positioned primarily at the two highest levels of the taxonomy (Levels 3 and 4), which is why the paper is classified as an applications paper. However, Paper 2 also contains a smaller percentage of questions positioned at Level 2 of the taxonomy, designed to provide scaffolding and facilitate access to the more complex Level 3 and 4 questions.

## 2. Question structure of each examination paper

The diagrams below illustrate the structure of the Paper 1 and 2 examinations.




In Paper 1 there must be a question allocated to each of the first four Application Topics outlined in the curriculum. The final question must then draw on content and contexts integrated from a range of different Application Topics. The topic of Probability must be assessed in the context of one or more of the other questions. And the Basic Skills Topics will be assessed in the context of the other questions and no individual questions are allocated to the assessment of the contents of the Basic Skills Topics.

In Paper 2 each question must draw on integrated content, contexts and skills drawn from across the various Application Topics. As in Paper 1, the Basic Skills Topics will be assessed in the context of the other questions and no individual questions are allocated to the assessment of the contents of the Basic Skills Topics.

## 3. Mark allocations for examinations in Grades 10, 11 and 12

The table below shows the mark and time stipulations for Mathematical Literacy examinations in Grades 10, 11 and 12.

| | GRADE 10 | | GRADE 11 | | GRADE 12 | |
|---|---|---|---|---|---|---|
| TERM 1 | Control Test | | Control Test | | Control Test | |
| TERM 2 | Paper 1<br>1 hour<br>(50 marks) | Paper 2:<br>1 hour<br>(50 marks) | Paper 1:<br>1½ hours<br>(75 marks) | Paper 2:<br>1½ hours<br>(75 marks) | Paper 1:<br>2 hours<br>(100 marks) | Paper 2:<br>2 hours<br>(100 marks) |
| TERM 3 | Control Test | | Control Test | | Control Test<br>Paper 1:<br>3 hours<br>(150 marks) | Control Test<br>Paper 2:<br>3 hours<br>(150 marks) |
| TERM 4 | Paper 1<br>1½ hours<br>(75 marks) | Paper 2<br>1½ hours<br>(75 marks) | Paper 1:<br>2 hours<br>(100 marks) | Paper 2:<br>2 hours<br>(100 marks) | Nationally set examination<br>Paper 1:<br>3 hours<br>(150 marks) | Paper 2:<br>3 hours<br>(150 marks) |

The examination papers in the Learner's Book reflect the structure of end-of-year examination papers for Grade 11. The examination papers are both out of 100 marks with a time allocation of 2 hours per paper. The examination papers also assess the content covered for the whole curriculum (and/or for the contents of the whole Learner's Book).

## 4. Explaining the exam analysis

An exam analysis is provided in the pages that follow. This exam analysis will provide guidance on:

- the topic and section to which each question relates in the curriculum;
- the content, skills or contexts required to answer each question;
- the taxonomy level (level of difficulty or cognitive demand) of each question;
- the mark allocation of each question.

To begin with, it is useful to consider the following table which shows the percentage of marks allocated to each of the levels of the taxonomy in both examination papers.

| | Paper 1 | | Paper 2 | | Combined | |
|---|---|---|---|---|---|---|
| **Taxonomy Level** | **% of paper** | **Required** | **% of paper** | **Required** | **%** | **Required** |
| Level 1 – Knowing | 49% | 60% (±5%) | 4% | 0% (±5%) | 26,5% | 30% |
| Level 2 – Routine procedures | 43% | 35% (±5%) | 24% | 25% (±5%) | 33,5% | 30% |
| Level 3 – Multi-step procedures | 8% | 5% (±5%) | 27% | 35% (±5%) | 17,5% | 20% |
| Level 4 – Reasoning and reflecting | 0 | 0% (±5%) | 45% | 40% (±5%) | 22,5% | 20% |

Analysis of the values in this table reveals the following:

- In Paper 1:
  - The allocation of Level 1 questions is below the required percentage.
  - The allocation of Level 2 questions is quite high above the required percentage.
  - This suggests that the examination paper is possibly more difficult than it should be.
- In Paper 2:
  - There is an allocation of marks to Level 1 questions, which should not be in the paper.
  - The allocation of Level 3 questions is significantly below the required percentage.
  - This suggests that the examination paper is possibly easier than it should be.
- Both papers combined:
  - Although the information in the analysis grid above suggests that Paper 1 is slightly more difficult and Paper 2 slightly easier than they ideally should be, the combination of the two papers gives an allocation of marks at the different levels of the taxonomy that falls within the required stipulations.
  - This suggests that when the marks for both papers are combined the result should be a reasonably accurate reflection of the ability / performance of the learners.

# Grade 11 Mathematical Literacy

# Paper 1

# (Basic Skills Paper)

**100 Marks** **2 Hours**

Read these instructions carefully.

- Answer all the questions.
- It is advisable to show all working and to work neatly.
- You may use a calculator.
- Drawings are NOT to scale (unless otherwise stated).

## QUESTION 1: SALARY SLIP

This is Solomon's salary slip. There seems to be something wrong with the payslip programme which has affected the deductions.

Answer the following questions in order to calculate the missing information:

Clothing Connection
*Payslip*

**Employee:** S. Mbanje Pay Period: Oct. 2011
ID No: 7215128002080 Pay cycle: Monthly
Bank Details: Go Bank
a/c no: 456 8796 566
Tax number: 22356894

| arnings | Amount | Deductions | Amount |
|---|---|---|---|
| Basic Salary | R 7 620,00 | Income Tax<br>UIF<br>Xmas Fund | X&%^&&<br>**()$%%<br>R 80.00 |
| **Gross Earnings** | **R 7 620,00** | **Total Deductions** | ****&*&^^** |
| **NET SALARY TRANSFERRED** | | | ***&&%%^^** |

1.1 Explain the difference between Gross Salary (Earnings) and Net Salary. [2]

1.2 1.2.1 Show that Solomon's total annual gross salary is R91 440,00. [2]

1.2.2 Income tax on Solomon's salary is worked out according to the following equation:

$$Annual\ Income\ tax = 18\%\ of\ Annual\ Gross\ Salary - R10\ 755{,}00$$

Calculate Solomon's total annual income tax using the above formula. [3]

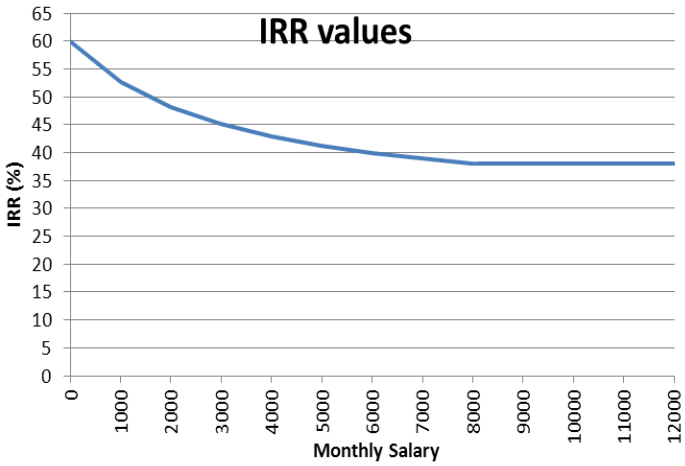
1.2.3 Calculate the amount that will appear on his payslip as his monthly income tax deduction. [2]

1.3 1.3.1 The employee UIF contribution is calculated at 1% of gross monthly salary for Solomon. Calculate the amount that will be deducted from his salary per month for UIF. [2]

1.3.2 Using your previous answers, calculate the Net Salary that will be transferred into Solomon's account. [3]

1.4 When an employee claims UIF, they are paid a daily benefit based on their salary and an IRR (Income Replacement Rate) factor. The IRR factor can be read off the following graph:

1.4.1 Read off the approximate IRR value for a person who earnsR6 000,00 per month. [2]




1.4.2 There is a minimum IRR value that applies to all people with high monthly salaries. Use the graph to determine the approximate value of this IRR rate. [2]

1.4.3 Solomon's IRR value is 38,388%. If he were to be unemployed, he would beable to claim a monthly amount calculated as follows:

$$Monthly\ Income = IRR \times Gross\ Monthly\ Salary$$

Calculate the monthly income that Solomon would receive from the UIF. [3]

1.4.4 According to the UIF rules, you may claim one day's income for every six days that you have worked. For how many days could Solomon claim if he has worked for his company for a total of 852 days? [2]

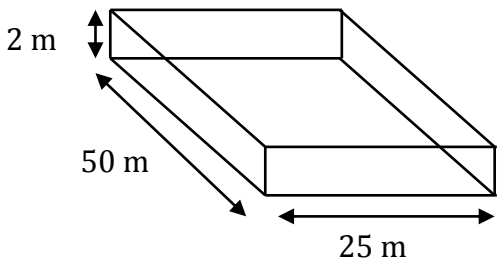
**[23]**

## QUESTION 2:VOLUME

2.1 The Midmar Dam is situated near Howick in KwaZulu-Natal in South Africa.

2.1.1 The volume of the dam is said to be approximately two hundred and thirty five million, four hundred thousand cubic metres. Write this number in figures. [2]

2.1.2 An Olympic swimming pool has the dimensions shown alongside:




Use the formula for volume of a rectangular prism to calculate its volume in m3:

$Volume = length \times breadth \times height$

[3]

2.1.3 How many Olympic size swimming pools could be filled using water from a full Midmar Dam? [2]

2.2 The sketch of a cylinder alongside is similar to an American Coke can. The diameter of the can is 2,5 inches and the height is 4,75 inches.
It claims to contain 12 fluid ounces (fl. oz.) of Coke.

| 1 inch = 2,54 cm | 1 fl. Oz = 29,57353 mℓ |
|---|---|

2.2.1 Convert 4,75 inches into cm. [2]

2.2.2 The diameter of the can converts to 6,25 cm. Calculate the volume of cold drink that this specific can contains as if it were a cylinder. Round your answer to the nearest cm3. [4]

Use the following formula:

$Volume = \pi \times radius^2 \times height$ ($\pi$ = 3,142)

2.2.3 If a can only contains 95% of its maximum volume (due to the gas inside), calculate the actual amount of cold drink that will be found inside the can to the nearest mℓ [3]
(1 mℓ= 1 cm3)

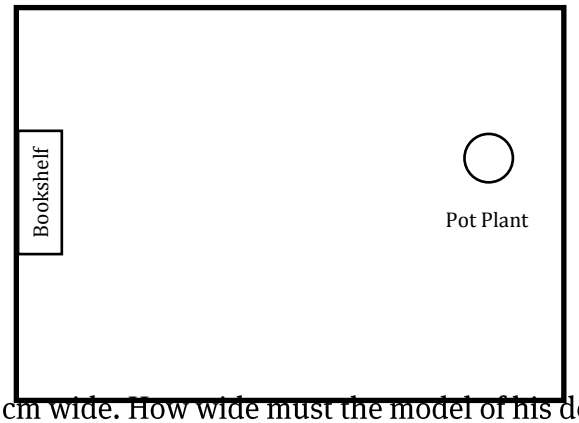
2.2.4 Convert the answer from question 2.2.3 into fluid ounces. [2]

2.2.5 Calculate the percentage that your answer in question 2.2.4 differs from the stated volume of 12 fl. Oz. [3]

**[21]**

## QUESTION 3: MAPS AND PLANS

A business man is thinking of changing the layout of his office and has created a small plan with movable furniture:

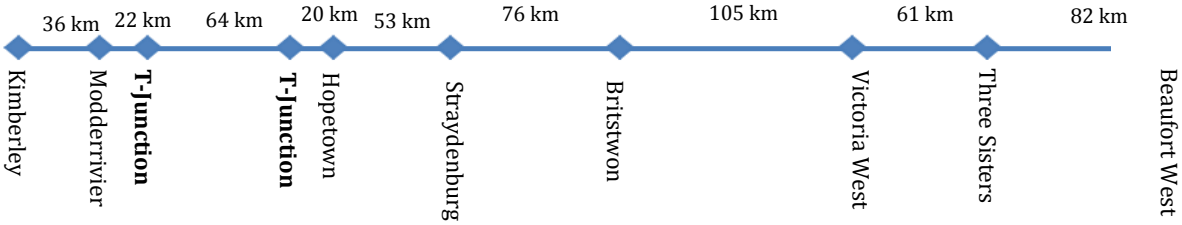



3.1 The scale of his drawing is 1:25. Explain what this means. [2]

3.2 He would like to make a model of his desk to put into the drawing. His desk is 265 cm wide. How wide must the model of his des

3.3 The long wall of the drawing measures 18 cm. Using the scale of 1:25, calculate the length of the wall in real life (answer in metres). [4]

3.4 A motorist is travelling from Kimberley to Beaufort West. Here is a strip map indicating the distances between stops:




3.4.1 What is the distance between Kimberley and Hopetown? [2]

3.4.2 The distance between Britstown and Three Sisters is 171 km. The motorist is travelling at an average speed of 90 km/h. How long will it take to drive from Britstown to Three Sisters? Give your answer to the nearest minute. [4]

**[14]**

## QUESTION 4: DATA, DATA EVERYWHERE

4.1 In a small survey, 22 people were asked the number of times in the month they had driven a car after consuming alcohol. The results were:

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 1 | 0 | 3 | 5 | 8 | 3 | 0 | 0 | 0 | 4 |
| 3 | 2 | 5 | 2 | 4 | 2 | 0 | 5 | 2 | 3 | 0 |

4.1.1 Summarise the above data in a frequency chart. [3]

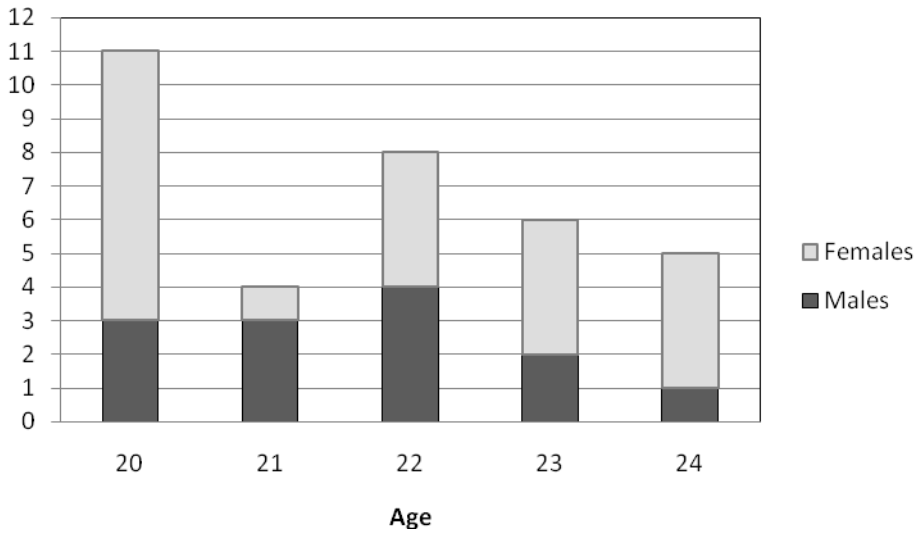
4.1.2 Calculate the mean for the above data. [3]

4.1.3 Give the mode for the above data and give a definition for the term 'mode'. [2]

4.1.4 Calculate the median for the above data. [2]

4.1.5 Calculate the probability of someone from the above sample saying that they have driven a car (after consuming alcohol) at least 5 times in a month. [2]

4.2 The graph below shows the numbers of males and females aged between 20 and 24, who work for a particular company.




4.2.1 Which of the age groups has the largest percentage of females? Show calculations to prove your answer. [4]

4.2.2 What percentage of the females shown in the graph are 23 years old? [3]

4.2.3 5% of the company employees are 23 years old. How many employees in total work for the company? [3]

**[22]**

## QUESTION 5: HARRY'S HAIR

Harrison Gumede (Hairy Harry to his friends) is planning to set up a male haircutting booth near a local taxi rank.
He needs to analyse whether it is a viable business or not.
Sources: arjay.typepad.com; http://www.gandhiappliances.com

5.1 5.1.1 Harry can do a basic man's trim with his electric shaver in 10 minutes. Convert 10 minutes into hours as a decimal rounded to 4 decimal places (e.g. 30 minutes = 0,5000 hours). [2]

5.1.2 In order to work out the electricity usage, he needs to convert the wattage of his shaver into kiloWatts. Convert 13 Watts into kiloWatts. (Hint: 1 000 grams = 1 kilogram). [2]

5.1.3 We calculate the units of electricity using the following formula:

Units of electricity = Power of appliance (in kiloWatts) × time (in hours)

Use the equation above to work out how many units of electricity Harry uses for a basic men's trim. [2]

5.1.4 He estimates that he will use approximately 2 units of electricity per day. He will pay the owner of the neighbouring booth R100 per month for electricity. Electricity costs R1,20 per unit. Harry plans to operate his booth for 25 days out of every month. How much will he overpay the owner of the neighbouring booth for electricity? [4]

5.2 5.2.1 He will pay R500 to the municipality per month for the use of the booth, R100 for his electricity (as mentioned before) and he expects to have additional costs that total R2 000 per month.
Calculate his total costs. [2]

5.2.2 He estimates that he will do an average of 20 haircuts per day. He plans to charge an average of R30 per cut. How much income would he make in a month? [3]

5.2.3 Using your previous two answers, calculate his percentage profit per month. [3]

5.3 Explain what the word 'average' means in question 5.2.2. [2]

**[20]**

# Paper 1: Marking Guidelines

The following table shows the percentage of marks allocated to each of the levels of the taxonomy in this Paper 1 examination paper.

| | Paper 1 | |
|---|---|---|
| **Taxonomy Level** | **% of paper** | **Required** |
| Level 1 – Knowing | 49% | 60% (±5%) |
| Level 2 – Routine procedures | 43% | 35% (±5%) |
| Level 3 – Multi-step procedures | 8% | 5% (±5%) |
| Level 4 – Reasoning and reflecting | 0 | 0% (±5%) |

| Question | Working | Taxonomy Level and Marks | | | | Comment / analysis | |
|---|---|---|---|---|---|---|---|
| | | TL 1 | TL 2 | TL 3 | TL 4 | | |
| 1.1 | Gross salary is the raw salary without deductions√a, while the net salary is the amount remaining after deductions.√a | 2 | | | | *Topic ⇢ Finance; Section ⇢ financial documents* | This question is assessing knowledge of the difference between gross and net salary and the ability to make sense of a particular financial document (i.e. a payslip). |
| 1.2.1 | Annual Salary = R7 620,00 × 12√m<br>= R91 440,00√a | 2 | | | | | Testing understanding of the term "annual". |
| 1.2.2 | Annual Tax = 0,18 × R91 440√m - R10 755<br>= R16 459,20√a - R10 755,00<br>= R5 704,20√ca | | 3 | | | | This question tests ability to substitute a value into a financial formula. |

| Question | Working | Taxonomy Level and Marks | | | | Comment / analysis | |
|---|---|---|---|---|---|---|---|
| | | TL 1 | TL 2 | TL 3 | TL 4 | | |
| 1.2.3 | Monthly Income Tax = R5 704,20 ÷ 12√m<br>= R475,35√a | 2 | | | | | Testing understanding of the ability to convert from an annual to a monthly value. |
| 1.3.1 | UIF = 1% ×√m R7 620,00 = R76,20√a | 2 | | | | *Topic ⇢ Finance; Section ⇢ taxation*<br>• Testing understanding of UIF and how to calculate a UIF value.<br>• Understanding of percentage calculations also required. | |
| 1.3.2 | Net Salary<br>= R7 620,00 –√m(475,35 + R76,20 + R80,00√m)<br>= R7620,00 – R631,55<br>= R6 988,45√a | 3 | | | | *Topic ⇢ Finance; Section ⇢ financial documents*<br>This question tests understanding of the concept of Net Salary and of how to calculate a Net Salary. | |
| 1.4.1 | It is approximately 40%√√ | | 2 | | | *Topic ⇢ Finance; Section ⇢ UIF*<br>*Topic ⇢ Patterns, relationships …; Section ⇢ interpreting graphs* | This question is testing ability to read information from a financial graph. |
| 1.4.2 | The value is 38%√√ | | 2 | | | | This question tests the additional concept of the understanding of the term 'minimum' with respect to the lowest point on a graph. |

| Question | Working | Taxonomy Level and Marks | | | | Comment / analysis |
|---|---|---|---|---|---|---|
| | | TL 1 | TL 2 | TL 3 | TL 4 | |
| 1.4.3 | Monthly Income = IRR x Gross monthly Income<br>= 38,388% x R7 620,00√√m<br>= R2 925,17√a | | 3 | | | *Topic ⇢ Finance; Section ⇢ Taxation*<br>Testing the ability to substitute a value into an unfamiliar financial formula. |
| 1.4.4 | 852 days ÷ 6 days√m = 142 UIF days√a | 2 | | | | • Topic → Finance; Section → Taxation<br>• Topic → Numbers; Section → Number operations<br>Testing ability to perform a calculation involving a division of financial values. |
| 2.1.1 | 235 400 000√√a | 2 | | | | *Topic → Numbers; Section → Number formats*<br>• Testing understanding of different number formats and how to translate from words to numbers. |
| 2.1.2 | Volume = length × width × height<br>= 50 m × 25 m × 2 m√m<br>= 2 500√a $m^3$√units | | 3 | | | *Topic ⇢ Measurement; Section ⇢ Calculating volume*<br>Testing ability to determine the volume of a rectangular container. |
| 2.1.3 | No. of pools = 235 400 000 $m^3$ ÷ 2 500 $m^3$√m<br>= 94 160√a | 2 | | | | • Topic → Measurement; Section → Calculating volume<br>• Topic → Numbers; Section → Number operations<br>Testing ability to perform a calculation involving a division of volume values. |
| 2.2.1 | 4,75 inch ×√m 2,54 cm/inch = 12,07 cm√a | 2 | | | | *Topic ⇢ Measurement; Section ⇢ Conversions*<br>Testing ability to convert |

| Question | Working | Taxonomy Level and Marks | | | | Comment / analysis |
|---|---|---|---|---|---|---|
| | | TL 1 | TL 2 | TL 3 | TL 4 | |
| | | | | | | between different units of measurement (and/or different systems) using a given conversion factor. |
| 2.2.2 | Volume = π × $r^2$ × h<br>= 3,14 × (3,175 cm✓a)$^2$ × 12,07cm✓m<br>= 382,054 $cm^3$✓ca<br>≈ 382 $cm^3$✓a (rounding) | | 4 | | | *Topic ⇢ Measurement; Section ⇢ Calculating volume*<br>Testing ability to determine the volume of a cylindrical container + understanding of the need to convert from a diameter to a radius. |
| 2.2.3 | Amount of drink = 95% ×✓m<br>382 = 362,9 $cm^3$✓a<br>= 363 m✓ca | 3 | | | | • Topic → Numbers; Section → Number operations<br>• Topic → Measurement; Section → Conversions<br>Testing ability to:<br>• calculate a percentage of a value;<br>• convert between different systems of measurement using a given conversion factor. |
| 2.2.4 | Fluid ounces = 363 mℓ÷✓m<br>29,57353fl.OZ/ml<br>= 12,27fl. Oz✓a | 2 | | | | • Topic → Measurement; Section → Conversions<br>Testing ability to convert between different systems of measurement using a given conversion factor. |
| 2.2.5 | Difference = 0,27<br>% difference = difference ÷ 12 fl. Oz x 100<br>= 0,27✓a ÷ 12 fl. Oz x 100✓m<br>= 2,25 %✓ca | | 3 | | | *Topic ⇢ Numbers; Section ⇢ Percentages*<br>Testing ability to express a value as a percentage in the context of a calculation involving measurement values. |

| Question | Working | Taxonomy Level and Marks | | | | Comment / analysis | |
|---|---|---|---|---|---|---|---|
| | | TL 1 | TL 2 | TL 3 | TL 4 | | |
| 3.1 | This means that 1 unit on the drawing is equal to 25 units in real life.√√ | 2 | | | | *Topic ⇢ Maps, plans and other represent ations; Section ⇢ Scale* | Testing understanding of what scale represents. |
| 3.2 | M R<br>1 : 25<br>**10,6 cm√m√a** : 265 cm | | 2 | | | | Testing understanding of ability to use a given scale and an actual dimension to determine a measured value on a plan: i.e. *from actual to measured.* |
| 3.3 | M R<br>1 : 25<br>18 cm : **450 cm√√m√a**<br>450 cm ÷ 100 = 4,5 m√ca | | 4 | | | | This question is the reverse of Q3.2 ⇢ i.e. this question tests ability to use a given scale and a measured value to work out an actual dimension: *from measured to actual.* |
| 3.4.1 | Total Dist. = 36 km + 22 km + 64 km + 20 km√m<br>= 142 km√a | 2 | | | | *Topic ⇢ Maps, plans and other representations; Section ⇢ Maps*<br>Testing ability to make sense of the information shown on a strip-chart and to use that information to solve a problem. | |
| 3.4.2 | Hours = 171 km ÷√m 90 km/h = 1,9 hours√a<br>Time = 1 hour + 0,9 x 60 minutes√m<br>= 1 hour 54 minutes√ca | | | 4 | | • Topic → Maps, plans and other representations; Section → Maps<br>• Topic → Numbers; Section →Rates (i.e. speed)<br>• Topic → Measurement; | |

| Question | Working | Taxonomy Level and Marks | | | | Comment / analysis | |
|---|---|---|---|---|---|---|---|
| | | TL 1 | TL 2 | TL 3 | TL 4 | | |
| | | | | | | Section → Conversions<br>Testing ability to use understanding of speed to determine the length of a trip; and to convert time values from hours into minutes. | |
| 4.1.1 | **No. Frequency**<br>0 6<br>1 1<br>2 4<br>3 5<br>4 2<br>5 3<br>6 0<br>7 0<br>8 1<br>Total: 22<br>√m √√a | 3 | | | | *Topic ⇢ Data Handling; Section ⇢ Organising data*<br>Testing ability to organise data into a frequency table. | |
| 4.1.2 | Mean = 47 ÷√m 22√a = 2,14 times√ca | 3 | | | | *Topic ⇢ Data Handling ; Section ⇢ Measuring data* | Testing ability to calculate a mean measure |
| 4.1.3 | Mode = o√a. It is the value that occurs most often in the data set. √a | 2 | | | | | Testing ability to identify a modal measure and understanding of what a modal measure is. |
| 4.1.4 | Data is already ordered in frequency table:<br>Median occurs between 2 & 3:<br>Therefore median = (2 + 3) ÷ 2√m = 2,5 times√a | 2 | | | | | Testing ability to calculate a median measure for a data set that contains an *even* number of data values. |

| Question | Working | Taxonomy Level and Marks | | | | Comment / analysis | |
|---|---|---|---|---|---|---|---|
| | | TL 1 | TL 2 | TL 3 | TL 4 | | |
| 4.1.5 | 4√a out of 22√a | | 2 | | | *Topic ⇢ Probability; Section ⇢ Expressions of probability*<br>Testing understanding of what probability is and of how to describe or express the probability of an event. | |
| 4.2.1 | 20 years of age: 8 ÷ 11 = 72,72%<br>21 years of age: 1 ÷ 4 = 25%<br>22 years of age: 4 ÷ 8 = 50%<br>23 years of age: 4 ÷ 6 = 67%√√√m<br>24 years of age: 4 ÷ 5 = 80%√a | | 4 | | | *Topic ⇢ Data Handling ; Section ⇢ Representing data*<br><br>*Topic ⇢ Numbers ; Section ⇢ Percentages* | • Interpreting and reading information from a vertical stack bar graph.<br>• Using this information and the percentage calculation involving expressing a comparison of values as a percentage to make deductions about a data set. |
| 4.2.2 | 23 year old females: 4<br>Total females: 21<br>% of females who are 23 = 4 ÷ 21 x 100√√m<br>= 19,05%√a | | 3 | | | | • Interpreting and reading information from a vertical stack bar graph.<br>• Adding together the different components for one |

| Question | Working | Taxonomy Level and Marks | | | | Comment / analysis | |
|---|---|---|---|---|---|---|---|
| | | TL 1 | TL 2 | TL 3 | TL 4 | | |
| | | | | | | | category of the data.<br>• Using this information and the percentage calculation involving expressing a comparison of values as a percentage. |
| 4.2.3 | Total 23 year olds = 6√a<br>**No. of people** **%**<br>6 : 5<br>120√m√a : 100 | | 3 | | | *Topic ⇢ Data Handling ; Section ⇢ Representing data*<br>*Topic ⇢ Numbers ; Section ⇢ Proportion* | • Interpreting and reading information from a vertical stack bar graph.<br>• Using the notion of proportion to determine an answer that is dependent on a larger value that is not shown on the graph. |
| 5.1.1 | 10 mins ÷√m 60min/h = 0,1667 hours√a | 2 | | | | *Topic ⇢ Measurement; Sections ⇢ Conversions and Time*<br>*Topic ⇢ Numbers; Section ⇢ Rounding*<br>*Topic ⇢ Finance; Section ⇢ Tariff systems*<br>Testing ability to convert a time value from minutes into hours | |

| Question | Working | Taxonomy Level and Marks | | | | Comment / analysis |
|---|---|---|---|---|---|---|
| | | TL 1 | TL 2 | TL 3 | TL 4 | |
| | | | | | | and then to round the answer to a specified number of decimal places. |
| 5.1.2 | 13 Watts ÷√m 1 000 kW/W = 0,013 kW√a | 2 | | | | *Topic → Numbers; Section → Number formats*<br>*Topic → Finance; Section → Tariff systems (electricity)*<br>Testing understanding of different number systems and specifically of the meaning of the term 'kilo' as equating to a denomination of 1 000 (in the context of an electricity tariff system, which is a Finance context). |
| 5.1.3 | Units of electricity = 0,013 kW ×√m 0,1667 hrs<br>= 0,0022 units√a | | 2 | | | *Topic ⇢ Patterns, relationships and representations; Section ⇢ Equations*<br>*Topic ⇢ Finance; Section ⇢ Tariff systems*<br>Testing ability to substitute a value into a potentially unfamiliar formula relating to an electricity tariff system (which is a Finance context). |
| 5.1.4 | Total paid for electricity = 2 x R1,20 x 25 days√m<br>= R60,00√a<br>So he overpays by R100 –√m R60,00<br>= R40,00√ca | | | 4 | | *Topic ⇢ Numbers; Section ⇢ Number operations*<br>*Topic ⇢ Finance; Section ⇢ Tariff systems (electricity)*<br>Calculating electricity costs using various operations and making a comparison. |
| 5.2.1 | Total costs = R2 000 + R500 + R100√m | 2 | | | | *Topic ⇢ Finance; Section ⇢ Income and expenditure* |

| Question | Working | Taxonomy Level and Marks | | | | Comment / analysis |
|---|---|---|---|---|---|---|
| | | TL 1 | TL 2 | TL 3 | TL 4 | |
| | = R2 600√a | | | | | Testing understanding of the concept of expenditure and how to determine the expenses involved in running a business. |
| 5.2.2 | Total income = 20 cuts x 25 days x R30√√m<br>= R15 000√a | 3 | | | | *Topic ⇢ Finance; Section ⇢ Income and expenditure*<br>Testing understanding of the concept of income and how to determine the income generated in running a business. |
| 5.2.3 | Percentage profit = Profit ÷ costs x 100<br>= (15 000 - 2 600√m) ÷√m 2 600 x 100<br>= 476,92%√a | | 3 | | | *Topic ⇢ Finance; Section ⇢ Income, expenditure, profit and profit margin*<br>*Topic ⇢ Numbers; Section ⇢ Percentages*<br>• Testing understanding of what profit is and how to calculate profit.<br>• Plus testing understanding of how to determine percentage profit using a number calculation involving expressing a comparison of two values as a percentage. |
| 5.3 | Average means that he could have done more on some days and less on others. √√a | 2 | | | | *Topic ⇢ Data Handling; Section ⇢ Measuring data*<br>Testing understanding of what an average is and what an average represents. |
| | **Total (%)** | **49 %** | **43 %** | **8 %** | **0 %** | |

# Grade 11 Mathematical Literacy

# Paper 2

# (Applications Paper)

**100 Marks** **2 Hours**

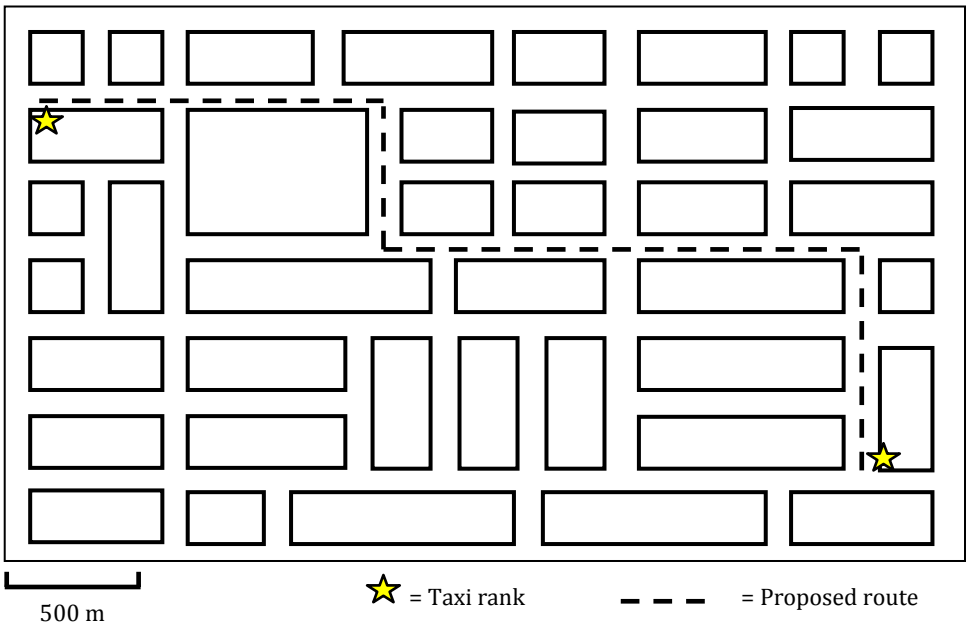
Read these instructions carefully.

- Answer all the questions.
- It is advisable to show all working and to work neatly.
- You may use a calculator.
- Drawings are NOT to scale (unless otherwise stated).

## QUESTION 1: TAXI DRIVER

Monwa wants to start a taxi business. He can buy a second-hand taxi for R 180 000 from a friend and operate the taxi himself. First he needs to check whether it will be a viable business.

1.1 There is a licence available for a route in town:




1.1.1 He will need to know the total distance for his route. Explain how he would [2]

use the map above to work out the total distance of his route.

1.1.2 The speed limit in town is 60 km/h, but he will probably only be able to travel at an average speed of 30 km/h even though there is nothing wrong with his vehicle. What could cause him to travel so much slower than the speed limit? Give TWO reasons. [2]

1.1.3 He calculates that his route is approximately 4,5 km long. Calculate how long one trip from one taxi rank to the other will take at an average speed of 30 km/h. Answer to the nearest minute. [3]

1.2 Monwa calculates that he will have to drive approximately 150 km per day in his taxi. He plans to operate his taxi 5 days per week for the whole year. Calculate the total distance that he will drive in his taxi in a year. [3]

1.3 According to the AA website (www.aa.co.za), it will cost Monwa R3,33 / km to operate his vehicle (including repairs, tyres and petrol). Besides this cost, he also has to pay his doorman (the man who opens the door and collects the money) R200,00 per day and he has to pay the taxi association R150 per day as a licence for the route.
His total costs per day can be summarised by the following equation:

$$Total\ daily\ cost = R15{,}00 \times no.\ of\ trips + R350{,}00$$

Explain where each of the numbers in the equation comes from. [3]

1.4 The fare for his route is R4,00 per person. He can carry a maximum of 13 people in his taxi (legally!) and the route is very busy so he will always be full. Write an equation for his total daily income depending on the no. of trips that he does in a day. [2]

1.5 Draw graphs of the equations for daily cost and daily income on the same set of axes. [7]

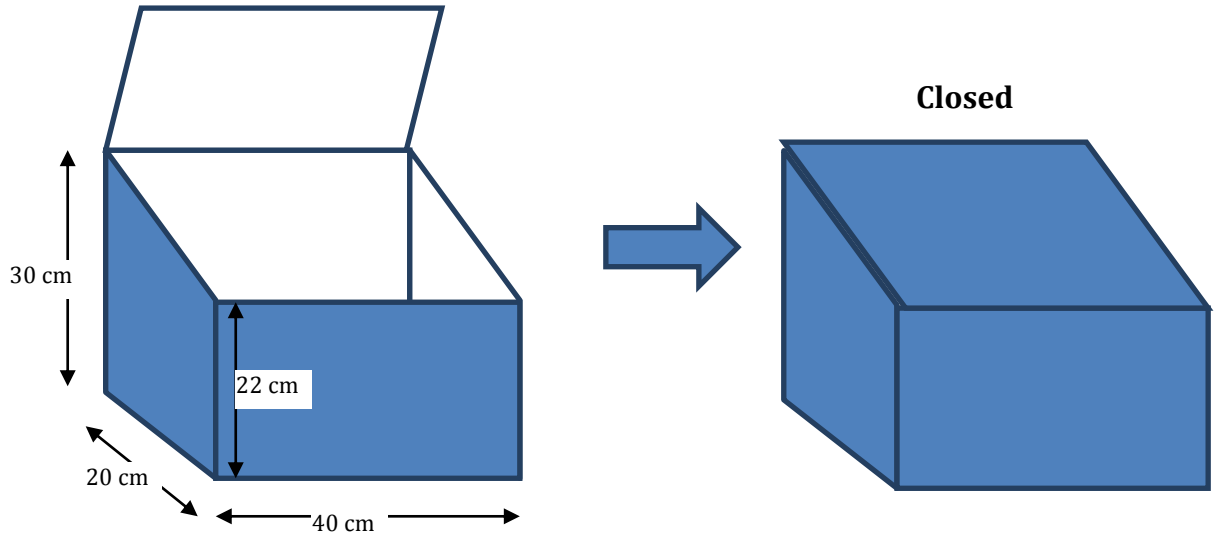
1.6 Use your graphs to indicate how many trips it will take Monwa to make a profit of R500,00 in a day. Indicate where you read off your solution on the graph. [3]

1.7 Based on the calculations above, do you think that Monwa should start his taxi business? You must give one FINANCIAL reason and one NON-FINANCIAL reason. [2]

**[27]**

## QUESTION 2: THE MAILBOX

Mr. Moloi is making a new mailbox. It is made out of wood with a sloped lid which is attached with hinges.



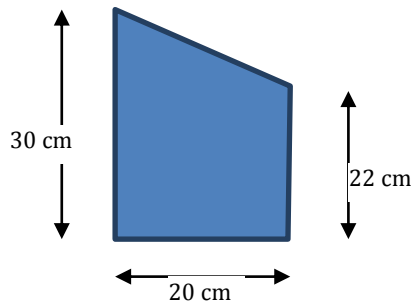

2.1 What are the dimensions of the back of the box? [2]

2.2 The side of the box has the following dimensions:

Calculate the area of the side of the box.

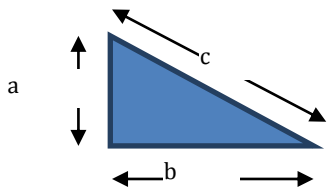
$Area\ of\ rectangle = length \times breadth$

$Area\ of\ triangle = \frac{1}{2} \times base \times height$




[4]

2.3 The lid fits perfectly over the top of the box. The width of the lid is 21,54 cm. Show how this is calculated using Pythagoras' Theorem for right-angled triangles:



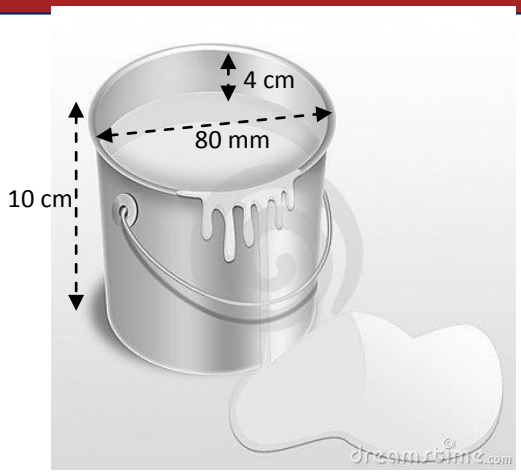

$c = \sqrt{(a^2 + b^2)}$

[3]

2.4 Only the outside of the box is going to be painted (including the bottom). Calculate the total surface area to be painted. (Answer in cm2.) [4]

2.5 Convert your answer from question 2.4 into square metres (m2). [3]

2.6 Mr. Moloi has paint left over in a tin with the dimensions given in the picture alongside.
He does not know how much paint is in the tin, but he can measure the level from the top of the tin (it is 4 cm from the top of the tin to the level of the paint).
Calculate the volume of paint that is left in the tin. (Answer in cm3).

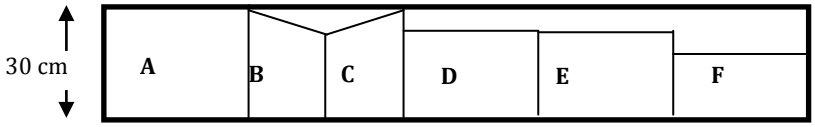



$$Volume\ of\ cylinder = \pi \times radius^2 \times height$$

[4]

2.7 1ℓof paint covers 7 m2. Use your previous answers to work out if Mr. Moloi has enough paint to cover his new mailbox with 2 coats of paint. (1ℓ= 1 000 cm3) [4]

2.8 Mr. Moloi cuts all of the wood for the post box from one wooden board:




Use the picture of the post box, answer the questions which follow:

2.8.1 State where section F would be used on the post box. Give a reason for your answer. [2]

2.8.2 Give the dimensions of section D and state where it could be found on the post box. [3]

**[29]**

## QUESTION 3 : BATTING FIRST OR SECOND

When a cricket team tours South Africa, the captain who wins a toss of the coin before the match has to choose whether to bat first or bowl first. Here is a summary of the number of times a team has won when batting first or second at the major cricket grounds in South Africa:

| | Batting first | Batting second | TOTAL |
|---|---|---|---|
| Wanderers, Johannesburg | 17 | 21 | **38** |
| Supersport Park, Centurion | 18 | 23 | **41** |
| St. George's Park, Port Elizabeth | 17 | 15 | **32** |
| Newlands, Cape Town | 24 | 11 | **35** |
| Chevrolet Park, Bloemfontein | 10 | 13 | **23** |
| Kingsmead, Durban | 17 | 14 | **31** |
| Buffalo Park, East London | 9 | 10 | **19** |
| **TOTAL** | **112** | **107** | **219** |

Source: www.espncricinfo.com (ODI match statistics sourced 19 December 2011)

3.1 Calculate the probability of a team that bats first at Kingsmead, winning. Express your answer as a percentage. [3]

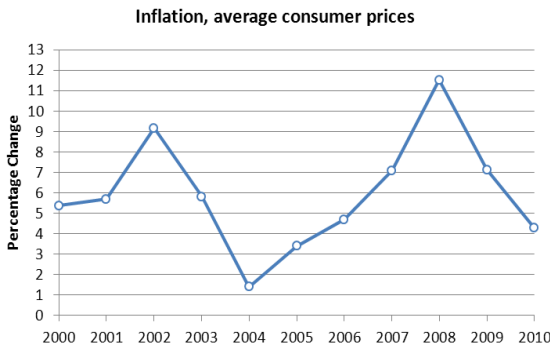
3.2 Overall in South Africa, does it matter whether a team bats first or second? Show calculations to prove your answer. [3]

3.3 There is one cricket ground in South Africa where it is important to make the right choice. Which ground is that? Give a reason for your answer. [2]

**[8]**

## QUESTION 4: PRICES

The graph alongside shows the inflation rates for consumer prices from 1980 to 2010. Use it to answer the questions which follow:




4.1 Explain why it is called an average inflation rate. [2]

4.2 Felicia looks at the graph and says that prices dropped from 2002 to 2004. She is incorrect. What is actually happening between 2002 and 2004? [2]

Source: www.indexmundi.com/south_africa

4.3 What would the graph look like if there was an overall decrease in prices in a year? Give a reason for your answer. [2]

4.4 Miriam received an annual increase of 6% p.a. every year from 1996 to 2002. She went on strike in 2002 for a greater increase. Why did she do this? [2]

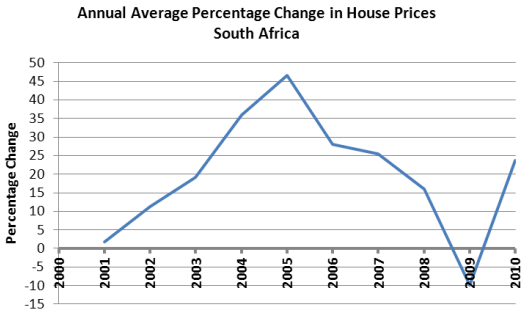
4.5 The average cost of a loaf of bread in 2005 was R4,64.

4.5.1 If the price increased by the inflation rate, shown in the graph, of 4,5%, what would the price be in 2006? [3]

4.5.2 Michael worked out his answer to 4.5.1 and got a price of R25,64. Explain why this answer is impossible. [2]

4.5.3 Continuing to use the inflation rates from the graph, what would the price of bread be in 2008 and in 2009? [5]

4.6 House prices also change on an annual basis. The graph alongside shows the average annual change in house prices for the years 2000 to 2010.
Use it to answer the questions which follow:




Source: www.fnb.co.za/downloads/home - July indices (sourced: 19 December 2011)

4.6.1 What happened to the percentage increase in house prices between the years 2005 and 2008? [1]

4.6.2 What happened to the inflation rate between the years 2005 and 2008? [1]

4.6.3 Referring to your answers to the previous question and to both of the above graphs, what is the apparent relationship between house prices and inflation? [2]

4.7 Here is a list of house prices for 3-bedroom freestanding houses in two areas which are very close to each other in KwaZulu-Natal.

| Hilton | Howick |
|---|---|
| R 840 000 | R 695 000 |
| R 750 000 | R 865 000 |
| R 3 700 000 | R 895 000 |
| R 1 195 000 | R 980 000 |
| R 1 195 000 | R 1 000 000 |
| R 1 150 000 | R 1 100 000 |
| R 1 100 000 | R 1 300 000 |
| R 920 000 | R 1 395 000 |
| R 1 750 000 | R 1 650 000 |
| R 1 395 000 | R 1 680 000 |
| R 1 200 000 | |

Source: www.harcourts.co.za (sourced 19 December 2011)

4.7.1 Calculate the mean price for the houses in Hilton. [3]

4.7.2 The mean price for a house in Howick is 'One million, one hundred and fifty six thousand Rand'. Compare this value to the answer from the previous question and decide which area has the higher priced houses. [2]

4.7.3 There is a value in the Hilton house price data which is distorting the data. Which value is it and what do we call this type of data? [2]

4.7.4 Without the value mentioned in the previous question, the mean for the house prices in Hilton drops to R1 149 500. Compare this value to the mean house price for Howick in question 4.7.2. [2]

4.7.5 The median is a more accurate measurement of the 'average'. The median for house prices in Howick is R1 050 000. Calculate the median house price for Hilton and use it to decide which area has the higher 'average' house price. [3]

4.7.6 Often people from the UK purchase houses in South Africa. Using an exchange rate of 1 British Pound (£) to 13,0063 Rand (R), calculate how much a R1 050 000 house would cost in British Pounds. [2]

# Paper 2: Marking Guidelines

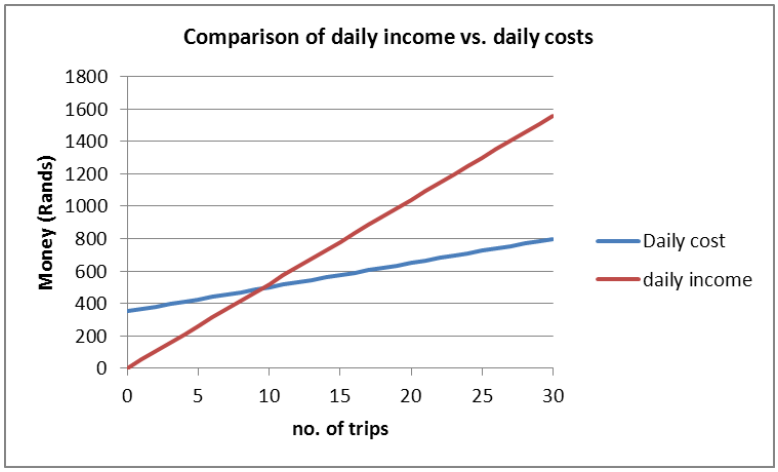
The following table shows the percentage of marks allocated to each of the levels of the taxonomy in this Paper 2 examination paper.

| | Paper 2 | |
|---|---|---|
| **Taxonomy Level** | **% of paper** | **Required** |
| Level 1 – Knowing | 4% | 0% |
| Level 2 – Routine procedures | 24% | 25% (±5%) |
| Level 3 – Multi-step procedures | 27% | 35% (±5%) |
| Level 4 – Reasoning and reflecting | 45% | 40% (±5%) |

| Question | Working | Taxonomy Level and Marks | | | | Comment / analysis |
|---|---|---|---|---|---|---|
| | | TL 1 | TL 2 | TL 3 | TL 4 | |
| 1.1.1 | He will need to measure his route with a ruler√a and then use the bar scale at the bottom to convert this measurement into a real life measurement by performing a scale calculation.√a | | 2 | | | *Topic ⇢ Maps, plans …; Section ⇢ Scale*<br>This question is testing understanding of the purpose of including a scale on a map and how to use that scale. In this instance, the type of scale being dealt with is a bar scale. |
| 1.1.2 | Any two sensible reasons (e.g. heavy traffic will slow him down; he will stop regularly to pick up passengers; lots of turns on his route, etc.) √√a | | | | 2 | *Topic ⇢ Maps, plans …; Section ⇢ Map work*<br>This question is testing ability to draw on real-life experience of a situation in order to make a decision or provide an opinion. |
| 1.1.3 | Hours = 4,5 km ÷√m 30 km/h = 0,15 hours√a<br>Minutes = 0,15 × 60 = 9 minutes√ca | | 3 | | | • Topic → Maps, plans …; Section → Map work<br>• Topic → Numbers; Section → Rates (speed)<br>• Topic → Measurement; Section → Time<br>This question is testing |

| Question | Working | Taxonomy Level and Marks | | | | Comment / analysis |
|---|---|---|---|---|---|---|
| | | TL 1 | TL 2 | TL 3 | TL 4 | |
| | | | | | | understanding of the concept of speed and ability to perform a calculation involving both speed concepts and time conversions. |
| 1.2 | Total distance in a week = 5 × 150 = 750km✓a<br>Total in a year = 52 weeks × 750 km✓m<br>= 39 000 km✓ca<br>OR<br>Total driving days in a year = 5/7 × 365 days✓m<br>= 261 days✓a<br>Total driving distance = 261 × 150<br>= 39 150 km✓ca | | | 3 | | • Topic → Maps, plans …; Section → Map work<br>• Topic → Measurement; Section → Time<br>• Topic → Numbers; Section → Operations<br>This question is testing understanding of the relationship between weeks and months and the ability to use basic number operations and calculations involving time and distance values. |
| 1.3 | R15,00 = 4,5 km × R3,33/km✓m<br>= R14,985 ≈ R15,00✓a<br>R350 = R200 + R150✓a | | | | 3 | • Topic → Finance; Section → Income and Expenditure<br>• Topic → Patterns, …; Section → Equations<br>This question tests ability to interpret a given equation, to make sense of the different variables and constant values in the equation, and the ability to communicate what those variables/constant values represent and how they have been determined.<br>The interpretation and reasoning demands of the question make |

| Question | Working | Taxonomy Level and Marks | | | | Comment / analysis |
|---|---|---|---|---|---|---|
| | | TL 1 | TL 2 | TL 3 | TL 4 | |
| | | | | | | the question a Level 4 question. |
| 1.4 | 13 people × R4,00 = R52,00√a<br>Total daily income = R52,00 x√a no. of trips | | | | 2 | • Topic → Finance; Section → Income and Expenditure<br>• Topic → Patterns, …; Section → Equations<br>This question builds on the skills assessed in the previous question by now testing ability to construct an equation and according to a given set of criteria. Again, there is reasoning involved in determining not only what variable to include in the equation, but also how to constitute the constant value. |
| 1.5 | √ key; √ title; √ both axes labelled<br>√ income graph starting at 0;<br>√ income graph points correct;<br>√ cost graph starting at 400;<br>√ cost graph points correct | | 7 | | | • Topic → Finance; Section → Income and expenditure<br>• Topic → Patterns, …; Section → Drawing Graphs<br>• This question tests ability to construct two linear functions on a set of axes and to locate the point of intersection of the two functions.<br>• Importantly, notice that one of the functions starts at the origin (i.e. 0 on the vertical axis) while the other starts at a higher value on the vertical axes. |

| Question | Working | Taxonomy Level and Marks | | | | Comment / analysis |
|---|---|---|---|---|---|---|
| | | TL 1 | TL 2 | TL 3 | TL 4 | |
| |  | | | | | |
| 1.6 | Answer is 23 trips√√ (22 trips is too few)<br>At that point the two graphs are R500 apart.√ | | | | 3 | • Topic → Finance; Section → Income and expenditure<br>• Topic → Patterns, …; Section → Interpreting graphs<br>This question is testing two concepts simultaneously:<br>1. understanding of both the concept of profit (and of how to calculate profit as the difference between income and expenditure);<br>2. how to locate and read off appropriate income and expenditure values from a graph, which can then be used to determine profit. |
| 1.7 | Yes or no with valid justification√√<br>Financial (Can make a lot of money, etc.)<br>Non-financial (Would be his own boss, Hours too long). | | | | 2 | • Topic → Finance; Section → Income and expenditure<br>• Topic → Interpreting and communicating answers and calculations<br>This question tests ability to analyse previous calculations and/or resources and to make a |

| Question | Working | Taxonomy Level and Marks | | | | Comment / analysis |
|---|---|---|---|---|---|---|
| | | TL 1 | TL 2 | TL 3 | TL 4 | |
| | | | | | | decision and communicate an opinion based on that analysis. |
| 2.1 | 30 cm✓ high by 40 cm✓long | 2 | | | | • Topic → Maps, plan and other representations; Sections → Plans and Models<br>This question is testing ability to interpret a 3-dimensional drawing of an object and to identify information on that drawing.<br>The question is also testing understanding of the meaning associated with the term 'dimensions'. |
| 2.2 | Area of end = rectangle + triangle<br>= (22 cm × 20 cm✓) +✓m(1/2 × 8 cm × 20 cm)✓<br>= 520 cm²✓a | | | 4 | | • Maps, plan and other representations; Sections → Plans and Models<br>• Topic → Measurement; Section → Calculating perimeter, area and volume<br>This question tests various things:<br>1. ability to interpret and make sense of a 2-dimensional drawing;<br>2. ability to associate area with the space covered by the shapes contained in the drawing;<br>3. ability to use given area formulae to calculate the area of a rectangle and the area of a triangle. |

| Question | Working | Taxonomy Level and Marks | | | | Comment / analysis |
|---|---|---|---|---|---|---|
| | | TL 1 | TL 2 | TL 3 | TL 4 | |
| | | | | | | The question is classified as a Level 3 – Multistep question as learners first have to determine the height of the triangle by subtracting the height of the whole side from the height of the rectangular portion, and then to use this height to determine the area of the triangle. |
| 2.3 | width = √[(8cm✓a)² + (20 cm)²]✓m<br>= √[64 cm² + 400 cm²]<br>= √[464 cm²]<br>= 21,54 cm✓a | | | 3 | | • Maps, plan and other representations; Sections → Plans and Models<br>• Topic → Measurement; Section → Measuring lengths and distances<br>• Topic → Patterns, …; Section → Equations<br>This question tests various things:<br>1. ability to interpret and make sense of a 2-dimensional drawing and to make connection between the components of this 2-D drawing and the 3-D drawing given in the introduction;<br>2. ability to substitute appropriately and accurately into a potentially unfamiliar formula. |

| Question | Working | Taxonomy Level and Marks | | | | Comment / analysis |
|---|---|---|---|---|---|---|
| | | TL 1 | TL 2 | TL 3 | TL 4 | |
| 2.4 | Surface Area<br>= (2 × end)√m + front + top + back + bottom<br>=(2 × 520 cm²) + (22 cm ×√m 40 cm)<br>+ (21,54 cm × 40 cm) + (30 cm × 40 cm)<br>+ (20 cm× 40 cm) √a (all values correct)<br>= 1 040 cm² + 880 cm² + 861,60 cm² + 1 200 cm² + 800 cm²<br>= 4 781,6 cm²√ca | | | | 4 | • Maps, plan and other representations; Sections → Plans and Models<br>• Topic → Measurement; Section → Calculating perimeter, area and volume<br>This question tests ability to:<br>1. interpret and make sense of a 3-D picture in order to determine appropriate dimensions;<br>2. perform a calculation involving surface area of primarily rectangular shapes;<br>3. associate the surface area of an object with the area to be painted. |
| 2.5 | 100 cm = 1 m<br>10 000 cm² = 1 m²√m√a<br>Area = 0,48 m²√ca | | | 3 | | *Topic ⇢ Measurement; Section ⇢ Conversions*<br>• This question tests understanding of the process involved in converting from $cm^2$ to $m^2$ and, particularly, tests whether learners understand that just because 1 m = 100 cm this does not mean that 1 $m^2 \neq$ 100 $cm^2$. |
| 2.6 | Vol = π × radius² × h<br>= 3,142 × (4cm√a)² × 6cm√sub<br>= 3,142 × (16 cm)√a × 6 cm<br>≈ 301,44 cm³√ca | | | 4 | | • Maps, plan and other representations; Sections → Plans and Models<br>• Topic → Measurement; Section → Calculating perimeter, area and volume |

| Question | Working | Taxonomy Level and Marks | | | | Comment / analysis | |
|---|---|---|---|---|---|---|---|
| | | TL 1 | TL 2 | TL 3 | TL 4 | | |
| | | | | | | This question tests ability to:<br>1. interpret a 3-D picture and identify appropriate dimensions on the diagram;<br>2. use a given formula to determine the volume of a cylindrical shape.Note that before it is possible to calculate volume the 'height' of the paint must first be determined through a subtraction of total height from gap height. | |
| 2.7 | Vol of paint = 0,3 ℓ✓m<br>Area coverage = 0,3 ℓ×✓m 7 m²/ℓ= 2,1 m²✓a<br>Therefore he does have enough to cover his mailbox.<br>✓ca | | | | 4 | *Topic ⇢ Measurement; Section ⇢ Conversions*<br>This question tests ability to use a given conversion factor to convert from an area value (in m²) to a liquid measure in litres.<br>The question also asks learners to make sense of the converted value in order to make a decision and offer an opinion regarding the amount of paint available for the painting project. | |
| 2.8.1 | Section F would be the bottom piece✓a. It does not have the same height as the front of the edge piece✓a. | | | | 2 | *Topic ⇢ Maps, plan and other representations; Sections ⇢ Plans and Models* | Both of these questions test ability to associate a 2-D picture with a 3-D representation of the picture and, particularly, to be able to identify the component parts that make up the object shown on the |
| 2.8.2 | Either 40 cm × 22 cm or 40 cm × 21,54 cm<br>It is either the front of the box or it is the lid.✓a<br>✓a (length); ✓a (width) | | | | 3 | | |

| Question | Working | Taxonomy Level and Marks | | | | Comment / analysis | |
|---|---|---|---|---|---|---|---|
| | | TL 1 | TL 2 | TL 3 | TL 4 | | |
| | | | | | | | 3-D picture as represented on a 'cutting list'. |
| 3.1 | 17✓a ÷ 31✓a × 100 = 54,84%✓ca | | 3 | | | *Topic ⇢ Probability; Section ⇢ Expressions*<br>This question tests understanding of what a probability value is and of how to represent a probability value from raw data values. | |
| 3.2 | Overall, the statistics do not favour either choice✓ca (51,14% batting first wins✓a vs. 48,86% batting second✓a). | | | | 3 | *Topic ⇢ Probability; Section ⇢ Prediction*<br>*Topic ⇢ Data handling; Section ⇢ analysing data* | Both Questions 3.2 and 3.3 test ability to:<br>1. interpret data value and to make a decision / offer an opinion based on the data;<br>2. justify an opinion through the use of a calculation involving percentages (and/or probability values).<br>Both questions are Level 4 questions as the method required to find a solution to the question is not immediately obvious, and an opinion must be offered. |
| 3.3 | Newlands, Cape Town✓a. The Team batting first has a 68,57% chance of winning✓a. | | | | 2 | | |
| 4.1 | The inflation rate is the average of the price change for a collection of goods.✓✓a | 2 | | | | *Topic ⇢ Finance; Section ⇢ Inflation*<br>This question tests | |

| Question | Working | Taxonomy Level and Marks | | | | Comment / analysis |
|---|---|---|---|---|---|---|
| | | TL 1 | TL 2 | TL 3 | TL 4 | |
| | | | | | | understanding of the concept of inflation and what the inflation rate represents. |
| 4.2 | The prices are increasing√a but *at a decreasing rate*.√a | | | | 2 | • Topic → Finance; Section → Inflation<br>• Topic → Patterns, …; Section → Interpreting graphs<br>This question tests ability to analyse a given graph containing inflation values and then to explain the significance or meaning of the shape of the graph in a section of the graph with respect to changes in the inflation rate. In other words, the question is testing the ability to associate the shape of a graph to a change in a financial situation. |
| 4.3 | The graph would dip below the horizontal axis√a. This would represent a negative percentage change√a (so a percentage decrease). | | | | 2 | • Topic → Finance; Section → Inflation<br>• Topic → Patterns, …; Section → Interpreting graphs<br>• Topic → Interpreting answers and calculations<br>This question tests ability to make sense of an existing graph showing changes in inflation rates and to suggest a potential alternative shape for the graph based on an alternative scenario or set of criteria. |

| Question | Working | Taxonomy Level and Marks | | | | Comment / analysis |
|---|---|---|---|---|---|---|
| | | TL 1 | TL 2 | TL 3 | TL 4 | |
| 4.4 | Although her salary was increasing√a, the inflation rate was increasing more than her salary increased, so she was losing overall√a. | | | | 2 | • Topic → Finance; Section → Inflation<br>• Topic → Patterns, …; Section → Interpreting graphs<br>• Topic → Interpreting answers and calculations<br>This question tests ability to:<br>1. make sense of information regarding a salary increase;<br>2. compare this salary increase percentage to the inflation rate for the same period;<br>3. interpret the difference between salary increase rate and inflation rate in order to provide an opinion or make a decision. |
| 4.5.1 | Increase = 4,5 ÷ 100 × R4,64 = R0,21√m√a<br>New price = R4,64 + R0,21 = R4,85√ca | | 3 | | | *Topic ⇢ Finance; Section ⇢ Inflation*<br>This question tests ability to use a given inflation value to determine a predicted price of an item that changes in line with the inflation rate.<br>Notice that the type of calculation used here is simply 'increasing a value by a percentage'. |
| 4.5.2 | This represents an increase of over 100% and cannot sensibly be a small increase of 4,5%.√√a | | | | 2 | • Topic → Finance; Section → Inflation<br>• Topic → Interpreting answers and calculations<br>This question tests ability to interpret a calculated value and to determine the |

| Question | Working | Taxonomy Level and Marks | | | | Comment / analysis | |
|---|---|---|---|---|---|---|---|
| | | TL 1 | TL 2 | TL 3 | TL 4 | | |
| | | | | | | appropriateness of the solution in relation to given information and to the context. | |
| 4.5.3 | Increase to 2008 = 7%√a<br>Therefore price in 2008 = 1,07 × R4,85√m<br>= R5,19√ca<br>Increase to 2009 = 11,5%√a<br>Therefore price in 2009 = 1,115 × R5,19<br>= R5,79√ca | | | 5 | | *Topic ⇢ Finance; Section ⇢ Inflation*<br>This question tests ability to use a given inflation value to determine a price of an item that changes in line with the inflation rate. NB : the type of calculation used here is a 'compounding calculation' where every year a new value must be calculated using a previously calculated value; and every year a new percentage inflation rate is used in the calculation. | |
| 4.6.1 | They decreased√a | | 1 | | | *Topic ⇢ Data Handling; Section ⇢ Representing data graphically* | Both Questions 4.6.1 and 4.6.2 test ability to interpret a graph and to identify, understand and explain the significance of the shape of the graph over a period of time. |
| 4.6.2 | It increased√a | | 1 | | | | |
| 4.6.3 | As inflation increases, house prices tend to fall a year later. √√a | | | | 2 | | This question tests ability to identify and describe the trend as represented on a graph. |

| Question | Working | Taxonomy Level and Marks | | | | Comment / analysis |
|---|---|---|---|---|---|---|
| | | TL 1 | TL 2 | TL 3 | TL 4 | |
| 4.7.1 | Mean = Total ÷ no. of pieces of data<br>= R 15 195 000√a ÷ 11√a<br>= R 1 381 364√ca | | 3 | | | • Topic → Data Handling; Section → Summarising<br>This question tests understanding of what a mean average is and the method for calculating a mean average. |
| 4.7.2 | Hilton has higher priced houses on average.√aHowick has a mean value of R1 156 000.√a | | | | 2 | • Topic → Data; Section → Summarising data<br>• Topic → Data; Section → Analysing data<br>This question tests ability to compare mean averages and to explain the significance of differences between the averages. |
| 4.7.3 | R3 700 000√a. This is an outlier√a | | | | 2 | • Topic → Data; Section → Summarising data<br>• Topic → Data; Section → Analysing data<br>This question tests understanding of the meaning of the term 'distort' and the ability to identify an outlier in a data set. |
| 4.7.4 | The house prices are then approximately the same√a with Howick being slightly higher√a. | | | | 2 | • Topic → Data; Section → Summarising data<br>• Topic → Data; Section → Analysing data<br>As with 4.7.4, this question tests ability to compare mean averages and to explain the significance of differences between the averages.<br>The question also tests ability to adjust previous answers to suit changing conditions. |

| Question | Working | Taxonomy Level and Marks | | | | Comment / analysis |
|---|---|---|---|---|---|---|
| | | TL 1 | TL 2 | TL 3 | TL 4 | |
| 4.7.5 | Arrange data in order from smallest to largest√m.<br>The middlemost value will be R1 150 000√a<br>Therefore Hilton has a slightly higher "average" house price. √a | | | | 3 | *Topic ⇝ Data Handling; Section ⇝ Summarising data*<br>This question tests understanding of what a median average is and the method for calculating a median average (including the need to sort the data). |
| 4.7.6 | £ R<br>1 : 13,0063<br>**80 730** : 1 050 000√m√a | | 2 | | | *Topic ⇝ Finance; Section ⇝ Exchange rates*<br>This question tests ability to perform a calculation involving a currency conversion with a given exchange rate. |