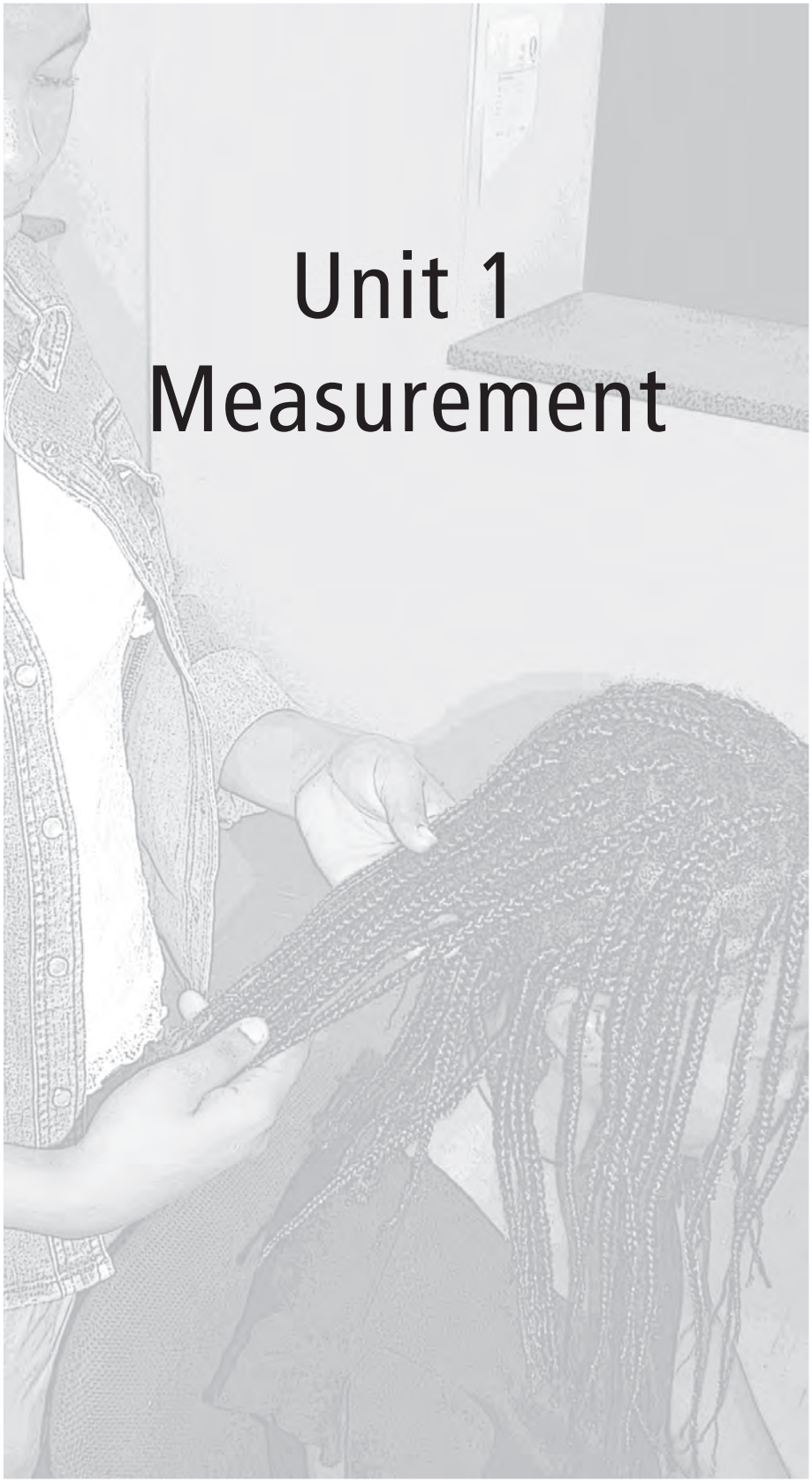
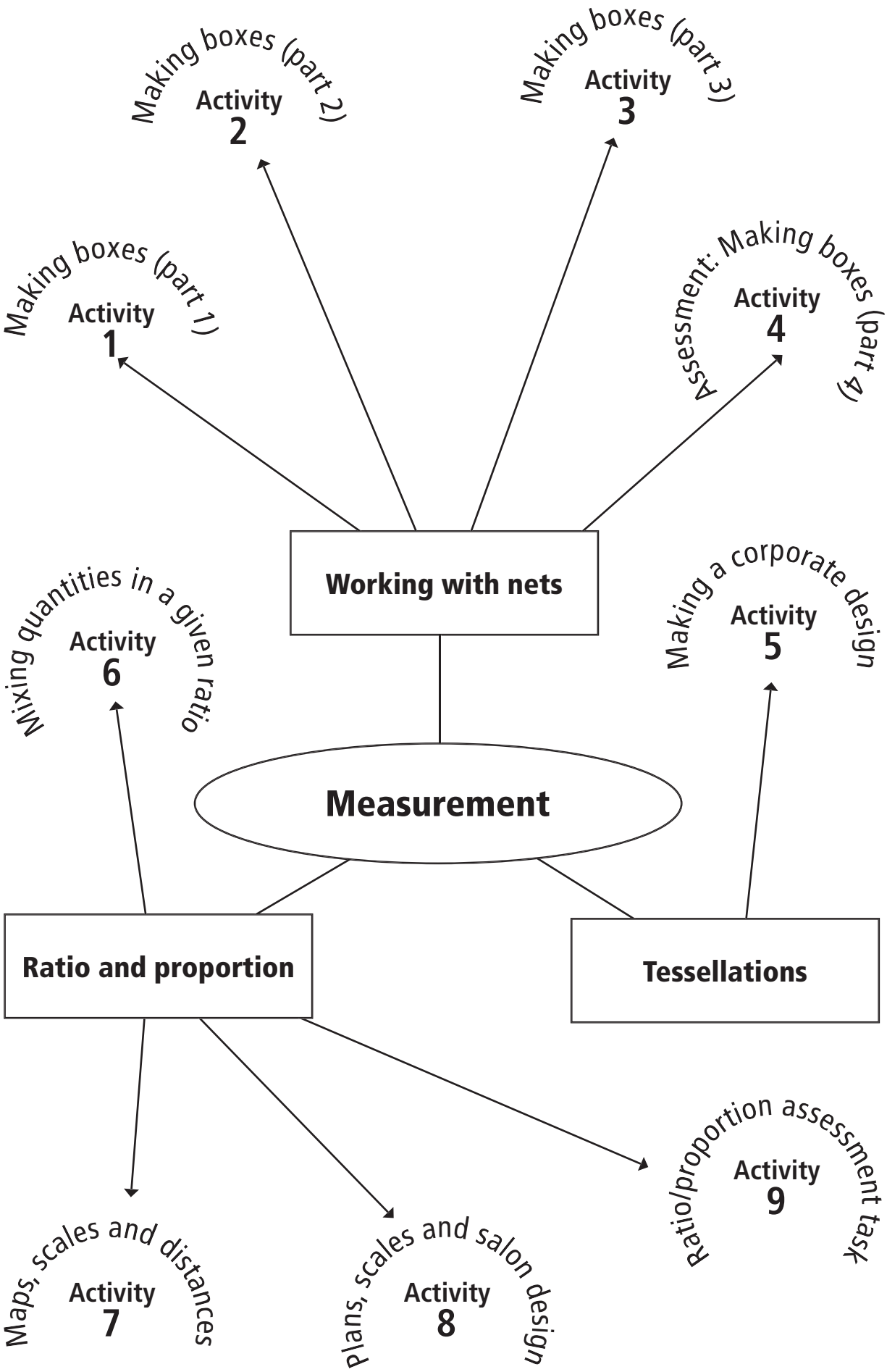
Mathematical Literacy

NQF LEVEL 3



Unit 1
Measurement

Hairdressing


Making boxes (part 1)
Activity 1
Making boxes (part 2)
Activity 2
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Activity 4
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Making a corporate design
Activity 5
Mixing quantities in a given ratio
Activity 6
Measurement
Ratio and proportion
Tessellations
Ratio/proportion assessment task
Activity 9
Maps, scales and distances
Activity 7
Plans, scales and salon design
Activity 8

Overview

In this unit learners develop a variety of mathematical skills needed for working with measurement.

The skills developed in the first four activities are the ability to work with nets in order to make three-dimensional boxes and the ability to estimate the area of cardboard needed for bottles of differing volumes. These are all related to the packaging in the haircare workplace. Learners are required to calculate areas involving the altering of linear dimensions.

Learners explore the best economic solutions for packaging of bottles which develops problem solving ability.

Learners will be required to explore and describe tessellating patterns.

In the last section of this unit, learners will be working with measuring instruments namely measuring jugs and rulers. They will estimate and measure quantities and make decisions on which instrument is the most suitable for the task at hand. Calculations using ratio are done and decision about economical use of materials are made. The learners also make unit of measurement conversions which are relevant to the haircare industry.

The learners will interpret maps and do distance/ time calculations. Spatial concepts are dealt with. Learners will work with scale drawings, converting from the drawings to real life and visa versa.

This unit consists of 9 activities broken into 3 main groups. There are two assessment tasks. The first four tasks deal with making boxes with emphasis on volume and surface area. The tasks follow on from each other. The fifth task is a stand alone task on tessellations. The last four task all deal with ratio and proportion. They are independent of each other except for the very last task which is an assessment of the previous three activities. This activity therefore relies on the skills developed in the previous activities.

Activity 1: Making boxes (part 1)
This is a practical activity in which the learners make boxes from nets. This activity prepares the learners for the next three activities.

Activity 2: Making boxes (part 2)
In this activity the learners do calculations with the dimensions of the boxes that they made in the previous activity. Dimensions are altered and the

Unit outcomes

The following Unit Standards, Specific Outcomes and Assessment Criteria are addressed by this unit:
Describe, apply, analyse and calculate shape and motion in 2- and 3—dimensional space in different contexts(9013)

- Measure, estimate, and calculate physical quantities in practical situations. (SO1).
  - Scales on the measuring instruments are read correctly.
  - Quantities are estimated to a tolerance justified in the context of the need.
  - The appropriate instrument is chosen to measure a particular quantity.
  - Quantities are measured correctly to within the least step of the instrument.
  - Calculations are carried out correctly.
  - Symbols and units are used in accordance with SI conventions and as appropriate to the situation.
- Explore, describe and represent, interpret and justify geometrical relationships and conjectures. (SO2).
  - Descriptions are based on a systematic analysis of the shapes and reflect the properties of the shapes accurately, clearly and completely.
  - Descriptions include quantitative information appropriate to the situation and need.
  - Conjectures, as appropriate to the situation, are based on well-planned investigations of geometrical properties.
  - Representations of the problems are consistent with and appropriate to the problem context. The problems are represented comprehensively and in mathematical terms.
  - Results are achieved through efficient and correct analysis and manipulation of representations.
  - Problem-solving methods are presented clearly, logically and in mathematical terms.
  - Solutions are correct and are interpreted and validated in terms of the context of the problem.

affect on surface area is observed. Learners are asked to generalise calculations and develop formulae which are used in the next activity.

Activity 3: Making boxes (part 3)
In this activity consider the problem of reducing the amount of cardboard wasted in the manufacturing of boxes. This is a practical exercise.

Activity 4: Making boxes (part4) assessment task.
In this activity the learners revisit the previous three activities. They make a box and determine the most economical sized sheet of cardboard needed to manufacture the boxes. This is done as an assessment task.

Activity 5: Making a corporate design for the salon by tessellating
In this activity the learners explore tessellating four different shapes to make patterns.

Activity 6: Making quantities in a given ratio
This activity deals with the mixing and diluting of products in a particular ratio. Learners have to do various unit conversions. In this activity learners have to make decisions as to the appropriate measuring instrument to use in order to make these dilutions. Estimation and appropriate rounding off are also dealt with.

Activity 7: Maps, scale and distance
In this activity the learners work with ratio and proportion in the context of a street map. Skills covered are, giving accurate and clear directions, finding and giving grid references and converting distances on the map into actual distances.

Activity 8: Plans, scale and salon design
This activity reinforces the skills learnt in the previous activity. The context is the salon and the learners are asked to calculate dimensions of styling, washing and drying stations. They compare floor space needed for these stations and draw conclusions from their calculations.

Activity 9: Ratio and proportion assessment task
This activity is an assessment task covering aspects of all three of the previous activities.

Describe, apply, analyse and calculate shape and motion in 2- and 3-dimensional space in different contexts												
		ACTIVITY	1	2	3	4	5	6	7	8	9
SO1	Estimate, measure and calculate physical quantities to solve problems in practical situations.										
	AC1	Scales on the measuring instruments are read correctly.		✓	✓	✓		✓	✓	✓	✓
	AC2	Quantities are estimated to a tolerance justified in the context of the need.		✓				✓	✓	✓	✓
	AC3	The appropriate instrument is chosen to measure a particular quantity.						✓	✓	✓	✓
	AC4	Calculations are carried out correctly.						✓	✓	✓	✓
	AC5	Symbols and units are used in accordance with SI conventions and as appropriate to the situation.		✓	✓	✓		✓	✓	✓	✓
	AC6	Rough sketches are interpreted or used correctly to represent and describe situations.			✓	✓		✓	✓		✓
SO2	Explore, describe and represent, interpret and justify geometrical relationships and conjectures.										
	AC1	Descriptions are based on a systematic analysis of the shapes and reflect the properties of the shapes accurately, clearly and completely.	✓	✓	✓	✓	✓			✓	
	AC2	Descriptions include quantitative information appropriate to the situation and need.	✓	✓	✓	✓	✓	✓	✓	✓	✓
	AC3	Conjectures, as appropriate to the situation, are based on well-planned investigations of geometrical properties.		✓	✓	✓	✓			✓	
	AC4	Representations of the problems are consistent with and appropriate to the problem context. The problems are represented comprehensively and in mathematical terms.	✓	✓	✓	✓		✓	✓	✓	✓
	AC5	Results are achieved through efficient and correct analysis and manipulation of representations.		✓	✓	✓		✓	✓	✓	✓
	AC6	Problem-solving methods are presented clearly, logically and in mathematical terms.		✓	✓	✓		✓	✓	✓	✓
	AC7	7. Solutions are correct and are interpreted and validated in terms of the context of the problem.		✓	✓	✓		✓	✓	✓	✓

Activity 1 — Making boxes (part 1)

ABOUT THIS ACTIVITY

This is the first in a series of three activities looking at packaging. In this activity the learners will be making two boxes from given nets. They will explore one of these boxes in the next activity.
This activity is aligned with unit standard 9013 and addresses AC 1,2,4 of SO2.

MANAGING THIS ACTIVITY

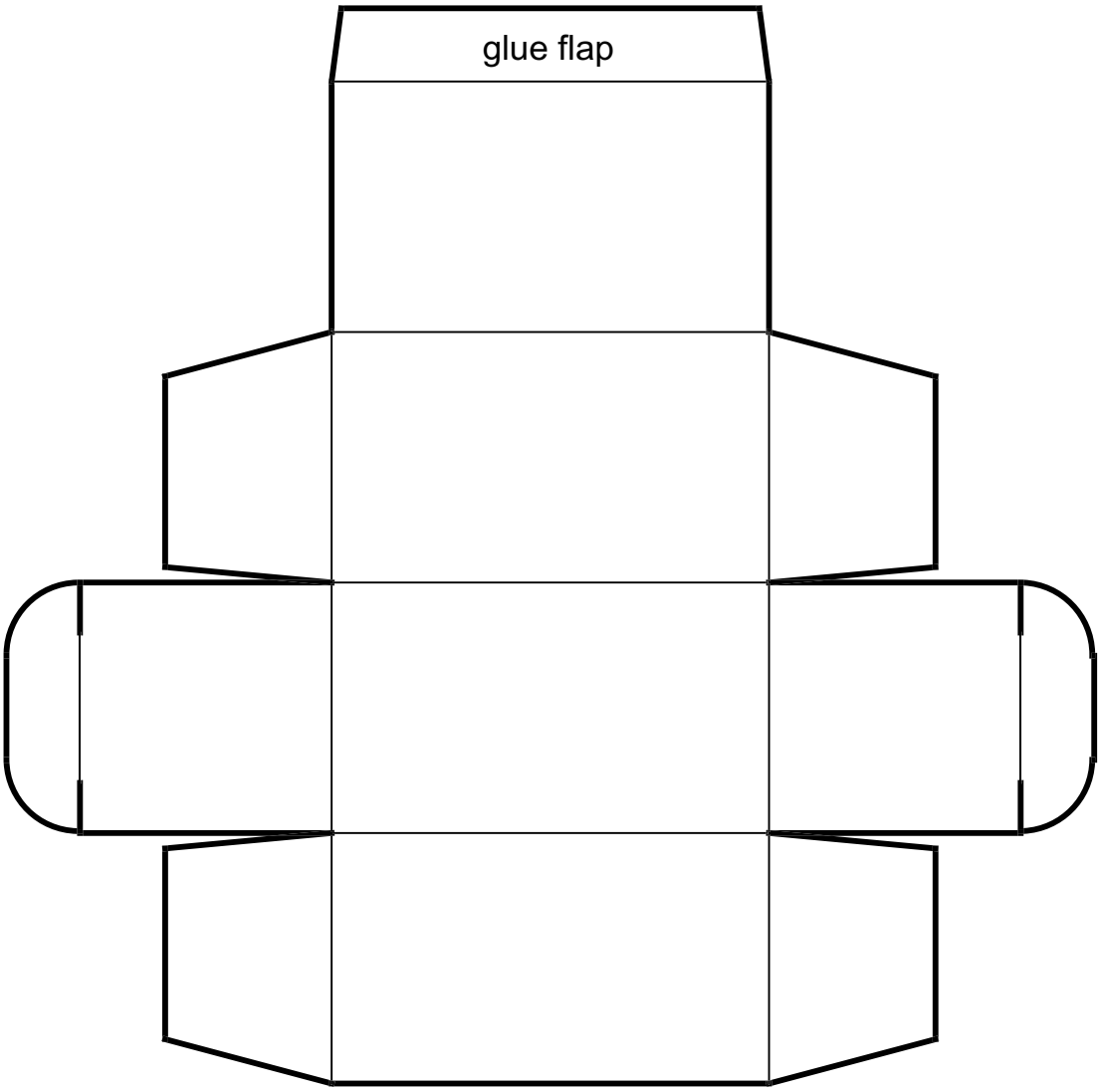
Students will need firm cardboard, a ruler, a pencil and a pair of scissors.
There is no need for solutions to this activity.

Activity 1 — Making boxes (part 1)

An important aspect of selling hair products and other cosmetics is the packaging in which it comes. The package can be used to give the directions for the use of the product and also to advertise its various features.

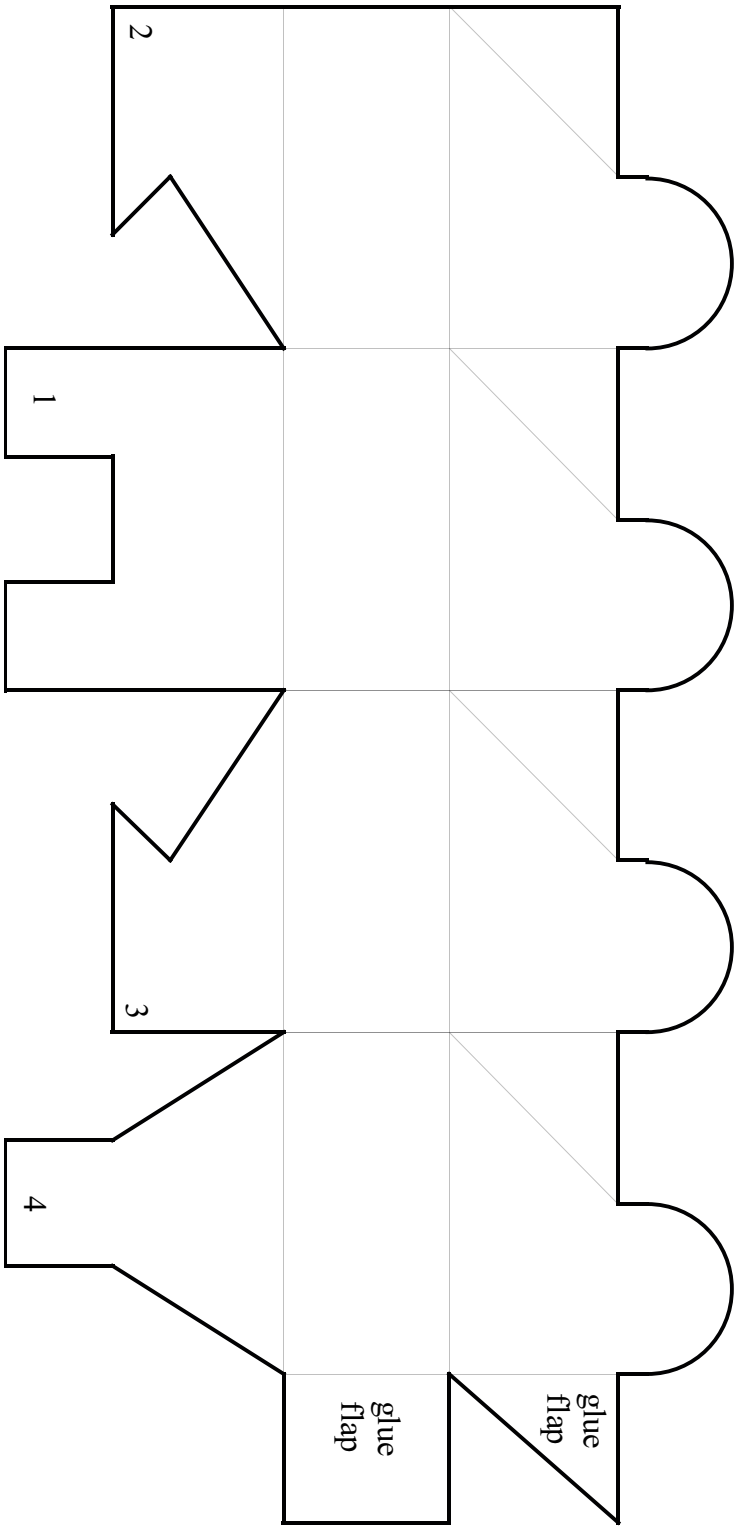
1.1 The nets for two different boxes are given as part of this worksheet. For each box you must:
1.1.1 Trace the net onto a sturdy piece of cardboard.
1.1.2 Cut out the box from the cardboard.
1.1.3 Construct the box as per the instructions supplied for each box.

1.2 Decide on the kind of product for which each box is best suited.



Instructions:
- Cut out along the solid lines.
- Score (bend) along the thin lines.
- Glue the glue flap to the inside of the box to complete the walls.

Closing the box:
- First fold down the two side flaps.
- Then fold down and push in the middle flap.

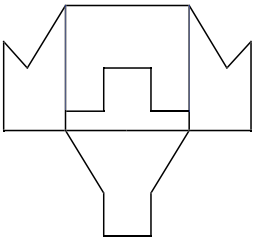


Instructions:

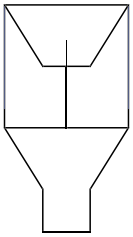
- Cut out along the solid lines.
- Score (bend) along the thin lines.
- Glue the glue flaps to the inside of the box to complete the walls.

Closing the bottom

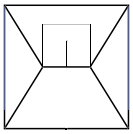
- First fold down flap 1.



- Next fold down flaps 2 and 3, tucking the sharp points under flap 1.

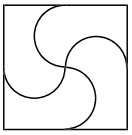


- Finally, fold down flap 4 and push the narrow strip under flap 1.



Closing the top:

- Gently push the four sides inward, folding along the diagonal lines.
- Tuck the four semi-circles under each other.



Activity 2 — Making boxes (part 2)

ABOUT THIS ACTIVITY

In this activity the students use the net of the first box they made in the previous activity and calculate the dimensions needed for packaging bottles of various sizes. Dimensions vary according to the size and shape of the bottle as well as the type of lid that is used to close the bottle. They deal with given data as well as actual bottles found in the salon. They also determine the dimensions of the labels needed for each box. The final task is to compare the volume of the bottle and the amount of cardboard needed to make up the box.
This activity is aligned with unit standard 9013 and addresses AC 1,2,5 of SO1 and all of the AC's of SO2 .

MANAGING THIS ACTIVITY

Students will need at least four bottles of hair care products and a calculator.

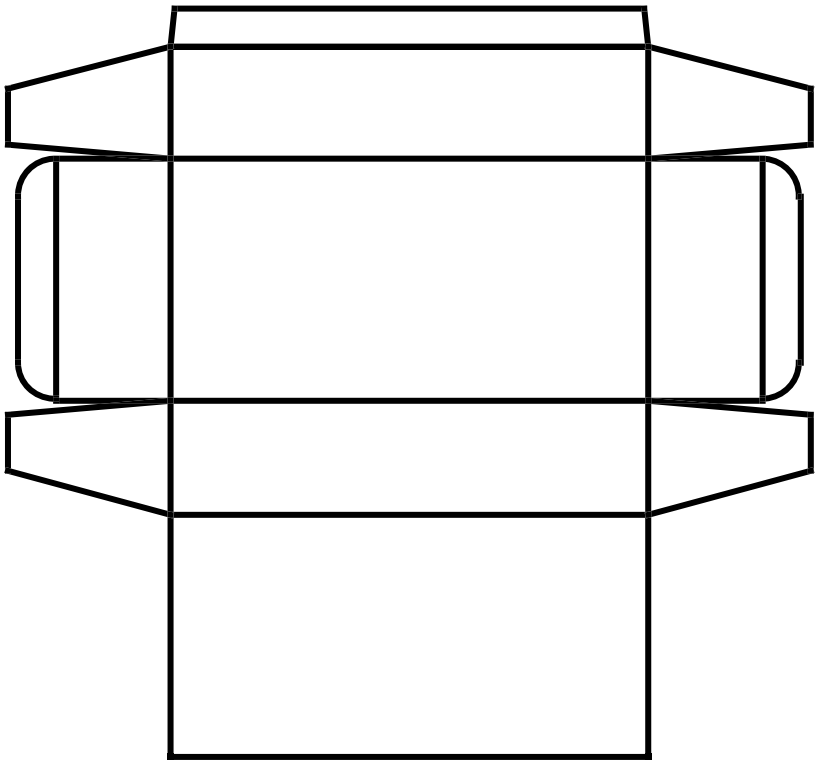
2.1.1 h = 85mm + 3mm = 88mm
s = 37mm
2.1.2 h = 132mm + 6mm = 138mm
s = 59mm
2.1.3 h = 117mm + 3mm = 120mm
s = 45mm
2.1.4 h = 177mm + 20mm = 197mm
s = 70mm
2.1.5 h = 221mm + 6mm = 227mm
s = 87mm

2.2 Each student will have four of his/her own measurements.

2.3 Each student will have four of his/her own measurements.

2.4 Each student will have four of his/her own measurements.

2.5 1:2 scale model of Bottle number 3 with a flip dispenser.



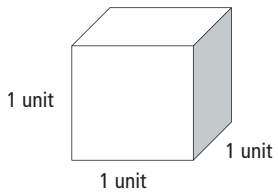
2.6 Dimensions of labels:

Bottle type	Height	Length of label
60ml type 1 bottle with a regular screw cap	48mm	Diameter of bottle (d) = 37mm ∴ circumference = π d = $\pi \times 37$ ∴ length of label ≈ 116mm
240ml type 1 bottle with a flip dispenser	72mm	Diameter of bottle (d) = 59mm ∴ circumference = π d = $\pi \times 59$ ∴ length of label ≈ 185mm
120ml type 2 bottle with a regular screw cap	57mm	Diameter of bottle (d) = 45mm ∴ circumference = π d = $\pi \times 45$ ∴ length of label ≈ 141mm
480ml type 2 bottle with a snip-top dispenser	90mm	Diameter of bottle (d) = 70mm ∴ circumference = π d = $\pi \times 70$ ∴ length of label ≈ 220mm
1000ml type 2 bottle with a flip dispenser	119mm	Diameter of bottle (d) = 87mm ∴ circumference = π d = $\pi \times 87$ ∴ length of label ≈ 273mm

2.7.1 $l = 4s + 1$
2.7.2 $b = h + 2s + 2$
2.7.3 Area = lb
$= (4s + 1)(h + 2s + 2)$

2.8.1 l = 181mm; b = 209mm; A = 37 829mm2
2.8.2 l = 225mm; b = 257mm; A = 57 825mm2
2.8.3 l = 281mm; b = 319mm; A = 89 639mm2

2.9 The purpose of this question is to address the range statement which refers to calculations involving the effects on area and volume when altering linear dimensions. This is illustrated below.



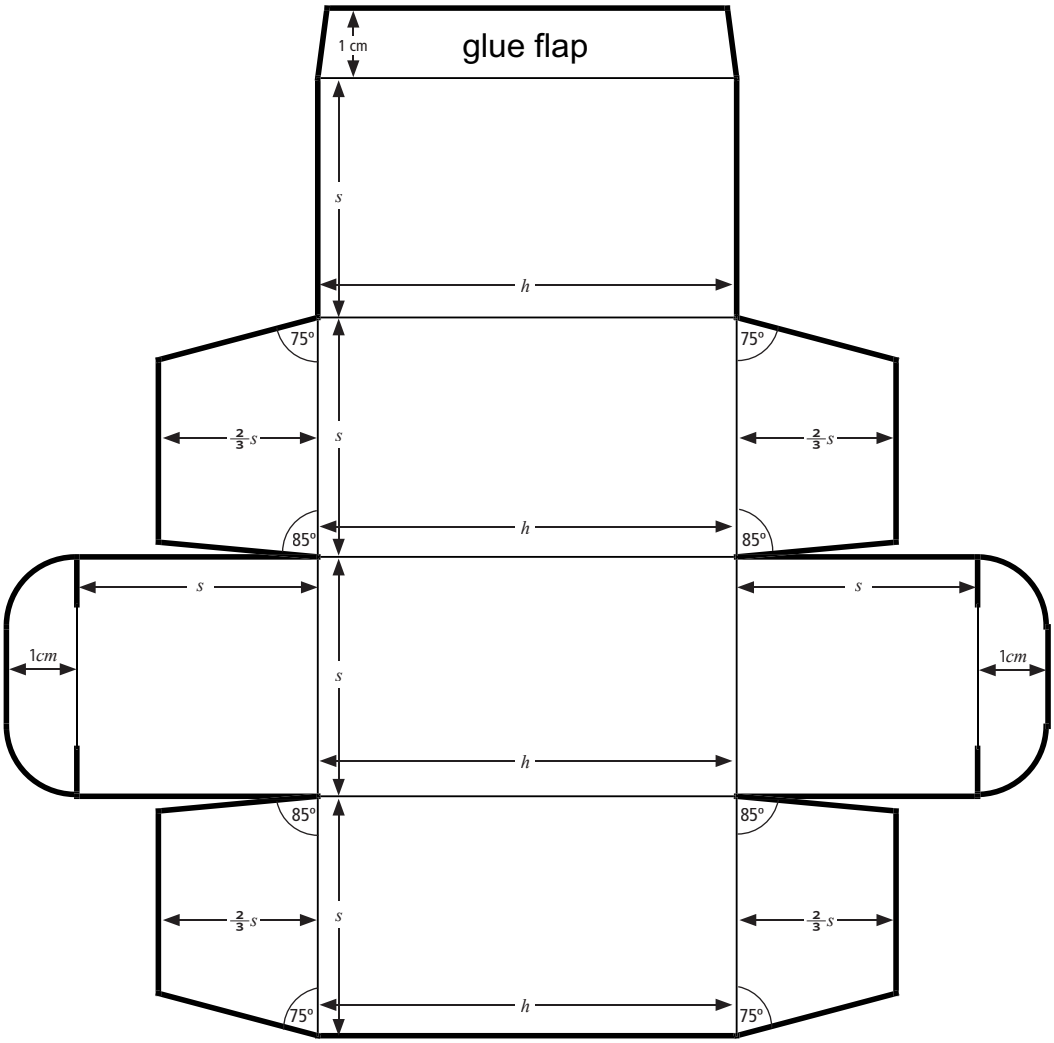
Length of sides of cube	Surface area	Volume
I	6	1
2	24	8
4	98	64

It can be seen from the table above that when the length of the sides doubles, the surface area quadruples and the volume goes up by a factor of 8, ie. they don't all double.

Returning to the problem in the activity, the student should find that although the volume doubles, the area of cardboard doesn't. It seems to go up by approximately 1,5 times. The flaps distort the answer.

Activity 2 — Making boxes (part 2)

In the previous activity we looked at the nets for two different boxes and made those boxes. In this activity we take the idea a little further and design boxes for a range of actual bottles. The diagram below shows the net for the ordinary box from the previous activity with the dimensions, in general form, shown on it.



2.1 The handout has sketch diagrams of three different kinds of bottles and a few different types of bottle tops (closures). Determine the values of h and s to be used in designing a box to hold the following:

2.1.1 60ml type 1 bottle with a regular screw cap

2.1.2 240ml type 1 bottle with a flip dispenser

2.1.3 120ml type 2 bottle with a regular screw cap

2.1.4 480ml type 2 bottle with a snip-top dispenser

2.1.5 1000ml type 2 bottle with a flip dispenser

2.2 For at least four of the bottles of hair care products that you own, measure the appropriate dimensions to complete the table below.

Product	Volume (ml)	Height (mm)	Width (mm)	Depth (mm)	Label height (mm)

2.3 For each of the bottles in your table, determine the values of h and s to be used in designing a box to hold the bottle.

2.4 For one of the bottles that you own, design the net of the box that will hold the bottle. Cut out the net and assemble the box. Check that your bottle fits snugly inside the box.

2.5 Design a net that can be used to make a box for bottle number 3 with a flip dispenser. Draw a scale model of the net.

2.6 Determine the dimensions of the label for each of the bottles described on the handout, as well as for your own four.

2.7 breadth (b)

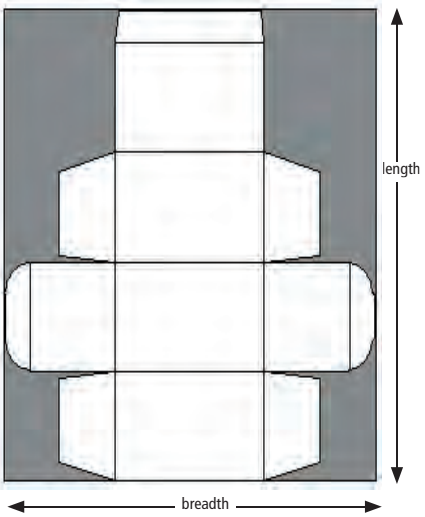
2.8 length (l)

2.9 We will now be comparing a bottle's volume with the amount of cardboard used to make its box. Look at the diagram alongside and refer to your earlier calculations.

2.9.1 Determine a formula for the length (in the diagram) in terms of h and/or s.

2.9.2 Determine a formula for the breadth (in the diagram) in terms of h and/or s.

2.9.3 Hence determine a formula in terms of h and s for the area of the cardboard sheet with length (l) and breadth (b) needed to cut out a box for a given bottle.



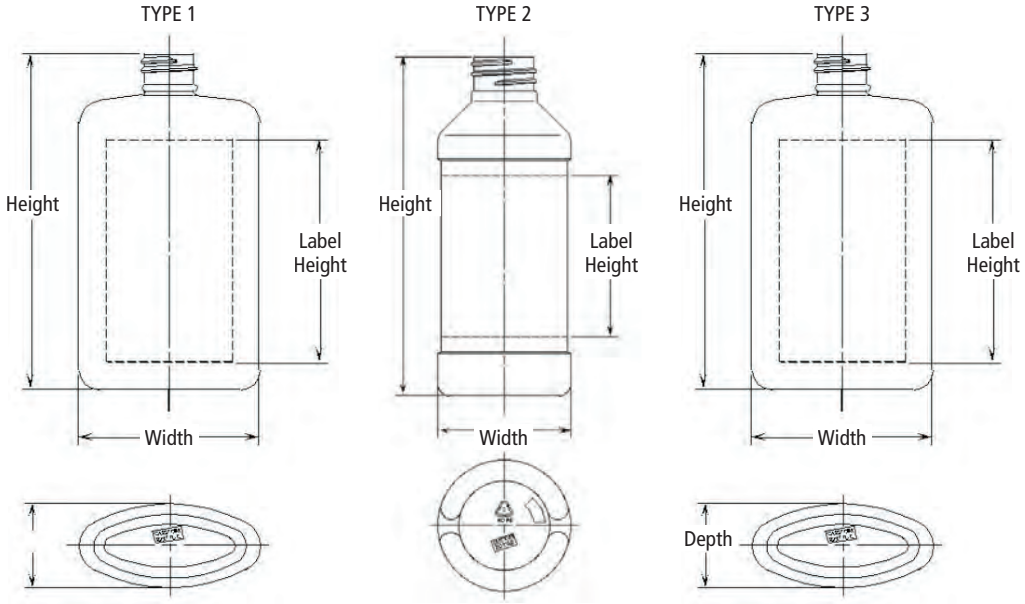
2.10 Use the formula you developed in 2.7 to determine the length (l), the breadth (b) and the area (A) of the cardboard sheet needed to make the box for each of the following bottles:

2.10.1 120ml type 2 bottle

2.10.2 240ml type 2 bottle

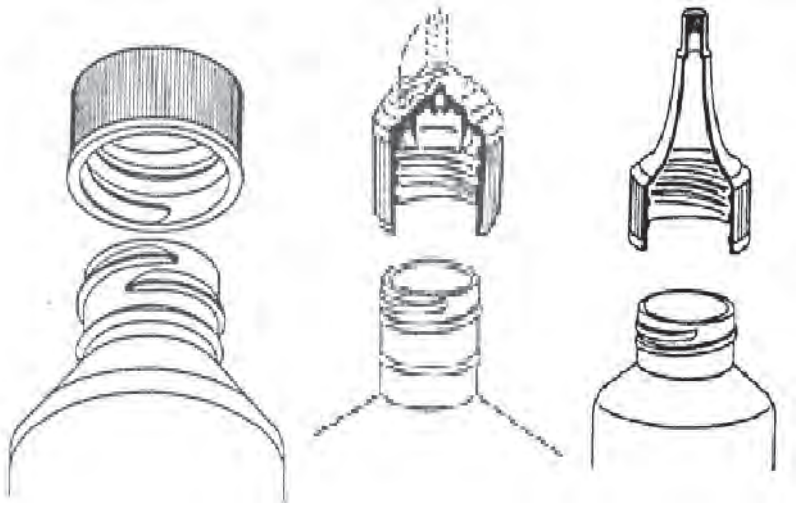
2.10.3 480ml type 2 bottle

2.11 Determine whether or not the area of cardboard increases in proportion to the increase in the volume of the bottle. Do you find this result surprising? Give reasons for your answer.



Bottle type	Volume (ml)	Height (mm)	Width (mm)	Depth (mm)	Label height (mm)
1	60	85	37		48
1	120	107	48		63
1	240	132	59		72
1	360	145	68		85
2	120	117	45		57
2	240	143	56		68
2	480	177	70		90
2	1000	221	87		119
3	120	120	64	30	80

NOTE:
Increase the height of the bottle for the bottle top as shown below:
Regular screw cap: 3mm
Flip dispenser: 6mm
Snip-top dispenser: 20mm



Activity 3 — Making boxes (part 3)

ABOUT THIS ACTIVITY
In this activity the students explore the most economical way of making boxes. They tessellate nets of boxes onto various sized sheets of cardboard in order to determine which arrangement makes the most efficient use of cardboard. This mathematical modelling has to be done physically as it cannot be done by calculation.

This activity is aligned with unit standard 9013 and addresses AC 1,5,6 of SO1 and AC 1,2,3,4,5,6,7 of SO2.

MANAGING THIS ACTIVITY
Students will need the handouts on tessellations and the nets of the three boxes, a pair of scissors and a calculator for this activity.

3.1 Tiled floors, beading, basket weaving, found in churches/mosques, Ndebele huts, or any other relevant examples.

3.2 Individual answer.

3.3 See example in the activity sheet.

3.4

	Number of boxes that can be cut out of a given sheet of cardboard		
	120ml box	240ml box	480ml box
A4 paper	1	0	0
A3 paper	2	1	1
A2 paper	5	3	2
A1 paper	10	6	4

3.5 To find the area of cardboard needed, add the four rectangles shown in the diagram alongside 3.5 in the activity.

3.5.1 Area of shaded portions =

$$(12 \times 5{,}5) + 2\left[\left[2 \times \frac{2}{3} \times 4{,}5 + 12\right] \text{ x } 4{,}5\right] + ((2 \times 4{,}5 + 2 + 12) \text{ x } 45) = 331{,}5\text{cm}^2$$

3.5.2 Area = 500cm^2

3.5.3 Area = 765cm^2

3.6

	Percentage of cardboard sheet used to manufacture boxes		
	120ml box	240ml box	480ml box
A4 paper	53%	-	-
A3 paper	53%	40%	61%
A2 paper	66%	60%	61%
A1 paper	66%	60%	61%

3.7 In each case the A2 and A1 cardboard wasted the least amount of cardboard.

Activity 3 — Making boxes (part 3)

In the previous two activities we explored making boxes to package different bottles of hair products. In this and the next lesson we will explore two further aspects related to making these boxes, namely:

- reducing the amount of cardboard wasted in the manufacture of the boxes; and
- decorating the boxes (see activity 5).

For both of these aspects we will explore the use of tessellating—the word mathematicians use for tiling.

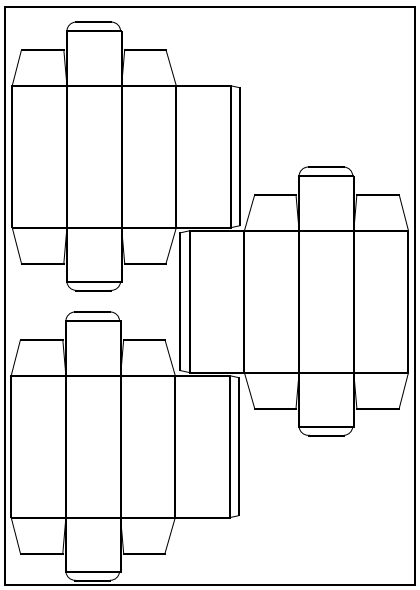
Tessellating

3.1 Study the handout on tessellating. Write down at least five examples of tiling (tessellations) that you come across in your daily life.

3.2 Draw a rough sketch of at least one of the tessellations mentioned in 3.1.

Reducing cardboard waste

The cardboard from which the boxes are cut comes in large sheets. The boxes to be cut out must be arranged in a way that will reduce the amount of wasted cardboard. The process of finding the best way to place the nets of the boxes on the cardboard sheet is a form of tessellating. The diagram on the right gives an example of how three boxes (240ml type 2 bottles with a screw cap) can be placed on an A2 sheet of cardboard in the most economical way.



On the handout are three 1 : 4 scale drawings of boxes for type 2 bottles with a screw cap.

3.3 Make a 1 : 4 scale drawing of the following sizes of paper:

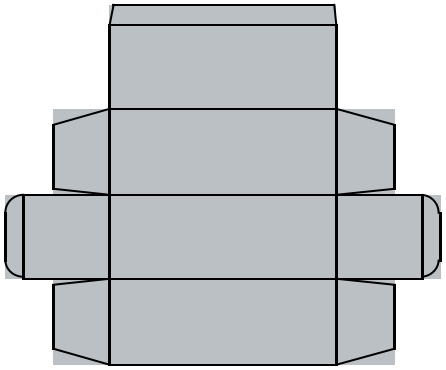
3.3.1 A4 210mm × 298mm
3.3.2 A3 298mm × 420mm
3.3.3 A2 420mm × 596mm
3.3.4 A1 596mm × 840mm

3.4 Cut out the scale drawings of the boxes provided and use these and your scale drawings of the different types of paper to complete the table below:

	Number of boxes that can be cut out of a given sheet of cardboard		
	120ml box	240ml box	480ml box
A4 paper			
A3 paper			
A2 paper			
A1 paper			

The best size cardboard to use is not necessarily the one that can be used to make the largest number of boxes, but rather the one that wastes the least amount of cardboard.

Rather than calculating the exact area of each box it is good enough to approximate the area as shown in the diagram on the right, since the extra bits in this diagram are of little consequence.



3.5 Based on the diagram alongside, determine the shaded area for the following bottles (you should refer to the calculations you did in activity 2 and the handout with the dimensions of the bottles from the same activity):

3.5.1 120ml type 2 with a screw cap

3.5.2 240ml type 2 with a screw cap

3.5.3 480ml type 2 with a screw cap

3.6 The following formula can be used to determine the percentage of cardboard used for each of the arrangements in the table from question 3.4:

$$\text{percentage of cardboard sheet used} = \frac{\text{no of boxes} \times \text{area of box}}{\text{area of cardboard sheet}} \times 100$$

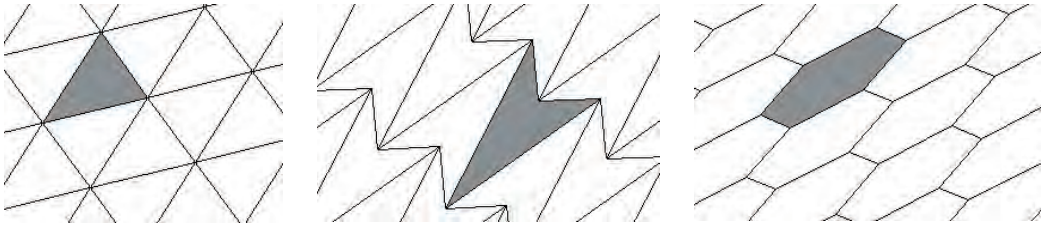
Use the formula to complete the table below:

	Percentage of cardboard sheet used to manufacture boxes		
	120ml box	240ml box	480ml box
A4 paper			
A3 paper			
A2 paper			
A1 paper			

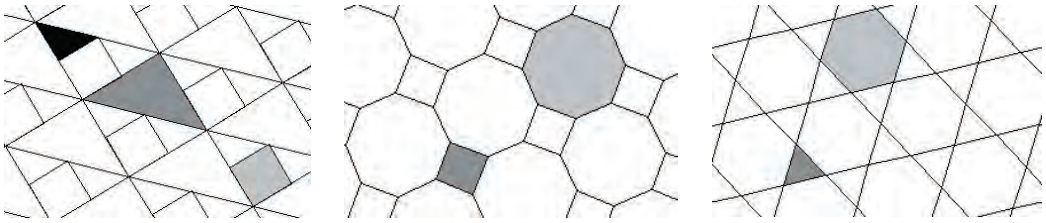
3.7 Which size sheet wastes the least amount of cardboard in manufacturing each of the different boxes? Is this what you expected?

Tessellating

Tessellating is a term used by mathematicians to describe tiling. When a tile or combination of tiles are used to cover a surface (usually a flat surface), we say the tiles have tessellated the surface.

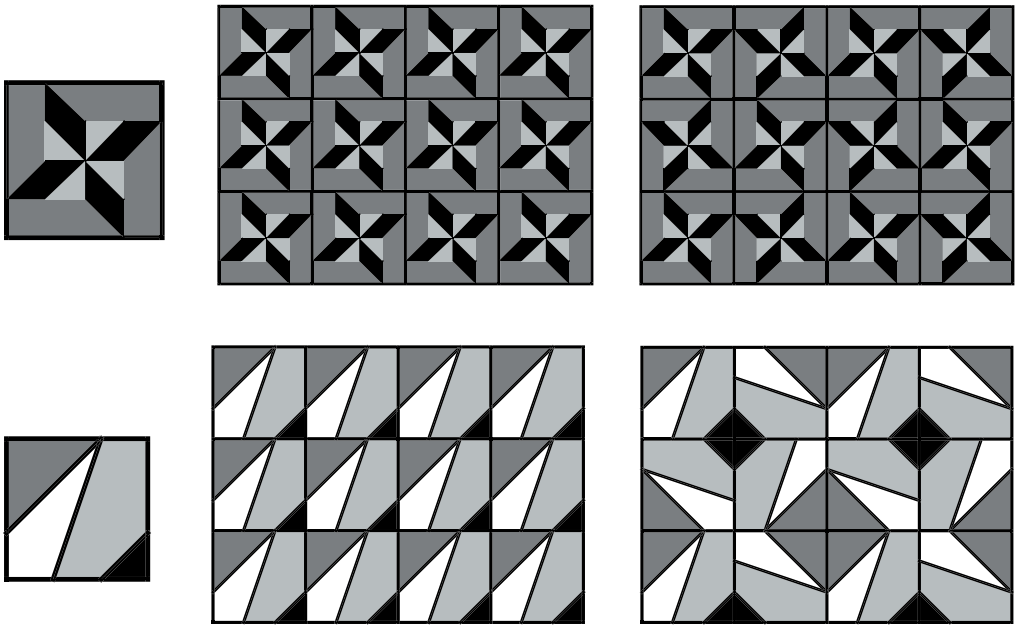


The illustrations below show three different tessellations, each made from only one shape:

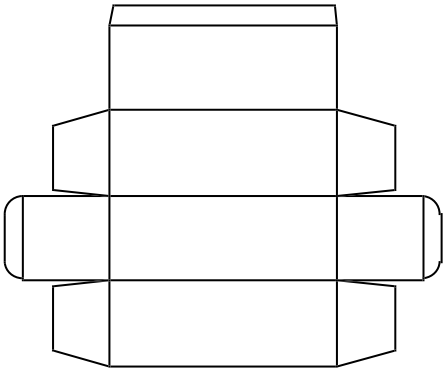


The illustrations below show two- and three-shape tessellations:

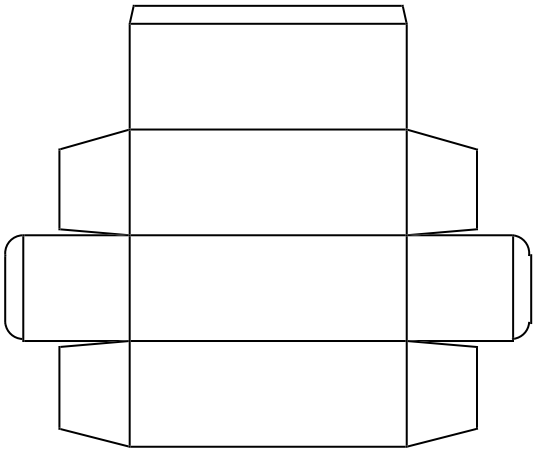
The **quilting patterns** below are also a form of tessellation. A basic tile is made using different shapes and the tile is used to tessellate (tile) the plane:



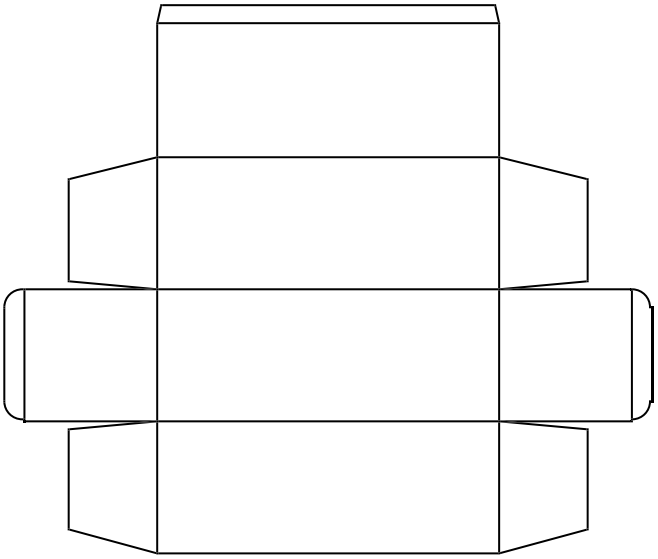
1 : 4 scale drawings of boxes for type 2 bottles with a screw cap



120ml



240ml



480ml

Activity 4 — Making boxes (part 4): Assessment task

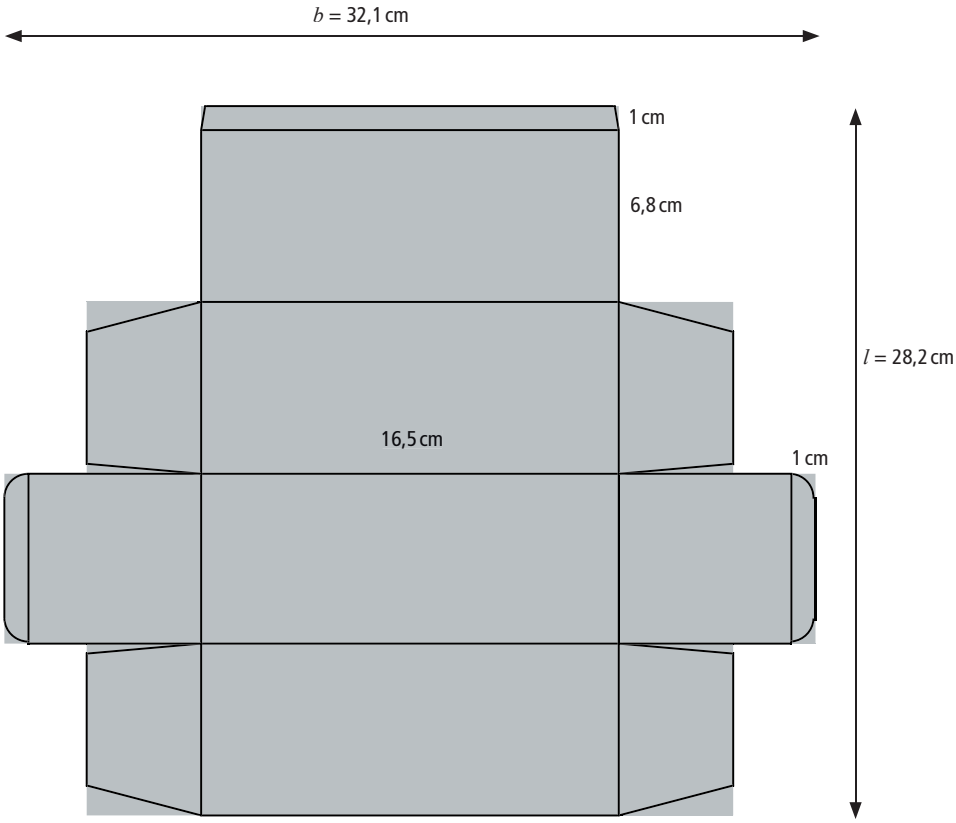
ABOUT THIS ACTIVITY

This is an assessment task. In this activity the students make a box and then determine the best sized cardboard to use to make the boxes. They use the skills learnt in the previous three activities.
This activity is aligned with unit standard 9013 and addresses AC 1,5,6 of SO1 and AC 1,2,3,4,5,6,7 of SO2.

MANAGING THIS ACTIVITY

Students will need the handout from activity 2 as well as the information found in activity 3 about the dimensions of the various sized sheets of cardboard. A pair of scissors and a calculator are also needed for this activity.

4.1.1 Below is a diagram of a 1:3 scale model of the 360ml type 1 bottle with a snip top dispenser.
The area of the shaded part ≈ 695cm^2 (as calculated by GSP). The smallest piece of cardboard that can be used is an A3 sheet.



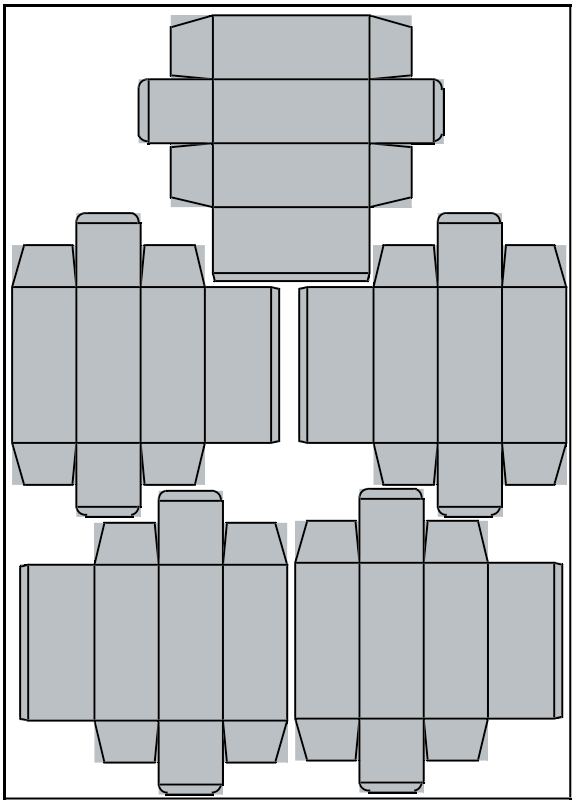
4.2 Height of label = 85mm
Diameter of bottle (d) = 68 mm
circumference = πd
= $\pi \times 68$
length of label ≈ 214 mm

4.3.1 –
4.3.2 –

4.3.3

	360ml box
A4 paper	0
A3 paper	1
A2 paper	2
A1 paper	5

A1 solution.



4.3.4 Area of shaded portion =

$$(16{,}5 \times 7{,}8) + 2\left[\left[2 \times \frac{2}{3} \times 6{,}8 + 16{,}5\right] \text{ x } 6{,}8\right] + ((2 \times 6{,}8 + 2 + 16{,}5) \text{ x } 6{,}8) = 695\text{cm}^2$$

$$\text{percentage of cardboard sheet used} = \frac{\text{no of boxes} \times \text{area of box}}{\text{area of cardboard sheet}} \times 100$$

360ml box	% cardboard used	% cardboard wasted
A4 paper	-	-
A3 paper	56	44
A2 paper	56	44
A1 paper	69	31

4.3.5 A1 would be the best cardboard to buy.

Activity 4 — Making boxes (part 4): Assessment task

This activity allows you to consolidate the skills developed in the previous three activities.

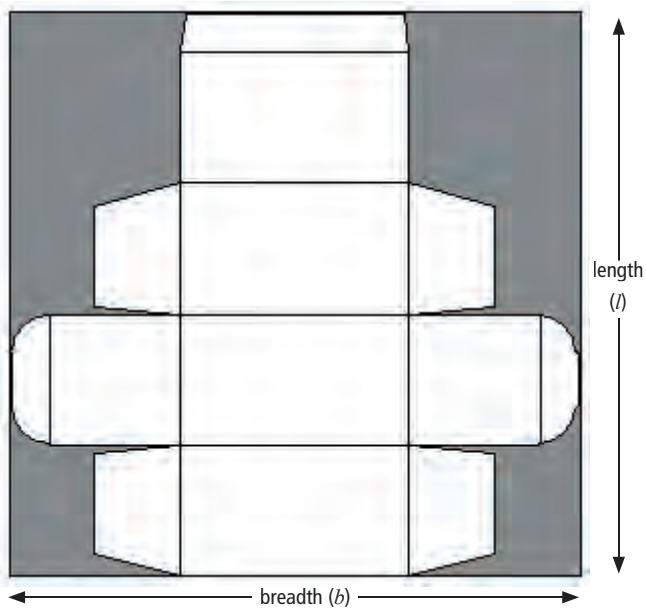
You will need to refer to the diagram of the standard box used in activities 2 and 3 and to the information provided in the handout of activity 2.

4.1 Manufacture a box for a 360ml type 1 bottle with a snip-top dispenser. You must:

4.1.1 Draw a rough sketch that shows the dimensions.

4.1.2 Determine the length and breadth shown in the diagram alongside for the 360ml type 1 bottle with a snip-top dispenser, then write down the size of the smallest piece of cardboard that can be used to manufacture one box (refer to the sizes listed in activity 3).

4.1.3 Cut out and construct the box as neatly as you can.



4.2 Determine the dimensions of the label for the 360ml type 1 bottle.

4.3 Reducing paper wastage

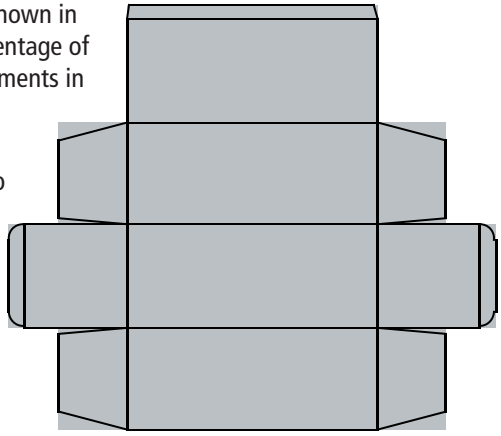
4.3.1 Draw and cut out a 1 : 3 scale model of the net you developed in question 4.1.

4.3.2 Draw a 1 : 3 scale model of the following sizes of paper: A3, A2 and A1

4.3.3 By drawing around your cut out net, determine the largest number of boxes that can be cut out from each of the pieces of paper.

4.3.4 By approximating the area of the net as shown in the diagram alongside, calculate the percentage of cardboard wasted for each of the arrangements in 4.3.3.

4.3.5 Use the information from 4.3.4 to decide on which size cardboard to buy in order to reduce wastage and hence costs.



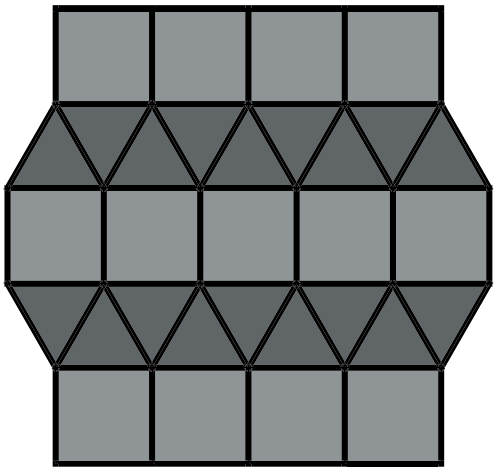
Activity 5 — Managing a corporate design for the salon by tessellating

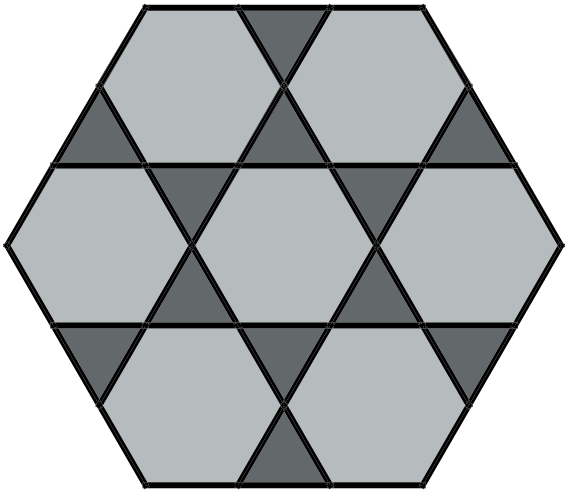
ABOUT THIS ACTIVITY
In this activity the students explore tessellating four different shapes to make patterns.

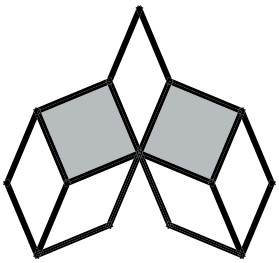
This activity is aligned with unit standard 9013 and addresses AC 1,2,3 of SO2 .

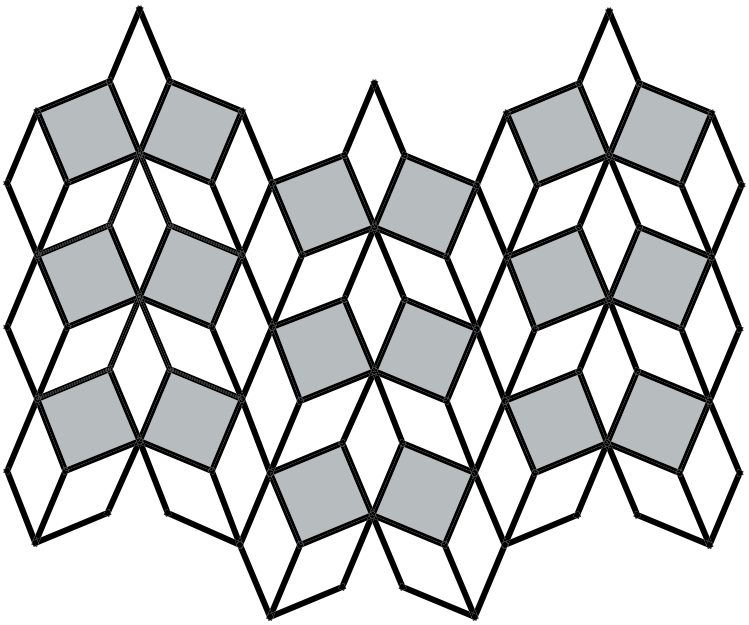
MANAGING THIS ACTIVITY
Students will need a pair of scissors and coloured paper. They may also need to refer to the handout on tessellations from activity 3.

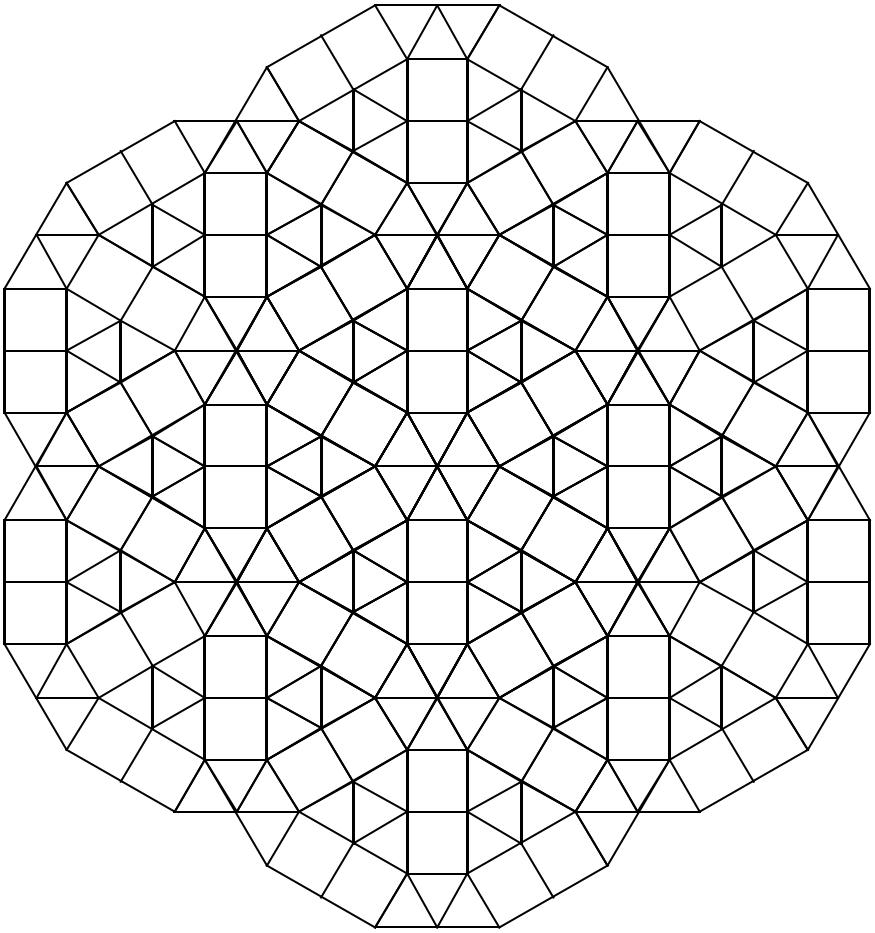
Some suggested answers for 5.3 :



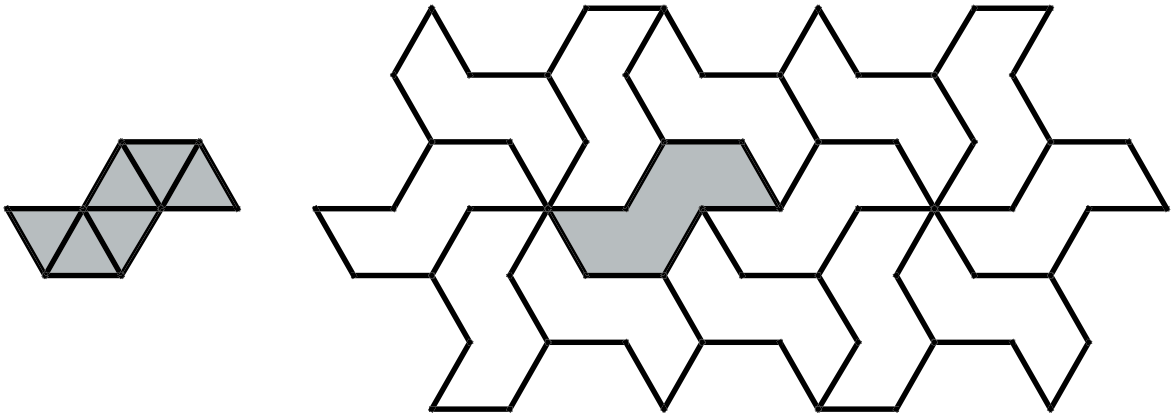








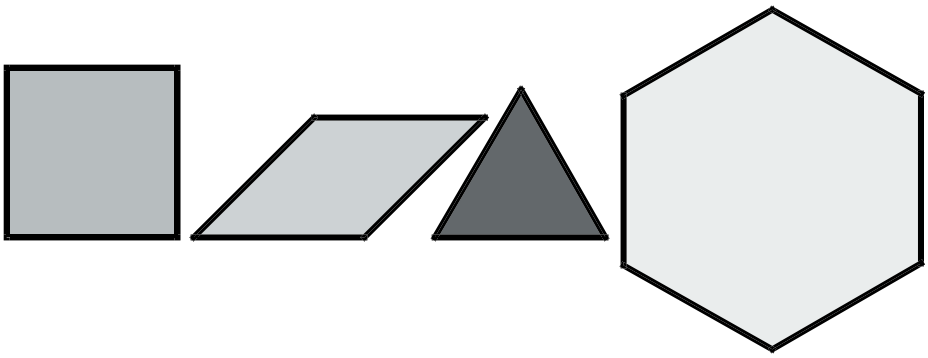
An answer for 5.4:



Activity 5 — Making a corporate design for the salon by tessellating

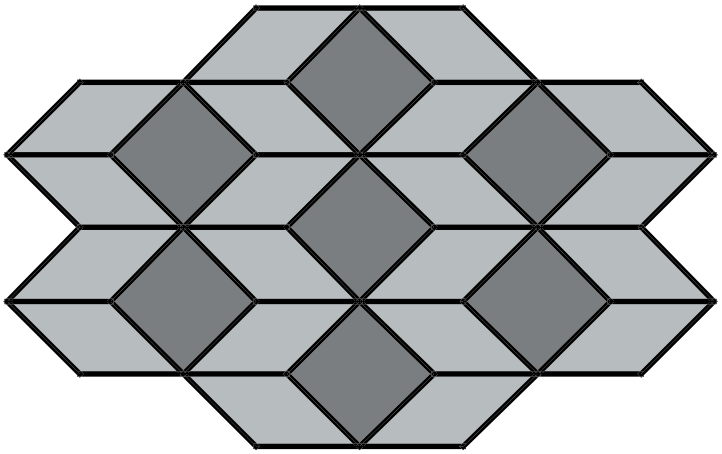
In activity 3 the word tessellation was introduced. To tessellate a plane (surface) is to cover (tile) it using a shape or combination of shapes in a predictable way (pattern). In activity 3 we "tessellated" the box design on the cardboard sheets to determine the most economical use of the cardboard. This was not a true tessellation in that we left some gaps between the shapes, but the process we used was very similar to tessellating.

By tessellating shapes we can generate some pretty patterns. Such patterns can be used to decorate the boxes we use to package our product, to form the background for the labels and other stationery in the salon, and even to tile the walls and floor of the salon—we can use the tessellations to create a logo or image for our salon.



5.1 Cut out the shapes above and trace around them onto coloured paper. Use a different colour for each shape. Cut out a large number of each of the shapes.

5.2 Make and extend the following tessellation using your own shapes:



5.3 Make at least four different tessellations using the shapes provided. Paste each of the tessellations onto a separate piece of paper (you may want to refer to the handout for activity 3 for some ideas).

5.4 Use the shapes that you have to make another shape and then tessellate the plane using your new shape.

5.5 Choose one of the tessellations that you developed in 5.3 and 5.4 and motivate why you think it is would be a good pattern to use for the packaging, stationery and wall tiles in your salon.

5.6 The photographs below show different hair braiding patterns. Each of these patterns in also an example of a tessellation.

Look through your magazines and textbooks on hair design and find at least three other examples of braiding that incorporate tessellating. Either photocopy or make a sketch of the pattern.

Activity 6 — Mixing quantities in given ratios

ABOUT THIS ACTIVITY

In this activity the students work with ratios. They will simplify ratios, increase and decrease in a given ratio and share in a given ratio. The context used is the diluting of a disinfectant which is used by hairdressers. Different strengths of the product are considered. The students have to choose the best measuring instrument to use in a particular situation from a list of options.

This activity is aligned with unit standard 9013 and addresses AC 1,2,3,4,5,6 of SO1 and AC 2,4,5,6,7 of SO2.

MANAGING THIS ACTIVITY

The students will need a calculator for this activity.

6.1.1 1st Barbicide bottle:

473ml = 16 *fl oz*, therefore there will be

$\frac{473}{16}$ *ml* in 1 *fl oz*

= 29,5625*ml* per *fl oz*.

2nd Barbicide bottle:

1890ml = 64 *fl oz*, therefore there will be

$\frac{1890}{64}$ *ml* in 1 *fl oz*

= 29,53125*ml* per *fl oz*.

6.1.2 They only differ in the second decimal place. This is insignificant.

6.1.3 30ml to 1 *fl oz*.

6.2 Amount of water needed and quantity of mixture:

6.2.1 (a) 960ml water. This makes 1,02l of mixture.

(b) 240ml water. This makes 255ml of mixture.

(c) 80ml water. This makes 85ml of mixture.

(d) 2l water. This makes 2,125l of mixture.

6.2.2 (a) 50ml concentrate. This makes 850ml of mixture.

(b) 75ml concentrate. This makes 1,275l of mixture.

(c) 31ml concentrate. This makes 531ml of mixture.

6.3 Measuring instruments:

	1	2	3	4	5	6	7
Concentrate	¼ cup	tablespoon	teaspoon	½ cup	250*ml* jug	250*ml* jug	tablespoon
Water	l*l* jug	250*ml* jug	250*ml* jug	l*l* jug	l*l* jug	l*l* jug	500*ml* jug

6.4 250ml ÷ 4 = 62,5*ml*.

So ¼ cup is actually 2,5*ml* more than the ¼ cup measure. This is why the volumes are "inaccurate". The *ml* are "lost" in the rounding off.

6.5.1 One pint makes 64 quartz

∴ one pint makes $\frac{64}{2} \times 3\frac{1}{4}$ pints

∴ one pint makes 104 pints

This means that the ratio of concentrate to mixture is 1:104

Therefore 16 *fl oz* will make 16 × 104 *fl oz*.

Therefore 16 *fl oz* will make 1664 *fl oz*.

Therefore 16 *fl oz* will make 1664 × 30*ml*.

Therefore the total volume of mixture is 49,92*l* ≈ 50l

6.5.2 1:103

6.6 Barbicide would be useful if only small volumes were needed as the dilution is I:32 whereas the Barbicide Plus needs to be diluted in the ratio of 1:103. To make up a small volume using the Barbicide Plus, one would be working with very small volumes of concentrate and accurate measurement may be difficult. The decision, however, is also economical as it depends on which product is more cost effective.

6.7.1 *Barbicide*: 2500ml ÷ 17 $\approx 147\,ml$
Therefore amount of concentrate $\approx 147\,ml$
amount of water $\approx 147\,ml \times 16 \approx 2\,353\,ml$
Barbicide Plus: $2500\,ml \div 104 \approx 24\,ml$
Therefore amount of concentrate $\approx 24\,ml$
amount of water $\approx 24\,ml \times 103 \approx 2\,476\,ml$

6.7.2 *Barbicide*: $250\,ml \div 17 \approx 15\,ml$
Therefore amount of concentrate $\approx 15\,ml$
amount of water $\approx 15\,ml \times 16 \approx 235\,ml$
Barbicide Plus: $250\,ml \div 104 \approx 2\,ml$
Therefore amount of concentrate $\approx 2\,ml$
amount of water $\approx 2\,ml \times 103 \approx 248\,ml$

6.7.3 *Barbicide*: $4\,000\,ml \div 17 \approx 235\,ml$
Therefore amount of concentrate $\approx 235\,ml$
amount of water $\approx 235\,ml \times 16 \approx 3\,765\,ml$
Barbicide Plus: $4\,000\,ml \div 104 \approx 38\,ml$
Therefore amount of concentrate $\approx 38\,ml$
amount of water $\approx 38\,ml \times 103 \approx 3\,962\,ml$

Activity 6 — Mixing quantities in given ratios

There are several instances when people working in a hair salon will have to mix products together— in particular the mixing of tints and peroxide for the colouring of hair. This mixing is usually done according to a given ratio.

Ratios
A ratio is a comparison of two numbers (called terms of the ratio) and can be written in different ways. Suppose a given cold drink is made by mixing one part of concentrate with three parts of water. The ratio of concentrate can be written:

- with a colon 1 : 3
- as a fraction 13
- or in words 1-to-3

It is important to notice that the ratio involves no units. This is because the user decides on the units. If you want to make one glass of the cold drink you might choose to mix 50*ml* of concentrate with 150*ml* (50*ml* × 3) of water. On the other hand you could choose to empty the whole bottle of concentrate into a bucket and then to flll the bottle with water three times and add the water to the bucket. In the flrst example the unit was 50*ml*, in the second it was a bottle; in both cases we mixed 1 unit of concentrate with 3 units of water.

Barbicide
Barbicide is a hospital disinfectant for salon tools and is used by hairdressers around the world.

You will have seen the *Barbicide* jars on the right in hair salons and spas. The mixture inside the jar is made up by mixing the concentrate (see the picture on the left) with water.
Barbicide concentrate is sold in two different sized bottles: 473*ml* (16*fl oz*)[1] and 1,89*l* (64*fl oz*).

6.1 Converting between milliliters and fluid ounces

6.1.1 Use both of the *ml* – *fl oz* comparisons provided to determine the number of *ml* (milliliter) in one *fl oz* (fluid ounce).

6.1.2 You will notice that you got two different answers. Discuss whether or not this difference is important.

6.1.3 Given the measuring jars etc that are available to you, discuss what you think would be a useful conversion rate to use.

[1] Barbicide *is manufactured in the United States where they use the imperial system of measuring and hence the volume of the bottles is measured in fl oz (fluid ounces).*

6.2 The mixing instruction for *Barbicide* which is written on the side of the bottle is:
2 parts concentrate to 32 parts of water

6.2.1 How much water must be added to each of the following quantities of concentrate and how much mixture will be produced?

(a) 60*ml* (¼ of a cup) of concentrate

(b) 15*ml* (1 tablespoon) of concentrate

(c) 5*ml* (1 teaspoon) of concentrate

(d) 125*ml* of concentrate

6.2.1 How much concentrate must be added to the following quantities of water and how much mixture will be produced?

(a) 800*ml* water

(b) 1,2*l* water

(c) 500*ml* water

6.3 You have the following measuring instruments available in your salon. Determine which would be the most appropriate to measure out the water and the concentrate for the seven mixtures mentioned in question 6.2?

- Measuring spoons: teaspoon (5*ml*), tablespoon (15*ml*)
- Measuring cups: ¼ cup (60*ml*); ½ cup (125*ml*); ¾ cup (190*ml*); 1 cup (250*ml*)
- Measuring jugs: 250*ml* jug with 5*ml* markings; 500*ml* jug with 10*ml* markings; 1 l jug with 100*ml* markings

6.4 The volumes given for the different cup measures above are correct. However, notice that:
2 × 60*ml* (¼ cup) ≠ 125ml (½ cup).
Discuss why there is this "inaccuracy."

6.5 *Barbicide plus* is sold in 16fl oz bottles with the remark that:
"one pint makes 64 quarts".
Knowing the following conversions:
2 quarts = 3¼ pints and 5*fl oz* = ½ pint, determine:

6.5.1 The total volume (in litres) of mixture that can be made using one bottle of *Barbicide plus* concentrate.

6.5.2 The mixing ratio of concentrate to water for *Barbicide plus*.

6.6 Which of the two products do you think is the most useful for use in a typical hair salon? Explain your answer.

6.7 Determine the amount of concentrate and the amount of water that must be mixed together to make the following mixtures:

6.7.1 2,5*l* of mixture using *Barbicide* and using *Barbicide plus*.

6.7.2 250*ml* of mixture using *Barbicide* and using *Barbicide plus*.

6.7.3 4*l* of mixture using *Barbicide* and using *Barbicide plus*.

Activity 7 — Maps, scales and distance

ABOUT THIS ACTIVITY

In this activity the students once again deal with ratios. The context used is the scale drawings of maps. They will convert distances on the map to actual distances. This activity also looks at two dimensional co-ordinates and how they are used to locate places on maps.

This activity is aligned with unit standard 9013 and addresses AC 1,2,3,4,5,6 of SO1 and AC 2,4,5,6,7 of SO2.

MANAGING THIS ACTIVITY

Students will need the handout for this activity, which consist of two pages of a map. They will also need a ruler for measuring and a piece of string.

7.1.1 I5

7.1.2 G7

7.1.3 J4

7.1.4 E4

7.2.1 Gowie St or Rockridge Rd.

7.2.2 Spike St or Parry Rd or Grocott Rd.

7.3 No, the railway line cuts through Charles Street.

7.4 Scale: 7,8cm represents 1km.

7.4.1 Distance on map = 8,4cm

$$\therefore \text{ distance in reality} = \frac{8,4}{7,8} \times 1\,km$$
$$\approx 1,1\,km$$

7.4.2 Distance on map = 8,9cm

$$\therefore \text{ distance in reality} = \frac{8,9}{7,8} \times 1\,km$$
$$\approx 1,1\,km$$

7.4.3 Distance on map = 20,9cm

$$\therefore \text{ distance in reality} = \frac{20,9}{7,8} \times 1\,km$$
$$\approx 2,7\,km$$

7.4.4 Distance on map = 18,1cm

$$\therefore \text{ distance in reality} = \frac{18,1}{7,8} \times 1\,km$$
$$\approx 2,3\,km$$

7.5.1 From the B&B turn left into Allen Street, cross New St and continue until you meet High St. Allen St becomes Scotts Ave after crossing New St. Turn left into High St and continue until you meet Cuyler St which is the third street on the left hand side of the road. We are on the corner of Cuyler and High St.

Distance in km ≈ 0,5km so it should take about 5 minutes (distance calculated as in 7.4).

7.5.2 From the B&B turn right into Napier St, then first left into Caldecott St. Walk until you get to an intersection with Ayliff St, turn left and continue until you reach a traffic circle. Take the second right into High St. Continue past the cathedral and cross Hill St. The next road on your right is Cuyler St. We are on the corner of Cuyler and High St.

Distance in km ≈ 1km so it should take about 10 minutes(distance calculated as in 7.4).

7.5.3 From the B&B turn left into Hare St. Continue until you reach the T-junction then turn right into Cradock St. Continue until you reach the intersection with Worcester St then veer right into Somerset St. Continue along Somerset St until you reach High St and turn left. Go along High St and the fourth street on your left is Cuyler St. We are on the corner of Cuyler and High St.

Distance in km ≈ 1,7km so it should take about 17 minutes (distance calculated as in 7.4).

7.6.1 On map.

7.6.2 (a) Nil (b) R10 (c) R20 (d) R10

7.7.1 The distance is about 1,8km so this should take about 18 minutes.

7.7.2 A street map does not show elevation. Everything looks flat. The reason for it taking longer is that one might have hills to climb.

Activity 7 — Maps, scales and distance

One of the attributes of mathematically literate people is that they are able to read maps — in particular that they can use grid reference systems and scales.

A map of Grahamstown is supplied in the handout. Begin by cutting the two pieces out of the handout and sticking them together to form a single map. Now answer the following questions with respect to this map.

7.1 Give the grid references of the following points on the map:

7.1.1 The City Hall – marked with an A

7.1.2 The 1820 Settlers National Monument – marked with a B

7.1.3 The railway goods yard –marked with a C

7.1.4 Cradock Dam – marked with a D

7.2 For each of the following grid references write down the name of one of the streets that is completely contained within the grid reference:

7.2.1 H7

7.2.2 H4

7.3 Is it possible to drive a car from Henry St (H4) to Ayliff St (I4) by driving along Charles Street? Give reasons for your answer.

7.4 Use the scale to determine the following distances:

7.4.1 From corner Beaufort St and Somerset St (H7) to corner Beaufort St and York St (J6)

7.4.2 From corner African St and Hill St (H5) to corner Hill St and Lawrance St (I7)

7.4.3 From corner York St and Webber St (J6) to corner Worcester St and Somerset St (G5) travelling along York St, Beaufort St, and Somerset St.

7.4.4 From the intersection of Grey St and the N2 (G8) to the circle on High St at Spring St (I5)

7.5 Your hairdressing salon is located on High St at the intersection of High St and Cuyler St (H5)—marked E.

Clients often phone from the various B&Bs in town asking for directions to the salon.

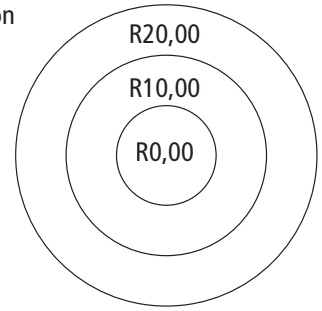
Write down the directions that you would give the following clients and try to estimate how long it would take them to walk to the salon if you assume that a healthy adult can walk 1km in ten minutes.

7.5.1 Courtyards B&B in Allen St (H5)—marked F

7.5.2 Hurdam Cottage B&B in Napier St (I4)—marked G

7.5.3 Hare House B&B in Hare St (F5)—marked H

7.6 Occasionally some of the elderly folk in town phone the salon and ask that one of the stylists visits them at their home to do a wash and set.
The owner of the salon has drawn three circles on the map. The first one has a radius of 0,5km, the second a radius of 1,0km and the third a radius of 1,5km. Clients are charged the additional fee shown in the circles alongside for treatments at their home.



7.6.1 Draw the three circles on your map.

7.6.2 Determine how much clients living at the following addresses would have to pay for a home visit:

(a) Hemming Street (H6)

(b) Drosty Road (G6)

(c) Bath Road (G3)

(d) University Road (G7)

7.7 After having her hair done, one of the tourists wants to walk to the 1820 Settlers National Monument from your salon.

7.7.1 Calculate the approximate time it should take her.

7.7.2 In reality it took her much longer. In what ways could the map be misleading when calculating walking times.

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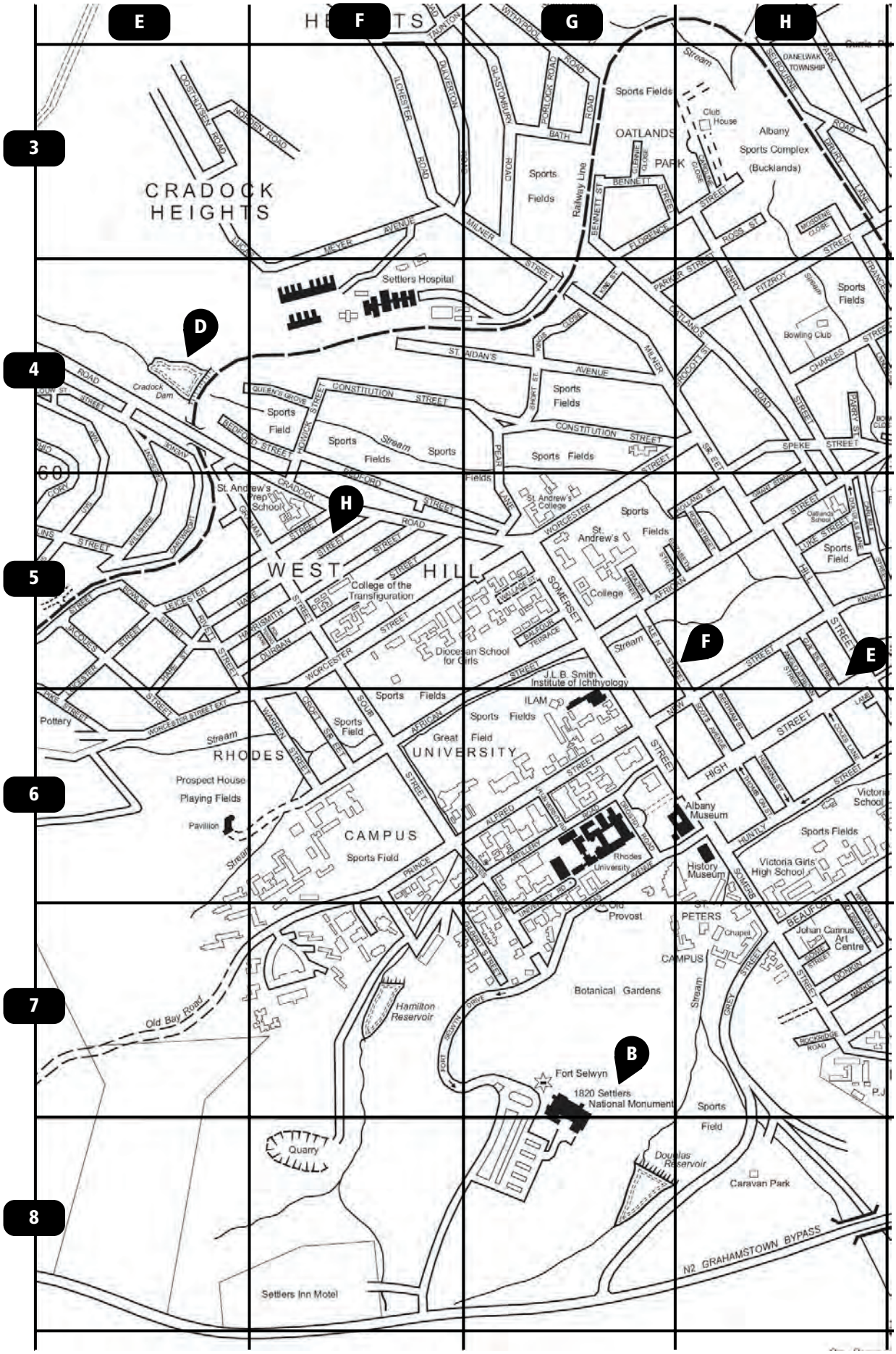
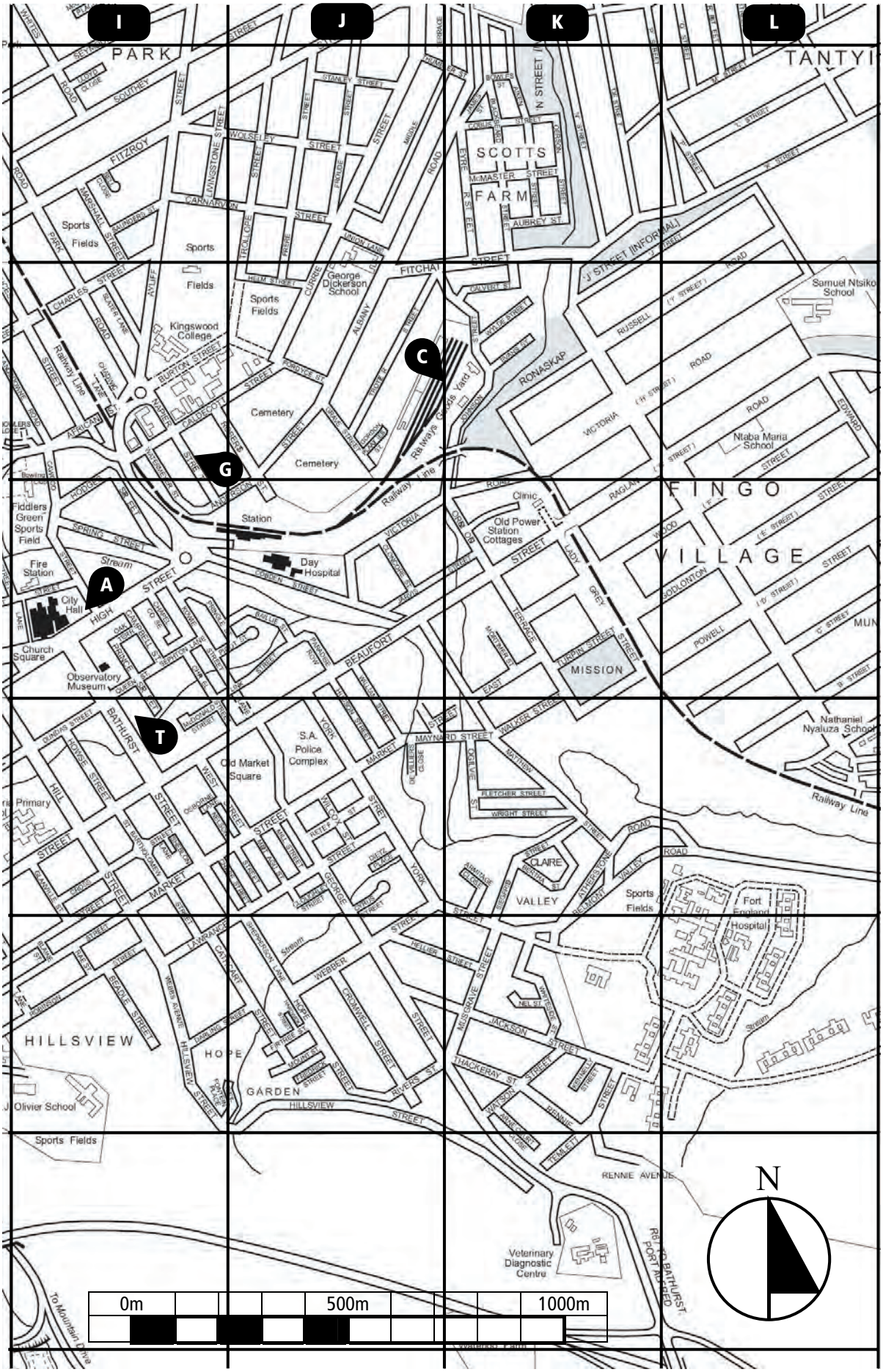
(Maps that follow must be issued
as 2-PAGE SPREAD, not back-to-back
on a single sheet)


E
F
G
H
3
4
5
6
7
8
D
H
F
E
B
CRADOCK HEIGHTS
Settlers Hospital
Cradock Dam
Sports Field
Sports Fields
Stream
St. Andrew's Prep School
WEST HILL
College of the Transfiguration
Diocesan School for Girls
St. Andrew's College
St. Andrew's College
J.L.B. Smith Institute of Ichthyology
ILAM
Great Field
UNIVERSITY
RHODES
CAMPUS
Pottery
Prospect House Playing Fields
Pavilion
Hamilton Reservoir
Old Bay Road
Fort Selwyn
1820 Settlers National Monument
Quarry
Douglas Reservoir
Caravan Park
Settlers Inn Motel
N2 GRAHAMSTOWN BYPASS
Botanical Gardens
Old Provost
ST PETERS
Chapel
Johan Carinus Art Centre
Rhodes University
Albany Museum
History Museum
Victoria Girls' High School
Victoria School
OATLANDS PARK
Club House
Albany Sports Complex (Bucklands)
Bowling Club
Railway Line
Oatlands School
Sports Field


I
J
K
L
C
G
A
T
PARK
TANTYI
SCOTTS
FARM
FITZROY
Sports Fields
Kingswood College
George Dickerson School
Cemetery
Railway Goods Yard
Railway Line
Station
Day Hospital
City Hall
Church Square
Observatory Museum
Fiddlers Green Sports Field
Fire Station
Stream
Samuel Ntsiko School
Ntaba Maria School
FINGO
VILLAGE
Clinic
Old Power Station Cottages
MISSION
Nathaniel Nyaluza School
S.A. Police Complex
Old Market Square
Primary
CLAIRE
VALLEY
Fort England Hospital
HILLSVIEW
HOPE
GARDEN
Olivier School
Veterinary Diagnostic Centre
RENNIE AVENUE
To Mountain Drive
N
0m
500m
1000m

Activity 8 — Plans, scale and salon designs

ABOUT THIS ACTIVITY

This activity reinforces skills learnt in the previous activity. The students once again work with scale drawings. In this activity they are asked to consider top views of styling, washing and drying stations and then to measure and calculate the actual dimensions. They compare the different floor space needed for each station and draw some conclusions as to why these differ.

This activity is aligned with unit standard 9013 and addresses AC 1, 2, 3, 4, 5 of SO1 and AC 1, 2, 3, 4, 5, 6, 7 of SO2 .

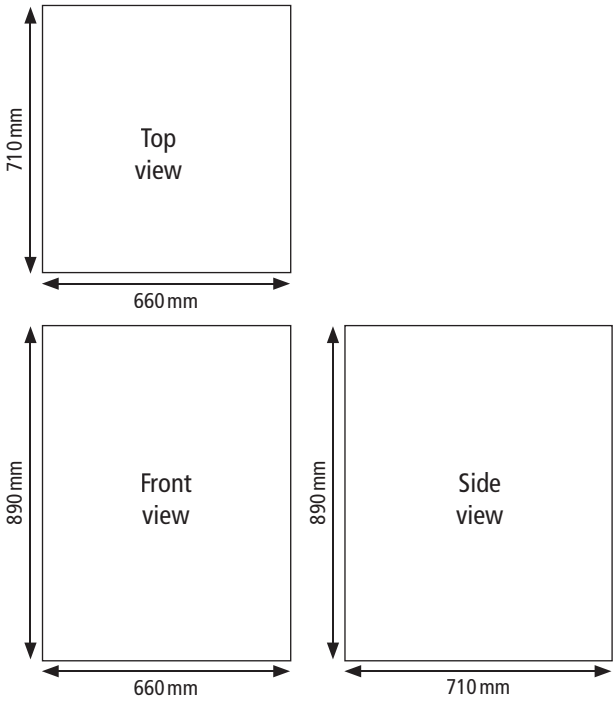
MANAGING THIS ACTIVITY

Students will need a ruler to measure distances, and a calculator. There are no handouts necessary for this activity.

8.1.1 See alongside (no details of the chair are given) the dimensions are correct.

8.1.2 See alongside (no details of the chair are given) the dimensions are correct.

8.1.3 See alongside (no details of the chair are given) the dimensions are correct.



8.2.1 Chair width = 3,3cm
Minimum distance = 2,2cm
Recommended distance = 3cm
Distance from chair to wall = 2,5cm
Distance from chair to counter = 1,2cm
Chair depth = 3,6cm
Distance between chairs = 3,6cm

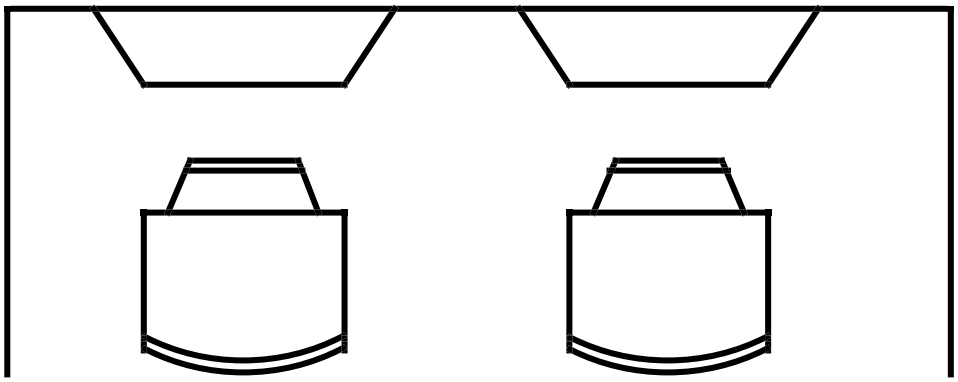
8.2.2 Chair width = 3,3 × 20cm = 66cm
Minimum distance = 44cm
Recommended distance = 60cm
Distance from chair to wall = 50cm
Distance from chair to counter = 24cm
Chair depth = 72cm
Distance between chairs = 74cm

8.2.3 100cm × 30cm × 66cm

8.2.4 No

8.2.5 Recommended floor space = 328cm × 180cm = 59 040 cm²
Minimum floor space = 296cm × 180cm = 53 280 cm²

8.3 1:25 plan



8.4.1 (a) 197,5cm × 215cm = 42 463 cm^2
(b) 152cm × 110cm = 16 940 cm^2

8.4.2 Floor space needed:

Washing station = 42 463 cm^2

Styling station = 53 280 cm^2 (from 8.2.6)

Drying station = 16 720 cm^2

They are different because the stations have different functions. The stylist needs to be able to move around the client without bumping the stylist working next to her/him, therefore the floor space required is much larger than for the other two stations. The washing station floor space is much larger than the drying station for a similar reason. At the washing station one needs to get behind the client in order to wash his/her hair whereas at the drying station the client sits under the drier.

8.5 One can measure a large diagram(ie with a smaller scale) more accurately than a small diagram that has a large scale.

Activity 8 — Plans, scale and salon design

In the previous activity we looked at maps and worked with scales. Another situation in which we often have to work with scales is in the context of building plans. In this activity we will look at some plans for salons.

Maps and plans

One of the challenges in developing maps and plans is to decide on what information to show and what information to leave out. In the previous activity we realised that while the map could show the roads and their orientation with respect to each other, it could not show the hills (a different map is needed for that).

Similarly, when drawing plans for a salon the architect will not draw a detailed picture of, say, each chair and might instead use an impression of the top of the chair to indicate dimensions/position.

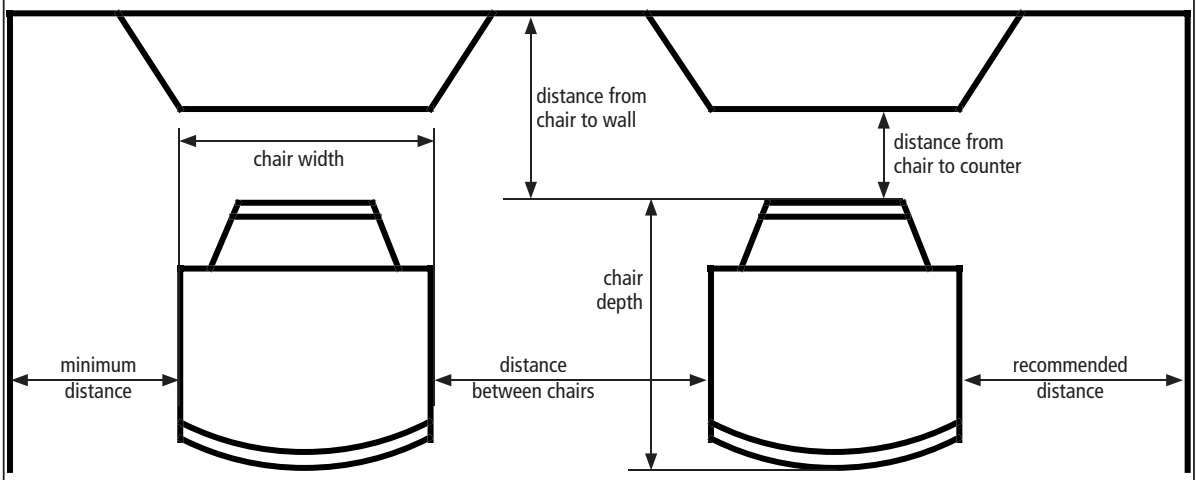
8.1 For the chair in the picture, draw rough sketches of the following views of the chair (filling in as many measurements as you can each time):

8.1.1 Top view

8.1.2 Front view

8.1.3 Side view

8.2 The sketch below is an architect's impression of two styling chairs in a salon. The plan has been drawn using a 1:20 scale.



8.2.1 Measure each of the lengths shown on the diagram as accurately as you can.

8.2.2 Calculate the actual dimensions using the scale provided.

8.2.3 Determine the dimensions of the counter as accurately as possible.

8.2.4 Is it possible to tell (from the plan) how high the counter is above the floor?

8.2.5 Assuming that a minimum distance of 0,6m must be kept free behind the styling chairs, calculate the floor space needed for a styling station with two chairs.

8.3 Redraw the architect's plan using a scale of 1:25. (You may want to do this on a piece of graph paper to make this task easier.)

8.4 The plans below are of a salon wash station (scale 1:25) and a salon drying station (scale 1:10).

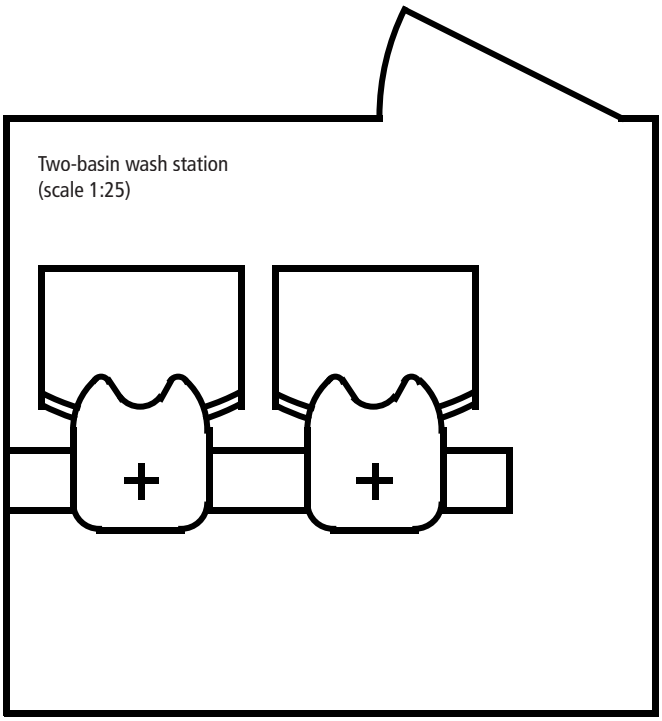
8.4.1 Use these scale drawings to determine:

(a) the floor space needed for a two-basin wash station

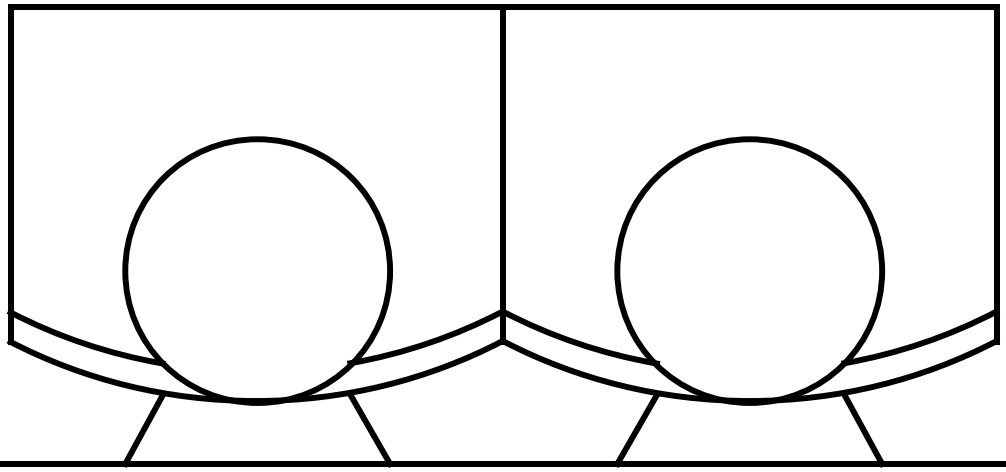
(b) the floor space needed for a two-dryer drying station

8.4.2 Compare the amount of floor space needed for the washing, styling and drying stations. Explain why these are different.

Two-basin wash station
(scale 1:25)



Two-dryer drying station
(scale 1:10)



8.5 Discuss how changing the scale of the drawing impacts on the accuracy with which you can calculate the actual floor dimensions.

Activity 9 — Ratio/proportion assessment task

ABOUT THIS ACTIVITY
This is an assessment task covering the skills relating to ratio and scale drawings learnt in the previous three activities. Questions are asked to facilitate students thinking about estimation in practical situations.

This activity is aligned with unit standard 9013 and addresses AC 1,2,3,4,5,6 of SO1 and AC 2,4,5,6,7 of SO2.

MANAGING THIS ACTIVITY
Students will need a ruler, calculator and string for this activity. They must have done the previous 3 activities in order for this to be used as an assessment task.

9.1 Ratio = 1:100
5ml × 100 = 500ml

9.2.1 It is more concentrated as she has added only 495ml of water and not 500ml as she should have.

9.2.2 It is not significant as it is just a cleaning agent. In other contexts this might not be the case.

9.3 505l

9.4.1 100ml of CAS. The CAS is more concentrated. One can make about 10l of CAS mixture and only about 1,6l of *Barbicide*.

9.4.2 16:100 = 4:25

9.5 16cm represents 1km.
16cm represents 100 000cm
scale of map = 1:6250

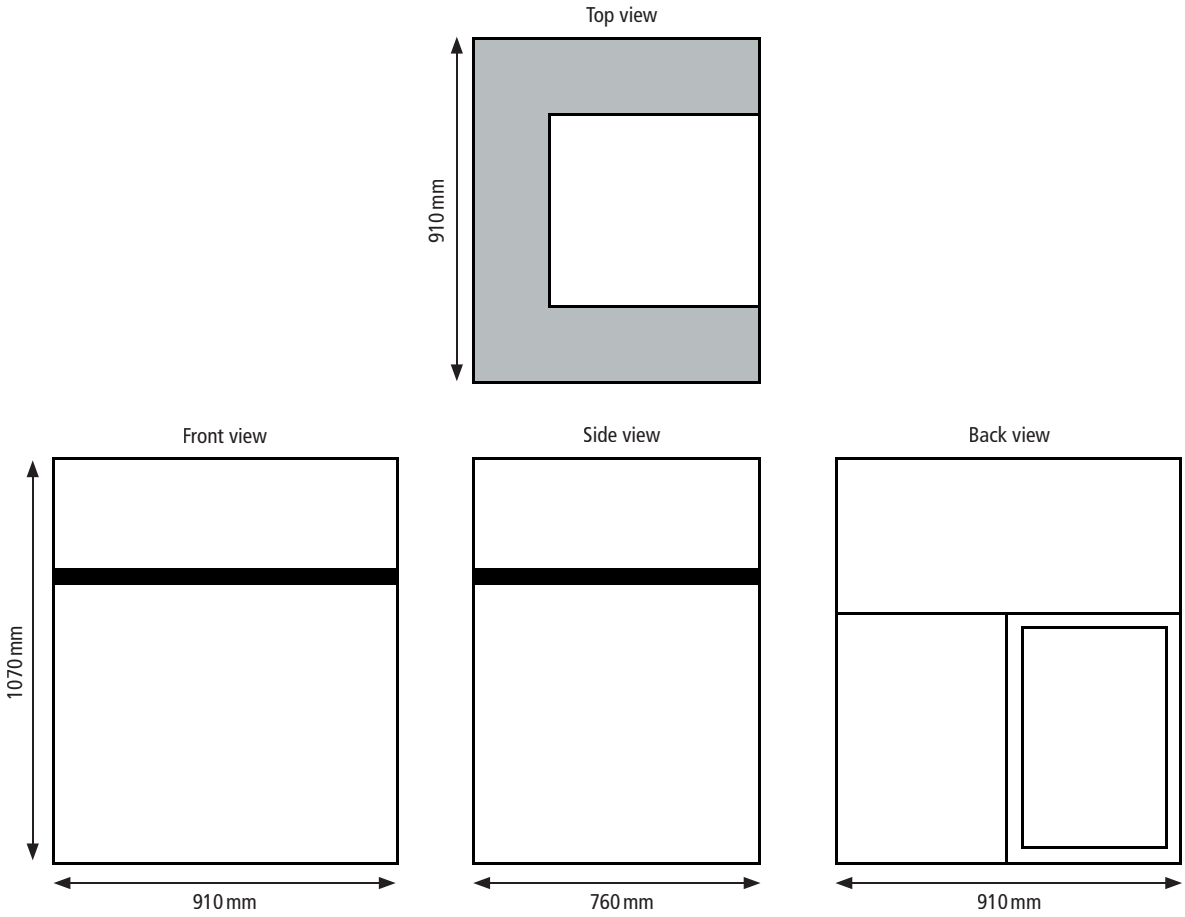
9.6.1 On the map Miriam walked about 24cm.
This means that she walked a distance of 24 × 6 250 ≈ 150 000cm. This is about 1,5km.

9.6.2 (a) Distance from Elsie's house to the school is about 12 × 6 250 ≈ 75 000cm. This is about 0,75km. Walking at 12minutes per km, this should take about 9 minutes. Miriam needs to be at Elsie's house at about 07:40.
(b) Distance between Miriam and Elsie's houses is about 7 × 6 250 ≈ 43 750cm. This is about 0,4km. This will take about 5 minutes. She must leave home at about 07:35.
(c) The whole journey takes 1,5 × 12minutes = 18 minutes, so she should get to work at about 07:53.

9.6.3 (a) Walk along Maseti St to the T-junction. Turn left into Nduna St. Turn right into Ncame St. and continue till the end of the street. At the ned turn left, then first right and then first left into Goba St.
(b) Distance walked is about 17 × 6 250 ≈ 106 250cm. This is about 1,1km.This will take about 13 minutes. She needs to leave home at 07:40.

9.7 The pictures give two different views of the counter if you were only shown the "front" view you would have no sense of the shelf at the back etc. i.e. it gives the prospective buyer a better idea of what the counter will look like.

9.8 The drawings on the next page are 1:20 scale (not 1:10 as the worksheet asks.


Top view
910 mm
Front view
1070 mm
910 mm
Side view
760 mm
Back view
910 mm

Activity 9 — Ratio/proportion assessment task

In this activity/task we consolidate the work done on ratio/proportion during the previous three activities related to mixing and scales used in maps and plans.

Mixing disinfectant

Barbicide (mentioned in activity 6) is one disinfectant used in salons. There is another that is manufactured in South Africa called *CAS* (Concentrated Antimicrobial Solution). *CAS* concentrate must be diluted in the ratio 1:100 and is sold in four different quantities:

- 5*ml* sachet
- 50*ml* sachet
- 1*l* container
- 5*l* container

9.1 Show that 500*ml* of water must be added to one 5*ml* sachet of concentrate to make up a mixture of *CAS*.

9.2 Amy, who works in a salon and is responsible for preparing the *CAS* mixture, usually empties one 5*ml* sachet in a ½ litre measuring jug and then fills the jug to the 500*ml* mark.

9.2.1 Is Amy's mixture more or less concentrated than the mixture in question 9.1? Give reasons for your answer.

9.2.2 Is the difference between the two mixtures significant or do we not need to worry about it? Justify your answer.

9.3 How many litres of mixture can be made using a 5*l* container of concentrate?

9.4 *Barbicide* is mixed in the ratio 2:32 and *CAS* in the ratio 1:100. If both products are considered to be equally effective:

9.4.1 Which of the two would you expect to pay more for: 100*ml* of *Barbicide* concentrate or 100ml of CAS concentrate? Justify your answer.

9.4.2 Write as a ratio the cost of 50*ml Barbicide* : the cost of 50*ml CAS* if the two products give the same value for money.

Map work

The questions that follow refer to the map of Makanas (one of the districts of Grahamstown) on the next page. The dimensions of the map section that has been provided are 1km by 1km. Miriam lives at point H, and runs a small informal braiding shop at point S.

9.5 Give the scale of the map in the form 1:____. Be sure to show your working in determining the scale.

9.6 In the morning Miriam walks from her home to her shop via point I where she is joined by her friend, Elsie a teacher at Makana School.

9.6.1 Calculate the total distance walked by Miriam.

9.6.2 Elsie must be at school by 07:50 and she and Miriam take approximately 12 minutes to walk one kilometer.

(a) At what time should Miriam be at Elsie's home if Elsie is to be at work on time?

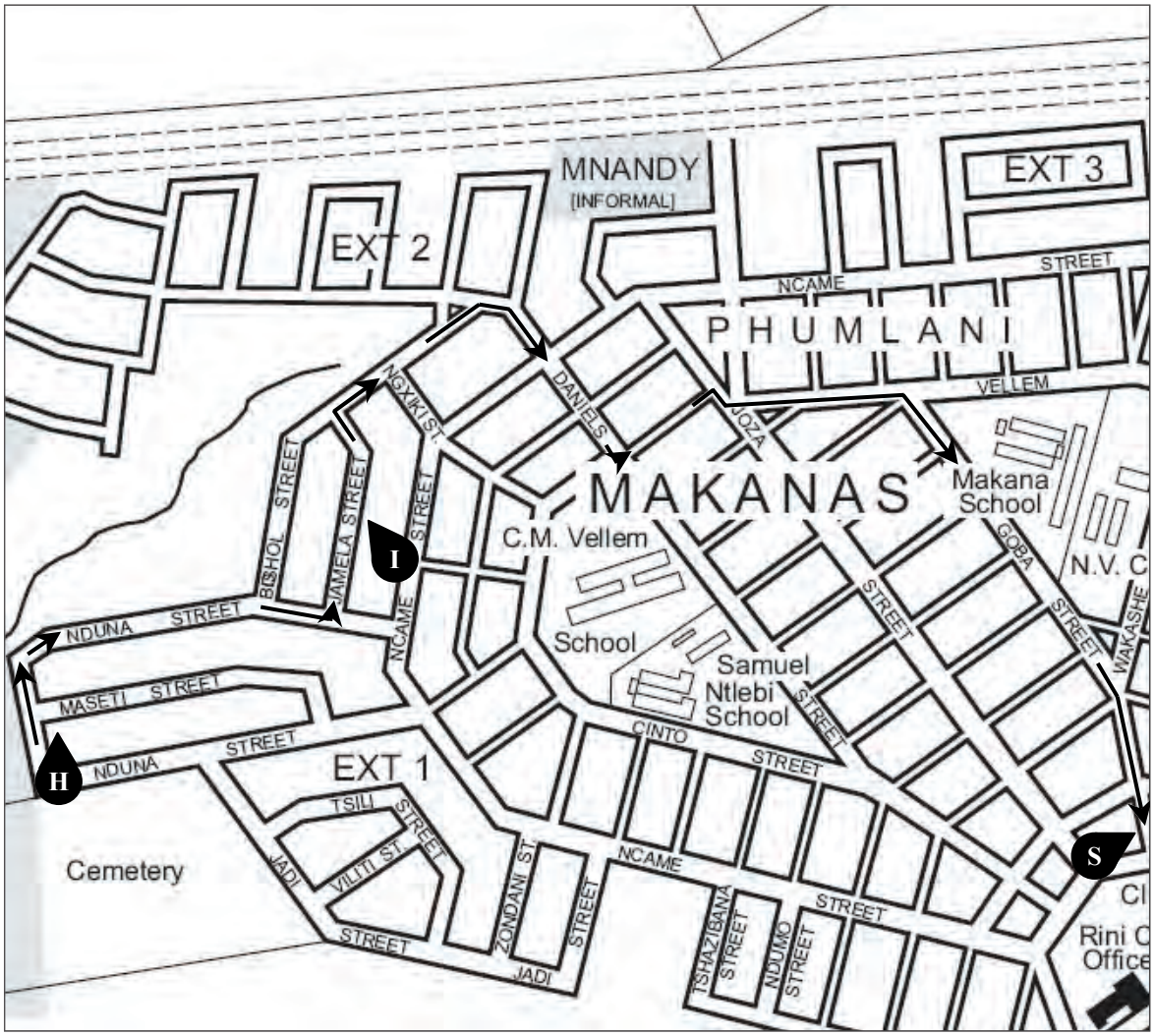
(b) At what time must Miriam leave home to be at Elsie's home on time?

(c) At what time do you expect Miriam to get to her shop?

9.6.3 If Elsie is ill one day and Miriam walks directly to work:

(a) Describe the shortest route that Miriam can take.

(b) At what time should Miriam leave home to be at work at her usual time?



Salon furniture

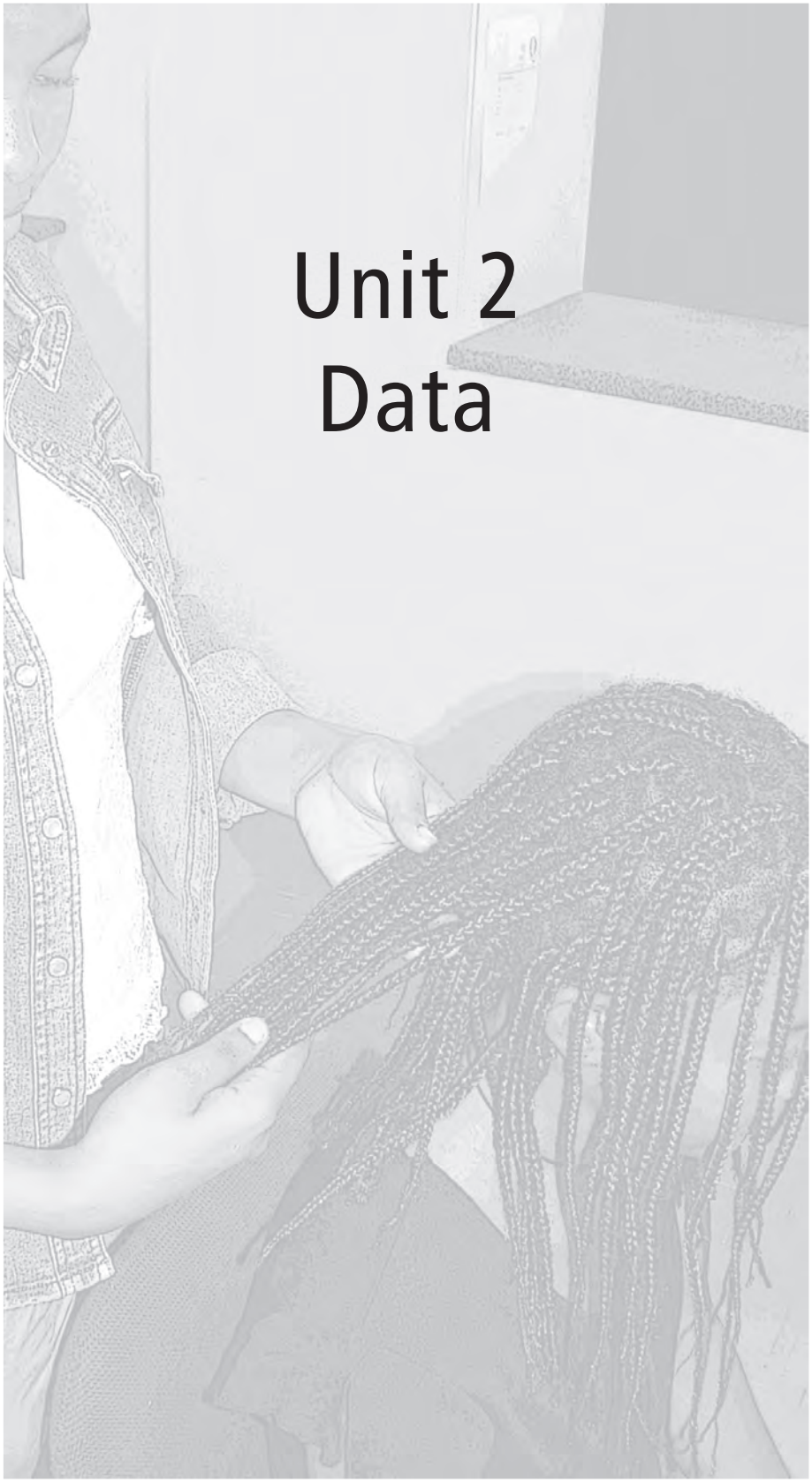
The two pictures alongside are from a salon furniture catalogue. The dimensions of the reception desk are 760mm D × 1070mm H × 910mm W.

9.7 Why are there two pictures of the reception desk in the catalogue?

9.8 Using a scale of 1:10, draw the following views of the table in as much detail as possible: top, front, back and side.

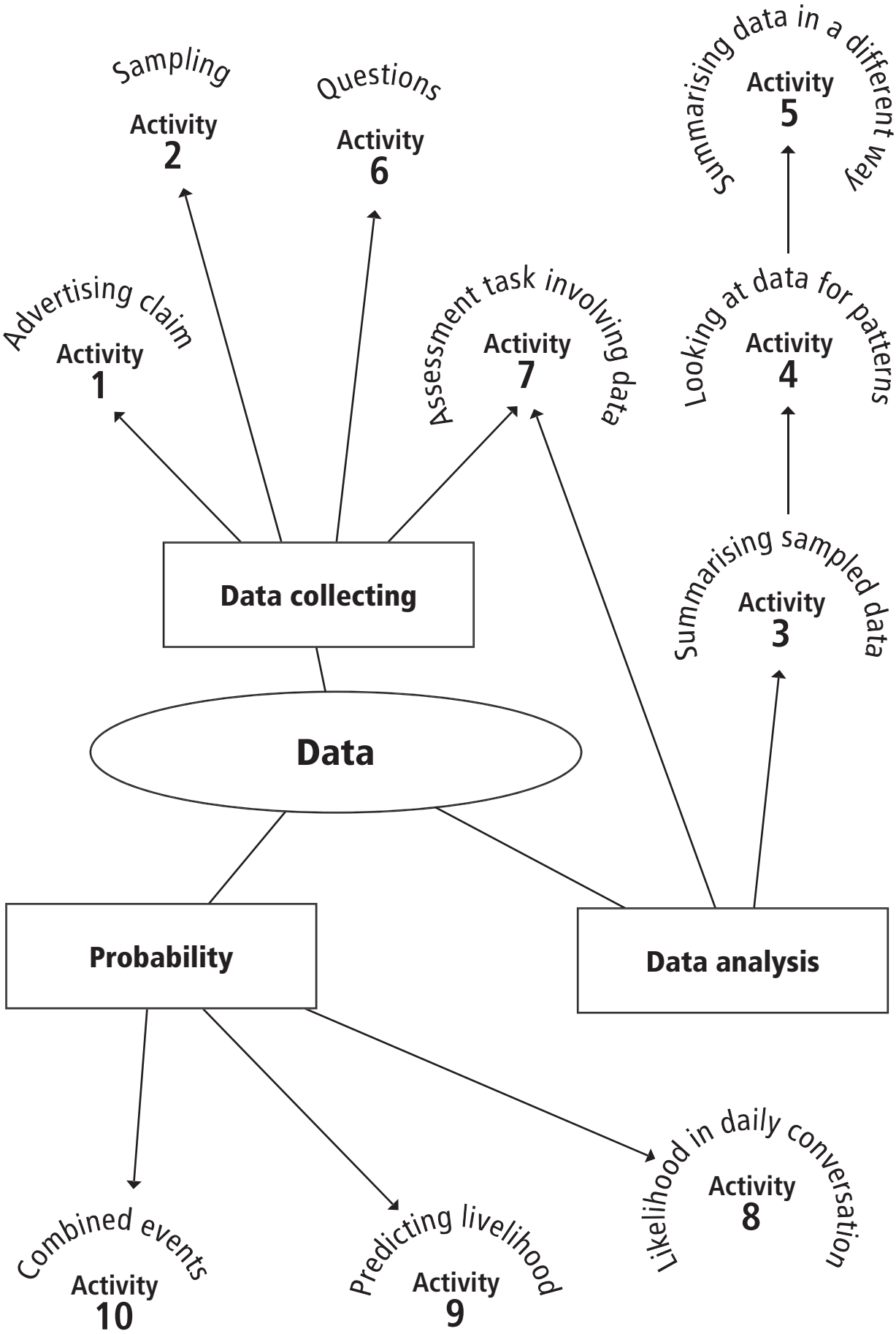
Mathematical Literacy

NQF LEVEL 3



Unit 2
Data

Hairdressing


Sampling
Activity 2
Questions
Activity 6
Summarising data in a different way
Activity 5
Advertising claim
Activity 1
Assessment task involving data
Activity 7
Looking at data for patterns
Activity 4
Data collecting
Summarising sampled data
Activity 3
Data
Probability
Data analysis
Combined events
Activity 10
Predicting livelihood
Activity 9
Likelihood in daily conversation
Activity 8

Overview

In this unit student's develop a variety of mathematical skills needed for working with data.

Learners should gain an understanding of how to formulate questions in surveys to obtain data and how to select a suitable sample group from a population.

Learners will look critically at advertisements and analyse the claims that are made. They will evaluate different methods of gathering data.

In this unit the learners calculate measures of central tendencies and identify when to use them appropriately. They will draw and use scatter plots to determine the correlation between two variables.

Learners will gain an understanding of the distinction between theoretical and experimental probabilities and be able to express each of these as a value on the probability scale or as a percentage. The learners will use tree diagrams to represent a situation and hence calculate the probability of that event. They will also consider combined events.

This unit consists of ten activities. Each activity is a stand alone activity, but they rely on an understanding of the concepts that have been raised preceding each activity. Three of the activities look at data collection and choosing a suitable sample from a population. Three of the activities look at the analysis of data using different measures. There is an assessment activity which assesses skills developed in all six of these activities. The last three activities deal with probability. Having worked through this unit, learners should have a greater ability to work intelligently with data of many shapes and forms.

Activity 1: Advertising claims
This activity focuses on advertisements and the claims that are made. Learners will be made aware of the Advertising Standards Authority and how they regulate advertisements. In this activity the learners consider different methods of gathering data.

Activity 2: Sampling
In this activity we look at sample size and the importance of selecting a representative sample of the population. The learners will interpret graphical representation of data. The population pyramid graphs of South Africa and the Western Cape are used in this activity. The learners do some data collecting.

Unit outcomes

The following Unit Standards, Specific Outcomes and Assessment Criteria are addressed by this unit:
Investigate life and work related problems using data and probabilities (9012)

- Pose questions, collect and organise data. (SO1).
  - Situations or issues that can be dealt with through statistical methods are identified correctly.
  - Variables contributing to a problem situation are identified and addressed in data gathering, e.g. crime is related to time of day and location.
  - Appropriate and efficient methods are used to collect, record and organise data.
  - Data samples are of adequate size and are representative of the population.
- Represent, analyse and interpret data using various techniques. (SO2).
  - Graphical representations and numerical summaries are consistent with the data, are clear and are appropriate to the situation and target audience.
  - Different representations of aspects of the data are compared to take a position on the issue.
  - Calculations and the use of statistics are correct and appropriate to the problem.
  - Interpretations of statistics are justified and applied to answer questions about the problem.
  - New questions that arise from the modelling of the data are discussed.
- Use random events to explore and apply probability concepts in simple life (SO3).
  - Data are gathered, organised, sorted and classified in a suitable manner for further processing and analysis.
  - Experiments and simulations are chosen appropriately in terms of the situation to be investigated.
  - Probabilities are determined correctly.
  - Distinctions are correctly made between theoretical and experimental probabilities.
  - Predictions are based on validated experimental or theoretical probabilities.
  - The outcomes of experiments and simulations are communicated clearly.

Activity 3: Summarising sampled data
The same data pyramids from activity 2 are used in this activity. The learners calculate and analyse measures of central tendency namely mean, median and mode.

Activity 4: Looking at data for patterns
In this activity the learners deal with the correlation between two sets of data. They draw scatter plot graphs and interpret them. Again the sample size is emphasised. The context used is the purchasing of a hair dryer. The relationship between the power of the motor and the cost of the dryer is analysed.

Activity 5: Summarising data in a different way
This activity looks at quartiles as a way of interpreting data. The learner will work through examples on how to calculate quartiles and then use the information on hair dryers from the previous activity to work with quartiles.

Activity 6: Questioning
In this activity we look at the types of questions that one can use in a survey. Examples are given and the learners generate their own examples. The context used is the setting up of a new salon in a shopping mall.

Activity 7: Assessment task involving data
In this activity the learners will use the skills that they have gain in the previous activities to make a proposal to set up a new salon. It covers all aspects of data handling covered in this unit.

Activity 8: Likelihood in daily conversation
This activity looks at the probability of an event occurring. A definition of probability is given and the learners work with the probability scale. A spinner is used to generate data. The spinner has colours of different sizes hence the probability of getting a particular colour differs for each colour. The relationship between intuition, experimentation and theoretical probability is explored.

Activity 9: Predicting likelihood
This activity is a continuation of the previous activity. The learners work from theoretical probability and predict what the experimental outcome will be. Spinners are used to collect data.

Activity 10: Combined events
In this activity two spinners are used and the results are combined. Tree diagrams are used to determine the outcomes of these two events and hence the probability of getting those outcomes can be calculated.

9012	Investigate life and work related problems using data and probabilities											
		ACTIVITY	1	2	3	4	5	6	7	8	9	10
SO1	Pose questions, collect and organise data.											
	AC1	Situations or issues that can be dealt with through statistical methods are identified correctly.	✓	✓	✓	✓	✓	✓	✓			
	AC2	Variables contributing to a problem situation are identified and addressed in data gathering, e.g. crime is related to time of day and location.	✓			✓	✓	✓	✓			
	AC3	Appropriate and efficient methods are used to collect, record and organise data.	✓	✓	✓	✓	✓	✓	✓			
	AC4	Data samples are of adequate size and are representative of the population.		✓	✓	✓	✓		✓			
SO2	Represent, analyse and interpret data using various techniques.											
	AC1	Graphical representations and numerical summaries are consistent with the data, are clear and appropriate to the situation and target audience.		✓	✓	✓	✓		✓			
	AC2	Different representations of aspects of the data are compared to take a position on the issue.		✓	✓	✓	✓		✓			
	AC3	Calculations and the use of statistics are correct and appropriate to the problem.		✓	✓	✓	✓		✓			
	AC4	Interpretations of statistics are justified and applied to answer questions about the problem.	✓	✓	✓	✓	✓		✓			
	AC5	New questions that arise from the modelling of the data are discussed.		✓	✓		✓		✓			
SO3	Use random events to explore and apply probability concepts in simple life.											
	AC1	Data are gathered, organised, sorted and classified in a suitable manner for further processing and analysis.								✓		✓
	AC2	Experiments and simulations are chosen appropriately in terms of the situation to be investigated.								✓		✓
	AC3	Probabilities are determined correctly								✓	✓	✓
	AC4	Distinctions are correctly made between theoretical and experimental probabilities.								✓	✓	✓
	AC5	Predictions are based on validated experimental or theoretical probabilities.								✓	✓	
	AC6	The outcomes of experiments and simulations are communicated clearly.								✓	✓	

Activity 1 — Advertising claims

ABOUT THIS ACTIVITY

This activity considers the statistical claims made in advertising and the interpretation of these claims by the public. It looks at the different ways in which data is collected in order to substantiate these claims. The learners are asked to analyse two different advertisements and to give their opinion on the claims that are made.

This activity is aligned with unit standard 9012 and addresses AC 1,2,3 of SO1 and AC 4 of SO2.

MANAGING THIS ACTIVITY

The learners will need the worksheet and handout for this activity. This activity deals with only two advertisements so in order to encourage class discussion the learners could be asked to bring to class other advertisements which make statistical claims.

1.1.1 Two different types. A television commercial and an in-store display.

1.1.2 The advertisement claims that 3 out of 4 dentists recommend Sensodyne toothpaste.

1.1.3 In the TV commercial reference is made to sensitive teeth and therefore the claim is made in the context of sensitive teeth. This is not the case with regard to the in-store display. There is no reference to sensitive teeth.

1.1.4 A survey of dentists was conducted and the survey data showed that 3 out of 4 dentists recommend Sensodyne toothpaste for sensitive teeth.

1.1.5 (a) The conclusion from the TV commercial would be that Sensodyne toothpaste is recommended for sensitive teeth. The conclusion from the in-house store advertisement would be that the toothpaste is recommended for all teeth.

(b) The TV commercial has dentists talking about sensitive teeth whereas the in-store advertisement does not mention sensitive teeth at all.

1.1.6 The claim against the TV commercial was not upheld but the claim against the in-house store advertisement was.

1.2.1 Firstly he raises the concerns that there is no basis against which the claim that your hair will be five times healthier can be measured. Secondly, he claims that there is no scientific measure for "healthiness".

1.2.2 The advertiser means that your hair will have fewer split ends and breakages. An explanation is written on the screen in order to convey this message.

1.2.3 In order to substantiate the claim, the advertiser took virgin hair switches and washed them using their products and a non-conditioning shampoo. The switches were then combed. This was repeated five times. The number of split ends were counted and the fibres lost in the process were collected and counted. These results were then compared.

1.2.4 Individual response. Yes/no with a relevant reason. Example : Yes, one should question claims that don't indicate how the data was collected.

1.2.5 Individual response. Yes/no with a relevant reason. Example : Yes. There was no indication as to how the advertiser came to his/her conclusion. There was no experimental evidence or data shown.

1.3 Sensodyne toothpaste: Data was collected by surveying a sample of dentists.

Sunsilk Fruitrience shampoo: Experiments were conducted.

A survey depends on people's opinion about something so is subjective, whereas an experiment can be measured in a more scientific way and is therefore more objective.

Activity 1 — Advertising claims

An important aspect of selling hair products and other cosmetics is advertising.

A crucial skill of being a consumer is the ability to make sense of the claims that are made in advertisements.

Think about the advertisement claim that "7 out of 10 men prefer our shampoo to their old one." What did the people who "preferred" the shampoo actually say? Did they think that the shampoo was much better or only slightly better or did they not really care that much? What if the remaining 3 out of 10 men really hated the shampoo because their skin reacted badly to it? What questions were the men asked? Could it be that they preferred the shampoo because it was less expensive? The claim does not allow us to answer any of these questions and yet by making the bold claim that it does, it tries to encourage us to want to buy the shampoo.

The Advertising Standards Authority of South Africa (ASA) (http://www.asasa.org.za) is "an independent body set up and paid for by the marketing communications industry to regulate advertising in the public interest through a system of self-regulation." The ASA deals with complaints by the public and from competitors about advertisements. It publishes its rulings with respect to these complaints on its website.

1.1 Read the ASA ruling (number 3552) supplied in the handout and answer the following questions:

1.1.1 How many different types of advertisements does the ruling deal with?

1.1.2 What is the claim that is being made in the advertisements?

1.1.3 In what way does the ASA regard the claim to be different in the different advertisements?

1.1.4 On what basis has the claim been substantiated in one of the advertisements?

1.1.5 The ruling claims that the "reasonable person" would draw different conclusion from the different advertisements.

(a) What are the different conclusions?

(b) How do the different advertisements cause the "reasonable person" to draw different conclusions?

1.1.1 Why is the claim "partially upheld"? Discuss in detail.

1.2 Read the decisions by the New Zealand ASA (number 03/209) supplied in the handout and answer the following questions:

1.2.1 What are the two concerns that A. Abernethy raises with respect to the advertisement?

1.2.2 What does the advertiser mean by healthy hair and how is this conveyed to the person watching the advertisement?

1.2.3 How does the advertiser claim to support the "five times" claim? Describe, in detail, the method used to collect the evidence.

1.2.4 Do you think that A. Abernethy is representative of the "reasonable person" that the South African ASA talks about, or do you think that he is being picky? Give reasons for your answer.

1.2.5 Although the advertiser has managed to convince the New Zealand ASA that the presentation is truthful (the complaint was not upheld), do you think that the advertiser is nonetheless taking advantage of the "reasonable person"? Give reasons for your answer.

1.3 Two different types of support were provided for the claims made by the advertisers in the two complaints. Describe these data collection techniques and discuss how they are different.

GSK Group / Colgate Palmolive / 3552 Ruling of the: ASA Directorate
In the matter between:
Colgate-Palmolive (Pty) Ltd (Complainant(s)/Appellant(s))
GlaxoSmithKline South Africa (Pty) Ltd (Respondent)

09 Dec 2005

Colgate Palmolive lodged a competitor complaint against GlaxoSmithKline for advertising for its Sensodyne toothpaste.
The television commercials state, "3 out of 4 dentists recommend Sensodyne".
The in-store displays state, "Recommended by 3 out of 4 dentists".

COMPLAINT
The complainant submitted that these claims require substantiation in terms of the Code.
Furthermore, the complainant submitted that the claims made are broad and appear to refer to all toothpaste, not merely toothpaste formulated for sensitive teeth, which make them misleading.

RELEVANT CLAUSES OF THE CODE OF ADVERTISING PRACTICE
The complainant identified the following clauses of the Code as relevant:
- Section II, Clause 4.1 – Substantiation
- Appendix A, Clause 5 – Impressions of professional advice or support

RESPONSE
The respondent submitted a confidential research survey by ImagineNationAlliance.

ASA DIRECTORATE RULING
The ASA Directorate considered all the relevant documentation submitted by the respective parties.
Clause 4.1.3.1 of Section II states that survey data shall emanate from an entity approved by or acceptable to the Southern African Market Research Association (SAMRA).
The Directorate is satisfied that ImagineNationAlliance is SAMRA approved, as the respondent provided the Directorate with a letter from SAMRA in this regard.

Television commercials
The television commercials all commence with the text "A dentist talks about sensitive teeth." As the commercials progress, each dentist talks about the symptoms of sensitive teeth and what he or she would recommend for sensitive teeth. The claim in question appears on the screen while the dentist talks about sensitive teeth and their treatment.
The hypothetical reasonable person who sees this advertisement would therefore understand that the claim "3 out of 4 dentists recommend Sensodyne" is made in the context of sensitive teeth.
The respondent has provided the Directorate with survey data from ImagineNationAlliance that shows that 3 out of 4 dentists do recommend Sensodyne for sensitive teeth.
As such, the claim in the television commercial is not in breach of Clause 4.1 of Section II or Clause 5 of Appendix A of the Code.

Point of sale advertising
In the point of sale advertising the claim "Recommended by 3 out of 4 dentists" appears in isolation. Consumers who walk past the point of sale advertisement would have no reason to draw the conclusion that the claim is only true in the context of sensitive teeth. The hypothetical reasonable person would understand that 3 out of 4 dentists recommend Sensodyne for all teeth.
The respondent's substantiation, however, only substantiates the claim in respect of a recommendation for sensitive teeth.
For the above reasons, the claim as it appears in the point of sale advertising is not substantiated and therefore breaches Clause 4.1 of Section II of the Code. It is therefore not necessary to consider Clause 5 of Appendix A at this time.

In light of the above, the respondent is required to:
1. Withdraw the claim in its current format;
2. The process of withdrawing this claim must be actioned with immediate effect;
3. The process of withdrawing the claim must be completed within the deadlines stipulated in Clause 15.3 of the Procedural Guide; and
4. The claim may not be used again in future.

The claim is partially upheld.

Source: http://www.asasa.org.za (December 2005)

Complaint 03/209

Complainant: A. Abernethy
Advertisement: Unilever Australasia - Rexona Sunsilk Fruitrience Shampoo

Complaint: The Sunsilk Fruitrience (Key No: REXO 0396 K1) showed three young women, referring to their hair as being "weak", "wrecked" and "lifeless" until they discovered Sunsilk Fruitrience which "nourishes and revitalises to make your hair five times healthier".

The Complainant, A. Abernethy, said: I wish to make a complaint regarding an advertisement screened on TV One at about 7:15 pm on 18th July. This advertisement was for 'Sunsilk Fruitrience' shampoo, and claimed that this product would make one's hair (was it "up to"?) five times healthier.

I challenge this claim on two grounds. First, there is no basis against which the five times claim can be compared and second that there is no scientific basis for measuring "healthiness".

The Chairman ruled that the following provisions were relevant:

Code of Ethics
Rule 2: Truthful Presentation — Advertisements should not contain any statement or visual presentation or create an overall impression which directly or by implication, omission, ambiguity or exaggerated claim is misleading or deceptive, is likely to deceive or mislead the consumer, makes false and misleading representation, abuses the trust of the consumer or exploits his/her lack of experience or knowledge. (Obvious hyperbole, identifiable as such, is not considered to be misleading).

The Advertiser, Unilever Australasia, said: "The Script for the Sunsilk Fruitrience Television Advertisement referred to as above states:

"Fruitrience nourishes and revitalises to make your hair more than 5 times healthier."

To clarify this statement there is a superimposition which moves across the screen saying "More than 5 times healthier*" with an explanation on the screen referenced by the asterisk - "* Reduces split ends and breakage vs. non-conditioning shampoo."

The summary of the support for this statement is below:
Sunsilk Fruitrience shampoo and conditioners are especially formulated with conditioning ingredients to nourish and care for the hair and to protect it from damage and breakage. Hair that is in good condition with no split ends and resistant to the everyday stresses of wear and tear is regarded as healthy looking hair. Sunsilk Fruitrience shampoo and conditioner formulations were evaluated for their ability to protect hair from breakage and the formation on split ends caused by repeated washing and combing.

The highest conditioning variant, Mango and Passion Fruit for Dry hair, and the lowest conditioning variant, Lime and Mandarin for fine hair, were tested on virgin hair switches versus a standard non-conditioning shampoo base as the control.

Hair switches were washed in the product under test following the standard washing protocol and are then combed to stimulate the blow drying process that consumers use. This washing and combing is repeated and the number of split ends produced is counted after 5 cycles. Fibre breakage can also be measure by collecting any fibres lost from individual switches.

When compared against hair switches washed with the non-conditioning shampoo, both the dry and the fine variants of the Sunsilk Fruitrience shampoo and conditioner system provided statistically fewer split ends and broken fibres. The number of split ends and broken fibres was reduced by more than five times for the Fruitrience variants compared to the non-conditioning shampoo.

Sunsilk Fruitrience conditions hair and protects it from damage. Hair that is protected and in good condition is more resistant to breakage and therefore is stronger, healthier hair.

I hope that this helps clarify the advertisement for Mr Abernethy. Please feel free to contact me further if you require more information."

Television Commercial Approvals Bureau (TVCAB) said on behalf of the media: "The complainant believes that this commercial is misleading in terms of its claim that, 'Sun Silk Fruitrience makes your hair more than 5 times healthier.' We have been asked to respond to this complaint under the Code of Ethics Rule 2.

Prior to approving this commercial TVCAB requested and were supplied with substantiation for the claim that,' Sun Silk Fruitrience makes your hair more than 5 times healthier.' We are satisfied that this information sufficiently verifies this claim.

Accordingly we submit that the complaint should not be upheld."

Deliberation
The Complaints Board perused the relevant correspondence and viewed the Sunsilk Fruitrience Shampoo advertisement. It noted that the Complainant, A. Abernethy, was of the view that the advertisement was misleading as there was no basis against which the five times claim could be compared and there was no scientific basis for measuring "healthiness".

In making its determination the Complaints Board observed that the television advertisement included a superimposition which moved across the screen and said, "More than five times healthier*", the asterisk referring to a graphic which stated "*Reduces split ends and breakages vs. non-conditioning shampoo." This specifically clarified that the description "healthier" referred to the quantity of split ends and broken fibres in a person's hair. Furthermore the Complaints Board noted that the advertiser had carried out product tests which verified and, in the Board's view, sufficiently substantiated the claim made in the advertisement. …

Accordingly, the Complaints Board ruled that the Sunsilk Frutience advertisement was not misleading and did not breach Rule 2 of the Code of Ethics.

The Complaints Board ruled to not uphold the complaint.

Decision: Complaint Not Upheld

Source: http://www.asa.co.nz/decisions/FULL/D03209.rtf

Activity 2 — Sampling

ABOUT THIS ACTIVITY
This activity looks at the importance of sample size when collecting data. The learners sample a very small population group and analyse the data collected to establish any trends. They then analyse and compare population pyramids for South Africa, the Western Cape and the Bergriver area.

This activity is aligned with unit standard 9012 and addresses AC 1,3,4 of SO1 and AC 1,2,3,4,5 of SO2.

MANAGING THIS ACTIVITY
The learners will need the worksheet and handout for this activity. The learners need to make a survey sheet and interview 20 people in preparation for this activity. An example of a survey sheet is given in the worksheet.

1.1.1 It is trying to create the impression that most dentists would recommend the toothpaste. Surveying dentists and not the general public also creates a good impression as they are specialists in the field.

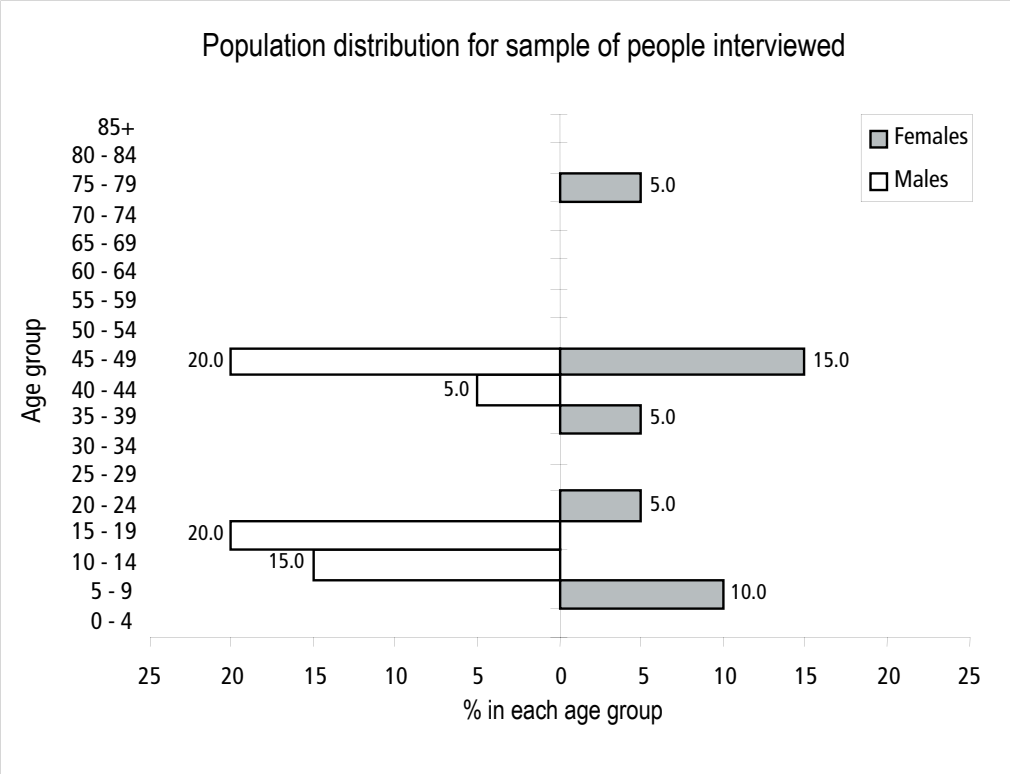
1.1.2 One cannot interview every dentist. However, one needs to interview as many dentists as possible. Four would definitely not be sufficient.

1.2 An example follows:

1.2.1

	..... Males			..... Females		
	Tallies	Total	Percentage	Tallies	Total	Percentage
0 – 4 years						
5 – 9 years				//	2	10
10 – 14 years	///	3	15			
15 – 19 years	////	4	20			
20 – 24 years				/	1	5
25 – 29 years						
30 – 34 years						
35 – 39 years				/	1	5
40 – 44 years	/	1	5			
45 – 49 years	////	4	20	///	3	15
50 – 54 years						
55 – 59 years						
60 – 64 years						
65 – 69 years						
70 – 74 years						
75 – 79 years				/	1	5
80 – 84 years						
85+ years						

2.2.2



2.3.1 No

2.3.2 (a) Yes, it indicates that families were surveyed.

(b) No

(c) No

(d) No

2.4.1 No, the sample size was too small.

2.4.2 (a) They all tend to have a broad base which narrows as age increases. There tends to be more females than males in most age groups.

(b) There is an increase in the population in South Africa and the Western Cape in the age groups from 5 years to 19 years whereas in the Bergriver this increase happens later (i.e in the 25 to 34 year age group).

2.4.3 (a) They all tend to have a broad base which narrows as age increases. There tends to be more females than males in most age groups.

(b) In the SA, Western Cape, Coloured and Indian/Asian population distribution the largest age groups are from 5 years to 19 years whereas in the Black African population the largest groups are from 20 years to 34 years. The white population has two broader bands, one at 15-19 years and the other at the 30 to 44 year age group.

2.4.4 The graphs are unable to show the socio-economic status of the population,

Activity 2 — Sampling

In the two advertising complaints we studied in activity 1 we came across different ways of supporting a claim. In the case of the toothpaste commercial we saw that the advertiser had used a market research company to "survey" dentists on the toothpaste they would recommend for the treatment of sensitive teeth. In the case of the shampoo commercial the manufacturer has tested the shampoo on "switches" of hair. How many dentists and how many switches of hair were used? Where did the dentists work (urban or rural)? Had the dentists recently been visited by representatives of the toothpaste company? Were the tests conducted on the hair switches performed by the shampoo manufacturer themselves or by an independent laboratory?

These questions – namely the number of people surveyed, the kinds of people surveyed and the questions that the people were asked – all have to do with sampling and the methods of data collection.

Sampling

2.1 The number and nature of the participants in a survey can have a dramatic effect on the data collected.

2.1.1 When the toothpaste advertisement says "3 out of 4 dentists" recommend, what is the impression that it is trying to create?

2.1.2 How many dentists do you think should be interviewed before such a claim can be made? Four? All dentists? Justify your answer.

2.2 Make a survey sheet such as the one alongside and collect information for 20 people.

2.2.1 Use the data you have collected to complete the "tallies" and "total" columns of the data summary table provided in the handout.

2.2.2 Complete the "percentage" columns of the tables as follows:

$$\text{percentage of females in age group} = \frac{\text{number of females in age group}}{\text{number of people in survey}} \times 100$$

2.2.3 Use the percentages calculated on your table to complete the graph supplied on the handout – your completed graph should look similar to the graph on the right.

2.3 Answer the following questions for the data you have collected:

2.3.1 Are there any clear trends visible in the data?

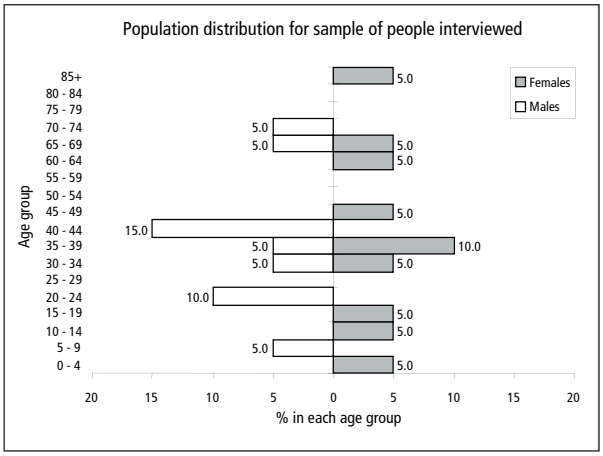
Please complete the survey below:

What is your gender?

Male	☐	Female	☐

To which age group do you belong?

0 – 4 years	☐	45 – 49 years	☐
5 – 9 years	☐	50 – 54 years	☐
10 – 14 years	☐	55 – 59 years	☐
15 – 19 years	☐	60 – 64 years	☐
20 – 24 years	☐	65 – 69 years	☐
25 – 29 years	☐	70 – 74 years	☐
30 – 34 years	☐	75 – 79 years	☐
35 – 39 years	☐	80 – 84 years	☐
40 – 44 years	☐	85+ years	☐



2.3.2 Does the data tell you anything about the people in your:
(a) social circle?
(b) community?
(c) town?
(d) country?

2.4 The handout has two sets of population pyramid graphs. These graphs have been developed using data from Census 2001 (http://www.statssa.gov.za). Each set of graphs shows the South African population and different samples from the population. Answer the following questions based on the pyramids provided:

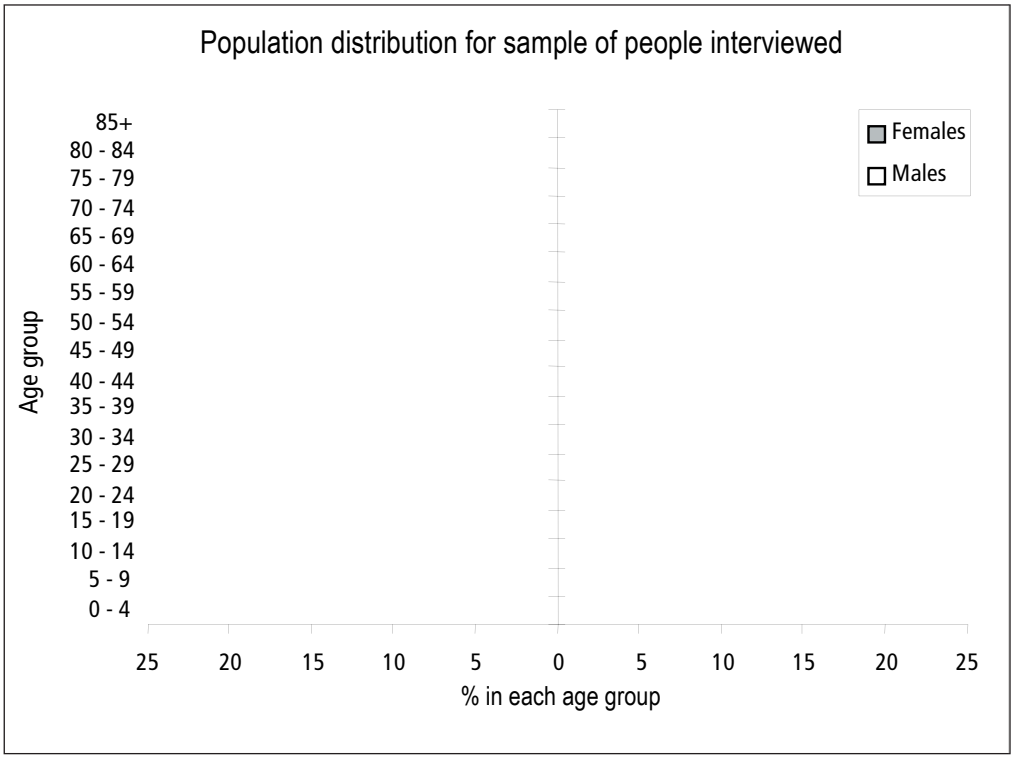
2.4.1 Is the population graph you developed in question 2.2 similar to any of the graphs on the handout? If not, why not?

2.4.2 In what ways would are the graphs for South Africa, the Western Cape and Bergriver (Western Cape):
(a) similar?
(b) different?

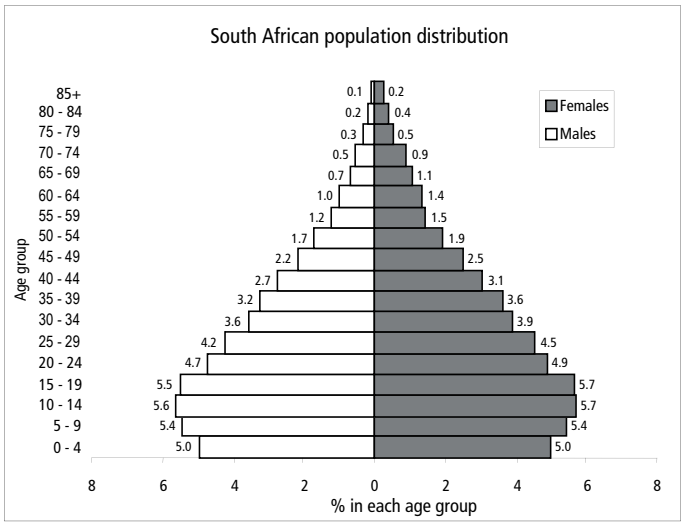
2.4.3 In what ways are the graphs for South Africa, the Western Cape and the four population groups (used in the Census 2001 data) in the Western Cape:
(a) similar?
(b) different?

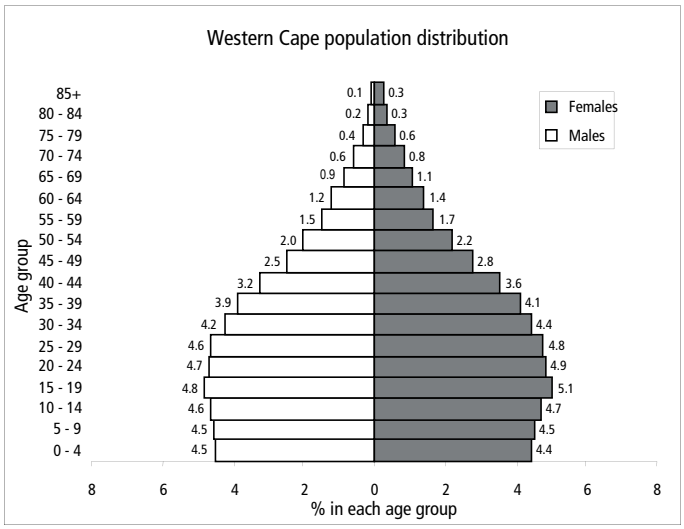
2.4.4 What are the graphs unable to show us regarding the samples selected from the population (South Africa)?

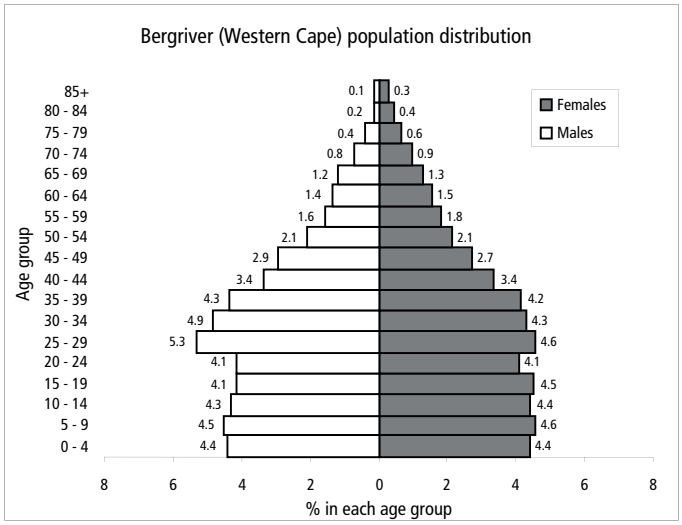
	Males			Females		
	Tallies	Total	Percentage	Tallies	Total	Percentage
0 – 4 years						
5 – 9 years						
10 – 14 years						
15 – 19 years						
20 – 24 years						
25 – 29 years						
30 – 34 years						
35 – 39 years						
40 – 44 years						
45 – 49 years						
50 – 54 years						
55 – 59 years						
60 – 64 years						
65 – 69 years						
70 – 74 years						
75 – 79 years						
80 – 84 years						
85+ years						



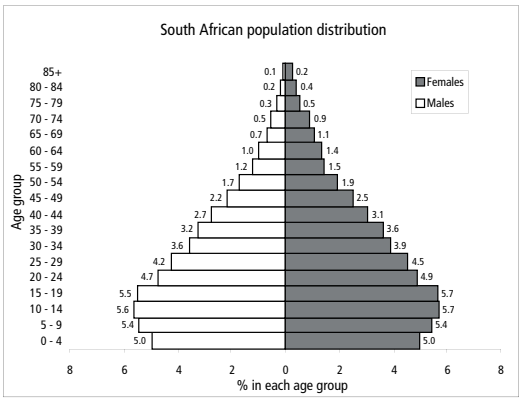
Population pyramids for South Africa, the Western Cape and the Bergriver municipality (Western Cape)
Graphs have been developed using data from Census 2001 (http://www.statssa.gov.za).

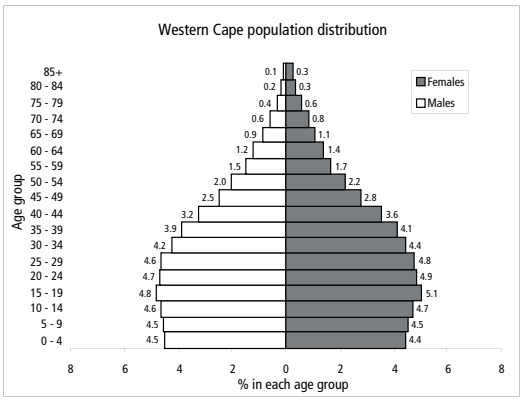


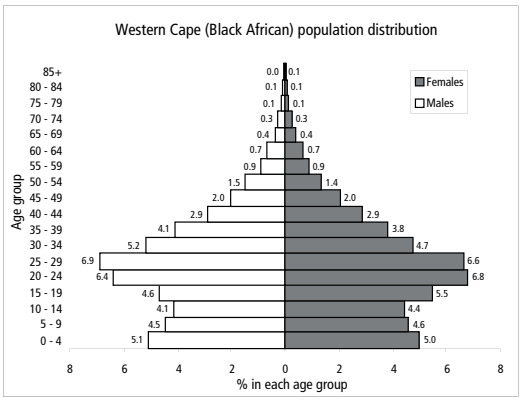


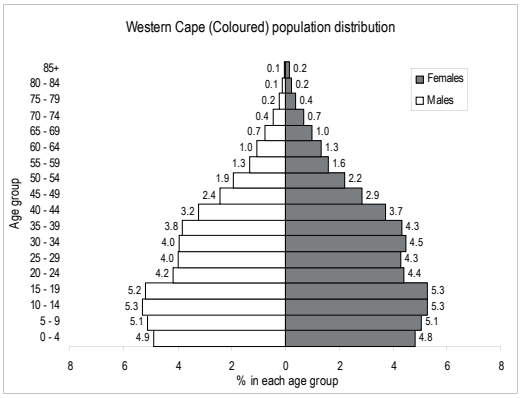


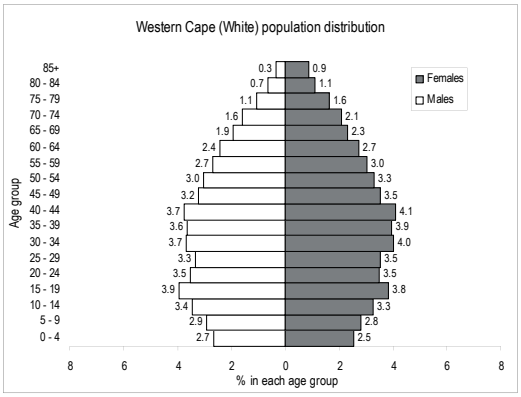
Population pyramids for South Africa, the Western Cape and the different population groups of the Western Cape
Graphs have been developed using data from Census 2001 (http://www.statssa.gov.za).

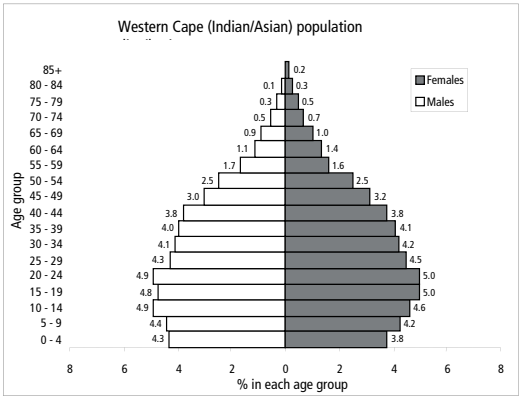












Activity 3 — Summarising sampled data

ABOUT THIS ACTIVITY

This activity deals with measures of central tendency, namely the mean, median and mode. These measures are calculated for the age group data of the previous activity to see how the measures for the whole population and different samples of that population can differ.

This activity is aligned with unit standard 9012 and addresses AC 1,3,4 of SO1 and AC 1,2,3,4,5 of SO2.

MANAGING THIS ACTIVITY

The learners will need the worksheet and handout for this activity. The handout is the same as the handout for activity 2. The learners will need a calculator. The methods of calculating the mean, median and mode of a group of data are revised in the worksheet.

3.1.1 Sum of the ages = (5,0 + 5,0) × 2 + (5,4+ 5,4) × 7 + (5,6 + 5,7) × 12 + (5,5 + 5,7) × 17 + (4,7 + 4,9) × 22 + (4,2 + 4,5) × 27 + (3,6 + 3,9) × 32 + (3,2 + 3,6) × 37 + (2,7 + 3,1) × 42 + (2,2+ 2,5) × 47 + (1,7 + 1,9) × 52 + (1,2 + 1,5) × 57 + (1,0 + 1,4) × 62 + (0,7 + 1,1) × 67 + (0,5 + 0,9) × 72 + (0,3 + 0,5) × 77 + (0,2 + 0,4) × 82 + (0,1 + 0,2) × 87 = 2 672

Mean age = 2 672 ÷ 100= 26,72 years.

3.1.2 Use the same method as in 3.1.1. Answer = 28,81.

3.1.3 Use the same method as in 3.1.1. Answer = 25,31.

3.1.4 Use the same method as in 3.1.1. Answer = 27,32.

3.1.5 Use the same method as in 3.1.1. Answer = 37,42.

3.1.6 Use the same method as in 3.1.1. Answer = 29,17.

3.2.1 4

3.2.2 1

3.3.1 To find the median, start at the bottom of the pyramid and add the total in each age group until you get to 50%.

(5,0% + 5,0%) + (5,4% + 5,4%) + (5,6% + 5,7%) + (5,5 %+ 5,7%) + (4,7%+ 4,9%) = 52,9%

This indicates that the median must be in the 20 - 24 age group therefore the median age is 22 years.

3.3.2 Use the same method as in 3.3.1. Answer = 27.

3.3.3 Use the same method as in 3.3.1. Answer = 22.

3.3.4 Use the same method as in 3.3.1. Answer = 27.

3.3.5 Use the same method as in 3.3.1. Answer = 37.

3.3.6 Use the same method as in 3.3.1. Answer = 27.

3.4.1 4

3.4.2 1

1.5 If one compares the white population pyramid to the Western Cape and South African pyramids, one can see that they differ in shape. The white pyramid does not bulge out as much as the other two pyramids in the younger age groups. Therefore the median falls in a higher age group in the white population pyramid compared to the other two population pyramids where the median falls in a younger age group.

3.6 Finding the mode:

3.6.1 mode = 10 –14 years. This is calculated by finding the sum of the male and female percentages in a particular age group. The mode will be the age group with the largest total.

3.6.2 15 – 19 years.

3.6.3 25 – 29 years.

3.6.4 10 - 14 years.

3.6.5 40 – 44 years.

3.6.6 20 – 24 years.

3.7.1 4

3.7.2 1

3.8

Population	Mean (in years)	Median (in years)	Mode (in years)
South African	26,72	22	10-14
Western Cape	28,81	27	15-19
Black African (WC)	25,31	22	25-29
Coloured (WC)	27,32	27	10-14
White (WC)	37,42	37	40-44
Indian/Asian (WC)	29,17	27	20-24

3.9.1 One cannot survey every person in the population therefore a sample is selected to reflect that population.

3.9.2 The sample that is chosen must reflect the nature of the population. In the example used in this activity, one can see that if only the white population in South Africa was surveyed it would not reflect the population of South Africa correctly. It would give a false picture of the age groups in South Africa.

3.9.3 (a) The population consists of both genders and the sample is only female.

(b) The population consists of people of all ages and the sample concentrates on one particular age group.

(c) The population consists of people of all race groups and the sample concentrates on only one race group.

(d) The population consists of people of all religons and the sample concentrates on one particular religion.

(e) The population lives the Western Cape and the sample concentrates on people living in Mitchell's Plane.

(f) The population consists of people in all socio-economic groups and the sample concentrates on only the rich people.

Activity 3 — Summarising sampled data

In previous courses on data handling/statistics you have already dealt with measures of central tendency such as mean, median and mode. These measures, also called statistics, help us to summarise a large amount of data using a single number. In this activity we will calculate these measures/statistics for the age group data of the previous activity to see how the measures for the whole population and different samples of that population can differ.

Mean

The mean, the number commonly referred to as the average in daily use and sometimes called the arithmetic mean, is found by adding all of the values and dividing by the number of values added together.

Example: The mean age of Linda's extended family with the following ages is 29,8.

84	10	4	3	69	3	9
65	38	2	34	41	1	33
63	43	36	35	39	38	36
39	36	39	1	13	39	4
44	40	5	73	11	11	2

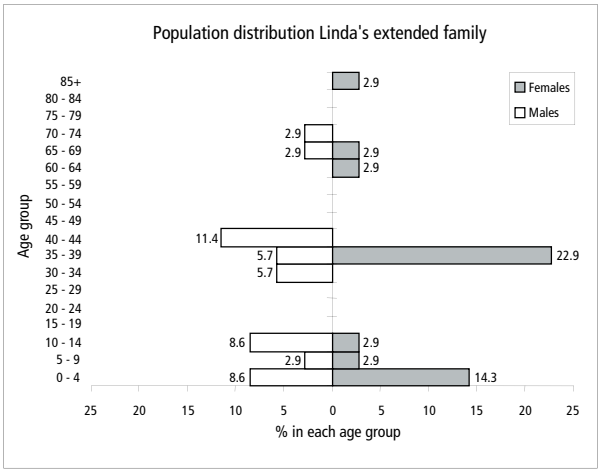
Since:

sum of the ages = 84 + 10 + 4 + 3 + 69 + 3 + 9 + 65 + 38 + 2 + 34 + 41 + 1 + 33 + 63 + 38 + 2 + 34 + 41 + 1 + 33 + 63 + 43 + 36 + 35 + 39 + 38 + 36 + 39 + 36 + 39 + 1 + 13 + 39 + 4 + 44 + 40 + 5 + 73 + 11 + 11 + 2 = 1043

and:

sum of ages ÷ number of people = 1043 ÷ 35 = 29,8

The population pyramid for this family appears on the right.



To develop the population pyramid we first grouped the data. That is, we developed different age groups and counted the number of people in each group according to gender.

After grouping the data we calculated the percentage of the whole family (population) in each group.

Having grouped the data and converted the numbers to percentages, we use a slightly different technique for determining the mean:

- Firstly, we treat all of the people in each group as if their age is the middle age in the group. In other words, we say that all of the people in the 35 – 39 year old age group are 37 years old.
- To develop the pyramid we calculate the percentage of the family in each group. Looking at the pyramid, we no longer know how many people there are in the family and/or in each group.

For this reason we treat each 1% as one person. Since there are 5,7% + 22,9% = 28,6% of the family in the 35 – 39 year old age group, we say that there are 28,6 people aged 37 in the family. Of course we cannot have 0,6 of a person in real life, but if we ignore the decimals our total will not be 100.

- We are now ready to calculate the mean of the grouped data as presented in the family's population pyramid.

  Sum of the ages = (8,6 + 14,3) × 2 + (2,9 + 2,9) × 7 + (8,6 + 2,9) × 12 + 5,7 × 32 + (5,7 + 22,9) × 37 + 11,4 × 42 + 2,9 × 62 + (2,9 + 2,9) × 67 + 2,9 × 72 + 2,9 × 87 = 2973,3

  and

  mean age = sum of ages ÷ number of people = 2973,3 ÷ 100 = 29,7

  Notice how using the grouped data gave us a slightly different mean age – this is unavoidable.

3.1 Use the handout from the previous activity to calculate the mean age of each of the following:

3.1.1 The South African population

3.1.2 The Western Cape population

3.1.3 The Western Cape (Black African) population

3.1.4 The Western Cape (Coloured) population

3.1.5 The Western Cape (White) population

3.1.6 The Western Cape (Indian/Asian) population

3.2 How many of the sample populations have a mean age that is:

3.2.1 greater than the South African population's mean age?

3.2.2 less than the South African population's mean age?

Median

The *median* is the middle (or central) value of a set of values arranged in ascending order.

Example: The median age of Linda's extended family is 36.

Since: 36 is the middle number in the list of ages arranged from smallest to largest:

1 1 2 2 3 3 4 4 5 9 10 11 11 13 33 34 35 $\boxed{36}$ 36 36 38 38 39 39 39 39 40 41 43 44 63 65 69 73 84

NOTE: In the case of Linda's family there is an obvious middle to the list since there are an odd number of family members. If there is an even number of values the median is calculated by adding the two values immediately on either side of the middle together and dividing by two.

Illustration: If we remove the largest value from the list of Linda's family members we get:

1 1 2 2 3 3 4 4 5 9 10 11 11 13 33 34 35 36 36 36 38 38 39 39 39 39 40 41 43 44 63 65 69 73

and the median value is:

1 1 2 2 3 3 4 4 5 9 10 11 11 13 33 34 $\boxed{35}$ $\boxed{36}$ 36 36 38 38 39 39 39 39 40 41 43 44 63 65 69 73

$$\frac{35 + 36}{2} = 35{,}5$$

To determine the median value for grouped data we determine the group in which the middle value is and use the value that represents the group as the median.

Illustration: Working from the bottom of the population pyramid for Linda's extended family we see that:

- The 0 – 4 age group accounts for 8,6% + 14,3% = 22,9% of the family
- Adding the 5 – 9 and 10 – 14 age groups takes the total to:
  22,9% + (2,9% + 2,9%) + (8,6% + 2,9%) = 40,2% – still not 50%
- Adding the 30 – 34 age group gives:
  40,2% + 5,7% = 45,9% – still not 50%
- Adding the 35 – 39 age group gives:
  45,9% + (5,7% + 22,9%) = 74,5% – significantly more than 50%

It follows that the middle age must be some where in the 35 – 39 age group and so we say that the median age is 37 years.

3.3 Use the handout from the previous activity to calculate the median age of each of the following:

3.3.1 The South African population

3.3.2 The Western Cape population

3.3.3 The Western Cape (Black African) population

3.3.4 The Western Cape (Coloured) population

3.3.5 The Western Cape (White) population

3.3.6 The Western Cape (Indian/Asian) population

3.4 How many of the sample populations have a median age that is

3.4.1 greater than the South African population's median age?

3.4.2 less than the South African population's median age?

3.5 Why do you think that the Western Cape (White) population's median age is so different from the Western Cape and South African median ages?

Mode

The *mode* is the value that occurs most often in a set of values.

Example: The mode for Linda's extended family is 39, since 39 is the age that occurs most often.

1 1 2 2 3 3 4 4 5 9 10 11 11 13 33 34 35 36 36 36 38 38 39 39 39 39 40 41 43 44 63 65 69 73 84

NOTE: It is possible that two or more values all appear the same number of times and that there is no other value that occurs more often—such data has more than one mode. When a set of data has two modes, it is said to be bi-modal.

Illustration: The adjusted data for Linda's extended family below has more than one modal age.

1 1 2 2 3 3 4 4 5 9 11 11 11 13 33 34 35 36 36 36 38 38 39 39 39 40 41 43 44 63 65 69 73 84

In grouped data, the group with the largest number of elements is the modal group.

Illustration: The modal group for Linda's extended family is 35 – 39 years since there is no other group with more people in it.

3.6 Use the handout from the previous activity to calculate the modal age group for each of the following

3.6.1 The South African population

3.6.2 The Western Cape population

3.6.3 The Western Cape (Black African) population

3.6.4 The Western Cape (Coloured) population

3.6.5 The Western Cape (White) population

3.6.6 The Western Cape (Indian/Asian) population

3.7 How many of the sample populations have a modal age that is

3.7.1 greater than the South African population's modal age?

3.7.2 less than the South African population's modal age?

3.8 Summarise the mean, median and modal ages for the South African population and the five different samples from that population in a table.

You should notice at least two things from this table (a) the mean, median and mode can be quite different for any group and (b) the mean, median and mode for a sample can be quite different to the mean, median and mode of the population from which the sample is drawn.

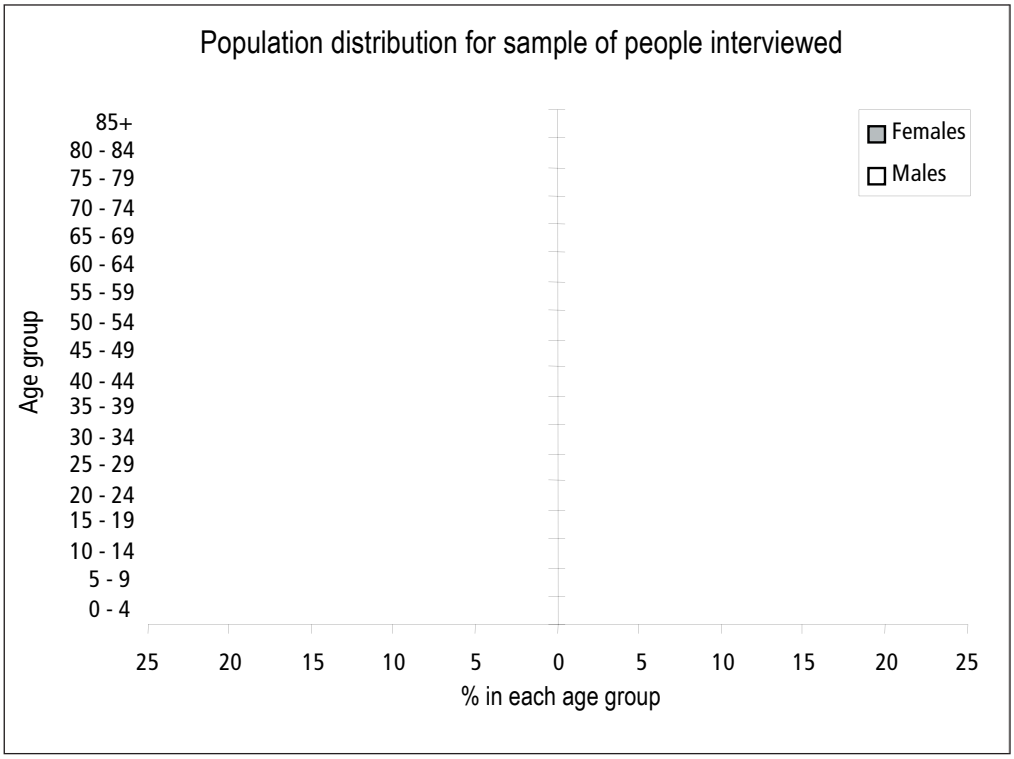
3.9 Discuss the role of sampling in collecting data:

3.9.1 Discuss why it may be necessary to use a sample when conducting a survey of research.

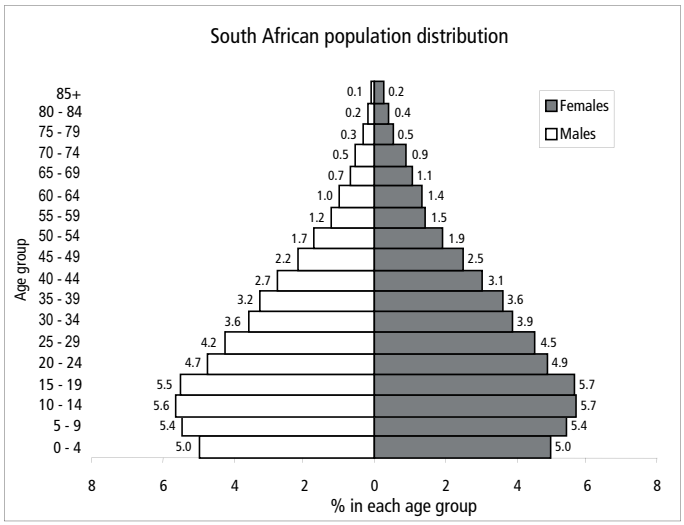
3.9.2 Discuss how the choice of sample can impact on the results of the survey and/or research.

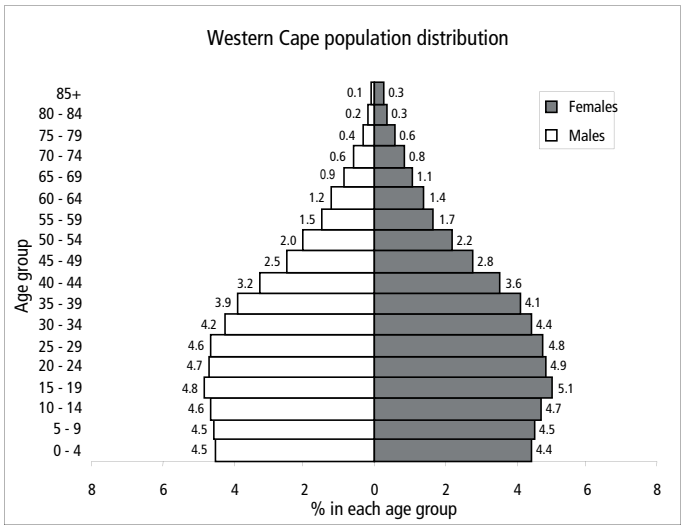
3.9.3 Make a list of ways in which samples can differ from the population.

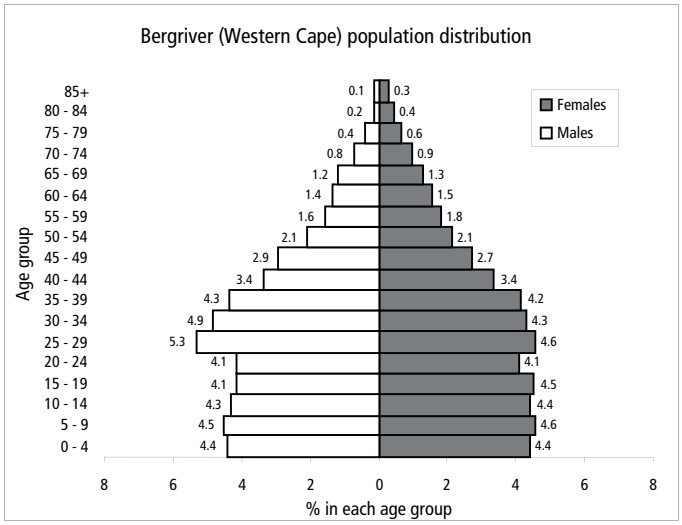
	Males			Females		
	Tallies	Total	Percentage	Tallies	Total	Percentage
0 – 4 years						
5 – 9 years						
10 – 14 years						
15 – 19 years						
20 – 24 years						
25 – 29 years						
30 – 34 years						
35 – 39 years						
40 – 44 years						
45 – 49 years						
50 – 54 years						
55 – 59 years						
60 – 64 years						
65 – 69 years						
70 – 74 years						
75 – 79 years						
80 – 84 years						
85+ years						



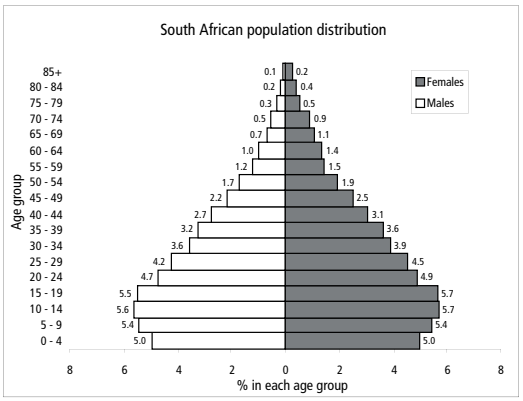
Population pyramids for South Africa, the Western Cape and the Bergriver municipality (Western Cape)
Graphs have been developed using data from Census 2001 (http://www.statssa.gov.za).

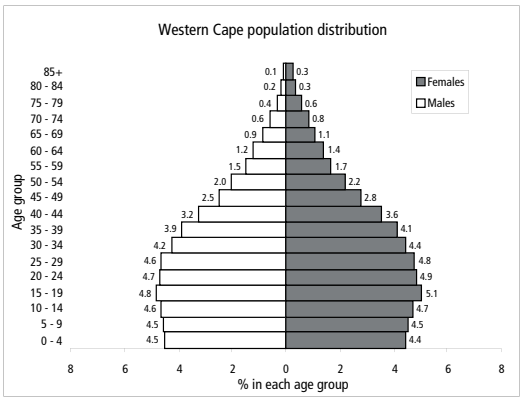


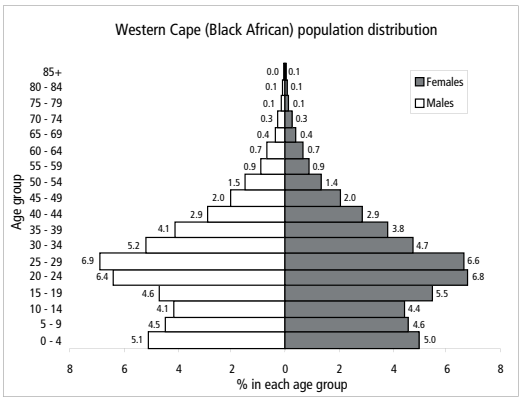


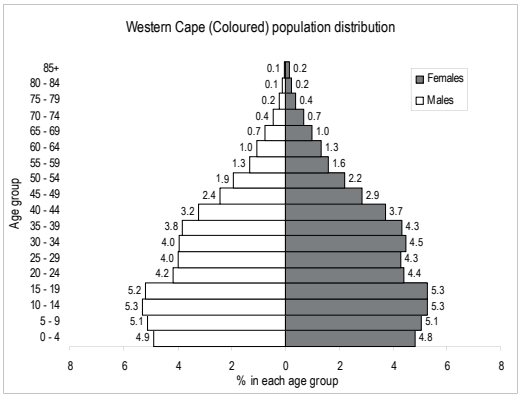


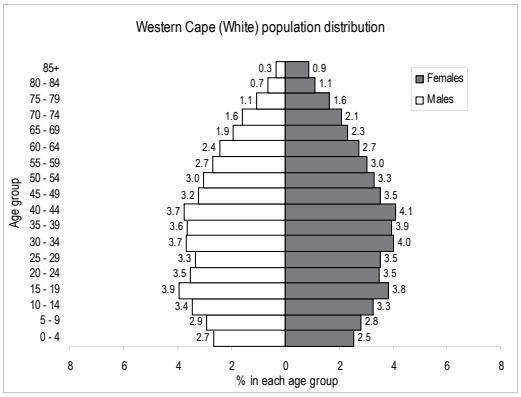
Population pyramids for South Africa, the Western Cape and the different population groups of the Western Cape
Graphs have been developed using data from Census 2001 (http://www.statssa.gov.za).

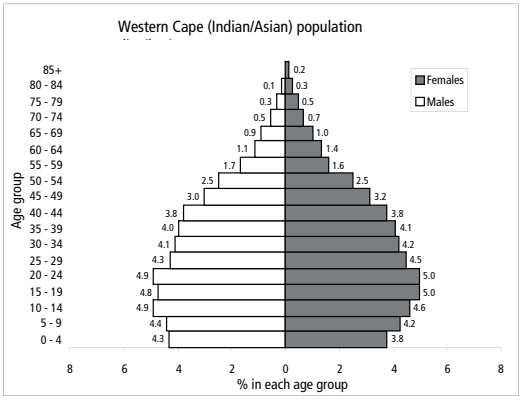












Activity 4 — Looking at data for patterns

ABOUT THIS ACTIVITY

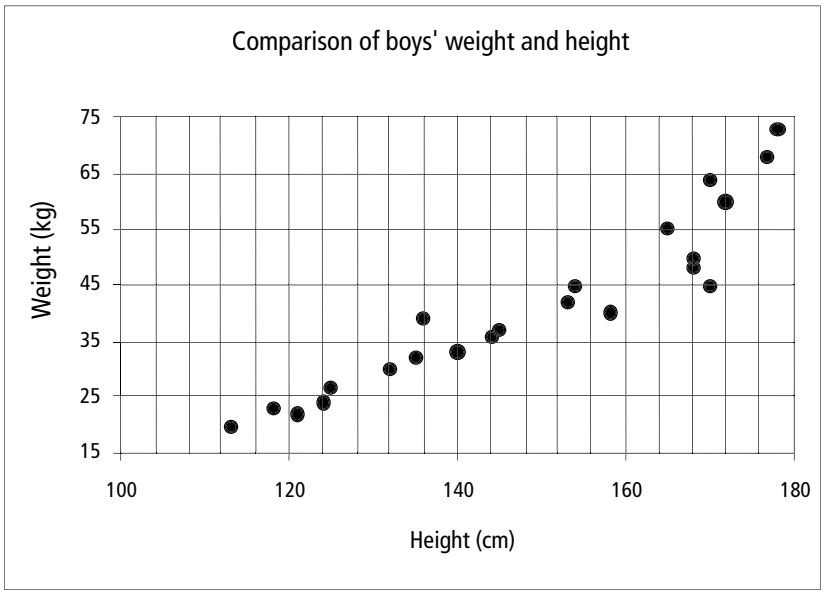
In this activity the learners compare two sets of data and establish if they are linked ie. if there is a correlation between the two sets of data. They are shown how to draw a graph to test correlation and to interpret the result. The importance of sample size is emphasized again.

This activity is aligned with unit standard 9012 and addresses AC 1,2,3,4 of SO1 and AC 1,2,3,4 of SO2.

MANAGING THIS ACTIVITY

This activity consists of a worksheet and handouts. The learners need to complete the graphs on the handout. A table of data is also provided on the handout.

4.1.1

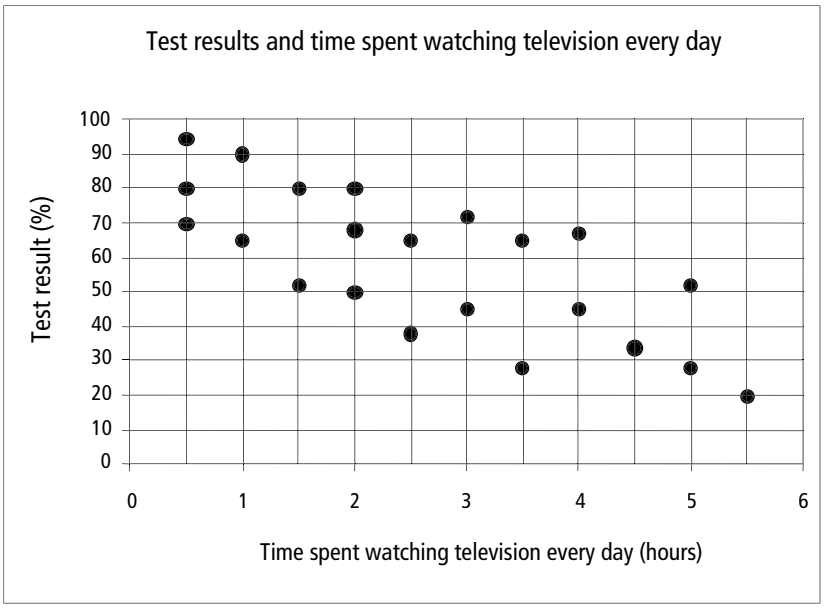


4.1.2 As the boys' heights increase so does their weight.

4.1.3 (a) 25 - 30kg

(b) 150 – 155cm

4.2.1



4.2.2 Yes. As the hours spent watching TV increase, the test scores tend to decrease.

4.2.3 Weak negative correlation.

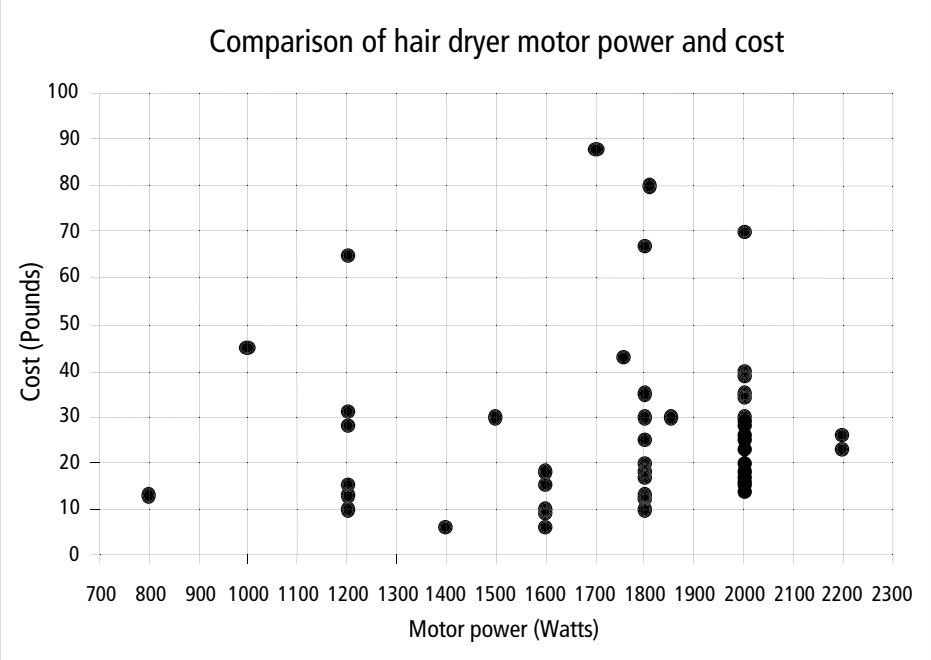
4.2.4 Yes. The more time spent watching TV, the less time available to study.

4.2.5 (a) Yes.

(b) Yes. The graph shows a correlation between motor power and cost. As the power increases so does the cost of the dryer.

(c) No. She has only compared four dryers.

4.2.6



(a) No. There are dryers with powerful motors that are cheaper than dryers with less powerful motors.

(b) No.

Activity 4 — Looking at data for patterns

The main reason for collecting data is to answer a question or questions. In the previous activities we have explored how the nature of the sample can impact on the data we collect and hence on the answers we can develop to the questions posed.

Sometimes we want to compare two sets of information to see if there is a connection between them. If we find that there is a connection between the sets of information we might try to explain this. In statistical terms we call such a connection between data a correlation.

An obvious correlation exists between the length of a person's hair and the amount of tint needed to colour the hair. The longer the hair the more tint we need to mix. Similarly the longer a person's hair, the longer it takes to dry, and the longer a person's hair, the more shampoo he/she needs to use every time he/she washes it.

One way of looking for a correlation is to draw a scatter plot. With a scatter plot we plot the values of one variable against the values of the other variable and then see if the points display some relationship.

4.1 Height and weight in young boys

A doctor has collected the height and weight of a number of his patients over a period of time. The data is recorded in the table below.

Height (cm)	113	118	121	135	124	132	136	144	154	170	168
Weight (kg)	20	23	22	32	24	30	39	36	45	64	50

Height (cm)	178	165	172	153	140	125	168	158	170	145	177
Weight (kg)	73	55	60	42	33	27	48	40	45	37	68

4.1.1 Use the blank graph provided on the handout to plot the data in the table and develop a scatter plot.

4.1.2 Describe any trend that you can see in the data plotted on the scatter plot.

4.1.3 Use your scatter plot to predict:

(a) A reasonable weight range for a young boy who is 125cm tall.

(b) A reasonable height range for a young boy who weights 43kg.

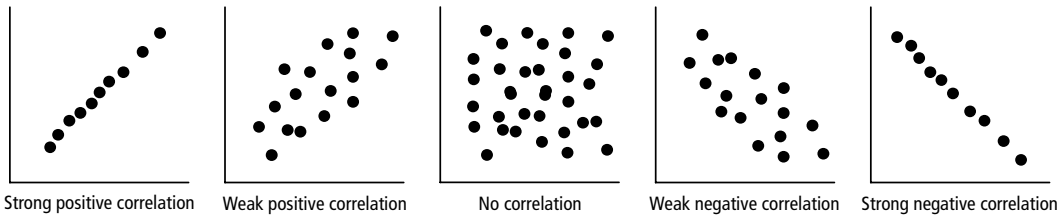
There are typically three different situations that will arise when we draw scatter plots to look for a link between data:

(a) There exists a positive correlation between the data – as the value of the one variable increases so does the value of the other.

(b) There exists no correlation between the data.

(c) There exists a negative correlation between the data – as the value of the one variable increases so the value of the other variable decreases.

We also talk about strong and weak correlation. The graphs below illustrate these different possibilities.



4.2 Time spent watching television and test results

A lecturer has conducted a survey of the amount of time that her students spend watching television every day. She has recorded the most recent test score of all the students against the time they spend watching television in the table below.

Time (hours)	3	0.5	5.5	1	2.5	4	2	4.5	3.5	3.5	2
Test result (%)	45	95	20	65	38	67	80	34	28	65	50

Time (hours)	1.5	1	0.5	1.5	2.5	3	2	4	5	5	0.5
Test result (%)	52	90	70	80	65	72	68	45	52	28	80

4.2.1 Use the blank graph provided on the handout to plot the data in the table and develop a scatter plot.

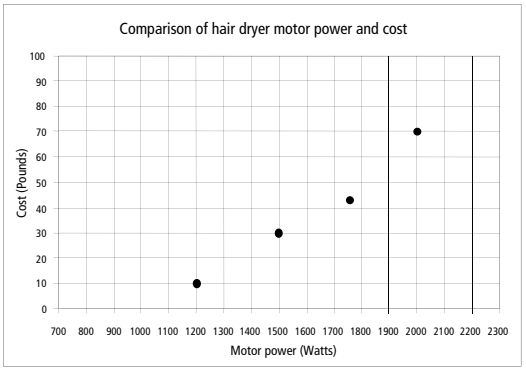
4.2.2 Does the graph you have drawn suggest any correlation between test score and the time spent watching television? Give reasons for you answer.

4.2.3 If your answer to 4.2.2 was yes, describe the kind of correlation the graph suggests.

4.2.4 Even if the graph did suggest some form of correlation, do you believe that there is a causal (i.e. the one causes the other) relationship between time spent watching television and test scores? Give reasons for your answer.

Cost of hair dryers

One of the students in your class has done some research on hair dryer costs in the United Kingdom (using the internet). She developed the graph alongside based on her research and has made the following claim: "The cost of a hair dryer is determined by the power of its motor."



4.2.5 Answer the following questions:

(a) Does the claim made by the student seem reasonable, if you think that the power of a hair dryer's motor determines both how strong the air flow is and how long the hair dryer will last?

(b) Does the graph developed by the student support her claim? Discuss.

(c) Do you think that the student has collected enough data in completing her research? Discuss.

4.2.6 Use the motor power and cost information from the table provided in the handout to complete the graph on the handout.

4.2.7 Answer the following questions:

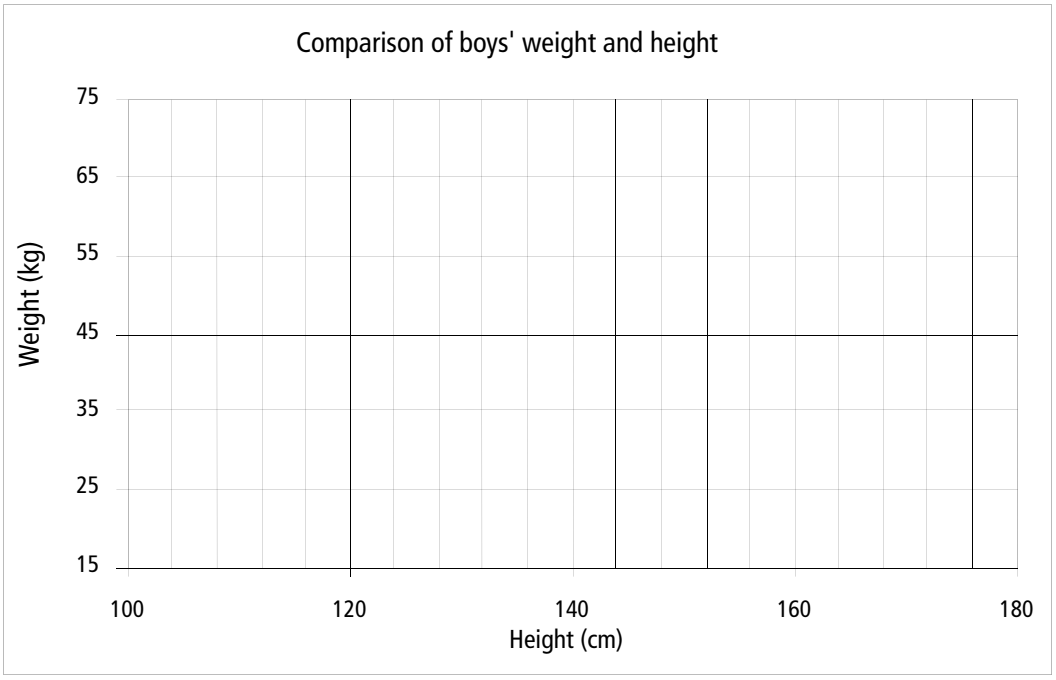
(a) Does the graph you have developed still support the claim made by the student? Discuss.

(b) Does the graph suggest that there any correlation between motor power and cost for hair dryers? If yes, describe the kind of correlation you see.

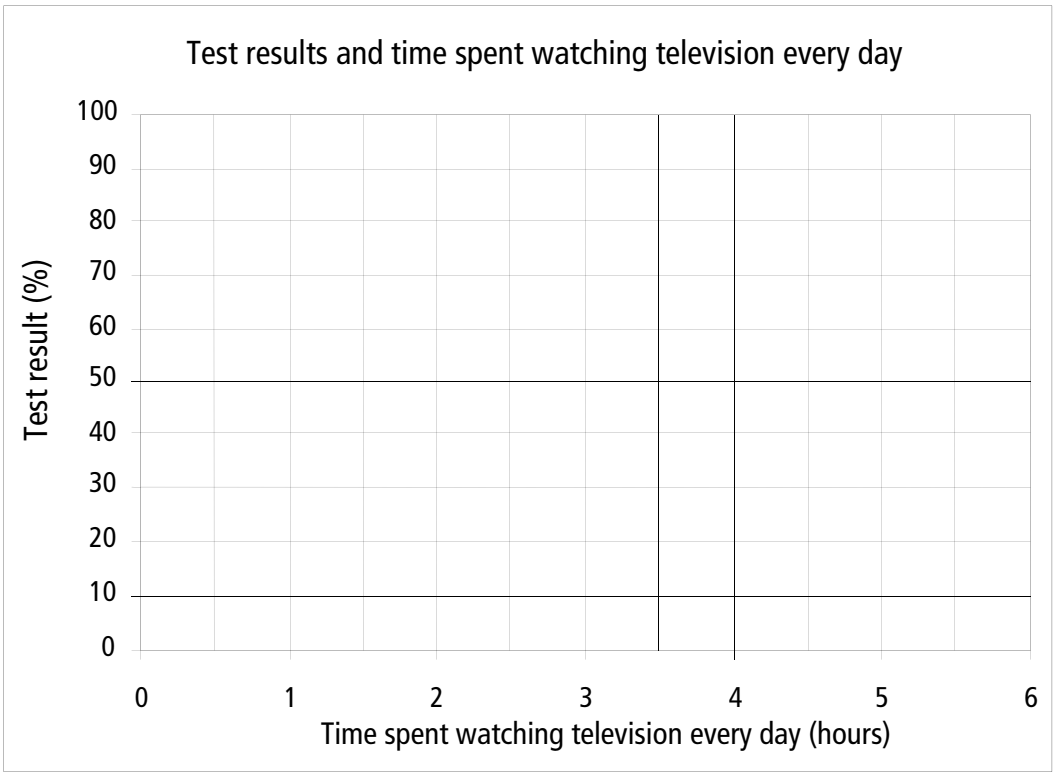
A last thought (caution)

It is important that we are careful in our interpretation of scatter plots. Plotting certain data on a scatter plot may suggest a correlation, while there is absolutely no causal relationship between the data. For example, if we developed a scatter plot of shoe size and reading ability, we would find a positive correlation—that is, we would find that people with larger feet are better readers. This is completely normal as we expect both foot size and reading ability to increase with age. However, it would be wrong to conclude that we could improve people's reading ability by stretching their feet.

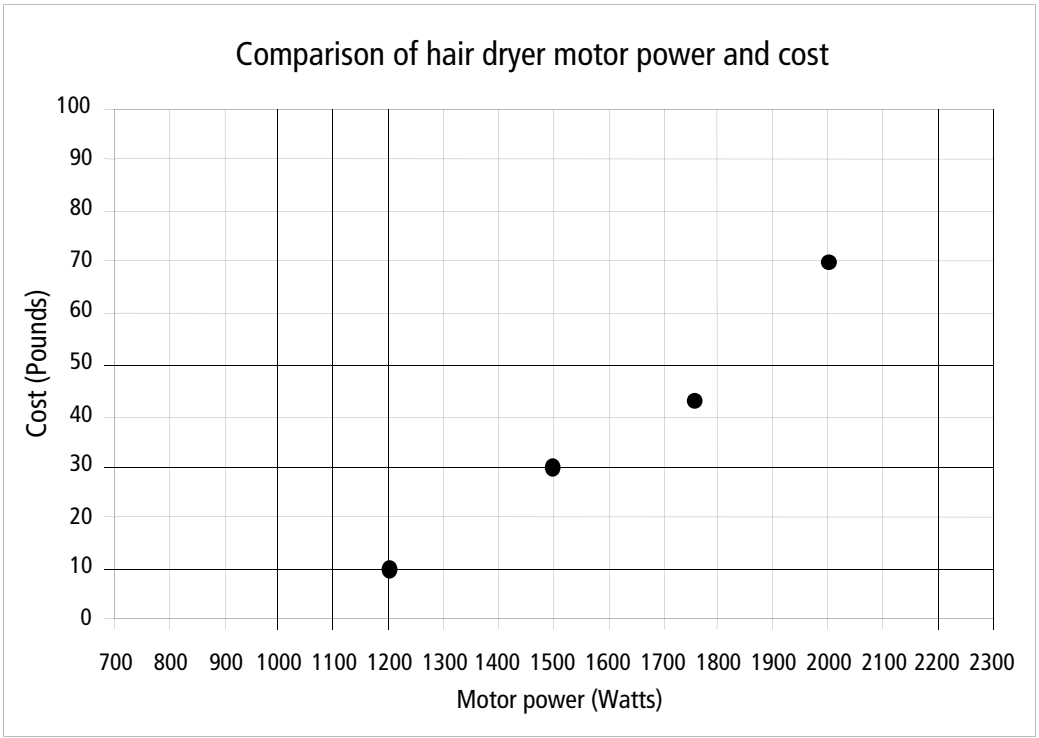
Graph for question 4.1



Graph for question 4.2



Graph for question 4.3



Hair dryer	Motor Power (Watts)	Cost (UK pounds)	Hair dryer	Motor Power (Watts)	Cost (UK pounds)
Babyliss Pro Ionic Conditioning Hairdryer	2000	40	Nicky Clarke 2200w Ionic Dryer	2200	23
Super IONIC Hair Dryer	1810	80	Nicky Clarke Frizz Control Dryer	2000	26
T3 T3 Tourmaline Ionic Hair Dryer	1800	67	Power 1800 Watt Hairdryer Hp4836	1800	18
Revlon Hair Dryer, 9092u	2000	23	Professional 1800w Dryer 5158	1800	20
Braun Futurpro Ion-care Dryer	2000	30	Revlon 2000w Professional Hair Dry...	2000	25
Babyliss Hair Dryer	2000	23	Essentials 2000w Dryer 21022	2000	15
Morphy Richards 21025 Compact Trav...	1200	10	Nicky Clarke Ncd40 2000w Power Dry...	2000	18
Vidal Sassoon Vs543uk 2200w Hair D...	2200	26	Revlon 9123c Power Dry Hairdryer	1600	10
T3 Tourmaline Overnight Travel Hai...	1200	65	Vidal Sassoon 1800 Watt Travel Pow...	1800	13
Wahl Powermax 2000 Professional Pl...	2000	39	Nicky Clarke Travel Hair Dryer, Nc...	1800	17
Professional 2000w Lightweight Hai...	2000	30	Revlon Calfornia Cream.	2000	28
Compact Chrome 1600w Dryer 9166	1600	15	Babyliss Patrick Cameron Experts Pr...	2000	30
2000w Superlight Weight Dryer Vs93...	2000	15	Nicky Clarke Salon Standards Dryer...	2000	30
Revlon 2000w Professional Hair Dry...	2000	25	Babyliss Babyliss Adee & Paul Pro B...	2000	30
Tresemmé Proceramic Light Dryer	2000	30	Adee & Paul Hair Dryer, Pro Bloww ...	2000	30
Revlon Retro Dryer	2000	29	Daniel Hersheson Pro Hair Dryer, D...	1700	88
Wigo Wigo Taifun Professional Hair...	1000	45	Carmen Hair Dryer, Girls Night Out...	1800	12
Babyliss Pro Megaturbo Dryer	1800	30	Braun E-go Travel Hair Dryer, Pd2	1200	15
Babyliss 1800w Dry & Shine Hair Dr...	1800	20	Tresemme Hair Dryer, Hp4882/07	2000	17
Revlon 1600w Compact Chrome Dryer ...	1600	15	Nicky Clarke Nc121	800	13
Remington Big Shot Glamour Bs2000d...	2000	35	Vidal Sassoon Vs536bduk Hair Dryer	2000	20
Morphy Richards Head Gear Dryer	1800	30	Revlon Midnight Silver 2000 9190u.	2000	20
Wahl 3500 Whispertek Professional ...	1850	30	Revlon Midnight Silver 2000 8190u.	2000	15
Professional 1500w Hairdryer Zx237	1500	30	Vidal Sassoon Classic 2000 Watt Dr...	2000	18
Panache Hair Dryer - White 1200w Travel	1200	31	Nicky Clarke Touch To Go 2000w Ion...	2000	30
Remington Big Shot Travel D2007bs	1600	18	Vidal Sassoon Travel Gift Set, Vbb...	1200	13
Big Shot Volume & Curl D2015bs	2000	34	Babyliss Digital Control 2000.	2000	23
Professional's 2000 Watt Hairdryer	2000	16	Vidal Sasson Vs520r	2000	14
Nicky Clarke Frizz Control 1800w I...	1800	18	Andrew Collinge 10593 Smart Hairdr...	1200	10
Babyliss Hair Dryer, 555u Colour R...	1800	35	Babyliss Blow Drying Kit 5524u.	2000	20
Panache Hair Dryer - Ivory 1200w Travel	1200	31	Princess Handsfree Hairdryer.	2000	70
Parlux Sexy Silver Drying Machine	1760	43	Visiq Hair Dryer With Diffuser.	1600	9
Morphy Richards Drying Essentials ...	2000	15	Visiq 1400w Compact Hair Dryer.	1400	6
Braun Futurpro 2000 Dryer	2000	25	Visiq 1400 Watt Travel Dryer.	1400	6
2000 Watt Soft Touch Vs536	2000	20	Revlon Power Dry 1800w.	1800	10
Nicky Clarke Frizz Control 1800w A...	1800	25	Living Essentia Lehd1000	1600	6
Panache Hair Dryer - Ivory 1200w Sleek	1200	28	Parlux Super Ionic Hair Dryer	1810	80
Remington Compact Hair Dryer, D341...	2000	18	Big Shot Glamour Kit	2000	40

Activity 5 — Summarising data in a different way

ABOUT THIS ACTIVITY

This activity deals with using quartiles to analyse data. The need for other ways to interpret data is demonstrated. The learners will calculate approximate values for the different quartiles. Worked examples are given in the worksheet.

This activity is aligned with unit standard 9012 and addresses AC 1,3,4 of SO1 and AC 1,2,3,4,5 of SO2.

MANAGING THIS ACTIVITY

The learners will need the worksheet for this activity and the handout from activity 4. It might be useful to explain the use of a stem and leaf diagram although this is not essential. Explanations as to how to calculate the quartiles are given.

5.1.1 Mean: sum of the points = 99 + 75 + 60 + 55 + 111 + 87 + 75 + 59 + 54 = 675
Therefore mean = 675 ÷ 9 = 75
Median: You must first rank the data. 54 55 59 60 75 75 87 99 111
↑ median
Mode: The most commonly occurring point is 75

5.1.2 Mean: sum of the points = 147 + 75 + 30 + 15 + 183 + 111+ 75 + 27 + 12 = 675
Therefore mean = 675 ÷ 9 = 75
Median: You must first rank the data. 12 15 27 30 75 75 111 147 183
↑ median
Mode: The most commonly occurring point is 75.

5.1.3 The mean, median and mode for both sets of data are exactly the same. However, your position has changed from being the top scorer in the first scenario to being third from the top in the second scenario. The mean indicates that you are doing better than most. The median tells you that you are in the top half of the scores and the mode tells you the score that most people got which you are above. It does not really tell you how well you are doing in the competition.

5.2.1 12 15 27 30 75 75 111 147 183
↑ median
Values below true median:
12 15 27 30
Median of these values = $\frac{12+15}{2}$ = 13,5
The values below 13,5 are in the first quartile.

5.2.2 Values above the true median:
75 111 147 183
Median of these values = $\frac{111+147}{2}$ = 129
The values above 75 and below 129 are in the third quartile.

5.2.3 The third quartile.

5.3.1 This question is done using a stem and leaf diagram to rank the data. There are 76 prices so the median will be the average of the 38th and 39th prices. These are indicated on the stem and leaf in bold. There are 38 prices below the median so the median value of these prices will be the average of the 19th and 20th prices.

0	6	6	6	9																				
1	0	0	0	0	2	3	3	3	4	5	5	5	5	5	5	5	6	7	7	8	8	8	8	8
	8																							
2	0	0	0	0	0	0	3	3	3	3	5	5	5	5	6	6	8	8	9					
3	0	0	0	0	0	0	0	0	0	0	0	0	1	1	4	5	5	9						
4	0	0	3	5																				
5																								
6	5	7																						
7	0																							
8	0	0	8																					

Approximate value of the first quartile = $\frac{15+15}{2}$ = £15

5.3.2 The 38th and 39th prices are both equal to £23 so the median is £23.

5.3.3 The approximate value of the third quartile will be the average of the 57th and 58th prices. This will be £30.

5.4 Repeat the above process to calculate the following answers:

5.4.1 £18

5.4.2 £25

5.4.3 £30

5.5 Repeat the process in 5.3 to calculate the following answers:

5.5.1 £15

5.5.2 £20

5.5.3 £30

5.6.1 The T3 Tourmaline Hair Dryer is in the last quartile of the sample of all hair dryers as well as the sample of the 1800W hair dryers. It is one of the more expensive hair dryers.

5.6.2 The Tresemme Hair Dryer is in the second quartile of the sample of all hair dryers which means that it is not one of the cheapest hair dryers but that it is cheaper than half the hair dryers. It is in the first quartile of the sample of the 2000W hair dryers which means that it is one of the cheapest 2000W dryers.

5.6.3 The Revlon Retro Dryer is in the third quartile of the sample of all hair dryers as well as the sample of the 2000W hair dryers. This means that it is more expensive than half of the hair dryers but it is not the most expensive in those samples.

5.6.4 The Wigo WigoTaifun Professional Hair Dryer is in the last quartile of the sample of all hair dryers. It is one of the more expensive hair dryers. It is the only 1000W hair dryer listed.

Activity 5 — Summarising data in a different way

When working with data in previous activities and in earlier years, we have frequently used the statistics mean, median and mode to summarise data. These "measures of central tendency" are a useful way of summarising data, but like all tools they can have their limitations.

In this activity we introduce a different way of analysing data, namely using quartiles.

5.1 Points earned through sales

Think about the following scenario: One of the haircare product distributors is offering an incentive to the hairstylists in the salon. They have assigned a point value to each of their products. For each product that one of your customers buys you get the point value of that product. At the end of the promotion, the 25% of stylists with the most points will each receive a prize.

Scenario 1: After some weeks the nine stylists working in your salon have earned the following number of points, with you having scored 111 points:

99	75	60	55	111	87	75	59	54

5.1.1 Calculate the mean, median and modal number of points earned by the stylists in this scenario.

Scenario 2: After some weeks the nine stylists working in your salon have earned the following number of points, with you having scored 111 points:

147	75	30	15	183	111	75	27	12

5.1.2 Calculate the mean, median and modal number of points earned by the stylists in this scenario.

5.1.3 By referring to the two scenarios above discuss how the mean, median and mode do not provide you with enough information to know how you are doing in the competition.

While the mean, median and mode provide a useful way of summarising data, they also hide some information. In the case of the incentive competition, all that you can conclude with confidence is that a score of 111 is greater than the mean, the median and the mode. The statistics do not reveal that in one scenario you are leading the race, while in the other you are lying third out of the nine participants.

Quartiles

In order to help us address this issue we introduce another form of analysing/summarising data – quartiles. Quartiles divide all of the data into four groups (quartiles – quarters – four) and help us to identify into which group a particular data sample falls. That is, we can say whether the data sample is in the "top quarter" or "top 25%," the "bottom quarter" or "last 25%" etc.

- The first quartile of a group of values is the value such that 25% of the values fall at or below this value.
- The second quartile of a group of values is the value such that 50% of the values fall at or below this value. The second quartile is the same as the median value of the data.
- The third quartile of a group of a group of values is the value such that 75% of the values fall at or below this value.

Determining the quartiles:

- The first quartile may be approximated by placing the data values in ascending order and determining the median value of the values below the true median.
- The third quartile may be approximated by placing the data values in ascending order and determining the median value of the values above the true median.
- For an odd number of observations the true median is excluded from the calculation of the first and third quartiles.

Illustration: For the values in scenario 1

- Place the values in ascending order (note that the highlighted 75 is the true median):

  54 55 59 60 $\boxed{75}$ 75 87 99 111

- Because there are an odd number of observations exclude the middle number:

  54 55 59 60 75 87 99 111

- Approximate the first quartile by calculating the median value of the values below the true median:

  $\frac{55+59}{2} = 57$ – values below 57 are in the first quartile (bottom 25%).

- Approximate the third quartile by calculating the median value of the values above the true median:

  $\frac{87+99}{2} = 93$ – values below 93 are in the first quartile (bottom 75%).

- For our scenario this means that your score of 111 is in the top 25% of all scores because it is above the third quartile!

5.2 Scenario 2

5.2.1 Determine the approximate value of the first quartile for the values in scenario 2.

5.2.2 Determine the approximate value of the third quartile for the values in scenario 2.

5.2.3 Into which quartile does your score of 111 points fall for this scenario?

NOTE: In the discussion above, we have used the word "approximate." This has been done quite deliberately as there are more precise ways of calculating the quartiles. The approximate method we have shown is, however, adequate for our purposes.

The cost of a hair dryer

In the previous activity we saw, using a scatter plot, that there is no correlation between motor power and the cost of a hair dryer.

What may be useful is to be able to consider a hair dryer and to know that its price is among the most expensive 25% of all hair dryers or among the least expensive 25% percent of all hair dryers etc.

5.3 Refer to the information provided in the handout of the previous activity and calculate the approximate value of the following for all of the hair dryers on the list:

5.3.1 The approximate value of the first quartile

5.3.2 The median value (i.e. the value of the second quartile)

5.3.3 The approximate value of the third quartile

5.4 Refer to the information provided in the handout of the previous activity and calculate the approximate value of the following for all of the 2000W hair dryers on the list:

5.4.1 The approximate value of the first quartile

5.4.2 The median value (i.e. the value of the second quartile)

5.4.3 The approximate value of the third quartile

5.5 Refer to the information provided in the handout of the previous activity and calculate the approximate value of the following for all of the 1800W hair dryers on the list:

5.5.1 The approximate value of the first quartile

5.5.2 The median value (i.e. the value of the second quartile)

5.5.3 The approximate value of the third quartile

5.6 Describe the cost of each of the following hair dryers in terms of the cost of all of the hair dryers in your sample, and in terms of other hair dryers with the same motor:

5.6.1 T3 Tourmaline Ionic Hair Dryer (1800W) = £67

5.6.2 Tresemme Hair Dryer, Hp4882/07 (2000W) = £17

5.6.3 Revlon Retro Dryer (2000W) = £29

5.6.4 Wigo Wigo Taifun Professional Hair Dryer (1000W) = £45

Activity 6 — Questioning

ABOUT THIS ACTIVITY

In this activity the learners explore and develop different kinds of questions that they can include in a survey. They will use the context of setting up a new hair salon in a shopping centre where there is no salon at the moment.

This activity is aligned with unit standard 9012 and addresses AC 1, 2, 3 of SO1.

MANAGING THIS ACTIVITY

This activity needs only the worksheet and is self-explanatory. Class discussion of questions after completion could be helpful. The solutions below are suggested answers.

6.1 *Is this the closest shopping mall to your home?* Yes / No.

If this is the closest shopping mall then the customer is more likely to return.

Do you have a regular salon that you use? Yes / no.

If they have a regular salon then you will have to give incentives to get them to come to your new salon. If they do not have a regular salon, then you can encourage them to use your new salon regularly.

6.2 *How often do you visit a hair salon?*

- Once a week
- Once every two weeks
- Once a month
- Once every 6 weeks
- Once every 2 months
- Once every 3 months

This will give you an indication as to how busy you can expect to be.

When do you usually go to the salon?

- Weekday mornings
- Weekday afternoons
- Saturdays

This will give you an indication as to when to open your salon.

6.3 *How important is it to you that a hair salon offers refreshments as part of its service?*

- Very important
- Important
- Neither
- Unimportant
- Very unimportant

This will help you decide if you need to offer refreshments to keep the customers happy.

How necessary is it to have credit card facilities?

- Absolutely necessary
- Would be nice to have
- Ambivalent
- Not necessary

6.4 *If refreshments were offered, please place a "1" next to preferred drink and "2" next to your next choice*

- _____ tea
- _____ rooibos tea
- _____ coffee
- _____ water
- _____ fruit juice

This would help you budget for refreshments.

If music or a radio station is played in the background, rank the following in order of preference. Let "1" be your best choice.

- Classical music
- Jazz
- Hip hop
- SAFM
- Radio 2000
- Religious music
- Country and Western
- Heavy Metal
- Blues
- No music or radio station

This would help you to determine if your clientele would like background music and what type they would prefer.

6.5 *Does the décor of a salon affect you?*

This would indicate the type of clientele you are catering for.

Describe your best salon experience.

You can gain some insights into customer service.

Activity 6 — Questioning

In the various activities of this unit we have explored the role of sampling when collecting data, different ways of summarising data, looking for trends/patterns in data and the use of quartiles to enable us to compare observations within the population we are dealing with.

All of this data must, however, be collected before we can do anything with it!

There are many ways of collecting data. Simple observations is one way – recall the experiments with the hair switches that supported the claims of the shampoo company in its advertisement. Another common technique used to collect data is to use a questionnaire in a survey – we can imagine that the market research company used a questionnaire when they surveyed the dentists to make the claim about the toothpaste in the advertisement.

In this activity we will explore and develop different kinds of questions that we can include in a survey. We will use the context of setting up a new hair salon in a shopping centre where there is no salon at the moment.

Yes/No questions

An example of a Yes/No question is:

Do you live in this town?
- *Yes*
- *No*

A Yes/No question can be used to identify people that we want to survey. If we are thinking about setting up a salon at a shopping centre there would be no purpose in interviewing a person who does not live in the town and who is unlikely to visit the shopping centre again.

6.1 Develop at least two more Yes/No questions that will be helpful in our survey. Give a reason for asking each of your questions.

Multiple-choice questions

Examples of a multiple-choice question include:

What gender are you?
- *Male*
- *Female*

How much do you earn per month?
- *No income*
- *R1,00 – R400,00*
- *R401,00 – R800,00*
- *R801,00 – R1 600,00*
- *R1 601,00 – R3 200,00*
- *R3 201,00 – R6 400,00*
- *R6 401,00 – R12 800,00*
- *R12 801,00 or more*

In these examples there is no other possible choice of answer. In the next example the choice "other" is included because there may be other options we have not considered:

How do you travel to this shopping centre?
- *By foot*
- *By public transport*
- *By own car*
- *Other (please specify)*

6.2 Develop at least two more multiple-choice questions that will be helpful in our survey. Give a reason for asking each of your questions.

Rating scales

Rating scales measure the direction and intensity of attitudes. The following are two examples of questions involving a rating scale—these scales are sometimes referred to as Likert scales.

How important is it to you that a hairdressing salon also offers a manicure/pedicure service?

- *Very important*
- *Important*
- *Neither important or unimportant*
- *Unimportant*
- *Very unimportant*

This shopping centre needs a hairdressing salon?

- *Strongly agree*
- *Agree*
- *Neither agree nor disagree*
- *Disagree*
- *Strongly disagree*

6.3 Develop at least two more questions that use a rating scale that will be helpful in our survey. Give a reason for asking each of your questions.

Rank order scale

Rank order scaling questions allow certain products to be ranked based on some characteristic or other requirement. The following is an example of a question involving a rank order scale.

Based on your memory of the last year, please place a "1" next to the procedure that you had done at a hairdressing salon the most often, and "2" next to the procedure you had done the next most often and so on.

- _____ *Wash and set*
- _____ *Wash, cut and dry*
- _____ *Tint*
- _____ *Perm*
- _____ *Manicure*
- _____ *Pedicure*
- _____ *Other (please specify):* _____

6.4 Develop at least two more questions that use a rank order scale that will be helpful in our survey. Give a reason for asking each of your questions.

Open-ended questions

Open-ended questions are used to explore in-depth responses to a situation. Although they can provide a great deal of information and can be an important source of information, they are very time-consuming both in the data gathering stage and in the data analysis stage. The following is an example of an open-ended question.

Why do you think the previous hairdressing salon that operated from this shopping centre closed down?

6.5 Develop at least two more open-ended questions that will be helpful in our survey. Give a reason for asking each of your questions.

Activity 7 — Assessment task involving data

ABOUT THIS ACTIVITY

This is an assessment task and assesses all of the six previous activities. The learners are asked to make a proposal regarding the launching of a new salon. They are asked to develop a survey questionnaire, consider a sampling method, collect data on other salons, represent the data collected and then analyse their findings.

This activity is aligned with unit standard 9013 and addresses AC 1,2,3,4 of SO1 and AC 1,2,3,4,5 of SO2.

MANAGING THIS ACTIVITY

This is a research assessment task and will require an extended period of time.

No solutions are required here. Each task will have to be assessed individually.

Activity 7 — Assessment tasks involving data

In this task you get the opportunity to put into practice all of the knowledge and skills that we have developed in the earlier activities of this unit.

Your task is to make a proposal regarding the launching of a new hairdressing salon in a shopping centre that currently does not have a salon.

Your proposal must provide the following (with data to support your claims and recommendations):

- A detailed description of the anticipated clientele
- A list of the range of services that you feel the salon should offer and the prices you feel you can charge for these
- The number of stylists that the salon should employ

You must give evidence of the following steps used in developing your proposal:

7.1 Develop and administer a survey questionnaire for prospective clients of the salon. The questionnaire should include a range of different question types.

7.2 Discuss and justify the sampling method you used in administering the questionnaire.

7.3 Develop and administer an observation sheet that you can use to collect data on the location of other salons in the area, on the services they provide and on the prices they charge.

7.4 Show evidence of organising and sorting the data that you collect.

7.5 Show evidence summarising the data using mean, median, mode and quartiles as appropriate.

7.6 Show evidence of representing the data in the most effective way to support your proposal and recommendations.

7.7 Show evidence of considering the factors that may influence the findings that you make (e.g. size of data sample etc.).

Activity 8 — Likelihood in daily conversation

ABOUT THIS ACTIVITY

The next three activities deal with the likelihood or probability of an event happening. This activity looks at the probability scale and explores how our intuition, experimentation and the mathematics of probability are related. Experiments are done using a spinner and data is collected.

This activity is aligned with unit standard 9012 and addresses AC 1, 2, 3, 4, 5, 6 of SO3.

MANAGING THIS ACTIVITY

Learners will need the worksheet from this activity as well as the handout. The handout requires the learners to make a spinner so they will need firm cardboard, a ruler, a pencil, a pair of scissors and a drawing pin.

8.1 Personal responses.

8.2 Personal responses.

8.3 No.

8.4 Blue, green, yellow, red.

8.5 Blue $= \frac{1}{2} \times 120 = 60$ times

Green $= \frac{1}{4} \times 120 = 30$ times

Yellow $= \frac{1}{6} \times 120 = 20$ times

Red $= \frac{1}{12} \times 120 = 10$ times

8.6 Personal response.

8.7 Personal response.

8.8 See table in 8.8.

8.9 Using the table in 8.8:
Green, blue, red, yellow.

8.10 Personal response.

8.11 Personal response.

Activity 8 — Likelihood in daily conversation

Likelihood, or in mathematical language, probability, is often based on statistics. There are certain things that you feel confident to predict because of your past experience and your expectation that the future will be similar to the past.

You might say:

- The sun will *definitely* come up tomorrow.
- There is a *good chance (very likely)* that Alan will be late for class.
- It is *more likely* to rain in Cape Town in July than in December.
- Mrs. Japhta will *almost certainly* complain about the haircut I give her.

8.1 Make a list of at least three similar statements that you feel confident to make.

8.2 Describe why you feel confident about making these statements.

What all of these statements have in common is that our experience of these events makes us feel confident about predicting the future. The sun has come up on every single day of our lives – we have no reason to expect it not to come up tomorrow. I have cut Mrs. Japhta's hair six times this year and despite all my efforts to please her she has had a complaint every single time – why should it be any different the next time?

Statisticians have developed a branch of Mathematics that deals with likelihood. They prefer to use the term probability. *Probability is a measure of how likely it is that an event will happen*. In this and the next two activities we will be exploring probability.

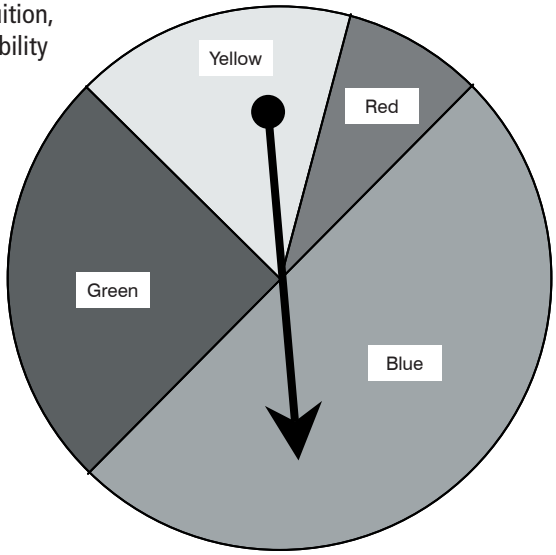
Probability scale

Mathematicians measure probability using a scale that goes from 0 to 1. 0 corresponds to events that are impossible – they will never happen. At the other end of the scale is 1, which corresponds to events that are certain to happen. In the middle of the scale is 12 which corresponds to events that are just as likely to happen as not. The best known example of this is the tossing of a coin: the chance/likelihood/probability of a head coming up is just as good as the chance/likelihood/probability of a tail coming up when we toss the coin. This is the reason that the toss of a coin is often used to decide who will kick off in a soccer match etc.

The mathematics of probability is concerned with developing mathematical ways of determining the likelihood of an event occurring – in those cases where it is possible to determine this likelihood. By contrast, most of our everyday (colloquial) predictions of likelihood are based on our instinct or gut sense of how likely it is that an event will occur.

	IMPOSSIBLE				CERTAIN
Probability scale	0	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{3}{4}$	1
Probability expressed as a percentage	0%	25%	50%	75%	100%
Other terms used		unlikely	fifty-fifty even chance	likely	

What happens when we spin a spinner?
By using a spinner we will explore how our intuition, experimentation and the mathematics of probability are related.



8.3 If we spin the spinner many times, do you think that the spinner will land on each of the different coloured segments approximately the same number of times?

8.4 If your answer to 8.3 was no, write down the colours of the segments in the order of the segment on which you predict the spinner will land most often to the segment on which you predict it will land least often.

8.5 If you spun the spinner 120 times, write down the number of times that you predict that the arrow will land on each of the colours.

Refer to the hand out and make a spinner according to the instructions provided.

8.6 Spin the spinner 12 times (each time you spin the spinner is called a trial) and record the colour of the segment on which the arrow lands (the result of the spin i.e. the colour on which the arrow stops is called the outcome of the trial). Record the outcomes of the trials in the table below.

Trial number	1	2	3	4	5	6	7	8	9	10	11	12
Outcome												

8.7 Study the list of outcomes that you have recorded. Are you able to predict with confidence what the outcome of the next trial will be? Give reasons for your answer.

8.8 Use the table provided in the handout to summarise the outcomes of the first 12 trials (the table below gives an example of what your table could look like).

		Yellow	Red	Blue	Green
1st 12 trials	Tallies	/	/ /	/ / / /	~~////~~
	Number of outcomes	1	2	4	5
	Number of outcomes as a fraction of the trials	$\frac{1}{12}$	$\frac{2}{12}$	$\frac{4}{12}$	$\frac{5}{12}$

8.9 Write the colours of the segments in order from the colour of the segment with the largest total number of outcomes to the segment with the smallest total number of outcomes. How does this compare with your prediction in question 8.4? Discuss reasons for any possible difference at this stage.

8.10 Repeat the activity nine more times. Add the results of your spins to the table in the handout after every twelve spins (the table below gives an example of what your table could look like after two sets of 12 spins).

		Yellow	Red	Blue	Green
1st 12 trials	Tallies	/	/ /	/ / / /	~~////~~
	Number of outcomes	1	2	4	5
	Number of outcomes as a fraction of the trials	$\frac{1}{12}$	$\frac{2}{12}$	$\frac{4}{12}$	$\frac{5}{12}$
2nd set of 12 trials	Tallies	/ /	/	~~////~~ /	/ / /
	Number of outcomes	2	1	6	3
	Number of outcomes as a fraction of the 12 trials	$\frac{2}{12}$	$\frac{1}{12}$	$\frac{6}{12}$	$\frac{3}{12}$
	Total number of all trials	1 + 2 = 3	2 + 1 = 3	4 + 6 = 10	5 + 3 = 8
	Number of outcomes as a fraction of all the trials	$\frac{3}{24}$ =12,5%	$\frac{3}{24}$ = 12,5%	$\frac{10}{24} \approx 42\%$	$\frac{8}{24} \approx 33\%$

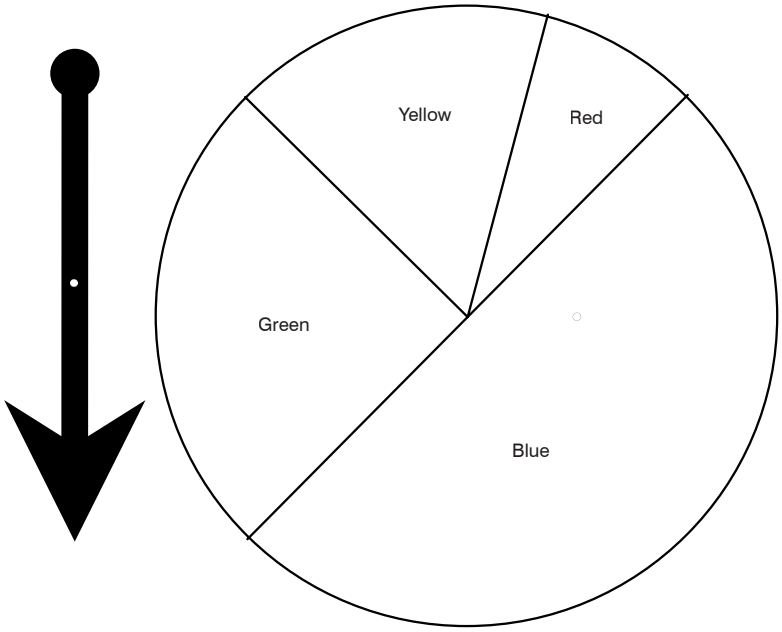
8.11 Having spun the spinner 120 times, compare the actual number of times that you got each colour with the predictions you made in question 8.5.

The number of times that you got each outcome is called the frequency of the outcome. As you look back over your table you will almost certainly notice the following:

The fraction of each outcome will vary quite a lot from one set of 12 trials to the next set of 12 trials.

As the number of sets of trials increases so the number of outcomes as a fraction of all trials will begin to get closer to some value – the value becoming more apparent as the number of trials increases. In the next activity we will look at how to predict this fraction.

Making a spinner:



INSTRUCTIONS:

1 Copy the circle and arrow onto heavy cardboard.

2 Cut out the arrow and colour in the spinner using the colours given. Make a small hole through the arrow at the point indicated.

3 Push a drawing pin through hole marked at the centre of the circle.

4 Balance the arrow onto the point of the drawing pin.

5 Test the spinner by spinning the arrow a few times and make sure that the arrow spins freely on the drawing pin.

		Yellow	Red	Blue	Green
1st 12 trials	Tallies				
	Number of outcomes				
	Number of outcomes as a fraction of the trials				
2nd set of 12 trials	Tallies				
	Number of outcomes				
	Number of outcomes as a fraction of the 12 trials				
	Total number of all trials				
	Number of outcomes as a fraction of all the trials				
3rd set of 12 trials	Tallies				
	Number of outcomes				
	Number of outcomes as a fraction of the 12 trials				
	Total number of all trials				
	Number of outcomes as a fraction of all the trials				
4th set of 12 trials	Tallies				
	Number of outcomes				
	Number of outcomes as a fraction of the 12 trials				
	Total number of all trials				
	Number of outcomes as a fraction of all the trials				
5th set of 12 trials	Tallies				
	Number of outcomes				
	Number of outcomes as a fraction of the 12 trials				
	Total number of all trials				
	Number of outcomes as a fraction of all the trials				
6th set of 12 trials	Tallies				
	Number of outcomes				
	Number of outcomes as a fraction of the 12 trials				
	Total number of all trials				
	Number of outcomes as a fraction of all the trials				
7th set of 12 trials	Tallies				
	Number of outcomes				
	Number of outcomes as a fraction of the 12 trials				
	Total number of all trials				
	Number of outcomes as a fraction of all the trials				
8th set of 12 trials	Tallies				
	Number of outcomes				
	Number of outcomes as a fraction of the 12 trials				
	Total number of all trials				
	Number of outcomes as a fraction of all the trials				
9th set of 12 trials	Tallies				
	Number of outcomes				
	Number of outcomes as a fraction of the 12 trials				
	Total number of all trials				
	Number of outcomes as a fraction of all the trials				
10th set of 12 trials	Tallies				
	Number of outcomes				
	Number of outcomes as a fraction of the 12 trials				
	Total number of all trials				
	Number of outcomes as a fraction of all the trials				

Activity 9 — Predicting livelihood

ABOUT THIS ACTIVITY

This activity deals with the definition of probability and writing the probability of an event as a fraction or percentage. In this activity the learners use theoretical probability to calculate the number of outcomes. They are ask to discuss the correlation between theoretical probability and the experimental outcome.

This activity is aligned with unit standard 9012 and addresses AC 3,4,5,6 of SO3.

MANAGING THIS ACTIVITY

Learners will need the worksheet only for this activity only. There are no handouts. The learner will, however, have to refer to his/her results in the spinner experiment conducted in activity 8. A calculator is necessary.

9.1.1 Two. Yes, it could possibly be a very small percentage of the spinner.

9.1.2 Red. Red is $\frac{220}{300} \times 100\% = 73\%$ of the spinner, therefore green will be 27% of the spinner.

Hence red is 46% larger than green.

9.1.3 Number of red outcomes = $\frac{220}{300} \times 100 = 73$

Number of green outcomes = $100 - 73 = 26$

9.2 360.

9.3.1 Probability of a yellow outcome = $\frac{60}{360} = \frac{1}{6} \approx 0{,}167 \approx 16.7\%$

9.3.2 Probability of a green outcome = $\frac{90}{360} = \frac{1}{4} = 0{,}25 = 25\%$

9.3.3 Probability of a blue outcome = $\frac{180}{360} = \frac{1}{2} = 0{,}5 = 50\%$

9.4 Yellow = $\frac{1}{6} \times 120 = 20$

Green = $\frac{1}{4} \times 120 = 30$

Blue = $\frac{1}{2} \times 120 = 60$

Red = $\frac{1}{12} \times 120 = 10$

9.5 Personal response.

9.6.1 Spinner 1: green = blue = red = $\frac{1}{3}$

Spinner 2: green = blue = $\frac{1}{4}$; red = $\frac{1}{2}$

Spinner 3: green = blue = $\frac{135}{360} = \frac{3}{8}$; red = $\frac{1}{4}$

9.6.2 Spinner 1: green = blue = red = $\frac{1}{3} \times 600 = 200$ times

Spinner 2: green = blue = $\frac{1}{4} \times 600 = 150$; red = $\frac{1}{2} \times 600 = 300$

Spinner 3: green = blue = $\frac{135}{360} = \frac{3}{8} \times 600 = 225$; red = $\frac{1}{4} \times 600 = 150$

9.6.3 It would not be completely accurate if one conducted the actual experiment. However, it would show some correlation.

Activity 9 — Predicting livelihood

In the previous activity you worked with a spinner and collected data for a large number of spins. As you summarised the data after every 12 spins you calculated the fraction of all of the spins that landed on each colour – we call this relative frequency. You may have noticed that while the fraction/ relative frequency for green (and the other colours) changed quite a bit at first, as the number of trials increased so the fraction started changing less dramatically – in mathematical terms it stabilised.

That the relative frequency stabilised as the number of trials increased should come as no surprise if we think about the early data activities in which we dealt with samples. By increasing the number of trials we were effectively increasing the size of the sample!

Having spun the arrow a very large number of times and calculated the relative frequency with which it landed on each colour, we are in a position to make some predictions about future events. That is, we can use the relative frequency we calculated to predict the frequency with which the arrow will land on each of the colours if the arrow is spun, say, 240 times. In this case we are basing our prediction on experience – more accurately on experimental evidence. In mathematical terms we talk about experimental probability.

9.1 In an experiment with a certain spinner a student records the following results:
- Number of trials: 300
- Number of red outcomes: 220
- Number of green outcomes: 80

9.1.1 How many different colours do you think the spinner has? Is it possible for the spinner to have more colours? If yes, why do you think there are no outcomes for that colour?

9.1.2 Consider the red and green segments of the spinner. Which segment do you think is larger and by how much?

9.1.3 If somebody were to conduct 100 trials using the spinner, predict the number of red outcomes and the number of green outcomes. Show your working in detail.

Experimental probability plays a very important role in our everyday lives. The various statements in the previous activity about the likelihood of the sun coming up on any given day and of Alan being late for class are all based on experience – informal experiments.

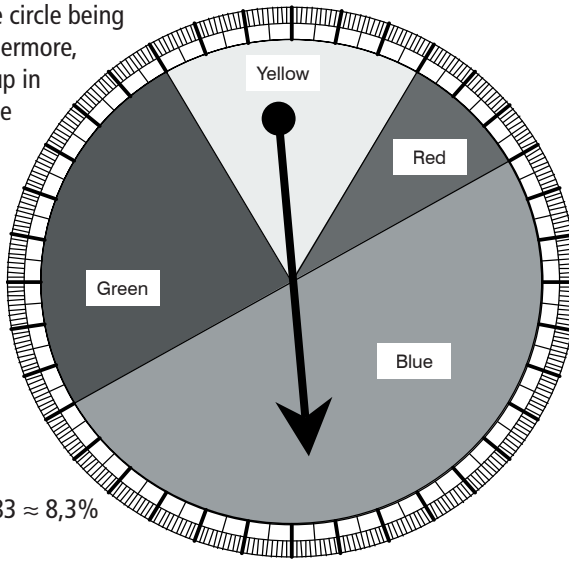
Mathematicians prefer, however, to see if it is possible to make predictions based on their knowledge of the situation rather than experimental evidence. In the case of Alan being late for class this may be very difficult, because the reason for Alan being late probably has a lot more to do with his personality than something that we can measure. The spinner, however, is different. Let us think about the spinner…

Mathematicians define probability as follows:

$$\text{probability of an event} = \frac{\text{number of ways in which the event can happen}}{\text{total number of (equally likely) possible outcomes in the situation}}$$

Let us try to make sense of that statement in the context of the spinner from the previous activity. To do so let us divide the spinner into segments using degrees.

By introducing the degrees we can imagine the circle being divided into 360 equally sized segments. Furthermore, let us imagine that the arrow will always end up in one of these segments. Finally we must assume that the spinner is not biased – the arrow can stop anywhere.



9.2 How many different, equally likely, positions can the arrow stop in?

Hopefully you answered 360!

Now (since 30 of the segments are red) we can say:

probability of a red outcome = $\frac{30}{360} = \frac{1}{12} \approx 0{,}083 \approx 8{,}3\%$

since 30 of the possible outcomes are red (the number of ways in which we can get a red) and there are 360 equally likely possible outcomes.
We say that the theoretical probability of a red is one twelfth. This means that we would expect/ predict one in twelve outcomes of a very large set of trials to be red.

IMPORTANT NOTES:

- The theoretical probability does not say that exactly one outcome in exactly twelve trials will always be red. It predicts the ratio of red outcomes to all outcomes as the experiment is repeated very many times.
- The theoretical probability cannot tell us what the outcome of the next trial will be in a series of experiments. If we get a red on the first trial, we can just as easily get another red on the second trial. The theoretical probability does not say that because we got a red on trial one, we must wait for eleven spins before we can expect another red!

9.3 In the same way, calculate the probability of:

9.3.1 a yellow outcome;

9.3.2 a green outcome; and

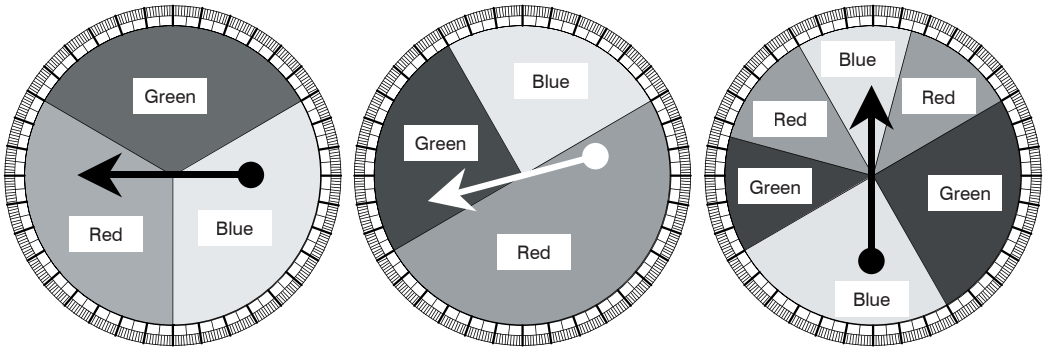
9.3.3 a blue outcome.

We can use this probability to predict how many outcomes of a particular kind we can expect in a large number of experiments.

Illustration: We can predict that approximately $\frac{1}{12} \times 120 = 10$ of the outcomes will be red if we spin the spinner 120 times.

9.4 Use the theoretical probability calculated in 9.3 to predict the number of each of the possible outcomes when the spinner is spun 120 times.

9.5 Compare your answers for question 9.4 with the actual results you recorded in activity 8. Are your predictions and results identical, similar or very different? Try to explain your observation.



9.6 For each of the spinners above:

9.6.1 Calculate the theoretical probability of the arrow landing on each colour of the spinner.

9.6.2 Predict the number of times you expect to get each of the possible outcomes (colours) if each spinner is spun 600 times.

9.6.3 Discuss whether or not you would actually get the outcomes you predict if you actually conducted the 600 trials for each spinner. Give reasons for your answers.

Activity 10 — Combined events

ABOUT THIS ACTIVITY

In this activity events are combined and the probability of combined events is calculated. Tree diagrams are used to calculate the probabilities of the combined events. The product law is mentioned and learners are encouraged to use either method.

This activity is aligned with unit standard 9012 and addresses AC 1, 2, 3, 4 of SO3.

MANAGING THIS ACTIVITY

The learners will need the worksheet for this activity. It is a continuation of the previous activities. Tree diagrams are used to find solutions.

10.1 $\text{Red}^1 = \frac{1}{8}$; $\text{red}^2 = \frac{1}{8}$; $\text{blue}^1 = \frac{1}{8}$; $\text{blue}^2 = \frac{1}{4}$; $\text{green}^1 = \frac{1}{8}$; $\text{green}^2 = \frac{1}{8}$

10.2 $\frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{4} + \frac{1}{4} + \frac{1}{8} = 1$

10.3 Red = 90° ; blue = 135° ; green = 135°

10.4 Red = $\frac{1}{4}$; blue = $\frac{3}{8}$; green = $\frac{3}{8}$

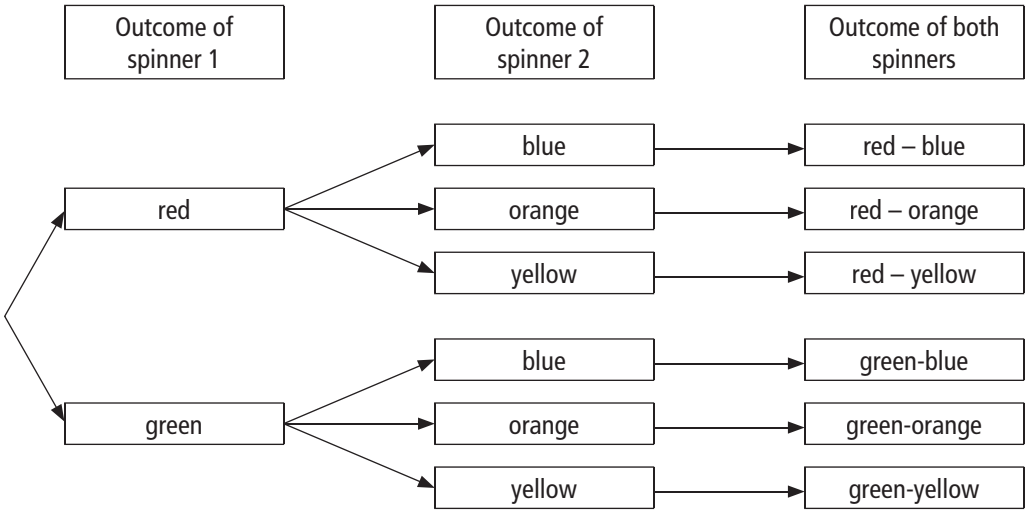
10.5.1 (a) correct
(b) correct
(c) correct

10.5.2 No. Whether it lands in red or red, it still lands on red.

10.6 Spinner 1: red = green = $\frac{1}{2}$

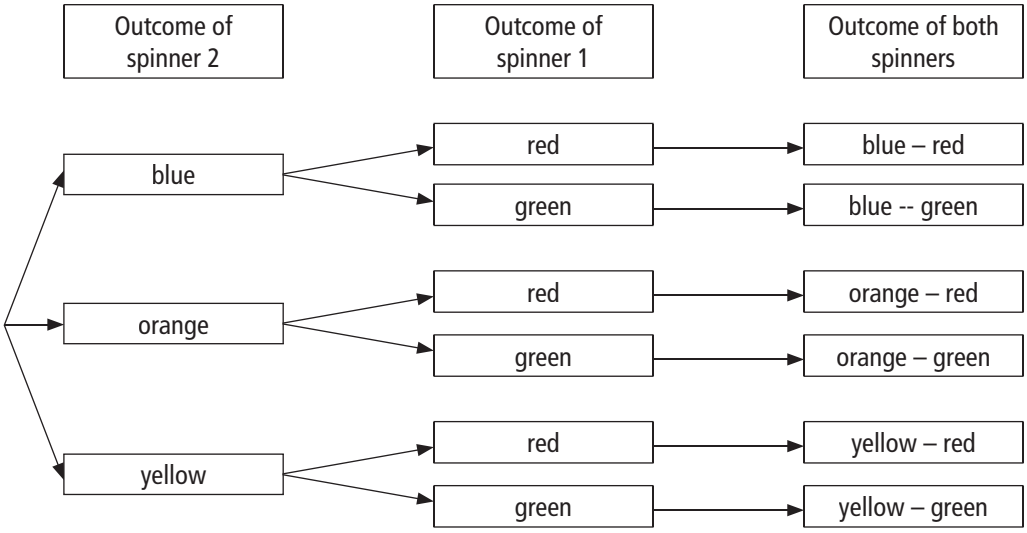
10.7 Spinner 2: orange = blue = yellow = $\frac{1}{3}$

10.8



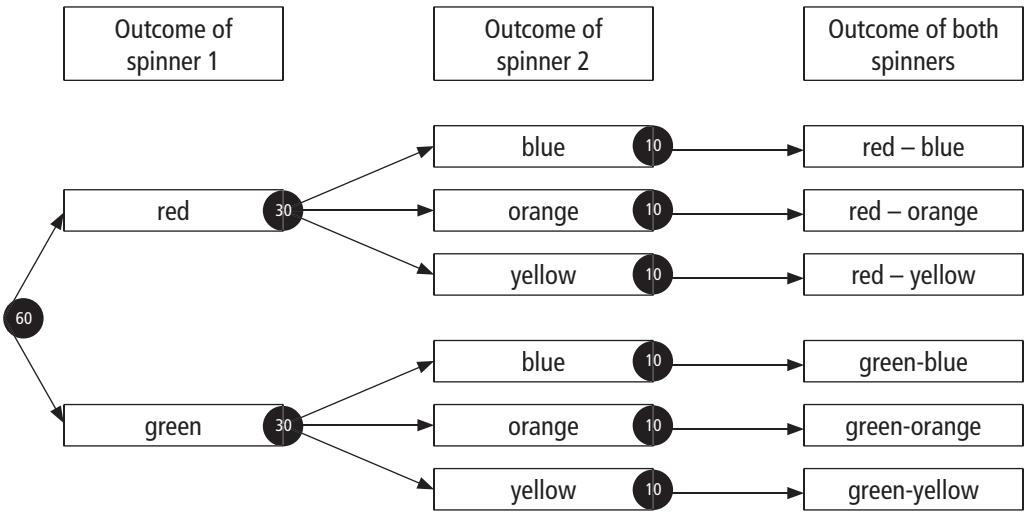
10.9 6

10.10



10.11 Six. No, blue-red or red-blue is the same outcome so the number of outcomes will be the same although the order has changed.

10.12



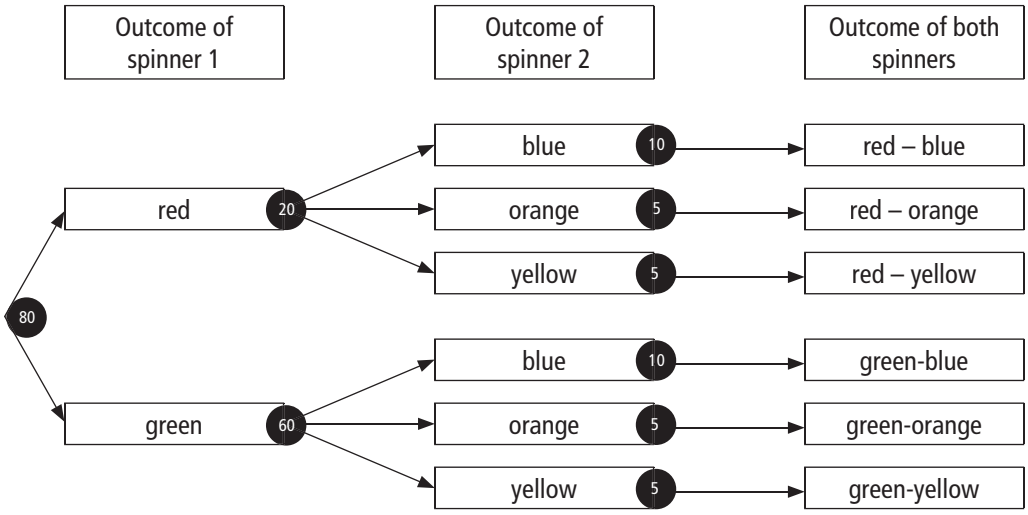
10.13 The probability for all the outcomes will be $\frac{1}{6}$.

10.14 If you used 90 trials, then there would be 15 of each outcome. This was calculated by dividing 90 by 3 in order to get the number of blue, orange and yellow outcomes. This means that each outcome has 30 trials. This is then halved to give 15 red and 15 green.

10.15 The probability of each outcome = $\frac{15}{90} = \frac{1}{6}$. The probabilities are the same as for 10.13 which is what it should be.

10.16 Yes, true for all outcomes.

10.17 (a) and (b)



(c) red-blue $= \frac{10}{80} = \frac{1}{8}$ or $\frac{1}{4} \times \frac{1}{2} = \frac{1}{8}$

red-orange $= \frac{5}{80} = \frac{1}{16}$ or $\frac{1}{4} \times \frac{1}{4} = \frac{1}{16}$

red-yellow $= \frac{5}{80} = \frac{1}{16}$ or $\frac{1}{4} \times \frac{1}{4} = \frac{1}{16}$

green-blue $= \frac{10}{80} = \frac{1}{8}$ or $\frac{1}{4} \times \frac{1}{2} = \frac{1}{8}$

green-orange $= \frac{5}{80} = \frac{1}{16}$ or $\frac{1}{4} \times \frac{1}{4} = \frac{1}{16}$

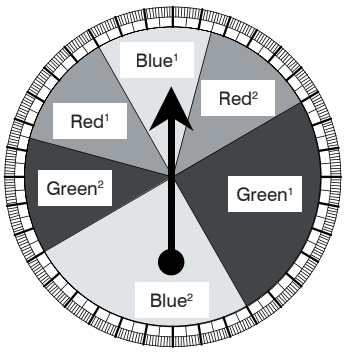
green-yellow $= \frac{5}{80} = \frac{1}{16}$ or $\frac{1}{4} \times \frac{1}{4} = \frac{1}{16}$

Activity 10 — Combined events

In this activity we will explore combined events. This is an enormously complex concept; the best we can do in this activity is to work through some situations together to provide you with a sense of what we mean by this and to give you a flavour of how complex the problems can become.

One such calculation is the calculation of the probability of winning the Lotto. We will not attempt to do so in this course but be assured that there are 13,9 million equally likely tickets every time the Lotto is played – the probability that any one ticket will win is, therefore, 1 in 13,9 million! You decide if it makes sense to play.

Let us return to the last spinner in the previous activity. In this spinner there were two regions of each colour, which for the purpose of our discussion are marked accordingly alongside.



10.1 Determine the theoretical probability of the arrow landing in each of the regions (red¹; red²; blue¹; blue²; green¹; and green²).

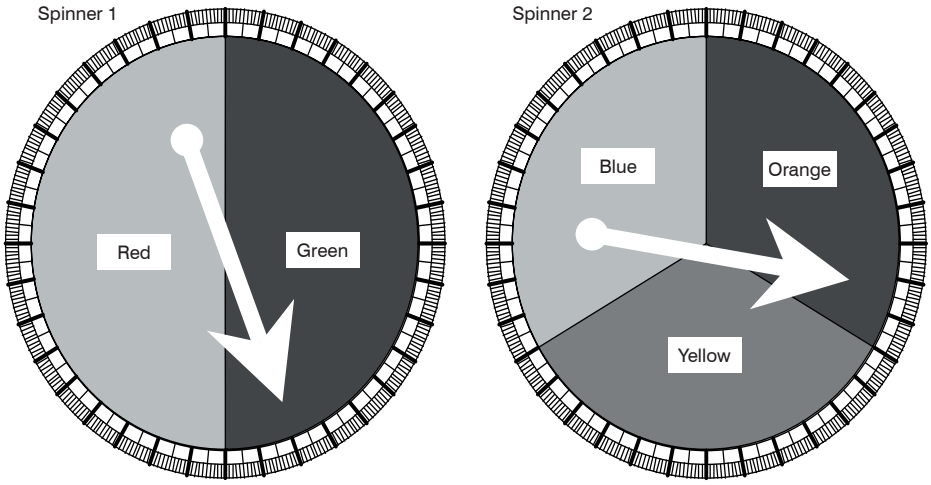
10.2 Add all of the probabilities that you calculated in 10.1 together. Your answer should be 1 — hopefully this does not surprise you.

10.3 If you moved the segments around so that each of the segments with the same colour are next to each other, how many degrees would each of the coloured segments be?

10.4 Now calculate the probability of the arrow landing in the combined red, combined blue and combined green segments.

10.5.1 Check whether the following statements are correct:
(a) probability (red¹) + probability (red²) = probability (red¹ + red²)
(b) probability (blue¹) + probability (blue²) = probability (blue¹ + blue²)
(c) probability (green¹) + probability (green²) = probability (green¹ + green²)

10.5.2 Does it surprise you that these statements are true? Discuss

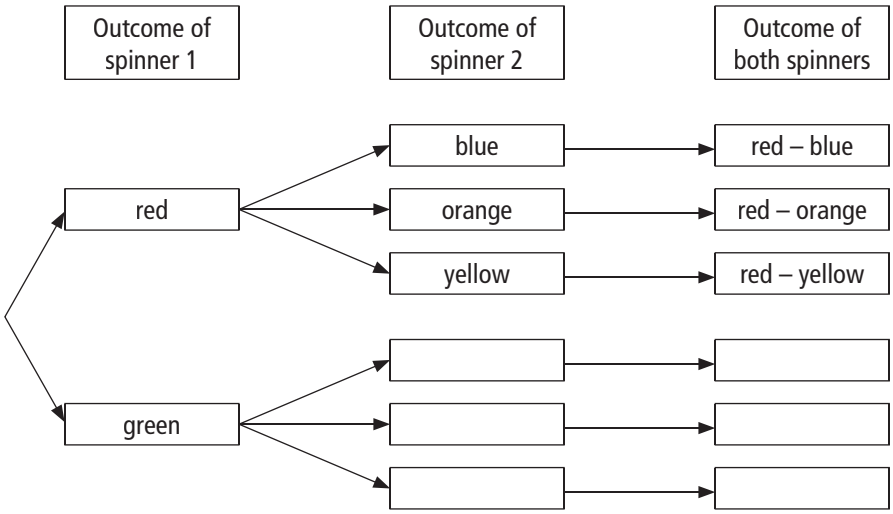


Let us now consider a different situation — two spinners.

10.6 Determine the theoretical probability of the arrow landing on each of the colours in spinner 1.

10.7 Determine the theoretical probability of the arrow landing on each of the colours in spinner 2.

What would happen if we asked somebody to spin both spinners? What are all the possible outcomes? A systematic way of listing all of the outcomes is to use a tree diagram such as the one below.



This diagram shows us that there are two outcomes for the first spinner: red and green. Say we get red and then spin the second spinner. There are three possible outcomes: blue, orange and yellow. Given that the outcome from the first spinner was already red, there are now three combined outcomes: red – blue; red – orange; and red – yellow.

10.8 Complete the remainder of the tree diagram.

10.9 How many different possible outcomes are there when we combine the results of the two spinners?

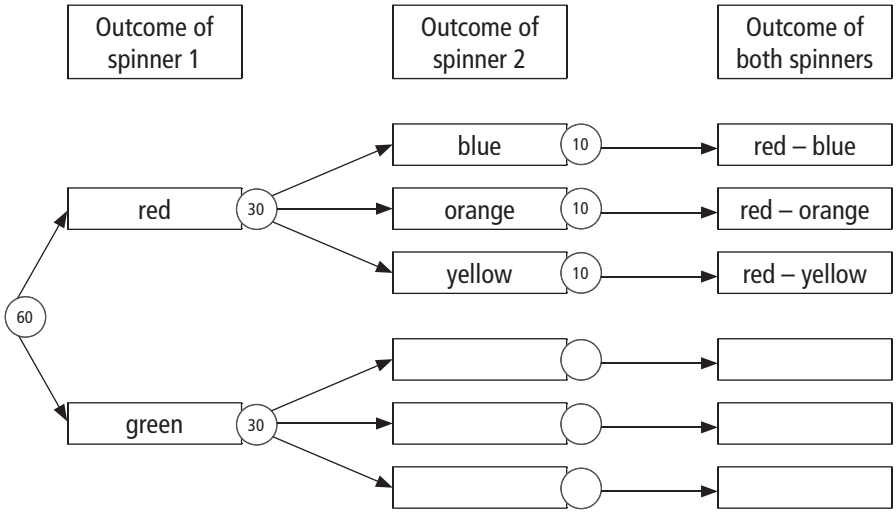
10.10 To confirm that you understood what we did when we constructed the tree diagram draw a new diagram but this time swap the order in which we spin the spinners.

10.11 How many different outcomes are there in this case? Should we be surprised by the answer? Discuss.

To determine the probability of each of the different outcomes that arise from spinning the two spinners we will think about the tree diagram as a sieve and we will imagine that we conduct 60 trials.

Assuming that the outcomes of the trials behave exactly according to the probability predictions, 30 of the 60 spins on the first spinner will end up on red and the other 30 on green. Now think about those that ended up on red. For each of these 30 outcomes we must spin the second spinner and since the segments are the same size we expect exactly $\frac{1}{3}$ of the spins to land on each colour. Since $\frac{1}{3} \times 30 = 10$, we expect 10 of the 30 spins to end on blue, 10 on orange and 10 on yellow.

Putting that all together gives us 10 red – blue, 10 red – orange, and 10 red – yellow outcomes.



10.12 Complete the remainder of the tree diagram.

Let us now determine the probability of each of the six possible outcomes. We will do so as follows:

$$\text{probability (red – blue)} = \frac{\text{number of red – blue outcomes}}{\text{total number of trials}} = \frac{10}{60} = \frac{1}{6}$$

10.13 Calculate the probability of all of the possible outcomes when we spin the two spinners.

10.14 To confirm that you understood what we did with these 60 trials, use the tree diagram you drew in 10.10 to predict how many of each outcome you will get if you conduct 90 trials.

10.15 Calculate the probability of each outcome based on the results of your 90 trials. Are the probabilities you calculated this way the same as those we calculated in 10.13? Are you surprised?

Did you notice the following:

$$\text{probability (red – blue)} = \text{probability (red)} \times \text{probability (blue)} = \frac{1}{2} \times \frac{1}{3} = \frac{1}{6}$$

10.16 Check if the same is true for all of the other outcomes.

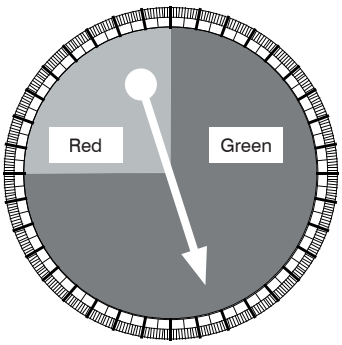
10.17 To consolidate what you have learnt in this activity, do the following for the two spinners below:

(a) Draw a tree diagram to determine all of the possible outcomes if an experiment consists of spinning the two spinners.

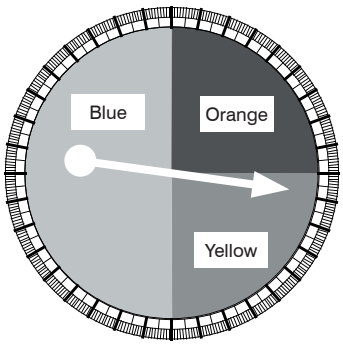
(b) Determine the number of each of the possible outcomes that you would expect if you performed 80 trials.

(c) Hence, or otherwise, determine the probability of each of the possible outcomes.

Spinner 1

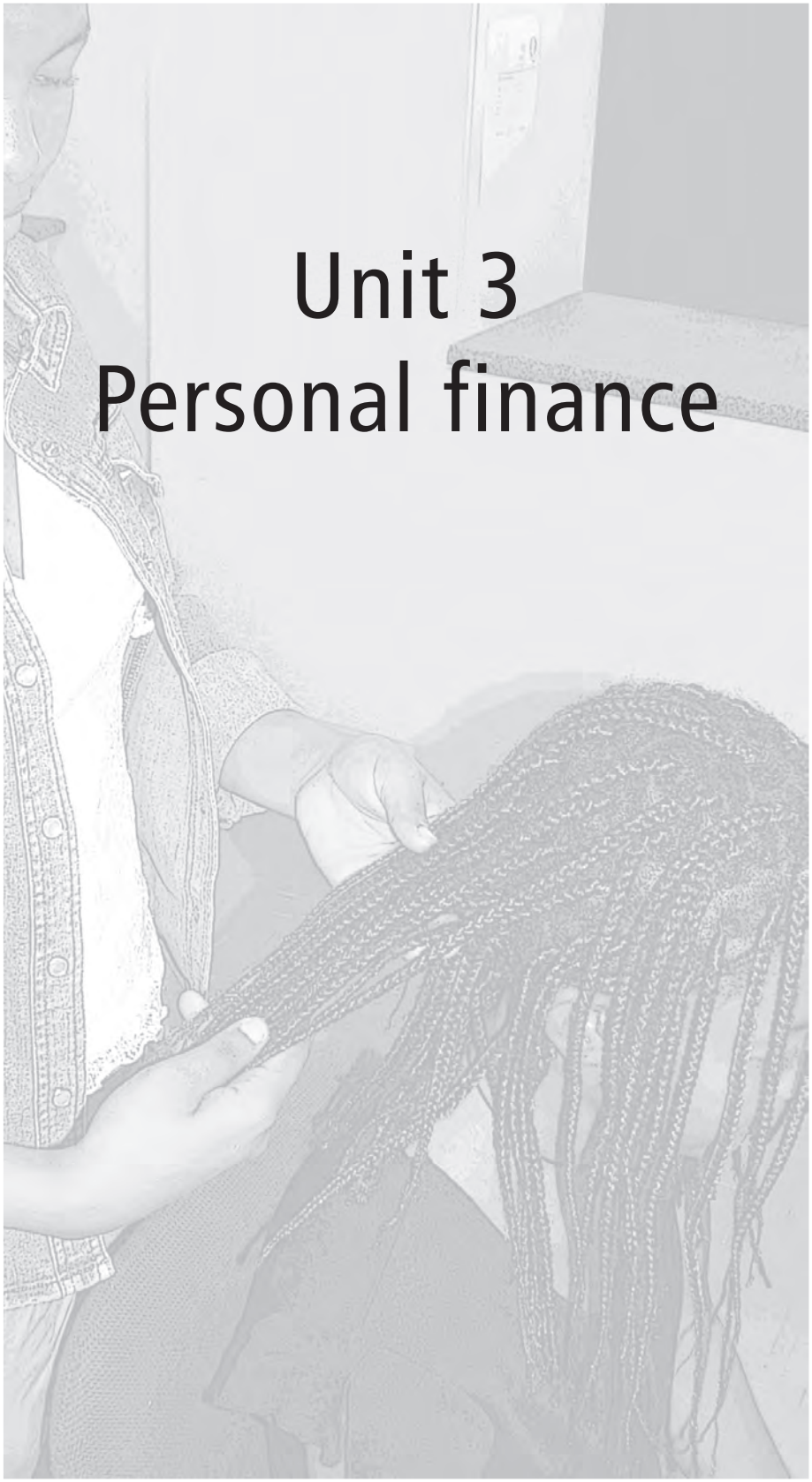


Spinner 2



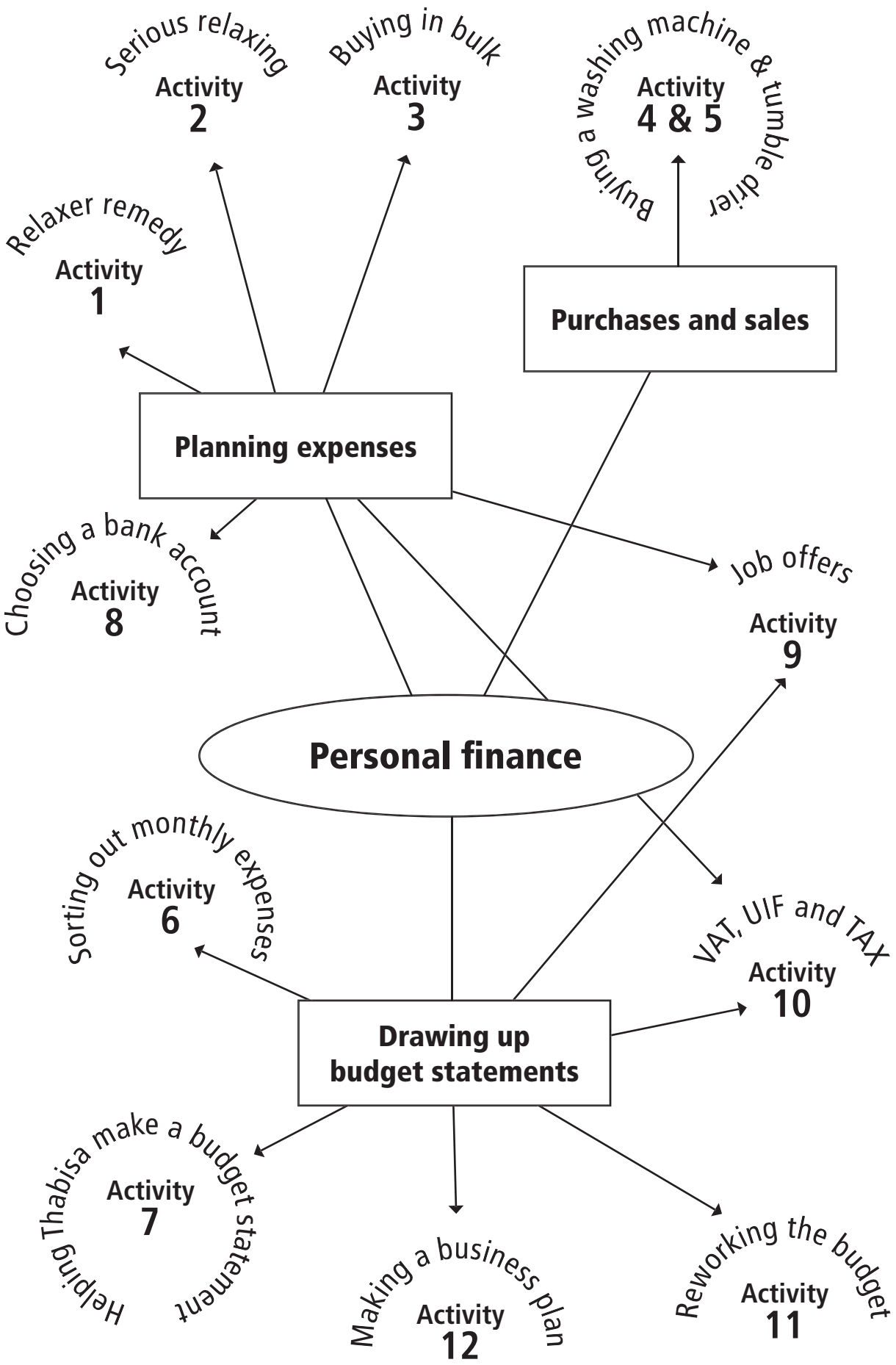
Mathematical Literacy

NQF LEVEL 3



Unit 3
Personal finance

Hairdressing


Serious relaxing
Activity 2
Buying in bulk
Activity 3
Buying a washing machine & tumble drier
Activity 4 & 5
Relaxer remedy
Activity 1
Purchases and sales
Planning expenses
Choosing a bank account
Activity 8
Job offers
Activity 9
Personal finance
Sorting out monthly expenses
Activity 6
VAT, UIF and TAX
Activity 10
Drawing up budget statements
Helping Thabisa make a budget statement
Activity 7
Making a business plan
Activity 12
Reworking the budget
Activity 11

Overview

This unit aims to increase Learners' familiarity with and understanding of the financial aspects of personal, business and national issues.

Learners should gain an understanding of what income and expenditure statements are. The relationship between budgets on a small scale personal level and those on a large scale national level is highlighted.

Learners will use the context of Thabisa's *"Relaxer Remedy"* in order to gain an understanding of how to plan and budget. A number of different issues come into play as Thabisa's home business grows and her client base increases. Learners are expected to describe the issues and attempt to plan Thabisa's finances accordingly.

Students will also be exposed to the issues involved in making good decisions about purchases. Simple and compound interest are addressed and the applications of these are explored in the activities.

This unit consists of twelve activities. Each activity is a stand alone activity, but they rely on an understanding of the concepts that have been raised preceding each activity. Having worked through this unit, Learners should have a greater ability to deal with some of the financial aspects of running personal finances.

Activity 1: Relaxer remedy
This activity focuses on planning and budgeting for expected expenditure. Learners will consider Thabisa's own personal expenditure and try to plan for the expected costs involved in doing relaxer treatments from her home.

Activity 2: Serious relaxing!
This activity again focuses on planning and budgeting for expected expenditure but in more detail than the previous activity. Learner's will consider more aspects of Thabisa's expenditure and try to plan for the expected costs incurred in her new line of work.

Activity 3: Buying in bulk
Now that Thabisa is treating hair on a regular basis and no longer works at the Spur, she needs to stock up on "Relaxer Remedy Products" more often and is investigating buying the products from a mass discount store. In this activity, learners will compare product prices and other costs involved in order to determine how much Thabisa will save if she buys most of her stock at "Budget Hyper" rather than buying all of the stock at her local spaza.

Activity 4: Buying a washing machine and a tumble dryer
The context of buying washing machine and tumble dryer, for the purposes of speeding up the process of washing and drying the towels that Thabisa uses for her clients, is used to introduce different purchase options. In this activity, we look at two options that Thabisa is considering in order to buy the washing machine and tumble dryer: using a stokvel saving scheme, and paying the store a hire-purchase price for the washing machine and tumble dryer. In the next activity we will consider two other options: a loan calculated using simple interest (borrowing money from a friend) and a loan calculated using compound interest.

Unit outcomes

The following Unit Standards, Specific Outcomes and Assessment Criteria are addressed by this unit:
Use mathematics to investigate and monitor the financial aspects of personal, business and national issues (7456).

- Use Mathematics to plan and control personal, regional and/or national budgets and income and expenditure (SO1).
  - o Use Mathematics to plan and control personal, regional and/or national budgets and income and expenditure.
- Use simple and compound interest to make sense of and define a variety of situations (SO2).
  - o Use simple and compound interest to make sense of and define a variety of situations.
- Use Mathematics to debate aspects of the national economy (SO3).
  - o Use Mathematics to debate aspects of the national economy.

Activity 5: Buying a washing machine and a tumble dryer continued…
This activity follows on from the previous activity which deals with payment options for purchasing a washing machine and tumble dryer. In this activity we will look at loans: one of which is a simple interest calculation and one of which is a compound interest calculation.

Activity 6: Sorting our monthly expenses
This activity focuses on types of expenses that one incurs during a month and helps to categorise these expenses into essential and nonessential expenses. The aim is to help learners develop a way of budgeting their finances.

Activity 7: Helping Thabisa to make a budget statement
This activity focuses on income and expenditure on a more personal level. Through knowledge of Thabisa's income and expenses, learner's are asked to fill in certain details onto a budget and to estimate budget figures for the next month.

Activity 8: Choosing a bank account
This activity focuses on investigating which of the three listed bank accounts will be best suited to Thabisa's needs. Learners will do various calculations in order to investigate the fees for different transactions with each of the listed bank accounts; analyse what kinds of transactions Thabisa will be making and how often she will make these transactions; and finally make a recommendation to Thabisa about which bank account is more suitable for her needs and justify this recommendation.

Activity 9: Job Offers
In this activity, learners are asked to examine 2 different salary structures outlined on the handout. The salary structures are slightly different and learners will be asked to do a series of calculations using the 2 different salary structures. Based on these calculations, the learners are asked to draw conclusions about the salary structures and make a recommendation as to which they job offer they feel Thabisa should accept.

Activity 10: VAT, UIF and TAX
This activity focuses on types of expenses that one incurs during a month and helps to categorise these expenses into essential and nonessential expenses. The aim is to help learners develop a way of budgeting their finances.

Activity 11: Reworking the budget
This activity is an extension from activity 7 where we introduced the budget statement. In this activity learners apply their knowledge about budgets in order to help Thabisa to formulate new budget figures for October 2005, when she is working at her new job, so that she can determine whether or not she can survive financially under these new conditions.

Activity 12: Making a business plan
This activity is designed as an assessment task. Learners are asked to draw up a business plan for cutting and styling hair. They will need to gather information about the costs involved in setting up, make a price list and draw up a budget showing how they intend to cover their expenses and make a sustainable profit.

7456	Use mathematics to investigate and monitor the financial aspects of personal, business and national issues													
		ACTIVITY	1	2	3	4	5	6	7	8	9	10	11	12
SO1	Use mathematics to plan and control personal, regional and/or national budgets and income and expenditure													
	AC1	Use mathematics to plan and control personal, regional and/or national budgets and income and expenditure	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
SO2	Use simple and compound interest to make sense of and define a variety of situations													
	AC1	Use simple and compound interest to make sense of and define a variety of situations.				✓	✓	✓	✓			✓		✓
SO3	Use mathematics to debate aspects of the national economy													
	AC1	Use mathematics to debate aspects of the national economy							✓	✓		✓		✓

Activity 1 — Advertising claims

ABOUT THIS ACTIVITY
This activity focuses on planning and budgeting for expected expenditure. Learners will consider Thabisa's own personal expenditure and try to plan for the expected costs involved in doing relaxer treatments from her home.

This activity is aligned with unit standard 7456 and addresses specific outcome 1.

MANAGING THIS ACTIVITY
For this activity, learners will need only the worksheet, but a calculator will be helpful.

1.1.1 1 teaspoon is about 5ml, therefore 4 teaspoons is about 20ml. With 400ml, Thabisa could wash about 20 heads of long hair (400ml ÷ 20ml = 20).

1.1.2 1 tablespoon is about 15ml, therefore with 400ml Thabisa could wash about 26 heads of short hair (400ml ÷ 15ml = 26, 7 but we allow for a little spillage).

1.2.1 With 250ml of Formex Pre-treatment Cream Thabisa could do about 16 heads of long hair (250ml ÷ 15ml = 16,7).

1.2.2 With 250ml of Formex Pre-treatment Cream Thabisa could do about 25 heads of short hair (250ml ÷ 10ml = 25).

1.3.1 With 1 litre (1000ml) of Alco Reconstructor Thabisa could do about 50 heads of long hair (1000ml ÷ 20ml = 50).

1.3.2 With 1 litre (1000ml) of Alco Reconstructor Thabisa could do about 66 heads of long hair (1000ml ÷ 15ml = 66,7).

1.4.1 See table below:

Products	Price	No. of heads used for	Per head of long hair
Sensations Normalising Shampoo (400ml)	R89,99	20	R4,50
Formex Pre-treatment (250ml)	R83,65	16	R5,23
Rejuvenating Relaxer (9 appl.)	R245,25	4,5	R54,50
Alco Reconstructor (1 litre)	R225,99	50	R4,52
	COST–PRICE PER HEAD OF LONG HAIR		**R68,75**

1.4.2 See table below:

Products	Price	No. of heads used for	Per head of short hair
Sensations Normalising Shampoo (400ml)	R89,99	26	R0,35
Formex Pre-treatment (250ml)	R83,65	25	R3,35
Rejuvenating Relaxer (9 appl.)	R245,25	9	R27,25
Alco Reconstructor (1 litre)	R225,99	66	R3,42
	COST-PRICE PER HEAD OF SHORT HAIR		**R34,37**

1.5 With one of each of the products, the maximum number of *"Relaxer Remedies"* that Thabisa can do is 9 because the relaxer kit comes with 9 applications in it. However, if all of the people have long hair then she could only do 4. So she could do between 4 and 9 *"Relaxer Remedies"* with one 400ml bottle of Sensations Normalising Shampoo, one 250ml bottle of Formex Pre-treatment, one pack of 9 relaxer applications and one litre bottle of Alco Reconstructor.

1.6 In order to do 20 long hair and 20 short hair *"Relaxer Remedies"*:

1.6.1 She would need 2 bottles of Sensations Normalising Shampoo, 2 bottles of Formex Pre-treatment, 7 boxes of Rejuvenating Relaxer and 1 bottle of Alco Reconstructor.

Products	20 long	20 short	TOTAL	No. of items needed
Sensations Normalising Shampoo (400ml)	20ml × 20	15ml × 20	700ml	2
Formex Pre-treatment (250ml)	15ml × 20	10ml × 20	500ml	2
Rejuvenating Relaxer (9 appl.)	2 × 20	1 × 20	60 appl.	7
Alco Reconstructor (1 litre)	20ml × 20	15ml × 20	700ml	1

1.6.2 She would need 2 bottles of Sensations Normalising Shampoo, 2 bottles of Formex Pre-treatment, 7 boxes of Rejuvenating Relaxer and 1 bottle of Alco Reconstructor.

Products	Cost per bottle	No. of items needed	
Sensations Normalising Shampoo (400ml)	R89,99	2	R179,98
Formex Pre-treatment (250ml)	R83,65	2	R167,30
Rejuvenating Relaxer (9 appl.)	R245,25	7	R1 716,75
Alco Reconstructor (1 litre)	R225,99	1	R225,99
		TOTAL COST	R2 290,02

1.7 One working day is usually from 08h00 – 17h00 which is 9 hours. This means that Thabisa could physically do 6 treatments a day. However, practically speaking Thabisa would need to allow time for lunch and few minutes rest in between treatments, so it would be more sensible to say that she could do a maximum of 5 treatments a day.

1.8 The products used for 1 long hair *"Relaxer Remedy"* treatment cost R68,75 (see 1.4.1). If she'd like to make a profit of R120 and she can do 5 treatments in a day, she should add R24 onto the price for each treatment. She would therefore charge R92,75 per long hair *"Relaxer Remedy"* treatment.

1.9 The products used for 1 short hair *"Relaxer Remedy"* treatment cost R34,37 (see 1.4.1). If she'd like to make a profit of R120 and she can do 5 treatments in a day, she should add R24 onto the price for each treatment. She should therefore charge R58,37 per short hair *"Relaxer Remedy"* treatment.

1.10 This does not affect the prices calculated in 1.8 and 1.9 because we advised Thabisa to add R24 onto each treatment, so irrespective of whether she treats someone with long hair or someone with short hair she will still recover R24 × 5 = R120 if she sees 5 people in the day.

1.11 It seems more sensible to imagine that Thabisa could see, on average, 3 clients a day. Therefore she should add R40 onto the price per treatment to ensure that if she does see only 3 people in a day, she will still make R120 profit for that day. Thus the short hair *"Relaxer Remedy"* treatment would cost R74,37 and the long hair *"Relaxer Remedy"* treatment would cost R108,75.

Activity 1 — Relaxer Remedy

Many years ago Thabisa Mvuto's aunt, Funeka, used to relax hair. People would come to her aunt's home to have their hair relaxed. Funeka is now old and frail and has not worked for some time, but she has agreed to give Thabisa her old *"Relaxer Remedy"* and teach her so that Thabisa can set-up a mini relaxing salon from her home. Many of Thabisa's friends would like to have their hair relaxed so she is anxious to learn quickly in order to get working.

In this activity we will be looking at how to help Thabisa to plan the costs involved in relaxing hair so that she can work out ow much money she needs to spend on products and is able to set a realistic price for the relaxing treatments.

Funeka's *"Relaxer Remedy"* is made up of the following four products:
Sensations Normalising Shampoo
Formex Pre-treatment Cream
Rejuvenating Relaxer Solution
Alco Reconstructor

1.1 Funeka used about 4 teaspoons of the normalising shampoo to wash a head of long hair and about 1 tablespoon of the normalising shampoo to wash a head of short hair. If Thabisa buys a 400 ml bottle of Sensations Normalising Shampoo:

1.1.1 How many heads of long hair could she wash with this bottle?

1.1.2 How many heads of short hair could she wash with this bottle?

1.2 Funeka used about 1 tablespoon of the pre-treatment cream on a head of long hair and about 2 teaspoons of the pre-treatment cream on a head of short hair. If Thabisa buys a 250 ml bottle of Formex Pre-treatment Cream:

1.2.1 How many heads of long hair could she do with this bottle?

1.2.2 How many heads of short hair could she do with this bottle?

1.3 Funeka used to use about 4 teaspoons of the reconstructor for a long-haired person and about a tablespoon for a short-haired person. If Thabisa can buy the Alco Reconstructor in a 1 litre container:

1.3.1 How many heads of long hair could she do with this bottle?

1.3.2 How many heads of short hair could she do with this bottle?

The Rejuvenating Relaxer Solution used in the *"Relaxer Remedy"* comes in a kit with 9 applications. A long head of hair will need two applications but a short head of hair will only need one application or this relaxer.

1.4 Thabisa can buy the products for the following prices:
- Sensations Normalising Shampoo (400ml) = R89,99
- Formex Pre-treatment Cream (250ml) = R83,65
- Rejuvenating Relaxer Solution (9 applications) = R245,25
- Alco Reconstructor (1 litre) = R225,99

1.4.1 Calculate a *"Relaxer Remedy"* cost-price per head of long hair.

1.4.2 Calculate a *"Relaxer Remedy"* cost-price per head of short hair.

1.5 If Thabisa buys one of each of the products listed above, how many *"Relaxer Remedies"* can she do?

1.6 In order to do 20 long hair and 20 short hair *"Relaxer Remedies"*:

1.6.1 How many of each of the above products would Thabisa have to buy?

1.6.2 How much would it cost to buy all of this stock?

Thabisa lives in Cape Town and works 5 days a week at the Cherokee Spur in Maynard Mall, Wynberg. Thabisa earns an average net income of R120 per day working at the Spur.

She does hair relaxing in her free time and on the weekends because she really enjoys working with the people to make their hair look beautiful. Initially, Thabisa only did *"Relaxer Remedy"* treatments for her friends and family, and so she only charged them the cost of the products used. But once she is more confident and starts seeing clients regularly she may not need to work at the Spur. In this case, she needs to work out a more realistic price for the treatments that she could earn money for her time spend treating people's hair.

1.7 One *"Relaxer Remedy"* treatment takes approximately 1½ hours. What is the maximum number of treatments that Thabisa could do in one working day?

1.8 If Thabisa did a full day of long hair *"Relaxer Remedy"* treatments, she would also like to earn about R120 a day. Calculate a sensible price that Thabisa should charge per long hair treatment, if she would like to make R120 on that day.

1.9 If Thabisa did a full day of short hair *"Relaxer Remedy"* treatments, calculate a sensible price that Thabisa should charge per short hair treatment if she would like to make R120 on that day.

1.10 In reality, Thabisa would not necessarily have all long hair treatments in one day and all short hair treatments in one day. It would probably be a mixture. Would this affect the prices calculated in 1.8 and 1.9? Why or why not?

1.11 Thabisa also might not get 5 clients every day. Taking this into account, re-calculate a long hair and a short hair *"Relaxer Remedy"* treatment price that you suggest Thabisa should charge.

Activity 2 — Serious relaxing!

ABOUT THIS ACTIVITY

This activity again focuses on planning and budgeting for expected expenditure but in more detail than the previous activity. Learner's will consider more aspects of Thabisa's expenditure and try to plan for the expected costs incurred in her new line of work.

This activity is aligned with unit standard 7456 and addresses specific outcome 1.

MANAGING THIS ACTIVITY

For this activity, learners will need the worksheet and calculators. Most of the responses that learners give in this activity will be different. However, it is important that decisions should be made based on real values and researched prices. The important factors for consideration have been listed in the example solutions.

2.1 Thabisa was charged R2,32 per KL of water on the first account but R2,46 on the second, therefore the cost of water must have been increased.

2.2 The 4th bill was calculated on a period of 32 days, whereas the 3rd was for only 30 days.. The City of Cape Town gives each customer a certain amount of free water every day, so even though she has used the same amount of water in the 3rd and 4th accounts (11.000 KL), she had 2 extra amounts of free water in the period for the 4th bill– so she paid less for the this period.

2.3 The average daily water usage remained between 0,340 and 0,360 for the first 4 accounts shown, after which the average daily water usage increased to 0,464 and then to 0,500.

2.4 Average daily water usage = 118.000 KL ÷ 42 days = 0,356.

2.5 The average water cost that Thabisa incurred over the first 4 listed accounts = (R10,32 + R11,01 + R12,50 + R11,53) ÷ 4 = R11,34.

2.6 R11,34 ÷ 42 days = 0,27 per day.

2.7 We calculated that a short hair *"Relaxer Remedy"* treatment would cost R74,37 and the long hair *"Relaxer Remedy"* treatment would cost R108,75. If Thabisa's average daily water usage remains at about 0,500 KL due to the extra water used for hair treatments, and her daily water expenditure is roughly 87 cents, then her water expense has increased by 60 cents per day when treating one head of her per day. Therefore she should add at least 60 cents onto the prices calculated in 1.11 – making it R74,97 for short hair and R109,35 for long hair.

2.8 Thabisa's electricity consumption was fairly constant until the months of November and December when she used much more electricity.

2.9 Before the month of November Thabisa spent an average of R120 on electricity per month. This is calculated as follows: (R120 + R115 + R125 + R120) ÷4 = R120.

2.10 In the month of November, Thabisa spent R150 on electricity. This is R30 more than her average monthly usage.

2.11 In the month of December, Thabisa spent R185 on electricity. This is R65 more than her average monthly usage.

2.12 Being December, she could have used more electricity doing extra cooking due to the festive season. It is unlikely that the increase is all due to the hair treatments.

2.13 An extra R65 for the month of December is approximately R2,10 per day. Seeing that she was, on average, doing only one treatment per day at this point, this means we should add an additional R2,10 to every treatment making it R77,07 for a short hair *"Relaxer Remedy"* treatment and R111,45 for a long hair *"Relaxer Remedy"* treatment.

Activity 2 — Serious relaxing!

Thabisa has successfully treated several close friends' and family members' hair with the *"Relaxer Remedy"*. Everyone loved it and word spread around that Thabisa had a knack with hair relaxing. Friends of Thabisa's friends began to ask if they could also get their hair relaxed. In December 2005, Thabisa took time off from her job at the Spur because she had lots of customers coming to her home for *"Relaxer Remedy"* treatments. Now that she is working on people's hair more regularly she needs to examine her finances a bit more carefully to ensure that she covers her costs.

The first handout shows the information taken from Thabisa's water bolls over the last few months. Study the details shown and answer the questions that follow:

The first handout shows information taken from Thabisa's water bills over the last few months. Study the details shown and answer the questions that follow:

2.1 It seems that Thabisa's average water use was the same for the first two accounts and yet the second account, dated 19/08/2005, was more expensive. Can you see any reason for this? Explain.

2.2 It seems that Thabisa used the same amount of water in the 3rd and 4th accounts shown yet the 4th account, dated 22/10/2005, was less expensive. Can you see any reason for this? Explain.

2.3 What do you notice about Thabisa's average daily water usage over the months shown?

2.4 Work out the Thabisa's average daily water usage over the first 4 listed accounts, using the following formula:
Average daily water usage = total KL of water used ÷ total number of days

2.5 Calculate the average water cost that Thabisa incurred over the first 4 listed accounts.

2.6 Calculate an average price per day that Thabisa paid for water during the first 4 listed accounts.

By the last account shown, Thabisa's average daily water usage had increased to 0.500 KL, meaning that her water bill had increased to R28,29. It seems reasonable to assume that this increase can be attributed mostly to the fact that Thabisa's uses quite a lot of water to wash her clients' hair.

2.7 In activity 1 (question 1.11), you calculated long hair and short hair *"Relaxer Remedy"* treatment price that you suggested Thabisa should charge. At this point Thabisa was doing on average only one relaxer treatment per day, but we can see an increase in her water bill which she should allow for in her prices. Revise the prices calculated in 1.11, taking into account Thabisa's water expenses.

Thabisa has an electricity meter and buys prepaid electricity. She has a book in which she keeps a record of how much she spends on electricity units every month. Study the excerpts taken from Thabisa's electricity book (found on handout 2).

2.8 What do you notice about Thabisa's electricity usage over the last 6 months of last year?

2.9 What was Thabisa's average electricity usage before November 2005?

Treating a person's hair involves an extra use of electricity (for example, the geyser which uses electricity to make the water hot for washing hair and for washing towels, as well as the use of an electric hair dryer to dry her clients hair after the treatment).

2.10 How much additional electricity did Thabisa use in the month of November whenshe did treatments for her friends and family?

2.11 How much additional electricity did Thabisa use in the month of December when lots of clients came to her home for treatments?

2.12 Is it reasonable to assume that all of the increase was due to the hair treatments?

2.13 Assume that Thabisa is convince that increase in her electricity is all due the hair treatment work she has been doing, and adjust the cost per treatments that you calculated in 2.6 to take into account this extra electricity usage.

Account Details as at 21/07/2005

WATER (Period 18/06/2005 to 14/07/2005 – 28 days) (Actual Reading)
AT 00028000WYN, 5 CRESCENT ROAD, WYNBERG/ ERF 280
Meter No: Z031358964 / Consumption 10.000 KL / Daily Average 0.357 KL

*	Consumption charge (Dom) (1) 5.5230 KL Free (2) 4.4770 KL @ R 2.3200	R 10.32

Account Details as at 19/08/2005

WATER (Period 15/07/2005 to 12/08/2005 – 28 days) (Actual Reading)
AT 00028000WYN, 5 CRESCENT ROAD, WYNBERG/ ERF 280
Meter No: Z031358964 / Consumption 10.000 KL / Daily Average 0.357 KL

*	Consumption charge (Dom) (1) 5.5230 KL Free (2) 4.4770 KL @ R 2.4600	R 11.01

Account Details as at 19/09/2005

WATER (Period 13/08/2005 to 12/09/2005 – 30 days) (Actual Reading)
AT 00028000WYN, 5 CRESCENT ROAD, WYNBERG/ ERF 280
Meter No: Z031358964 / Consumption 11.000 KL / Daily Average 0.367 KL

*	Consumption charge (Dom) (1) 5.9180 KL Free (2) 5.0820 KL @ R 2.4600	R 12.50

Account Details as at 22/10/2005

WATER (Period 13/09/2005 to 15/10/2005 – 32 days) (Actual Reading)
AT 00028000WYN, 5 CRESCENT ROAD, WYNBERG/ ERF 280
Meter No: Z031358964 / Consumption 11.000 KL / Daily Average 0.344 KL

*	Consumption charge (Dom) (1) 6.3130 KL Free (2) 4.6870 KL @ R 2.4600	R 11.53

Account Details as at 20/11/2005

WATER (Period 16/10/2005 to 13/11/2005 – 28 days) (Actual Reading)
AT 00028000WYN, 5 CRESCENT ROAD, WYNBERG/ ERF 280
Meter No: Z031358964 / Consumption 15.000 KL / Daily Average 0.464 KL

*	Consumption charge (Dom) (1) 5.5230 KL Free (2) 9.477 KL @ R 2.4600	R 23.31

Account Details as at 21/12/2005

WATER (Period 14/11/2005 to 22/06/2005 – 38 days) (Actual Reading)
AT 00028000WYN, 5 CRESCENT ROAD, WYNBERG/ ERF 280
Meter No: Z031358964 / Consumption 21.000 KL / Daily Average 0.500 KL

*	Consumption charge (Dom) (1) 7.4960 KL Free (2) 13.5040 KL @ R 2.4600	R 33.21

July 2005
2 July – R60
18 July – R40
25 July – R20

October 2005
1 Oct – R65
17 Oct – R25
23 Oct – R30

August 2005
1 Aug – R50
20 Aug – R50
28 July – R15

November 2005
2 Nov – R50
14 Nov – R50
28Nov – R50

September 2005
3 Sept – R100
25 Sept – R25

December 2005
1 Dec – R100
22 Dec – R50
26 Dec – R20
29 Dec – R15

Activity 3 — Buying in bulk

ABOUT THIS ACTIVITY

Now that Thabisa is treating hair on a regular basis and no longer works at the Spur, she needs to stock up on "Relaxer Remedy Products" more often and is investigating buying the products from a mass discount store.
In this activity, learners will compare product prices and other costs involved in order to determine how much Thabisa will save if she buys most of her stock at "Budget Hyper" rather than buying all of the stock at her local spaza.

This activity is aligned with unit standard 7456 and addresses specific outcome 1.

MANAGING THIS ACTIVITY

This activity has no handout. The activity could be extended by tasking the learners to compare pricing of certain specified hair products at their local stores and mass discount stores such as Makro.

3.1.1 Budget Hyper stocks Sensations Normalising Shampoo in a 2 litre container for R429,95 — this works out to R21,50 per 100ml (R429,95 ÷ 20). The spaza stocks Sensations Normalising Shampoo in a 400ml container for R89,99 — this works out to R22,50 per 100ml (R89,99 ÷ 4). Therefore it is cheaper to buy this product from Budget Hyper

3.1.2 With a 2 000ml bottle, she could wash about 100 heads of long hair (2000ml ÷ 20ml).

3.1.3 With a 2 000ml bottle, she could wash about 133 heads of short hair (2000ml ÷ 15ml).

3.2.1 Budget Hyper stocks Formex Pre-treatment Cream in a 1 litre container for R339,95 — this works out to R34,00 per 100ml (R339,95 ÷ 10). The spaza stocks Formex Pretreatment Cream in a 250ml container for R83,65 — this works out to R33,46 per 100ml (R83,65 ÷ 2½). Therefore it is slightly cheaper to buy this product from the spaza.

3.2.2 With a 1 000ml bottle, she could wash about 66 heads of long hair (1000ml ÷ 15ml).

3.2.3 With a 1 000ml bottle, she could wash about 100 heads of short hair (1000ml ÷ 10ml).

3.3.1 Budget Hyper stocks Alco Reconstructor in a 750ml bottle for R169,49 — this works out to per 100ml (R169,49 ÷ 7½). The spaza stocks Alco Reconstructor in a 1 000ml bottle for R225,99 — this works out to R22,60 per 100ml (R225,99 ÷ 10).

Therefore it is the same price as buying this product from Budget Hyper.

3.3.2 With a 750ml bottle, she could wash about 37 heads of long hair (750ml ÷ 20ml).

3.3.3 With a 750ml bottle, she could wash about 50 heads of short hair (750ml ÷ 15ml).

3.4.1 Cost-price per head of long hair:

Products	Price	No. of heads used for	Per head of long hair
Sensations Normalising Shampoo (2 litres)	R429,95	100	R4,29
Formex Pre-treatment	R339,95	66	R5,15
Relaxer (10 appl.)	R199,95	5	R39,95
Alco Reconstructor (750ml)	R169,49	37	R4,58
	COST– PRICE PER HEAD OF LONG HAIR		R53,97

3.4.2 Cost-price per head of short hair:

Products	Price	No. of heads used for	Per head of long hair
Sensations Normalising Shampoo (2 litres)	R429,95	133	R3,23
Formex Pre-treatment	R339,95	100	R3,40
Relaxer (10 appl.)	R199,95	10	R20,00
Alco Reconstructor (750ml)	R169,49	50	R3,39
	COST– PRICE PER HEAD OF LONG HAIR		R30,02

3.5 She would save R14,78 per head of long hair (R68,75 – R53,97) and R7,46 per head of short hair (R37,48 – R30,02).

3.6 Advantages:
- Since the products mainly come in larger containers the stock will last longer.
- Thabisa will save money.

Disadvantages:
- Thabisa will have to have enough money to buy her stock in bulk.
- It will cost Thabisa to travel to Budget Hyper whereas the spaza was local and she could just walk there.

3.7.1 She would need 1 bottle of Sensations Normalising Shampoo, I bottle of Formex Pre-treatment, 12 boxes of relaxer and 2 bottles of Alco Reconstructor.

Products	20 long	20 short	TOTAL	No. of items needed
Sensations Normalising Shampoo (2 litres)	20ml × 40	15ml × 40	1 400 ml	1
Formex Pre-treatment	15 ml × 40	10 ml × 40	1 000 ml	1
Relaxer (10 appl.)	2 × 40	1 × 40	120 appl.	12
Alco Reconstructor (750 ml)	20 ml × 40	15 ml × 40	1 400 ml	2

3.7.2 The total cost would be R3 508,32 (calculated as follows):

Products	Price	No. of heads used for	Per head of long hair
Sensations Normalising Shampoo (2 litres)	R429,95	1	R429,95
Formex Pre-treatment	R339,95	1	R339,95
Relaxer (10 appl.)	R199,95	12	R2 399,40
Alco Reconstructor (750ml)	R169,49	2	R338,98
COST– PRICE PER HEAD OF LONG HAIR			R3 508,32

3.7.3 Thabisa would have spent R3 508,32 if she stocked up with all these products. She would therefore get a 15% discount, which is R526,25 (calculated as follows): Discount amount = R3 508,32 × 15%.

Activity 3 — Buying in bulk

Now that Thabisa is treating hair on a regular basis she needs to stock up with her *"Relaxer Remedy"* products more often. Up until now it has been very convenient for Thabisa just to pop down to her local spaza to buy more when she runs out of one of the products, but the spaza does not stock large quantities of her product and is battling to restock often enough for Thabisa. Thabisa would like to investigate the possibility of buying her products in bulk from a mass discount store which we will refer to as 'Budget Hyper'.

During this activity you will need to refer to the following information gathered in activity 1:

"Relaxer Remedy" products available from Thabisa's local spaza:
Sensations Normalising Shampoo (400m1) = R89,99
Formex Pre-treatment Cream (250ml) = R83,65
Rejuvenating Relaxer Solution (9 applications) = R245,25
Alco Reconstructor (1 litre) = R225,99

3.1 Budget Hyper stocks Sensations Normalising Shampoo in a 2 litre container for R429,95, We established in activity 1 that Thabisa needs to use 20ml of this product to treat long hair and 15ml to treat short hair. Answer the following questions:

3.1.1 At Budget Hyper, is the Sensations Normalising Shampoo cheaper, more expensive or the same price as it is at the spaza?

3.1.2 How many heads of long hair could she wash with this bottle?

3.1.3 How many heads of short hair could she wash with this bottle?

3.2 Budget Hyper stocks Formex Pre-treatment Cream in a 1 litre container for R339,95. We established in activity 1 that Thabisa needs to use 15 ml of this product to treat long hair and 10 ml to treat short hair. Answer the following questions: month. Is it more economical to pay this fee on a weekly or a monthly basis?

3.2.1 At Budget Hyper, is the Formex Pre-treatment Cream cheaper, more expensive or the same price as it is at the spaza?

3.2.2 How many heads of long hair could she do with this bottle?

3.2.3 How many heads of short hair could she do with this bottle?

3.3 Budget Hyper stocks the Alco Reconstructor in a 750 ml bottle for R169,49. We established in activity that Thabisa needs to use 20 ml of this product to treat long f hair and 15 ml to treat short hair. Answer the following questions:

3.3.1 At Budget Hyper, is the Alco Reconstructor cheaper, more expensive or the same price as it is at the spaza?

3.3.2 How many heads of long hair could she do with this bottle?

3.3.3 How many heads of short hair could she do with this bottle?

3.4 Budget Hyper do not stock the Rejuvenating Relaxer Solution, but they stock a similar relaxer solution which contains 10 applications for only R199,95. If Thabisa chooses to buy this relaxer, and therefore can purchase all her stock at Budget ' Hyper':

3.4.1 Calculate a *"Relaxer Remedy"* cost-price per head of long hair.

3.4.2 Calculate a *"Relaxer Remedy"* cost-price per head of short hair.

3.5 In activity 1 you calculated that a *"Relaxer Remedy"* cost-price per head of long hair was R68,75 and for short hair was R37,48. By buying all of the products from Budget Hyper, how much does Thabisa save per head long hair? And per head of short hair?

3.6 What are the advantages and disadvantages of buying the stock in bulk from Budget Hyper?

3.7 Thabisa's hair salon is now quite busy and she would like to buy enough stock for 40 heads of short hair and 40 heads of long hair, which should last at least 2 months.

3.7.1 Calculate how many of each of the products Thabisa should buy if she would like to stock up for 40 heads of short hair and 40 heads of long hair.

3.7.2 Calculate the total cost of stocking up with 40 heads of short hair and 40 heads of long hair's worth of products.

3.7.3 If Thabisa spends more than R1 000 at Budget Hyper then she will be given a 10% discount and if she spends more than R3 000 she will be given a 15% discount. Calculate the amount of discount that Thabisa will be given in this case.

Activity 4 — Buying a washine machine & tumble dryer

ABOUT THIS ACTIVITY

The context of buying washing machine and tumble dryer, for the purposes of speeding up I the process of washing and drying the towels that Thabisa uses for her clients, is
used to introduce different purchase options. In this activity, we look at two options that Thabisa is considering in order to buy the washing machine and tumble dryer: using a stokvel saving scheme, and paying the store a hire-purchase price for the washing machine and tumble dryer. In the next activity we will consider two other options: a loan calculated using simple interest (borrowing money from a friend) and a loan calculated using compound interest.

This activity is aligned with unit standard 9012 and addresses specific outcomes 1 and 2.

MANAGING THIS ACTIVITY

Interest calculations will be made in this activity and therefore a calculator would be useful to speed up the answering process.

4.1 If Thabisa starts a stokvel saving plan with 7 of her friends there will be 8 stokvel members in total. Therefore, Thabisa will receive the lump sum payout in one of the next 8 months. The longest period of time that she may have to wait for her payout is 8 months.

4.2 The lump sum payout is equal to the pay-in amount multiplied by the number of stokvel members. Therefore if Thabisa requires a lump sum payout of R3 599,48 then we could determine what each individual monthly pay-in must be by dividing this number by 8: R3 599,48 ÷ 8 = R499,94. If Thabisa sets the individual monthly pay-in at R450,00 then her lump sum payout will be enough to purchase the washing machine and tumble dryer provided that the price has not increased by the time she receives the payout.

4.3 The advantage of Thabisa using a stokvel saving plan to help her finance the washing machine and tumble dryer is that she will not be required to take a loan of some kind and therefore will not have to pay any interest. However, Thabisa may only receive her lump sum payout several months from now and by then the price of the washing machine and tumble dryer could have increased. (This could, though, be factored into the original individual monthly pay-in amount). Furthermore, in this case she would also have to live without the equipment for another 8 months.

4.4 If 4 other members join, this means that each member will receive only one payout each year and therefore Thabisa may have to wait up to 12 months before she receives her payout. However, the advantage of having more members of the stokvel is that, if the individual monthly pay-in amount remains fixed, the payout would now be a total of R5 400 (12 × 450) instead of R3 600, since there are more people contributing to the savings. Alternatively, if the payout amount remains the same then the individual monthly pay-in could be reduced from R450 to R300 (3600 ÷ 12).

4.5 The non-cash price (cash price + 20%) is R4 319,38, calculated as follows:
3 599,48 + 3 599,48 x 20% = 4 319,38.

4.6 The deposit (10% of non-cash price) is R431,94, calculated as follows:
4319,38 × 10% = 431,94.

4.7 She still owes non-cash price — deposit:
4 319,38 – 431,94 = R3 887,44.

4.8 Amount owing + R100 + R4 R3 887,44 + R100 + R4 = R3 991,44.

4.9 The calculations are as follows:

Amount owing	R3 991,44
Repayment period	6 months
Interest	6,5%
Interest amount	**R259,44**
Total due:	**R4 250,88**

R3 991,44 × 6,5% = R259,44

R3 991,44 + R259,44 = R4 250,88

Amount owing	R3 991,44	R3 991,44	R3 991,44
Repayment period	12 months	18 months	24 months
Interest	12,5%	17,8%	24%
Interest amount	R498,93	R710,47	R957,95
Total due:	**R4 490,37**	**R4 701,91**	**R4 949,39**

No, this is not the full amount that Thabisa will pay. She also has to pay the deposit therefore the full amount will be these totals + the deposit.

4.10 Monthly payment = $\frac{\text{total due}}{\text{no. of payments}}$

Repayment period	6 months	12 months	18 months	24 months
Total due	R4 250,88	R4 490,37	R4 701,91	R4 949,39
Due per month	**R708,47**	**R374,20**	**R261,22**	**R206,22**

4.11

Repayment period	6 months	12 months	18 months	24 months
Total due	R4 250,88	R4 490,37	R4 701,91	R4 949,39
+ Deposit	R431,94	R431,94	R431,94	R431,94
Total cost	**R4 682,82**	**R4 922,31**	**R5 133,85**	**R5 381,33**

– original cash price	**R3 599,48**

Extra Paid	**R1 083,34**	**R1 322,83**	**R1 534,37**	**R1 781,85**

Therefore you she has to pay this much more for each of the payment plans.

4.12 The advantage for Thabisa if she pays a hire-purchase price or the washing machine and tumble dryer is that, provided she can raise the deposit fee, she will be able to purchase it straight away and she will not have to approach the bank for a loan. The disadvantage of using the hire-purchase option is that Thabisa may not have R431,94 saved to put down as a deposit and even if she does, by taking a hire-purchase option she will end up having to pay quite a lot more than the original cash price because she will be charged interest and other levies.

Activity 4 — Buying a washine machine & tumble dryer

Sometimes we are unable to pay for the things we want to buy because we simply do not have the full amount in cash.

When purchasing a property, for example, very few people have sufficient money to be able to pay the full amount in cash. Most often, a prospective buyer has to borrow money from the bank in order to pay the purchase price of the property. An agreement will need to be reached between the purchaser and the bank as to how much money is going to be borrowed, how long the borrower has to pay it back, what the interest rate is going to be and what the monthly payments will be. The agreed repayment period for purchasing a house is usually between 20 and 30 years.

When purchasing items from a furniture or home appliance store, for example, the repayment period is likely to be shorter, often no more than 24 months.

Consider the following scenario:

Thabisa is now treating a lot of clients' hair. Her clients come to her home salon and word is getting around that Thabisa's salon is the new place to go if you're interested in having your hair relaxed. Thabisa goes through a lot of clean towels each day and, until now, she has had to handwash all the towels and hang them on her line outside to dry them (hoping that it doesn't rain).

Thabisa has done some research and she has decided that she needs to buy a washing machine and tumble dryer to speed up the process of having clean towels ready each day for her clients. One particular appliance store (let us call the store Appliance Africa) is offering Thabisa the special price of R3 599,48 for the washing machine and the tumble dryer together.

Thabisa has not had enough time to save enough money.to pay cash for the washing machine and tumble dryer. Let us explore three options available to her. Thabisa could: (1) use a stokvel saving method; (2) pay the appliance store over a period of time: or (3) take a loan with the bank — this is covered in the next activity.

The stokvel savinq option:
A stokvel or umgalelo is an informal saving scheme where groups of people pool their savings together. Each of the members of the stokvel must contribute a fixed amount of money each month. The total amount that is collected is given to one member who can then use the money. Each member of the stokvel gets a month when he/she receives the lump sum. In a stokvel of 12 members all contributing R500 every month, once a year each person in the group gets a lump sum of (in this case) R6 000. The key points of a stokvel are believed to be discipline and trust.

4.1 If Thabisa starts a stokvel with 7 of her friends, how long might she have to wait before she receives a lump sum payout?

4.2 If Thabisa would like to be able to buy the washing machine and tumble dryer with her lump sum payout, she will need to make sure that everyone in the stokvel is contributing enough money. How much money must each person contribute in order that the lump sum payout is at least R3 599,48?

4.3 What do you think are some of the advantages and disadvantages of Thabisa choosing to use a stokvel saving plan with the aim of buying the washing machine and tumble dryer?

4.4 If Thabisa can find 4 more members who'd like to join the stokvel, making the stokvel membership 12, what would the advantages and disadvantages be for Thabisa in her quest to acquire the washing machine and tumble dryer?

Buying over 24 months from the appliance store:
Thabisa decides to also investigate buying her washing machine and tumble dryer on hire-purchase. To determine what the monthly repayments will be for her purchase you need to do the following:

4.5 **Step 1:** Determine the non-cash price of the item(s). Because she will not be paying cash, Appliance Africa adds 20% to the cash price. Calculate the non-cash price of the washing machine and tumble dryer.

4.6 **Step 2:** Determine the deposit she must pay. Appliance Africa expects her to pay a deposit of 10% of the non-cash price. How much deposit must she pay?

4.7 **Step 3:** Calculate the outstanding amount. How much do she still owe for the items once she has paid the deposit?

4.8 **Step 4: Add standard costs.** Before calculating the monthly repayment, Appliance Africa adds some standard costs to the amount still owing. They add R100 insurance cost and R4 for stamp duty (on the contract Thabisa is about to enter into) to the amount still owed. What is the total now owed?

4.9 **Step 5: Calculate the interest.** Appliance Africa now adds a percentage to the amount owing. They call this interest. The percentage is dependent on the number of months over which a customer plans to pay for the items. The table below lists the different percentages (these will change from time to time):

Repayment period	6 months	12 months	18 months	24 months
Interest	6,5%	12,5%	17,8%	24%

Calculate the interest amount owed for each of the different repayment periods and add this to the amount owed. Is this is the full amount Thabisa will pay?

4.10 **Step 6: Calculate the monthly repayments.** Calculate how much will have to be paid to Appliance Africa each month by dividing the full amount owing by the number of months over which the amount will be paid.

4.11 For each of the different repayment periods calculate how much Thabisa will actually pay for the washing machine and tumble dryer. How much more is this than the cash price?

4.12 What are the advantage(s) and disadvantage(s) of Thabisa paying for the washing machine and tumble dryer on hire-purchase?

Activity 5 — Buying a washing machine & tumble dryer continued …

ABOUT THIS ACTIVITY

In this activity, the context of buying a washing machin9nd tumble dryer for the purposes of 'I speeding up the washing and drying of the towels that Thabisa uses for her clients is used to introduce different purchase options. In the last activity we looked at the possibility of saving by means of a stokvel or paying for the washing machine and tumble dryer on hire-purchase. In this activity we will look at loans: one of which is a simple interest calculation and one of which is a compound interest calculation.

This activity is aligned with unit standard 9012 and addresses specific outcomes I and 2.

MANAGING THIS ACTIVITY

Interest calculations will be made in this activity and therefore a calculator would be useful to speed up the answering process.

5.1 After 1 year Thabisa would have to pay her uncle a total of R4 499,35, calculated as follows:
3 599,48 + 3 599,48× 25% = 4 499,35.

5.2 After 2 years Thabisa would have to pay her uncle a total of R5 399,22, calculated as follows:
3 599,48 + 3 599,48× 25% × 2 = 4 499,35.

5.3 After 3 years Thabisa would have to pay her uncle a total of R6 299,09, calculated as follows:
3 599,48 + 3 599,48× 25% × 3 = 6 299,09.

5.4 Total interest after 3 years = 6 299,09 – 3 599,48 = R2 699,61.

5.5 After 1 year Thabisa would have had to pay the bank a total of R4 391,37, calculated as follows:
$3\,599{,}48(1 + 22\%)^1 = 4\,391{,}37$.

5.6 This is less than the amount she would have to pay her uncle. We would expect it to be less because the interest rate is lower.

5.7 After 2 years Thabisa would have had to pay the bank a total of R5 357,47, calculated as follows:
$3\,599{,}48(1 + 22\%)^2 = 5\,357{,}47$.

5.8 This is only R41,75 less than the 2 year loan agreement with her uncle because the interest on the bank loan is compounded, therefore even thought the interest rate is lower, because Thabisa is charged "interest on interest" (since this is a compound interest calculation) it is still only slightly less than the interest that Thabisa's uncle is charging.

5.9 After 3 years Thabisa would have had to pay the bank a total of R6 536,11, calculated as follows:
$3\,599{,}48(1 + 22\%)^3 = 6\,536{,}11$.

5.10 This is R237,02 more expensive than the 3 year loan agreement with her uncle because the interest on the bank loan is compounded, therefore Thabisa is charged "interest on interest". After 3 years of the interest being compounded Thabisa is now paying more interest, even though the interest rate is 3% lower that her uncle's interest rate.

5.11 The cash price was R3 599,48. Minimum monthly repayment = $\frac{3\,599{,}48}{40}$ = R89,99.

5.12 This table is drawn up as an example based on a cash price of R3 599,48, a monthly repayment of R708,47 and an interest rate of 21% per annum (this amount will change from time to time).

Previously outstanding total + interest:
3 599,48 + 62,99 = 3 662,47

	Interest on outstanding balance	Outstanding total	Payment	Remaining balance
Start of loan period	0,00	3 599,48	0,00	3 599,48
End of 1st month	62,99	3 662,47	708,47	2 954,00
End of 2nd month	51,70	3 005,70	708,47	2 297,23
End of 3rd month	40,20	2 337,43	708,47	1 628,96
End of 4th month	28,51	1 657,47	708,47	949,00
End of 5th month	16,61	965,61	708,47	257,14
End of 6th month	4,50	261,64	261,64	0,00
		Total paid to the bank	R 3 803,99	

Since the interest rate is quoted per annum but the interest is calculated monthly, the monthly interest rate is $\frac{21\%}{12} = 1{,}75\%$ and: $3599{,}48 \times 1{,}75\% = 62{,}99$ or $3599{,}48 \times \frac{1{,}75}{100} = 62{,}99$

5.13 12 months. See details below.

	Interest on outstanding balance	Outstanding total	Payment	Remaining balance
Start of loan period	0,00	3 599,48	0	3 599,48
End of 1st month	65,99	3 665,47	350	3 315,47
End of 2nd month	69,07	3 384,54	350	3 034,54
End of 3rd month	63,22	3 097,76	350	2 747,76
End of 4th month	57,25	2 805,01	350	2 455,01
End of 5th month	51,15	2 506,15	350	2 156,15
End of 6th month	44,92	2 201,07	350	1 851,07
End of 7th month	38,56	1 889,64	350	1 539,64
End of 8th month	32,08	1 571,71	350	1 221,71
End of 9th month	25,45	1 247,17	350	897,17
End of 10th month	18,69	915,86	350	565,86
End of 11th month	11,79	577,65	350	227,65
End of 12th month	4,74	232,39	232,39	0,00
		Total paid to the bank	**R4 082,39**	

5.14 The hire-purchase option, in this instance, is R408 more expensive.

	Payments over **12 months**
Hire-purchase total	R4 490,39
Blue Bank loan	R4 082,39

5.15

BLUE BANK LOAN	
Advantages	Disadvantages
• No deposit required. • Avoid the non-cash price increase. • You can reduce the impact of interest by increasing your monthly payment. • You only have to pay a minimum payment per month.	• You have to be 21 years or older, have a clean bank record and be earning a minimum of R 3 000,00 – even though Thabisa is now relaxing a lot of hair, she may not be able to prove that she is earning as much as R3 000 a month. • If you only pay the minimum payment per month it could take a lot longer to pay off than on a 24 month hire-purchase plan.

Activity 5 — Buying a washing machine & tumble dryer continued …

Consider the following scenario used in the previous activity:
Thabisa is now relaxing hair on a large scale. You can imagine that a hairdresser, like I Thabisa, needs to use a lot of clean towels in her salon. However, she no longer has enough time to handwash all the towels that she uses for her clients. She also does not
have an undercover washing line and so it is difficult for her to dry all the towels that she washes by hand. So she has decided to look into purchasing a washing machine and a tumble dryer.

She has done some research and has found an appliance store that will sell her the washing machine and the tumble dryer for the special price of R3 599,48.

Thabisa has not had enough time to save enough money to pay cash for the washing machine and tumble dryer, so she must look into different kinds of loan agreements that she could pursue.

We have already explored options involving stokvel saving and hire-purchase. Let us now look at two forms of loans that Thabisa could investigate: (1) take a loan from a friend (calculated with simple interest), or (2) take a loan from a bank (which will be calculated with compound interest).

Simple interest scenario:
Thabisa has an uncle who is in a fortunate financial position. Her uncle, Thobani, has agreed to lend her R3 599,48 with which to buy the washing machine and tumble dryer, but he has told her that she must pay him back this amount as well as 25% interest for every year until she has paid him back.

When we borrow money we generally have to pay back more than we borrowed — i.e. we pay interest on the loan amount. In this kind of loan agreement the interest amount is called SIMPLE INTEREST and it is calculated as follows:

SIMPLE INTEREST = amount borrowed × interest rate × number of years taken to pay back

5.1 Calculate the total amount that Thabisa must pay her Uncle Thobani, if she borrows the money for 1 year.

5.2 Calculate the total amount that Thabisa must pay her Uncle Thobani, if she borrows the money for 1 year.

5.3 Calculate the total amount that Thabisa must pay her Uncle Thobani, if she borrows the money for 2 years.

5.4 How much is the total interest that Thabisa had to pay for the 3 year loan?

Compound interest scenario:
Instead of borrowing the money from her Uncle Thobani, Thabisa might choose to take a loan with the bank. Provided she meets certain conditions, such as being 21 years or older, having a clean bank record and earning a minimum of R 3 000,00 per month, the bank will happily give her a loan.

When we borrow money from a bank, the bank charges an interest rate per annum. Each year, the interest is added to the original loan amount. In this kind of loan agreement the interest amount is called COMPOUND INTEREST.

Here is an example to show how the interest is calculated in this instance:

If you borrow R500 at an interest rate of 15% p.a. (per annum) for 3 years:

After 1st year: interest = 15% × 500 = R75,00 therefore total = R575,00.

After 2nd year: interest = 15% × 575 = R86,25 therefore total = R661,25.

After 3rd year: interest = 15% × 661,25 = R99,19 therefore total = R760,44.

We can write the calculation like this: $500(1+15\%)(1+15\%)(1+15\%) = 500(1+15\%)^3$

— try this on your calculator and make sure you still get the total R760,44!

COMPOUND INTEREST = amount borrowed × $(1+\text{interest rate})^n$ where n is the number of years taken to pay back the loan.

5.5 If Thabisa was offered a loan amount of R3 599,48 from a bank at 22% p.a., what is the total amount that she would have had to pay back after 1 year?

5.6 Is this the same, more or less than she would have had to pay her uncle back after 1 year? Explain why.

5.7 If Thabisa was offered a loan amount of R3 599,48 from a bank at 22% p.a., what is the total amount that she would have had to pay back after 2 years?

5.8 Is this the same, more or less than she would have had to pay her uncle back after 2 years? Explain why.

5.9 If Thabisa was offered a loan amount of R3 599,48 from a bank at 22% p.a., what is the total amount that she would have had to pay back after 3 years?

5.10 How much is the total interest that Thabisa would have to pay after 3 years? How much more is this compared to the amount of interest she had to pay her uncle after 3 years?

Although this is a correct compound increase calculation, the repayment of a bank loan is usually calculated quite differently. The questions that follow are based on actual information supplied by a bank in Cape Town—let us call the bank Blue Bank.

Blue Bank sets a minimum amount of R 3 500,00 for a loan. You will not need to pay any deposit. Since the price of the washing machine and tumble dryer is R3 599,48 this is above the minimum loan amount.

5.11 **Step 1: Determine the minimum monthly repayment.** Blue Bank allows you to determine your own monthly repayment on the loan with the understanding that the monthly repayment exceeds a certain minimum. Calculate the minimum by dividing the amount of the loan by 40[1].

5.12 **Step 2: Choose a monthly repayment amount and calculate how long it will take to repay the loan.** First choose the monthly repayment that you would have had to pay Home Appliance Africa if you had paid for the washing machine and tumble dryer over 6 months (see question 4.11 in the previous activity). Draw a table such as the one below and complete it for your amounts—the example is based on a cash price of R3 750,00, a monthly repayment of R 698,00 (R697,40 rounded up to the nearest rand) and an interest rate of 21% per annum (this amount will change from time to time).

[1] Presumably this number—40—will vary depending on the interest rate.

	Interest on outstanding balance	Outstanding total	Payment	Remaining balance
Start of the loan period	0,00	3 750,00	0,00	3 750,00
End of first month	65,63	3 815,63	697,40	3 118,23
End of second month	54.57	3 172,79	697,40	2 475,39
End of third month	43.32	2 518,71	697,40	1 821.31
End of fourth month	31,87	1 853,19	697,40	1 155,79
End of fifth month	20,23	1 176,01	697,40	478,61
End of sixth month	8,38	486,99	486,99	0.00
		Total paid to the bank	3 973,99	

Since the interest rate is quoted per annum but the interest is calculated monthly, the monthly interest rate is

$$\frac{21\%}{12} = 1{,}75\% \quad \text{and:} \quad 3\,750 \times \frac{1{,}75}{100} = 65{,}63$$

5.13 Create a table such as the one above for the cash price of the washing machine and tumble dryer. How long will it take to repay the loan if you aim to pay R350,00 per month and the bank charges interest at 22% p.a.

5.14 If Thabisa had bought the washing machine and tumble dryer on hire-purchase over 12 months, she would have paid a deposit of R431,94 and 12 monthly installments of R374,20 each (R4 490,39 in total). Compare this to the total amount Thabisa would have to pay as calculated in 5.13.

5.15 List the advantages and disadvantages of financing the purchase of the washing machine and tumble dryer using a Blue Bank loan.

Activity 6 — Sorting out monthly expenses

ABOUT THIS ACTIVITY
This activity focuses on types of expenses that one incurs during a month and helps to categorise these expenses into essential and nonessential expenses. The aim is to help learners develop a way of budgeting their finances.

This activity is aligned with unit standard 7456 and addresses specific outcomes 1 and 2.

MANAGING THIS ACTIVITY
For this activity, learners will need a worksheet and a handout.

6.1 See the table below:

Fixed Expenses	Variable expenses
Rent	Water
Insurance	Cellphone
Gym	Telephone
Security company	Petrol
Car repayments	Chemist
School fees	Clothes
Mnet	Car repairs
	Electricity
	Food
	Bus fare

6.2 Irregular expenses:

6.2.1 Newspaper subscription per month: R831,97 ÷ 12 = R69,33

6.2.2 Car service per month: R1 300 ÷ 12 = R108,33

6.2.3 TV licence per month: R225 ÷ 12 = R18,75

6.2.4 Car licence per month: R366 ÷ 12 = R30,50

6.2.5 House maintenance per month: R2 600 ÷ 12 = R216,67

6.2.6 Doctors' bills per month: R1 000 ÷ 12 = R83,33

6.3.1

Fixed expenses	Variable Expenses	Irregular expenses
Rent Telephone rental Stokvel School fees	Electricity Water Medicine Landline calls Clothes Washing powder Bus farre Toiletries Food "Relaxer Remedy" supplies Gifts Taxi fare	TV licence Stove repair Christmas holiday Christmas presents

6.3.2 Answer on next page.

Thabisa's Expenses		
Fixed expenses		**Average per month**
Rent		R450,00
Loan repayment		R350,00
Telephone rental		R19,21
Stokvel		R150,00
School fees		R100,00
	Subtotal	**R1 069,21**
Variable expenses		**Average per month**
Electricity		R33,83
Water		R34,38
Medicine		R27,52
Landline calls		R51,09
Cellphone calls		R122,77
Clothes		R251,52
Washing powder		R41,99
Bus fare		R48,08
Toiletries		R26,32
Food		R523,63
"Relaxer Remedy" supplies		R1 014,87
Lamp		R59,99
Gifts		R32,50
Taxi fare		R40,22
	Subtotal	**R2 308,72**
Savings for irregular expenses:	**Annual**	**Average per month**
TV licence	R225,00	R18,75
Stove repair	R279,99	R23,33
Christmas holiday	R1 000,00	R83,33
Christmas presents	R302,86	R25,24
	Subtotal	**R150,65**
	TOTAL EXPENSES & SAVING	**R3 528,57**

6.3.3 Thabisa is now earning approximately R3 200 per month. Therefore the difference between her income and her expenses = R3 200 – R3 528,57 = R328,57.

6.4

Essential fixed expenses	Savings and investments	Essential variable expenses	Non-essential expenses
Rent Telephone rental School fees TV licence Loan repayment	Stokvel	Electricity Water Medicine Stove repair Clothes Washing powder Bus fare Toiletries Food "Relaxer Remedy" supplies Taxi fare	Landline calls Cellphone calls Christmas holiday Christmas presents Gifts Lamp

6.5 Her monthly non-essential expenses = R357,92. This is about 12% of her monthly income, calculated as follows: R357,92 ÷ R3 200 × 100 = 11,7%.

6.6 Thabisa would probably not want to forfeit her trip home to the Transkei at the end of the year, but she could cut down on her phone calls – especially her cellphone calls.

6.7.1 10% × R3 200 = R320.

6.7.2 She was saving R150 into a stokvel every month which is only about 5 % of her income (R150 ÷ R3 200 × 100 = 5,26%).

6.8 There are many expenses that Thabisa doesn't have. Some examples are: Thabisa doesn't have a bond, or a car (so she doesn't have to pay car maintenance or petrol expenses), or a security alarm for her home, or insurance. She also doesn't seem to spend money on entertainment (eg. Movies, restaurants etc.).

Activity 6 — Sorting out monthly expenses

In this activity we will look at how to plan your finances (by making a budget) in order to avoid overspending or getting into debt. We will continue to use Thabisa as an example. There are two main types of expenses every month that must be considered. The first type are called fixed expenses (as they remain the same from month to month) and the second type are called variable expenses.

6.1 Draw up a table with two columns, one with the heading 'fixed expenses' and the other with the heading 'vairable expenses'. Classify the following expenses as fixed or variable expenses:

Rent	Car repayments
Water	Car repairs
Food	Electricity
Security company	Bus fare
Clothes	School fees
Chemist	Mnet
Gym	Cellphone
Telephone	Insurance
Petrol	

6.2 There are also expenses which we call irregular expenses as they are paid out only once a year. For each of the following irregular expenses work out how much it would cost per month if you were to pay a portion of each expense monthly:

6.2.1 Newspaper subscription: R831,97

6.2.2 Car service: R1 300

6.2.3 TV licence: R225

6.2.4 Car licence: R366

6.2.5 House maintenance: R2 600

6.2.6 Doctors' bills: R1 000

6.3 Thabisa wants to budget to make sure that she doesn't overspend. She shares some of the household expenses with her housemates. She has kept a record of her monthly expenses for three months (see handout). Use the information in the handout to do the following tasks:

6.3.1 Classify each expense as one of the following: fixed expense, variable expenses or irregular expense.

6.3.2 Redraw the table below. Work out on average what Thabisa spends per month on each of the following expenses and write these averages in the appropriate space. You might need to leave more lines per category. Calculate Thabisa's average total monthly expenses.,

Thabisa's Expenses		
Fixed expenses		**Average per month**
Subtotal		
Variable expenses		**Average per month**
	Subtotal	
Savings for irregular expenses:	**Annual**	**Average per month**
	Subtotal	
	TOTAL EXPENSES & SAVING	

6.3.3 Thabisa is now earning a net income of approximately R3 200 per month. Find the difference between her income and her expenses.

6.4 From question 6.3.3 we can see that Thabisa is spending more than she is earning. She would like to get this under control. Help Thabisa to get an idea of what she is spending her money on by classifying each of her expenses into the four categories shown on the table below:

Essential fixed expenses	Savings and investments	Essential variable expenses	Non-essential expenses

6.5 Total her monthly non-essential expenses. What percentage of Thabisa's income is she spending on non-essential expenses?

6.6 Go through the list of expenses and suggest ways in which Thabisa could save more each month. Be realistic about your suggestions and give reasons why you think each would work. Work out approximately how much she would save if she followed your suggestions.

6.7 Economist say that you should be saving between 10% and 15% of your net income (your income after all your deductions).

6.7.1 Calculate 10% of Thabisa's income.

6.7.2 What percentage of her income is she saving before you change her spending habits?

6.7.3 The above exercise is a way in which you can get a picture of what your expenses are each month, as well as predicting how much you will need to earn in order to maintain that lifestyle. Can you think of other expenses that Thabisa doesn't have at present but which could occur?

NOTES made by Thabisa…

October

- *rent = R450*
- *electricity R32*
- *water = R11*
- *taxi fare = R42*
- *loan repayment = R350*
- *TV licence = R225 for the year*
- *telephone rental = R19,21*
- *landline calls = R48,23*
- *cell calls = R123,45*
- *medicine = R28,50*
- *stokvel= R150*
- *food =R521,95*
- *clothes = R215*
- *washing powder = R35,99*
- *bus fare R49,21*
- *toiletries = R23,46*
- *"Relaxer remedy" supplies = R829,45*
- *Catherine's birthday = R30*
- *School fees = R100*

November

- *Rent = R450*
- *electricity = R35*
- *water = R10,98*
- *taxi fare = R43,50*
- *loan repayment = R350*
- *TV licence = R225 for the year*
- *telephone rental = R19,21*
- *landline calls = R51,82*
- *cell calls = R104,20*
- *lamp = R59,99*
- *medicine = R15,85*
- *stove repair = R279,99*
- *stokvel = R150*
- *food = R508,75*
- *Granny's birthday = R35*
- *clothes = R179*
- *washing powder = R53,98*
- *bus fare = R52,86*
- *toiletries = R29,80*
- *"Relaxer remedy" supplies = R1 069,20*
- *school fees = R100*

December

- *Rent = R450*
- *electricity = R34,50*
- *water = R12,40*
- *taxi fare = R35,15*
- *loan repayment = R350*
- *TV licence = R225 for the year*
- *telephone rental = R19,21*
- *landline calls = R53,21*
- *cell calls = R140,65*
- *medicine = R38,20*
- *stokvel = R150*
- *food = R540,19*
- *clothes = R360,55*
- *washing powder = R35,99*
- *bus fare = R42,17*
- *toiletries = R45,69*
- *"Relaxer remedy" supplies = R1 145,95*
- *School fees = R100*
- *Christmas visit home to Transkei = R1 000*
- *Christmas presents = R302,86*

Activity 7 — Helping Thabisa make a budget statement

ABOUT THIS ACTIVITY

This activity focuses on income and expenditure on a more personal level. Through knowledge of Thabisa's income and expenses, learner's are asked to fill in certain details onto a budget and to estimate budget figures for the next month.

This activity is aligned with unit standard 7456 and addresses specific outcome 1, 2 and 3.

MANAGING THIS ACTIVITY

For this activity, learners will need the worksheet and a handout (which consists of 3 pages). Calculators will be helpful for this activity.

7.1.1 The word "REVENUE" is used to refer to income. "National transfer" and "Own revenue" are the two components that make up the total income/revenue.

7.1.2 The word "EXPENDITURE" refers to expenses. The three largest forms of expenditure listed on the statement are "Education", "Health" and "Social services and poverty alleviation".

7.2.1 If an organisation plans to spend money on certain things then these things are listed in the column labelled "budget" or "estimate". The "budget" or "estimate" column contains descriptions of costs that have not yet been incurred. The figures in this column are, therefore, merely the expected or estimated figures and are determined before payment is actually made. Once an expense is incurred (something is paid for) this expense would then be placed in a column marked "actual" and the figure represented next to this item would now be the "actual" (real/correct) amount incurred for this expense. In summary, a budget is prepared before the start of the year in order to guide behaviour during the year while the income/expenditure statement is a reflection of actual spending and can only be prepared at the end of the financial year.

7.2.2 Simply saying 2002 implies from January 2002 – December 2002. However, the provincial and national financial year does not run from January – December but runs for a revolving period of 12 months. Another example of a revolving 12 month period is the tax year, which runs from the beginning of March in one year till the end of February of the following year.

7.3 Learners are expected to identify the figures in the national and provincial budgets and to recognise that these figures are given in million rands.

7.3.1 National budget: R326 956 000 000,00

7.3.2 Western Cape budget: R17 372 000 000,00

7.3.3 National budget: R248 362 000 000,00

7.3.4 Western Cape budget: R14 796 000 000,00

7.4 No. The actual amount in the bank would be reflected in a statement of assets and liabilities, which is often another element of a financial report. The income and expenditure statements are plans of reports but are not in themselves an indicator of cash-in-the-bank.

7.5 No. For example, "housing" tells us the total amount spent on housing but it does not tell us how many houses were built or what each house cost. Similarly, "administration" does not tell us how much money is spent on each kind of administrative expense (i.e. paper and printing, telephone costs etc…).

7.6 One of the expenditure items listed on the national budget is "provincial equitable share" – part of this would be paid to the Western Cape and this is shown as a revenue item listed as "national transfer" on the provincial budget. See diagram below:

SOUTH AFRICAN BUDGET: R million	
Revenue	
Tax Revenue	252 393
Expenditure	
Provincial Equitable Share	107 460

WESTERN CAPE BUDGET: R million	
Revenue	
National Transfer	12 085
Expenditure	
Education	4 273

7.7 One method of showing a deficit/loss is to put brackets around a number, for example the figure (24 233) would mean –R24 233,00. However, the method used in these budgets for showing a deficit/loss is to use a negative sign before the number. For example the Western Cape statement shows a profit at the end of the 2001/2002 column as 535, meaning +R535 000 000,00 and a deficit at the end of the 2002/2003 column as –648, meaning –R648 000 000,00.

7.8 Total Revenue – Total Expenditure = Profit/Loss. If revenue exceeds expenditure then the outcome would be a surplus, but if the expenditure exceeds revenue then the outcome would be a deficit (shown with a negative sign).Income/revenue: Spur wages and money from hair relaxing. Expenses/expenditure: rent, electricity, travelling costs, water, food and household expenses, medical costs, telephone, stokvel, clothes, loan for washing machine and tumble dryer, "Relaxer Remedy" expenses and school fees.

7.9 The net total of (131) means that Thabisa has made a deficit/loss of R131. In other words, she has overspent by R131.

7.10 Thabisa would have had to spend quite a lot of money setting herself up to do "Relaxer Remedy" treatments. Some of this money may have been spend on buying a chair, a mirror, some towels etc. These kinds of set-up costs could be very costly and therefore it is likely that she would not recover this money from profits of relaxing hair straight away.

7.11 15 days at R120 a day would work out to R1 800 for the Spur income and R74,37×5 + R108,75 × 7 = R1 133,10 for hair relaxing income. See figures given in the budget after the solution to question 7.15.

7.12 Rent, school fees, stokvel and loan repayment are all fixed expenses.

7.13 See figures given in the budget after the solution to question 7.15.

7.14 Thabisa managed to end the month without overspending. In fact she had a surplus of R23 because her income was more than her expenses. See budget below 7.15.

7.15 See budget below. This is a suggested solution only – there are many possibilities. Some of the expenses have been curtailed so that Thabisa does not overspend. In particular she must try to keep her phone bills lower than she has previously, and she must not buy clothing this particular month.

THABISA'S BUDGET

	Actual Jan 05	Actual Feb 05
INCOME		
Spur wages	2 400	1 800
Money from hair relaxing	130	1 133
TOTAL INCOME	2 530	2 933
EXPENSES		
Rent	450	450
Electricity	35	38
Water	34	36
Food & household expenses	523	504
Medicine	35	41
Telephone	73	75
Cellphone	122	142
Clothes	251	269
Loan for washing machine & tumble dryer	0	0
Transport	88	90
Stokvel	150	150
Relaxer Remedy expenses & supplies	800	1 015
School fees	100	100
TOTAL EXPENSES	2 661	2 904
NET SURPLUS (DEFICIT)	(131)	23

Activity 7 — Helping Thabisa make a budget statement

Money is very important to any business—without money you cannot run a business. In this activity we will be looking at financial planning and management. There are two key aspects to managing finances. Firstly, you need to keep a record of actual income and expenditure and secondly, you need to plan ahead. The record is usually summarised on an income/expenditure statement while planning is done by means of a budget, which reflects anticipated (expected) income and expenditure. Income and expenditure statements as well as budgets should be prepared on a monthly and yearly basis for the business, as well as for any specific projects undertaken.

For the first set of questions you must refer to page 1 and 2 of handout 7 which has the following information:

- Western Cape Budget Framework, based on the Budget speech of the Provincial Minister of Finance, Economic Development and Tourism Ebrahim Rasool on 3 March 2004
- South African Budget Framework, based on the Budget speech of the Minister of Finance Trevor Manuel on 18 Feb 2004

7.1 Refer to the Western Cape Budget Framework to determine the following:

7.1.1 What word does the statement use to refer to income? List the different forms of income that appear on the statement.

7.1.2 What word does the statement use to refer to expenses? List 3 of the largest expenses that are incurred.

7.2 Refer to both the national and provincial budget statements to determine the following:

7.2.1 You will notice that each of these documents has different columns for different years. Some are labelled "actual" while others are labelled "budget" or "estimate." Why are these different labels used?

7.2.2 You will notice that the national and Western Cape budgets refer to years as 2002/2003 – why is it necessary to label these columns in this way instead of merely labelling the column "2002"?

7.3 Give the total (in rands) of the following amounts of money referred to in each of the following statements:

7.3.1 National budget: estimated total revenue 2004/2005.

7.3.2 Western Cape budget: estimated total revenue 2004/2005.

7.3.3 National budget: actual total revenue 2001/2002.

7.3.4 Western Cape budget: actual total expenditure 2002/2003.

7.4 Can you tell from the statements how much money is in their bank account at any time?

7.5 Can you tell from the statements how the money allocated to a particular expense is actually spent?

7.6 Examine the income and expenditure columns of the statements. Can you see how the provincial and the national statements are linked together? You should be able to see that an income item on one of the statements links to a specific expenditure item on the other. Explain this link.

7.7 How do the statements indicate a deficit/loss? Give an example from the Western Cape statement of a deficit/loss?

7.8 How is the calculation to determine if there is a deficit or a loss performed?

Refer to page 3 of the handout to answer the following questions:

Please note that the figures listed in Thabisa's budget are rounded off to the nearest rand.
We already know that at the beginning of this year Thabisa had two sources of income – her Spur wages (where she worked 20 days in January) and a little income from the hair relaxing that she was starting to do.

7.9 What does the net total for the month of January tell you about Thabisa's financial situation at the time?

7.10 Thabisa made only R130 from relaxing hair and yet she spent R800 on hair relaxing supplies this month. Can you think of any reason why she would need to spend such a lot even though she is only just starting to relax hair?

7.11 By February 2005 Thabisa was doing more relaxing so she worked only 15 days at the Spur. She was now charging R74,37 for a short hair treatment and R108,75 for a long hair treatment, and she did 5 short hair treatments and 7 long hair treatments in February. Knowing this, fill in the income section of the February column of Thabisa's budget.

7.12 Four of Thabisa's February expenses have been omitted. What do we call these kinds of expenses?

7.13 Knowing this, fill in the missing amounts into the February expenses column and fill in the total for all the expenses. (Thabisa has not yet taken the loan for the washing machine and tumble dryer.)

7.14 Did Thabisa's finances run at a net surplus or a net deficit that month? Explain your answer.

Remember from the previous activity that the "budget" or "estimate" column of a statement such as this contains descriptions of costs that have not yet been incurred. The amounts entered into this column are expected/estimated figures, which are determined before the payment is actually made so that pre-empted/anticipated expenses can be budgeted for.

7.15 Examine the two existing "actual" columns and use the trends that are visible to complete an "estimated' column for March 2005. Bear in mind thatthis month Thabisa plans to work only 10 days of the month for the Spur and hope to do a lot more hair relaxing in the rest of the time. She also plans to buy the washing machine and tumble dryer this month and so from now on she will have to pay a monthly repayment of R450. Thabisa will have to cut down in some areas of her spending to be able to afford this repayment. Try to set the budget figures so that if Thabisa is able to stick to these figures then she will not overspend.

Western Cape Budget Framework
Based on the Budget speech of the Provincial Minister of Finance, Economic Development and Tourism Ebrahim Rasool on 3 March 2004[1]

R million	2001/2002 Actual	2002/2003 Actual	2003/2004 Estimate	2004/2005 Estimate
Revenue				
National transfer	12 085	13 314	14 963	16 342
Own revenue	954	834	1 015	1 030
Total Revenue	**13 039**	**14 148**	**15 978**	**17 372**
Expenditure				
Provincial administration	280	396	307	312
Provincial parliament	20	24	29	31
Provincial treasury	48	69	200	145
Community safety	97	118	140	147
Education	4 273	4 678	5 030	5 356
Health	3 581	3 871	4 291	4 504
Social services and poverty alleviation	2 384	3 216	3 762	4 324
Housing	382	460	519	547
Environmental affairs	93	121	122	129
Transport and public works	1 060	1 379	1 543	1 641
Agriculture	114	139	169	198
Local government	30	65	63	63
Economic development and tourism	52	152	80	61
Cultural affairs and sport	90	108	137	143
Total expenditure	**12 504**	**14 796**	**16 392**	**17 601**
Surplus/Deficit(-)	**535**	**-648**	**-414**	**-229**

[1] Based on details sourced at: http://www.capegateway.gov.za/eng/pubs/budgets/2004/52862 (June 2004)

South African Budget Framework
Based on the Budget speech of the Minister of Finance Trevor Manuel on 18 Feb 2004[2]

R million	2001/2002 Actual	2002/2003 Actual	2003/2004 Estimate	2004/2005 Estimate
Revenue (National Revenue Fund)				
Tax revenue	252 398	282 180	303 318	333 694
Departmental and other receipts	4 169	4 587	6 704	6 590
Less: SACU	-8 205	-8 259	-9 723	-13 328
Total Revenue	**248 362**	**278 508**	**300 299**	**326 956**
Expenditure				
Statutory appropriations				
State debt cost	47 581	46 808	47 326	50 432
Provincial equitable share	107 460	123 457	144 743	159 971
Skills development funds	2 541	3 259	3 700	4 300
Other	335	350	183	197
Appropriated by vote				
Central government administration	11 841	14 914	19 032	23 188
Financial and administrative services	9 552	10 791	13 113	14 961
Social services	19 806	19 859	23 655	28 573
Arts and culture	442	592	926	1 141
Education	8 616	9 314	10 584	11 344
Health	6 223	7 059	7 695	8 787
Labour	1 396	1 283	1 054	1 191
Science and technology	701	801	1 068	1 276
Social development	2 327	639	2 100	4 548
Sports and recreation	101	171	228	286
Justice and protection services	44 051	49 956	53 792	58 269
Economic services and infrastructure	19 427	22 090	25 922	25 283
Standing appropriations	294	30	46	34
Total expenditure	**262 888**	**291 514**	**331 512**	**365 208**
Surplus/Deficit(-)	**-14 526**	**-13 006**	**-31 213**	**-38 252**

NATIONAL TREASURY

10 YEARS OF FREEDOM south africa 1994 - 2004

[2] Based on details sourced at: http://www.finance.gov.za/ (June 2004)

THABISA'S BUDGET

	Actual Jan 05	Actual Feb 05	Budget Mar 05
INCOME			
Spur wages	2 400		
Money from hair relaxing	130		
TOTAL INCOME	**2 530**		
EXPENSES			
Rent	450		
Electricity	35	38	
Water	34	36	
Food & household expenses	523	504	
Medicine	35	41	
Telephone	73	75	
Cellphone	122	142	
Clothes	251	269	
Loan for washing machine & tumble dryer	0		
Transport	88	90	
Stokvel	150		
Relaxer Remedy expenses & supplies	800	1 015	
School fees	100		
TOTAL EXPENSES	**2 661**		
NET SURPLUS (DEFICIT)	**(131)**		

Activity 8 — Choosing a bank account

ABOUT THIS ACTIVITY

This activity focuses on investigating which of the three listed bank accounts will be best suited to Thabisa's needs. Learners will do various calculations in order to investigate the fees for different transactions with each of the listed bank accounts; analyse what kinds of transactions Thabisa will be making and how often she will make these transactions; and finally make a recommendation to Thabisa about which bank account is more suitable for her needs and justify this recommendation.

This activity is aligned with unit standard 7456 and addresses specific outcomes 1 and 3.

MANAGING THIS ACTIVITY

For this activity, learners will need the worksheet and the handout (with the 3 different banks' account rates as published in their rates brochure). Learners will need a basic calculator with which to do certain calculations.

This activity could be extended in several ways. Learners will almost certainly have noticed that the Mzansi transaction fees are all more expensive for small transaction values than the corresponding fees for the Bronze and Silver accounts—yet Mzansi accounts were introduced as low cost accounts for the previously unbanked. This appears to be wrong. To understand this apparent contradiction would require learners consider a full monthly bank statement and to take into account other factors such as basic monthly fees (Silver), minimum balances (Bronze) and the range of services available with each account type (e.g. debit orders, cheque books or not etc.) It could also be interesting to compare the interest paid to clients for each account type.

8.1 The Bronze account requires you to keep at least R50 in your bank account at all times.

8.2 If you take out Silver account, you pay a monthly fee of R31 ,50.

8.3 With an Mzansi account you will not be able to issue a cheque and you will not be able to have a stop order or debit order (for example, if you where linked to a security company like ADT they would automatically take their monthly fee out of your account. This is called a debit order).

8.4 An account balance enquiry at your branch would cost:

8.4.1 R4,00 with an Mzansi account.

8.4.2 R2,65 with a Bronze account.

8.4.3 R2,65 with a Silver account.

8.5 A cash withdrawal of R200 from your bank would cost:

8.5.1 R8,00 with an Mzansi account.

8.5.2 200 × 0,90% = R1,80 therefore you'd have to pay the minimum R16,25 with Bronze account.

8.5.3 R2,90 transaction fee + 200 × 0,90% = R2,90 + R1,80 = R4,70 with a Silver account.

8.6 A cash withdrawal of R200 from your bank's own ATM would cost:

8.6.1 R4,00 with an Mzansi account,

8.6.2 R4,70 with a Bronze account.

8.6.3 R2,90 transaction fee + 200 × 0,90% = R2,90 + R1,80 = R4,70 with a Silver account.

8.7 A cash withdrawal of R200 from another bank's ATM would cost:

8.7.1 R4,00 with an Mzansi account.

8.7.2 R11,40 with a Bronze account.

8.7.3 R9,60 transaction fee + 200 × 0,90% = R11,40 with a Silver account.

8.8 A cash deposit of R200 at your own bank's ATM would cost:

8.8.1 R4,00 with an Mzansi account.

8.8.2 R4,00 + 200 × 0,40% = R4,80 with a Bronze account.

8.8.3 R2,90 transaction fee + 200 ×0,90% = R4,70 with a Silver account.

8.9 A cash deposit of R200 from another bank's ATM would cost:

8.9.1 R4,00 with an Mzansi account.

8.9.2 R7,00 + 200 × 0,53% = R8,06 with a Bronze account.

8.9.3 R2,90 transaction fee + 200 × 0,90% = R4,70 with a Silver account.

8.10.1 With a Bronze account you pay a flat fee for a cash withdrawal, but for a deposit there is a fee of R4,00 as well as 0,40% of the amount deposited.

8.10.2 For the Silver account the charge for a deposit and for a withdrawal is the same: you pay R2,90 + 0,90% of the transaction amount.

8.11 When you use your bank's ATM it is much easier for your bank to monitor the transactions. When you use another bank's ATM then this bank has to have an association with your bank which involves more admin/ paper work and time.

8.12 For a stop/debit order of R299, you would:

8.12.1 not have this facility with an Mzansi account.

8.12.2 pay R4,70 with a Bronze accounts.

8.12.3 pay R2,90 + 299 x 0,53% = R4,48 with a Silver account.

8.13 For a stop/debit order of R2 300, you would:

8.13.1 not have this facility with an Mzansi account.

8.13.2 pay R4,70 with a Bronze account.

8.13.3 R13,50. R2,90 + 2300 x 0,53% R15,09 but the max fee is R13,50 so you would be charged R13,50 with a Silver account.

8.14 For a point of cash sale of R295,86, you would pay:

8.14.1 R2,00 with an Mzansi account.

8.14.2 R2,00 with a Bronze account.

8.14.3 R2,90 + 295,86 x 0,53% = R4,47 with a Silver account.

8.15 For a point of cash sale of R295,86, and a point of sale cash back you would pay:

8.15.1 R2,00 + R2,00 = R4,00 with an Mzansi account.

8.15.2 R2,00 + R2,00 R4,00 with a Bronze account.

8.15.3 R2,90 + 295,86 x 0,53% + R2,90 + 500 × 0,53%= R10,02 with a Silver account.

8.16 Banks like to keep your money to invest and earn interest on etc, so when you want cash back they charge you for it because they won't be able to use this money anymore.

8.16.1 With an Mzansi account Thabisa would not have cheque or stop/debit order facilities. She would pay R1,35 more for a balance enquiry at the bank than she will with the other two accounts, She will be charged a flat rate of R8 a time for cash withdrawals and cash deposits — so if she frequently draws out or deposits small amounts of money this account could work out more expensive.

8.16.2 With a Bronze account Thabisa would have to keep R50 in her account at all times. She would also be charged a minimum fee of R16,25 for cash withdrawals — so she will pay at least double the amount that she would pay with an Mzansi account. The majority of the other transaction costs are also more expensive than the Mzansi account.

8.16.3 With Silver account Thabisa will have to pay a monthly fee of R31,50. If a given transaction involves a large amount of money she will, on the whole, pay more for the transactions with this account than with the Mzansi account. The point of sale transactions are 6,75 times more expensive thaTMzansi or Bronze account.

8.17.1 With an Mzansi account Thabisa does not have to pay a monthly fee and does not have to keep a minimum balance in the account. In addition the transaction fees are set fees per transaction – they do not depend on the amount of money, therefore this would be easier to keep track of. The larger the amounts of money, the higher the transaction costs on the other two accounts. With the Mzansi account, because the fees are set rates per transactiorthis would work out much less. Also, with an Mzansi account Thabisa can use any ATM to do cash withdraws and she will be charged the same amount, whereas on the other accounts she is charged more for using another bank's ATM. She can also deposit a cheque and do a cellphone top-up for free!

8.17.2 Thabisa would not have to pay a monthly fee with a Bronze account. She would be charged less than the Mzansi account for balance enquiries at the bank and at her own bank's ATMs. She would also be able to deposit cheques for free and she would be able to have a stop/debit order facility.

8.17.3 With SiIver account Thabisa can draw/deposit small amounts of money (R50 or R100) for a smaller transaction fee than with the Mzansi bank account. She can also deposit cheques for free and she would charged less than the Mzansi account for balance enquiries at the bank and at her own bank's ATMs. If Thabisa uses her own ATM she can top up her cellphone for free!

8.18 Mzansi account.

Activity 8 — Choosing a bank account

Thabisa is now in full-time hair styling and needs to open a bank account in order to manage her finances in a more structured manner. Thabisa has decided to take out an account with her local bank. This particular bank offers three types of bank accounts: Mzansi account, Bronze account and Silver account, This activity will help the learners familiarise themselves with the structure of these bank accounts and the fees that are charged on each account, so that they can decide which bank account will best suit Thabisa.

Some terminology which might come in handy:

A stop order: is an arrangement that you make with your bank so that a fixed amount of money goes out of your account into another account every month.

A debit order: is an arrangement that a third party makes with your bank giving them the authority to take money out of your account every month in order to settle a variable fee. For example, if you have a cellphone contract, the cell provider organises a debit order to give them the authority to take out of your account the amount of money that you owe on your cellphone bill for each particular month.

An automatic payment order: if you borrow money from the bank, the bank organises an automatic payment order which entitles them to take a certain amount of money out of your account each month as a loan repayment.

Point of sale purchase: is the payment of an item, not with cash, but with your bank card.

Point of sale cash back: is a facility whereby you are charged more than the purchase price and given the extra money back in cash.

8.1 Which of the three bank accounts requires you to always keep a minimum amount of money in your account, and how much is this minimum?

8.2 Which of the three listed accounts charges you a monthly fee, and how much is it?

8.3 Can you do all transactions on all three accounts? If not, list the accounts that have limitations and state the limitations that they have.

8.4 How much do you have to pay for an account balance enquiry, at your branch, if you have:

8.4.1 an Mzansi account?

8.4.2 a Bronze account?

8.4.3 a Silver account?

8.5 How much would you have to pay for a cash withdrawal of R200 from your bank if you have:

8.5.1 an Mzansi account?

8.5.2 a Bronze account?

8.5.3 a Silver account?

8.6 How much would you have to pay for an ATM withdrawal of R200 from your own bank's ATM if you have:

8.6.1 an Mzansi account?

8.6.2 a Bronze account?

8.6.3 a Silver account?

8.7 How much would you have to pay for an ATM withdrawal of R200 from another bank's ATM if you have:

8.7.1 an Mzansi account?

8.7.2 a Bronze account?

8.7.3 a Silver account?

8.8 How much would you have to pay for a cash deposit of R200 at your own bank's ATM if you have:

8.8.1 an Mzansi account?

8.8.2 a Bronze account?

8.8.3 a Silver account?

8.9 How much would you have to pay for a cash deposit of R200 at another bank's ATM if you have:

8.9.1 an Mzansi account?

8.9.2 a Bronze account?

8.9.3 a Silver account?

8.10 With an Mzansi account, a cash withdrawal and a cash deposit cost the same nount when you use your own bank's ATM, Is this true for:

8.10.1 a Bronze account? If not, explain the difference.

8.10.2 a Silver account? If not, explain the difference.

8.11 Why is it that with some accounts you are charged more when you use other bank's ATMs than when you use your bank's ATM?

8.12 How much would you have to pay for a stop order/debit order of R299,00 if you have:

8.12.1 an Mzansi account?

8.12.2 a Bronze account?

8.12.3 a Silver account?

8.13 How much would you have to pay for a stop order/debit order of R2 300,00 if you

8.13.1 an Mzansi account?

8.13.2 a Bronze account?

8.13.3 a Silver account?

8.14 How much would you have to pay if you go to Pick 'n Pay and you use your bank card to pay for R295,86 worth of groceries if you have:

8.14.1 an Mzansi account?

8.14.2 a Bronze account?

8.14.3 a Silver account?

8.15 How much would you have to pay if you go to Pick 'n Pay, use your bank card to pay for R295,86 worth of groceries and ask for R500 cash back, if you have:

8.15.1 an Mzansi account?

8.15.2 a Bronze account?

8.15.3 a Silver account?

8.16 On the whole, it seems that bank fees are much higher for transactions involving cash than for other transactions. Why do think this is the case?

8.17 Think about Thabisa's situation. She is running a small business where most of her clients would pay cash.

8.17.1 List the disadvantages for Thabisa if she chooses to open an Msanzi account.

8.17.2 List the disadvantages for Thabisa if she chooses to open a Bronze account.

8.17.3 List the disadvantages for Thabisa if she chooses to open a Silver account.

Thabisa's clients will pay her by cash or cheque. Thabisa will need to make cash deposits quite often, but she will limit the number of cash withdrawals that she makes and rather use cash from her clients to pay for her daily expenses. She does not need a cheque book, but would like to be able to deposit cheques. She would like to open a bank account where she does not pay a monthly fee.

8.18 Which bank account would you recommend to Thabisa?

The data that is supplied here is based on the rates of one of the commercial banks in South Africa as published in its rates brochure.

Type of transaction	Mzansi account	Bronze account	Silver account
Monthly fee	0,00	0,00	31,50
Minimum balance	not applicable	50,00	not applicable
Branch transactions			
Cash withdrawal	8,00	0,90%; 16,25 minimum (1)	2,90; 0,90% (2)
Cash deposit	8,00	4,00; 0,53% (2)	2,90; 0,90% (2)
Cheque deposit	0,00	0,00	0,00
Balance enquiry	4,00	2,65	2,65
Other transactions			
Stop/debit order	not available	4,70	2,90; 0,53%; 13,50 (3)
Cheque fee	not available	not available	2,90; 1,10%, 26,00 (3)

ATM transaction		Own ATM	Other ATM	Own ATM	Other ATM
Cellphone top-up	free	free	11,40	Free	9,60; 0,90% (2)
Cash withdrawal	4,00	4,70	11,40	2,90; 0,90% (2)	9,60; 0,90% (2)
Cash deposit	4,00	4,00; 0,40% (2)	7,00; 0,53% (2)	2,90; 0,90% (2)	2,90; 0,90% (2)
Cheque deposit	0,00	free	free	free	free
Balance enquiry	2,00	1,05	3,35	1,05	3,35

Point of sale purchase	2,00	2,00	2,90; 0,53%; 13,50 (3)
Point of sale cash back	2,00	2,00	

NOTES

(1) "0,90%; 16,25 minimum" means that the transaction fee is 90% of the transaction value with a minimum fee of 16,25. In other words, you would have to pay 90% of the transaction value, but if this amount is less than R16,25 then you would be charged R16,25 instead.

(2) "2,90; 0,90%" means there is a basic transaction fee of R2,90 and an additional fee of 0,90% of the transaction value.

(3) "2,90; 0,53%; 13,50" means there is a basic transaction fee of R2,90 and an additional fee of 0,53% of the transaction value; however, the maximum transaction fee is R13,50.

Activity 9 — Job offers

ABOUT THIS ACTIVITY

In this activity, learners are asked to examine 2 different salary structures outlined on the handout. The salary structures are slightly different and learners will be asked to do a series of calculations using the 2 different salary structures. Based on these calculations, the learners are asked to draw conclusions about the salary structures and make a recommendation as to which they job offer they feel Thabisa should accept.
This activity is aligned with unit standard 7456 and addresses specific outcome 1.

MANAGING THIS ACTIVITY

For this activity, learners will need the worksheet and the handout.

9.1 Hair Trendz is offering a bigger basic salary.

9.2 Sally's Salon takes off only 15% for stock, while Hair Trendz takes off 25%. Sally's Salon takes off 2 times the basic salary, while Hair Trendz takes off only 1½ times. Sally's Salon multiplies by 45% to get the final commission figure while Hair Trendz multiplies only by 40%.

9.3 Both salons take off the same amount of VAT. This is because VAT is fixed at 14% in South Africa.

9.4 If Thabisa made a total turnover of R10 000:

9.4.1 Sally's salon: R10 000 ÷ 1,14 = R8 771,93
R8 771,93 ÷ 1,15 = R7 627,77
R7 627,77 – 2(R3 000) = R1 627,77
R1 627,77 × 0,45 = R732,49
R732,49 + R3 000 = R3 732,49
Gross salary = R3 732,49

9.4.2 Hair Trendz: R10 000 ÷ 1,14 = R8 771,93
R8 771,93 ÷ 1,25 = R7 017,54
R7 017,54 – 1,5(R3 200) = R2 217,54
R2 217,54 × 0,40 = R887,02
R887,02+ R3 200 = R4 087,02
Gross salary = R4 087,02

9.5 Under these conditions, Thabisa would earn more at Hair Trendz.

9.6 If Thabisa made a total turnover of R15 000:

9.6.1 Sally's salon: R15 000 ÷ 1,14 = R13 157,89
R13 157,89 ÷ 1,15 = R11 441,64
R11 441,64 – 2(R3 000) = R5 441,64
R5 441,64 × 0,45 = R2 448,74
R2 448,74 + R3 000 = R5 448,74
Gross salary = R5 448,74

9.6.2 Hair Trendz: R15 000 ÷ 1,14 = R13 157,89
R13 157,89 ÷ 1,25 = R10 526,32
R10 526,32 – 1,5(R3 200) = R5 726,32
R5 726,31 × 0,40 = R2 290,53
R2 290,52 + R3 200 = R5 490,53
Gross salary = R5 490,53

9.7 Under these conditions, Thabisa would earn more at Hair Trendz.

9.8 If Thabisa made a total turnover of R20 000:

9.8.1 Sally's salon: R20 000 ÷ 1,14 = R17 543,86
R17 543,86 ÷ 1,15 = R15 255,53
R15 255,53 – 2(R3 000) = R9 255,53
R9 255,53 × 0,45 = R4 164,99
R4 164,99 + R3 000 = R7 164,99
Gross salary = R7 164,99

9.8.2 Hair Trendz: R20 000 ÷ 1,14 = R17 543,86
R17 543,86 ÷ 1,25 = R14 035,09
R14 035,09 – 1,5(R3 200) = R9 325,09
R9 325,09 × 0,40 = R3 694,04
R3 694,04 + R3 200 = R6 894,04
Gross salary = R6 894,04

9.9 Under these conditions, Thabisa would earn more at Sally's Salon.

9.10 If Thabisa made a total turnover of R25 000:

9.10.1 Sally's salon: R25 000 ÷ 1,14 = R21 929,82
R21 929,82 ÷ 1,15 = R19 069,42
R19 069,42 – 2(R3 000) = R13 069,42
R13 069,42 × 0,45 = R5 881,24
R5 881,24 + R3 000 = R8 881,24
Gross salary = R8 881,24

9.10.2 Hair Trendz: R25 000 ÷ 1,14 = R21 929,82
R21 929,82 ÷ 1,25 = R17 543,86
R17 543,86 – 1,5(R3 200) = R12 743,85
R12 743,85 × 0,40 = R5 097,54
R5 097,54 + R3 200 = R8 297,54
Gross salary = R8 297,54

9.11 Under these conditions, Thabisa would earn more at Sally's Salon.

9.12 If your total turnover is not all that high, then the Hair Trendz salary structure is better, but if you do a large turnover (more than about R16 000) then the Sally's Salon salary structure is better.

9.13 If Thabisa expects to turn over between R10 000 and R15 000 then Hair Trendz's salary structure would be more lucrative.

9.14 If Thabisa expects to turn over more than R16 000 then Sally's Salon's salary structure would be more lucrative.

9.15 The longer she works at a salon the bigger her client base should get, therefore the larger her turnover capacity. Therefore, I would recommend that Thabisa takes the job offer at Sally's Salon. Even if her turnover is less than R16 000 initially, she hopes to turn over about R20 000 once she is established at the new salon and therefore she would earn more with Sally's Salon.

Activity 9 — Job offers

Over the last 12 months Thabisa has become known for her excellent hair treatment and 2 local hair salons (Sally's Salon and Hair Trendz) have offered her jobs which she needs to consider. Although she has enjoyed working for herself and setting up her own business there may be advantages for her if she considers joining an established hair salon.

Look carefully through the information given on the handout which explains the pay structures of salaries at both hair salons. NOTE: these calculations are to find the gross salary (i.e. before deductions such as TAX, UIF, medical aid etc.

9.1 Which salon is offering Thabisa a bigger basic salary?

9.2 There are other differences in the payment structures. List these.

9.3 What part of the salary structures remains the same? Can you explain why?

9.4 If Thabisa made a total turnover of R10 000, follow the instructions shown on the handout to calculate what Thabisa's gross salary would be at:

9.4.1 Sally's salon

9.4.2 Hair Trendz

9.5 Under these conditions, at which salon would Thabisa's gross salary be more?

9.6 If Thabisa made a total turnover of R15 000, follow the instructions shown on the handout to calculate what Thabisa's gross salary would be:

9.6.1 at Sally's salon.

9.6.2 at Hair Trendz.

9.7 Under these conditions, at which salon would Thabisa's gross salary be more?

9.8 If Thabisa made a total turnover of R20 000, follow the instructions shown on the handout to calculate what Thabisa's gross salary would be:

9.8.1 at Sally's salon.

9.8.2 at Hair Trendz.

9.9 Under these conditions, at which salon would Thabisa's gross salary be more?

9.10 If Thabisa made a total turnover of R25 000, follow the instructions shown on the handout to calculate what Thabisa's gross salary would be:

9.10.1 at Sally's salon.

9.10.2 at Hair Trendz.

9.11 Under these conditions, at which salon would Thabisa's gross salary be more?

9.12 What did you notice about the above calculations?

9.13 If Thabisa expects to turn over between R10 000 and R15 000, which job's salary structure would be more lucrative?

9.14 If Thabisa expects to turn over more than R16 000, which job's salary structure would be more lucrative?

9.15 Do you think that Thabisa's turnover capacity is likely to improve the longer she works at a salon? With this in mind, which job offer would you recommend Thabisa accepts and why?

OB OFFER from SALLY's SALON

BASIC SALARY

- Thabisa's basic salary offer is R3 000.

COMMISSION

One of the employees explains how commission is calculated at Sally's Salon:

- The income from very customer that the stylist sees as well as the income from any products that the stylist sells to the customer is added together to make up the TOTAL TURNOVER.
- Last month my total turnover was R26 324, 29
- The salon first takes off 14% VAT, since the turnover (or gross takings) include VAT.
    - o R19 324,29 ÷ 1,14 = R23 091,48
- Then the salon subtracts 15% for the use of salon products when styling clients' hair.
    - o R23 091,48 ÷ 1,15 = R20 079,55
- Next the salon takes off 2 × basic salary earned by an employee.
    - o R20 079,55 – 2(R3 000) = R14 079,55
- Finally the salon multiplies this amount by 45%, so my commission last month was
    - o R14 079,55 × 0,45 = R6 335,80
- This means that I earned a total of:

o R3 000 + R6 336,80 = R9 335,80

JOB OFFER from HAIR TRENZ

BASIC SALARY

- Thabisa's basic salary offer is R3 200.

COMMISSION

One of the employees explains how commission is calculated at Hair Trendz:

- The income from very customer that the stylist sees as well as the income from any products that the stylist sells to the customer is added together to make up the TOTAL TURNOVER.
- Last month my total turnover was R16 934, 64
- The salon first takes off 14% VAT, since the turnover (or gross takings) include VAT.
    - o R16 934, 64 ÷ 1,14 = R14 854,94
- Then the salon subtracts 25% for the use of salon products when styling clients' hair.
    - o R14 854,94 ÷ 1,25 = R11 883,96
- Next the salon takes off 1½ × basic salary earned by an employee.
    - o R11 883,96– 1,5(R3 200) = R7 083,95
- Finally the salon multiplies this amount by 40%, so my commission last month was
    - o R7 083,95× 0,40 = R2 833,58
- This means that I earned a total of:
    - o R3 200 + R2 833,58 = R6 033,58

Activity 10 — VAT, UIF, and TAX

ABOUT THIS ACTIVITY

In the previous activity, through looking at Thabisa's job offers, learners have been exposed to new terminology – such as income tax (which up until now Thabisa has not had to pay because she did not earn enough money. This activity is designed for familiarise learner's with the South African tax system and the various forms of taxation.
This activity is aligned with unit standard 7456 and addresses specific outcomes 1, 2 and 3.

MANAGING THIS ACTIVITY

Learners will need to be given the activity and the handout page with information about the South African tax system. This activity is a more comprehension-based activity and therefore could be given as a homework task.

10.1 Direct taxes are taken off your income, but indirect taxes are paid when you purchase things.

10.2.1 Unemployment insurance fund is a direct tax, because a UIF amount is deducted from your income.

10.2.2 Value added tax is an indirect tax payable on goods and services to a registered VAT vendor.

10.2.3 Income tax is a direct tax which is deducted from your income.

10.4 He earns R3 323 per month (calculated as follows R43 199 ÷ 13 = R3 323).

10.4.1 His monthly to contribution to UIF would be R33,23 (calculated as follows: R3 323 × 1%).

10.4.2 His employee's contribution would also be R33,23 per month.

10.4.3 The total monthly UIF contribution would be R66,46 (calculated as follows: R33,23 × 2).

10.5.1 The VAT amount on R1 842,10 would be R257,89 (calculated as follows: R1 842,10 × 14%).

10.5.2 The total (VAT inclusive) price was R2 099,99 (calculated as follows: R1 842,10 + R257,89 = R2 099,99).

10.6.1 The VAT amount on R1 315,78 would be R184,21 (calculated as follows: R1 315,78 × 14%).

10.6.2 The total (VAT inclusive) price was R1 499,99 (calculated as follows: R1 315,78 + R184,21= R1 499,99).

10.7.1 He pays about 4½% of his gross income in income tax (calculated as follows: R1 964,21 ÷ R43 199 × 100 = 4,547).

10.7.2 In an average month, he pays R151,09 in income tax.

10.7.3 He will receive R3 138,68 in net income (calculated as follows: gross income – UIF – income tax = R3 323,00 – R33,23 – R151,09 = R3 138,68).

10.8.1 He pays about 27% of his gross income in income tax (calculated as follows: R81 558 ÷ R306 000 × 100 = 26,652).

10.8.2 In an average month, he pays R6 273,69 in income tax.

10.9 The more you earn, the MORE you pay in UIF.

10.9.1 This is true because the UIF contribution is calculated as a percentage of your gross income. It also makes sense because if you should become unemployed and you are generally earning more money, then you will need to have paid more into the unemployment insurance fund so that they will be able to pay you out enough for you to live on.

10.9.2 Generally speaking, the more money you earn the MORE you pay in income tax.

10.9.3 This seems fair. If you have more, then you should be able to afford to pay more.

10.10 We have to pay tax so that the government has enough money to cover its expenses (incurred in operations such as assisting the poor, reducing unemployment etc.), but our tax paying also serves as a gauge of the total disposable income available in our country which is used as an indication of our country's economic position.

Activity 10 — VAT, UIF and TAX

In the previous activity we have looked two different job offers that Thabisa was considering. Being new at the formal employment scene, Thabisa was a little confused about some of the terms used in the employment contracts that she has been reading through. In this activity we try to become familiar with these acronyms and do the various calculations involved in determining how much VAT, UIF and TAX a person must pay, and why. Before we go any further, read through the information provided on the handout about the South African tax system.

10.1 Explain the difference between direct taxes and indirect taxes.

10.2 Classify the following as a form of direct or indirect tax:

10.2.1 Unemployment insurance fund.

10.2.2 Value added tax.

10.2.3 Income tax.

10.3 Thabisa's uncle is earning a annual gross salary of R43 199.

10.4 How much money does he earn each month (assuming he has 13 pay cheques per year)?

10.4.1 How much would his monthly to contribution to UIF be?

10.4.2 How much would his employer's monthly to contribution to UIF on his behalf be?

10.4.3 What would the total monthly UIF contribution be?

10.5 Most stores advertise the VAT inclusive prices (i.e. the prices already include VAT). However, if Thabisa paid R1 842,10 (excluding VAT) for her washing machine:

10.5.1 How much would the VAT amount be that would still be added to this price?

10.5.2 What was the total (VAT inclusive) price?

10.6 If Thabisa paid R1 315,78 for her tumble dryer:

10.6.1 How much would the VAT amount be that would still be added to this price?

10.6.2 What was the total (VAT inclusive) price?

10.7 As explained in the handout notes, the amount of tax you pay is determined by reading the SARS tax tables. Thabisa's uncle has studied these tax tables and since his annual gross income is R43 199, he is required to pay R1 964,21 income tax per annum.

10.7.1 What percentage of his gross income does he have to pay in tax?

10.7.2 How much tax does he pay i month (assuming he has 13 pay cheques per year)?

10.7.3 In 10.4.2 you calculated his monthly UIF contribution which is deducted from his pay. If he has no other deductions, calculate his net income per month (the actual amount that he will receive in his bank account).

10.8 Mr Magothso is a director of a company and he earned R306 000 last year. According to the TAX tables, he is required to pay R81 558 in income tax for the year.

10.8.1 What percentage of his gross income does he have to pay in tax?

10.8.2 How much tax does he pay each month (assuming he has 13 pay cheques per year)?

10.9 Rewrite the sentences choosing the correct words, and then answer the question that follows:

10.9.1 The more you earn, the LESS/MORE you pay in UIF.

10.9.2 Why is this true and does this make sense?

10.9.3 Generally speaking, the more money you earn the LESS/MORE you pay in income tax.

10.9.4 Does this seem fair?

10.10 In your own words, list some reasons why we have to pay tax.

THE SOUTH AFRICAN TAX SYSTEM

The South African tax system consists of different kinds of taxes, which can broadly be broken up into two categories: direct taxes and indirect taxes. Direct taxes are charged on income and indirect taxes are charged on transactions (i.e. tax on spending rather than income).

SARS (South African Revenue Services) is an independent body who are responsible for the administration of the South African tax system and for collecting the direct and indirect taxes. Generally, if you have a tax problem or need information on tax, you should contact SARS or visit their website at www.sars.co.za.

Why do we have to pay taxes? "The primary purpose of paying taxes is to assist the State in funding its expenditure. Every year, usually in February, the Minister of Finance tables a budget in Parliament that sets out the government's budgeted expenditure for the ensuing year on how expenditure will be funded. A significant portion of this expenditure is financed by taxes collected from tax payers, whereas the balance is usually financed by borrowing from both local and foreign institutions.

However, financing government expenditure is not the only reason why we pay tax. Indeed, the taxation system plays an important role in the economic policy of our country. It determines the disposable income of taxpayers and, accordingly, their estimated levels of expenditure and, ultimately, the amount of surplus money that they have available for investments. This enables the State to use taxes to achieve certain economic and social objectives, such as assisting the poor, reducing unemployment and controlling inflation. (Deloitte & Touche's Pay Less Tax 2004 – 2005, 17th edition).

- **VAT (Value Added Tax)** is an indirect tax that you generally pay a registered vendor on the supply of goods and services to you, or others pay you (if you are a registered vendor) on the supply of your goods and services to them. The current VAT rate in South Africa is 14%.

- **UIF (Unemployment Insurance Fund)** is a direct tax (sometimes called payroll taxes because it is deducted from your income). It is compulsory for all employees and employers to make a monthly contribution to this fund.The South African Revenue Service (SARS) Guidelines for Employers - Tax Year 2005 states: "The amount of the contribution payable by an employee must be 1% of the remuneration paid to him by his employer" and also that "The amount of the contribution payable by the employer in respect of any of its employees must be equal to 1% of the remuneration paid to the employee". Therefore the total contribution is calculated at 2% of an employee's earnings up to a prescribed amount per month (which is currently R176,72).

- **TAX (Income Tax)** is also a direct tax that you pay on your taxable income (money that you earn) at graduated rates. To determine your tax liability (i.e. how much tax you have to pay) you need to refer to the SARS tax tables.

Gross Income: your tax liability is calculated on your gross income (which is your total earnings before any deductions have been taken off i.e. medical aid, or pension).

Net Income is the amount of money that you receive in your bank account (or in cash) after your tax and other deductions have been taken off.

Activity 11 — Reworking the budget

ABOUT THIS ACTIVITY

This activity is an extension from activity 7 where we introduced the budget statement. In this activity learners apply their knowledge about budgets in order to help Thabisa to formulate new budget figures for October 2005, when she is working at her new job, so that she can determine whether or not she can survive financially under these new conditions.

This activity is aligned with unit standard 7456 and addresses specific outcome 1.

MANAGING THIS ACTIVITY

Learners will need the worksheet, the handout and a calculator.

11.1 May 2005.

11.2 Between May and September 05, Thabisa's average income was R3 419,40. This is calculated as follows: (R3 279 + R3 429 + R3 398 + R3 562 + R3 429)÷5.

11.3 Yes. Thabisa has signed a repayment agreement and she will have to continue paying off this loan until she has fully paid back the agreed amount.

11.4 No, not unless Thabisa would like to continue to do "Relaxer Remedy" treatments on the weekends. All the supplies that she uses during work hours will now come from Sally's Salon and this will be deducted from her earnings.

11.5 See the budget on the next page.

11.6 See estimated figure in the budget.

11.7 There will be 21 working days in October 2005. this means that Thabisa would have to pay Lilethu R2 520 in October for looking after Christina.

11.8 Thabisa will now spend at least R241,50 on transport costs (21 working days × 11,50). Therefore a good estimate for her total transport costs for next month would be something like R300.

11.9 Thabisa's electricity should be less now that she'll not be at home during the day. Her water bill should also be quite a bit less, since she will not be washing so many people's hair at home. She would most likely not use the landline telephone as often but would probably use her cellphone more, because she will be out all day at work. However, there is no reason why her food and household costs should be that different.

11.10

$$\textit{Basic salary} + \left[\frac{(\textit{total turnover} \div 1{,}14)}{1{,}15} - 2 \times \textit{basic salary}\right] \times 0{,}45$$

$$3000 + \left[\frac{17500 \div 1{,}14)}{1{,}15} - 2 \times 3000\right] \times 0{,}45 = \text{R}6\,306{,}86$$

11.11 R6 306,86 – R1 500 = R4 806,86.

11.12 Yes. Thabisa will have enough money in October. The budget shows a surplus of R32.

11.13 Thabisa doesn't seem to have a lot more money left over at the end of this month, but she should be able to increase her turnover when she has built up an established client base at Sally's salon and then her income will increase.

Activity 11 — Reworking the budget

In activity 7, we helped Thabisa to make a budget statement. Since then, Thabisa has decided to accept a job at Sally's Salon. With the new job will come new commitments and new expenses and thus… a new budget it needed.

Look carefully at the budget shown on the handout.

11.1 When did Thabisa stop working at the Spur?

11.2 What was Thabisa's average income from May to September 05?

11.3 When Thabisa begins her new job, will she still have to pay off the washing machine and tumble dryer that she bought for washing the towels she use to do hair treatments at home? Type in a figure in the appropriate column for the October budget.

11.4 When Thabisa begins her new job, will she still have to budget for "Relaxer Remedy" expenses and supplies? Type in a figure in the appropriate column for the October budget.

11.5 Thabisa has now also taken out a bank account, and so she will be charged banking fees for October 05. From your knowledge of banking fees covered in the previous activity, estimate how much Thabisa should budget for banking fees and add this to the budget.

11.6 Fill in the fixed expense amounts in the October budget column.

11.7 Now that Thabisa will be working for Sally's Salon and not at home she will need to hire someone to look after her 18 month old daughter, Christina. Thabisa has agreed to pay the Lilethu R120 per day to look after Christina. Calculate how much Thabisa would have to pay Lilethu for the month of October and add this figure to the budget.

11.8 Thabisa will also have to travel to and from work every day and she will need to spend R11,50 a day on transport costs. Estimate a realistic transport figure that Thabisa should budget for October and put this into the budget.

11.9 Do you expect any of Thabisa's other variable expenses to be very different?

11.9.1 If so, explain why/

11.9.2 Readjust these figures on the budget for October 05.

Sally's Salon have offered Thabisa a basic salary of R3 000. Thabisa's gross salary is then calculated as follows:

$$\textit{Basic salary} + \left[\frac{(\textit{total turnover} \div 1{,}14)}{1{,}15} - 2 \times \textit{basic salary}\right] \times 0{,}45$$

11.10 If Thabisa estimates that she should do a total turnover of about R17 000 initially, calculate what her gross salary would be for October 2005.

11.11 Approximately a further R1 500 would be deducted from Thabisa's salary for income tax, UIF and medical aid before the money goes into her account. How much income would Thabisa actually get in her bank account?

11.12 If this is the case, will Thabisa have enough money in October?

11.13 Does this new job seem worthwhile? Explain your answer.

THABISA'S BUDGET

	Actual Jan 05	Actual Feb 05	Actual Mar 05	Actual Apr 05	Actual May 05	Actual June 05	Actual July 05	Actual Aug 05	Actual Sept 05	Budget Oct 05
INCOME										
Spur wages	2 400	1 800	1200	1 080	0	0	0	0	0	0
Other income	130	1 133	1950	2 560	3 279	3 429	3 398	3 562	3 429	4 806
TOTAL INCOME	**2 530**	**2 933**	**3 150**	**3 640**	**3 279**	**3 429**	**3 398**	**3 562**	**3 429**	**4 806**
EXPENSES										
Rent	450	450	450	450	450	450	450	450	450	450
Electricity	35	38	35	32	38	39	38	40	38	30
Water	34	36	40	37	36	40	39	41	40	20
Food & household expenses	523	504	450	523	528	580	669	450	450	500
Childcare	0	0	0	0	0	0	0	0	0	2 520
Medicine	35	41	35	35	41	35	35	35	35	35
Telephone	73	75	50	73	75	68	52	75	60	50
Cellphone	122	142	100	122	105	60	123	142	103	150
Clothes	251	269	0	251	269	269	200	250	300	300
Loan for washing machine & tumble dryer	0	0	450	450	450	450	450	450	450	450
Transport	88	90	90	60	54	40	45	42	50	300
Stokvel	150	150	150	150	150	150	150	150	150	150
Banking fees	0	0	0	0	0	0	0	0	0	169
"Relaxer Remedy" expenses & supplies	800	1015	1 200	800	1 015	1 200	1 150	1 280	1 200	0
School fees	100	100	100	100	100	100	100	100	100	100
TOTAL EXPENSES	**2 661**	**2 904**	**3 150**	**3 083**	**3 311**	**3 481**	**3 501**	**3 505**	**3 416**	**4 774**
NET SURPLUS (DEFICIT)	**(131)**	**23**	**0**	**557**	**(32)**	**(52)**	**(103)**	**57**	**3**	**32**

Activity 12 — Making a business plan

ABOUT THIS ACTIVITY

This activity is designed as an assessment task. Learners are asked to draw up a business plan for cutting and styling hair. They will need to gather information about the costs involved in setting up, make a price list and draw up a budget showing how they intend to cover their expenses and make a sustainable profit.

This activity is aligned with unit standard 7456 and addresses specific outcomes 1, 2 and 3.

MANAGING THIS ACTIVITY

Learners should be given the worksheet and asked to complete the task on their own in a given period of time (1 week should be sufficient).

The responses to this task will be varied, but some ideas about what is expected are provided below:

- ✓ If you were going to set up a small hair cutting and styling business you would need scissors, combs, hair dryer, shampoo and conditioner etc.
- ✓ To investigate the current prices of items learners should be encouraged to visit local shops or to get quotes from wholesalers.
- ✓ Examples of suitable places where your 'mini salon' could operate: in your garage at home (with your parents' permission), in a hall/room at school or at college.
- ✓ The initial finance will have to either come from savings or from a loan. Either your parents or a friend might lend you the money, you might be due for a stokvel payment, you might take extra money out of a student loan, or you might borrow from a bank.
- ✓ The 'mini salon' could be designed to cut and style hair for learners for their school dances or parties, or it could target friends and neighbours in the surrounding area.
- ✓ Flyers could be made up and put in people's letterboxes, SMS's could be sent out to potential clients or notices could be put up in schools.
- ✓ There would be fixed expenses such as rent or loan repayment and variable expenses such as water, electricity, stock, laundry of towels..
- ✓ The estimated number of clients would vary in different situations, but the working hours might only be something like Friday 17h00 – 19h00, Saturday 09h00 – 18h00 and Sunday 09h00 – 12h00 therefore the expected number of clients should be a reasonable guess based on a maximum of 14 hours per weekend. More than this would be unreasonable since they will also need some rest/studying time over the weekend.
- ✓ Activity 7 and activity 11 are good places of reference in terms of what should be covered in the budget statement.

Activity 12 — Making a business plan

In the previous activities we have looked at many of the procedures involved in running a small business. Imagine you (while studying to be a hair stylist) were looking for a weekend job and decided to set up a 'mini salon' where you could cut and style hair in order to make some money.

Listed below are the suggested key points which you should investigate and think about before setting up your 'mini salon' business plan.

In your completed assignment you should cover all these points with particular attention given to the final point (compiling a projected budget statement).

- ✓ If you were going to set up a small hair cutting and styling business – let's call it a 'mini salon' — what kinds of items/materials would you need to purchase?
- ✓ Investigate the current prices of the items you have listed above and calculate a total amount that you will have to invest in setting up your 'mini salon'.
- ✓ Investigate a suitable place where your 'mini salon' could operate and determine the cost of the premises.
- ✓ Decide how you will be able to afford the start-up costs involved – i.e. where will you get your initial finance.
- ✓ Decide on a target market. In other words, what kinds of people will you get to come to your 'mini salon'?
- ✓ Decide how you would tell people or advertise your 'mini salon' to attract clients.
- ✓ Make a list of all the expected expanses that your 'mini salon' would have. Separate these expenses into fixed and variable expenses.
- ✓ Estimate how many clients you expect to see over the weekend and make a price list (ensuring that the prices you charge will enable you to pay your expenses and make some profit).
- ✓ Make a budget statement listing all the 'mini salon' expenses and the projected income for 1 month (4 weekends).