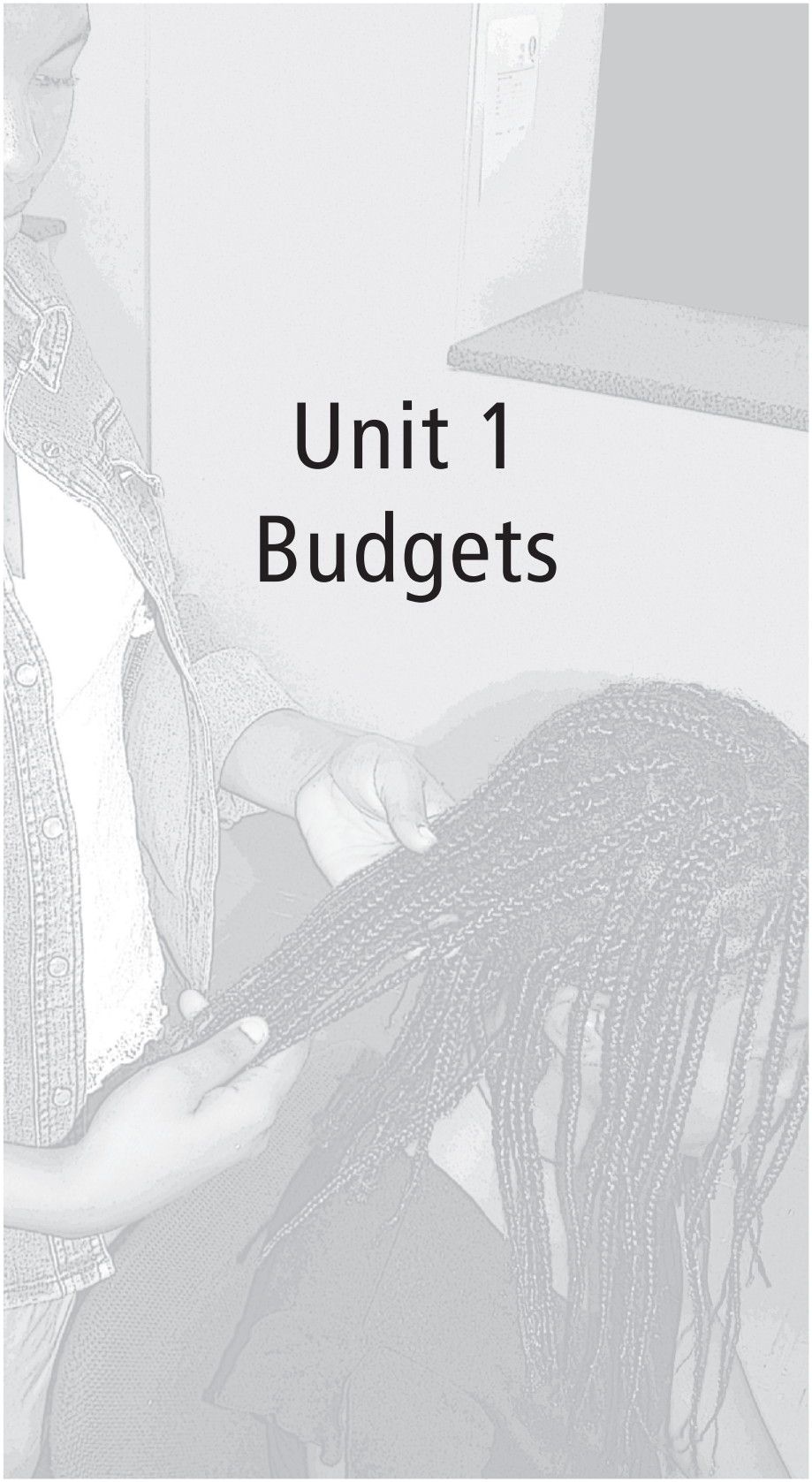
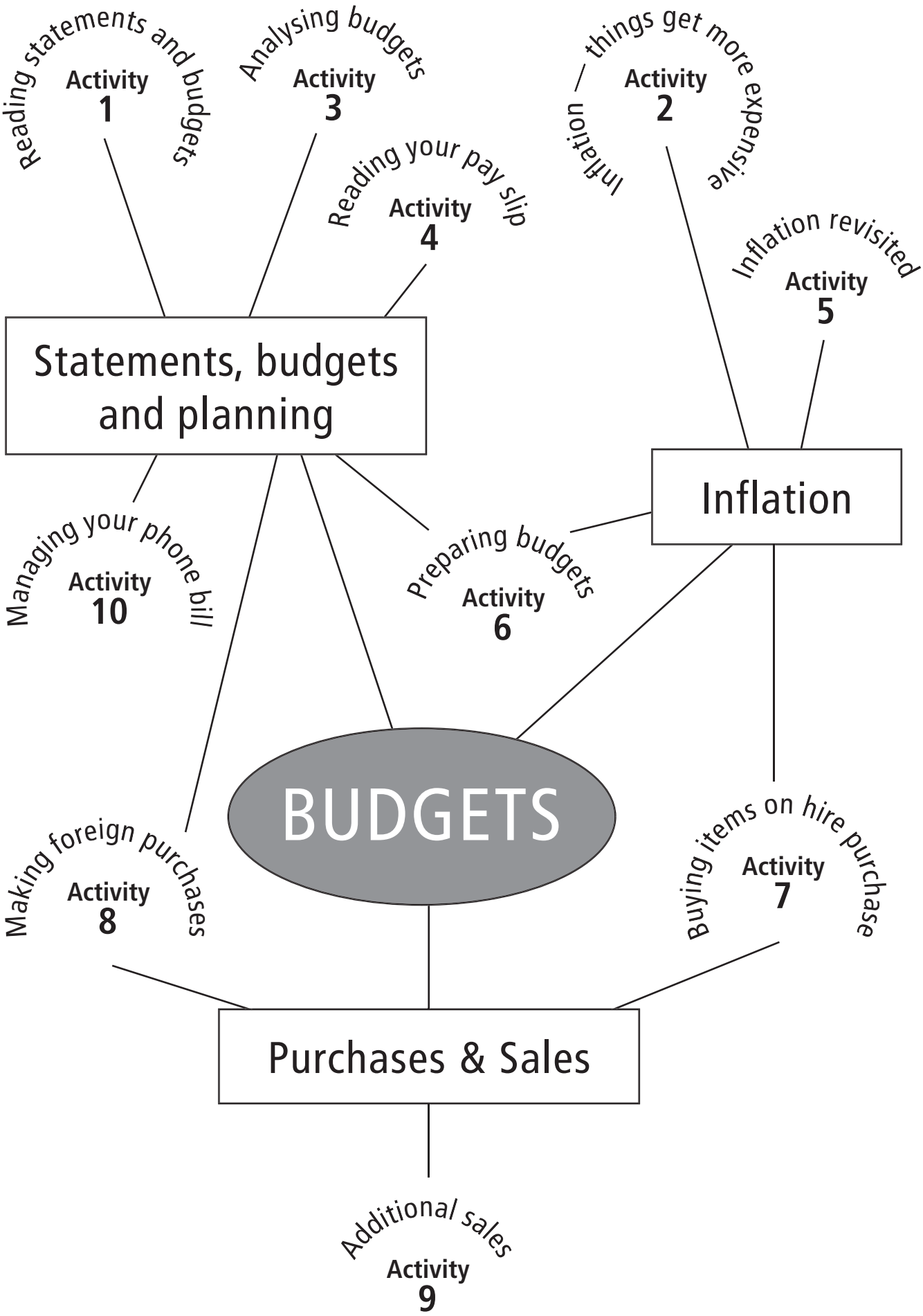
Mathematical Literacy

NQF LEVEL 4



Unit 1
Budgets

Hairdressing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Overview

This unit aims to increase learners' familiarity and understanding of the financial aspects relating to the running of a hair salon business.

Learners should gain an understanding of what income and expenditure statements are. The relationship between budgets on a small scale business level to those on a large scale national level are drawn out.

Inflation has a significant effect on individuals as well as on all businesses. It is imperative that learners gain a clear understanding of what inflation is and how to run a business whilst making allowances for the effects of inflation.

Aspects of national economy are also considered. This unit gives the learner an understanding of what the sources of government income are and how it uses it's resources. Government budgeting is also carefully looked at.

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. Having worked through this unit, learners should have a greater ability to deal with some of the financial aspects of running a successful business. They should also have a greater understanding of the country's national budget.

Activity 1: Reading statements and budgets
In this activity we want learners to gain an understanding of how to read budget statements. This is because many of the later activities in this unit relate back to budget statements.

We start by asking learners to reflect on their own personal income and expenditure statements. Two budget statements are included with the activity: one is for a hair salon and the other is the national income and expenditure statement. It is important for learners to recognize the similarities that exist between all budget statements.

Activity 2: Inflation – things get more expensive
This activity introduces the concept of inflation, and gives learners the opportunity to discover for themselves that prices go up over time. It allows learners to realise that not all items increase in price by the same amount over a fixed period of time. The ideas of simple and compound interest are also introduced.

Activity 3: Analysing budgets
In this activity we will combine the ideas learnt in the first two activities and explore how inflation plays a significant role in preparing and understanding budgets.

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 (9014)

- Use Mathematics to investigate and analyse regional and/or national budgets and income (SO1).
  - Regional and/or national budgets from the media and other sources are accessed, and income and expenditure are described realistically.
  - Calculations are carried out efficiently and correctly using computational tools.
  - Solutions obtained are verified in terms of the context.
  - Different ways of representing budgets are critically analysed and related.
  - Actual income and expenditure is analysed and compared to planned income and expenditure. Variances are identified

- Use compound growth to make sense of inflationary effects on the national economy (SO2).
  - Methods of calculation are appropriate to the problem types.
  - Computational tools are used efficiently and correctly and solutions obtained are verified in terms of the context or problem.
  - Solutions to calculations are interpreted in terms of base rates or indices
  - Appropriate formulae are understood and used to calculate solutions to problems.

- Use Mathematics to critique and debate aspects of the national economy (SO3).
  - Values are calculated correctly.
  - Mathematical tools are used to compare the effects of changes in different sectors of the national economy.
  - Critique and debating points are based on well-reasoned arguments and are supported by mathematical information.

Activity 4: Reading your pay slip
This activity looks at pay slips in detail and gives learners the opportunity of understanding the information that is provided on a pay slip. In addition, it shows learners how tax and commission is calculated based on income and takings.

Activity 5: Inflation Revisited
This activity enables learners once again to interact with the important concept of inflation. We look at a case study of what can happen when inflation gets out of control. The concepts learned are then applied to the running of a hair salon.

Activity 6: Preparing budgets
This activity is designed to be used as an assessment activity. It is intended to recap principles that have been learnt in the first 5 activities. There is an opportunity for learners to make their own judgments about how a business develops and to draw up a budget accordingly. If time allows it may be worthwhile for learners to share their budgets with each other, explaining the reasons behind their decisions.

Activity 7: Buying items on hire purchase
In this activity we expose learners to the different payment options available when purchasing items on credit. We also consider the various factors at play when deciding which option is most suitable.

Activity 8: Making foreign purchases
In this activity we consider the effect of exchange rates on the cost of purchasing items from foreign countries. We also look at different purchasing options, considering whether to buy in bulk or in smaller quantities as funding allows.

Activity 9: Additional sales
In this activity we look at an alternative source of income for a salon. The aim of the activity is to allow learners to think through the requirements of producing a gift pack for sale. Learners should realise that decisions that are made can have far-reaching effects on a business's profits. Many decisions not only have direct economic consequences but may, for example, affect the image of the salon which could also influence the profits of the business.

Activity 10: Managing your hair salon's phone bill
This activity is completely self-contained. It deals with ways of managing one of the significant budget items: telephone costs.

9014	Use mathematics to investigate & monitor the financial aspects of personal, business and national issues											
		ACTIVITY	1	2	3	4	5	6	7	8	9	10
SO1	Use mathematics to investigate and analyse regional and/or national budgets and income											
	AC1	Regional and /or national budgets from the media and other sources are accessed, and income and expenditure are described realistically.	✓		✓	✓		✓				✓
	AC2	Calculations are carried out efficiently and correctly using computational tools.	✓		✓	✓		✓			✓	✓
	AC3	Solutions obtained are verified in terms of the context.	✓		✓	✓		✓			✓	✓
	AC4	Different ways of representing budgets are critically analysed and related.	✓		✓	✓		✓				
	AC5	Actual income and expenditure is analysed and and compared to planned income and expenditure. Variances are identified.	✓		✓			✓				
SO2	Use compound growth to make sense of inflationary effects on the national economy.											
	AC1	Methods of calculation are appropriate to the problem types.		✓	✓		✓		✓			
	AC2	Computational tools are used efficiently and correctly and solutions obtained are verified in terms of the context or problem.		✓	✓		✓		✓			
	AC3	Solutions to problems are interpreted in terms of base rates or indices.		✓			✓					
	AC4	Appropriate formulae are understood and used to calculate solutions to problems.		✓	✓		✓		✓			
SO3	Use mathematics to critique and debate aspects of the national economy.											
	AC1	Values are calculated correctly.	✓		✓		✓			✓		
	AC2	Mathematics are used to compare the effects of changes in different sectors of the national economy.	✓				✓			✓		
	AC3	Critique and debating points are based on well-reasoned arguments and are supported by mathematical information.			✓		✓			✓		

Activity 1 — Reading statements and budgets

ABOUT THIS ACTIVITY

In this activity we want learners to gain an understanding of how to read budget statements. This is because many of the later activities in this unit relate back to budget statements.

We start by asking learners to reflect on their own personal income and expenditure statements. Two budget statements are included with the activity: one is for a hair salon and the other is the national income and expenditure statement. It is important for learners to recognize the similarities that exist between all budget statements.

This activity addresses the following Specific Outcomes and Assessment Criteria: S.O.1 – AC 1, 2, 3, 4, 5; SO3 – AC 1, 2.

MANAGING THIS ACTIVITY

Learners could be asked to bring in their previous month's bank account statement to assist them with the first few questions. If this is not possible it would be helpful for them to look through it before the lesson and to note down their major income and expense items.

1.1.1 Income: The learners should note that some items are regular fixed amounts, while others may be one-off amounts. All items should be specified, including any interest received (if their accounts are in credit).

1.1.2 Expenses: Learners should categorise their expenditure as indicated in the question. Don't forget to include items like bank charges and loan repayments.

1.1.3 One week of a statement may look something like the example printed below. For certain items, it may be useful for learners to write a summary statement at the end of the month and to ignore the specific dates (as has been done for 'expenditure' in the example).

Summary of income and expenditure for: Great Spender For the period: February 2005					
Income			Expenditure		
Date	Description	Amount	Date	Description	Amount
2 Feb	monthly loan advance	R1 000		stationery purchases	R123,95
5 Feb	'pocket money'	R250		monthly groceries	R735,20
8 Feb	wage	R885		rental	R650
				clothing	R184
				transport costs	R128,65
	Total	R2 135		Total	R1821,80
				Surplus or deficit (total income – total expenses)	R313,20

1.2 Haircuts and procedures; rent-a-chair; sales of hair products; sales of gift packs; student training allowance; interest.

1.3 Stylists' salaries; stock charges; operators' salaries and rent. In 2003 capital expenses were also a significant expense but this was a one-off expense and is not repeated during the periods shown.

1.4 Revenue.
The majority of its income is derived from taxes. These taxes are from a variety of sources including: personal income, VAT, company taxes, fuel, customs and excise duties.

1.5 R282 180 000 000 or R282 180 million or R282,18 billion. It would be worthwhile to discuss these different representations with your learners.

1.6 Provincial equitable share.
This is money that is allocated to the 9 provinces for social services. These social service items also receive allocations at a national level, from where much of the administration is carried out.

1.7 The indented items show how the 'social services' total has been made up. The boxes used in the Great Styles statement perform the same function as the indenting. They show how the 'other income' totals have been made up.

1.8 The national government financial year end is the last day in February each year. This means that a financial year runs from 1st March to 28th February (29th in the case of a leap year) of the following year. The financial year is therefore recorded over two years, i.e. 2001/2002; 2002/2003 etc.
The salon records its income from 1 January to 31 December of each year, hence its year can simply be recorded as 2002, 2003 etc.

1.9 The actual figures are all historic. These expenses and incomes have actually taken place and have been verified. When we look into the future we make judgements on what we think is likely to occur. These are 'estimates' and are usually referred to as 'budgets' in the context of financial reporting.

1.10 The values in the "actual" column are specified to a greater level of accuracy. When predicting what is likely to occur it is difficult to be too precise as the necessary information is not yet available.

1.11 The Great Styles Salon uses brackets to indicate a deficit while the national budget uses a negative sign. Both of these approaches are fairly widely used.

1.12.1 R326 956 million or R326 956 000 000.
1.12.2 R742 100

1.13 No, you can't. The income and expenditure statement merely gives an account of the inflows and outflows. It doesn't give an indication of the overall financial position of the business.

1.14 No, you can't. For example, the capital expenditure for Great Styles in 2003 doesn't give us the details of how exactly this money was spent. The same applies for 'provincial equitable share' in the national budget.

Activity 1 — Reading budgets

Money is very important to your hair salon—without money there is no business. In this activity we will be looking at financial planning and management. There are two key aspects to managing the finances of your salon. 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 income and expenditure. Both income and expenditure statements and budgets should be prepared for the salon on a monthly as well as a yearly basis. The same principal applies to any projects that you undertake.

1.1 Before we go any further, think about your personal income and expenditure over the last month.

1.1.1 Make a list of all the sources of your income and also the amounts (e.g. bursary, loan, pocket money, wages etc.).

1.1.2 Make a list of all the main expenses you incurred during the month as well as the amount for each (e.g. rent, transport, groceries, toiletries, entertainment, clothes etc.).

1.1.3 Draw and complete a table such as the one below for the income and expenditure you listed above (you will have to add more rows and you will almost certainly not remember the dates—this is not a problem for now).

Summary of income and expenditure for: _____(insert name here)_____ For the period: ____(insert month here)_____					
Income			Expenditure		
Date	Description	Amount	Date	Description	Amount
	Total			Total	
			Surplus or deficit (total income – total expenses)		

If your income exceeds your expenses you have a surplus - money you can save or carry over to next month or project. If your expenses exceed your income you have a deficit - money you will have to take out of your savings or cover with a loan.

For the next set of questions you must refer to handout 1, which consists of;

- the income expenditure statement for the Great Styles Salon; and
- the national income and expenditure statement presented by the National Minister of Finance to Parliament.

1.2 Make a list of the different forms of income for the Great Styles Salon.

1.3 What are the largest expenses for the Great Styles Salon?

1.4 What word does the national budget use to refer to income? What are its sources of income?

1.5 How much money did the government collect in taxes in the 2002/2003 financial year?

1.6 What are the three largest expense items in the national budget? What is this money used for?

1.7 Explain the purpose of indenting as used under the line item 'social services' in the national budget? What is the purpose of the boxes used under 'income' in the financial statement for the Great Styles Salon?

1.8 You will notice that the national budget refers to years as 2002/2003 etc., while the Great Styles Salon refers to 2002 and 2003 only. Why is there this difference?

1.9 You will notice that the documents have different columns for different years. Some are labeled 'actual' while others are labeled 'budget' or 'estimate'. Why are these different labels used?

1.10 What do you notice about the values used in the 'budget' and 'estimate' columns compared with the 'actual' columns? What is the reason for this?

1.11 The different statements provided use two different ways to indicate a deficit/loss. What are these?

1.12 What actual amount of money do the following numbers refer to in each of the following statements:

1.12.1 National Budget: 326 956 (estimated revenue 2004/2005)

1.12.2 Great Styles Salon: 742 100 (budget income 2004)

1.13 Can you tell from the Great Styles Salon statement (or the national statement) how much money is in their bank account at any given time?

1.14 Can you tell from the Great Styles Salon statement (or the national statement) how the money allocated to a particular expense is actually spent?

Financial statement and budget of the Great Styles Salon for the years 2002, 2003 and 2004

	Actual 2002	Actual 2003	Budget 2004
INCOME			
Haircuts and procedures	551 098	584 908	726 000
Other income	12 508	11 100	16 100
Sales of hair products	9 716	8 290	12 000
Sales of gift packs	0	250	800
Student training allowance	200	300	300
Interest	2 592	2 260	3 000
TOTAL INCOME	**563 606**	**596 008**	**742 100**
EXPENSES			
Bank charges	2 834	3 607	3 400
Capital expenses	0	58 324	0
Electricity	5 485	6 139	8 000
Stylists' salaries	229 460	247 186	318 200
Operators' salaries	72 683	78 638	85 750
Industrial council & union fees	6200	6 200	6 820
Insurance	13 850	15 080	16 500
Magazine subscriptions	986	1 212	1 460
Stock charges	150 971	163 571	190 000
Tea & coffee	1 362	1 685	2 500
Telephone	3 305	4 735	5 700
Rent (incl water)	32 600	33 800	37 180
TOTAL EXPENSES	**519 736**	**620 177**	**675 510**
NET SURPLUS (DEFICIT)	**43 870**	**(24 169)**	**66 590**

South African Budget Framework

based on the Budget speech of the Minister of Finance, Trevor Manuel, on 18 Feb 2004[1]

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

[1] Based on details sourced at: http://www.finance.gov.za/ (June 2004)

Activity 2 — Inflation: things get more expensive

ABOUT THIS ACTIVITY

This activity introduces the concept of inflation, and gives learners the opportunity to discover for themselves that prices go up over time. It allows learners to realise that not all items increase in price by the same amount over a fixed period of time. The ideas of simple and compound interest are also introduced.

This activity addresses the following Specific Outcomes and Assessment Criteria: S.O.2 – AC 1,2,3,4;

MANAGING THIS ACTIVITY

Bear in mind that 1.1 requires research to be done by the learners as homework. The Shopping Basket handout should therefore be given out a few days before the activity is discussed in class. Allow the learners time in class to share out the research within their groups. Each item should have more than one person researching its current price.

2.1 Check that within each group the current cost for the majority of the items has been obtained. It is not essential that all items have been costed.

2.2 Learners should be able to check their answers against others in their group. Where there are discrepancies, learners should recheck their calculations until they have ensured that all members of the group have obtained the same results.

2.3 It is worthwhile stressing the fact that absolute increases don't tell us much, especially when we want to compare the increases for various categories. A percentage increase is therefore used at it is easily comparable and has more meaning.
In order to reinforce the formula, ask the learners to calculate the percentage increase on an item that was R100 and is now R120. They should be able to respond with "20%". Ask them how they calculated the answer, and show them that when using the given formula they are performing the same operation.
Once again, learners should compare their results to those of the other members in their group.

2.4 As groups will have costed the items in a variety of stores, the results from groups may differ. The important issue to highlight is that the categories have increased by differing percentages, as have the individual items - some have increased by more than the average and others by less.

2.5.1 Learners should be aware of the fact that inflation is currently averaging between 3 and 6%. Over the past 16 years the average annual inflationary increase has been in the region of 10%. It seems most unlikely that the Argus would have pushed up their prices by such a high percentage each year, as this would make the newspaper extremely expensive and people would not want to buy it.
We are trying to create an environment for introducing compound increases. We therefore want to alert the student to the 'problem'.

2.5.2 This figure seems a little more reasonable and could be believed as being accurate. – even though the calculation isn't correct.

2.5.3 It will be interesting to hear what the learners' opinions are. Tito Mboweni has targeted annual inflation to fall within the range of between 3 and 6 %. At the time of writing inflation is running at 4,4%.

2.5.4 There is an error in the calculation shown. The calculation doesn't take into account the compounding effect (which is demonstrated in question 1.6). In the compounding effect the annual price increase is calculated on the existing price, i.e. the price after the last increase.
It would probably be advisable to allow some discussion at this point. However after completing question 1.6, it would be worthwhile to again address this question. They should realise that the compounding effect means that price increases appear to be quite significant after a few years when compared to the original price. For this reason it is easy to incorrectly calculate large percentage increases, believing the calculation to be correct.

2.5.5 Zimbabwe is currently experiencing inflation of over 500%. After the 2nd World War Germany (and other countries) experienced exceptionally high inflation while trying to rebuild their economies.
Extreme levels of inflation are usually experienced when there is a very large demand for items that are in low supply. This tends to drive prices up at unusually high rates.

2.6

	Simple Interest Account		Compound Interest Account	
	Interest earned	Balance	Interest earned	Balance
		100,00		100,00
After 1 year	10,00	100,00	10,00	110,00
After 2 years	10,00	100,00	11,00	121,00
After 3 years	10,00	100,00	12,10	133,10
After 4 years	10,00	100,00	13,31	146,41
After 5 years	10,00	100,00	14,64	161,05

2.7 In order to complete the table the following formula is required:

$$\text{newprice} = \text{oldprice} \times (1+ \frac{\textit{inflation rate}}{100}$$

Predicted price for items based on the South African inflation figures[1]							
	year-on-year inflation	tuna price	Argus price	Item 1	Item 2	Item 3	shopping basket
1988		1,49	0,40				
1989	14,5	1,71	0,46				
1990	14,3	1,95	0,52				
1991	15,6	2,25	0,61				
1992	13,7	2,56	0,69				
1993	9,9	2,82	0,76				
1994	8,8	3,06	0,82				
1995	8,7	3,33	0,89				
1996	7,3	3,57	0,96				
1997	8,6	3,88	1,04				
1998	6,9	4,15	1,11				
1999	5,2	4,37	1,17				
2000	5,4	4,60	1,24				
2001	5,7	4,86	1,31				
2002	9,3	5,32	1,43				
2003	5,8	5,62	1,51				
Current price		4,25	3,00				

In working this out learners should only specify two decimal places in the answer for each year as these decimals represent cents. It is advisable to keep the additional decimal places on their calculator screens and then round the answer off each time. This increases the level of accuracy.

2.8 Inflation has a significant impact on our daily lives. The cost of items that we purchase continues to increase. Unless our income increases at the some rate we will not be able to cover the expenses that we currently incur, or we would have to find an additional source of income. Encourage discussion on the consequences of the above. The learners should become aware of the economic forces at work in our society. In other words, wages and salaries also go up – not just prices. For instance, records show that a worker who was paid R14 a day in 1988 will, in 2004, earn about R80 a day for doing exactly the same work.

When people's wages and salaries go up this increases the costs of the goods they make and of the services they provide. Therefore the goods (e.g. loaves of bread) and the services (e.g. new roads or refuse collection) have to be bought at a higher price. When prices go up pressure is put on the various sources of money to increase the supply: people borrow more money (bank loans, hire purchase etc.) and demand higher wages and salaries. This in turn tends to push up prices again. This is sometimes called the "inflationary spiral".

Activity 2 — Inflation: things get more expensive

You will no doubt remember a time when you paid a lot less for an item than you do today. What did you pay for a soft-drink five years ago? Was there a time when you could go to the movies for less than you pay today? Of course! We call the annual increase in prices inflation. Not only does inflation play an important role in our day to day lives, it also impacts on financial planning. That is why you will have noticed that the projected amounts for items in the budgets for any year in Activity 1 are higher than the actual amounts spent on them in earlier years. In this activity we will try to develop a better understanding of what inflation is.

For the next few questions you will have to refer to handout 2, which consists of a table of items as well as the price you would have paid for each of the items in 1988.

2.1 Share the items among the members of your group and collect the current prices for the items by visiting shops near to you. You may have to find similar items if the actual product is no longer available.
Complete the table.

2.2 The categories referred to in the table are:
C: Clothing; G: Groceries; H: Household; M: Motor and S: Sports.
Complete the table below for the items on your shopping list. Do not complete the "% increase" column yet.

Comparison of the cost of a 1988 shopping basket with the current cost			
	Total cost (by category) of the items in the basket		% increase
	1988	Current	
Clothing			
Groceries			
Household			
Motor			
Sport			
Total			

2.3 It is difficult to compare the categories to see which increased the most and which increased the least since the amounts are all different. In order to be able to compare the changes we must calculate the % increase for each category and for the total. Complete the '% increase' column by using the following formula:

$$\%\ increase = \frac{current\ price - 1988\ price}{1998\ price} \times 100$$

2.4 Answer the following questions based on the percentage increases you have calculated in your table:

2.4.1 Which category appears to have increased the most?

2.4.2 Which category appears to have increased the least?

2.4.3 Which categories have shown a greater increase than the total?

2.4.4 Which categories have increased less than the total?

2.5 In completing the '% increase' column for the table you will have calculated some rather large numbers, maybe even as high as 600 or 700%. For example:

In 2004 the calculation for the Cape Argus was:

$$\%\ increase = \frac{3{,}00 - 0{,}40}{0{,}40} \times 100 = 650\%$$

and for Pick 'n Pay 'no name brand' tuna the calculation was:

$$\%\ increase = \frac{4{,}25 - 1{,}49}{1{,}49} \times 100 \approx 185\%$$

2.5.1 You might conclude that the Cape Argus increased by

$\frac{650}{16} \approx 40{,}6\%$ per year

Do you think this is correct? Give a reason for your answer.

2.5.2 Do you think that

$\frac{185}{16} \approx 11{,}6\%$

for tuna is more realistic?

2.5.3 What do you think is a reasonable estimate of annual increase?

2.5.4 Why do you think that there is a difference between your expectation and the calculation above?

2.5.5 Do you know of any situations/countries where prices do increase by amounts like 50% per year? If so, make a list of these

While it is true that in South Africa we do not typically experience annual increases of 50% for items, the calculation giving 650% for the 16 year period is not incorrect. How do we explain this? The effect can be explained by the term compound increase.

To understand compound increase, consider a simple example in which we compare two kinds of interest: simple interest and compound interest. Banks offer these two forms of interest on savings accounts. With simple interest you earn interest every year (or month) and the interest is paid out—it is not added to the account. With compound interest you earn interest every year (or month) and the interest earned is added to the amount in the savings account.

2.6 Let us say that the bank offers you 10% interest per year for money in your savings account. Complete the table below for the two kinds of account.

	Simple Interest Account		Compound Interest Account	
	Interest earned and paid out to client	Balance	Interest earned and added to the bank balance	Balance
		100,00		100,00
After 1 year	10,00	100,00	10,00	110,00
After 2 years	10,00	100,00	11,00	121,00
After 3 years				
After 4 years				
After 5 years				

You should notice from the table above that you earned 5 × R 10,00 = R 50,00 interest in the simple interest account over the five year period and the balance remained unchanged. By comparison you earned more than R 60,00 interest in the compound interest account. This is because you earned "interest on interest" in the compound interest account. This principle explains how a much less than 44% increase per year can nonetheless appear to look like 700% over 16 years.

2.7 Statistics South Africa is responsible for publishing financial statistics for the country. Among other figures, they publish year-on-year inflation figures.

Use the year-on-year inflation figures provided in the table to complete the table for the Cape Argus newspaper and three other items from your shopping basket, as well as for the entire shopping basket.

Predicted price for items based on the South African inflation figures[1]							
	year-on-year inflation	Tuna price	Argus price	Item 1	Item 2	Item 3	Shopping basket
1988		1,49	0,40				
1989	14,5	1,71	0,46				
1990	14,3	1,95	0,52				
1991	15,6	2,25	0,61				
1992	13,7	2,56	0,69				
1993	9,9	2,82					
1994	8,8	3,06					
1995	8,7	3,33					
1996	7,3	3,57					
1997	8,6	3,88					
1998	6,9	4,15					
1999	5,2	4,37					
2000	5,4	4,60					
2001	5,7	4,86					
2002	9,3	5,32					
2003	5,8	5,62					
Current price		4,25	3,00				

As you can see from the table, some items (Cape Argus) have increased more than we may have predicted in terms of inflation, while other items (tuna) have not increased as much as we may have expected. This is because inflation measures the 'average' increase of the shopping basket.

2.8 How does inflation impact on your life? Answer this question by thinking about the cost of living (you may want to refer to the income expenditure statement you prepared in activity 1).

[1] Figures supplied by Statistics South Africa.

Shopping Basket		Price in Rands	
Item	**Category**	**1988**	**Current**
Jeans - Denim	C	39,95	
Ladies' Jackets (pastel shades)	C	19,99	
Ladies' Matching Skirts (to go with above)	C	19,99	
Ladies' Matching Slax (to go with above)	C	19,99	
Men's Suits - Mohair (Monatic), each	C	199,99	
Men's Suits - Pure Wool (Monatic), each	C	139,99	
Men's Suits - Wool & Trevira (Monatic), each	C	129,99	
Ceres fruit juice, 1 litre	G	1,29	
Coke, 2 litre	G	1,69	
Edib Sunflower Oil	G	1,58	
Eggs- large, 1doz.	G	1,66	
Frozen Turkeys (whole), per kg	G	4,68	
Klipdrif Brandy, 750 ml bottle	G	8,77	
Peaches - Koo, 410 g tin	G	0,69	
Peas (Helderberg), 410g tin	G	0,69	
Peas Frozen (I & J), 1 kg	G	3,69	
Picnic Shoulder Ham (DAK), 900 g tin	G	7,29	
Potatoes - Class 1 Medium, 5kg pocket	G	2,49	
Quality Street sweets, 1 kg	G	8,99	
Renown pork sausages, 500 g	G	2,49	
Salticrax - Pyotts, 200 g carton	G	0,99	
Sunshine D Margarine, 500 g block	G	1,58	
Tuna (P&P No Name), 200g tin	G	1,49	
Wine - Bellingham Johannesberger, 750 ml bottle	G	2,99	
Wine - Graca, 750 ml bottle	G	2,99	
Cape Argus	H	0,40	
Duvets, double - Trevira	H	39,99	
Duvets, single - Trevira	H	26,99	
Electric Auto Jug Kettle - 1,7 litre (Safeway De Luxe)	H	59,99	
Electric Fry Pan (Sunbeam Master Fryer)	H	79,99	
Electric Kettle - 2.2 litre	H	19,95	
Electric Sandwich Toaster (Safeway De Luxe)	H	49,99	
Electric Steam Iron (Salton Teflon coated)	H	34,95	
Electric Stove - 4 plate (Westpoint)	H	999,95	
Foreign Exchange - One £ UK Sterling	H	3,52	
Foreign Exchange - One US $	H	0,51	
Non Stick Frying Pan	H	14,65	
Engine Oil - Multigrade, 5 litre	M	8,95	
Tyres - Steel Radials (165 SR x 13), each	M	78,50	
Gym Shoes -Adidas Sportive	S	66,95	
Roller Skates - with boots	S	49,95	
Running Shoes - Reebok Royale	S	99,95	
Skateboard	S	19,99	
Tennis Balls - Slazenger, pack of 2	S	3,50	

Activity 3 — Analysing budgets

ABOUT THIS ACTIVITY

In activity 1 we looked at how statements are set out and how to read information from them. In activity 2 we looked at the effect that inflation has on the cost of items. In this activity we will combine the ideas learnt in the first two activities and explore how inflation plays a significant role in preparing and understanding budgets.

This activity addresses the following Specific Outcomes and Assessment Criteria: S.O.1 – AC 1,2,3,4,5; S.O.2 AC 1,2,4; S.O.3 – AC 1,3.

MANAGING THIS ACTIVITY

This activity allows learners to engage with the questions and express their views on the questions asked. Encourage learners to generate independent ideas and share these with each other, especially where there are opposing viewpoints.

3.1

	2001/2002	Percent increase/ decrease	2002/2003	Percent increase/ decrease	2003/2004	Percent increase/ decrease	2004/ 2005
Income							
National	248 362	12,14%	278 508	7,82%	300 299	8,88%	326 956
Great Styles			563 606	5,75%	596 008	24,51%	742 100
Expenditure							
National	262 888	10,89%	291 514	13,7%	331 512	10,16%	365 208
Great Styles			519 736	19,33%	620 177	8,92%	675 510

3.2 A percentage change tells you by what percentage a value has changed, not the amount of the change. The actual amounts are therefore irrelevant when calculating a percentage increase or decrease.

3.3 The income and expenditure increases are more varied for Great Styles. In both cases Great Styles has the largest and smallest percentage increases.

3.4 Great Styles is a small business and it is therefore quite possible that it experiences relatively large changes in its income and expenditure. It is not unusual for a small but growing business to experience changes far bigger than those experienced by Great Styles. On the other hand, the national budget is a massive budget and has been running for many years. There are therefore unlikely to be massive changes from year to year, so long as the interest rate remains at a low level. If the interest rate was very high this would naturally escalate both the income and expenditure proportionately.

3.5 The most significant difference is the 'capital expenses', although the other expenses have also increased from the previous year. The capital expenses could have increased for a number of different reasons, such as: purchase of new or additional equipment; expanding or modifying the salon; or painting and redecorating the salon.

3.6 Total income = R596 008; total expense = R561 853; net surplus = R34 155.
% increase in income: 5,75% (as given in 3.1)
% increase in expenditure: 8.1%
Although the expenditure is still greater than the income, it more closely resembles the national picture than the 19.33% previously calculated.

3.7 Either the stylists have been given a very large increase in their salaries or additional staff have been employed. The increase in salaries is 29%, which is significantly higher than the inflationary percentage for 2003 of 5.8%.

Get the learners to calculate the percentage increase and ask them if it seems a reasonable increase (let's hope that some of them will make the connection to activity 2).

The evidence therefore suggests that additional staff have been employed.

3.8 The electricity, stock charges and tea and coffee amounts have also risen significantly. These increases may all be evidence of more staff being employed by Great Styles.

The sale of hair products has risen sharply which might be as a result of more stylists promoting the products.

3.9 There is insufficient information to make definitive statements. The figures may suggest, though, that Great Styles has invested money into the business by acquiring more equipment and possibly expanding or improving the salon. They have also employed more staff in order to increase the income. As a result of the increase in the staff some of the expenditure items have also increased significantly, as discussed in 3.8.

3.10 The owners would naturally expect a capital expense, such as that in 2003, to have a positive effect on the business and increase its profitability.

Let us compare 2004 (post capital expenditure) with 2002 (pre capital expenditure). The profit has increased from R43 870 to R66 590. If we allow for the effects of inflation, R43 870 has the same value as R47 950 in 2003 (9.3% inflation in 2002) and R50 731.20 in 2004 (5.8% inflation in 2003).

After inflation the salon is better off by: R66 590 – R50 731 = R15 859. At this rate the salon will recover the amount spent on the 'capital expenses' in about four years. In addition, the capital expense may well result in continued growth for the salon. This seems to justify the expense.

3.11 We notice from the expenses column that there are no interest expenses in 2003 or 2004. This means that the business did not borrow the money from the bank in order to finance the capital expenses. It can therefore be assumed that the business had built up cash reserves which it was able to use to finance this deficit. Alternatively, the owners of the business may have funded the capital expenses from other personal capital investments.

3.12 Owing to the capital expenditure in 2003, it may be that there were many additional transactions going through the bank account resulting in additional bank charges.

Great Styles may also have changed their bank account to an alternative bank offering reduced banking charges.

3.13 According to these figures the industrial council decided not to increase the fees for 2003. There was, however, a budgeted increase of 10% in 2004.

3.14 This represents 0.05% of the salon's income for 2003 which is very small percentage. However, all sources of income must be recorded and declared to the Receiver of Revenue, regardless of how small the amount.

3.15 The profit is the figure recorded under 'net surplus / (deficit)'. It is calculated by subtracting the total expenses from the total income.

The profit can be increased by either increasing the income or decreasing the expenses.

3.16 The expenses will indeed be R5 000 less. This is, however, a rather simplistic view. By decreasing the amount you spend on these items you will be affecting the quality of the service that you provide. This in turn may result in a decrease in the number of clients and of the profitability of the business, quite possibly by more than R5 000.

Activity 3 — Analysing budgets

In activity 1 we looked at different representations of income and expenditure statements and budgets. In activity 2 we looked at inflation: what it is and the impact it has on the cost of living. In this activity we are going to revisit the income and expenditure statements and budgets of activity 1 in order to analyse them in terms of inflation.

3.1 Use the handouts from activity 1. Copy and complete the table below and calculate the percentage increase or decrease from year to year (see the sample calculation). We will take the 2002/2003 financial year on the national statement as being equivalent to the 2002 financial year on the Great Styles Salon statement (therefore 2003/2004 will be the equivalent to 2003, etc.)

	2001/ 2002	Percent increase/ decrease	2002/ 2003	Percent increase/ decrease	2003/ 2004	Percent increase/ decrease	2004/ 2005
Income							
National	248 362	12,14%	278 508				
Great Styles			563 606				
Expenditure							
National	262 888		291 514				
Great Styles			519 736				

Calculated as follows:

$$\frac{278508 - 248362}{248362} \times 100 = 12{,}14\%$$

3.2 You will recall from activity 1 that the amount 278 505 (income on the national statement for 2002/2003) represents R 278 505 000 000,00. The amount 563606 for the Great Styles Salon in the same year represents R563 606,00.

Does it matter that when we calculated the percentage increase/decrease in the table above we ignored this difference?

3.3 How does the annual percentage increase for income and expenses on the national budget compare with the income and expenses increases for the Great Styles Salon?

3.4 Does it seem reasonable that the percentage fluctuations in annual income and annual expenses for the hair salon are greater than the national budget? Give a reason for your answer?

3.5 Study the details of the financial statement for the Great Styles Salon. Why are the expenses for 2003 so much greater than those for 2002? What do you think these expenses could have been for?

3.6 If you remove the 'capital expense' cost from the 2003 column for the Great Styles Salon, what does the total income, total expense and net surplus / (deficit) become? Recalculate the percentage increase for the expenses in 2003 and compare it to the increase in the income for the same year. How do these compare now?

3.7 The stylists' salaries have increased quite significantly from 2003 to the budgeted figure for 2004. What are the possible reasons for this and which of these do you think is the most likely reason?

3.8 What other budgeted increases for 2004, for both income and expenses, support your answer to 3.7?

3.9 We are starting to gain interesting insights into the operations of Great Styles Salon. Look carefully at your answers to 3.5, 3.7 and 3.8. Also look once again at the income and expense figures for 2003 and 2004. What changes do you think may have taken place during 2003 and 2004 at the Great Styles Salon?

3.10 What is the expected financial result of the changes? Do you think the capital expenses in 2003 can be justified? Explain your answer carefully.

3.11 You will notice that the Great Styles Salon's financial statement suggests that they suffered a loss in 2003. How do you think they survived this?

3.12 Why do you think the bank charges in 2003 are more than the budgeted figure for 2004?

3.13 Do you think there is an error in the values specified for the 'industrial council and union fees'? What do you think the reason is for the values being the same in 2002 and 2003?

3.14 The 'student training allowance' is given to the salon by a training college as compensation for assisting with the training of students. What percentage of the salon's income does this amount represent in 2003? Do you think it is important to record such a relatively small amount?

3.15 How is the profit of Great Styles Salon calculated? What are the two ways in which the profitability of the business can be increased?

3.16 A colleague suggests decreasing the amount spent on stock, magazine subscriptions, tea and coffee and telephone by R5 000 in the next year, in order to increase the profits by R5 000. What do you think of this suggestion?

Activity 4 — Reading your pay slip

ABOUT THIS ACTIVITY
This activity looks at pay slips in detail and gives learners the opportunity of understanding the information that is provided on a pay slip. In addition, it shows learners how tax and commission is calculated based on income and takings.

This activity addresses the following Specific Outcomes and Assessment Criteria: S.O.1 – AC 1,2,3,4

MANAGING THIS ACTIVITY
This is a stand-alone activity and can be completed as part of a lesson or as self study. The facilitator will need to assist learners in understanding the principles behind the numbers, such as the necessity of the deductions and what the employee gets for these deductions.

4.1 Rose Ngwane.

4.2 This pay slip is for the month ending 31 May 2004. At the top right-hand corner of Rose's pay slip it states 'PERIOD END DATE: 31/05/2004'.

4.3 Rose has been working for Fringe Salon for 2 years and 1 month. At the top right-hand corner of Rose's pay slip, underneath the Period End Date, it states 'DATE ENGAGED: 01/05/2002'. This means that she has been employed there since 1 May 2002.

4.4 The first 6 digits of a person's ID number is that person's birth date. It states "ID NUMBER: 7505246578083" underneath the Date Engaged on Rose's pay slip. This means that 75/06/24 is Rose's birth date. Therefore, at the time of receiving this pay slip, Rose was about to celebrate her 29th Birthday.

4.5 Rose's income is made up of a basic salary, a commission and a retail (ret) commission.

4.6 The deductions are listed on the pay slip as: tax, UIF (Unemployment Insurance Fund), union fees, bargaining council, provident fund, sick benefit fund, sick fund.

4.7 R8 765.77 – as reflected next to 'NET PAY'.

4.8 According to handout 4.1, Rose is a stylist and has been in the employ of Fringe Salon for over 2 years. Accordingly, on handout 4.2, this would put her in the category 'Hairdresser Qualified Improved'.

4.9 The basic wage for this category is R2900 per month. However, Rose receives R4500 per month.
The basic wage is the minimum acceptable wage. In order to attract well-qualified and skilled employees, Fringe Salon is prepared to offer employees more than the basic wage. It may also be the Fringe Salon is situated in an affluent area which requires that the salon pays above the basic wage in order for employees to meet their increased personal expenses.

4.10 The employee is paying UIF on his/her basic salary. (R45,00 – 1% of R4 500,00)

4.11 The total company contribution is R486,00. Bearing in mind that Rose falls into the category 'Hairdresser Qualified Improved' Fringe Salon's contribution is made up as follows:

UIF	R45,00
Bargaining Council	R25,00
Contingency Fund	R73,00
Provident Fund	R174,00
Sick Fund Pay	R54,00
Sick Benefit Fund	R115,00
TOTAL	R486,00

4.12 The employee has not opted for the Sapmed Hospital Top Up Plan. As a result, Fringe Salon is not required to pay the employer contribution.

Rose may have decided against the top up plan as she is fairly young and therefore, we presume, reasonably healthy. As a result she may view the top up plan as an unnecessary expense at this stage in her life.

4.13 The commission payable is calculated as follows:

Operation	4.13.1	4.13.2	4.13.3
Gross takings	R30 000,00	R5 800,00	R22 355,28
Less VAT (14%)	R25 800,00	R4 988,00	R19 225,54
Less basic salary (R4 500)	R21 300,00	R488-00	R14 725,54
Stock deduction (15%)	R18 105,00	R414,80	R12 516,71
40% commission	R7 242,00	R165,92	R5 006,68

4.14

	4.14.1	4.14.2
Gross takings	R26 505,34	R26 505,34
Net takings (÷ 1.14)	R23 250,30	R23 250,30
Less basic salary (–R4500)	R18 750,00	R18 750,00
Less stock deduction	R15 000,00	R16 875,00
Total commission	R5 250,00	R8 437,50

4.15 The total earnings of R11 173,55 falls into the 11132 – 11181 category, for which the monthly tax payable is R1 952,78.

4.15.1 '10 582 – 10 631': R1 787,78

4.15.2 '13 382 – 13 431': R2 652,27

4.15.3 '15 482 – 15 531': R3 387,27

4.16 The year-to-date total will be made up of the tax paid in March and April as follows:

March: R2 177,78
April: R2 012,78
Total: R4 190,56

4.17 A 'tax year' runs from the beginning of March in one year until the end of February of the following year. The pay slip is for the month ending 31 May. The year-to-date totals therefore include March, April and May.

Activity 4 — Reading your pay slip

An employer is obliged to supply every employee with a pay slip at the end of each month. This pay slip must show the employee how his / her salary has been calculated.

In South Africa most hairdressing salons belong to the Employers' Association while most employees in the salons belong to a trade union, namely the United Association of South Africa (UASA). The Employers' Association and the union meet on an annual basis in the Hairdressing Bargaining Council to agree on the salary conditions for the industry. These conditions vary from town to town and region to region.

Answer the following questions relating to handout 4.1 – a pay slip for an employee of the Fringe Salon in Brackenfell.

4.1 What is the name of the employee?

4.2 For what month is the pay slip? Explain how you arrived at your answer.

4.3 How long has this employee been working for Fringe Salon? Explain how you arrived at your answer.

4.4 How old is the employee? Explain how you determined this.

4.5 Make a list of the different ways in which this employee earns money.

4.6 Make a list of the different deductions that the employer takes from the employee

4.7 How much does the employee actually receive in her bank account for the month represented by the pay slip?

Refer to handout 4.2 (Basic Wage Rates effective 1 April 2004, published by the Western Cape Hairdressing Bargaining Council) to answer the questions that follow.

4.8 What job category does the employee hold? How did you establish this?

4.9 What is the basic wage for this category of employee according to the basic wage schedule? What does the salary slip give as the basic salary for this employee? Why do you think these two amounts are not the same?

4.10 UIF stands for 'unemployment insurance fund.' 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 that: '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 one of its employees must be equal to 1% of the remuneration paid to that employee.'
By studying the pay slip, establish on what component of the earnings the employee is contributing UIF.

4.11 In the bottom left-hand corner of the pay slip you will notice the entry 'Co. Contribution'. This stands for 'company contribution.' By referring to the pay slip and the basic wage schedule, try to determine how the company contribution has been calculated.

4.12 What deduction(s) listed on the basic wage schedule (handout 4.3) has not been applied to this employee? Give a particular reason for this.

4.13 Study handout 4.4 (entitled Calculating Commission) to understand how the commission component of this employee's earnings has been worked out. Now determine the commission this employee would earn if her gross takings were:

4.13.1 R 30 000,00

4.13.2 R5 800,00

4.13.3 R22 355,28

4.14 Determine the commission the employee would earn for the gross takings on her pay slip if the salon:

4.14.1 deducted 20% for stock and paid 35% commission.

4.14.2 deducted 10% for stock and paid 50% commission.

4.15 Income tax is inevitable—we must all pay tax on the money we earn. To determine the tax payable by an employee, we refer to the tax tables (handout 4.5) to understand why this employee is paying R1 952,78 in taxes. What would the employee be paying in tax if her total earnings for the months had been:

4.15.1 R10 622,58.

4.15.2 R13 399,98.

4.15.3 R15 484,33.

4.16 If the employee's total earnings in March and April were R11 893,52 and R11 352,16 respectively, show how the tax component in the 'year to date' total has been determined.

4.17 Can you explain why the year-to-date totals refer to only three months, although this salary slip is not for March?

FRINGE SALON PTY LTD	EMP. CODE: 235	PERIOD END DATE: 31/05/2004
25 PERM STREET	EMP. NAME: ROSE NGWANE	DATE ENGAGED: 01/05/2002
BRACKENFELL 7561		ID NUMBER: 7505246578083
	JOB TITLE: STYLIST	

ADDITIONAL INFORMATION		EARNINGS		DEDUCTIONS	
BASIC SALARY:	4500.00	BASIC SALARY:	4500.00	TAX	1952.78
GROSS TAKINGS	26505.34	COMMISSION:	6375.10	UIF	45.00
		RET COMMISSION:	298.45	UNION	42.00
				BARG. COUNCIL	25.00
LEAVE DAYS DUE:	8			PROVIDENT FUND	174.00
				SICK BEN FUND	115.00
				SICK FUND	54.00
YEAR-TO-DATE TOTALS					
TAXABLE EARNINGS:	23245.68				
PERKS	0.00				
TAX	4190.56				
CURRENT PERIOD					
TOTAL PERKS:	0.00	TOTAL EARNINGS:	11173.55	TOTAL DEDUCTIONS	2407.78
CO.CONTRIBUTIONS	486.00				
				NET PAY	8765.77

BASIC WAGE RATES EFFECTIVE 1 APRIL 2004[1]

Job Category	Per Hour	Per Week	Per Month
Hairdresser Qualified Improved	14,88	670	2900
Hairdresser Qualified Trade Test 1st Year	10,47	471	2040
Hairdresser Effluxion of Time	9,09	409	1770
Operator	9,96	448	1940
Cleaner	7,18	323	1400
Receptionist First Year	8,82	397	1720
Receptionist Thereafter	11,60	522	2260

Apprentice/Learner Wages				
Part Time	Full Time	Per Hour	Per Week	Per Month
Until M1 Passed	First 3 months	6,36	286	1240
Until M2 Passed	After 3 months	6,62	298	1290
Until M3 Passed	After 6 months	7,18	323	1400
Until M4 Passed	After 9 months	7,44	335	1450
Until M5 Passed	After 12 months	8,00	360	1560
Until M6 Passed	After 15 months	8,67	390	1690
Until Trade Test Passed	After 18 months	8,82	397	1720
Unit Standard/Funded Learners Starting Wage		5,91	266	1150

"Full time apprentice" means an apprentice who has completed all 6 modules by attending college full time, prior to commencing employment. Such Apprentices are entitled to an automatic wage increase after every 3 months in employment.

Part time and casual employees are paid according to the hourly rate for their job category.

[1] These are the rates supplied by the Western Cape Hairdressing Bargaining Council. NOTE: the rates and deductions vary from one bargaining council to the next and so from one town to the next.

MONTHLY PAYMENTS/DEDUCTIONS EFFECTIVE 1 APRIL 2004

	Salary	Bargaining Council		Contingency Fund	Provident Fund	
		Employee	Employer	Employer	Employee	Employer
Hairdresser Qualified Improved	2900	25	25	73	174	174
Hairdresser Qualified Trade Test 1st Year	2040	25	25	51	122	122
Hairdresser Effluxion of Time	1770	25	25	44	106	106
Operator	1940	25	25	49	116	116
Cleaner	1400	25	25	35	84	84
Receptionist First Year	1720	25	25	43	103	103
Receptionist Thereafter	2260	25	25	57	136	136

UASA Trade Union R42 for all employees	EOHCB Employers' Organisation R132 per salon
Union membership is compulsory for all Learners/Apprentices while membership of the Funds is voluntary	

SICK PAY FUND			
Wage Band	Employee	Employer	Total
0 – 1500	27	27	54
1501 – 2000	32	32	64
2001 – 3000	38	38	76
3001 – 4000	48	48	96
4001 – 5000	54	54	108
5001 and more	65	65	130

SICK BENEFIT FUND			
	Employee	Employer	Total
Hairdresser Qualified and 1st Year Trade Test	115	115	230
Hairdresser Effluxion Time, Operator, Receptionist	92	92	184
Receptionist 1st Year, Cleaner and Learner	69	69	138

SAPMED HOSPITAL TOP UP PLAN				
Plan	Cover per Incident	Employee	Employer	Total
1	7500	108	62	170
2	15000	158	62	220
3	22500	238	62	300
4	30000	338	62	400
5	60000	398	62	460
6	150000	508	62	570
7	200000	582	62	660
Annual Limit: Plan 1 to 3 – R250 000/Plan 4 – R 350 000/Plan 5 – R400 000 Plan 6 – R650 000 Plan 7—R 1 000 000 Pregnancy R150				

CALCULATING COMMISSION

You will notice that more than half of the employee's earnings come from commission. 'Ret commission' stands for retail commission and is determined as a percentage of hair care product sales made by the employee. 'Commission' is based on the takings by the employee for hair treatments of all kinds. To determine the commission takes some calculations. The calculations will differ from one employee to the next within a salon because of their different employment contracts, and from one salon to the next since commission conditions are not governed by the basic wage agreement.

The calculations below show how the commission has been calculated for this employee:

- R 26 505,34 represents the gross takings by the employee—i.e. the total amount charged for hair treatments by the salon for work done by the employee.

- First the salon removes the VAT (14%) from this amount, since gross takings also include VAT.

  R 26 505,34 ÷ 1,14 = R 23 250,30

- Next, the salon takes away the basic salary earned by the employee since the employee only earns commission on takings that exceed her basic salary.

  R 23 250,30 – 4 500,00 = R 18 750,30

- This salon then deducts 15% for stock used by the employee in performing the treatments. Obviously the way stock value is calculated can and does vary from one salon to the next.

  R 18 750,30 × 0,85 = R 15 937,76

- Finally, the salon determines 40% of the amount remaining as the commission to be paid to the employee.

  R 15 937,76 × 0,40 = R 6 375,10

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MONTHLY DEDUCTION TABLE / MAANDELIKSE AFTREKKINGSTABEL

Remuneration Besoldiging	Annual Equivalent Jaarlikse Ekwivalent	Tax/Belasting Under 65 Onder 65	Tax/Belasting Over 65 Bo 65
10562 - 10631	127278	1787.78	1521.11
10632 - 10681	127878	1802.78	1536.11
10682 - 10731	128478	1817.78	1551.11
10732 - 10781	129078	1832.78	1566.11
10782 - 10831	129678	1847.78	1581.11
10832 - 10881	130278	1862.78	1596.11
10882 - 10931	130878	1877.78	1611.11
10932 - 10981	131478	1892.78	1626.11
10982 - 11031	132078	1907.78	1641.11
11032 - 11081	132678	1922.78	1656.11
11082 - 11131	133278	1937.78	1671.11
11132 - 11181	133878	1952.78	1686.11
11182 - 11231	134478	1967.78	1701.11
11232 - 11281	135078	1982.78	1716.11
11282 - 11331	135678	1997.78	1731.11
11332 - 11381	136278	2012.78	1746.11
11382 - 11431	136878	2027.78	1761.11
11432 - 11481	137478	2042.78	1776.11
11482 - 11531	138078	2057.78	1791.11
11532 - 11581	138678	2072.78	1806.11
11582 - 11631	139278	2087.78	1821.11
11632 - 11681	139878	2102.78	1836.11
11682 - 11731	140478	2117.78	1851.11
11732 - 11781	141078	2132.78	1866.11
11782 - 11831	141678	2147.78	1881.11
11832 - 11881	142278	2162.78	1896.11
11882 - 11931	142878	2177.78	1911.11
11932 - 11981	143478	2192.78	1926.11
11982 - 12031	144078	2207.78	1941.11
12032 - 12081	144678	2222.78	1956.11
12082 - 12131	145278	2237.78	1971.11
12132 - 12181	145878	2252.78	1986.11
12182 - 12231	146478	2267.78	2001.11
12232 - 12281	147078	2282.78	2016.11
12282 - 12331	147678	2297.78	2031.11
12332 - 12381	148278	2312.78	2046.11
12382 - 12431	148878	2327.78	2061.11
12432 - 12481	149478	2342.78	2076.11
12482 - 12531	150078	2357.78	2091.11
12532 - 12581	150678	2372.78	2106.11
12582 - 12631	151278	2387.78	2121.11
12632 - 12681	151878	2402.78	2136.11
12682 - 12731	152478	2417.78	2151.11
12732 - 12781	153078	2432.78	2166.11
12782 - 12831	153678	2447.78	2181.11
12832 - 12881	154278	2462.78	2196.11
12882 - 12931	154878	2477.78	2211.11
12932 - 12981	155478	2494.77	2228.10
12982 - 13031	156078	2512.27	2245.60
13032 - 13081	156678	2529.77	2263.10

Remuneration Besoldiging	Annual Equivalent Jaarlikse Ekwivalent	Tax/Belasting Under 65 Onder 65	Tax/Belasting Over 65 Bo 65
13082 - 13131	157278	2547.27	2280.60
13132 - 13181	157878	2564.77	2298.10
13182 - 13231	158478	2582.27	2315.60
13232 - 13281	159078	2599.77	2333.10
13282 - 13331	159678	2617.27	2350.60
13332 - 13381	160278	2634.77	2368.10
13382 - 13431	160878	2652.27	2385.60
13432 - 13481	161478	2669.77	2403.10
13482 - 13531	162078	2687.27	2420.60
13532 - 13581	162678	2704.77	2438.10
13582 - 13631	163278	2722.27	2455.60
13632 - 13681	163878	2739.77	2473.10
13682 - 13731	164478	2757.27	2490.60
13732 - 13781	165078	2774.77	2508.10
13782 - 13831	165678	2792.27	2525.60
13832 - 13881	166278	2809.77	2543.10
13882 - 13931	166878	2827.27	2560.60
13932 - 13981	167478	2844.77	2578.10
13982 - 14031	168078	2862.27	2595.60
14032 - 14081	168678	2879.77	2613.10
14082 - 14131	169278	2897.27	2630.60
14132 - 14181	169878	2914.77	2648.10
14182 - 14231	170478	2932.27	2665.60
14232 - 14281	171078	2949.77	2683.10
14282 - 14331	171678	2967.27	2700.60
14332 - 14381	172278	2984.77	2718.10
14382 - 14431	172878	3002.27	2735.60
14432 - 14481	173478	3019.77	2753.10
14482 - 14531	174078	3037.27	2770.60
14532 - 14581	174678	3054.77	2788.10
14582 - 14631	175278	3072.27	2805.60
14632 - 14681	175878	3089.77	2823.10
14682 - 14731	176478	3107.27	2840.60
14732 - 14781	177078	3124.77	2858.10
14782 - 14831	177678	3142.27	2875.60
14832 - 14881	178278	3159.77	2893.10
14882 - 14931	178878	3177.27	2910.60
14932 - 14981	179478	3194.77	2928.10
14982 - 15031	180078	3212.27	2945.60
15032 - 15081	180678	3229.77	2963.10
15082 - 15131	181278	3247.27	2980.60
15132 - 15181	181878	3264.77	2998.10
15182 - 15231	182478	3282.27	3015.60
15232 - 15281	183078	3299.77	3033.10
15282 - 15331	183678	3317.27	3050.60
15332 - 15381	184278	3334.77	3068.10
15382 - 15431	184878	3352.27	3085.60
15432 - 15481	185478	3369.77	3103.10
15482 - 15531	186078	3387.27	3120.60
15532 - 15581	186678	3404.77	3138.10

R10582 — R15581 TABLE / TABEL C

RIGLYNE VIR WERKGEWERS SARS

Activity 5 — Inflation Revisited

ABOUT THIS ACTIVITY

This activity enables learners once again to interact with the important concept of inflation. We look at a case study of what can happen when inflation gets out of control. The concepts learned are then applied to the running of a hair salon.

This activity addresses the following Specific Outcomes and Assessment Criteria: S.O.2 AC 1,2,3,4; S.O.3 – AC 1,2,3.

MANAGING THIS ACTIVITY

Learners should be given the article entitled 'Zimbabwe shuts schools over fee hikes'. Once the learners have had an opportunity to read the article, engage them in a discussion of their responses to and opinions of the article.

5.1 Most people can remember what the cost of a packet of sweets or chips used to be. The further back that learners can remember, the more dramatic the price rise is likely to be. Point out the importance of taking the time frame into account. A dramatic price rise in a short time frame will equate to a large annual percentage increase.

5.2 The fee increases are exceptionally high. From our perspective in South Africa the fee increases are unheard of. No South African would be prepared to accept a three, four or five-fold fee increase in an eight-month period.

5.3 If the expenses remained the same, including the teachers' salaries, then the net surplus would increase significantly.

5.4 According to the article, in January 2003 it stood at around 200%. In April 2004 it was a staggering 583.7%!

5.5 This would only ease the economic hardship on parents if their salaries had been increased during the same time period. If the school fees remained the same and their salaries had not increased they would not feel any effect. However, if school fees were frozen and their salaries continued to rise in line with inflation they would be economically better off.

5.6 With inflation running at such extreme levels this ruling would have an enormous effect on the schools. Firstly, teachers would be requiring (if not demanding) higher salaries in order for them to survive in such economic conditions. This would result in a significant increase in the schools' expenditure. In addition, all other items that a school purchases would have increased in cost and this would also add to overall expenditure. If the income remained exactly the same it is unlikely that a private school would be able to survive under those conditions for very long, unless it had significant cash reserves. Regardless of how long they would be able to survive the quality of the service provided would necessarily decrease, as they would no doubt be attempting to reduce their expenses by any means possible.

5.7 As explained above, unless their income is also increasing at the same rate as inflation, families and schools will be left with a reduced net surplus if not a deficit. This will reduce their buying power and increase their economic hardship.

5.8 It doesn't seem reasonable in an environment where inflation is running at such extremely high levels.

5.9 If we ignore the other factors that would be at play in running a hair salon, inflation will have the effect of pushing up the cost of the expenditure items. Items such as salaries, rent, stock, telephone, electricity, insurance, magazines and all capital expenses will be affected by inflation.

5.10 Clients would expect the prices to go up as they are used to seeing the prices of all items and services increasing. They would, however, only be prepared to pay more if their income had also increased. If their income had increased by more than the percentage increase of the hair procedure, they would be pleased with their increased 'net surplus'.

5.11 No. The inflationary percentage is an average percentage increase for a number of different products. The items mentioned in 5.9 will all be affected differently; however, you wouldn't expect any of the increases to be significantly more or significantly less than the average inflation for the year.

5.12 Advantages: This is an easy way to calculate the new prices. It should also be a reasonably accurate method as your expenditure should increase by approximately the same inflationary percentage. Your clients will not end up paying more for their hair procedures in 'real terms'. By real terms we mean the cost of an item / service after the effect of inflation has been taken into account.

Disadvantages: This method doesn't take into account the fact that some of your large expenses may increase by more than inflation. If, for example, your rent is increased at significantly more than inflation and you don't take this into account, your net profit will be adversely affected. This method also doesn't take into account what your clients can afford. If they were finding your prices expensive in the past and their incomes have not increased in real terms, you may lose clients by pushing up your prices in line with inflation.

5.13 If the clients had received inflationary increases, and the salon increases its prices by the same inflationary percentage, the clients will not be affected.

If the clients have received above inflationary increases they will be more than happy as their hair procedures will now be using a smaller percentage of their income, leaving them with more over each month in real terms.

The converse is true if clients get below inflationary increases or lose their jobs. Having to pay for more expensive hair procedures will then have a negative effect on their financial position.

5.14 If they increase their prices by significantly more than inflation they run the risk of losing clients who are not prepared to pay for procedures at what clients may consider to be over-inflated prices.

If they increase their prices by significantly below inflation they run the risk of reducing their profits. Their expenses will increase by approximately the inflation percentage and their income may not necessarily be able to cover the expenses. On the other hand, keeping prices low may well attract more clients.

5.15 The hair salon needs to take into account the national inflationary figure. They should use this as a guide when recalculating their prices for the new year. In addition, the salon should take into account the personal circumstances of their clientele. If, for example, they are operating in an area of high unemployment or low wage increases they need to be very aware of the cost of their procedures.

5.16 The salon should start by looking at the country's inflationary percentage – as published by Statistics South Africa. They should also consider their average client's financial position. Lastly they should consider how well the salon is doing. If the salon can afford to lose some clients they could try pushing up the prices to what they think most people would still be willing to pay. If, however, the salon needed more clients to stay in business modest increases should be made.

5.17 As explained in 5.16, if a salon needed to increase client numbers price decreases might be necessary. Also, additional competition may result in the salon having to reduce prices. If the quality of the services had been reduced clients would also not be prepared to pay as much and this may require a reduction in the prices.

Activity 5 — Inflation revisited

In order to understand how inflation can dramatically affect prices, we will study an example of inflationary effects in Zimbabwe schools.

Read through the extract headed 'Zimbabwe shuts private schools over fee hikes' (handout 5) and answer the questions that follow.

5.1 Education Minister Chigwedere states that some schools had 'trebled, quadrupled and quintupled fees since September' (a period of approximately eight months). What is the most dramatic price rise for an item or service that you can recall (it may help to think back to the table you completed in activity 2).

5.2 Do you think it sounds reasonable for a school to increase its fees by that amount in such a short space of time?

5.3 If the schools' expenses remained the same during the eight month period, what would be the effect on the schools' profits?

5.4 What was Zimbabwe's annual inflation figure in January 2003 and in April 2004? Note: Annual inflation is often referred to by the symbols CPIX (computer price index excluding mortgage rates) or CPI (consumer price index).

5.5 According to the article, in January 2003 the government froze all school fees in order to 'ease economic hardship.' Under what personal circumstances will this ruling ease the economic hardship of parents? Under what conditions will it have no effect?

5.6 What effect would this ruling have on schools and the quality of the service that they would be able to provide?

5.7 Explain the economic effect on schools and families when inflation is running at 583.7%

5.8 What do you think about Mr Chigwedere's decision to close schools down because some schools had 'trebled, quadrupled and quintupled fees since September'?

Let us now consider how inflation could affect the running of a hair salon.

5.9 In what ways will inflation affect the running of a hair salon? Mention as many items as you can think of that will be affected by inflation.

5.10 Will clients be prepared to pay more for hair procedures in a year's time compared to what they are currently paying? Give a reason for your answer?

5.11 Will all the items mentioned in 5.9 increase by the same inflationary percentage?

5.12 What are the advantages and disadvantages for a salon of calculating its new price list by multiplying all the procedures by the annual inflationary percentage?

5.13 If the salon was to adopt the approach suggested in 5.12, what are the three possible effects that this could have on their clients' financial position. You should consider whether their clients have received above inflation, below inflation or inflationary salary increases.

5.14 What are the potential problems which the hair salon may experience if it increases prices by significantly more or significantly less than inflation?

5.15 In what ways do the national economy and the clients' personal financial situations affect the pricing of procedures in a hair salon?

5.16 Every year a hair salon calculates its new price list in December for the following year. How would you suggest they go about doing this?

5.17 Is it possible that prices for hair procedures might need to be reduced? If so, what reasons could there be for reducing prices?

CAPE TIMES

May 5, 2004

Zimbabwe shuts private schools over fee hikes

HARARE — Zimbabwe police yesterday shut down 46 private schools over a fee hike dispute as the education minister branded them "racist" institutions trying to keep out blacks by being prohibitively expensive.

Education Minister Aeneas Chigwedere said he had instructed that 46 schools which raised fees without government approval be closed as the new mid-year term began.

He said the schools, some of which had "trebled, quadrupled, quintupled" fees since September last year, would remain shut until the issue was resolved.

Some schools are charging tuition fees of up to 30 million dollars (R38 313) per annum.

"We are dealing with racist schools. They are all former white schools — all racist," Chigwedere told state television yesterday.

"They throw Africans out simply by hiking fees," he said.

The state-run Herald Daily said at least 30 000 pupils would be affected by the closures.

In his Independence Day address recently, President Robert Mugabe also slammed the fee hikes.

"Our principal goal of attaining education for all appears to be in real jeopardy with some schools charging as much as 10 million dollars a term," Mugabe said.

Yesterday, scores of parents and children were seen standing outside a school close to Mugabe's official residence while half-a-dozen police officers kept guard at the gate.

At a school in Harare's plush suburb of Borrowdale, parents were telephoned about two hours after they had dropped off their children for day one of the term to come and collect them.

"Police instructed us to close the school until an agreement has been reached between the school and the ministry.

"We could re-open within a week," said an official at the school.

"It's very inconveniencing. It's frustrating," said a parent collecting her daughter.

Another angry mother said: "This is a private school. I don't know what government has to do with this. We had a meeting as parents and we agreed on a 94% increase, but government decides to close it."

"It's traumatic. My daughter was crying after we were turned back. She is confused. She does not understand what is happening," another parent said.

Other schools only stuck notices on their gates that they had been closed until further notice, while another had informed parents on Monday not to bother bringing their children to school on Tuesday.

In January last year, when inflation stood at around 200%, the government froze all school fees in wide-ranging price controls that it said were aimed at easing economic hardship.

Boarding schools complained that without fee increases they would not be able to feed children.

Annual inflation last month stood at 583.7%.

For years, Zimbabwe's education system was widely considered among the best in the region. In 2002, police reported that at least 30 schools were closed in two southern districts of Zaka and Bikita, after teachers refused to work for fear of being attacked during the political violence that marked the run-up to presidential polls. — Sapa-AFP

Activity 6 — Preparing budgets

ABOUT THIS ACTIVITY

This activity is designed to be used as an assessment activity. It is intended to recap principles that have been learnt in the first 5 activities. There is an opportunity for learners to make their own judgments about how a business develops and to draw up a budget accordingly. If time allows it may be worthwhile for learners to share their budgets with each other, explaining the reasons behind their decisions.

This activity addresses the following Specific Outcomes and Assessment Criteria: S.O.1 – AC 1,2,3,4,5.

MANAGING THIS ACTIVITY

6.1

Description	Cost	Number performed	Income
Pre-school cut	R25-00	218	R5 450
Girls' cut	R45-00	178	R8 010
Boys' cut	R35-00	133	R4 655
Gents' haircut	R55-00	102	R5 610
Gents' beard trim	R20-00	8	R160
Ladies' cut and blow dry	R85-00	234	R19 890
TOTAL			**R43 775**

6.2 Total expenses add up to R23 924.

6.3

	Actual 2003/4	Budget 2004/5
INCOME		
Haircuts and procedures	43 775	
TOTAL INCOME	**43 775**	
EXPENSES		
Salaries and wages	18 000	
Basic equipment	5 145	
Hairdresser's chair	1 300	
Coffee table	828	
Bank charges	783	
Capital expenses	7 273	
Advertising	2 450	
Appointment cards	500	
Magazines & newspapers	380	
Pictures & flowers	1 200	
Cleaning equipment	625	
Stock charges	9 178	
Sweets	259	
Telephone	2 276	
TOTAL EXPENSES	23 924	
NET SURPLUS (DEFICIT)	1 851	

6.4 This requires a personal judgment to be made which may be different for different learners. One response may be that the business is doing well as Cutting Waves has only been going for 8 months and is already fairly busy. Others may say that making a profit of less than R20 000 after 8 months of hard work is not a good return.

6.5 The following items are unlikely to be repeated: Coffee table, hairdresser's chair, basic equipment, advertising board, magazine table, telephone installation.

6.6 Consumable items are items that are used up over a period of time, such as stock items eg shampoo, conditioner, washing powder, etc.

6.7 Stock items, appointment cards, cleaning equipment, sweets.

6.8 There may be, as these items will not necessarily all be used up on 28 February.

6.9 This means that you may not need to purchase any more of that item during the new business year or you may require a smaller amount as you are starting the year with an existing amount.

6.10 Hopefully, learners will have positive outlooks about potential growth in the business. The fact that Cutting Waves needs to employ additional help is a good sign for the future of the business.
It would be a good idea to get learners to be specific about how they see things developing. How many procedures - and how did they get to these totals? Will additional staff be required?

6.11 For each additional stylist employed, Cutting Waves will need an extra hairdresser's chair. The salon will also need additional mirrors, scissors, combs, towels, etc. They would need to ensure that there are enough basins to handle the clients. In addition Cutting Waves may wish to consider expanding its range of services offered, which would require the purchase of additional equipment such as drying hoods.

6.12 As Cutting Waves is still in its infancy and not yet making large profits, it would be best to pay a new employee the basic wage rate and offer a commission, which would work as an incentive to her. The basic wage rate for a hairdresser who has passed her trade test is R2040 per month.

6.13 A deduction of 20% for stock and a commission of 35% could be offered. A higher commission rate could be offered if takings are over a certain amount. This would act as an incentive to reach targets.

6.14 Learners should prepare their own budgets and should be able to explain their expenses and income statement to each other.

6.15 No, the items will not necessarily go up by the same percentage.

6.16

Description	Cost in previous year	Current price	% Increase/ (decrease)
Scissors	R78,95	R85,49	8,3
Mirror	R159	R175	10,1
Shaver	R385	R418	8,6
Hair dryer	R425	R379	(10.8)
Hairdresser's chair	R1 300	R1 550	19,2

6.17 The hair dryer might be reduced due to it being on sale or old stock.

6.18 The calculation for Sampa's commission should include these steps:

Gross takings	R11 405
Net takings (÷ 1.14)	R10 004,39
Less basic salary (–R2 040)	R7 964,39
Less stock deduction (20%)	R6 371,51
Total commission (35%)	R2 230,03

Activity 6 — Preparing budgets

You started running a haircutting business, Cutting Waves, from home eight months ago. It's the end of the tax year, 28 February, and it's time for you to complete your first income and expenditure statement for your first year in business.

Your records reveal the following information:

- Cuts and procedures you have performed:

Description	Cost	Number performed
Pre-school cut	R25,00	218
Girls' cut	R45,00	178
Boys' cut	R35,00	133
Gents' haircut	R55,00	102
Gents' beard trim	R20,00	8
Ladies' cut and blow dry	R85,00	234

- You have made the following payments and purchases for the business:

Description	Payment amount
Personal salary	R18 000
Scissors, combs, hairdryers, mirrors & other basic equipment	R5 145
Hairdresser's chair	R1 300
Shampoos, conditioners and other stock items	R9 178
Advertising boards and adverts in local newspapers	R2 450
Telephone installation, rental and calls	R2 276
Appointment cards	R500
Pictures and flowers	R1 200
Magazines and newspapers	R380
Coffee table	R828
Cleaning equipment	R625
Bank charges	R783
Sweets for children	R259

6.1 What is the total income for Cutting Waves since you started the business?

6.2 What is the total expenditure for Cutting Waves?

6.3 Prepare an income and expenditure statement for Cutting Waves for the past year up to the end of February. What is the net surplus / deficit? You may wish to refer to the income and expenditure statement for the Great Styles Salon in activity 1 to assist you.

6.4 How well do you think the business is going at this stage? Why do you say this?

6.5 What items under your expenditure column are unlikely to be repeated again next year if you were to continue running the business from home?

6.6 What are consumable items?

6.7 What are the consumable items that you have purchased?

6.8 Is there a difference between the amount of these items bought and spent on these items and the amount used?

6.9 How will this affect the amount that you will need to spend on these items in the next year?

You have been so busy running the salon that you have not made the time to prepare a budget for the next year … now is the time! Although the business started slowly it has been very busy in the past few months. In fact, you have been turning people away because you can't keep up with the demand. You realise that you need help to run the salon in order to satisfy the demands of your customers. In quiet times, it will free you up to organize the banking, place orders for stock and other consumables and conduct many of the other tasks that you have been too busy to get around to. You therefore decide to advertise for a newly qualified stylist who will be paid a basic salary plus a commission based on the takings for all hair treatments performed by her.

In order to answer the next few questions you will need to make several assumptions about your business and the way you expect it to develop.

6.10 Write down what your assumptions are for how the business will develop in the next twelve months.

6.11 Are there any capital expenditure items that you will require?

6.12 What basic salary will you pay your employee? You may wish to refer to the basic wage rates handout in activity 4 to assist you in your decision.

6.13 How will you calculate her commission (you may wish to refer to the Calculating Commission handout in activity 4 as a starting point.

6.14 Now, prepare a budget for Cutting Waves for the next year based on your answers to the questions above. Include your figures next to the actual figures for the previous year that you prepared in answer to 6.3.

You have had an excellent response to your advert and have appointed a newly qualified stylist called Sampa Tyles. Before Sampa arrives you need to purchase some new items for the salon. The current prices and last year's prices are recorded below.

Description	Cost in previous year	Current price
Scissors	R78,95	R85,49
Mirror	R159	R175
Shaver	R385	R418
Hair dryer	R425	R379
Hairdressers chair	R1 300	R1 550

6.15 Do you think that all items have increased by the same percentage?

6.16 Calculate the percentage change in the cost of the items since the previous year.

6.17 What possible reasons are there for the price of the hair dryer to decrease?

6.18 Sampa's first month of employment is drawing to a close and you now need to calculate her earnings. What is her commission if her gross takings for March are R11 405. Cutting Waves deducts 25% for stock and Sampa earns 35% commission.

Activity 7 — Buying items on hire purchase

ABOUT THIS ACTIVITY
In this activity we expose learners to the different payment options available when purchasing items on credit. We also consider the various factors at play when deciding which option is most suitable.

This activity addresses the following Specific Outcomes and Assessment Criteria: S.O.2 AC 1,2,4

MANAGING THIS ACTIVITY
The discussion could be started by asking learners what items they have previously purchased on credit, their reasons for purchasing on credit and their thoughts on whether it was a financially sensible payment method.

7.1 R15 870 (remember to calculate for 4 pairs of scissors and 2 hair dryers)

7.2 A full payment in cash could be made.
A portion could be paid as a deposit up front and the remainder borrowed as a loan.
The full amount could be borrowed as a loan.

7.3 Hair Supply requires a 20% payment up front. In effect the loan from them is less than it would be from the bank, which doesn't require any payment up front.

7.4 R16 695,24 (20% of R15 870 + 6 monthly installments of R2 253,54)

7.5 The additional cost represents extra income for Hair Supply. Because you are not paying cash up front, there are additional administration tasks that need to be carried out by Hair Supply for which they need to receive payment.

Furthermore, due to the effect of inflation the value of the money is depreciating. In order to negate this effect Hair Supply will charge interest on money they loan you, meaning that the total payable will be more than the initial purchase price.

7.6 The total repayments amounts are made up of 20% of the purchase price as well as monthly installments.

6 months	12 months	18 months	24 months
R16 695,24	R17 359,92	R18 205,44	R18 832,08

7.7 The longer the period of the loan, the larger the total repayment amount. Due to inflation, the amount that needs to be repaid will increase with time.

7.8 If you repay the loan over six months the repayment amounts are greater each month. This means you will have less money available for other requirements that your salon may have.

The advantage is that you will not pay as much for your purchases. At current inflationary figures (of 4.5%) R16 695,24 will be the equivalent of R17 834,75 in 18 months' time. This gives a saving of over R1 000 by paying the loan over a shorter period. In addition, by paying off the loan more quickly you will sooner be in a position to direct the additional cash (as a result of not needing to pay off the Hair Supply loan each month) into other areas of the business where it may be needed.

7.9 The total repayments amounts to the bank are made up purely of monthly instalments.

6 months	12 months	18 months	24 months
R16 856,16	R17 732,64	R18 637,92	R19 572,00

7.10 The amount paid to the bank is greater than that paid to Hair Supply. Hair Supply has taken a 20% deposit up front which means that the effective size of the loan is less with Hair Supply compared to the bank. As a result the total repayment will be higher to take account of the inflationary depreciation effect on a larger amount borrowed.

7.11 Hair Supply requires an up front payment of R3 174 which the bank doesn't require. This amount could be difficult for the business to afford in one payment as the business is relatively new. In addition there may be a large rent payment required as well as a deposit of a month's rent on the rental agreement. As a result of the greater amount being borrowed from the bank, the depreciation will be larger over time — owing to inflation. The total repayment will therefore be higher to take this into account.

7.12 Paying with cash is the most economical way of paying for an item. Always buying with cash avoids getting into large debt, with the associated monthly repayments to meet.

The downside of buying with cash is that you obviously need to have the funds up front, which is not always possible or practical. Spreading payments over a period of time can help you to budget on a monthly and annual basis, as the cost of items is spread evenly over the time period.

7.13 They should look carefully at their projected cash requirements. If after thorough analysis there is sufficient cash available to purchase items with cash, then that it the most desirable option. However, anyone running a business needs to be aware of the problems that can arise from having no cash available to meet daily running cost requirements.

Activity 7 — Buying items on Hire Purchase

When purchasing expensive items, we may not necessarily be able to afford the total amount payable. However, a variety of payment options is usually available to us.

When purchasing a house, for example, very few people have sufficient funds to be able to pay cash for the purchase. They will need to borrow money from the bank in order to pay the purchase price of the house. An agreement will need to be reached between the purchaser and the bank as to how much money is going to be borrowed, over what time period the borrower must pay it back and what the interest rate is going to be. The agreed repayment period for purchasing a house is usually between 20 and 30 years. When purchasing items from a furniture store or a home appliance store the repayment periods are likely to be shorter, often 24 months, and the interest rate charged by the store is often higher than you would pay if you borrowed money for a house.

Before we consider the following scenario:

You have been running a hair salon from home for a few months and so far you have been offering a limited range of services. Your business is doing well and you have decided to rent some shop space in a busy shopping mall. You would like to expand the range of services you offer and therefore need to purchase some equipment. The items that you are considering purchasing from the supplier, Hair Supply, for your new salon are as follows:

Item	Quantity required	Cost of each item
Steamer	1	R5540
Hood dryer	1	R4495
Hairdresser's basin	1	R3700
Hair dryer	2	R485
Scissors	4	R135
Ceramic straightener	1	R625

7.1 What is the total value of items purchased from Hair Supply?

7.2 What are the different possible ways in which you could pay for your purchases?

Hair Supply is prepared to sell you the equipment provided you pay them 20% of the total purchase price up front and sign an agreement to pay back a certain amount to them each month. The table below shows the monthly repayment amounts for the above purchases, less the 20% already paid.

6 months	12 months	18 months	24 months
R2253,54 pm	R1182,16 pm	R835,08 pm	R652,42

Another alternative is to borrow the total amount from the bank and to pay Hair Supply in full with the bank's money. The repayments to the bank are at the same interest rate as they would have been to Hair Supply and will be as follows:

6 months	12 months	18 months	24 months
R2809,36 pm	R1477,72 pm	R1035,44 pm	R815,50 pm

7.3 Why are the repayments to the bank higher than they are to Hair Supply, even though they are both charging you interest at the same rate?

7.4 Calculate how much you will pay Hair Supply in total if you pay for your purchases over 6 months.

7.5 Why is this amount more than if you had paid Hair Supply in full when you initially purchased the items? What does Hair Supply do with the extra money they receive?

7.6 Calculate how much you will end up paying Hair Supply in total, if you pay for your purchases in 6,12,18 and 24 months respectively.

7.7 Do you notice a trend in 7.6? Can you think of possible reasons for this trend? Hint: It will also be helpful to think back to the previous two activities on inflation.

7.8 Discuss the advantages and disadvantages of paying the amount owing over 6 months compared to 24 months.

7.9 Calculate how much you will end up paying the bank in total if you pay for your purchases in 6,12,18 and 24 months respectively.

7.10 Compare your answers from 7.6 and 7.9. Why do you think the total amounts are different for the two options, even when the repayment periods and the interest rate used are exactly the same?

7.11 Discuss the advantages and disadvantages of borrowing the money from Hair Supply, rather than using the bank.

7.12 If you had the cash available to pay for your purchases without needing to borrow money from either Hair Supply or the bank, what advantages would there be to paying with cash? What negative effects could this approach have on your business?

7.13 If a friend were looking to start up a business with limited cash available, how would you suggest they finance the required purchases?

Activity 8 — Making foreign purchases

ABOUT THIS ACTIVITY

In this activity we consider the effect of exchange rates on the cost of purchasing items from foreign countries. We also look at different purchasing options, considering whether to buy in bulk or in smaller quantities as funding allows. This activity addresses the following Specific Outcomes and Assessment Criteria: S.O.3 – AC 1,3.

MANAGING THIS ACTIVITY

In order to prepare for this activity ask learners to track various exchange rates over a period of days, or preferably weeks. This should give them an indication that exchange rates are continuously changing, although at times these changes may be very small. This could lead to discussion about how a strengthening or weakening rand affects the cost of imports and exports.

8.1 Monday. You will have to pay fewer rands for a euro on Monday than at any other time during the given week.

8.2 For the chair costing €124-95 the rand values are as follows:

Monday	Tuesday	Wednesday	Thursday	Friday
R998,35	R1023,34	R1034,59	R1049,58	R1068,32

As expected, Monday would have been the best day for the purchase. These are the actual figures for 5 – 9 January 2004. You could point out to learners what the overall effect actually was i.e. a 7% difference in 5 days!

8.3 This question is fairly open-ended with little information having been given at this stage. It is intended to gain information on learners' perceptions at this early stage.

If you purchase one chair per month, you reduce the risk of buying at an extremely bad time as far as exchange rates are concerned. As we will discover later, though, the additional charges become quite significant when purchasing one at a time.

It is also almost impossible to predict what will happen with the exchange rates in the future. You can't therefore say with too much conviction whether it is currently the best time to purchase from overseas or not.

8.4 There is no way of telling from the information given. It looks at though the rand is depreciating (very quickly), but it would still be difficult to make a judgment for February and impossible to say anything for June.

8.5 For much of 2003 the exchange rate was higher than it was during the first week in January 2004. This means it would have been more expensive during most of the previous year to purchase items from Germany. Judging from the graph, January 2004 is a reasonably good time to be purchasing items from Europe although it would have been better to have done it a month earlier.

8.7 If the current exchange rate is higher than the figures presented in the table for January 2004, then it will be more expensive to purchase from overseas and (vice versa).

8.8 In our calculations we have used an exchange rate of R8,00 to the euro. It is recommended, however, that learners use the prevailing exchange rate (obtained in 8.6) for their own calculations.
Direct cost: €124,95 × 8-00 = R999,60
Shipping & packaging: €9,50 + €3,50 = €13,00 = R104,00
Total cost to German chair company: = R1103,60

8.9 Bank charges: R85 + 1.5% of R1 103-60 = R101,55

8.10 Total Cost for one chair: R101,55 + R1 103,60 = R1 205,15
Total cost for 6 chairs: R 1 205,15 × 6 = R7 230,90

8.11 Once again we will use R8,00 to the euro (although you should work with the current exchange rate).

Cost for six chairs:	6 × €124,95 = €749,70 6 × R999,60 = R5997,60
Shipping & packaging:	€9,50 +7 × €3,50 = €34,00 = R104,00
Total cost in euros:	€749,70 + €34,00 = €783,70
Total cost in rands:	€783,70 × 8 = R6 269,60
Bank charges:	R85 + 1.5% of R6 269,60 = R179,04
TOTAL COST:	R179,04 + R6 269,60 = R6 448,64

8.12 To purchase the chairs one at a time, at the same exchange rate, would cost R782,26 more. The difference is as a result of the reduction in per chair cost for shipping & packaging and bank charges when buying more than one chair at a time.

8.13 Advantages: The cost for shipping & packaging and bank charges is reduced per chair for the bulk purchase. You also know exactly how much the purchase will cost you, unlike when you purchase over six months where the exchange rate could change against you.

Disadvantages: If the exchange rate does improve you will not be able to take advantage of the improvement. The bulk purchase will also require you to have all the money available up front, whereas if you purchase one chair at a time you are able to spread the payments out over several months.

Activity 8 — Making foreign purchases

Businesses sometime require a product that is not available in South Africa. In addition, a product can at times be purchased more cheaply from overseas than locally. As there are many different currencies being used internationally it is necessary to convert costs in foreign currencies into a cost in rands.

Consider the following scenario:

Your salon wishes to purchase a new design of hairdressing chair which is available only in Germany. This chair is far more comfortable than the locally-produced chairs and you think it may even be cheaper than local chairs, although you still need to work this out.

The chairs cost 124,95 (= Euro) each and you would like to buy six of them within the next 6 months. The company from which you are purchasing the chairs charges 9,50 for shipping and packaging for the first 100 of items purchased from them. The cost for every additional 100 purchased is 3,50.

There are also bank charges to consider. To make the international payment into the German company's bank account, your local bank charges R85 plus 1.5% of the value of the amount transferred.

The table below sets out the rand : euro exchange rate during the first full working week in January 2004.

Monday	Tuesday	Wednesday	Thursday	Friday
R7,99	R8,19	R8,28	R8,40	R8,55

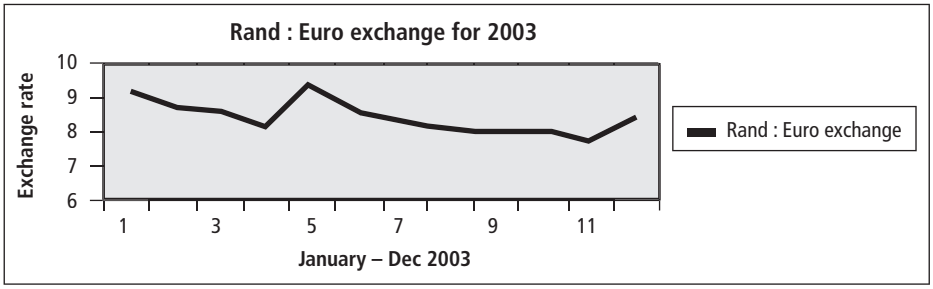
8.1 On which day of the given week will it be best to make a purchase from Germany?

8.2 If you ignore all the additional costs (shipping and packaging and bank charges), how much will it cost to purchase a chair on each of the days of the week? Does this answer support your answer to 8.1?

8.3 Do you think it would be better to purchase one chair a month for the next six months or to purchase all of them at the same time? Why do you say this?

8.4 The exchange rates have been printed for the first week in January. What do you think the rand : euro exchange rates will be for the first week in February? Can you predict what the exchange rate will be in June?

8.5 The graph below shows the Rand : Euro exchange rate for 2003. Based on the graph, do you think early January 2004 is a good time to be purchasing items from Germany?



8.6 What is the current rand : euro exchange rate? You should look this up in your local newspaper which will give the daily exchange rate for the Rand against major currencies.

8.7 Is it more or less expensive to purchase a chair from Europe now compared to our scenario?

8.8 How much would you need to pay the German chair company if you decided to purchase one chair at today's exchange rate? Remember to include the cost of shipping and packaging.

8.9 How much would you need to pay your bank for their services?

8.10 Assume that the exchange rate remained exactly the same for the next six months (this is obviously highly unlikely). What would it cost you to purchase one chair per month until you had purchased the six chairs that you required?

8.11 How much would you need to pay in total if you decided to purchase all six chairs at today's exchange rate? Remember to include the cost of shipping and packaging as well as the bank charges.

8.12 How does this amount compare to purchasing the chairs one at a time? What is the difference? Why is there a difference?

8.13 What are the advantages and disadvantages to purchasing all the chairs at the same time.?

Activity 9 — Additional sales

ABOUT THIS ACTIVITY

In this activity we look at an alternative source of income for a salon. The aim of the activity is to allow learners to think through the requirements of producing a gift pack for sale. Learners should realise that decisions that are made can have far-reaching effects on a business's profits. Many decisions not only have direct economic consequences but may, for example, affect the image of the salon which could also influence the profits of the business.

This activity addresses the following Specific Outcomes and Assessment Criteria: S.O.1 – AC 2,3.

MANAGING THIS ACTIVITY

9.1 400ml (Pantene): 400ml ÷ 25ml = 16 bottles
200ml (Pantene): 200ml ÷ 25ml = 8 bottles
1000ml (Salon Quality): 1000ml ÷ 25ml = 40 bottles

9.2 400ml (Pantene): R34,95 ÷ 16 bottles = R2,18
200ml (Pantene): R19,95 ÷ 8 bottles = R2,49
1000ml (Salon Quality): R27,95 ÷ 40 bottles = R0,70

9.3 Advantages: Pantene is a better quality shampoo and conditioner. (Clients will assume it is, based on the fact that it is more expensive and is well advertised in the media.) Selling this product will give your salon a better name than if you were to sell an inferior product.

Disadvantages: It is more expensive to buy and customers who are not discerning may not realise that the shampoo and conditioner are of a superior quality compared to Salon Quality. In that case the extra money spent will not have been worthwhile.

9.4 The bigger the bottle the more economical the product. A disadvantage could be that if a large bottle were only partially used, there could be quite a lot of wastage (assuming that the left-over product could not be used in the salon.

9.5 There is likely to be a vast range of answers from learners here. No answer is wrong but learners should give reasons for their decision. What factors did they take into account in making their decision?

9.6 The more you make the bigger your potential profit is.

The less you make the smaller the risk is that you won't sell them all. If you don't sell them all you will lose the money that you have spent producing them.

9.7 Eight packs is probably the least number. This requires the purchase of 200ml of Pantene shampoo and conditioner, which will all be used up. In addition most of the roses and gift cards will also be used.

There may well be other acceptable arguments, which merely need to be justified in order to be accepted. Multiples of eight (16,24,32,40, etc) are all good numbers, with 40 being particularly good (especially if you decide to use the Salon Quality shampoo and conditioner).

9.8 In order to limit the amount of shampoo and conditioner left over we will need to purchase a 200ml and a 400ml bottle of Pantene.

Component	Description	Quantity	Amount required	Price	Total cost
Shampoo	Pantene	400 ml	1	R 34,95	R34,95
	Pantene	200 ml	1	R 19,95	R19,95
	Shop brand	1000 ml	0	R 27,95	
Conditioner	Pantene	400 ml	1	R 34,95	R34,95
	Pantene	200 ml	1	R 19,95	R19,95
	Shop brand	1000mll	0	R 27,95	
25ml plastic bottle	Shop brand	25 bottles	2	R 11,95	R23,90
Fresh roses	Florist wholesaler	12	2	R 20	R40,00
Gift cards	Budget pack	10	3	R 9,69	R29,07
Decorative paper bag	Art group	1	24	R 1,95	R46,80
TOTAL					R249,57

9.9 If the extra shampoo and conditioner could be used in the salon it would be better to purchase two 400ml bottles of Pantene (rather than one 400ml and one 200ml bottle). This would effectively reduce the cost to one and a half 400ml bottles of shampoo and conditioner. The cost savings would be R4,95.
The cost for all 24 packs would now be R249,57 – R4,95 = R244,62.
The cost per pack would be: R244,62 ÷ 24 = R10,19.

9.10 This answer is again a personal choice. There are, though, a number of factors to consider:
- The shopping mall will be busy and you are only trying to sell 24 gift packs.
- It is Mother's Day weekend and there will be many people looking for a gift to purchase.
- The person who looks after the 'gift pack stand' will need to be paid for their time.
- A suggested selling price of R25-00 would probably not be unreasonable.

9.11 The more you sell the gift packs for the more money you will make on each individual pack. However, the advantage of keeping the price low is that the risk of not selling all your gift packs is reduced. Basically, the higher the price the less likely people are to purchase the packs.

9.12 This calculation will be different for each learner depending on how many gift packs he / she has decided to produce and whether Pantene or Salon Quality has been used. It could be set out as for the solution shown in 9.8.

Learners will again have to make a judgment on what they think would be a reasonable selling price, based on the number of packs that they have decided to produce and on what shampoo and conditioner they have used. Encourage the learners to share and to justify their choices in groups.

9.13 The cost of producing the goods is fixed, as calculated in 9.12. The profit can be calculated by multiplying the number of packs sold by the selling price and subtracting the cost of production.

9.14 It is important to sell as many of the packs as possible. The key to maximizing profits is to try and price the packs such that all will be sold at the maximum price that people will be prepared to pay.

Activity 9 — Additional sales

Your salon is conveniently situated in a busy shopping mall. Mother's Day is approaching and you realise that there will be a lot of passing trade in the mall on the Saturday beforehand. You decide to explore the possibility of putting together and selling gift packs in order to provide your salon with an additional source of income on this day.

Before you can consider the price at which you will sell the gift packs you need to determine how much it will cost to make a gift pack. The gift pack you are going to sell will consist of the following items:

25ml	shampoo
25ml	conditioner
2	25 ml plastic bottles (1 for the shampoo and 1 for the conditioner)
1	fresh rose
1	small gift card
1	small decorative paper bag

One of the members of your hair salon has collected the prices listed below for the various items. All items can be purchased only in the quantities specified.

Component	Description	Quantity	Price
Shampoo	Pantene	400 ml	R 34,95
	Pantene	200 ml	R 19,95
	Salon Quality	1000 ml	R 27,95
Conditioner	Pantene	400 ml	R 34,95
	Pantene	200 ml	R 19,95
	Salon Quality	1000mll	R 27,95
25ml plastic bottle	Shop brand	25 bottles	R 11,95
Fresh roses	Florist wholesaler	12	R 20
Gift cards	Budget pack	10	R 9,69
Decorative paper bag	Art group	1	R 1,95

9.1 How many 25 ml plastic bottles will you be able to fill from each of the three different sizes of shampoo bottles available?

9.2 For each of the three conditioner options available for your gift packs, calculate the cost of 25ml of conditioner.

9.3 What are the advantages and disadvantages of choosing to sell Pantene products in your gift packs instead of the Salon Quality products?

9.4 What is the best size shampoo and conditioner bottle to purchase for making your gift packs? Can you think of any reasons for purchasing the shampoo and conditioner in the other sizes?

9.5 Before you purchase the items needed for your gift pack, you need to decide how many gift packs you are going to make. Taking into account the information you have available about the expected busyness of the mall and approaching Mothers' Day, how many gift packs do you think would be a good number to make?

9.6 What are the advantages of making more than your suggestion in 9.5? What are the advantages of making fewer?

9.7 What is the least number of gift packs that it would be economically sensible to produce? Are there other numbers that could be economically produced?

9.8 Assume that you have decided to use Pantene products in the gift packs. What would it cost to make 24 gift packs, if you try to limit the items you are left with after making the packs?

9.9 Could you make the packs more economically if the unused shampoo and conditioner would be used at a later stage in the salon? What would each pack now cost to make?

9.10 Based on your answer to 9.8 and 9.9, what price do you think the salon should sell the gift packs for if you produced 24 packs? Explain your answer.

9.11 What are the advantages of selling the gift packs for more than your answer to 9.10? Are there any advantages to selling your gift packs for less than your answer to 9.10?

9.12 Calculate what it would cost per pack to make the number of gift packs you suggested in 9.5. What do you suggest the selling price should be in this instance? Assume that unused shampoo and conditioner could be used in the salon at a later stage. You also need to decide whether you would use the Pantene or the Salon Quality products.

9.13 Calculate the profit for the salon if you sold all the gift packs at the price suggested in 9.12.

9.14 Do you think it is better to push your prices up as high as possible or do you think it is better to ensure that you sell all the gift packs at a lower price?

Activity 10 — Managing your hair salon's phone bill

ABOUT THIS ACTIVITY

This activity is completely self-contained. No data needs to be collected and learners should be able to complete the activity in class or even as a homework assignment. You should supply each learner with the handout and provide support where needed. If you wish, you could ask the learners to do the activity with more recent tariff tables.

This activity addresses the following Specific Outcomes and Assessment Criteria: S.O.1 – AC 1,2,3.

MANAGING THIS ACTIVITY

10.1 This question has been very carefully structured to include a number of each of the different types of calls: conventional vs cellular; minimum charge calls vs rate based calls; local vs long distance etc. Learners will have to use the tariff table and information very carefully to avoid making mistakes. It may be a good idea to demonstrate one or two of the calculations for the class.

The examples have also been deliberately chosen to help learners see the influence of factors such as the time of day, the length of a call etc on the cost of a call. You may want to ask questions such as: 'Why is call (b) less expensive than call (a) even though it is so much longer?' or 'Look at the difference that 45 minutes make when you compare (d) and (e)?'

10.1.1 Cellular call
Day = Sunday ∴ Rate 2
58 sec (i.e. call does not exceed first 60 sec.) ∴ **R 0,97** (VAT excl)

10.1.2 National call (0-50 km)
Day = Sunday ∴ Callmore rate
5 min: 2 sec = 302 sec
302 × 0,204 = 61,608 cents
61,608 cents is less than the minimum call charge ∴ **R 0,86** (VAT excl)

10.1.3 National call (>50 km)
Day = Sunday ∴ Callmore rate
4 min: 54 sec = 294 sec
294 × 0,724 = 212,856 cents
212,856 cents is greater than the minimum call charge ∴ **R 2,13** (VAT excl)

10.1.4 National call (0-50 km)
Day = Monday before 07:00 ∴ Callmore rate
3 min: 24 sec = 204 sec
204 × 0,204 = 41,616 cents
41,616 cents is less than the minimum call charge ∴ **R 0,48** (VAT excl)

10.1.5 National call (0-50 km)
Day = Monday between 07:00 and 19:00 ∴ Standard rate
1 min: 35 sec = 95 sec
95 × 0,542 = 52,06 cents
52,06 cents is greater than the minimum call charge ∴ **R 0,52** (VAT excl)

10.1.6 Cellular call
Day = Monday between 07:00 and 20:00 ∴ Rate 1
1 min: 48 sec = 1 "First 60 sec" and 2 lots of "Next 30 sec"
1,598 + 2 × 0,799 = **R 3,20** (VAT excl)

10.1.7 National call (>50 km)
Day = Tuesday after 19:00 ∴ Callmore rate
1 min: 52 sec = 112 sec
112 × 0,724 = 81,088 cents
81,088 cents is less than the minimum call charge ∴ **R 0,87** (VAT excl)

10.1.8 Cellular call
Day = Tuesday between 07:00 and 20:00 ∴ Rate 1
1 min: 28 sec = 1 "First 60 sec" and 1 "Next 30 sec"
1,598 + 1 × 0,799 = **R 2,40** (VAT excl)

10.1.9 Cellular call
Day = Tuesday after 20:00 ∴ Rate 2
1 min: 52 sec = 1 "First 60 sec" and 2 lots of "Next 30 sec"
0,973 + 2 × 0,487 = **R 1,95** (VAT excl)

10.1.10 National call (0-50 km)
Day = Tuesday after 19:00 ∴ Callmore rate
9 min: 45 sec = 585 sec
585 × 0,204 = 119,34 cents
119,34 cents is greater than the minimum call charge ∴ **R 1,19** (VAT excl)

10.1.11 National call (>50 km)
Day = Wednesday between 07:00 and 19:00 ∴ Rate 1
2 min: 14 sec = 134 sec
134 × 1,447 = 193,898 cents
193,898 cents is greater than the minimum call charge ∴ **R 1,94** (VAT excl)

10.1.12 National call (>50 km)
Day = Thursday between 07:00 and 19:00 ∴ Rate 1
55 × 1,447 = 79,585 cents
79,585 cents is less than the minimum call charge ∴ **R 0,87** (VAT excl)

10.1.13 National call (0-50 km)
Day = Friday after 19:00 ∴ Callmore rate
4 min: 52 sec = 292 sec
292 × 0,204 = 59,57 cents
59,57 cents is less than the minimum call charge ∴ **R 0,87** (VAT excl)

10.1.14 Cellular call
Day = Friday between 07:00 and 20:00 ∴ Rate 1
5 min: 11 sec = 1 "First 60 sec" and 9 "Next 30 sec"
1,598 + 9 × 0,799 = **R 8,79** (VAT excl)

10.2 Instead of allowing learners to compare their answers in groups you may wish to discuss them as part of a whole class activity — this is fine. The important thing is for all learners to understand how to calculate call costs properly.

10.3.1 Case 1: Local (0-50km) & Standard time: 48,4 ÷ 0,542 = 89 sec
Case 2: Long distance (>50 km) & Standard time: 86,8 ÷ 1,447 = 59 sec
Case 3: Local (0-50km) & Callmore time: 48,4 ÷ 0,204 = 237 sec
Case 4: Long distance (>50 km) & Callmore time: 86,8 ÷ 0,724 = 119 sec

10.3.2 Case 1: Rate 1 time: 89 sec = 1,598 + 1 × 0,799 = R 2,40
Case 2: Rate 1 time: 59 sec = R1,60
Case 3: Rate 2 time: 237 sec = 0,937 + 3 × 0,487 = R 2,40
Case 4: Rate 2 time: 119 sec = 0,937 + 2 × 0,487 = R 1,91

10.4.1 It is safe to assume that a hair salon employee will make all of her calls during Standard Time (Rate 1-- cellular).

10.4.2 This question can lead to some debate but to complete this activity we have to assume that all of the calls are of about the same length — without such assumption we cannot do any of the calculations.

10.4.3 It is safe to assume that all of the calls made by a hair salon employee to clients will be 0-50 km (NOTE: this is only important in the case of conventional (landline) calls).

10.5 The calculations are the same as those done in question 1 with the answers shown in the table below:

60 sec calls		Week I		Week II		Week III		Week IV		Total
		calls	cost (c)	calls	cost (c)	calls	cost (c)	calls	cost (c)	
Martha	Landline	2	96.8	1	48.4	4	193.6	3	145.2	
	Cellular	12	1917.6	15	2397	10	1598	16	2556.8	
	Total		2014.4		2445.4		1791.6		2702	R 89.53
Adelle	Landline	14	677.6	16	774.4	14	677.6	10	484	
	Cellular	5	799	6	958.8	8	1278.4	5	799	
	Total		1476.6		1733.2		1956		1283	R 64.49

10.6 Instead of allowing learners to compare their answers in groups you may wish to discuss them as part of a whole class activity—this is fine. The important thing is for all learners to understand how to calculate call costs properly.

10.7 The calculations are the same as those done in question 1 with the answers shown in the tables below:

90 sec calls		Week I		Week II		Week III		Week IV		Total
		calls	cost (c)	calls	cost (c)	calls	cost (c)	calls	cost (c)	
Martha	Landline	2	97.56	1	48.78	4	195.12	3	146.34	
	Cellular	12	2876.40	15	3595.50	10	2397.00	16	3835.20	
			2973.96		3644.28		2592.12		3981.54	R 131.92
Adelle	Landline	14	910.56	16	1040.64	14	910.56	10	650.40	
	Cellular	5	1198.50	6	1438.20	8	1917.60	5	1198.50	
			2109.06		2478.84		2828.16		1848.90	R 92.65

120 sec calls		Week I		Week II		Week III		Week IV		Total
		calls	cost (c)	Calls	cost (c)	calls	cost (c)	calls	cost (c)	
Martha	Landline	2	130.08	1	65.04	4	260.16	3	195.12	
	Cellular	12	3835.20	15	4794.00	10	3196.00	16	5113.60	
			3965.28		4859.04		3456.16		5308.72	R 175.89
Adelle	Landline	14	910.56	16	1040.64	14	910.56	10	650.40	
	Cellular	5	1598	6	1917.60	8	2556.80	5	1598.00	
			2508.56		2958.24		3467.36		2248.40	R 111.83

150 sec calls		Week I		Week II		Week III		Week IV		Total
		calls	cost (c)	calls	cost (c)	calls	cost (c)	calls	cost (c)	
Martha	Landline	2	162.60	1	81.30	4	325.20	3	243.90	
	Cellular	12	4794.00	15	5992.50	10	3995.00	16	6392	
			4956.60		6073.80		4320.20		6635.90	R 219.87
Adelle	Landline	14	1138.20	16	1300.80	14	1138.20	10	813.00	
	Cellular	5	1997.50	6	2397.00	8	3196.00	5	1997.50	
			3135.70		3697.80		4334.20		2810.50	R 139.78

180 sec calls		Week I		Week II		Week III		Week IV		Total
		calls	cost (c)	calls	cost (c)	calls	cost (c)	calls	cost (c)	
Martha	Landline	2	195.12	1	97.56	4	390.24	3	292.680	
	Cellular	12	5752.80	15	7191.00	10	4794.00	16	7670.40	
			5947.92		7288.56		5184.24		7963.08	R 263.84
Adelle	Landline	14	1365.84	16	1560.96	14	1365.84	10	975.60	
	Cellular	5	2397.00	6	2876.40	8	3835.20	5	2397.00	
			3762.84		4437.36		5201.04		3372.60	R 167.74

10.8 Learners should notice that the costs (with the exception of week 3) are always less for Adelle. Furthermore, the ratio of costs for the trial period seems reasonably independent of the assumed call length.

	Martha : Adelle
Based on calls of 60 seconds	1,39 : 1
Based on calls of 90 seconds	1,42 : 1
Based on calls of 120 seconds	1,57 : 1
Based on calls of 150 seconds	1,57 : 1
Based on calls of 180 seconds	1,57 : 1

NOTE: An important observation that learners should make is that Martha is not only more expensive in terms of actual costs, but actually makes fewer calls over the trial period (63 vs. 78 calls by Adelle).

10.9 Learners should be able to motivate their responses to these questions. The test of the quality of the motivation should be the extent to which they are able to 'convince' other members of the class.

Activity 10 — Managing your hair salon's phone bill

A significant expense on the income and expenditure statement for the Great Styles Salon is telephone costs. On investigation the following is revealed:

- The salon keeps a record of clients home, work and cell phone numbers.
- The salon phones clients to confirm important appointments and to inform them if the appointment time needs to be changed.
- The responsibility for phoning clients is shared between Martha and Adelle.
- They each have a different habit when it comes to phoning clients and each believes that the other one is wasting money.

I seldom phone clients on their home or work landline (Telkom) phone. I used to find that I would never find the clients at these numbers. If you phone the clients on their cell phones, you usually get through first time. I only phone clients on their cell phones, unless they don't have one.

Martha

I always try a landline number first. Only if I get an answering machine or a reply to tell me that the client is not there will I try the cellular telephone number. I also use the cellular telephone number if there is no reply on the landline—but this does not happen very often.

Adelle

Martha and Adelle have decided to keep a record of all of the telephone calls they each make over a four week period. Their records are illustrated below:

		Week I	Week II	Week III	Week IV
Martha	Landline	II	I	IIII	III
	Cellular	~~IIII~~ II	~~IIII~~ ~~IIII~~ ~~IIII~~	~~IIII~~ ~~IIII~~	~~IIII~~ ~~IIII~~ ~~IIII~~ I
Adelle	Landline	~~IIII~~ ~~IIII~~ IIII	~~IIII~~ ~~IIII~~ ~~IIII~~ I	~~IIII~~ ~~IIII~~ IIII	~~IIII~~ ~~IIII~~
	Cellular	~~IIII~~	~~IIII~~ I	~~IIII~~ III	~~IIII~~

Before we can decide on who spends more money on phone calls, we must establish how much telephone calls cost. Telkom has a detailed tariff sheet that is more than 70 pages long (it can be downloaded from the Telkom website on the Internet). An extract from the tariff sheet that deals with domestic (i.e. not international) phone calls is printed on handout 10. This extract does not include the monthly service rental charge since that is constant every month irrespective of the number of calls that you make, and our problem deals with trying to save money through the types of calls we make.

10.1 Before comparing the cost profiles for Martha and Adelle, try to determine the costs of each of the calls listed in table 2, printed on your handout. You will need to refer to table 1 as well as the calendar provided to assist you in this exercise.

10.2 Before going on to the next question compare your answers to question 10.1 with at least three other learners.

10.3 Based on your work in questions 10.1 and 10.2, determine:

10.3.1 For how long can you talk when making a conventional (landline) call and only pay the minimum charge (there are four different cases)?

10.3.2 For each of the cases identified above, determine the cost of a cellular call of the same duration.

10.4 We are now ready to study the telephone records for Martha and Adelle. To do so we must make some assumptions. What do you think we should assume about the following:

10.4.1 The call rate that applies to the phone calls recorded in their table. Should we assume that they are all standard time or all callmore time for the landline calls and what rate (rate group 1 or rate group 2) should we apply for the calls to cellular phones?

10.4.2 The duration of each of the calls?

10.4.3 The distance of each call?

10.5 For this question we make the following assumptions:

- all calls are made between 08:00:00 and 17:00:00 on normal weekdays;
- all calls are 60 seconds in duration; and
- all calls are local (i.e. the 0-50 km rate applies).

Calculate the costs that Martha and Adelle will incur for each week of the trial and for the whole four week trial.

10.6 Before going on to the next question, compare your answers to question 10.5 with at least three other learners.

10.7 As a member of a group of 4 learners repeat the calculations you did in question 10.5, with each learner doing the calculations for one of the different durations: 90 seconds; 120 seconds; 150 seconds; and 180 seconds.

10.8 Share the answers that each of the different group members gets for question 10.7.

Based on the work that you have done in this activity, answer the following questions:

10.9 Is there a significant difference in the costs that Martha and Adelle incur as a result of their different phoning habits?

10.10 What would you recommend in terms of a phoning policy for the salon? You must, of course, motivate your answer.

Table 1: TELKOM's DOMESTIC TELEPHONE CALL CHARGES

	Minimum charge cents (Excl VAT)	Minimum charge cents (Incl VAT)	Cents per second (Excl VAT)	Cents per second (Incl VAT)	Minimum charge cents (Excl VAT)	Minimum charge cents (Incl VAT)	Cents per second (Excl VAT)	Cents per second (Incl VAT)
	Standard Time: Monday to Friday 07:00 to 19:00				Callmore time: Monday to Friday 19:00 to 07:00 and Friday 19:00 to Monday 07:00			
Conventional calls (National)								
Local (0-50km)	48.4	55.2	0.542	0.618	48.4	55.2	0.204	0.233
Long distance (>50km)	86.8	99	1.447	1.65	86.8	99	0.724	0.825
Outgoing calls to Mobile Cellular (MTN & Vodacom & Cell C)								
	Price Rand (Excl VAT)	Price Rand (Incl VAT)			Price Rand (Excl VAT)	Price Rand (Incl VAT)		
	Rate group 1: Weekdays from 07:00 to 20:00				Rate group 2: Weekdays from 20:00 to 07:00 and from Friday 20:00 to Monday 07:00			
First 60 sec	1.598	1.82			0.973	1.11		
Next 30 sec	0.799	0.91			0.487	0.56		
Calls are charged in increments of one minute for the first minute and in increments of 30 seconds thereafter								

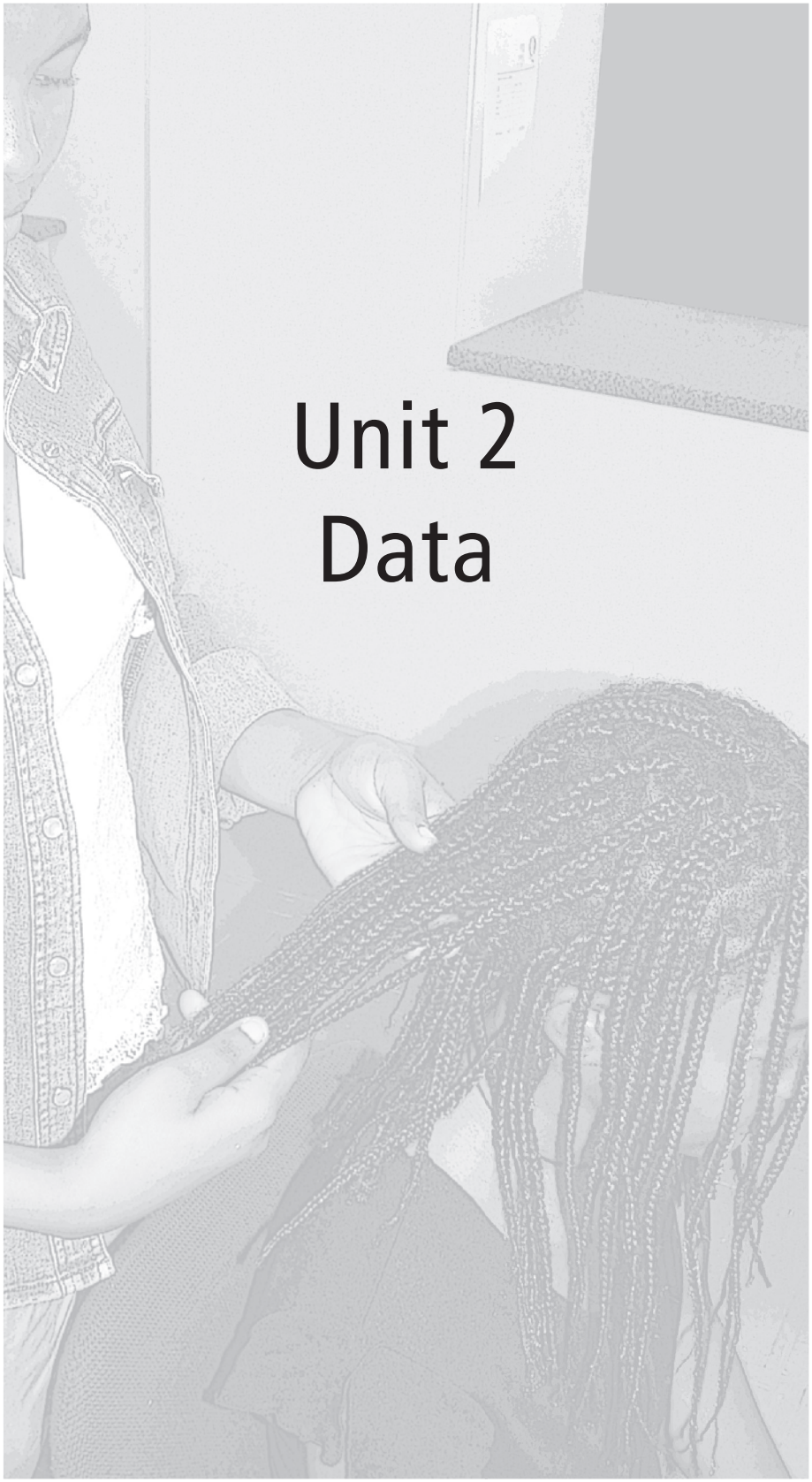
Table 2: Calculation of telephone costs for January 2004.
Note: the conventions used in the table below are:
Time is given as: hh:mm:ss Duration is given as: mm:ss

Call	Date	Time	Duration	Call type	Distance
10.1.1	4 Jan 04	11:09:41	00:58	Cellular	
10.1.2	4 Jan 04	16:34:35	05:02	National	0-50 km
10.1.3	4 Jan 04	20:13:22	04:54	National	>50 km
10.1.4	5 Jan 04	06:30:15	03:24	National	0-50 km
10.1.5	5 Jan 04	07:15:12	01:35	National	0-50 km
10.1.6	5 Jan 04	11:10:14	01:48	Cellular	
10.1.7	6 Jan 04	19:15:03	01:52	National	>50 km
10.1.8	6 Jan 04	19:25:36	01:28	Cellular	
10.1.9	6 Jan 04	20:13:22	01:52	Cellular	
10.1.10	6 Jan 04	20:22:11	09:45	National	0-50 km
10.1.11	7 Jan 04	14:26:13	02:14	National	>50 km
10.1.12	8 Jan 04	10:14:43	00:55	National	>50 km
10.1.13	9 Jan 04	19:05:21	04:52	National	0-50 km
10.1.14	9 Jan 04	19:13:18	05:11	Cellular	

January 2004						
Sun	Mon	Tue	Wed	Thu	Fri	Sat
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

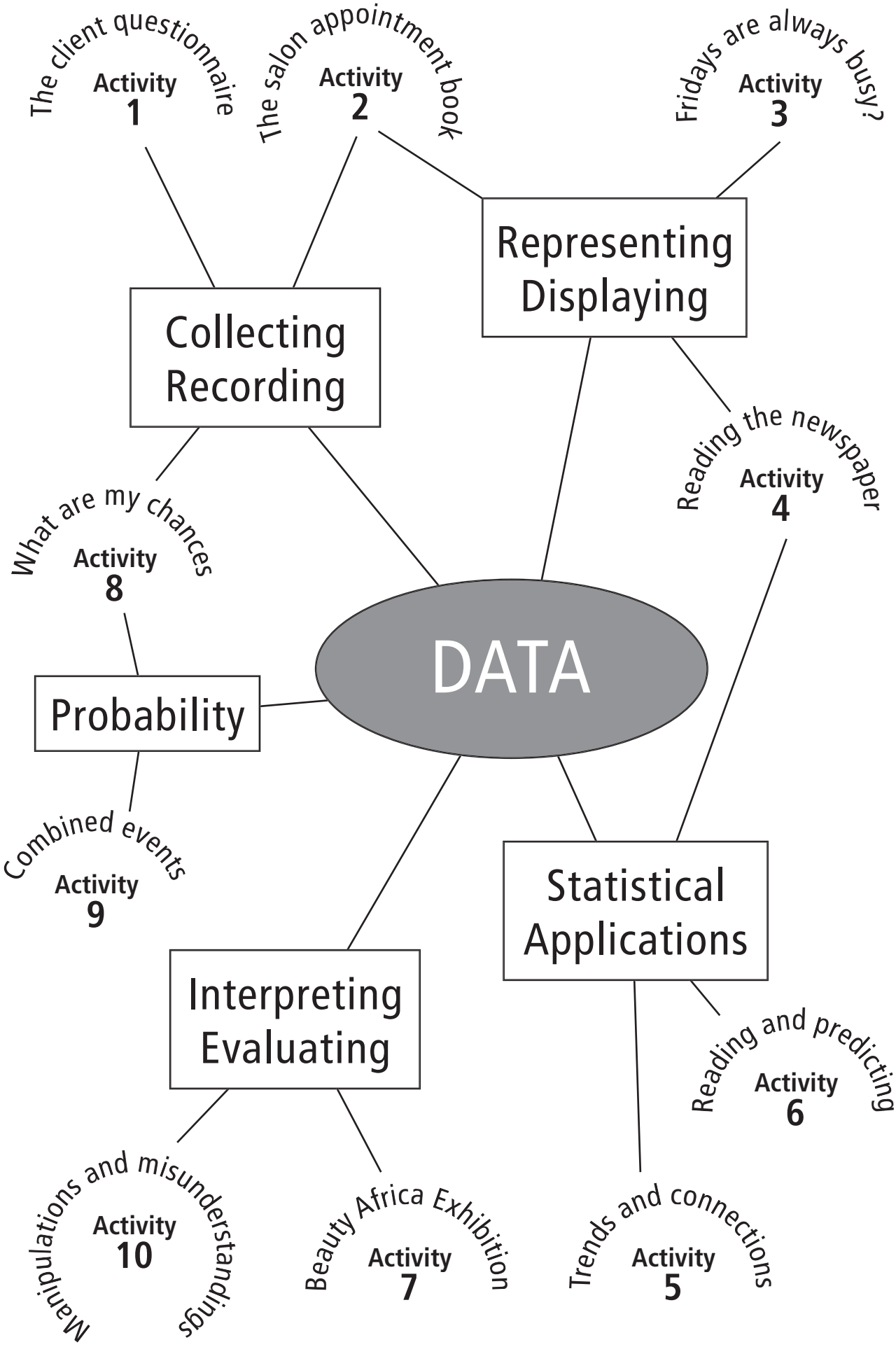
Mathematical Literacy

NQF LEVEL 4



Unit 2
Data

Hairdressing


The client questionnaire
Activity 1
The salon appointment book
Activity 2
Fridays are always busy?
Activity 3
Representing Displaying
Collecting Recording
Reading the newspaper
Activity 4
What are my chances
Activity 8
DATA
Probability
Combined events
Activity 9
Statistical Applications
Interpreting Evaluating
Reading and predicting
Activity 6
Manipulations and misunderstandings
Activity 10
Beauty Africa Exhibition
Activity 7
Trends and connections
Activity 5

Overview

In this unit students develop a variety of mathematical skills with respect to data handling. These include:

- Data collection and organisation, using the context of a client questionnaire.
- Graphical representation of data using an appointment book as a data source.
- Analysis of data to answer questions, using graphs and tables.
- Reading and interpreting the figures in a newspaper report.
- Finding connections and correlations between data, and predicting trends.
- Analysis of existing data to aid decision making, in the context of planning an exhibition.
- Verification of experimental results by analysis and probability calculation, using the lotto as a context.
- Calculating probabilities involving more than one event.
  Analysing and critiquing ways in which data can be manipulated and misunderstood.

Activity 1: The client questionnaire
This is a preliminary activity designed to raise some of the issues involved in data collection. Students will collect their own data, using possible clients in the hairdressing industry as a context, and reflect on it. In order to locate this in a bigger context, an information handout has been included that defines some common statistical terms and ideas. Potential problems such as sample size and representativeness are introduced.

Activity 2: The salon appointment book
This activity involves the organisation and representation of data using a pie chart and bar graph. Students use data to answer questions and to determine the different central tendencies of the data. The salon appointment book is used as a data source.

Activity 3: Fridays are always busy?
This activity involves reading information from tables. Students explore what information can be obtained from a table of data and what sorts of conclusions can be drawn. They use numbers to back up an argument and present a comparative bar graph to illustrate their conclusions. The context is the interpretation of the monthly figures for visits to the hair salon.

Unit outcomes

The following Unit Standards, Specific Outcomes and Assessment Criteria are addressed by this unit:

Apply knowledge of statistics and probability to critically interrogate and effectively communicate findings on life-related problems. (9015).

- Critique and use techniques for collecting, organising and representing data.
  - Situations or issues that can be dealt with through statistical methods are identified correctly.
  - Appropriate methods for collecting, recording and organising data are used so as to maximise efficiency and ensure the resolution of a problem or issue.
  - Data sources and databases are selected in a manner that ensures the representativeness of the sample and the validity of resolutions.
  - Activities that could result in contamination of data are identified and explanations are provided of the effects of contaminated data.
  - Data is gathered using methods appropriate to the data type and purpose for gathering the data.
  - Data collection methods are used correctly.
  - Calculations and the use of statistics are correct.
  - Graphical representations and numerical summaries are consistent with the data, are clear and appropriate to the situation and target audience.
  - Resolutions for the situation or issue are supported by the data and are validated in terms of the context
- Use theoretical and experimental probability to develop models.
  - Experiments and simulations are chosen and/or designed appropriately in terms of the situation to be modelled.
  - Predictions are based on validated experimental or theoretical probabilities.
  - The results of experiments and simulations are interpreted correctly in terms of the real context.
  - The outcomes of experiments and simulations are communicated clearly.
- Critically interrogate and use probability and statistical models.
  - Statistics generated from the data are interpreted meaningfully and interpretations are justified or critiqued.
  - Assumptions made in the collection or generation of data and statistics are defined or critiqued appropriately.
  - Tables, diagrams, charts and graphs are used or critiqued appropriately in the analysis and representation of data, statistics and probability values.
  - Predictions, conclusions and judgements are made on the basis of valid arguments and supporting data, statistics and probability models.
  - Evaluations of the statistics identify potential sources of bias, errors in measurement, potential uses and misuses and their effects.

Activity 4: Reading the newspaper
This activity involves more reading and interpretation of data tables. Students study newspaper tables with figures comparing the South African elections of 1994, 1999 and 2004. They make comparisons and present a comparative bar graph to illustrate their conclusions. The activity is self-contained and suitable for evaluation purposes as it draws on ideas and terminology from previous activities.

Activity 5: Trends and connections
In this activity students interpret the range and distribution of data. They extend the idea of determining 'the centre', to the idea that there are patterns and important connections between certain variables that can also be measured. They examine variance from the mean and identify outliers as well as trends. They identify correlations and use a line of best fit to make simple predictions.

Activity 6: Reading and predicting
In this activity students read data and make predictions by analysing trend lines. They observe patterns and measure important connections between variables. They identify variance from the mean as well as outliers, suggesting what implications these may have in real life situations.

Activity 7: Beauty Africa Exhibition
In this activity students analyse data and use it to make decisions and plans. Tables and pie charts are used and information is given as percentages which students use to calculate actual numbers. Problems relating to transferring data and contamination of data are raised.

Activity 8: What are my chances?
This activity introduces the idea of probability. A preliminary handout has been included with background information on some of the common applications and terminology used in this branch of statistics. The students work with single events in the context of the 'Lotto draw', comparing 'counted' results with calculated probability. In this way they work with the mathematical verification of experimental results.

Activity 9: Combined events
In this activity students move from probabilities involving single events, to probabilities of combined events. They work with the multiplication principle and are introduced to the ideas of dependent, independent and mutually exclusive events.

Activity 10: Manipulations and misunderstandings
In this activity students critique the ways that data is used to support arguments. They identify how data is manipulated and how one can be misled by incomplete statistics, inappropriate samples and graphical methods.

9015	Apply knowledge of statistics and probability to critically interrogate and effectively communicate findings on life related problems											
		ACTIVITY	1	2	3	4	5	6	7	8	9	10
SO1	Critique and use techniques for collecting, organising and representing data.											
	AC1	Situations or issues that can be dealt with through statistical methods are identified correctly.		✓	✓	✓			✓			
	AC2	Appropriate methods for collecting, recording and organising data are used so as to maximise efficiency and ensure the resolution of a problem or issue.	✓	✓	✓							
	AC3	Data sources and databases are selected in a manner that ensures the representativeness of the sample and the validity of resolutions.	✓		✓	✓						
	AC4	Activities that could result in contamination of data are identified and explanations are provided of the effects of contaminated data.			✓	✓	✓	✓				✓
	AC5	Data is gathered using methods appropriate to the data type and purpose for gathering the data.	✓									
	AC6	Data collection methods are used correctly.	✓									
	AC7	Calculations and the use of statistics are correct.	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	AC8	Graphical representations and numerical summaries are consistent with the data, are clear and appropriate to the situation and target audience.		✓	✓	✓	✓	✓				
	AC9	Resolutions for the situation or issue are supported by the data and are validated in terms of the context			✓	✓	✓	✓	✓			
SO2	Use theoretical and experimental probability to develop models.											
	AC1	Experiments and simulations are chosen and/or designed appropriately in terms of the situation to be modelled.								✓		
	AC2	Predictions are based on validated experimental or theoretical probabilities.							✓	✓		
	AC3	The results of experiments and simulations are interpreted correctly in terms of the real context.							✓	✓		
	AC4	The outcomes of experiments and simulations are communicated clearly.							✓			
SO3	Critically interrogate and use probability and statistical models.											
	AC1	Statistics generated from the data are interpreted meaningfully and interpretations are justified or critiqued.					✓		✓	✓	✓	
	AC2	Assumptions made in the collection or generation of data and statistics are defined or critiqued appropriately.						✓	✓			
	AC3	Tables, diagrams, charts and graphs are used or critiqued appropriately in the analysis and representation of data, statistics and probability values.					✓	✓				✓
	AC4	Predictions, conclusions and judgements are made on the basis of valid arguments and supporting data, statistics and probability models.					✓	✓	✓	✓	✓	
	AC5	Evaluations of the statistics identify potential sources of bias, errors in measurement, potential uses and misuses and their effects.					✓	✓				✓

Activity 1 — The client questionnaire

ABOUT THIS ACTIVITY

This is a preliminary activity designed to raise some of the issues involved in data collection. Students will collect their own data, using possible clients in the hairdressing industry as a context, and reflect on it. In order to locate this in a bigger context, an information handout has been included that defines some common statistical terms and ideas. Potential problems such as sample size and representativeness are introduced. This activity addresses the following Specific Outcomes and Assessment Criteria: SO1 - AC2, 3, 6, 7.

MANAGING THIS ACTIVITY

The students need to be familiar with the terms and ideas in the handout. This could be done as a teacher-led discussion, a question and answer session or a student-led presentation. It would be useful for each student to have a copy of Handout 1 and for students to suggest their own simple examples to illustrate each statistical idea. These terms will be used frequently in the next few activities.

Give each student a copy of Worksheet 1 with instructions that they should choose any 20 people and fill in the data sheet. This will take some time and is best done as a homework exercise in the students' own environment to achieve a greater variety of data. Back in class, students should combine their individual totals on a new sheet to create a larger sample group. These totals can be filled in on the cumulative table. It may be necessary to discuss the idea of a cumulative table – this is a table that adds the data from all the sheets together and just records the totals. The students are now in a position to answer the questions and complete the worksheet.

1.1 A variety of answers would be expected. The teacher could draw attention to the highest and lowest numbers; the different needs of children, men and women; and the fact that some procedures happen at almost every visit. Discuss what decisions could be made using this information, for example only one staff member needs to be skilled at braiding, but all staff must be skilled cutters.

1.2 An interview with closed questions, so this is a survey.

1.3 Students collected data for 20 people, so 20 is the sample size.

1.4 The class sample should be 20 multiplied by the number of students in the class.

1.5 It is probably a poor representation because students are likely to collect information from friends or family, which means either too many are in one age group or one socio-economic group. Some samples may be more representative than others.

1.6 Calculate by: number of highlights, divided by total number of procedures and multiplied by 100. For example: suppose a student had 4 highlights in her sample of 124 procedures, and the class found 275 highlights out of a total of 3000. The comparison in percentages would be:

Student: $\frac{4}{124} \times 100 = 3{,}2\%$

Class: $\frac{275}{3000} \times 100 = 9{,}2\%$

1.7 Sample size should be discussed, with the understanding that the bigger and the more diverse the sample, the greater the representativeness. In our example above, the class sample had about three times the number of highlights that the student did. A larger sample could be more reliable – however, a sample of 3000 is still a relatively small sample and ours is not a random sample, so we would have to be cautious about drawing conclusions from our data.

1.8 A variety of responses is expected.

Example: How far from home is the salon you usually visit (an important question when trying to consider the needs of prospective clients)?

Example: Do you visit a salon? Yes/No. If no, why not (this could raise questions of cost, transport, friends who do each other's hair, parents who cut children's hair)?

Activity 1 — The client questionnaire

Choose any 20 people and fill in the following table of data. Use ticks to indicate which age category they belong to, M or F to indicate male or female and numbers to indicate how many times they made use of each hairdressing service last year.

Name		Age (years)			Gender	How many of each procedure last year?							
		0-15	16-30	30+	M/F	Cut	Blowdry	Highlight	Perm	Braid	Extension	Straighten	Style/Set
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													
16													
17													
18													
19													
20													
	Totals												

Cumulative data:

Procedure	Cut	Blowdry	Highlight	Perm	Braid	Extension	Straighten	Style/Set
Totals								

Age (year)	Cut	Blowdry	Highlight	Perm	Braid	Extension	Straighten	Style/Set
0 – 15								
16 - 30								
30 +								

Gender	Cut	Blowdry	Highlight	Perm	Braid	Extension	Straighten	Style/Set
Male (M)								
Female (F)								

Now answer the following questions:

1.1 Did you find anything that was interesting or surprising about the data you collected? What sort of decisions could you make with this information? Note any problems that you encountered.

1.2 What data collection method did you use to get this information?

1.3 What was the size of your own sample ?

1.4 What was the size of your class sample (give exact numbers)?

1.5 Does your sample represent the population accurately? You should take into account issues of age, gender, socio-economic level, urban/rural etc.

1.6 Calculate the percentage of people who had highlights in your own sample and compare this with the percentage in the cumulative sample.

1.7 Discuss the reasons for any difference in the percentages above and indicate which sample would be more reliable if we were drawing conclusions about a large number of people.

1.8 Write down three new questions that could have been asked to your sample of people to get additional useful information. Give a reason why you think your questions would give useful new information.

Statistics (background information for students and teacher)

Data handling involves the collecting, organising, representing and analysing of information, in order to make accurate and informed decisions and recommendations. The accuracy of these methods depends on asking the right questions, choosing the right data and knowing how to use this data to come to useful conclusions. Having an understanding of factors that may contaminate data and mislead the analysis is essential too.

Data can be collected in a variety of ways:

- **Observation**. By simply watching people and their reactions, one can gain informal data intuitively.
- **Personal Interviews**. A set of questions is asked to individuals in the hope that they will supply useful information. The questions could be open or close-ended. When the questions are closed (only facts, no opinions), we speak of a survey. Some problems of this method are interviewer bias or interviewer influence (by manner and reactions). Some people are also uncomfortable about giving certain information to strangers and may not answer honestly.
- **Telephone Interview**. This is a time and cost-effective method of gaining information, but not everyone answers questions honestly and the same problems as with personal interviews will still be a factor.
- **Mail Questionnaire**. This is cheap and a good way to avoid interviewer bias, but many are ignored and the response is usually very poor. Those who do respond are often interested in the topic and so are not a suitable sample to analyse a bigger part of the population.

Information is collected and analysed in order to help us make effective and useful decisions and recommendations. Population is a term that refers to all measurements or observations of interest. For example, if we were studying 18-year-old girls in South Africa our population would be every single 18-year-old girl in South Africa. Collecting information from this number of people would be an impossible task, so we would be much more likely to select a smaller group to represent 18-year-old girls in South Africa This selected part of a population is called a sample.

Two factors are important when choosing a sample — size, and representivity. Generally speaking, the bigger the sample, the more accurate the data. Selecting a completely representative sample is difficult because there are many possible variations that need to be taken into account. These include factors such as age, gender, geographical location (urban, rural), and social and economic differences. A random sample is a sample chosen completely by chance and tends to be more representative than any other.

Activity 2 — The salon appointment book

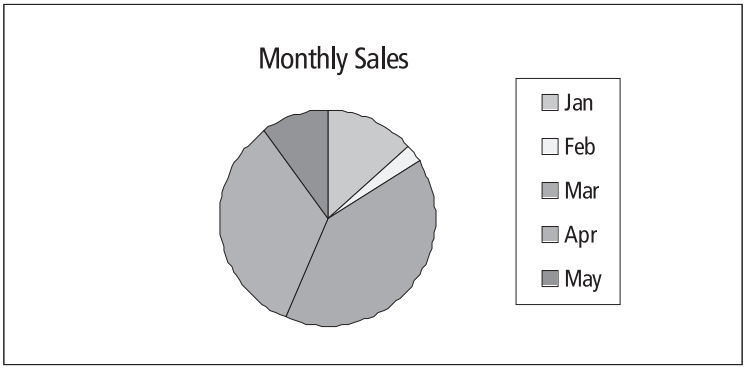
ABOUT THIS ACTIVITY

This activity involves the organisation and representation of data using a pie chart and bar graph. Students use data to answer questions and to determine the different central tendencies of the data. The salon appointment book is used as a data source. The Specific Outcomes and Assessment Criteria addressed are: S01 – AC1, 2, 5, 7, 8.

MANAGING THIS ACTIVITY

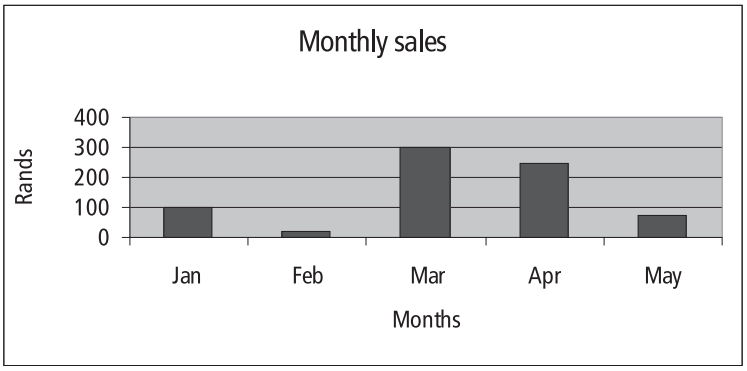
Students should be asked to prepare for this activity by finding examples of as many different types of graphic representations as possible, by paging through newspapers or magazines. If possible they should cut these out and bring them to class. The lesson could start with a class discussion around the features common to these graphs (for example: labelling of axes, scale, key, headings). Particular attention should be paid to the pie chart and the bar graph. It may be necessary to remind students how to calculate the sizes of the pie 'slices' (the fraction we want, multiplied by 360°, will give the size of the angle). It will not be necessary at this point to measure angles accurately, but students should be familiar with a half-circle, where the angle is half of 360° = 180°, as well as the quarter circle = 90°, one third of a circle = 120° and two-thirds of a circle = 240°. Examples of a pie chart and bar graph are shown below:

Example of a pie chart:



Notice that the actual figures are not always shown on a pie chart, but the comparison between 'slices' is easily seen. Figures and percentages can sometimes be used, depending on what is being illustrated.

Example of a bar graph



Class discussion should include the idea of frequency – how many times something occurs; and the tally counting method, which uses 4 vertical lines with a slash across to count in groups of 5 (IIII). Students should be given the definitions of the different measures of central tendency of the data and should be encouraged to discuss when each one may be useful:

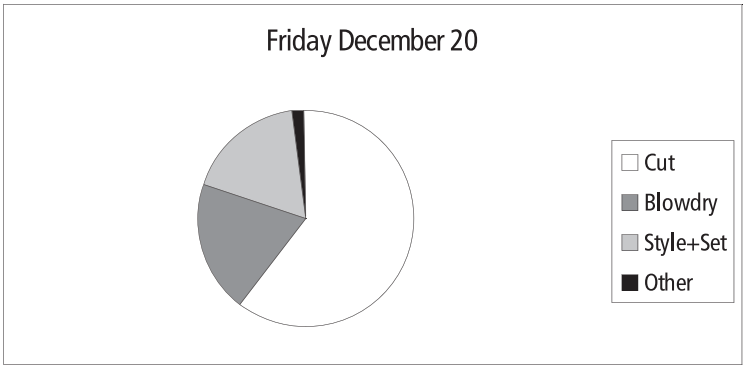
- Mean (average) is the sum of all items divided by the number of items.
- Median is the middle item when the data is arranged in order (ascending or descending). If there is an even number of items, we calculate the median by taking the average of the two in the middle.
- Mode is the item that occurs most frequently.

At this point students should each be given copies of Handout 2 and Worksheet 2.

2.1 The tables below illustrate the total frequencies and the calculations for the size of the 'slices' in the pie charts:

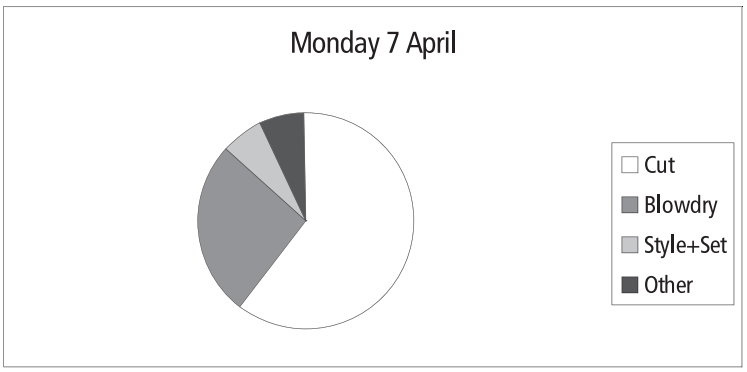
FRIDAY DECEMBER 20

Procedures	Frequency	Calculation
Cut	30	30 ÷ 50 × 360° = 216°
Blowdry	10	10 ÷ 50 × 360° = 72°
Style + Set	9	9 ÷ 50 × 360° = 65°
Other (Perm, braid, highlight)	1	1÷ 50 × 360° = 7°
TOTAL	50	360°



MONDAY 7 APRIL

Procedures	Frequency	Calculation
Cut	9	9 ÷ 15 × 360° = 216°
Blowdry	4	4 ÷ 15 × 360° = 96°
Style + Set	1	1 ÷ 15 × 360° = 24°
Other (Perm, braid, highlight)	1	1 ÷ 15 × 360° = 24°
TOTAL	15	360°



2.2 The mode in each is a cut because cutting occurs most often.

2.3 The mode shows that cutting is the procedure most often required, so when employing part-time staff the other skills need not be emphasised, but cutting skill is essential.

2.4 Very similar, with a slightly larger perm/highlight slice on April 7.

2.5 Very different – 15 procedures is very much less than 50 in a day (less than a third).

2.6 Pie charts cannot show the size of the sample, only the percentages within it. Thus there is nothing to indicate from our two graphs that there is any big difference between the two days – which clearly there is.

2.7 Yes – 1 in 2 is the same as 50% or ½ and on both days more than half the procedures were cuts.

2.8 Yes (approximately), because 9 ÷ 50 × 100 = 18%

2.9

2.10 Total visits for the year divided by number of months: 4948 ÷ 12 = 412,3.

2.11 The salon is closed on Sundays, so 4948 ÷ (365-52) = 15,8.

2.12 First write the monthly number of visits in order:
192, 255, 320, 350, 396, <u>402</u>, <u>412</u>, 452, 467, 509, 573, 620
The median is the sum of the middle two, divided by 2: (402 + 412) ÷ 2 = 407.

2.13 April and May are the two months with the least clients, so this would be the best time for leave to be taken. October and December are the busiest, so all staff will be needed at work. There is some flexibility in the other months.

2.14 The mode (620) gives the busiest time, so the time where additional help will most likely be necessary. It also indicates the maximum number of visits the salon is likely to reach in a month. The mean (412) gives the typical month the salon can cope with. The difference between the two tells us how much busier the salon is than usual. In December, therefore, the salon had 208 visits more than the mean (620 - 412) which would be difficult for the staff to cope with without additional help.

2.15

Available hours:	4 staff x 6½ hours each	= 26 hours
Hours needed :	30 cuts @ ½ hour each	= 15 hours
	10 blowdries @ ½ hour each	= 5 hours
	19 style+ sets @ ½ hour each	= 9,5 hours
	1 braid	= 2 hours
Total needed		= 31½ hours

So on December 20 someone extra needs to come in.

Activity 2 — The salon appointment book

Michelle, the manageress of a busy city hair salon, decided to collect certain information from her old salon appointment book in order to plan for the year ahead. She needs to decide on suitable times for staff to take leave and whether she should employ any part-time staff to help during busy times. She also needs to be sure that part-time staff are skilled in the appropriate techniques for the needs of the salon.

She decided to collect and compare data for a busy day and a quiet day – she chose Friday December 20 as a typical busy day and Monday 7 April as a very quiet day. She also determined the total number of visits for each month. The information she gathered is recorded on Handout 2.

2.1 Complete the following frequency tables using the given data and illustrate each on a pie graph. Approximations for the angles are acceptable. Draw 4 'slices' – Cut / Blowdry / Style + Set / Others (perm, braid, highlight)

FRIDAY DECEMBER 20		
	Tally	Frequency
Cut		
Blowdry		
Style + Set		
Others (perm, braid, highlight)		
TOTAL		

MONDAY APRIL 7		
	Tally	Frequency
Cut		
Blowdry		
Style + Set		
Others (perm, braid, highlight)		
TOTAL		

2.2 What is the modal hair procedure on December 20? And on April 7?

2.3 Explain how the mode of this data could help Michelle to decide what part-time staff should be employed.

2.4 Compare the two pie charts you have drawn. Do they look fairly similar or are they very different?

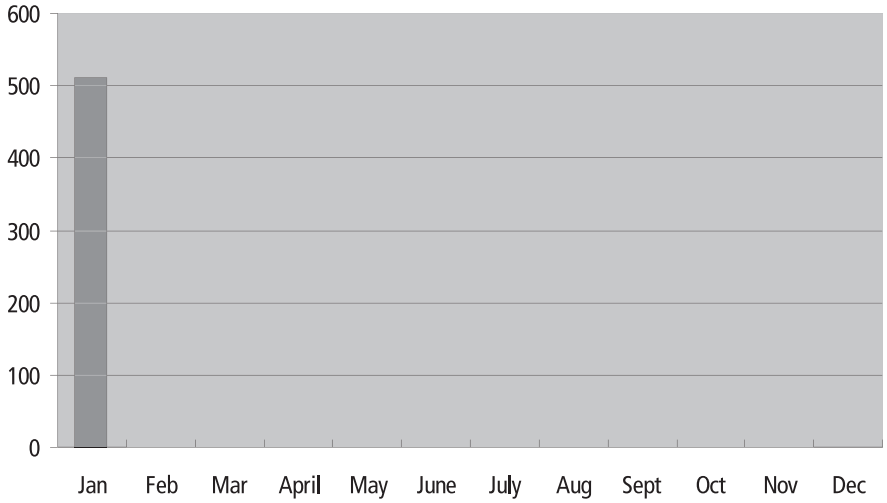
2.5 Are the total number of visits on Friday Dec 20 and Monday April 7 fairly similar or very different?

2.6 Using your answers to 2.4 and 2.5, explain what pie graphs cannot show and why they are limited.

2.7 Would it be true to say that more than 1 in 2 hair procedures is a cut?

2.8 Would it be true to say that on December 20 about 20% of all hair procedures were style + sets?

2.9 Complete the bar graph below which represents the monthly totals of all visits to the salon. January has been filled in already.



2.10 Calculate the mean number of visits to the hair salon per month.

2.11 Calculate the average number of daily visits to the salon for the year.

2.12 What is the median number of monthly visits?

2.13 Explain how this data could be used to make a decision about when staff should take leave.

2.14 In order to make a decision about employing a part-time hairdresser, the mean and the mode are useful in different ways. Explain.

2.15 If we assume that each staff member should work an eight-hour day with an hour for lunch and two 15 minute tea breaks, use the given data to decide whether part-time help should be considered on December 20. Use actual figures to back up your answer. Assume that each procedure takes half an hour, except perm (1 hour) and braids (2 hours).

Extracts from the salon appointment book:

DATE: FRIDAY DECEMBER 20

Time	Michelle	Shane	Ayesha	Lindi
7.00	C			
7.30	C/BW			
8.00		C	C	C
8.30	C/BW		C/BW	C
9.00		SS		C
9.30	SS			C
10.00				Br
10.30	C	C		
11.00	C		SS	
11.30				
12.00	C/SS	C/BW	C/BW	
12.30				C/BW
1.00		C	C/BW	
1.30	C/SS	C		C
2.00	C		BW	C
2.30		C		C/SS
3.00			SS	
3.30	C/BW	C		
4.00		SS	C/SS	
4.30	C/BW			
5.00				

Key to abbreviations

C	BW	P	HL	Br	SS	E
Cut	Blowdry	Perm	Highlight	Braid	Style + Set	Extension

DATE: MONDAY 7 APRIL

Time	Michelle	Shane	Ayesha	Lindi
7.00				
7.30				
8.00				
8.30		SS		
9.00				
9.30	C/BW	C		
10.00				
10.30				
11.00		C	C	
11.30			HL	
12.00				
12.30				
1.00	C/BW			C/BW
1.30				
2.00				
2.30		C		
3.00				
3.30				
4.00		C/BW		C
4.30				
5.00				

MONTHLY TOTALS (TOTAL NUMBER OF ALL VISITS TO THE SALON):

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
509	402	452	192	255	320	350	412	396	573	467	620

Activity 3 — Fridays are always busy?

ABOUT THIS ACTIVITY

This activity involves reading information from tables. Students explore what information can be obtained from a table of data and what sorts of conclusions can be drawn. They use numbers to back up an argument and present a comparative bar graph to illustrate their conclusions. The context is the interpretation of the monthly figures for visits to the hair salon. The Specific Outcomes and Assessment Criteria addressed are SO1 – AC1, 2, 3, 4, 7, 8, 9.

MANAGING THIS ACTIVITY

To prepare for this activity, students should listen to the radio or television, or look in newspapers or magazines, to identify examples of numbers being used to back up arguments or sell products (adverts are a good source). A teacher-led class discussion or a student-led presentation would be a good way to raise issues around the validity of the numbers, the source of the numbers and the justification for the conclusions. Students should criticise where possible and try to identify instances where numbers are loosely used and the conclusions are broad and inaccurate. The word 'all' is often used inappropriately and sample size needs to be criticised. Students should be given a copy of Handout 3 and Worksheet 3.

3.1 October is the busier month with 569 visits to April's 149.

3.2 The completed table:

Day	April total visits	October total visits	Average visits April	Average visits October
Mondays	8	66	8÷2=4	66÷4=16,5
Tuesdays	37	117	37÷5=7,4	117÷5=23,4
Wednesdays	35	118	35÷5=7	118÷5=23,6
Thursdays	14	77	14÷4=3,5	77÷5=15,4
Fridays	35	127	35÷3=11,6	127÷4=31,8
Saturdays	20	64	20÷3=6,6	64÷4=16
TOTAL	149	569	6,7	21

3.3 569 – 149 = 420 visits.

3.4 35 ÷ 149 × 100 = 23,5%. There are only three Fridays, which is significant because there are five Tuesdays and Wednesdays and four Thursdays. Our figure of 23,5% of visits being on Fridays would be a lot higher if we were counting visits for five Fridays, so percentage of all visits is not a suitable way to analyse which day is busiest. We need to look at the average number of visits per day of the week to get a more accurate idea.

3.5 127 ÷ 569 × 100 = 22,3%.

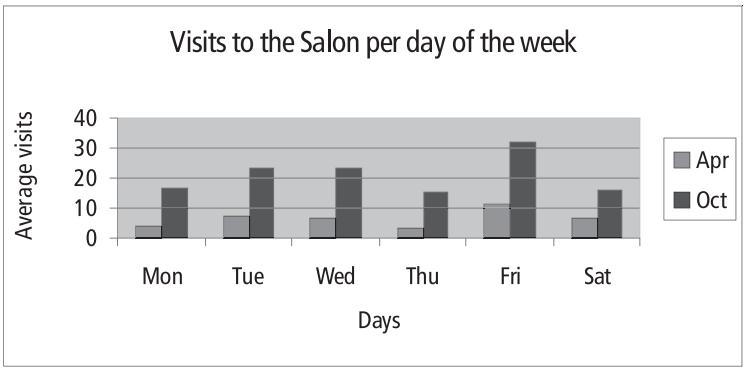
3.6 In April, Thursday is the quietest day with an average of only 3,5 visits. In October, Thursday is also the quietest with an average of 15,4 visits.

3.7 Yes, it has the highest average number of daily visits in both April and October. It has 11,6 visits on average in April and 31,8 in October. One could also mention that Saturday, the half-day, is also very busy - all appointments happen before noon, meaning 'very busy' but for a short time.

3.8 This sample is only one salon and in the city, a very small sample when the salesman implies a population of all salons.

3.9 Various suggestions will come up here – different needs, times and transport. In the city customers may well use a salon during a lunch break, while a corner salon is likely to do most of its business at weekends.

3.10 Arguments will differ here – points that should be mentioned include sample size as well as location. A generalization from one city salon to all salons is incorrect (although it may be true for other city salons). In our city sample Friday is a popular day in April and October, but this may be quite different in a township salon.



Activity 3 — Fridays are always busy?

On Handout 3 you have been given a table titled 'Daily visits to the salon', which is additional data gathered at our city hair salon for the months of April and October. The data records the number of visits per day during these months. Your task is to examine and analyse the statement made by a visiting salesman, selling a new range of hair products, that 'at hair salons, Fridays are always busy'. Use the data tables to answer the following questions.

3.1 Which is the busier of the two months?

3.2 Complete the following table to help you answer the questions that follow. Fill in both the actual number of visits per day of the week, as well as the average number of visits per day of the week in April and October. For example, average visits on Mondays in April is 8 visits ÷ 2 Mondays = 4. On Sunday the salon is closed and Saturday is a half-day closing at noon. Remember to take into account the public holidays in April.

Day	April total visits	October total visits	Average visits April	Average visits October
Mondays				
Tuesdays				
Wednesdays				
Thursdays				
Fridays				
Saturdays				
TOTAL				

3.3 What is the difference between the total number of all visits to the salon in April and October?

3.4 What percentage of all the visits are on a Friday in April? How many Fridays does this include and why is this significant?

3.5 What percentage of the visits are on a Friday in October?

3.6 What, in this data, is the quietest day? Use averages to support your answer.

3.7 In this sample is Friday the busiest day? Give a reason for your answer.

3.8 What is this sample? What is the population implied by the salesman's comment?

3.9 What are some differences you might expect to find in the figures at:
- a suburban salon
- a township salon
- a rural salon
- a corner salon

3.10 Using the information obtained during this exercise, give a short argument, backed up with figures and a bar graph, to criticise the statement: 'At hair salons Fridays are always busy'. Use a double bar graph to show the average figures for different days of the week.

Data sheet – additional data which was gathered at the hair salon, where the number of visits per day was recorded for the months of April and October:

DAILY VISITS TO THE SALON			
APRIL		OCTOBER	
1 Tue	12	1 Tue	22
2 Wed	8	2 Wed	20
3 Thu	3	3 Thu	18
4 Fri	15	4 Fri	22
5 Sat	10	5 Sat	11
6 Sun	0	6 Sun	0
7 Mon	6	7 Mon	15
8 Tue	4	8 Tue	22
9 Wed	8	9 Wed	24
10 Thu	0	10 Thu	5
11 Fri	11	11 Fri	36
12 Sat	5	12 Sat	14
13 Sun	0	13 Sun	0
14 Mon	2	14 Mon	16
15 Tue	10	15 Tue	20
16 Wed	6	16 Wed	22
17 Thu	11	17 Thu	16
18 Fri	Easter	18 Fri	29
19 Sat	Easter	19 Sat	19
20 Sun	Easter	20 Sun	0
21 Mon	Easter	21 Mon	14
22 Tue	7	22 Tue	26
23 Wed	6	23 Wed	28
24 Thu	0	24 Thu	15
25 Fri	9	25 Fri	40
26 Sat	5	26 Sat	20
27 Sun	0	27 Sun	0
28 Mon	Holiday	28 Mon	21
29 Tue	4	29 Tue	27
30 Wed	7	30 Wed	24
		31 Thu	23

Activity 4 — Reading the newspaper

ABOUT THIS ACTIVITY

This activity involves more reading and interpretation of data tables. Students study newspaper tables with figures comparing the South African elections of 1994, 1999 and 2004. They make comparisons and present a comparative bar graph to illustrate their conclusions. The activity is self-contained and suitable for evaluation purposes as it draws on ideas and terminology from previous activities. The Specific Outcomes and Assessment criteria addressed are SO1 – AC1, 3, 4, 7, 8, 9.

MANAGING THIS ACTIVITY

Little management is required here. In preparation, it may be useful to spend time drawing on the general knowledge of the students about political parties and provincial voting structures in South Africa. They need to realise that the tables they are working with show both provincial and national figures, which means questions should be read carefully to make sure figures are taken from the appropriate source. It may be necessary to remind students what a comparative bar graph is – it needs to show double, triple or more bars (as required), comparing data. Students should be given a copy of Handout 4 and Worksheet 4.

4.1 Count 7 parties.

4.2 1994 - from adding the column - 19 374 202 people voted.
1999 - 15 739 746 votes.
2004 – 15 402 463 votes.

4.3 125 280 (read directly from table).

4.4 44 323, read from the Western Cape table of results.

4.5 7,84%, read in the percentage column of Western Cape table.

4.6 The ANC decreased by 1 359 404 votes (10 878 251 – 12 237 655).
The DA increased by 1 592 775 votes (1 931 201 – 338 426).
The IFP decreased by 969 630 votes (1 088 664 – 2 058 294).

4.7 The total number of voters dropped from 19 374 202 in 1994 to 15 402 463 in 2004, so the percentages are calculated for a lower total figure. Students may notice inaccuracies in the percentages given on the table, probably because there were more parties than those shown in the handout, but their number of votes was small.

$$\frac{12237655}{19374202} \times 100 \approx 63{,}16\%$$

$$\frac{10878251}{15402463} \times 100 \approx 70.6\%$$

4.8 Read directly from the table 0,71%.

4.9 DA/DP : the percentage rose from 1,73% to 12, 37% , an increase of 10,64%.
NNP: the percentage dropped from 20,39% to 1,65%, a decrease of 18,7%.

4.10 Read from the small table: 76,73%. To find the total number, we must round off to the nearest 'whole' person:

$$\frac{100}{76{,}73} \times 15402463 = 20073587$$

4.11 1 539 893 voted (add the column) while 2 160 647 were eligible:

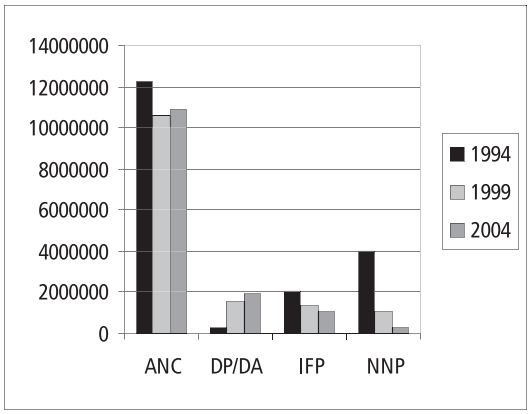
$$1539893 \times \frac{100}{71{,}27} = 2160647$$

4.12 ID first participated in the elections in 2004, and received 7,84% of the Western Cape vote.

4.13 From 1994 - 1999 the drop was from 20,39% to 6,87% = 13,52%. From 1999 - 2004 the drop was from 6,87% to 1,65% = 5,22%.

4.14 Adding the seats : 396.

4.15



Activity 4 — Reading the newspaper

On Handout 4 you have been given three tables of information taken from the 'Sunday Times' of 18 April 2004, comparing the South African Election figures of 1994, 1999 and 2004. Notice that some of the figures are national and some are provincial. Study the data carefully and then answer the questions that follow.

4.1 Refer to the table 'National Results' — how many parties participated in 1994?

4.2 How many people voted in 1994? In 1999? In 2004?

4.3 How many people voted nationally for the UCDP in 1999?

4.4 How many people voted for the ACDP in 1999 in the Western Cape?

4.5 What percentage of votes did the ID get in 2004 in the Western Cape?

4.6 Consider the ANC, the DA and the IFP – what was the increase or decrease in actual number of votes between 1994 and 2004?

4.7 Explain how it is possible that the ANC vote dropped naturally from 12 237 655 to 10 878 251 in 10 years and yet the percentage rose from 62,65% to 69,68%?

4.8 What percentage of the votes did the PAC get in 1999?

4.9 Which party had the greatest percentage increase in votes in 10 years? Which party had the greatest percentage decrease in 10 years? Use numbers to support your answer.

4.10 What was the national percentage voter turnout in 2004? What was the total number of eligible voters nationally?

4.11 How many people voted in the Western Cape in 2004? How many were eligible to vote?

4.12 In which year did the ID vote for the first time? What percentage of the Western Cape vote did it get?

4.13 By what percentage did the NNP vote drop nationally from 1994 to 1999? And from 1999 - 2004?

4.14 How many seats were won in parliament by the 10 parties who voted in 2004?

4.15 Draw a bar graph, showing the comparative figures for the National Votes between the elections of 1994, 1999 and 2004. Consider only the ANC, DP/DA, IFP and NNP. Draw your own conclusions about the voting patterns that you observe.

NATIONAL ELECTION RESULTS							
Party	**1994**	**%**	**1999**	**%**	**2004**	**%**	**Seats**
ANC	12 237 655	62.65	10 601 330	66.35	10 878 251	69.68	279
DP/DA	338 426	1.73	1 527 337	9.56	1 931 201	12.37	50
IFP	2 058 294	10.54	1 371 477	8.58	1 088 664	6.97	28
UDM			546 790	3.42	355 717	2.28	9
ID					269 765	1.73	7
NNP	3 983 690	20.39	1 098 215	6.87	257 824	1.65	7
ACDP	88 104	0.45	228 975	1.43	250 272	1.6	6
FF	424 555	2.17	127 217	0.8	139 465	0.89	4
UCDP			125 280	0.78	117 792	0.75	3
PAC	243 478	1.25	113 125	0.71	113 512	0.73	3
WESTERN CAPE RESULTS							
Party	**1994**	**%**	**1999**	**%**	**2004**	**%**	**Seats**
ANC	705 576	33.01	668 106	42.07	709 052	45.25	19
DA	141 970	6.64	189 183	11.91	424 832	27.11	12
NP	1 138 242	53.25	609 612	38.39	170 469	10.88	5
ID					122 867	7.84	3
ACDP	25 731	1.2	44 323	2.79	53 934	3.44	2
UDM					27 489	1.75	1
AMP	20 954	0.98	38 071	2.4	11 019	0.7	
NLP					10 526	0.67	
W-FF	44 003	2.06	6.394	0.4	9 705	0.62	

NUMBER OF VOTERS WHO CAST THEIR BALLOTS IN 2004	
NATIONAL	76.73%
EASTERN CAPE	79.31%
MPUMALANGA	78.30%
FREE STATE	77.76%
NORTH WEST	75.55%
LIMPOPO	74.80%
GAUTENG	74.23%
N.CAPE	74.70%
KZN	72.84%
W. CAPE	71.27%

(Sunday Times 18 April 2004)

Activity 5 — Trends and connections

ABOUT THIS ACTIVITY

In this activity students interpret the range and distribution of data. They extend the idea of determining 'the centre', to the idea that there are patterns and important connections between certain variables that can also be measured. They examine variance from the mean and identify outliers as well as trends. They identify correlations and use a line of best fit to make simple predictions. Specific Outcomes and Assessment Criteria addressed are as follows: S01 – AC 4, 7; S03 – AC 1, 3, 4, 5.

MANAGING THIS ACTIVITY

A number of new terms and ideas are introduced here and it would be a good idea for the teacher to precede the activity with a lesson explaining and giving examples of each. Explain the limitations of determining the central tendency. For example:

- The four numbers 1; 2; 48; 49 have a mean of 25 (add them and divide by 4).
- The four numbers 24; 25; 25; 26 also have a mean of 25.

Despite the fact that the mean is the same, there is clearly a large difference between these two selections of numbers. In the first case two numbers are very high and two are very low, whereas in the second case all four numbers are close to each other. We need to describe this difference in terms of spread and range.

The range is the difference between the highest and the lowest numbers, while the spread is the distance from the mean. So in the first example the range is 99 – 1 = 98, while the range in the second example is 26 – 24 = 2. If the data is clustered around the mean we say the spread is small, while if it is far from the mean we say it is widely spread. The statistical term variance is the numerical way of calculating the spread.

In some data samples, we notice that the variables are connected. They vary together in a pattern and as one increases (or decreases), so does the other. For example, as a child increases in height, we expect a corresponding increase in weight. We say that there is a correlation between height and weight.

Other data have no link, for example a person's age is not linked to the city in which s/he lives. In these cases we say there is no correlation. Patterns of correlation are easy to identify in a scatter graph, where each piece of data is represented by one point on the graph. If there is a correlation we can see a trend in how the points are positioned. We can also draw a trend line or line of best fit, which is a line drawn as close to as many points as possible.

Often we find one or two points that are 'odd' or out of the pattern – we call these outliers and they can be significant in identifying problems. A trend line is useful as it can be extended to make predictions about data that has not been measured.

Each student should get a copy of Handout 5 and Worksheet 5.

5.1 Count 6 points, Each one represents a person, therefore there were 6 people in the sample.

5.2

Age in years	18	25	40	58	64	78
Change	R2.50	R10	R25	R12	R50	R3

5.3 No connection and no pattern can be seen on the graph, just an array of dots.

5.4 Yes, and the connection can be seen in the linear pattern of the dots, except for one dot that is out of the pattern.

5.5 Mean height is 2080 ÷ 12 = 173,3 cm; mean weight is 770 ÷ 12 = 64 kg.

5.6 Height range is 204 – 145 = 59cm; weight range is 98 – 20 = 78kg.

5.7 The data is clustered around the mean and the variance is small except for one point that is different from the rest.

5.8 Yes. The height is 160cm and the weight is 20kg which is very different from the trend. It is useful information because this person is very underweight for his/her age and there is either a severe medical problem that needs to be identified or an error in the experimental measurement.

5.9 Accept very approximate answers here – 130cm and 70kg.

5.10 New height average is 174,5cm, new weight average is 68kg. The height average remains much the same, but the weight average is skewed by 4kg. Another outlier would skew the average still more.

Activity 5 — Trends and connections

This activity refers to the data sheet given on Handout 5. Data was collected from a number of people by finding out how old they were and how much change they had in their pockets.

Refer to the scatter plot showing 'my age' against 'change in my pocket'

5.1 How many people were measured in this sample?

5.2 Read from the graph the age of each person and how much change is in his/her pocket (give approximate answers only).

5.3 Is there any connection between age and change in your pocket? How is this supported by the graph?

Refer to the scatter plot showing height against weight

5.4 Do you think there is a connection between height and weight? How does the graph support your answer?

5.5 The data used to draw the scatter plot is shown in the table below. Calculate the mean height and the mean weight in the given sample.

Height	170	196	151	177	190	158	163	185	181	204	145	160
Weight	60	92	45	78	85	49	52	77	73	98	41	20

5.6 What is the range of height and weight?

5.7 Is the variance from the mean big or small? In other words, is the data clustered around the mean or widely scattered?

5.8 Is there an outlier? If so, read off the height and weight of this person. How could this information be useful?

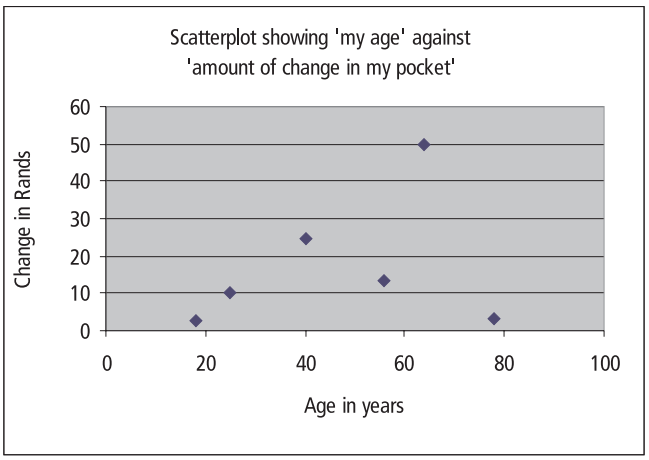
5.9 Draw an approximate trend line on the given graph and give a prediction for the following:

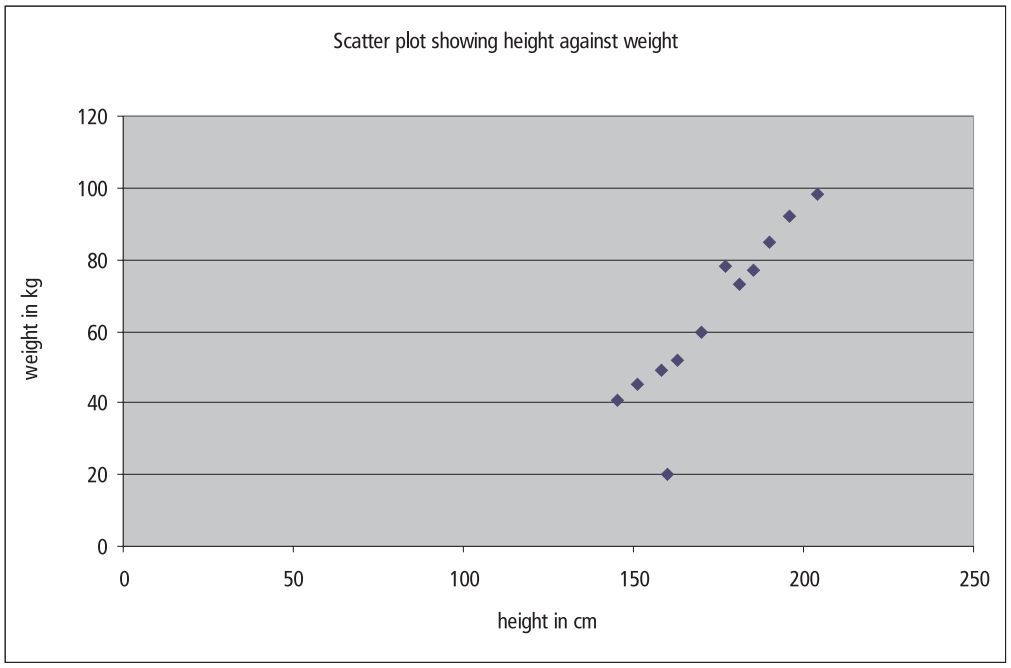
The approximate height of someone who weighs 20kg is …

The approximate weight of someone who is 175 cm tall is …

5.10 Calculate the average height and weight again, but this time without the outlier. Does the outlier skew the average? What do think would happen if there was another outlier?

Data Sheet


Scatterplot showing 'my age' against
'amount of change in my pocket'
Change in Rands
60
50
40
30
20
10
0
0
20
40
60
80
100
Age in years


Scatter plot showing height against weight
weight in kg
120
100
80
60
40
20
0
0
50
100
150
200
250
height in cm

Activity 6 — Reading and predicting

ABOUT THIS ACTIVITY

In this activity students read data and make predictions by analysing trend lines. They observe patterns and measure important connections between variables. They identify variance from the mean as well as outliers, suggesting what implications these may have in real life situations. The Specific Outcomes and Assessment Criteria addressed are as follows: SO1 – AC 4, 7, 8, 9; SO3 – AC 2, 3, 4, 5.

MANAGING THIS ACTIVITY

This activity requires very little management and is well suited to an assessment task. Students are required to read, measure, calculate and interpret using many ideas from the previous activities. Explain to them the idea of a percentile — if an item is in the 60th percentile, it means that 60% of the other items are either equal to or less than this one. Discuss the idea of Body-Mass-Index, which is used as a health indicator. A BMI of between 19 and 22 is considered to be ideal. To calculate BMI use the following formula:

BMI = Weight (kg) ÷ Stature (cm) ÷ Stature (cm) × 10 000

Students should each receive copies of Handout 6 and Worksheet 6.

6.1 Expected height measured against age.

6.2 If your height is in the 90th percentile, it means that 90% of all people are 'on' or below your height. Only 10% of people are therefore taller than you.

6.3 One graph shows age against weight, the other shows age against height (stature). The scale shows both cm and inches; as well as kg and lb (pounds). All calculations here will use cm and kg only.

6.4 173 – 152 = 21. Read this on the age 16 line from the top to the bottom trend line.

6.5 Yes, she is in the 95th percentile, so only 5% of girls are taller than she is.

6.6 No, she would be underweight. She should weigh between 24 and 47kg.

6.7 About 31kg – read off the 5th percentile line because her height is in the 5th percentile.

6.8 Weight – 33kg; height -138cm. Read off the 50th percentile line to find the average.

6.9 90cm – read off the 90th percentile line for age 2.

6.10 Body- Mass- Index – this is a measure used by health professionals to make medical decisions and recommendations. BMI = 70 ÷ 165 ÷ 165 x 10 000 = 25,7. Ideal BMI is considered to be 19 – 22, so this is higher than ideal. Of course, this remains an indicator only and variation is expected.

6.11 About 69kg – split the difference in the trend lines.

6.12 At 17 she would be about 68kg and at 18 about 69kg — draw your own trend line three steps higher than the 50th percentile to read these figures.

Activity 6 — Reading and predicting

Refer to the data sheet (Handout 6) - 2 to 20 years: Girls Stature-for-age and Weight-for-age percentiles

This interesting graph shows trend lines for the normal expected growth of girls between 2 and 20 years. The lowest trend line is the normal growth pattern expected for short or small girls and the highest line is for the tall, large girls. Most girls are expected to fall somewhere between these two, with some variation. A problem could be indicated when there is a sudden sharp drop or rise which is not the expected trend.

6.1 What does stature-for-age mean?

6.2 What is a percentile? What does it mean to say that your height is in the 90th percentile?

6.3 There are two graphs shown here. What is the difference between them?

6.4 The sets of parallel lines show the trends of girls' height and weight measured over a large sample. In this data, what is the range of heights for a girl of 16?

6.5 If a young woman of 18 is 174 cm tall, is she tall for her age? In what percentile is her height?

6.6 If a girl of 10 weighs 20kg, would she be of average weight? Explain.

6.7 If a girl of 12 was 140cm tall, what would you expect her weight to be according to this data?

6.8 According to this data, what is the mean height and weight for a girl of 10?

6.9 A two-year-old is tall for her age and her height is in the 90th percentile. How tall is she?

6.10 What is BMI? Using the formula given in the table in the top left of the graph, and repeated below, calculate the BMI of a young woman of 20 who is 165 cm tall and weighs 70kg.

BMI = Weight (kg) ÷ stature (cm) ÷ stature (cm) × 10 000.

6.11 What do you think the weight of the same young woman of 20 was when she was 19?

6.12 If a girl of 14 weighs 60kg, predict her weight at 17 and 18 years if she follows the trends shown on this graph.

2 to 20 years: Girls
Stature-for-age and Weight-for-age percentiles

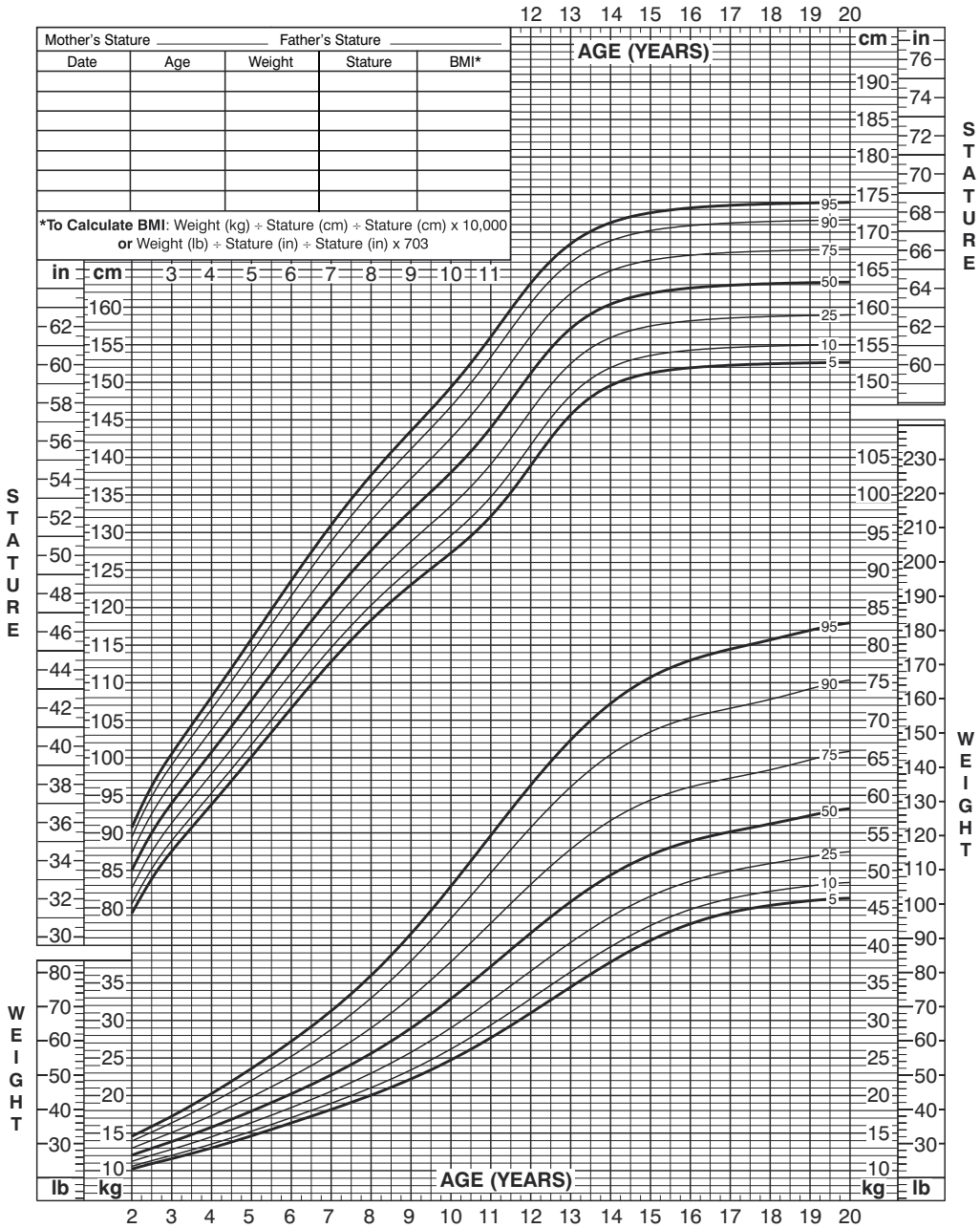
NAME _____

RECORD # _____

Mother's Stature _____ Father's Stature _____

Date	Age	Weight	Stature	BMI*

***To Calculate BMI**: Weight (kg) ÷ Stature (cm) ÷ Stature (cm) x 10,000
or Weight (lb) ÷ Stature (in) ÷ Stature (in) x 703



Published May 30, 2000 (modified 11/21/00).
SOURCE: Developed by the National Center for Health Statistics in collaboration with the National Center for Chronic Disease Prevention and Health Promotion (2000).
http://www.cdc.gov/growthcharts

SAFER • HEALTHIER • PEOPLE™

Activity 7 — Beauty Africa Exhibition

ABOUT THIS ACTIVITY

In this activity students analyse data and use it to make decisions and plans. Tables and pie charts are used and information is given as percentages which students use to calculate actual numbers. Problems relating to transferring data and contamination of data are raised. Specific Outcomes and Assessment Criteria are SO1 – AC1, 7, 9; S.0.3 – AC1, 2, 4.

MANAGING THIS ACTIVITY

Students have already worked with all the graph and data types, so little new information is needed. The teacher should prepare students for this activity by asking them to identify situations in their experience where a plan or decision could be made using information from another, similar situation. Explain to them that data from one situation can be used to inform another, provided one takes into account all the factors that influence or change the expected result. Discuss some of the problems that could contaminate the data – interviewer bias, biased composition of sample, size of sample too small to draw reliable conclusions, etc. Discuss also the problems that could arise by simply 'transferring' information and not considering all the variables – the differences in context, the differences in gender, culture and financial status. This could result in an interesting discussion and students may have examples where data is flawed and unreliable. Students should receive copies of Handout 7 and Worksheet 7.

7.1 There was a total attendance of 15 039 people from all the provinces of South Africa as well as international visitors (Benin, Botswana, Brazil etc).

7.2 Sunday 13 July was the busiest day, with just over half the visitors attending on that day. The fraction is :

$$\frac{8055}{15039}$$

7.3 Students accounted for 992 ÷ 15039 x 100 = 6,6% and the greatest interest was shown by the trade sector with an attendance of 54,5%.

7.4 24,26% of 15039 = 3648 people (remember to round down to the nearest 'whole' person).

7.5 Beauty salons showed the highest attendance figures, accounting for 27,43%. The lowest figures were shown by the Associations at 0,39%. Also low was jewellery at 0,43%.

7.6 The mean number of visitors per day was 15039 ÷ 3 = 5013. The modal number was 8055 (on Sunday 12th). It is useful to know this figure to ensure that your venue is big enough to hold this number of people.

7.7 1,09% of 15039 = 163 members of the press attended.

7.8 Trade invitations were the most successful – seen by the biggest 'slice' of the pie.

7.9 Attending the 2003 exhibition were 24,26% of 15039 = 3648 people who may be interested in a smaller local exhibition. This figure should be seen as an indication only – the 2003 event was a lot more high profile than a smaller local event, it had international representatives, interesting competitions and people from many different sectors. A smaller event may not attract the same level of interest.

7.10 The venue can accommodate 3000 over three days – this is reasonable as our figures are likely to be less than 3648. If every one of the people from 2003 attended, however, the venue could not manage. The busiest day should be able to manage half the numbers – this would be a maximum of 3648 ÷ 2 = 1824 people. Again, if all the 2003 visitors arrived we would be short of space, but we are expecting a smaller crowd, so the figures seem reasonable.

7.11 Trade invitations, street posters, and radio and magazine inserts are all successful. We assume that word of mouth from the exhibitors and the organisers does not cost anything. There may be some variety in this answer.

7.12 Probably. Expect a lot fewer though, for a local, limited event.

7.13 9,79% + 4,29% = 14,08% of the people who attended the 2003 event were distributors or retailers – this is a total of 2117 people. One fifth of this is 423 people.

7.14 The number 423 should definitely be seen as an indication only and probably an overestimate. One would expect many more retailers and distributors to be interested in a high profile event where they could make international business contacts and partnerships.

7.15 A variety of answers should be expected here – it would have been useful to know, for example, how many invitations were refused and by whom. Refusals can give further information about who is unlikely to attend a local event.

7.16 A variety of responses would be expected.

Activity 7 — Beauty Africa Exhibition

The data given in Handout 7 gives the statistics of the visitors to the 5th Annual Beauty Africa Exhibition held from 12 – 14 July 2003 at the Sandton Convention Centre in Johannesburg. (source: http://195.166.37.12/it-group/beautyafrica).

This exhibition included exhibits from the cosmetic, hair, health, nail and beauty industries of Africa. There was a showcase of products and services for industry buyers, retailers, distributors, importers, exporters and potential international trading partners.

The Beauty Africa Consumer Expo targeted the consumers who ultimately purchase the health and beauty products. A number of events were hosted including the Beauty Africa Hairdressing Championships.

Your task is to analyse this data and make recommendations and decisions about planning a smaller local exhibition (approximately 3000 people in total) limited to the Hair Care Industry. You have access to a venue that can hold a maximum of 1500 people at once and you can use it for three days. You need to decide who should be involved, how you should advertise, etc.

Answer the following questions about the 2003 event to help you make your decisions.

7.1 How many people in total visited the exhibition and where were they from?

7.2 Which was the busiest day and what fraction of the visitors came on that day?

7.3 What percentage of the visitors were students and which sector (students / public / trade) showed the highest attendance figures?

7.4 How many people from the hairdressing salons attended?

7.5 Which registered trade showed the highest attendance figures? Which showed the least? Give percentages to back up your answer.

7.6 What was the mean number of visitors per day? What was the modal number of visitors and why would it be useful to know this figure?

7.7 How many members of the press attended?

7.8 What was the most successful way of informing visitors about the event?

7.9 Using the figures of the 2003 conference as a guide, how many hair care people may be interested in a smaller, local Hair Care Exhibition? How accurate do you think this figure is? What variables should be taken into consideration when planning for this new event?

7.10 Can your venue manage the numbers? Back up your answer using the attendance patterns of the 2003 event.

7.11 Finances limit you to only four types of advertising/ invitations. What would you choose?

7.12 Is the press likely to attend?

7.13 It is in the interests of the hair care industry to have representatives from the distributors and retailers. How many are likely to come? Assume that as the exhibition is about one fifth of the size of the 2003 event, about one fifth of the number of retailers and distributors will come.

7.14 Comment on the assumption made in the previous question. Do you think it could be a problem and result in unreliable numbers?

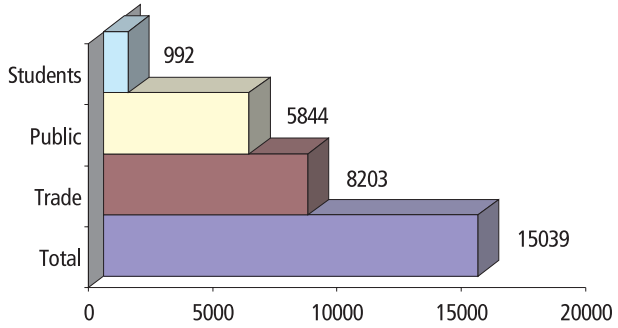
7.15 What other data would help you make more accurate decisions?

7.16 What events or attractions would you recommend to add interest and attract people to the exhibition? Use your own ideas and creativity for this question.

VISITORS STATISTICS - BEAUTY AFRICA EXHIBITION

Total Visitors	15039
Saturday 12 July 2003	3325
Sunday 13 July 2003	8055
Monday 14 July 2003	3659
Students	992
Public	5844
Trade	8203

2003 Visitors



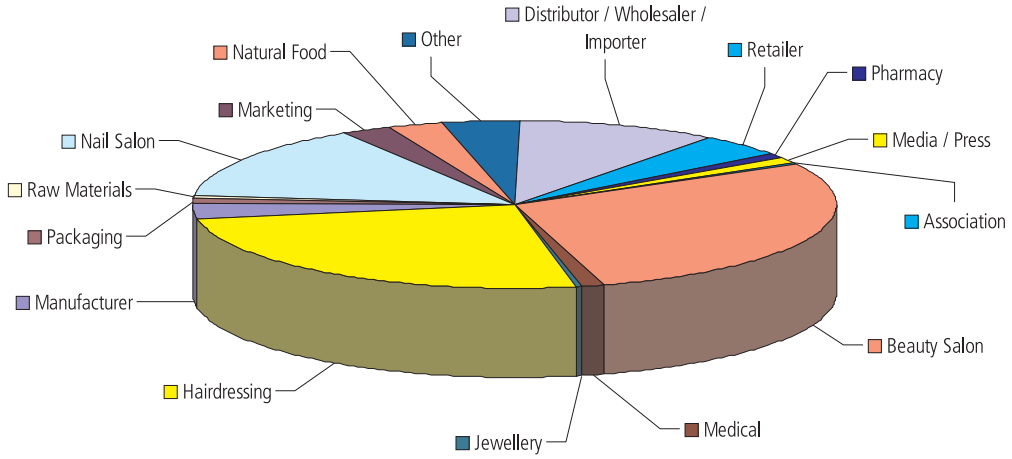
South African visitors from the following regions attended:
Gauteng, North West Province, Limpopo, Mpumalaga, KwaZulu Natal, Eastern Cape, Western Cape, Northern Cape and the Free State.

International visitors from the following countries attended:
Benin, Botswana, Brazil, Bulgaria, China, Egypt, England, France, Germany, Ghana, India, Italy, Ivory Coast, Kenya, Korea, Kuwait, Jordan, Lebanon, Malawi, Mauritius, Namibia, Netherlands, Nigeria, Pakistan, Seychelles, Swaziland, Taiwan, Uganda, USA, United Arab Emirates, West Indies, Zimbabwe.

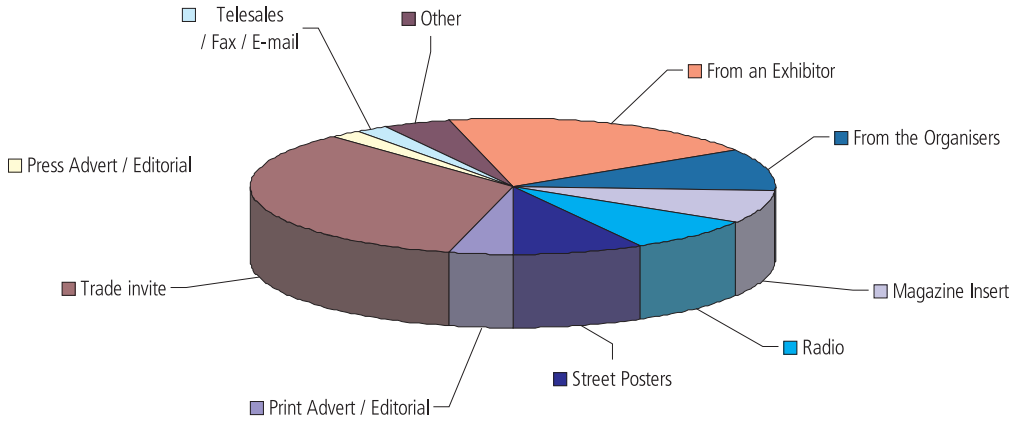
Nature of business (registered trade)

Distributor / Wholesaler / Importer	9.79%
Health & Fitness	4.06%
Retailer	4.29%
Manufacturer	3.02%
Pharmacy	0.65%
Packaging	0.69%
Media / Press	1.09%
Raw Materials	0.69%
Association	0.39%
Nail Salon	13.8%
Beauty Salon	27.43%
Marketing	2.43%
Medical	0.9%
Natural Food	2.61%
Jewellery	0.43%
Other	3.675%
Hairdressing	24.26%

Nature of business (registered trade)



How did the visitors hear about Beauty Africa?



Activity 8 — What are my chances?

ABOUT THIS ACTIVITY

This activity introduces the idea of probability. A preliminary handout has been included with background information on some of the common applications and terminology used in this branch of statistics. The students work with single events in the context of the 'Lotto draw', comparing 'counted' results with calculated probability. In this way they work with the mathematical verification of experimental results. The Specific Outcomes and Assessment Criteria addressed are: S02 – AC1, 2, 3, 4; S03 – AC1, 4.

MANAGING THIS ACTIVITY

Games of chance, gambling, betting on the horses and the national lottery are possible contexts where students have some experience of probability. A good way to introduce this topic would be for the teacher to generate a discussion around games of chance, drawing from the students some of the common words and expressions relating to probability, for example 'what are the odds?', 'the chances are..'. One could explore the idea that the chance of guessing correctly twice in a row is much less than the chance of guessing correctly once. Probability is not always an easy concept for students to grasp and it would be a good idea to spend plenty of time explaining and exploring the ideas mentioned in Handout 8. Students should then each get a copy of Handout 8 and Worksheet 8.

8.1 There were 600 numbers drawn (100 draws × 6 numbers each) and there were 120 numbers drawn between 30 and 39 (counted from the table of ticks). The fraction of the draw that includes at least one number between 30 and 39 is thus:

$$\frac{120}{600} \quad \& \quad \frac{120}{600} \times 100 = 20\%$$

8.2 There were 119 numbers drawn from 20 to 29 (found by counting ticks), therefore there were 600 – 119 = 481 numbers not between 20 and 29. Fraction is thus:

$$\frac{481}{600} = 80\%$$

8.3 Count 52 consecutive pairs, therefore percentage is 52 ÷ 600 = 8,7%.

8.4 Count 119 multiples of 5, therefore percentage is 119 ÷ 600 = 20% approximately.

8.5 Count a total of 15 draws of the number 1. The percentage is thus 15 ÷ 600 = 2,5%.

8.6 There are 10 numbers from 30 to 39 and a possible 49 numbers in total from which to select. So the probability of selecting a number between 30 and 39 is 'number of ways to select' ÷ 'total possible equally likely selections':

$$P = \frac{10}{49} = 20{,}4\%$$

8.7 There are 39 numbers that are not between 20 and 29, so the probability that the draw will not include any numbers between 20 and 29 is:

$$P = \frac{39}{49} = 79{,}6\%$$

8.8 There are 9 multiples of five between 1 and 49, so the probability of drawing one is 9 ÷ 49 = 18,4%.

8.9 The probability that the number 1 will be drawn is 1 ÷ 49 = 2,04%.

8.10 From the calculations, we see that the experimental data was not a perfect match with the statistical calculations, but was close in each case:
20% compared to 20,4%;
80% compared to 79,6%;
20% compared to 18,4%;
2,5% compared to 2,04%.

We would expect the experimental data to be more accurate the bigger the sample. But we can say that, our calculations did verify the experimental results.

Each number has a 1 in 49 (about 2%) chance of being drawn every week, so in fact no number occurs more frequently than any other. The reason that numbers seem to be 'hot' is because the sample is too small and we are not getting an accurate picture. Think of flipping a coin — it is quite possible to get 4 'heads' and 1 'tail' in 5 throws, but this certainly does not mean that the probability of getting 'heads' is 80%. It simply means that the sample was too small to get an accurate result.

Activity 8 — What are my chances?

The table below shows a selection of 100 Lotto draws arranged in numerical order, without the bonus number. Analyse each draw by filling in the table using ticks in each column. Each tick indicates one number, a blank indicates no number. Then answer the questions that follow:

Numbers drawn						1 to 9	10 to 19	20 to 29	30 to 39	40 to 49	Multiples of 5	Consecutive pairs
3	10	29	30	34	45							
16	21	28	34	45	49							
16	24	26	28	38	48							
7	11	26	34	45	46							
7	22	37	38	44	46							
2	5	11	16	28	33							
15	19	24	30	31	43							
3	9	13	24	32	48							
1	9	21	31	35	46							
4	5	7	16	19	40							
5	10	13	16	26	49							
9	15	31	33	34	42							
2	4	6	32	44	49							
1	7	18	30	44	49							
1	11	29	34	43	44							
6	18	20	31	40	43							
7	16	26	27	39	44							
9	13	14	33	43	45							
5	13	15	23	26	28							
11	20	32	33	46	48							
3	9	16	17	44	45							
6	14	15	36	38	49							
2	10	12	26	30	35							
4	18	21	23	43	48							
11	22	28	37	38	46							
14	24	30	32	41	48							
6	8	28	43	46	49							
2	3	19	27	41	46							
3	8	9	30	35	45							
1	13	26	29	37	45							
13	18	19	37	45	46							
22	29	30	31	34	40							
4	6	7	34	40	46							
6	16	24	33	35	48							
23	26	28	35	44	46							
5	23	30	36	43	46							
3	12	24	28	29	33							
3	8	14	25	26	31							
2	9	15	20	28	45							
11	17	24	35	42	43							
1	7	8	10	30	38							
2	15	16	18	38	40							
16	20	30	36	39	40							

1	4	23	35	39	48							
5	6	12	22	25	44							
4	12	24	35	43	46							
4	7	19	30	47	48							
3	10	14	28	36	44							
6	8	15	21	35	48							
14	16	20	30	37	39							
1	7	17	27	28	38							
2	5	27	44	45	46							
4	18	25	32	40	44							
18	19	21	36	37	45							
23	36	42	45	46	47							
4	11	14	15	33	36							
8	14	21	24	30	33							
2	12	17	23	36	38							
17	24	27	31	34	35							
5	9	23	29	35	45							
1	12	23	30	35	48							
1	4	7	10	35	38							
11	13	15	17	24	25							
10	13	19	30	32	42							
2	9	14	29	30	40							
9	10	28	33	37	40							
1	6	8	27	31	47							
15	19	21	32	42	46							
13	17	30	38	47	49							
6	18	21	31	36	45							
12	15	24	30	39	44							
8	11	20	27	42	46							
6	11	22	28	29	34							
6	10	27	29	35	49							
4	10	14	18	26	34							
2	8	14	34	41	49							
19	20	25	29	35	43							
3	4	5	7	11	14							
1	11	22	26	32	42							
16	23	24	27	28	40							
4	10	26	28	29	45							
16	22	26	35	38	43							
4	5	11	18	31	41							
15	16	31	32	36	41							
7	12	14	27	44	46							
7	22	24	26	33	43							
4	7	11	19	33	39							
15	16	20	28	44	46							
1	4	7	16	37	38							
3	8	19	26	27	34							
25	26	27	29	40	45							
1	4	15	30	46	49							
4	15	25	35	40	48							
3	14	24	26	42	46							

1	2	3	5	20	28							
11	23	34	41	44	45							
9	10	14	17	20	48							
1	2	24	40	43	49							
6	8	13	33	35	38							
5	8	24	39	40	41							
					TOTAL							

These questions involve counting the data that was found by experiment
We refer to these as experimental probabilities.

8.1 What fraction of the draws includes at least one number from 30 to 39? What percentage is this?

8.2 What fraction of the draw does not include any numbers from 20 to 29? Express this as a percentage.

8.3 What percentage of the draw includes a pair of consecutive numbers?

8.4 In what percentage of draws is a multiple of 5 drawn?

8.5 In what percentage of draws is the number 1 drawn?

The next four questions involve calculating probability using the probability formula

Notice that we are answering the same questions again in a more formal way.

Use the probability formula to calculate each of the following.

8.6 What is the probability that the draw will include at least one number from 30 to 39?

8.7 Calculate the probability that the draw will not include any numbers between 20 and 29.

8.8 Calculate the probability that a multiple of 5 will be drawn.

8.9 Calculate the probability that the number 1 will be drawn.

8.10 Did you find a match between your experimental results and your calculated results? Have you verified your experimental results mathematically?

8.11 When we refer to 'hot' numbers in the lotto draw, we mean that they are numbers that seem to occur more frequently than others. What is the probability of a 3 being drawn? A 24? A 56? How is it then possible that a number is 'hot'?

Probability (background information for students and teachers)

Probability is the study of 'chance'. It estimates answers to questions such as:
- What are the chances that it will rain today?
- What are the odds that 45 will be one of the numbers drawn in the Lotto on Saturday?
- What are the chances that a particular drug will cure a disease?
- How likely is it that an insurance claim will be made on a particular policy?
- How much profit is likely to be made on a particular product?

Probability provides a statistical tool for describing, managing, estimating and planning many important things in society across a variety of sectors. It is a ratio expressing the chance that something will happen. It can be expressed as a fraction, a percentage or an odds ratio. The following four statements all mean exactly the same:
- The odds are 50%.
- There is a 1 in 2 chance.
- The probability is 0,5.
- There are equal chances.

The probability scale is measured from 0 to 1. A zero probability means it is impossible and a probability of 1 means it is 100% certain. A probability of ½ means that there is 50% for and 50% against, in other words equal odds. Probability is defined as:

$$P = \frac{\textit{number of desired outcomes}}{\textit{total number of equally likely outcomes}}$$

When flipping a coin, there is 1 possible outcome out of 2 equally likely outcomes that it will land on heads, so the probability of getting heads is:

$$P = \frac{1}{2} \qquad \textit{or} \qquad 50\%$$

When throwing a six sided die, there is a 1 in 6 chance that it will land on a 4 (die is the singular of dice — one die, a pair of dice). There is thus a 16,7% probability of getting a 4.

Activity 9 — Combined events

ABOUT THIS ACTIVITY

In this activity students move from probabilities involving single events, to probabilities of combined events. They work with the multiplication principle and are introduced to the ideas of dependent, independent and mutually exclusive events. A handout has been included with further information necessary to answer a selection of probability questions. The Specific Outcomes and Assessment Criteria addressed are: SO2 – AC2, 3; S03 – AC1, 4.

MANAGING THIS ACTIVITY

Explain to students that events are often combined. Instead of only considering one probability, we now consider successive probabilities and work with a number of events happening together. Spend time discussing the ideas in Handout 9, getting students to suggest more of their own illustrative examples to try and help understand the differences between dependent, independent and mutually exclusive events. Students should each get a copy of Handout 9 and Worksheet 9.

9.1.1 There are 10 faulty bottles out of 100 possible bottles, so the probability is 10 ÷ 100, or 10%.

9.1.2 There are 9 faulty bottles left out of a possible 99 bottles, so the probability is 9 ÷ 99 or 9,09%.

9.1.3 They are dependent events, because selecting one bottle leaves a different number to select from next time.

9.1.4 Using the multiplication principle:

$$P = (\frac{10}{100})(\frac{9}{99}) = (\frac{1}{110}) \quad or \quad 0{,}91\%$$

9.2.1 From a total of 127 possible people an actual 58 came in, thus the likelihood that someone who walks past will come in is: 58 ÷ 127 = 45,7%.

9.2.2 From a total of 58 possible people 25 actually bought something, thus the likelihood that a person who comes in will buy something is: 25 ÷ 58 = 43%.

9.2.3 Using the multiplication principle for successive events:

$$P = \frac{58}{127} \times \frac{25}{58} = \frac{25}{127} = 19{,}7\%$$

9.3 These are mutually exclusive events, because a pair of denim jeans cannot be too tight and too loose. Thus simply add the probabilities together : 30% + 10% = 40% probability that the jeans will not fit.

9.4 We start with a total of 10 horses. After one has been chosen there are 9 left and after two have been chosen there are 8 left. We find the combined probability using the multiplication principle for successive events. Thus the probabilities are as follows:

9.4.1 $\frac{1}{10}$

9.4.2 $\frac{1}{9}$

9.4.3 $\frac{1}{10} \times \frac{1}{9} \times \frac{1}{8} = \frac{1}{720}$

9.5 We again use the multiplication principle for successive events and multiply the two individual probabilities:

$$P = \frac{60}{100} \times \frac{60}{100} = 36\%; \qquad P = \frac{3}{5} \times \frac{3}{5} = \frac{9}{25}$$

9.6 The probability scale is only from 0 to 1, or 0% to 100%. So 100% probability is a certainty already. Sometimes we hear people say 120% to emphasize how very certain they are, but 120% probability does not actually exist.

9.7.1 There are eight possible orders: TTT, TTF, TFT, FFT, FTF, TFF, FTT, FFF and only one way to choose TTT, therefore the probability is 1 / 8.

9.7.2 There are three ways to choose two trues and one false (TTF, TFT, FTT) therefore this probability is 3 / 8.

Activity 9 — Combined events

In this activity you have been given a number of problems to solve. You will need to decide whether you are dealing with a single event or combined events. If you are dealing with combined events, you will need to decide whether the events are dependent, independent or mutually exclusive. You will then need to use the probability formula and the fundamental counting principle to calculate the required probabilities.

9.1 In order to control the quality of a certain hair product, a procedure is put in place where one bottle is selected at random from each batch. A second bottle is then selected without replacing the first. If both bottles are faulty, the whole batch is discarded. If a batch of 100 contains 10 faulty bottles and each bottle has the same chance of being selected:

9.1.1 What is the probability of selecting a faulty bottle on the first draw?

9.1.2 What is the probability of selecting a faulty bottle on the second draw if the first was also faulty?

9.1.3 Are these events dependent or independent?

9.1.4 What is the probability that you will select two faulty bottles in succession?

9.2 The owner of a health-shop counted 127 people who walked past her shop yesterday. Of these, 58 came into the shop and of these 58, only 25 bought something.

9.2.1 What is the likelihood that someone who walks past the shop will come in?

9.2.2 What is the likelihood that a person who comes in will buy something?

9.2.3 What is the likelihood that a person who walks past will come in and buy something?

9.3 A clothing store sells second-hand denim jeans. If you buy a pair in your usual size without trying them on, the probability that the waist is too tight is 30% and the probability that it is too loose is 10%. If you choose a pair in your usual size, what is the probability that they will not fit (too loose or too tight)?

9.4 There are 10 horses racing at a racecourse and each horse has an equally likely chance of winning.

9.4.1 What is the probability of choosing the winning horse? Give your answer as a fraction.

9.4.2 Having decided on the winning horse, what is the probability of choosing the horse that will come in second?

9.4.3 What is the probability that you will correctly choose the first three positions (1st, 2nd, and 3rd)?

9.5 A sports match ends in a draw and must be decided by a penalty shootout. One of the goal-scorers has a season record of 60% success. What are the chances that he will now score two goals in a row assuming he is allowed consecutive shots? Give your answer as a percentage and also as a fraction.

9.6 Explain why 120% cannot be the probability of some event.

9.7 Your lecturer wants to set three true-false type questions. To decide on which questions to ask, she lists all the true-false possibilities (TTF, TFT…) on slips of paper and picks one from a hat at random. A student who does not know the answers guesses that all three are true.

9.7.1 What is the probability that the student is correct?

9.7.2 What is the probability that two questions are true and one is false?

Probability of combined events (background information for students and teachers)

The probability of 'combined events' refers to the probability of two or more events happening together one after the other. For example, how likely is it that you will throw a double five on a pair of dice or guess all six lotto numbers correctly?

We say two events are independent if the occurrence of one event does not change the probability of the other happening. For example, throwing a five on one die does not have any effect on throwing a five on a second die.

We say events are dependent if the occurrence of one changes the probability of the second one happening. For example, once you have drawn one number from the possible 49 in the lotto draw, there are only 48 to draw from next time.

We say events are mutually exclusive if they cannot happen together, for example if it is a very hot day, it cannot also be a very cold day.

The Fundamental Counting Principle says that if an event A can occur in 'r ' ways and an event B can occur in 's' ways then A and B can occur in succession in r × s ways.

For example, if we want to know the probability of getting two 5's when throwing a pair of dice, we argue like this – there is a 1 in 6 probability of throwing a 5 on one die and a 1 in 6 probability of throwing a 5 on the second die, so using the fundamental counting principle:

$$P \times \frac{1}{6} \times \frac{1}{6} = \frac{1}{36}$$

So to calculate the probability of events happening together, one after the other, we multiply the individual probabilities. This is also called the multiplication principle for successive events.
To calculate probability in the case of mutually exclusive events, we simply add the individual probabilities. For example, if 15% of the sweets in a bag are red and 5% are blue, the probability of selecting a red or blue sweet is 20%, since the sweets cannot be red and blue at the same time.

Activity 10 — Manipulations and misunderstandings

ABOUT THIS ACTIVITY

In this activity students critique the ways that data is used to support arguments. They identify how data is manipulated and how one can be misled by incomplete statistics, inappropriate samples and graphical methods. The Specific Outcomes and Assessment Criteria addressed are: S01 – AC4; S03 – AC3, 5.

MANAGING THIS ACTIVITY

Introduce students to the idea that numbers are only reliable when they are correctly understood. Statistics are very easy to manipulate and one often hears arguments that sound very convincing because they are backed up by figures or graphs that support the argument. However, if we look a little more carefully, we may find that only selected data was used, the sample was inadequate or the graph was not so convincing if you examined the figures closely. Sometimes genuine mistakes are made by the statistician, but at times manipulation is done deliberately for less honest reasons. One should always read 'the numbers' with critical eyes and well-informed questions.

10.1 When presenting a group of numbers we often summarise our data using an average, and while that average may be mathematically correct, it could be highly misleading. In the case of a firm that pays an average salary of R250 000, we may find that the CEO earns R3 000 000, while the other five employees each earn less than R80 000. In this case the median or mode value would give a more representative picture and we would be better able to judge whether the firm is a fair employer and whether its members are well paid or not.

10.2 When we say 80% prefer this product, we have no idea of the sample size or the sample composition. If, for example, the sample size was only 10 people and they were all 16 years old, all we would actually know was that eight sixteen-year-olds preferred this product. This is certainly not enough information to make a business decision about the product.

10.3 This is another example of an incomplete statement. Does this mean 22% less ink than other ink jet printers, other printers in general or printers developed 10 years ago? Without a basis of comparison, this claim is essentially worthless.

10.4 Here the problem is a misunderstanding of the difference between percentage and percentage points. A percentage point is a unit of measurement that is calculated as a portion of 100, while a percentage is a portion of a whole (where the whole isn't necessarily 100) multiplied by 100. So in the case of the microwaves, 63% ($33 \div 52 \times 100$) had a faulty component. The industry average is 35%, so this is 28 percentage points higher than the national average – that is 80% higher, because the base figure here is 35 not 100. So in order to calculate the percentage difference, you have to divide 28 by 35 and multiply by 100, giving the figure of 80%. ($28 \div 35 \times 100$).

10.5 Technically a graph should be more accurate than a statement, since it represents more of the variables of your data. However, graphs can be just as misleading when you are showing statistics. In 10.5.1, the results show slow but steady growth. In 10.5.2, the figures are exactly the same but the impression is of more rapid growth because the slope is steeper. This effect is created by starting the graph at 80 instead of 0. In 10.5.3, the slope is still greater, giving the impression of even better results although the figures remain identical. Changing the scale on the value axis thus creates quite different impressions and could easily be used to manipulate an argument. When trying to show strong growth the steeper slope would be more convincing, while when trying to encourage caution the flatter slope would be more suitable. Manipulating the scale is a simple way of dramatically altering the visual impact of a set of data.

10.6 The impact of changing the scale on the axes is again illustrated in these three bar graphs. The data is identical in each case. In 10.6.1, the impression is that the sales were steady over the six months with some fluctuation. In 10.6.2 the starting point on the value axis has been shifted to create the impression that there was much more fluctuation in sales and month two was a very poor month with sales of close to zero. In 10.6.3, the scale was changed on the x-axis. This created broader bars perhaps giving the impression of solid, healthy growth. Again we notice the different visual impact that could be misleading to the careless reader.

Activity 10 — Manipulations and misunderstandings

People often rely on the idea that 'the numbers don't lie'. If we have numerical evidence, the statement must be correct. However, data can easily be manipulated, creating very misleading results. In this activity you are asked to find the ways we could misunderstand the numbers, even though the numbers themselves are not wrong.

Study each of the following four situations critically and explain how, even if we accept that the figures are accurate, each one could be misleading: (reference: www.effectivemeetings.com)

10.1 A certain company claims that it is a fair employer and it pays good salaries to its senior staff. To back up this claim, they are proud of the fact that 'the average annual salary is R250 000.'

10.2 A sales representative selling a certain product claims that in a recent survey 80% of the people surveyed preferred this product to other brands on sale.

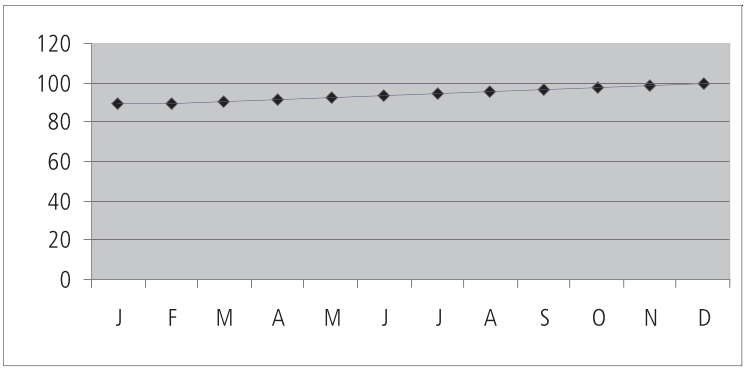
10.3 An advertisement for ink jet printers claims that Model X uses 22% less ink.

10.4 A manufacturer sold 52 microwave ovens in one month and 33 of them had a faulty component. The industry average for faulty parts is 35%. The manufacturer claims that his incidence of faulty parts is only 28% higher than the industry average.

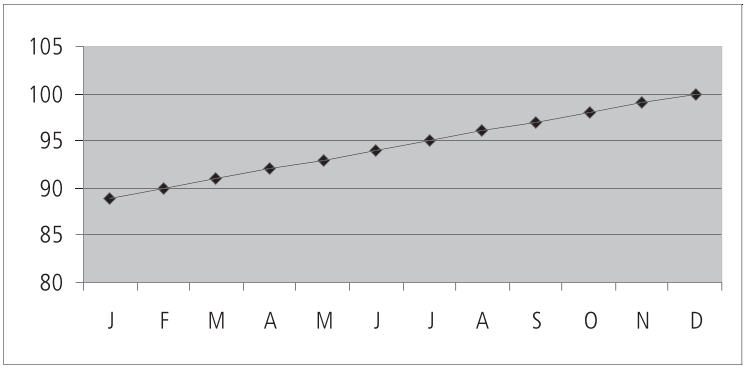
A graph is another popular way of presenting data. Study the following two groups of three graphs each. Look carefully at the figures and shapes in each case. What observations can you make and how could these graphs be used to manipulate an argument?

10.5 The following three line graphs show annual sales figures.

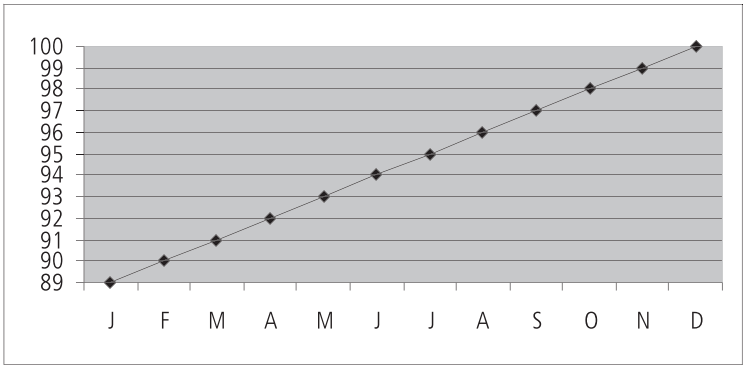
10.5.1



10.5.2

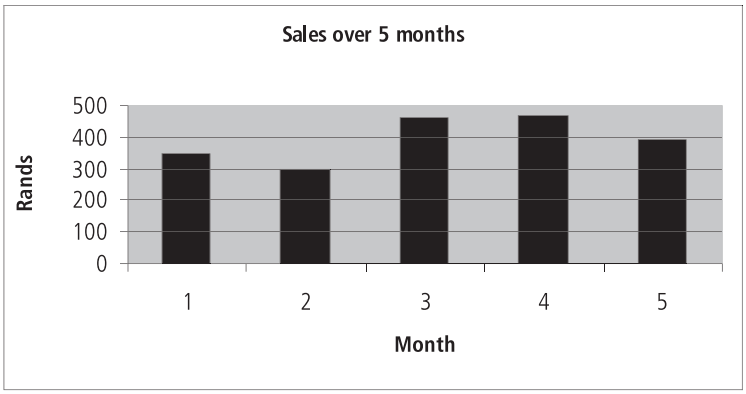


10.5.3

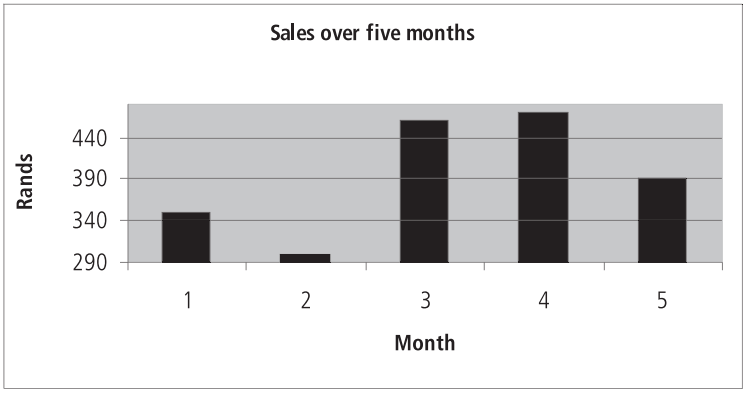


10.6 The following three bar graphs show sales over 5 months.

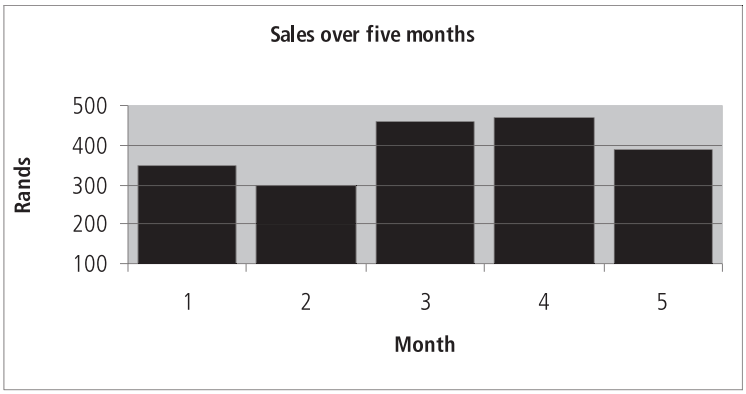
10.6.1



10.6.2



10.6.3



Mathematical Literacy

NQF LEVEL 4

Unit 3
Measurement

Hairdressing

Mathematical Literacy

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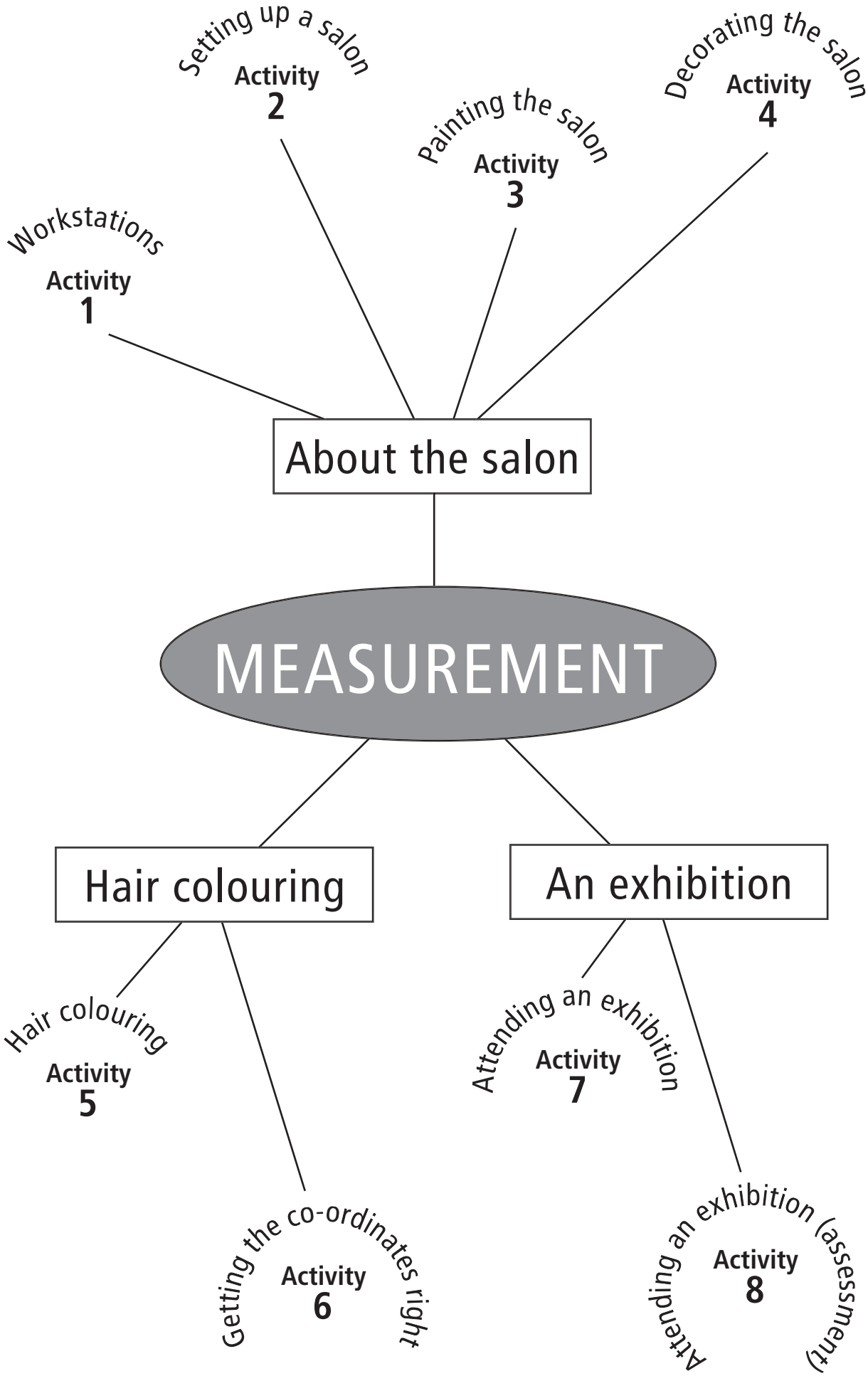
Measurement

Hairdressing


Setting up a salon
Activity 2
Decorating the salon
Activity 4
Painting the salon
Activity 3
Workstations
Activity 1
About the salon
MEASUREMENT
Hair colouring
An exhibition
Hair colouring
Activity 5
Attending an exhibition
Activity 7
Getting the co-ordinates right
Activity 6
Attending an exhibition (assessment)
Activity 8

Overview

This unit uses the contexts of the hair salon, hair colouring and travelling to an exhibition to develop mathematical skills including:

- Estimating dimensions to plan the use of space efficiently
- Working with total surface areas
- Using formulae and Pythagorus' theorem
- Working with ratios and percentages
- Reading plans
- Looking at three dimensional objects from different aspects
- Drawing diagrams to scale
- Developing tree diagrams
- Working with co-ordinates
- Reading information from tables and maps
- Calculations with distance, speed and time
- Planning routes and estimating time

In addition to developing the mathematical skills of learners, this unit is also intended to give learners an opportunity to develop an understanding of:

- Using space efficiently
- Read architectural plans
- How to estimate the quantity of paint needed to paint a room
- How to plan a route and decide on modes of transport
- How to read a colour chart

The unit consists of eight activities. The first four deal with the refurbishing of a salon. The next two deal with hair colouring and the last two deal with attending an exhibition.

Activity 1 – Workstations
This Activity deals with the work areas needed in a salon. We investigate the amount of space needed for a workstation and a washing station. This is in preparation for activity 2.

Activity 2 – Setting up a salon
In this Activity we look at the floor plan of a salon. We calculate the number of tiles needed to tile the floor. We also use the information gained in activity 1 to plan how we will arrange the work areas in the salon.

Activity 3 – Painting the salon
This Activity deals with painting the salon and estimating the amount of paint needed. We use the floor plans from activity 2 to calculate the surface area to be painted.

Activity 4 – Decorating the salon
This Activity deals with making a round table cloth and we estimate the amount of fabric required. We compare two different options for making the tablecloth.

Unit outcomes

The Following Assessment Standards are addressed by this unit. We know this when the learner:

Use Mathematics to represent, analyse and calculate shape and motion in 2- and 3-dimensional space in different contexts (MathLit 9016)

- Measure, estimate, and calculate physical quantities in practical situations relevant to the adult (SO1).
  - o Scales on the measuring instruments are read correctly (AC1)
  - o Quantities are estimated to a tolerance justified in the context of the need (AC2)
  - o The appropriate instrument is chosen to measure a particular quantity (AC3)
  - o Appropriate formulae are selected and used (AC4)
  - o Calculations are carried out correctly and the least steps of instruments are taken into account when reporting final values (AC5)
  - o Symbols and units are used in accordance with SI conventions and are appropriate to the situation (AC7)

- Explore, analyse and critique, describe and represent, interpret and justify geometrical relationships
  - o Descriptions are based on a systematic analysis of the shapes and reflect the properties of the shapes accurately, clearly and completely (AC1)
  - o Descriptions include quantitative information appropriate to the situation and need (AC2)
  - o 3-dimensional objects are represented by top, front and side views (AC3)
  - o Different views are correctly assimulated to describe 3-dimensional objects (AC4)
  - o Available and appropriate technology is used in producing and analysing representations AC5)
  - o Relations of distance and position between objects are analysed from different views (AC6)
  - o Conjectures as appropriate to the situation, are based on well-planned investigations of geometrical properties (AC7)
  - o Representations of the problems are consistent with and appropriate to the problem context. The problems are represented comprehensively and in mathematical terms (AC8)
  - o Results are achieved through efficient and correct analysis and manipulation of representations (AC9)
  - o Problem-solving methods are presented clearly, logically and in mathematical terms (AC10)
  - o Reflections on the chosen problem solving strategy reveal strengths and weaknesses of the strategy (AC11)

Alternative strategies to obtain the solution are identified and compared in terms of appropriateness.

Activity 5 – Hair colouring
This Activity deals with the calculations needed to determine the volumes of hair tint and hydrogen peroxide required when colouring a client's hair.

Activity 6 – Getting the co-ordinates right
This Activity deals with the International Colour Code for hair colouring. We look at the co-ordinates used to describe colour combinations. The first co-ordinate is the natural colour and the second co-ordinate is the fashion (tone/reflect) colour.

Activity 7 – Attending an exhibition
This Activity deals with reading maps and train timetables. We determine the best route to get to an exhibition from our salon. We then work out the time taken to travel this route by car and train. We also determine the cost of both modes of transport.

Activity 8 – Attending an exhibition (assessment)
This Activity uses the same context as activity 7 but our salon is much further away from the exhibition. This activity can be used for assessment.

9016	Represent, analyse and calculate shape and motion in 2-and 3-dimensional space in different contexts									
		ACTIVITY	1	2	3	4	5	6	7	8
SO1	Measure, estimate, and calculate physical quantities in practical situations relevant to the adult.									
	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	Quantities are measured correctly to within the least step of the instrument.	✓	✓		✓			✓	✓
	AC5	Appropriate formulae are selected and used.			✓	✓	✓		✓	✓
	AC6	Calculations are carried out correctly and the least steps of instruments used are taken into account when reporting final values.				✓	✓		✓	✓
	AC7	Symbols and units are used in accordance with SI conventions and as appropriate to the situation.	✓	✓	✓	✓	✓		✓	✓
SO2	Explore, analyse & critique, describe & represent, interpret and justify geometrical relationships.									
	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	3-dimensional objects are represented by top, front and side views.	✓	✓	✓					
	AC4	Different views are correctly assimilated to describe 3-dimensional objects	✓	✓	✓					
	AC5	Available and appropriate technology is used in producing and analysing representations.		✓		✓				
	AC6	Relations of distance and positions between objects are analysed from different views.	✓	✓					✓	✓
	AC7	Conjectures as appropriate to the situation, are based on well-planned investigations of geometrical properties.	✓	✓	✓	✓				
	AC8	Representations of the problems are consistent with and appropriate to the problem context. The problems are represented comprehensively and in mathematical terms.	✓	✓	✓	✓		✓	✓	
	AC9	Results are achieved through efficient and correct analysis and manipulation of representations.	✓	✓	✓	✓		✓	✓	✓
	AC10	Problem-solving methods are presented clearly, logically and in mathematical terms.	✓	✓	✓	✓	✓	✓	✓	✓
	AC11	Reflections on the chosen problem solving strategy reveal strengths and weaknesses of the strategy.	✓	✓	✓	✓			✓	
	AC12	Alternative strategies to obtain the solution are identified and compared in terms of appropriateness and effectiveness.	✓	✓	✓	✓				

1 Workstations.
2 Setting up the salon
3 Painting the salon
4 Decorating the salon
5 Hair colouring
6 Colour chart
7 Attending an exhibition
8 Attending an exhibition (assessment)

Activity 1 – Workstations

The first four activities in this unit use the context of setting up a hair salon. We begin this unit by looking at what work areas are needed in a salon, and how these work areas can be arranged in a confined space.

ABOUT THIS ACTIVITY
This activity focuses on representing and analysing shapes. Three-dimensional objects are viewed from the top and scale drawings are made. The students measure dimensions and use these measurements to estimate how much space an object occupies. This activity is aligned with unit standard 9016 and addresses AC 1, 2, 3, 4, 7 of SO1 and AC 1, 2, 3, 4, 6, 7, 8, 9, 10, 11 and 12 of SO2.

MANAGING THIS ACTIVITY
For this activity the students will need tape measures, squared paper (attached) and a pair of compasses. The students will be estimating the amount of space needed for a workstation and a washing station. With both these areas, additional work space for the stylist is necessary. Encourage the students to think carefully about the situation and to take realistic measurements.

1.1 Essential areas needed are :
- workstations for stylists
- washing stations for operators
- reception area
- area to mix products

1.2 Equipment and/or furniture needed for each area:
- workstations: small table with large mirror, chair for client, trolley for stylist's equipment
- washing stations: wash basin unit, chair for client
- reception area : reception desk and chairs/sofas for waiting clients.
- area to mix products : could be done in the kitchen

1.3 On diagram — see next page.

1.4 The stylist will need a semi-circle of space around the client. The middle of the client's head will be the centre of the circle. The radius of the circle will depend on the height of the stylist. The students need to decide what a reasonable estimated radius is. They will need to measure an actual person from the waist up in the position of bending over to cut a client's hair. The person they choose to measure is a point for discussion and they should be encouraged to substantiate their choice. Points for discussion might include:
- Is choosing the tallest person space effective(Perhaps introduce the concept of maximum space verses optimum space)
- What is meant by the average height of a group of people? How would you go about choosing an ' average' person?
- Would you measure the height of a male or female? Why?

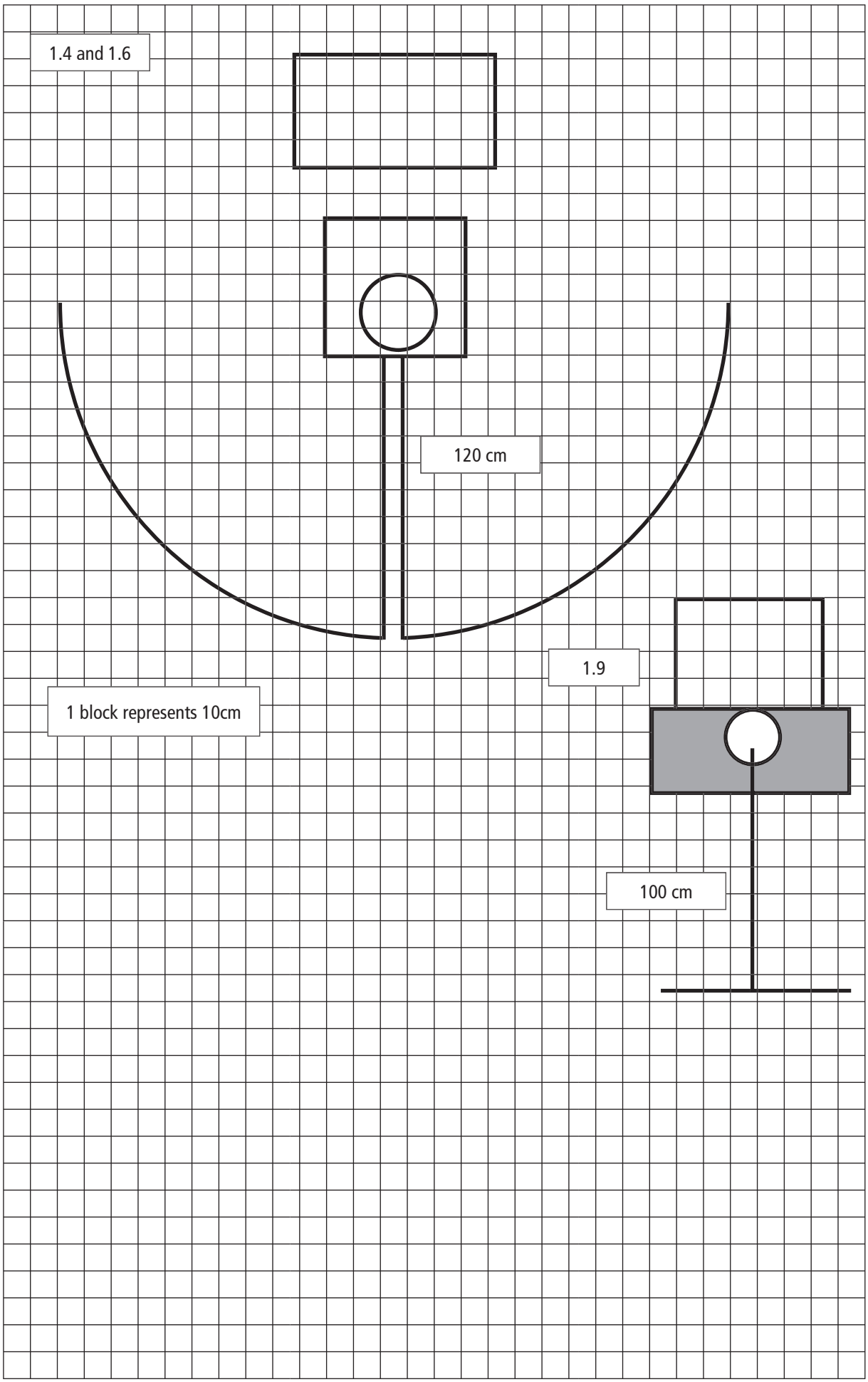
1.5 A length of 120cm will be used for this exercise.

1.6 On diagram — see next page.

1.7 The operators would not need as much space as they work only behind the client and not around the sides (unlike the stylists, who needs to move around the client).

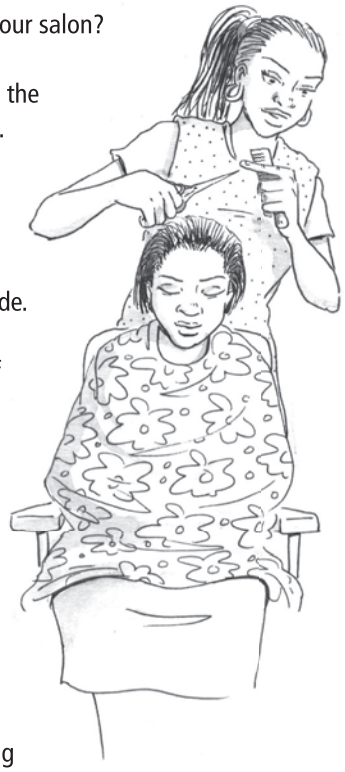
1.8 The student would need to measure an arm's length distance from the washstand.

1.9 On diagram — see next page.


1.4 and 1.6
120 cm
1.9
1 block represents 10cm
100 cm

Activity 1 — workstations

You are going to open your own salon and need to plan how you are going to use the space available.



1.1 What are the main working areas that you will need in your salon?

1.2 For each area that you listed in question 1.1, write down the equipment or furniture that you will need for that space.

1.3 In this question you will determine how much space is needed for your workstations. A workstation consists of a table, which the client faces, and a chair. The tables that you have available are 75cm in length and 45cm wide. The chairs are approximately 50cm wide and 45cm long. Using squared paper and a suitable scale draw a view of the table and the chair as if you were looking from the top (bird's eye view). You will need to estimate how far the client will sit from the table (use a fellow student to role play the client to help you with your to estimate measurement).

1.4 The workstations cannot be put side by side right next to each other as you must take into account that stylists need enough room to bend over a client without bumping the stylist working next to them. Discuss with your fellow students how you would go about estimating the amount of space you would need to leave around the client's chair in order for stylists to work comfortably. Write down your suggestions and give reasons for your suggestions.

1.5 Using a tape measure, measure the person or people that you have decided would give you an idea of the amount of space needed. Write down your estimated distance between work stations and explain why you made this choice. Draw a sketch to show how you did your measurement.

1.6 Go back to the top view that you drew in 1.3 and draw in the area that you think the stylist would need.

1.7 The washing stations also need space behind them in order for the operator to work behind the client. The washing stations consist of a basin and a chair. Would the person washing hair need as much room around the client as a stylist does? Explain your answer.

1.8 Estimate how much room the operator needs by doing the appropriate measurements. Explain, with the aid of a sketch, how you took your measurements.

1.9 Using squared paper and a suitable scale, draw a view from the top of the washing station, again indicating the area needed for the operator to work comfortably.

Activity 2 — Setting up a salon

This activity follows from the previous one. The students will now use the information gained in activity 1 to determine how many workstations and washing areas they can fit into a given space. The students have to interpret the plans of a salon. The plan of the salon is interpreted two-dimensionally in this activity and three-dimensionally in the next activity.

ABOUT THIS ACTIVITY

This activity focuses on the interpretation of plans, estimation of materials needed and analysis of the usage of space. The students will be asked to draw diagrams to describe situations. Three - Dimensional objects are viewed from above. This activity is aligned with unit standard 9016 and addresses AC 1, 2, 3, 4, 7 of SO1 and all of the ACs of SO2.

MANAGING THIS ACTIVITY

This activity has a handout which show the plans of a salon. The students will also need the sketches that they made in activity 1, as well as squared paper (handout 2.2), a pair of scissors and a calculator. The students will need to be able to convert centimetres to metres. It might prove useful to facilitate the discussion called for in question 2.7 and also to give the students opportunity to show their designs for their salon.

2.1 3,2m by 1,7m

2.2 4,8m by 2,4m

2.3 Bathroom:

$$\text{Tiles needed for width of room} = \frac{170\text{cm}}{30\text{cm}} = 5{,}666 = 6 \text{ tiles}$$

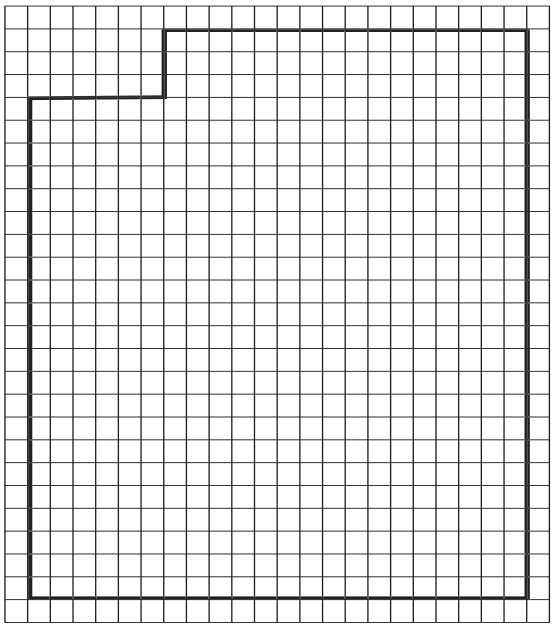
$$\text{Tiles needed for length of room} = \frac{320\text{cm}}{30\text{cm}} = 10{,}666 = 11 \text{ tiles} = 6 \times 11 = 66 \text{ tiles}$$

Kitchen:

$$\text{Tiles needed for width of room} = \frac{240\text{cm}}{30\text{cm}} = 8 \text{ tiles}$$

$$\text{Tiles needed for length of room} = \frac{480\text{cm}}{30\text{cm}} = 16 \text{ tiles} = 8 \times 16 = 128 \text{ tiles}$$

2.4 Each block represents a tile.

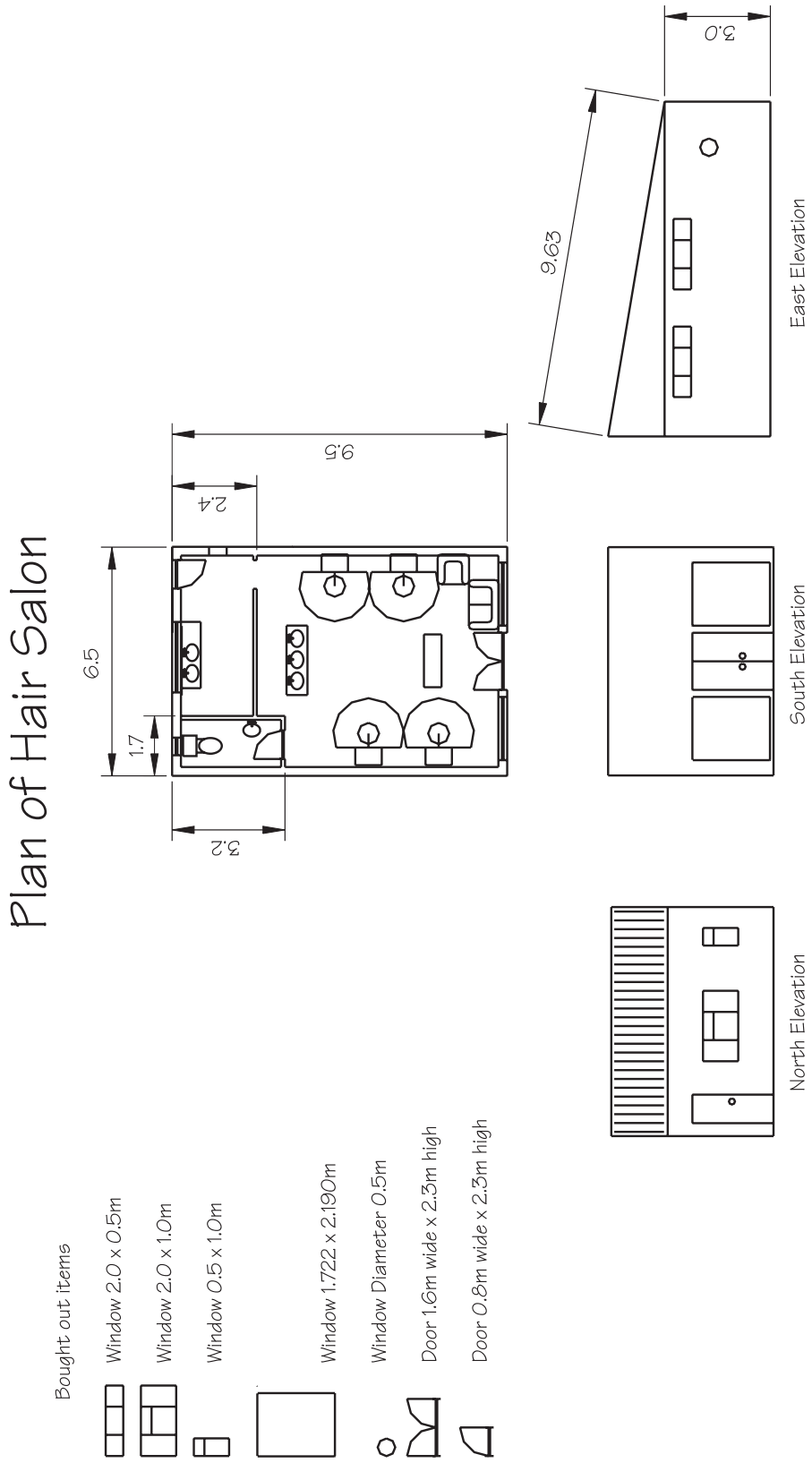


Number of tiles needed $=(16 \times 24) + (6 \times 21)$
$=510$ tiles

2.5 See answer diagram. This is just a suggestion.

2.6 See answer diagram.

2.7 For the above plan, the ratio is 4 : 3.
Encourage the students to discuss whether it is better to have more workstations than washing stations or visa versa. Encourage them to discuss the time taken at the two areas and the fact that you don't want clients waiting with wet hair. See if they can come up with a suitable ratio.



Activity 2 — Setting up a salon

On the handout for this activity is the plan of the salon that you are going to rent. It is the last unit of a row of semi-detached units. Answer the following questions using the handout.

2.1 What are the dimensions (the length and breadth) of the bathroom?

2.2 What are the dimensions (the length and breadth) of the kitchen?

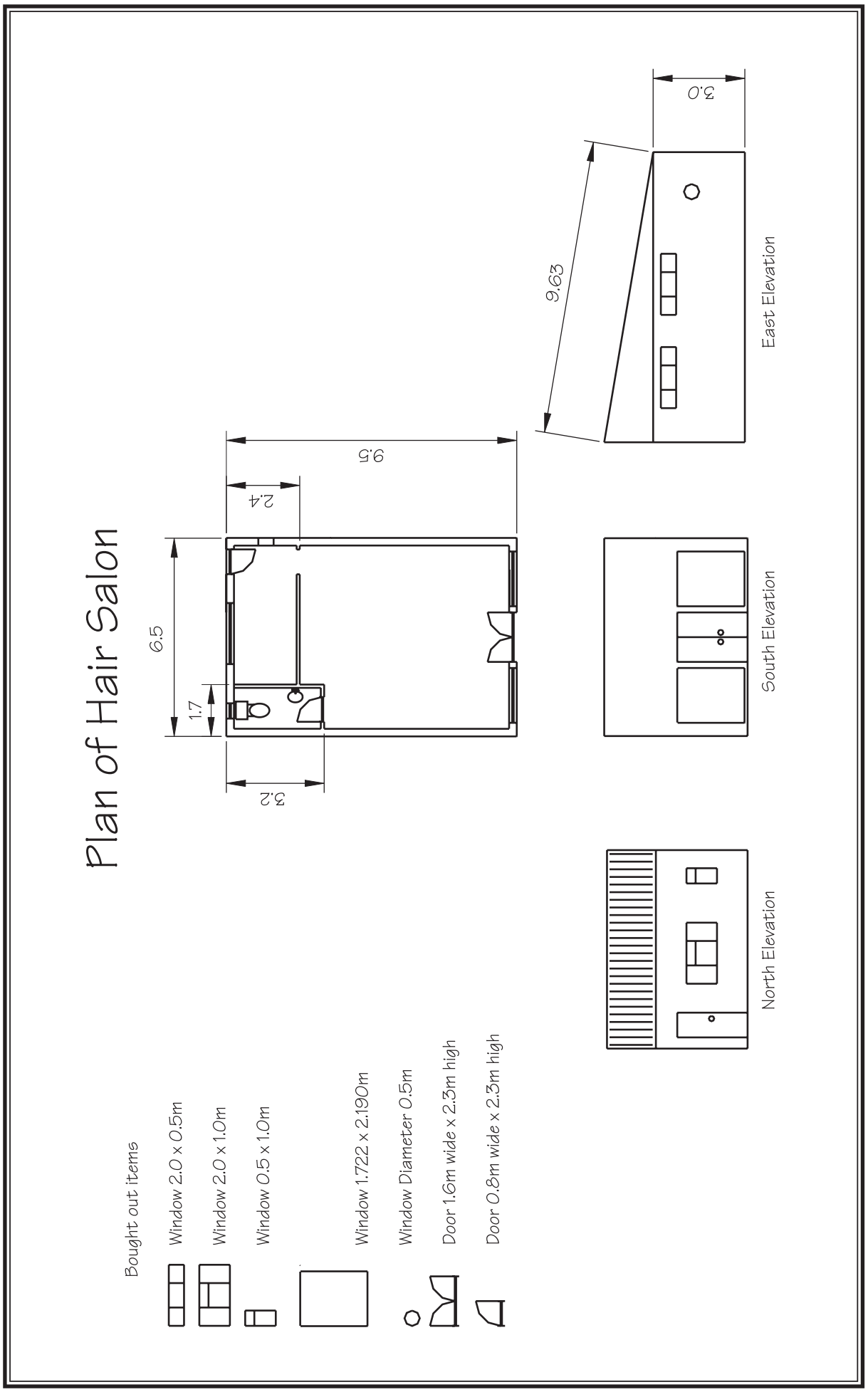
2.3 You want to tile these two rooms. If the tiles you choose are 30cm by 30cm,how many tiles would you need for each room?

2.4 Using a suitable scale, draw a sketch of the area to be tiled in the main salon section and fill in the dimensions. Show on your sketch how you would tile this area if the tiles are 30cm by 30cm. How many tiles did you need?

2.5 Now that the floor is tiled you need to work out how many workstations and washing stations you can fit into your salon. Using square paper and a suitable scale, draw a floor plan of the main section of your salon. Try make it as large as possible.

2.6 You want to plan how to arrange your reception area, work stations and washing stations in order to use the space available as effectively as possible. Go back to the drawing of the washing and work stations that you did in activity 1 and redraw them using same scale as you used for 2.5. Cut them out and then cut out a few more so that you can arrange them inside your floor plan. You also need to cut out some furniture for the reception area. Play around with your floor plan until you are happy with your design. Stick the pieces down and then compare your arrangement with a fellow student.

2.7 What is the ratio of workstations : washing stations in your floor plan? Discuss with other students why you chose this ratio and if it is suitable for your salon. Write down some of the points you discussed.


Plan of Hair Salon
6.5
1.7
3.2
2.4
9.5
9.63
3.0
East Elevation
South Elevation
North Elevation
Bought out items
Window 2.0 x 0.5m
Window 2.0 x 1.0m
Window 0.5 x 1.0m
Window 1.722 x 2.190m
Window Diameter 0.5m
Door 1.6m wide x 2.3m high
Door 0.8m wide x 2.3m high

Activity 3 — Painting the salon

This activity requires the student to read plans and work out the surface area of the walls. This is done in the context of estimating the volume of paint needed to paint the exterior of the salon.

ABOUT THIS ACTIVITY

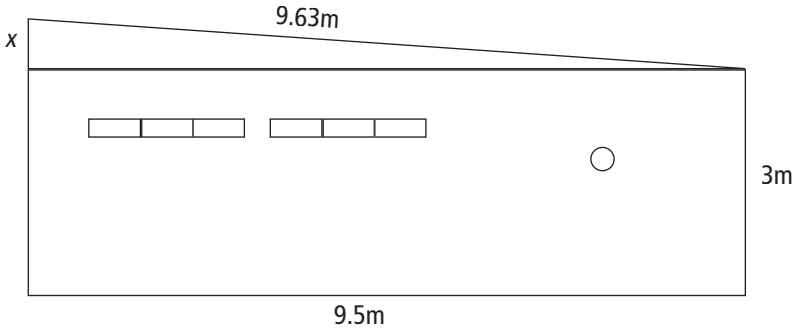
The students will be expected to determine the exact area to be painted using the plans of the salon used in the previous activity. They will then revisit the problem and calculate the total surface area of the walls, not taking all the doors and windows into account. The two methods will be compared to see how much paint is wasted if a rough estimate is used. This activity is aligned with unit standard 9016 and addresses AC 2, 5 and 7 of SO1 and AC 1, 3, 4, 7, 8, 9, 10, 11 and 12 of SO2.

MANAGING THIS ACTIVITY

Students should be given worksheet 3 and a copy of the handout of the plans of the salon from the previous activity. The students are required to calculate areas of rectangles, triangles and circles and need Pythagoras' Theorem in order to find the height of triangles.

3.1 See diagram on plan of hair salon. Students must fill in the dimensions on their diagram.

3.2



Let the height of the roof in the front = x (see sketch)

Using Pythagoras $x^2 = (9{,}63)^2 - (9{,}5)^2$

$x^2 = 2{,}4869\text{m}$

$x = \sqrt{2{,}4869}$

$x = 1{,}58\text{m}$

To work out the area of the round window you must first find the radius of the window.

$$\text{Radius of window} = \frac{0.5}{2}$$
$$= 0{,}25\text{m}$$
$$\text{Area of round window} = \pi r^2$$
$$= (3{,}14)(0{,}25)^2$$
$$= 0{,}196\text{m}^2$$
$$\approx 0.25\text{m}$$
$$\text{Area of rectangular windows} = 2\text{m} \times 0{,}5\text{m}$$
$$= 1\text{m}^2$$
$$\text{Area of rectangle} = 9{,}5\text{m} \times 3\text{m}$$
$$= 28{,}5\text{m}^2$$
$$\text{Area of triangle} = \frac{9.5\text{m} \times 1{,}58\text{m}}{2}$$
$$= 7{,}505\text{m}^2$$
$$\approx 7{,}51\text{m}^2$$
$$\text{Area of wall to be painted} = (28{,}5 + 7{,}51) - (0{,}2 + 1 + 1)$$
$$\approx 33{,}8\text{m}^2$$

3.3 See diagram on plan of hair salon. Students must fill in the dimensions on their diagram.

$$\text{Area of big window} = 1{,}722\text{m} \times 2{,}190\text{m}$$
$$= 3{,}77\text{m}^2$$
$$\text{Area of door} = 1{,}6\text{m} \times 2{,}3\text{m}$$
$$= 3{,}68\text{m}^2$$
$$\text{Area to be painted} = ((3\text{m} + 1{,}58) \times 6{,}5\text{m}) - (3{,}77 + 3{,}77 + 3{,}68)$$
$$= 18{,}55\text{m}^2$$

3.4 Total area to be painted $= 15{,}16\text{m} + 33{,}81\text{m} + 18{,}55\text{m}$
$= 67{,}52\text{m}^2$

3.5 Amount of paint needed for one coat

$$\text{Paint needed} = \frac{67{,}52}{9}$$
$$= 7{,}5l$$
$$\text{Amount of paint needed for 2 coats} = 7{,}5l \times 2$$
$$= 15l$$

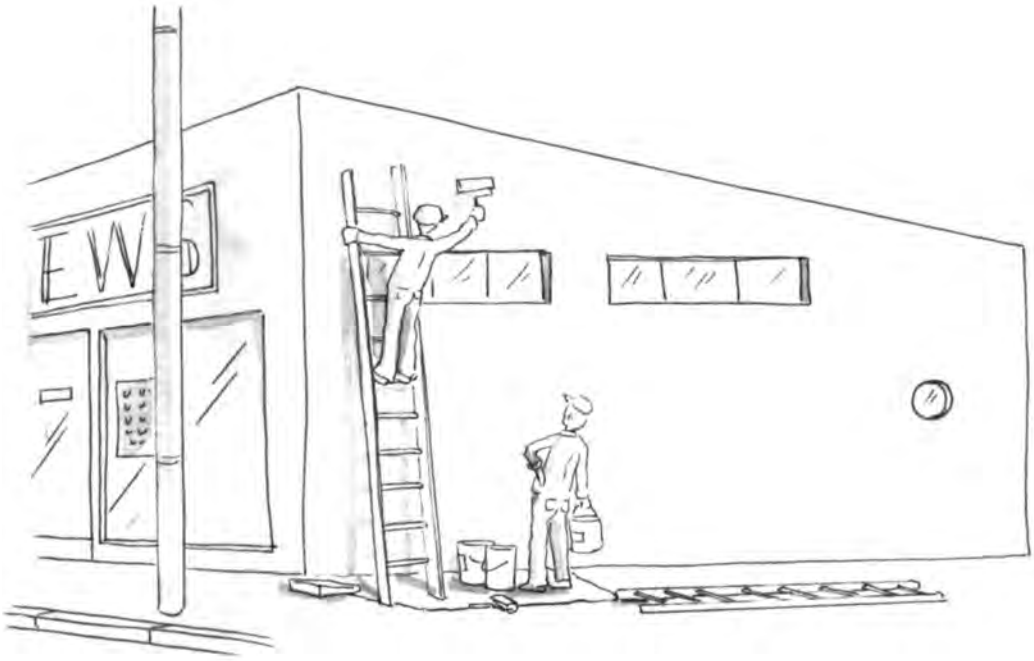
You would need three 5 litre tins.

3.6 Area of wall need without subtracting doors and windows:

$$\text{Area} = (6{,}5 \times 3) + (28{,}5 + 7{,}51) + (6{,}5 \times 4{,}58)$$
$$\text{Amount of paint needed for 2 coats} = 85{,}28\text{m}^2$$
$$= \frac{85{,}28}{9}$$
$$= 9{,}5l$$
$$\text{Amount of paint needed for 2 coats} = 9{,}5l \times 2$$
$$= 19l$$

There would be quite a lot of paint wasted as you would probably buy four 5*l* tins.

Activity 3 — Painting the salon



You want to paint the outside of the salon so you need to estimate the amount of paint you need to buy. Look at the plan on the handout from Activity 1. The salon is the last shop in a row of semi-detached buildings so only three sides need to be considered. It will be easier to consider each side separately.

3.1 Draw a rough sketch of the North elevation (back view) and fill in all the measurements on your sketch. Work out the area which needs to be painted. Remember that doors and windows don't get painted!

3.2 Draw a rough sketch of the East elevation (side of salon) and divide it into triangles and rectangles in order to work out the area. Fill in all the dimensions of the walls on your sketch. Calculate the height of the roof at the front of the salon and fill it in on your sketch. Calculate the area to be painted. Take $\pi = 3{,}14$.

3.3 Draw a rough sketch of the South elevation (front view) and fill in all the dimensions on your sketch. Work out the area which must be painted.

3.4 Work out the total area to be painted.

3.5 Paint comes in 20*l*; 5*l* and 1*l* tins. The instructions on the paint tin say that the rate of paint usage is $9m^2$ per litre, this means that 1 litre of paint is enough to cover $9m^2$. Calculate the number of litres of paint you will need if you plan to do two coats of paint. How many tins of paint do you need to buy and what size tins will you buy?

3.6 The above exercise was a lot of hard work. An alternative approach would be to work out the areas of the walls and not worry about the doors and windows. Do this and work out the amount of paint needed. Discuss whether this rougher estimation is acceptable or whether you will waste too much paint.

Activity 4 — Decorating the salon

This activity explores the relationship between the diameter and circumference of a circle.
The context used is the making of a round tablecloth.

ABOUT THIS ACTIVITY

This activity starts with the students measuring the diameter and circumference of various circular objects and estimating the value of π. From here the students are led into making a circular tablecloth. They have to calculate diameters, radii and circumferences. This activity is quite demanding so encourage the students to draw sketches wherever possible in order to assist them in solving the problem. This activity is aligned with unit standard 9016 and addresses all of the assessment criteria of SO1 and AC 1, 2, 5, 7, 8, 9, 10, 11, 12 of SO2.

MANAGING THIS ACTIVITY

For the investigation into pi and the main activity, the students will need the following:

- String
- A tape measure
- A ruler
- 5 circular (round) objects
- Squared paper (provided)
- A calculator
- Access to a computer and Excel spreadsheet(optional)
- A pair of compasses

The first part of this activity is an investigation into the value of pi. It is not essential to the rest of the activity so could be left out. The are some repetitive calculations in this activity which could be done on an Excel spreadsheet.

4.1 The table could be set up on an Excel spreadsheet so that the entire class's results can be analysed. The last column should come out to approximately 3,14 each time.

4.2 The result is often approximately equal to 3,14.

4.3 To get this relationship between the radius and the circumference:

$d = 2r$

Therefore $C = 2\pi r$

4.4 Using the diagram in the activity:

4.4.1 $d = 60\text{cm} + 60\text{cm} + 60\text{cm}$

$= 180\text{cm}$

4.4.2 No, because the fabric is only 150cm wide.

4.5 Calculations

4.5.1 Largest diameter = 150cm – (2 × 1,5cm) = 147cm

4.5.2 Width of frill = (180cm – 147cm) ÷ 2 = 16,5cm

4.5.3 Width of frill with seam allowances = 16,5cm + (2 × 1,5cm) = 19,5cm

4.6 Calculations:

4.6.1 Circumference = diameter.

$= 3{,}14 \times 147\text{cm}$

$= 461{,}58\text{cm}$

$\approx 4{,}62\text{m}$

4.6.2 Length of frill is $\frac{1}{3}$ longer than the circumference.

Length of frill $= \frac{4}{3} \times 4{,}62$

$\approx 6{,}15\text{m}$

4.6.3 Number of panels to be cut:

$$\text{Panels} = \frac{6{,}25}{1{,}50}$$
$$= 4{,}1$$
$$\approx 5$$

4.6.4 Amount of fabric needed = 150cm +(5 19,5cm)
= 247,5cm
≈ 2,5m

4.7 Wider frill:

4.7.1 Diameter = 180cm – (2 × 30cm) = 120cm

4.7.2 Circumference = π diameter.
= 3,14 × 120cm
= 376,8cm
≈ 3,77m

4.7.3 Length of frill is $\frac{1}{3}$ longer than the circumference.

$$\text{Length of frill} = \frac{4}{3} \times 3{,}77$$
$$\approx 5{,}02\text{m}$$

It is more than a metre shorter.

4.7.4 Number of panels:

$$\text{Panels} = \frac{5{,}02}{1{,}50}$$
$$= 3{,}34$$
$$\approx 4$$

4.7.5 Amount of fabric needed = 120cm + (2 × 1,5cm) + (4 × 19,5cm)
= 201cm
≈ 2,10m

This is about 40cm less than the 16,5cm frill.

4.7.6 The one with the 30cm frill as the frill is much shorter and will be easier to work with.

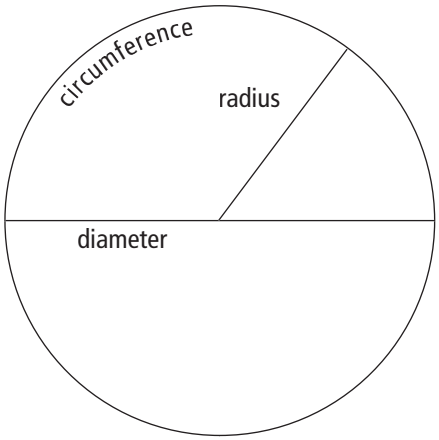
4.8 The diameter of the tablecloth must be 183cm including hems. Each semi-circle must have a radius of 91,5cm but you must add another 1,5cm for the join in the middle so all in all the radius is 93cm. The diameter of the material cut is therefore 186cm (see diagram on next page). The amount of material needed is approximately 3,4m. This is much more than for any of the other options. However, it would be less cumbersome to make. A negative about this design is the join in the middle.

Activity 4 — Decorating the salon

Before you can start on this activity you need to be introduced to pi (π), an important quantity in mathematics. Pi Is the ratio between the circumference of a circle and it's diameter or radius.

Make sure you have :
- a long piece of string
- a tape measure
- a ruler
- 5 round objects ranging from very big to very small. Examples are gluestick, cup, plate, tin of cold drink, car tyre (this can stay outside!)

Make sure you know the following words :



4.1 Redraw the following table and fill in the values.

Item being measured	Measure the circumference (C)	Measure the diameter (d)	Calculate $\frac{C}{d}$
1.			
2.			
3.			
4.			
5.			

4.2 What do you notice about the last column?

4.3 The ratio between the circumference and diameter of a circle ($C \div d$) is constant. This ratio is called pi and is denoted by the symbol π. The value of π is 3,1415926535…, which we approximate to π = 3,14. From this investigation you get an important formula relating the circumference to the diameter of a circle.

$$\pi = \frac{C}{d}$$

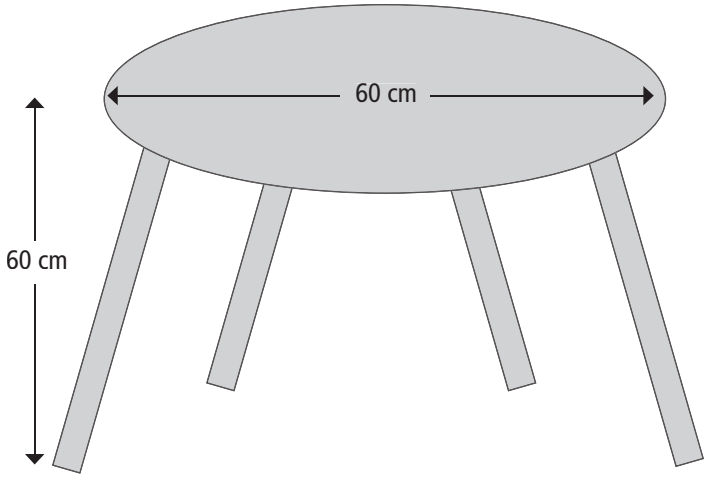
therefore $C = \pi d$

What would be the formula for the relationship between the circumference and the radius of a circle?

4.4 The reception area of your new salon has a round table for displaying flowers and pamphlets. You want to make a tablecloth to match the newly tiled floors and freshly painted walls. You need to estimate the amount of material you must buy for the tablecloth. The dimensions of the table are given below. The fabric you have chosen is 150cm wide.

4.4.1 What would the diameter of a round tablecloth be if it covered the table and reached the floor?

4.4.2 Would you be able to make this tablecloth from the fabric that you have chosen to use without joining it? Give a reason for your answer.



4.5 One solution would be to cut a circle to fit the fabric and then to add a frill onto the edge so as the cloth will reach the ground (see diagram).

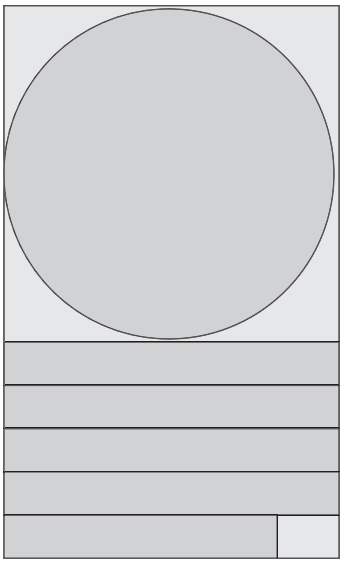
You decide to do some calculations to determine how wide you would have to make the frill. The seam allowance (i.e. the material needed to join the circular part to the frill) is 1,5cm.

4.5.1 What would be the largest diameter that the circular part could have after the seam allowances are subtracted?

4.5.2 What would be the width of the narrowest frill that would allow the cloth to reach the floor? Ignore the seam allowances .

4.5.3 What would be the width of the frill if you needed to allow 1,5cm to join the frill to the circular part and 1,5cm for the hem?

4.6 The frill must be $^1/_3$ times longer than the circumference of the circular part in order for it to be gathered up into a frill. The frill is very long and as the fabric is only 150cm you will need to join it a number of times. The diagram on the next page shows you a pattern of the tablecloth.



4.6.1 Using your answer from 4.5.1, work out the circumference of the circular part. This is where the frill will be joined to the circular part.

4.6.2 Calculate the length of the frill that is needed.

4.6.3 If the fabric is 150cm wide, how many panels will you need to cut in order to make the frill?

4.6.4 With the aid of the pattern in the diagram above, calculate the amount of fabric needed to make the tablecloth. Remember the seam allowances.

4.7 You decide that a wider 30cm frill would look more attractive.

4.7.1 What would be the diameter of the circular part? Don't worry about the seam allowance yet.

4.7.2 What would be the circumference of the circular part?

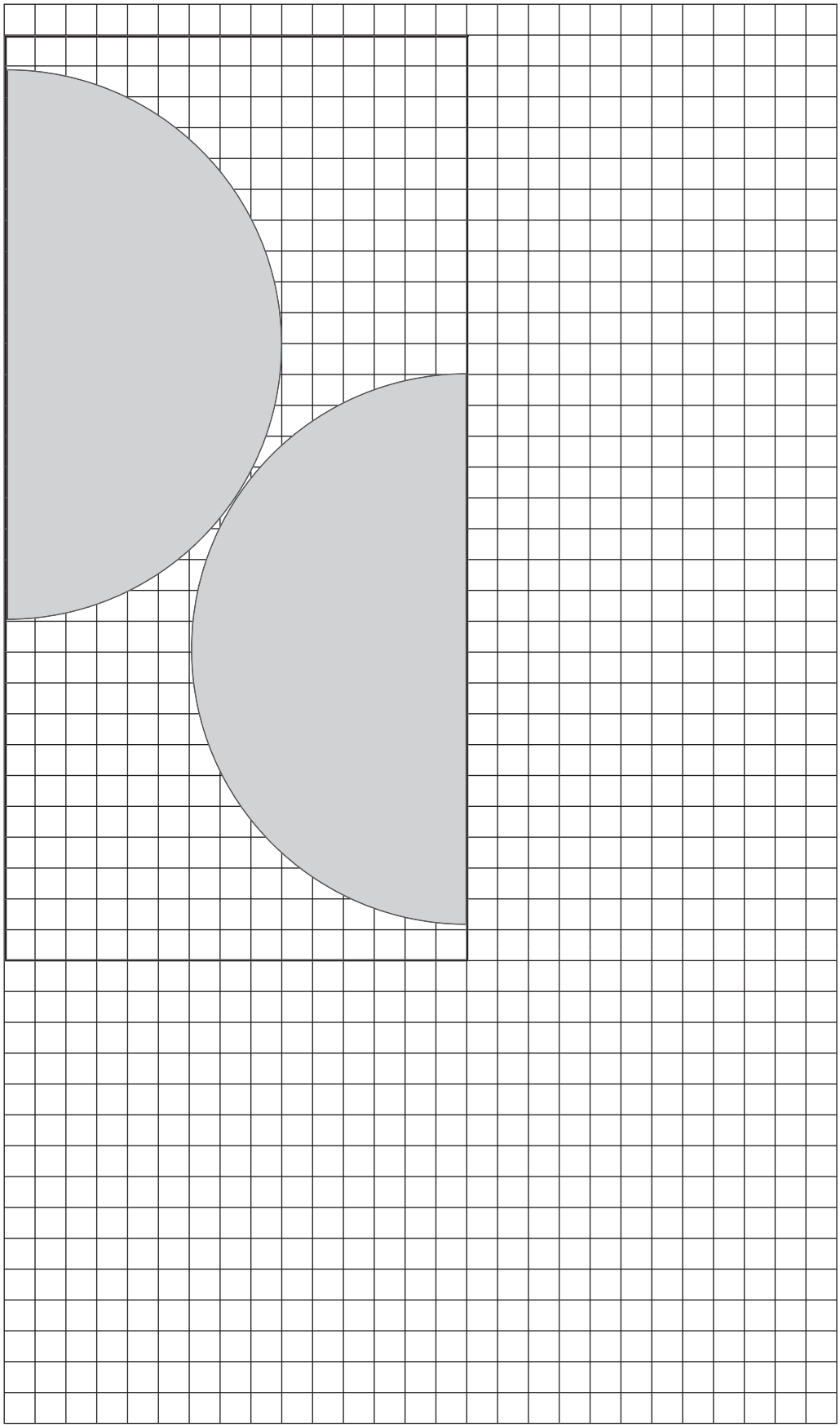
4.7.3 Calculate the length of the frill that is needed. How does this compare to the length of the 16,5cm frill?

4.7.4 If the fabric is 150cm wide, how many panels will you need to cut in order to make the frill?

4.7.5 Calculate the amount of fabric needed to make the tablecloth. Remember the seam allowances. How does this compare to the amount needed for of the 16,5cm frill tablecloth?

4.7.6 Which tablecloth do you think, will be easier to make?

4.8 Another solution would be to cut 2 semi-circles from the fabric and then join them. Using square paper and a suitable scale, draw the semi-circles so as to use the least amount of material. How much material would you need for this option? Discuss whether this option is a better one or not. Always give reasons for your answers.



Activity 5 — Hair colouring

In this activity the students have to calculate volumes of Hydrogen peroxide and hair tint in a particular ratio. The concept of a tree diagram to represent the decision making process is introduced.

ABOUT THIS ACTIVITY

The main focus of this activity is to practise working with ratios. The students have to read tables in order to get the information needed and then do the correct calculation. Although this activity does not require the student to actually measure the volumes, in reality these quantities would have to be accurately measured. This activity is aligned with unit standard 9016 and addresses AC 2 ,5, 7 of SO1 and AC 10, 11,12 of SO2.

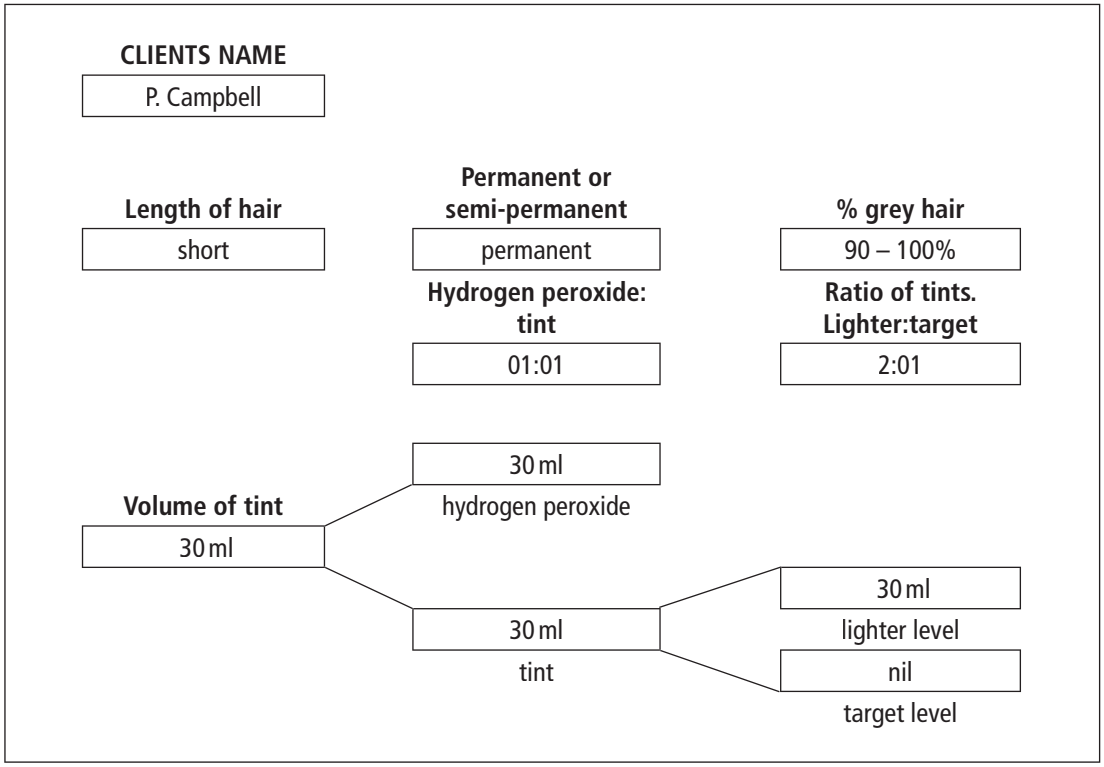
MANAGING THIS ACTIVITY

The students need to be able to work with ratios and also need to be able to interpret instructions given in table form. The ratios given here are for practice of skills and so might not comply completely with all product instructions. The students need to draw a tree diagram for each client.

5.1 1 hydrogen peroxide : 1 tint

5.2 1 hydrogen peroxide : 2 tint

5.3



CLIENTS NAME
D. Owens

Length of hair
short

Permanent or semi-permanent
permanent

% grey hair
50 – 70%

Hydrogen peroxide: tint
01:01

Ratio of tints. Lighter:target
01:01

Volume of tint
30 ml

30 ml
hydrogen peroxide

30 ml
tint

15 ml
lighter level

15 ml
target level

CLIENTS NAME
Ebrahim Naidoo

Length of hair
very short

Permanent or semi-permanent
semi-permanent

% grey hair
30 – 50%

Hydrogen peroxide: tint
01:02

Ratio of tints. Lighter:target
01:01

Volume of tint
15 ml

7.5 ml
hydrogen peroxide

15 ml
tint

7.5 ml
lighter level

7.5 ml
target level

CLIENTS NAME

I. Rasool

Length of hair

very long

Permanent or semi-permanent

semi-permanent

% grey hair

10 – 30%

Hydrogen peroxide: tint

01:02

Ratio of tints. Lighter:target

just target level

Volume of tint

60 ml

30 ml

hydrogen peroxide

60 ml

tint

Nil

lighter level

60 ml

target level

CLIENTS NAME

V. Abrahams

Length of hair

long

Permanent or semi-permanent

permanent

% grey hair

30 – 50%

Hydrogen peroxide: tint

01:01

Ratio of tints. Lighter:target

01:02

Volume of tint

60 ml

60 ml

hydrogen peroxide

60 ml

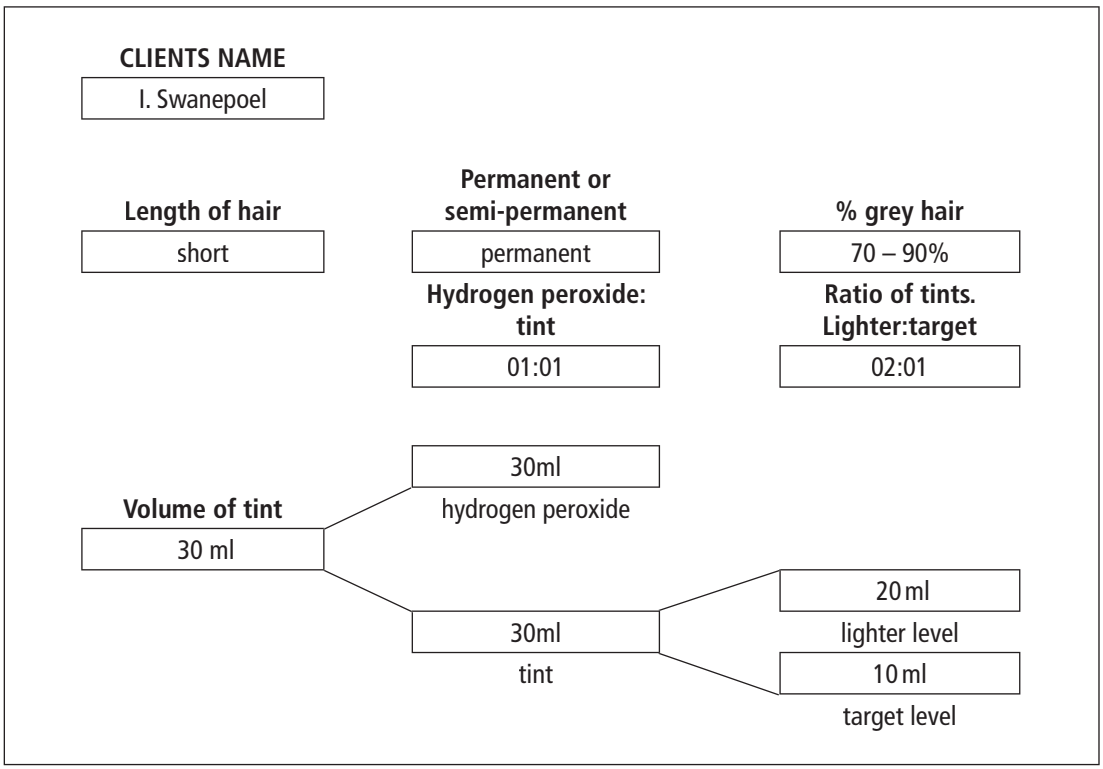
tint

20ml

lighter level

40 ml

target level


CLIENTS NAME
I. Swanepoel
Length of hair
short
Permanent or semi-permanent
permanent
% grey hair
70 – 90%
Hydrogen peroxide: tint
01:01
Ratio of tints. Lighter:target
02:01
30ml
hydrogen peroxide
Volume of tint
30 ml
30ml
tint
20 ml
lighter level
10 ml
target level

Activity 5 — Hair colouring

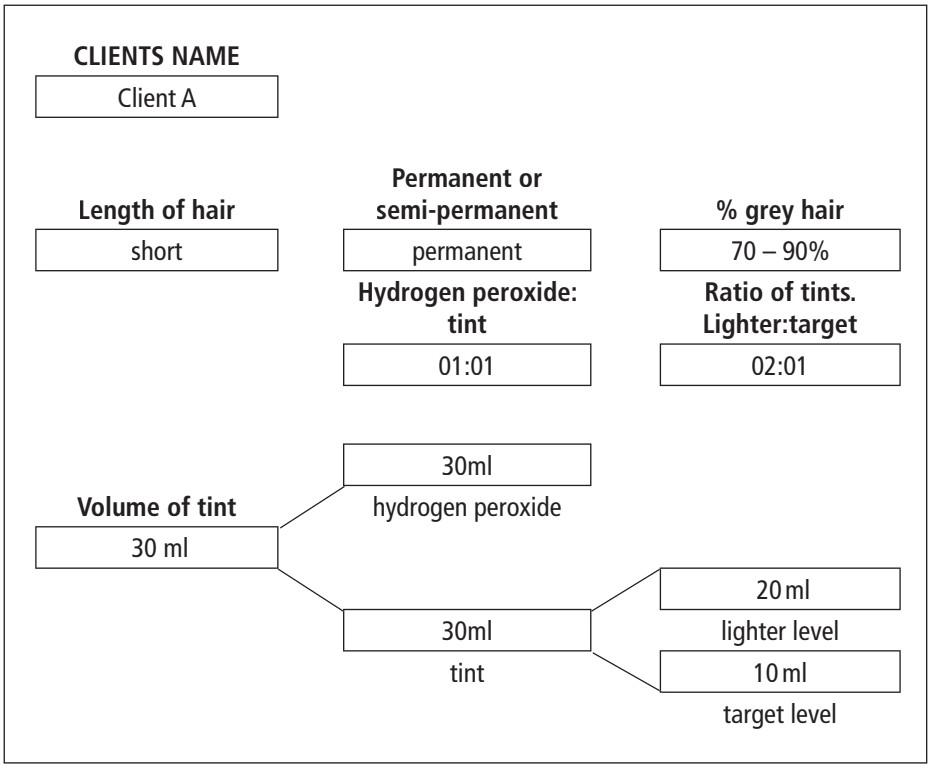
You have 6 new clients who want to colour their hair to cover their grey (unpigmented) hair. You have made some brief notes (see handout) on each client and now want to work out the quantities of hair products that you will need. You need to make various calculations depending on the client's requirements.

The first decision to make is whether they want a semi-permanent or a permanent colour. Once you know this you then need to work out the volumes of hydrogen peroxide and tint that you need for the job. Whether you need one colour or a combination of two colours depends on the amount of grey hair that needs to be covered. (use the ratios in tables 2 and 3 of handout for this exercise.)
The product that your salon uses suggests that for long hair you must use 60 ml of tint, for short hair 30ml and for very short hair only 15ml.

5.1 What is the ratio of Hydrogen peroxide (H_2O_2) : tint for a permanent colour?

5.2 What is the ratio of Hydrogen peroxide (H_2O_2) : tint for a semi-permanent colour?

5.3 Use a tree diagram to work out the components and volumes of product for tinting each of your client's hair. All the information you require to enable you to do this is provided on the handout for this activity. An example has been done for you.
CLIENT A : short, mostly grey with a little natural colour left. Wants permanent colour.
ANSWER : Mostly grey - ie 70% - 90% unpigmented hair (see Table 1)
Permanent- ratio of 1:1
Hair tint - for 70-90% grey use 1 part target level colour and 2 parts lighter level. (see table 3)



Draw a tree diagram for each client (see notes on handout) and fill in the relevant information.

ACTIVITY 5 — HAIR COLOURING

The following tables have been taken from a textbook of cosmetology and are here to assist you with the activity. These ratios could change depending on the product you use.

Table 1: Determining the percentage of unpigmented (grey) hair

Percentage of Unpigmented Hair	Characteristics
10% - 30%	Mostly pigmented; grey hair difficult to see; generally most heavily located on the temples and sides with some blending of colour throughout the head.
30% - 50%	More pigmented that unpigmented; easy to see in dark hair but may blend in with lighter natural hair.
50% - 70%	More unpigmented than pigmented; unnecessary to study hair to see unpigmented hair.
70% - 90%	Mostly unpigmented hair; generally majority of remaining hair located in back with rest blended over head.
90% - 100%	Virtually no pigmented hair; looks white.

Table 2: Semi-permanent colour formulation chart for unpigmented hair

Percentage of Unpigmented Hair	Formulation
0% - 30%	Target shade
30% - 50%	Equal parts target shade and one level lighter
50% - 70%	One level lighter than target shade

Table 3: Permanent colour formulation chart for unpigmented hair

Percentage of Unpigmented Hair	Formulation
10% - 30%	Target shade
30% - 50%	2 parts target shade and 1 part lighter level
50% - 70%	Equal parts target shade and lighter level
70% - 90%	2 parts lighter level and 1 part target shade
90% - 100%	One level lighter than target shade

Reference: Milady's Standard Textbook of Cosmetology.
ISBN L-56253-466-L

Notes made about clients:

1. Mrs P. Campbell - no natural colour, permanent, short
2. Ms D. Owens - short, more grey than own colour, easy to see grey, permanent
3. Mr Ebrahim Naidoo - very short, semi-permanent, can see grey in dark hair - mostly own colour.
4. Mrs I. Rasool - very little grey, mostly own colour, semi-permanent, very long hair.
5. Ms. V. Abrahams - long hair, permanent, can see grey but still mostly own colour.
6. Mrs I. Swanepoel - short, mostly grey but still has some natural colour - mainly at the back, permanent.

Activity 6 — Getting the co-ordinates right.

ABOUT THIS ACTIVITY

This activity uses a colour chart as a context for working with co-ordinates. This activity is aligned with unit standard 9016 and addresses AC 2, 8, 9, 10 of SO2.

MANAGING THIS ACTIVITY

The students can manage this activity with little guidance. Students must realise that this is an example of how to use a table and that colour numbers and tones will change depending on the product used. The principles, however, stay the same.

6.1 The co-ordinates would change to 8/5.

6.2 This means that they are natural colours without any reflect of fashion colour added.

6.3 The co-ordinates are filled in on the table:

Naturals	Level						
Lightest blonde	9/0						
Very light blonde	8/0		8/2				
Light blonde	7/0				7/4		
Medium blonde	6/0			6/3			
Dark blonde	5/0						
Light brown	4/0				4/4		
Medium brown	3/0						
Dark brown	2/0					2/5	
Black	1/0					1/5	
		/1	/2	/3	/4	/5	/6
		Ash (blue)	Mauve Ash (Violet)	Gold (yellow)	Warm (orange)	Red	Ash (green)

6.3.1 Very light blonde, violet
6.3.2 Dark brown, red
6.3.3 Medium blonde ,gold
6.3.4 Light brown, warm (orange)
6.3.5 Black, red

6.4 Co-ordinates are:
6.4.1 3/3
6.4.2 1/4
6.4.3 9/3

6.5 Client has dark blonde hair
6.5.1 Starts at 5
6.5.2 Ends at 8
6.5.3 8/1

6.6 Client has medium blonde hair
6.6.1 Starts at 6
6.6.2 Ends at 4
6.6.3 4/4

6.7 The co-ordinates 3/45 mean:
6.7.1 The client wants medium brown with orange/ red fashion colour.
6.7.2 Orange

6.8 6/21

Activity 6 — Getting the co-ordinates right

All clients have their own unique expectations with respect to hair colour. Our job is to find a way of recording this colour. Hair colour can be described using two dimensions. The first is the International Colour Code or natural colour. This ranges from Black (level 1) to Lightest Blonde (level 9). The second dimension is the tone, referred to as the fashion or reflect, and ranges from ash (blue) (level 1) to Ash (green) (level 6).

The table below shows the different possible combinations. We can refer to this table to determine a code for each possible combination. For example, we would say that a person who prefers dark blonde with a warm(orange) tone has a code of 5/4. This table is an example of a colour table.

Naturals	**Level**						
Lightest blonde	9/0						
Very light blonde	8/0						
Light blonde	7/0				7/4		
Medium blonde	6/0						
Dark blonde	5/0						
Light brown	4/0						
Medium brown	3/0						
Dark brown	2/0						
Black	1/0						
		/1	/2	/3	/4	/5	/6
		Ash (blue)	Mauve Ash (Violet)	Gold (yellow)	Warm (orange)	Red	Ash (green)

Using the table above, answer the following questions. An example has been done for you.

EXAMPLE:
The colour code on a client's card says 7/4. What does this mean?

Answer : 7/4 is shown on the table. It means that the client wants a warm light blonde colour.

Now answer the following questions.

6.1 The client from the example above with the colour 7/4 wants to go one shade lighter and have a red tone. What would be the new co-ordinates on her card?

6.2 Why are the levels labelled with /0 each time?

6.3 Fill the following co-ordinates in on the table and give the colours that they represent:
6.3.1 8/2
6.3.2 2/5
6.3.3 6/3
6.3.4 4/4
6.3.5 1/5

6.4 Give the co-ordinates of the following colours :
6.4.1 Medium brown with gold tone
6.4.2 Warm black
6.4.3 Gold lightest blonde

6.5 The client has dark blonde hair and wants to be three levels lighter.
6.5.1 What level did she start with?
6.5.2 What level will she end with?
6.5.3 If she wants a blue tone, what will the co-ordinates of her final colour be?

6.6 The client has medium blonde hair and wants to be two levels darker
6.6.1 What level did she start with?
6.6.2 What level will she end with?
6.6.3 If she wants an orange tone, what will the co-ordinates of her final colour be?

6.7 The co-ordinates 3/45 appear on a client's card.
6.7.1 What does this mean?
6.7.2 Which colour would be more dominant and why do you think this is so?

6.8 Give the co-ordinates for medium blonde with blue/ violet tone but violet being dominant.

Activity 7 — Attending an exhibition

This activity takes the students through an exercise in finding their way on a map, working out a sensible route, calculating distances and time as well as costing a trip. The skills learnt here can be applied to the planning of any journey.

ABOUT THIS ACTIVITY

The following two activities use the same context. The first one deals with travel choices in the city and the second with travel from outside the city. The aim of this activity is to expose the students to reading street maps, using grid references (working with co-ordinates) and measuring and working out distances. They should learn from this activity about planning a route and working out the approximate distance using ratios and time of travel. This activity is aligned with unit standard 9016 and addresses all the assessment criteria of SO1 and AC 6, 8, 9, 10, 11 of SO2.

MANAGING THIS ACTIVITY

There are two handouts in this activity which will be needed for both this activity and activity 9.The first handout contains a train timetable. The second handout is a street map of Cape Town city centre and the surrounding suburbs. The students will fill in on the map their responses to certain questions. The facilitator needs to explain the difference between highways, roads and railway lines to the students to help them interpret the maps. Each student will need a piece of string and a ruler.

7.1 See map.

7.2 Observatory.

7.3 Cape Town International Convention Centre. CTICC.

7.4 See map.

7.5 See map.

7.6 Using the route shown on the map, distance = 33cm. This may differ from student to student depending on the route chosen. To convert to km :

Must know 100cm = 1m
1000m = 1km

The scale is 1:20 000
This means

Distance on map	Distance on ground
1 cm	20 000cm
33cm	33 × 20 000cm = 660 000cm
33cm	6 600cm
33cm	6,66km

7.7 To work out time taken :

$$\text{Time} = \frac{\text{distance}}{\text{speed}}$$

$$t = \frac{6{,}6\text{km}}{40\text{km/h}}$$

$$t = 0{,}15 \text{ hours}$$

$$\text{Therefore } t = 0{,}15\text{ h} \times 60 \text{ minutes}$$

$$= 9 \text{ minutes}$$

You would need to leave the CTICC about 3:30pm as you need time to pay for parking, find your car and also need a bit of leeway in case of traffic.

7.8 Observatory Station or Salt River Station. See map.

7.9 Distance to Observatory station = 6,2 cm × 0,2 km = 1,24 km
Distance to Salt River station = 4,6 cm × 0,2 km = 0,92 km

Salt River Station is closest. Yes, one could walk this distance.

7.10 CA 24

7.11 See the possible route on the map.

7.12 Distance from station to CTICC = 7.3 cm × 0,2 km
= 1,46 km

7.13 Using the train timetable one can see that the time taken for the train trip is about 6 minutes.

To walk about 1,5km from the CTICC to the station will take about 20 minutes
To walk about 1 km from Salt River Station back to the salon will take about 12 minutes. These times are estimated values. The students should be encouraged to make reasonable estimations.

This makes the total trip about 40 minutes.

The latest train that you could catch would be train no. 197 at 15:38. This means you would arrive at the station at 15:44 and still have time to walk back to the salon.

7.14 Cost if travelling by car:

Petrol consumption = 10 litres per 100km

Therefore 1 km needs $\frac{10}{100}\,l \approx 0{,}1\,l$

6,6 km needs 6,6 km × 0,1 = 0,66 l

Amount needed for return journey = 2 × 0,66
= 1,32 l

cost of petrol = 1,32 l × R4,36
≈ R5,76

cost of parking 5 – 6 hours = R35

Total cost = R5,76 + R35
= R40, 76

Cost of return journey by train = R5,50 × 2 = R11,00

7.15 If 4 stylists were going then it would be more viable to take the car as the train fare is now R44 whereas the car costs don't change.

Activity 7 — Attending an exhibition

DO U CARE ABOUT HAIR?

IF YOU DO,THEN COME GET INSPIRED AT THE HAIRCARE EXHIBITION

LOCAL and INTERNATIONAL stylists will be showing off their talents and the latest in fashion.

All the BIG brand names will be THERE, giving advice and telling you about new products. Get the BUZZ , join in the excitement.

WHEN: Monday 14th till Saturday 19th May

TIME: 10am --- 5pm

WHERE: CAPE TOWN INTERNATIONAL CONFERENCE CENTRE

ENTRANCE: No charge

The advertisement above appeared in the local newspaper. You are going to attend the exhibition. You decide to get to the exhibition as soon as it opens and to be back at the salon in time for an appointment at 4 o'clock. You have a choice of taking your own car or going by train. Your salon is on the corner of Lower Main and Nelson Street. For this part of the activity you need to use handouts 1 and 2.

Answer the following questions using the information given in the handouts.

7.1 If the grid reading for Nelson Street is CC 29, find it on the map (handout 1) and mark your salon with an *.

7.2 In what suburb is the salon found?

7.3 Where is the exhibition being held and what is this name usually shortened to?

7.4 The grid reading for the venue is BZ 24. Find it on the map and mark it with a *.

7.5 Work out a route from your salon to the venue if you are going by car and mark it on the map.

7.6 The scale for the map is 1:20 000, which means that 1cm on the map represents 20 000 cm on the ground. Using a piece of string, measure the distance of your route in cm on the map and then convert this to the distance on the ground in km using the scale of the map.

7.7 The speed limit on most city roads is 60km/h. On the highway you can travel at 100km/h. For this activity let your average speed be 40km/h. Calculate approximately how long it would take you to get to the exhibition. What time would you leave the exhibition in order to get back to the salon in time? Explain your answer.

These formulae might help:

distance = speed × time

$$\text{time} = \frac{\text{distance}}{\text{speed}}$$

7.8 If you decided to go by train, there are 2 possible stations from which you could catch the train. Which stations are they ? Indicate them on your map and mark on the map the route you would walk from the salon to each station.

7.9 Find out which station is closer by working out the distance to each station in km. Would you be able to walk to the station?

7.10 The train stops at Cape Town station. Give the grid reading of Cape Town station.

7.11 You now need to walk to the CTICC. Mark a route on the map.

7.12 Work out the distance in km.

7.13 Using the train timetable provided, work out the approximate time the train journey will take. Find the time taken for the whole journey by adding the time you think you will need to get from the salon to the station and the time taken to get from the station to the CTICC. Which is the latest train that you can catch in order to get back in time for your 4 o'clock appointment?.

7.14 Using the information given below, work out the cost of the trip for each type of transport.

Petrol consumption	Your car uses 10 litres of petrol for every 100km
Petrol costs	R4,36 per litre

The following table shows the parking rates for the CTICC:

PARKING RATES

Hours	Fee
0 – ½	Free
½ – 2½	R10
2½ – 3½	R15
3½ – 4	R20
4 – 4½	R25
4½ – 5	R30
5 – 6	R35
6 – 8	R40
8 – 24	R50
Lost ticket	R50

Metrorail fare calculator

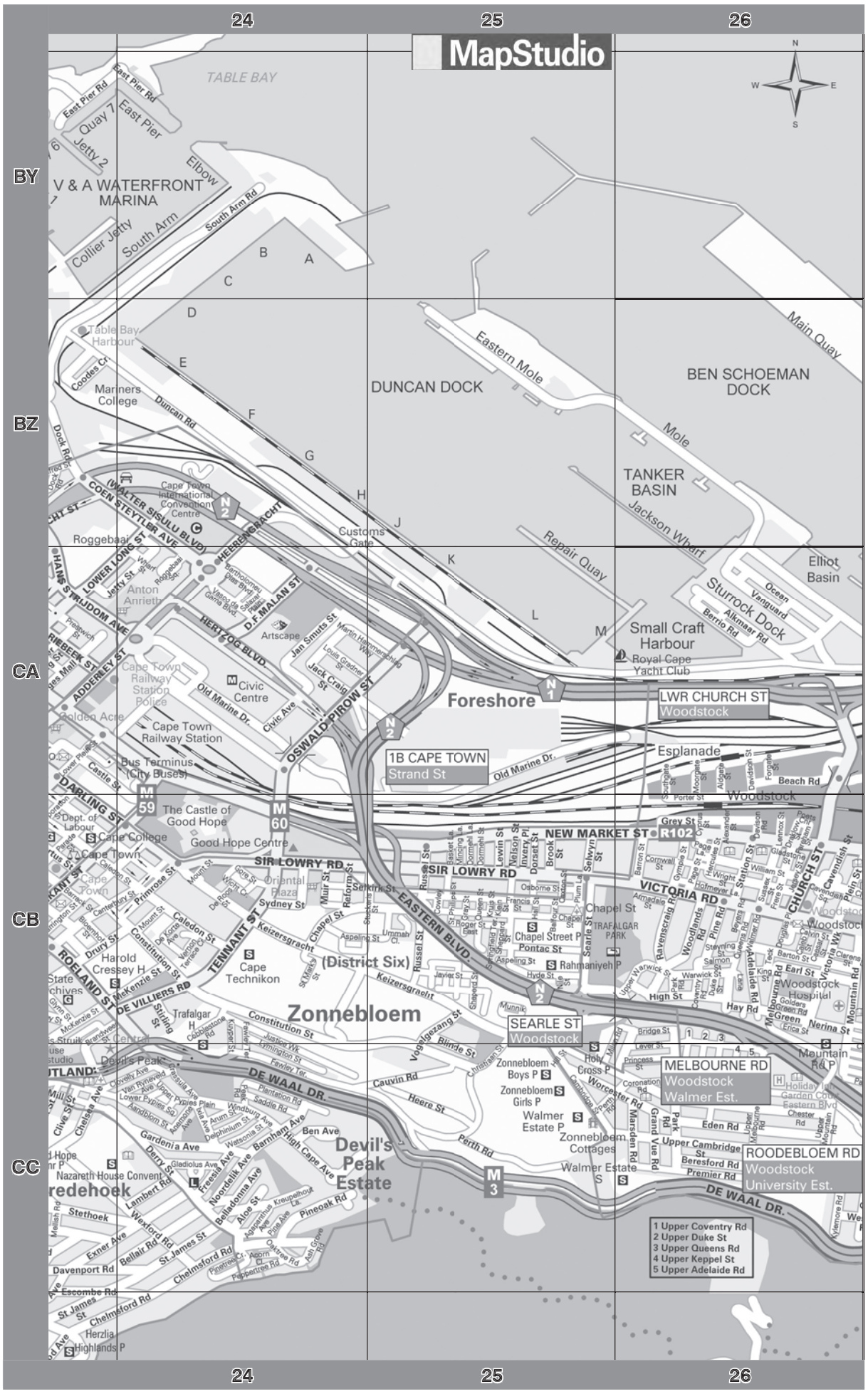
Start Station CAPE TOWN ***Period*** 2003 / 2004

End Station OBSERVATORY ***Discount*** FULL PRICE

FULL PRICE

	METRO PLUS		***METRO***	
	Adult	***Child***	***Adult***	***Child***
Single	R 5.50	R 2.80	R 4.20	R 2.10
Weekly	R 39.00	R 19.50	R 20.00	R 10.00
Monthly	R 128.00	R 64.00	R 70.00	R 35.00

7.15 From the above calculations you can see that If you were the only stylist going to the exhibition, it would be more economical to go by train. How many stylists would need to travel together to make going by car less expensive than going by train? Explain how you arrived at your answer.



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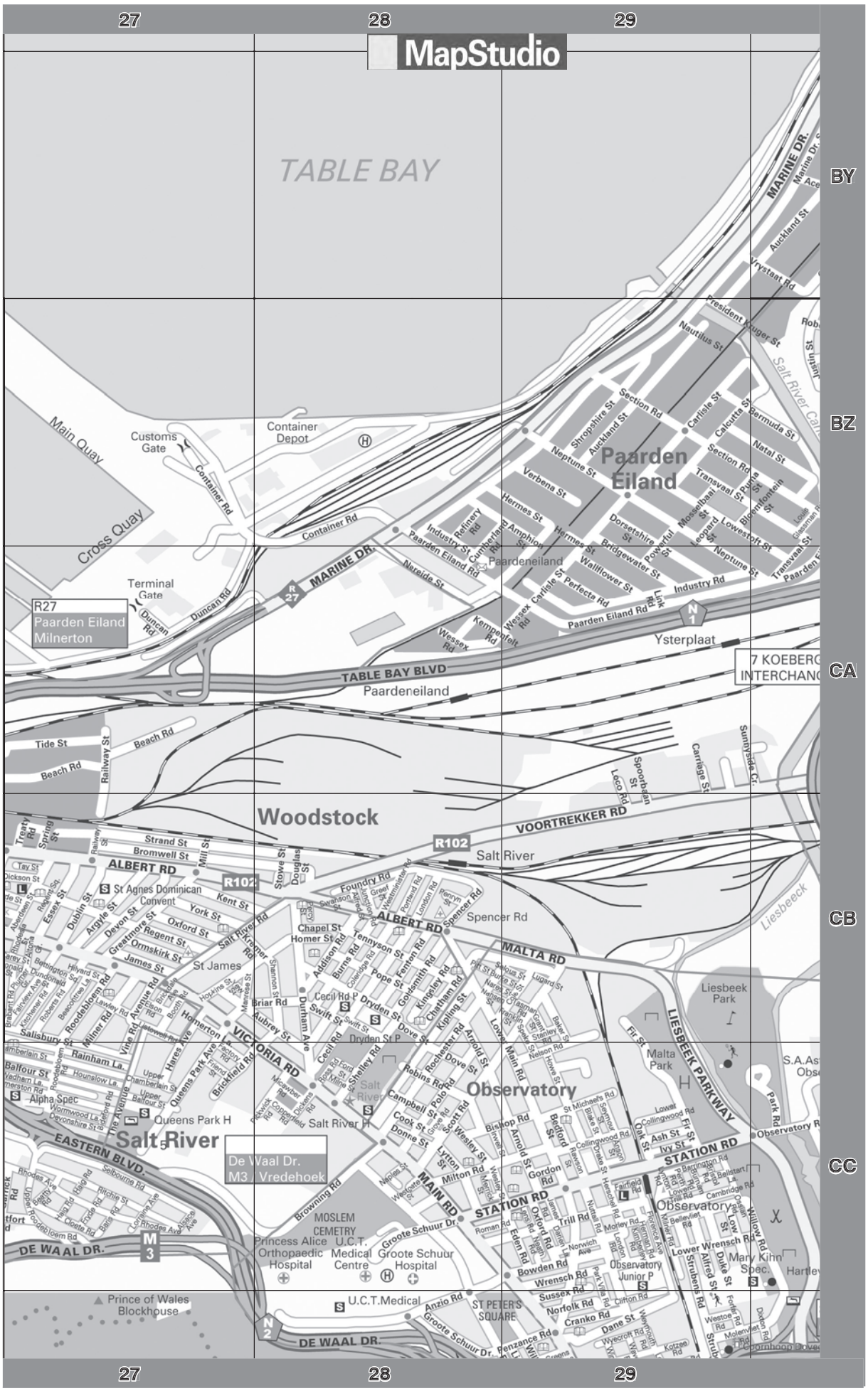

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Train timetable for Cape Town – Simonstown line

PLATFORM NO.	1	6	5	4	3	6	2	3	5	4	1	6	3	4
TRAIN NO.	169	173	175	177	179	181	183	187	189	191	193	195	197	199
CAPE TOWN	12:00	12:20	12:40	13:00	13:20	13:40	14:00	14:20	14:40	14:55	15:10	15:25	15:38	15:50
WOODSTOCK	12:03	12:23	12:43	13:03	13:23	13:43	14:03	14:23	14:43	14:58	15:13	15:28	15:41	15:53
SALT RIVER	12:06	12:26	12:46	13:06	13:26	13:46	14:06	14:26	14:46	15:01	15:16	15:31	15:44	15:56
OBSERVATORY	12:09	12:29	12:49	13:09	13:29	13:49	14:09	14:29	14:49	15:04	15:19	15:34	15:47	15:59
MOWBRAY	12:11	12:31	12:51	13:11	13:31	13:51	14:11	14:31	14:51	15:06	15:21	15:36	15:49	16:01
ROSEBANK	12:13	12:33	12:53	13:13	13:33	13:53	14:13	14:33	14:53	15:08	15:23	15:38	15:51	16:03
RONDEBOSCH	12:14	12:34	12:54	13:14	13:34	13:54	14:14	14:34	14:54	15:09	15:24	15:39	15:52	16:04
NEWLANDS	12:17	12:37	12:57	13:17	13:37	13:57	14:17	14:37	14:57	15:12	15:27	15:42	15:55	16:07
CLAREMONT	12:19	12:39	12:59	13:19	13:39	13:59	14:19	14:39	14:59	15:14	15:29	15:44	15:57	16:09
HARFIELD RD	12:21	12:41	13:01	13:21	13:41	14:01	14:21	14:41	15:01	15:16	15:31	15:46	15:59	16:11
KENILWORTH	12:22	12:42	13:02	13:22	13:42	14:02	14:22	14:42	15:02	15:17	15:32	15:47	16:00	16:12
WYNBERG	12:24	12:44	13:04	13:24	13:44	14:04	14:24	14:44	15:04	15:19	15:34	15:49	16:02	16:14
WITTEBOME	12:27	12:47	13:07	13:27	13:47	14:07	14:27	14:47	15:07	15:22	15:37	15:52	16:05	16:17
PLUMSTEAD	12:29	12:49	13:09	13:29	13:49	14:09	14:29	14:49	15:09	15:24	15:39	15:54	16:07	16:19
STEURHOF	12:30	12:50	13:10	13:30	13:50	14:10	14:30	14:50	15:10	15:25	15:40	15:55	16:08	16:20
DIEPRIVIER	12:32	12:52	13:12	13:32	13:52	14:12	14:32	14:52	15:12	15:27	15:42	15:57	16:10	16:22
HEATHFIELD	12:34	12:54	13:14	13:34	13:54	14:14	14:34	14:54	15:14	15:29	15:44	15:59	16:12	16:24
RETREAT	12:37	12:57	13:17	13:37	13:57	14:17	14:37	14:57	15:17	15:32	15:47	16:03	16:15	16:27
STEENBERG	12:40	13:00	13:20	13:40	14:00	14:20	14:40	15:00	15:20	15:35	15:50		16:18	16:30
LAKESIDE	12:42	13:02	13:22	13:42	14:02	14:22	14:42	15:02	15:22	15:37	15:52		16:20	16:32
FALSE BAY	12:45	13:05	13:25	13:45	14:05	14:25	14:45	15:05	15:25	15:40	15:55		16:23	16:35
MUIZENBERG	12:47	13:07	13:27	13:47	14:07	14:27	14:47	15:07	15:27	15:42	15:57		16:25	16:37
ST JAMES	12:49	13:09	13:29	13:49	14:09	14:29	14:49	15:09	15:29	15:44	15:59		16:27	16:39
KALK BAY	12:51	13:11	13:31	13:51	14:11	14:31	14:51	15:11	15:31	15:46	16:01		16:29	16:41
FISH HOEK	12:56	13:16	13:36	13:56	14:16	14:36	14:56	15:16	15:36	15:51	16:06		16:38	16:46
SUNNY COVE	12:58		13:38		14:18		14:58		15:38		16:08		16:40	
GLENCAIRN	13:03		13:43		14:23		15:03		15:43		16:13		16:45	
SIMON`S TOWN	13:08		13:48		14:28		15:08		15:48		16:18		16:49	

source: http://wwww.capemetrorail.co.za

Activity 8 — Attending an exhibition (Assessment)

This activity uses the same context as activity 7 except that the people going to the exhibition are coming from out of town. This activity can therefore be used as an assessment activity as all work has been covered before.

ABOUT THIS ACTIVITY

See notes on activity 7. This activity is aligned with unit standard 9016 and addresses all the assessment criteria of SO1 and AC 6, 8, 9, 10 of SO2.

MANAGING THIS ACTIVITY

The students need to be given the worksheet as well as the maps they worked on in activity 7. They will also need the handout from this activity which is a map of the Western Cape. The students will also need string and a ruler. They will mark some of their answers on the map. The facilitator needs to explain the different types of roads shown on the map.

8.1 See map. AI

8.2 See map. CI

8.3 See map.

8.4 Using the route shown on the map, the approximate distance = 9 cm. This may differ from student to student depending on the route chosen. To convert to km :

Must know 100cm = 1m

1000m = 1km

Therefore 100 × 1000 = 100 000cm

= 1km

The scale is 1:500 000

This means 1cm = 500 000cm

$1\text{cm} = \frac{500\,000}{100\,000}$

1cm = 5km

Therefore distance to CTICC ≈ 9 cm × 5km

≈ 45 km

8.5 The costs for the day :

Petrol consumption = 10 litres per 100km

Therefore 1km needs $\frac{10}{100}\text{l} \approx 0{,}1\,l$

45 km needs 45km × 0,1 = 4,5

Amount needed for return journey = 9l

cost of petrol = 9l x R4,36

= R39,24

cost of parking for 6 hours 10 min = R40

Total cost = R39,24 + R40

= R79,24

This means each stylist paid = $\frac{\text{R}79{,}24}{2}$

= R39,62

8.6 "Average speed" is calculated when the distance travelled is divided by the total time taken. This will include stopping times.

8.7 The stylists from Atlantis could travel most of the way by National Road which has a speed limit of 120km/h, whereas the stylists from Observatory had at least half of their journey inside the city.

8.8 To work out time taken :

$$\text{Time} = \frac{\text{distance}}{\text{speed}}$$

$$t = \frac{45\text{km}}{90\text{km/h}}$$

$$t \approx 0{,}5 \text{ hours}$$

$$\text{Therefore } t = 0{,}5\text{h} \times 60 \text{ minutes}$$

$$\approx 30 \text{ minutes}$$

9.9 The first 2½ hours are cheapest with each half hour costing only R2. The next hour costs you R5 but then each half hour cost R5 so this means that the parking rate between 3½ and 5 hours is the most expensive. The rate gets cheaper again with each hour costing R5 then 2 hours costing R5 and then 16 hours costs only R10.

Some possible reasons for the different price structure:

- It encourages people to deliver goods, drop off or fetch people in less than half an hour. This frees up the car park.
- It encourages people to pop back and buy something if they know that they do not have to pay for parking.
- The management must have decided that 2½ to 5 hours is a popular amount of time to spend at the exhibition so they can earn more money per half hour.
- Making it cheaper to stay longer encourages people to spend the day at the exhibition.

Activity 8 — Attending an exhibition. Assessment task

Two stylists from Atlantis also see the advertisement and decide to go to the exhibition. They will travel together and share the costs. Use the handout of the map of Cape Town that you used for the previous for question 7.2

8.1 Find Atlantis on the map in Handout 3 and mark it with a * . Write down the grid reference.

8.2 Using the more detailed map of Cape Town from the previous exercise to help you, decide where the CTICC is on the map of the Western Cape and mark it. Write down the grid reference.

8.3 Fill in on the map the route that the stylists would take to get to the exhibition.

8.4 If the scale of this map is 1:500 000, work out the approximate distance (in km) that the stylists traveled.

8.5 Using the following information, work out how much each stylist must contribute if they are sharing the costs.

Petrol consumption	Your car uses 10 litres of petrol for every 100km
Petrol costs	R4,36 per litre
Time spent at exhibition	10:30am till 4:40pm

8.6 The stylists' average speed for the journey is 90km/h. What is meant by the term "average speed" ?

8.7 Why is it reasonable to say that the stylists' average speed for the journey was 90km/h when in the previous activity your average speed was only 40km/h?

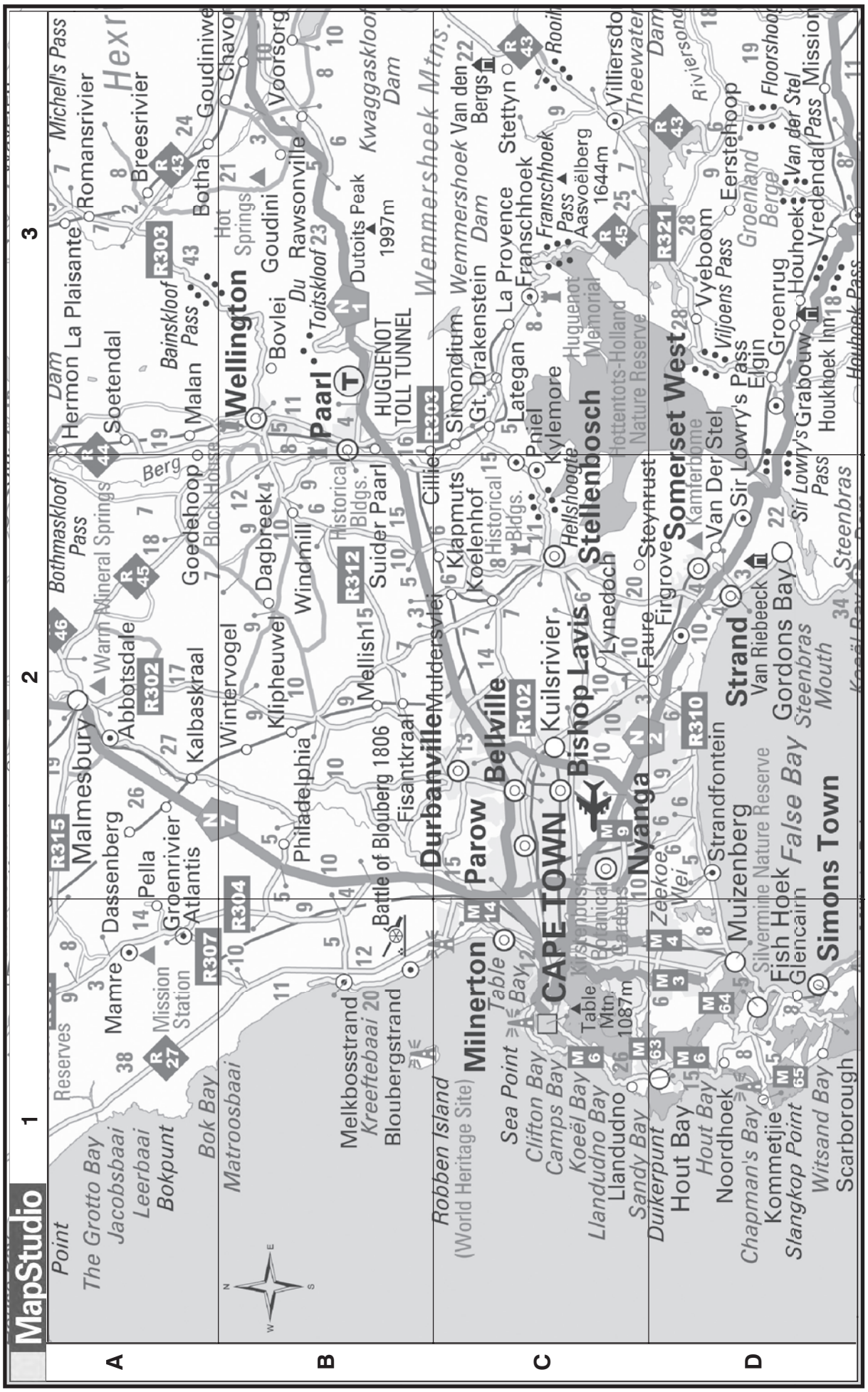
8.8 Calculate approximately how long it took them to get from Atlantis to the CTICC..

The table below shows the parking rates for the CTICC:

PARKING RATES

Hours	Fee
0 – ½	Free
½ – 2½	R10
2½ – 3½	R15
3½ – 4	R20
4 – 4½	R25
4½ – 5	R30
5 – 6	R35
6 – 8	R40
8 – 24	R50
Lost ticket	R50

8.9 Looking at the parking rates table, what do you notice about the way the price changes for different time periods? Give reasons why you think it is done in this way.



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