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Note to the teacher:
Please refer to the Teacher’s Guide for possible assessment tasks, exemplar control tests and exemplar examination papers.
INTRODUCTION

Welcome to the Solutions for all Mathematical Literacy Grade 11 Learner’s Book

In Mathematical Literacy, you will be exposed to both mathematical content and real-life contexts. You will have many opportunities to analyse problems and devise ways of working mathematically to solve problems in context.

Mathematical Literacy involves:
- the use of elementary mathematical content
- authentic real-life contexts
- solving familiar and unfamiliar problems
- decision-making and communication
- the use of integrated content and/or skills in solving problems

How to use the Solutions for all Mathematical Literacy Grade 11 Learner’s Book

The Solutions for all Mathematical Literacy series aims to be exactly what its name suggests – solutions for all learners, no matter what their level of ability or background.

In the Solutions for all Mathematical Literacy Learner’s Book, every exercise and activity gradually progresses from easier questions to more difficult questions, in manageable steps.

The Summary practice exercise at the end of each topic is useful for both learners who have mastered the skills taught in the topic, and those who may not have mastered all the skills.

Within each topic of Solutions for All Mathematical Literacy Learner’s Book you will find:
- Topic opener page – you are given an overview on what content will be covered within the topic.
- What you already know – you will be reminded of the skills you were taught in either a previous topic or in Grade 10.
- Check myself – you are given an opportunity to check whether you have acquired the knowledge and skills taught in previous topics or in Grade 10.
- Units – each topic is broken down into manageable units that use real-life examples to teach the skills and knowledge necessary for you to be successful during this year.
- Examples and solutions – full worked examples and solutions are given in each unit.
- Summary practice exercise – you are given an opportunity to check whether you have mastered the skills taught in the topic.
- Word bank – difficult words found within the topic are explained.
- Topic summary – you are given a summary of the work covered in the topic.

The publisher and authors wish you all the best in your study of Mathematical Literacy in Grade 11.
Topic 1

Patterns, relationships and representations

What you will learn about in this topic

You will:
- recognise and explain the story or message represented in a graph
- recognise and describe the relationship between two or more variables
- recognise and describe how the shape and direction of a graph affect the story or message represented by the graph
- recognise and describe the significance of certain points on a graph including:
  - where the graph cuts the vertical and horizontal axes
  - the maximum and minimum points on the graph
  - the point where two graphs cross
- draw graphs of two relationships on the same axes by:
  - plotting the points from a given table
  - constructing a table of values from a given equation
- consider the following when interpreting graphs:
  - identifying certain dependent and independent variables
  - identifying independent variables for which the dependent variable increases or decreases
  - determining and describing the break-even point
  - describing how the slope of the graph affects the relationship of the variables.

Let’s talk about this topic

In this topic you will revise some concepts learnt in Grade 10. You will also look at patterns and relationships in financial and measurement contexts, and the use of graphs and tables to represent data.
A graph represents data and can be illustrated using a diagram. Graphs have horizontal and vertical axes referred to as an x-axis and a y-axis respectively.

Here are some examples of different graphs.

**Check myself**

Discuss these questions in groups, or as a class.

1. Why do graphs have different shapes?
2. How does the shape of the graph help to tell the story?
3. Why is it important to label the axes?
The shape of a graph gives the reader information about the relationship between two elements.

Another word for an element in a relationship is variable. The values for the dependent variable depend on the values of the independent variable.

**Example**

The graph shows the amount of money in a savings account over time.

1. How much money was in the account at the start of the period shown on the graph?
2. Explain why the graph has a downward slope between month 0 and month 2.
3. How much money was in the account in month 4?
4. a) Describe the slope of the graph between month 2 and month 6.
   b) What does the slope of the graph tell you? Explain.
5. From month 6 to month 8 the graph is horizontal. What does this tell you about the amount of money in the bank account?
6. Two withdrawals were made from the account between month 8 and month 10.
   a) How much was each withdrawal.
   b) When was each withdrawal made?
7. How much money was in the account in month 9?
8. How much money was in the account at the end of the period shown on the graph?
9. Explain why the graph touches the horizontal axis at month 10.
Solution

1. There was R6 000 in the account.
2. The line slopes downwards because the amount in the savings account decreased during these months.
3. R8 000
4. a) The graph slopes upwards.
   b) The amount in the savings account is increasing during these months.
5. The amount in the savings account stays constant during these months.
6. a) In month 8, R4 000 was withdrawn.
   b) In month 10, R6 000 was withdrawn.
7. No money
8. R6 000
9. The value on the vertical axis is 0 when the graph touches the horizontal axis. In other words, there is R0 in the account.

Classwork activity 1.1

1. This graph appeared in a newspaper:
2

The graph shows the number of casual assistants employed at a supermarket over weekends. The calendar shows the school and public holidays for the same period shown on the graph.

<table>
<thead>
<tr>
<th>Week</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>February</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Valentine’s Day</td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
<tr>
<td>March</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>School holiday</td>
</tr>
<tr>
<td>3</td>
<td>Human Rights Day</td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
<tr>
<td>April</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Easter weekend</td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Freedom Day</td>
</tr>
</tbody>
</table>

a) Write a clear sentence to explain what information is represented by the graph.
b) In which month was the dam levels the lowest? Explain.
c) (i) Describe the slope of the graph between May and August.
   (ii) What does this tell you about the dam levels?
d) Approximately how full was the dam in April? Write your answer as a percentage.
e) Between which two months was there little or no rain? Explain.

The graph shows the number of casual assistants employed at a supermarket over weekends.

2

The graph shows the number of casual assistants employed at a supermarket over weekends. The calendar shows the school and public holidays for the same period shown on the graph.

<table>
<thead>
<tr>
<th>Week</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>February</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Valentine’s Day</td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
<tr>
<td>March</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>School holiday</td>
</tr>
<tr>
<td>3</td>
<td>Human Rights Day</td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
<tr>
<td>April</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Easter weekend</td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Freedom Day</td>
</tr>
</tbody>
</table>

a) What period does this graph refer to?
b) How many casual workers were employed during the first weekend of February?
c) By looking at the graph, how can you tell that the number of casual workers employed was greater on the second weekend of February?
d) (i) List the holidays in March.
   (ii) Explain how the holidays affected the number of casual employees each weekend in March.
e) By looking at the graph, how can you tell that the store is busier during school holidays?
f) (i) For the period February to April, which weekend was the busiest?
   (ii) Why do you think this was the busiest weekend?
   (iii) How many casual workers were employed on that weekend?
g) What is the relationship between holidays and the number of casual staff hired?
Homework activity 1.1

This graph shows the total money in the tills at a grocery store at different times during a day.

1. At what time did the shop open?
   How can you tell this from the graph?

2. How much money was in the tills at midday?

3. How much money did the shop make between 12:00 and 16:00?

4. During which time period were the most sales made?
   Explain.

5. Compare the slope of the graph between 14:00 and 16:00 and between 16:00 and 18:00.
   What does this tell you about the amount of money taken at the tills between those times?
Equations, tables and graphs

Graphs, tables and equations are different ways to show the same relationship between two variables.

Example

The equation, table and graph all show the relationship between hours worked and payment received:

Equation
Payment = (number of hours) × 150

Table

<table>
<thead>
<tr>
<th>Hours worked</th>
<th>1</th>
<th>3</th>
<th>5</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Payment (R)</td>
<td>150</td>
<td>450</td>
<td>750</td>
<td>1 050</td>
</tr>
</tbody>
</table>

Graph
Zero values

Maximum and minimum values on a graph

The maximum point on the graph is the highest point that the graph reaches. This is the highest value of the dependent variable.

The minimum point on the graph is the lowest point that the graph reaches. This is the lowest value of the dependent variable.
Slope of a graph

The slope of a graph tells you whether the graph is decreasing, increasing or constant.

Constant or fixed relationship

In this type of relationship, the value on the vertical axis remains the same when the value on the horizontal axis changes.

Example

A bus hire company charges R345 per day for renting a vehicle. There is no extra cost for the number of kilometres travelled. The relationship between the cost and the number of kilometres is constant at R345 per day.

<table>
<thead>
<tr>
<th>Kilometres driven per day</th>
<th>100</th>
<th>200</th>
<th>300</th>
<th>400</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of hire per day (R)</td>
<td>345</td>
<td>345</td>
<td>345</td>
<td>345</td>
</tr>
</tbody>
</table>

Direct proportion (constant difference) relationship

In this type of relationship, when the value on the horizontal axis changes, then the value on the vertical axis changes by the same factor. The values are in direct proportion to each other.

Example

The payment received increases in proportion to the number of hours worked.
Example

As the candle burns, its length decreases at a rate of 2 cm every 20 minutes.

Indirect (inverse) proportion relationship

As values on one axis increase, values on the other axis decrease.

Example

The graph shows how the percentage of illiterate people decreased over time in a particular town. In 1910, approximately 68% of people in the town were illiterate. By 2010, approximately 8% were illiterate.

The graph does not touch the axes, because, for various reasons, there will always be people who can and cannot read or write.
Data lines

When data is continuous, the points are joined with a solid line. In the graph of the candle length on page 11, the data is continuous because the candle decreases in length continuously. In other words, it decreases continuously between intervals shown on the graph – every minute, every second and every part of a second.

When data is discrete, the points are joined with a dotted line or else not joined at all.

Example

Data is discrete because you pay for whole books, not parts of a book.

Classwork activity 1.2

1 A tour operator arranges local day trips. She charges R250 to organise a tour and R6,50 per kilometre travelled.
   a) Complete:

<table>
<thead>
<tr>
<th>Kilometres travelled</th>
<th>0</th>
<th>10</th>
<th>50</th>
<th>70</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost (R)</td>
<td>250</td>
<td>315</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

b) (i) What are the two variables in the relationship?
   (ii) Which is the independent variable?
   (iii) Which is the dependent variable?

c) Use the information in the table to draw a graph of the relationship.

d) (i) Describe the shape of the graph.
   (ii) Why do you think the graph has this shape?

e) Explain why the graph cuts the vertical axis at (0; 250).

f) Is the data discrete or continuous? Explain.
2 A bus hire company charges R345 per day to hire a bus. The bus can take 12 passengers. There is no extra cost for the number of kilometres travelled. A group of tourists will split the cost of the transport equally among them.
a) Complete the table that shows how much each person will pay depending on the number of people sharing the bus.

<table>
<thead>
<tr>
<th>Number of people</th>
<th>1</th>
<th>2</th>
<th>4</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost per person</td>
<td>345</td>
<td>86.25</td>
<td>43.13</td>
<td></td>
</tr>
</tbody>
</table>

b) Use the information in the table to draw a graph.
c) What type of relationship is there between the number of people sharing the bus and the amount each person pays? Explain.
d) Complete the equation: Cost per person = ________________.
e) Use your equation to show how much it would cost per person if there were seven people on the bus.

Homework activity 1.2

1 The graph shows the level of charge on a cell phone battery after it has been fully charged.

a) What is the strength of the battery when it is fully charged? Give your answer in volts.
b) Use the graph to estimate how long it would take for the battery to be run down to half its capacity.
c) If you did not recharge the battery in between, would the phone work after 3 days? Explain.
d) Use the formula $3.5 - (1.17 \times \text{number of days})$ to show that the battery strength is 2.33 V after one day.
e) Now use the formula to calculate the battery strength at:
   (i) 12 hours (ii) 1.5 days
   (iii) 2 days (iv) $2 \frac{1}{2}$ days
Unit 3 Comparing two relationships

Graphs and tables are useful in helping you to make comparisons.

Example

Mothusi broke his leg and needed to hire a pair of crutches for 7 to 14 days. He asked two suppliers to give him quotations:

<table>
<thead>
<tr>
<th>Medical Supply Hire</th>
<th>Tshwane Hospital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deposit: R250</td>
<td>Deposit: R350</td>
</tr>
<tr>
<td>Daily rate: R25</td>
<td>Daily rate: R15</td>
</tr>
</tbody>
</table>

1. Write down an equation to calculate the cost from each supplier.
2. Draw up a suitable table to show what Mothusi would pay each supplier.
3. Use the values in the table to plot the points and draw the graphs on the same set of axes.
4. Which supplier should Mothusi choose if he needed the crutches for 7 days? Explain.
5. Which supplier should Mothusi choose if he needed the crutches for 14 days? Explain.
6. a) After how many days would the cost be the same?
   b) Where can you see this information on the table?
   c) Where can you see this information on the graph?

Solution

1. Medical Supply Hire: \[ \text{Cost} = 250 + 25 \times \text{number of days} \]
   Tshwane Hospital: \[ \text{Cost} = 350 + 15 \times \text{number of days} \]
2. | Days | 0  | 2  | 6  | 8  | 10 | 14  |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical Supply Hire cost (R)</td>
<td>250</td>
<td>300</td>
<td>400</td>
<td>450</td>
<td>500</td>
<td>600</td>
</tr>
<tr>
<td>Tshwane Hospital cost (R)</td>
<td>350</td>
<td>380</td>
<td>440</td>
<td>470</td>
<td>500</td>
<td>560</td>
</tr>
</tbody>
</table>
The point where the two graphs touch is called the **point of intersection**. At this point, both graphs have exactly the same value. This means that the co-ordinates are the same for both graphs.

Mothusi should choose Medical Supply Hire because the cost is lower than Tshwane Hospital.

Mothusi should choose Tshwane hospital. For 14 days hire Tshwane Hospital is cheaper than Medical Supply Hire.

a) 10 days

b) On the table the values are the same in the column for 10 days.

c) On the graph the point of intersection is at the value for 10 days.
Classwork activity 1.3

A cell phone company offers these two options:

Use these charges to answer questions 1, 2 and 3 that follow.

1. Complete:

<table>
<thead>
<tr>
<th>Call minutes</th>
<th>0</th>
<th>1</th>
<th>10</th>
<th>50</th>
<th>100</th>
<th>150</th>
<th>200</th>
<th>250</th>
<th>300</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Prepaid</strong></td>
<td>0,00</td>
<td>1,50</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Contract</strong></td>
<td>150,00</td>
<td>150,90</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a) Based on the information in the table, which is the better option? Explain.

b) Cebile does not have a cell phone. She thinks it would be better to buy a phone for R300 and use the prepaid option. Do you agree with her? Explain.
2. This graph shows the cost of a prepaid versus a contract arrangement:

![Comparison of pre-paid and contract billing costs](image)

a) Which option does Graph A represent? Explain.
b) Which option does Graph B represent? Explain.
c) (i) Write down a formula, then calculate the cost of 250 call minutes on the prepaid option.
(ii) Write down the co-ordinates for the point that represents the cost of 250 call minutes on the prepaid option.
d) Use a formula to calculate the cost of 250 call minutes on contract.
e) What can you conclude from your answer?

3. Use the table in question 1 and the graph in question 2 to answer these questions.
a) On average, how many call minutes does Cebile use in a 30-day month? Show your calculations.
b) On the prepaid option:
   (i) Calculate the cost of Cebile’s calls for one month.
   (ii) Based on the same average number of calls, what would her costs be for four months? Show your calculations.
c) On the contract option:
   (i) What would Cebile’s initial costs be?
   (ii) Calculate the cost of her calls.
   (iii) What would Cebile’s total costs be for the month? Show your calculations.
d) Complete the following table:

<table>
<thead>
<tr>
<th>Months</th>
<th>Additional costs</th>
<th>1</th>
<th>2</th>
<th>4</th>
<th>6</th>
<th>12</th>
<th>18</th>
<th>24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prepaid (R)</td>
<td>300</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contract (R)</td>
<td>0</td>
<td>258</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

e) Which option should Cebile choose? Give one reason for your answer.

Homework activity 1.3

For this exercise, use the information from Classwork activity 1.3.

1) How many call minutes does the businessman use in a 30-day month? Show your calculations.

2) Do the following calculations on the prepaid option.
   a) Calculate the cost of his calls for one month.
   b) Based on the same average number of calls, what would his costs be for six months? Show your calculations.

3) On the contract option:
   a) What would the initial costs be?
   b) Calculate the cost of the businessman’s calls for one month.
   c) What would his total costs be for one month? Show your calculations.
   d) Based on the same average number of calls, what would his costs be for 12 months? Show your calculations.

4) Complete:

<table>
<thead>
<tr>
<th>Months</th>
<th>Additional costs</th>
<th>1</th>
<th>2</th>
<th>4</th>
<th>6</th>
<th>12</th>
<th>18</th>
<th>24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prepaid (R)</td>
<td>2 700</td>
<td>3 510</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contract (R)</td>
<td>150</td>
<td>636</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5) Which option would you advise the businessman to take? Explain.
Unit 4 Comparing situations

To practise the skills that you have learnt, make sure you understand that:
- the same information can be represented in a table, on a graph or using an equation
- when you want to compare two situations, it is useful to plot the information for both graphs on the same set of axes
- when two graphs are on the same set of axes, you can compare their value at every point on the graph
- at the point of intersection of the two graphs, they have the same value
- you can compare two sets of information in a table by looking at the values in the different columns.

Classwork activity 1.4

Carla is trying to decide which bank account to choose. These are her options:

<table>
<thead>
<tr>
<th></th>
<th>Classic account</th>
<th>Flexi account</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Set fee of R90 per month</td>
<td>• No set monthly fees</td>
</tr>
<tr>
<td></td>
<td>• Transaction cost: R2 per</td>
<td>• five free transactions</td>
</tr>
<tr>
<td></td>
<td>transaction</td>
<td>• R8 per subsequent transaction</td>
</tr>
</tbody>
</table>

Note: Prices quoted exclude monthly admin charges

Using the fee structures for each account, she worked out that her monthly costs, depending on the number of monthly transactions, would be:

<table>
<thead>
<tr>
<th>Number of transactions</th>
<th>0</th>
<th>5</th>
<th>10</th>
<th>15</th>
<th>20</th>
<th>25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total monthly cost (R): Classic</td>
<td>90</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total monthly cost (R): Flexi</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
a) Complete the table.
b) Write an equation for the Classic Account that could be used to calculate the monthly cost for any number of transactions.
c) Write an equation that could be used to calculate the monthly cost for any number of transactions on the Flexi Account.
d) Use the equations to compare how much it would cost Carla if she made the following number of transactions per month:
   (i) 12 (ii) 30
e) Use the equations to advise Carla which bank account to choose if she made the following number of transactions per month:
   (i) 21 (ii) 22
f) Give one reason why an equation can be more useful than a table to investigate a relationship between two items.
g) Use the information in the table to draw a neatly labelled graph.
h) Complete the sentence: The point of intersection lies between _____ and _____ on the horizontal axis. Hint: Use your solutions to question e) and the graph to help you.

Homework activity 1.4

1 Mulalo is planning to buy a washing machine and is looking at two options that would allow him to pay the amount off over 24 months. Option 1 requires Mulalo to pay R109 per month. Option 2 requires a deposit of R109 and a payment of R90 per month.
   a) (i) Write an equation to calculate the total cost paid after three months on Option 1.
      (ii) Now write an equation to calculate the total cost paid after n months.
   b) Write an equation to calculate the total cost paid after three months on Option 2.
   c) Use your equations to compare how much Mulalo would have paid on each option after:
      (i) 5 months (ii) 6 months
   d) Prepare and complete a suitable table for the two options.
   e) Draw a neatly labelled graph based on the information in your table.
   f) (i) Between which two months does the point of intersection lie? Hint: Use your answers to c) to help you.
      (ii) What happens to the relationship between the two options at the point of intersection?
   g) Which option should Mulalo choose? Give a reason for your answer.
Summary practice exercise

1. Study the graph and then answer the questions.

   ![South African Rand to 1 USD Graph]

   **South African Rands to 1 USD**

   - a) What information does this graph show?
   - b) Suggest a suitable label for the horizontal axis.
   - c) What is the dependent variable?
   - d) Write the co-ordinates of the maximum value on the graph.
   - e) What is the minimum value on the graph?
   - f) Between which two months was the rate most stable? Explain.
   - g) Using the slope of the graph to guide you, describe the general pattern of the exchange rate between August and September.

2. Study the graph and then answer the questions.

   ![Petrol price trend: Jan to Sept 2011 Graph]

   **Petrol price trend: Jan to Sept 2011**

   - Study the graph and then answer the questions.
a) What did petrol cost in March 2011? Write your answer in rands and cents.
b) Describe the general trend of the petrol price for the first five months on the graph. Explain how the slope of the graph conveys this information.
c) Identify the period when the petrol price hardly changed. How does the slope of the graph convey the information?
d) In which two months for the period of the graph did the petrol price come down?
e) By how much did the price of petrol increase between January and June 2011? Give your answer in rands and cents.

3 Xola wants to buy a phone. There are two payment options to choose from:
Option 1: Pay a deposit of R1 800 with 12 monthly instalments of R250.
Option 2: Pay a deposit of R800 with 24 monthly instalments of R190.
a) Complete:

<table>
<thead>
<tr>
<th></th>
<th>Deposit</th>
<th>1</th>
<th>2</th>
<th>6</th>
<th>12</th>
<th>18</th>
<th>24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option 1</td>
<td>1 800</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Option 2</td>
<td>990</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

b) Use the information in the table to draw graphs of the two options on the same system of axes. Label the axes clearly.
c) Why does the graph for Option 1 end after 12 months?
d) List one advantage and one disadvantage of choosing Option 2.
e) How much more would Xola pay for the phone if he chose Option 2?
f) List two possible reasons why it would be acceptable to choose Option 2.

4 A transport hire company advertises these offers:

FANTASTIC FLEET
WINTER FLEET

Hire a minibus for R250 per day. First 200 km per day free. Pay only R0.50 per km after the first 200 km.

Terms and conditions:
An insurance fee of R300 per day.

Take advantage of this amazing offer and discover the countryside with your family and friends this holiday.

Call (011) 578 3838
Email: info@fantastic_fleet.com
You plan a day trip and calculate the cost depending on the number of kilometres you might travel.

a) Show that it would cost R600 to hire a vehicle from Wildspotters to travel 150 km.

b) Show that it would cost R900 to hire a vehicle from Fantastic Fleet to travel 300 km.

c) Complete:

<table>
<thead>
<tr>
<th>Kilometres</th>
<th>100</th>
<th>150</th>
<th>200</th>
<th>250</th>
<th>300</th>
<th>350</th>
<th>400</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fantastic Fleet cost</td>
<td>550</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wildspotters cost</td>
<td>350</td>
<td>600</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This graph represents the same information:

d) Consider Graph 1.

(i) What type of relationship is there between the cost and the distance travelled for the first 200 km travelled? How can you tell this from the shape of the graph?

(ii) What type of relationship is there between the cost and the distance travelled after the first 200 km? How can you tell this from the shape of the graph?

(iii) Which company does Graph 1 refer to?

(iv) Write down the co-ordinates for Point B.
e) Consider Graph 2.
   (i) If you travel 430 km, how many km will be charged for at a rate of R5 per km?
   (ii) Write the co-ordinates for the point where Graph 2 cuts the vertical axis.

f) How did you recognise the point at which it costs the same to hire a bus from either company?

g) Which company is cheaper to use if you were planning to travel these distances in a day:
   (i) 90 km
   (ii) 200 km
   (iii) 450 km

h) The vehicles can each carry a maximum of 12 passengers.
   Divide the cost of the vehicle hire equally amongst the passengers.
   You plan a trip that is 320 km in distance.
   (i) Calculate the cost of the trip using Fantastic Fleet.
   (ii) Calculate the cost of the trip using Wildspotters.

i) Using the number of passengers, complete the table to show what each passenger will pay for a 320 km trip:

<table>
<thead>
<tr>
<th>Passengers</th>
<th>2</th>
<th>4</th>
<th>6</th>
<th>8</th>
<th>10</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fantastic Fleet:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost per person</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wildspotters:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost per person</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

j) A group of six friends decide to do the journey of 320 km.
   (i) Which option is best – Fantastic Fleet or Wildspotters? Explain.
   (ii) What would each person pay if they divided the costs equally among themselves? Show your calculations.
Topics 1

Word bank

call minutes the amount of time spent on a call. For example, 2 calls are made. One call lasts 2 min 30 s and the other call lasts 3 min, the total call minutes for the two calls is 5 min 30 s

capacity the amount of charge the battery can hold

constant a quantity whose value does not change

continuous unbroken

dependent variable the quantity whose value depends on the value of another number, the independent variable

discrete individual values

downward slope the graph shifts from a high value to a low value as it continues

exchange rate the value of one country’s currency against another, for example, the value of 1 dollar in rand

fee structure a list showing the amounts that a business charges for various services or activities

horizontal having no slope

independent variable the quantity whose value does not depend on the value of another number

prepaid airtime that is bought at a shop, that is, not through a contract

transactions an activity (such as making a withdrawal or deposit) that affects a bank account

trend pattern

variable a quantity that can change in value

Topic summary

- Constructing tables, working with formulae and plotting graphs are three ways we can represent and make sense of situations.
- The equation is useful for working out specific values, and gives accurate answers.
- In a table, the top row indicates the independent variable or input value, and the bottom row indicates the dependent variable or output value.
- A table gives you accurate values for a limited range of points on the graph.
- A graph gives you a picture of what the variable is doing (increasing or decreasing) but it is not always possible to read off accurate values.
- When we have two graphs on the same set of axes, it is easy to compare the two situations. Where the graphs intersect, the conditions are the same for both situations.
Conversions and time

What you will learn about in this topic

You will:

- convert units of measurement from memory
- convert units of measurement using given conversion factors and tables
- convert units of measurement between different systems
- express measurement values and quantities in units appropriate to the context
- read, record and perform calculations involving time values
- convert between different units of time
- calculate elapsed time involving the different time formats
- work with lesson and exam timetables
- plan time-based events
- calculate average speed and distance.

Let’s talk about this topic

In this topic you will revise some practical skills relating to conversions of units of measurement and time formats.
Every day we work with different units of measurement for length, capacity, mass and time.

In Grade 10 you learnt about units of measurement and some useful conversions. Study the table that shows different conversions of measurement.

<table>
<thead>
<tr>
<th>Unit</th>
<th>Weight (mass)</th>
<th>Length</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thousands</td>
<td>kilogram (kg)</td>
<td>kilometre (km)</td>
<td>kilolitre (kl)</td>
</tr>
<tr>
<td></td>
<td>1 000 g = 1 kg</td>
<td>1 000 m = 1 km</td>
<td>1 000 ℓ = 1 kl</td>
</tr>
<tr>
<td>Base unit</td>
<td>gram (g)</td>
<td>metre (m)</td>
<td>litre (ℓ)</td>
</tr>
<tr>
<td>hundredths</td>
<td>centigram (cg)</td>
<td>centimetre (cm)</td>
<td>centilitre (cl)</td>
</tr>
<tr>
<td></td>
<td>100 cg = 1 g</td>
<td>100 cm = 1 m</td>
<td>100 cl = 1 ℓ</td>
</tr>
<tr>
<td>thousandths</td>
<td>milligram (mg)</td>
<td>millimetre (mm)</td>
<td>millilitre (ml)</td>
</tr>
<tr>
<td></td>
<td>1 000 mg = 1 g</td>
<td>1 000 mm = 1 m</td>
<td>1 000 ml = 1 ℓ</td>
</tr>
</tbody>
</table>

Group the units of measurement under the correct heading.

<table>
<thead>
<tr>
<th>Length</th>
<th>Mass</th>
<th>Capacity</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>kilogram</td>
<td>minutes</td>
<td>kilolitres</td>
<td>hours</td>
</tr>
<tr>
<td>centigram</td>
<td>seconds</td>
<td>millimetres</td>
<td>years</td>
</tr>
<tr>
<td>milligram</td>
<td>centimetres</td>
<td>millilitres</td>
<td>days</td>
</tr>
<tr>
<td>gram</td>
<td></td>
<td></td>
<td>gram</td>
</tr>
</tbody>
</table>

Conversions and time • 27
Metric conversions

Metric units are all multiples of ten (or a hundred, or one-tenth, and so on) of each other. You can convert between the various metric units by moving the decimal point the correct number of places. The basic metric units are metres (for length), grams (for mass), and litres (for volume).

There are many metric-unit prefixes, but the ones you will use are: kilo-, hecto-, deka-, deci-, centi-, and milli-. To convert between the various prefixes, you just move up and down this list of prefixes, moving the decimal point as you go.

To remember the prefixes in order, you can use the following sentence:

King Henry Doesn't [Usually] Drink Chocolate Milk

The first letters of the words stand for the prefixes, with "Usually" in the middle standing for the "unit", being meters, grams, or liters.

kilo- hecto- deka- [unit] deci- centi- milli-

Example

Which unit of measurement would you use to describe the mass of a banana? Would you use tons, kilograms, grams or milligrams?

Cool fact

Tonnes are for extremely heavy objects, kilograms are for heavy objects, milligrams are for very light objects.

Solution

You would use grams.

Example

Convert 400 mg to grams.

Solution

400 mg ÷ 1 000 = 0.4 g

1 000 mg = 1 g

When we convert mg to g we get a smaller number, so we divide by 1 000.
Example

Convert 2.5 km to cm.

Solution

\[2.5 \text{ km} \times 1000 = 2500 \text{ m}\]
\[2500 \text{ m} \times 100 = 250000 \text{ cm}\]

Cool fact

When we convert to a smaller unit we multiply. When we convert to a larger unit we divide. It is useful to ask yourself whether your answer must be bigger or smaller. If it’s bigger, you multiply. If it’s smaller, you divide.

Classwork activity 2.1

1. Choose the correct unit of measurement.
   a) Which unit of measurement would you use to measure:
      (i) the length of a classroom?
      (ii) the width of a cell phone?

\[1 \text{ km} = 1000 \text{ m}\]
\[1 \text{ m} = 100 \text{ cm}\]

When we convert km to m we get a bigger number, so we multiply by 1000.
When we convert m to cm we get a bigger number, so we multiply by 100.
(iii) the distance from Cape Town to Johannesburg?

b) Which unit of measurement would you use to measure the:
   (i) the volume of a can of cooldrink?
   (ii) the capacity of a dam?
   (iii) the liquid in a teaspoon

c) Which unit of measurement would you use to measure the mass of:
   (i) an aeroplane
   (ii) a packet of chips
   (iii) a person
   (iv) minute quantities

2 Convert each of the following. Do as many of the calculations as you can without looking at the conversions alongside.
   a) 105 mm to cm  
   b) 5,8 cm to mm  
   c) 32,6 km to m  
   d) 1 005 cm to km  
   e) 2 225 mg to kg  
   f) \( \frac{3}{4} \) kg to g  
   g) 0,07 ton to kg  
   h) 0,6 kg to mg  
   i) 8,7 ℓ to ml  
   j) 450 000 000 ml to ℓ

Cool fact

1 cm = 10 mm  
1 m = 100 cm  
1 km = 1 000 m  
1 g = 1 000 mg  
1 ℓ = 1 000 ml  
1 tonne = 1 000 kg  
1 kl = 1 000 ℓ

Homework activity 2.1

1 Convert:
   a) 12 450 mg to kg  
   b) 246 000 cm to m  
   c) \( \frac{1}{4} \) m to cm  
   d) 329 750 ml to ℓ  
   e) \( \frac{1}{2} \) ℓ to ml  
   f) 2,5 ton to kg
In the last unit we operated in the metric system. In this unit we convert between different measurement systems.

Conversion table

<table>
<thead>
<tr>
<th>LENGTH</th>
<th>Imperial to Metric</th>
<th>Metric to Imperial</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 mile</td>
<td>1,609 km</td>
<td>1 609 m</td>
</tr>
<tr>
<td>1 yard</td>
<td>91,44 cm</td>
<td>0,9144 m</td>
</tr>
<tr>
<td>1 foot</td>
<td>30,48 cm</td>
<td>304,8 mm</td>
</tr>
<tr>
<td>1 inch</td>
<td>2,54 cm</td>
<td>25,4 mm</td>
</tr>
</tbody>
</table>

| MASS (WEIGHT)     | 1 ton 0,907 tonnes | 1 tonne 1,102 ton |
| 1 pound           | 0,4536 kg          | 453,6 g           |
| 1 ounce           | 28,4 g             | 1 g 0,035 ounces  |

| CAPACITY          | 1 gallon 4,5461 ℓ  | 1 litre 0,22 gallons |
| 1 pint            | 0,5682 ℓ           | 1 litre 1,76 pints   |

Cool fact

<table>
<thead>
<tr>
<th>Imperial measurements</th>
<th>Abbreviations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pound</td>
<td>lb</td>
</tr>
<tr>
<td>Mile</td>
<td>mi</td>
</tr>
<tr>
<td>Ounce</td>
<td>oz</td>
</tr>
<tr>
<td>Foot</td>
<td>ft</td>
</tr>
<tr>
<td>Pint</td>
<td>pt</td>
</tr>
<tr>
<td>Gallon</td>
<td>gall</td>
</tr>
<tr>
<td>Yard</td>
<td>yd</td>
</tr>
<tr>
<td>Inch</td>
<td>in</td>
</tr>
</tbody>
</table>
Example
Convert 3 inches to millimetres.

Solution
1 in = 25,4 mm
∴ 3 in = (3 × 25,4) mm
= 76,2 mm

Example
a) Which wind speed is greater – 115 miles per hour or 30 km per hour?
b) Which is more – 5 inches or 14 mm?

Solution
1 mi = 1,609 km
∴ 115 mi = (115 × 1,609) km
= 185,0 km
115 miles per hour is a greater wind speed than 30 km per hour.

2 1 in = 25,4 mm
∴ 5 in = (5 × 25,4) mm
= 127 mm
5 inches is more than 14 mm.
Classwork activity 2.2

1. The scone recipe below has imperial measurements. Convert all measurements marked with an asterisk (*) to the metric equivalent. Show all your calculations.

**Scone Recipe Ingredients**
- 8 oz self-raising flour *
- 1 pinch of salt
- 1 tsp baking powder
- 1 1/2 oz margarine *
- 1/2 pint milk *
- 1/2 tbsp castor sugar

2. Karabo and Tumelo know their mass in pounds and ounces. Convert each mass to kilograms. Write your answer correct to one decimal place.
   a) Karabo weighs 189 lb 6 oz.
   b) Tumelo weighs 144 lb 12 oz.

3. Tebogo and Anthony are on holiday in Mexico. They hike up a mountain trail that is 4.6 mi long. They will climb to a height of 8 240 ft above sea level.
   a) What distance did they hike? Write your answer in kilometres, correct to one decimal place.
   b) What was the height above sea level? Write your answer in metres, correct to one decimal place.

Homework activity 2.2

1. Bheka wants to buy a cupboard via the Internet. The cupboard is 5.2 ft long. Will the cupboard fit along the wall that is 2.1 m long? Show your calculations.

2. Faiza has 1.7 ℓ of milk in the fridge. She makes a recipe that needs 2 pts of milk. Does she have enough milk? Show your calculations.

3. Maanda’s baby son weighs 7.8 lb. How much does he weigh in kg? Show your calculations.
In real life we often use spoons and cups to measure quantities. In this lesson we revise some practical conversions. We also convert temperature.

This table shows different measures:

<table>
<thead>
<tr>
<th>5 ml (1 teaspoon)</th>
<th>3 g flour</th>
<th>5 g butter or margarine</th>
<th>4 g rice</th>
<th>4 g sugar</th>
<th>3 g mealie meal</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 ml</td>
<td>15 g flour</td>
<td>25 g butter or margarine</td>
<td>20 g rice</td>
<td>20 g sugar</td>
<td>12 g mealie meal</td>
</tr>
<tr>
<td>100 ml</td>
<td>60 g flour</td>
<td>100 g butter or margarine</td>
<td>80 g rice</td>
<td>80 g sugar</td>
<td>50 g mealie meal</td>
</tr>
<tr>
<td>250 ml (1 cup)</td>
<td>150 g flour</td>
<td>250 g butter or margarine</td>
<td>200 g rice</td>
<td>200 g sugar</td>
<td>125 g mealie meal</td>
</tr>
</tbody>
</table>

Here is another conversion table for spoons and cups:

<table>
<thead>
<tr>
<th>1 teaspoon (tsp)</th>
<th>5 ml</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 tablespoon (Tbsp)</td>
<td>15 ml</td>
</tr>
<tr>
<td>1 cup</td>
<td>250 ml</td>
</tr>
</tbody>
</table>

**Example**

In the recipe below, convert all measurements to the unit indicated in brackets.

CAKE RECIPE INGREDIENTS
2 cups flour (g)
1 pinch of salt
1 tsp baking powder (ml)
50 ml margarine (g)
$\frac{2}{3}$ cups milk (ml)
1 tbsp caster sugar (g)
Solution

1 cup flour = 150 g
∴ 2 cups flour = 300 g

1 tsp baking powder = 5 ml

25 ml margarine = 25 g
∴ 50 ml = 50 g

1 cup milk = 250 ml
∴ \( \frac{2}{3} \) cups = \( \frac{2}{3} \times \frac{250}{1} \)
= 167 ml

1 Tbsp castor sugar = 15 ml
But 5 ml of castor sugar = 4 g
∴ 15 ml castor sugar = \((3 \times 4)\)
= 12 g

How to convert temperature

To convert from °Celsius to °Fahrenheit: °F = (1,8 × °C) + 32
To convert from °Fahrenheit to °Celsius: °C = (°F – 32) ÷ 1,8

Example

Convert 350 °F to °C

Solution

\[
\frac{350 - 32}{1,8} = \frac{318}{1,8}
\]
= 176,666666
≈ 176,7 °C

Example

Convert 140 °C to °F.

Solution

\[
140 ^\circ C = (1,8 \times 140) + 32
\]
= 284 °F
Classwork activity 2.3

1 Elana wants to use her grandmother’s old biscuit recipe:

**BISCUIT RECIPE**

**INGREDIENTS**

- 1$\frac{1}{2}$ cups flour
- $\frac{1}{2}$ tsp salt
- $\frac{1}{3}$ cup sugar
- $\frac{3}{4}$ cup cream
- 2 tsp baking powder

**METHOD**

- Preheat the oven to 350 °F.
- Mix all the ingredients.
- Roll the dough into 7$\frac{1}{2}$ inch rounds.
- Place on baking tray, 1 inch apart.
- Bake for 20 minutes.

   a) Rewrite all the ingredients using either grams or millilitres.
   b) What temperature should Elana heat the oven to?
      Write your answer in °C.
   c) Elana must roll the dough into 7$\frac{1}{2}$ inch rounds.
      Convert the measurement to cm.
   d) How far apart should the biscuits be on the baking tray?
      Write your answer in cm.

2 Nihal bakes a pie. The recipe says the oven must be set at 450 °F. What is the temperature in °C?

3 Mandisa is going to the United States of America. This is her **itinerary**:

<table>
<thead>
<tr>
<th>Date</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 September</td>
<td>Leave Johannesburg</td>
</tr>
<tr>
<td>21 – 24 September</td>
<td>Washington DC</td>
</tr>
<tr>
<td>25 – 27 September</td>
<td>Disney World</td>
</tr>
<tr>
<td>28 – 29 September</td>
<td>California</td>
</tr>
</tbody>
</table>
She gets a 10-day *weather forecast* for each place she will visit:

**Washington DC**

<table>
<thead>
<tr>
<th></th>
<th>Today</th>
<th>Thu</th>
<th>Fri</th>
<th>Sat</th>
<th>Sun</th>
<th>Mon</th>
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<tbody>
<tr>
<td>Sep 21</td>
<td>22</td>
<td>23</td>
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<td><img src="image1.png" alt="Clouds" /></td>
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<td>PC</td>
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<td></td>
<td>67 °F</td>
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<td>63 °F</td>
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<td>60 °F</td>
<td>57 °F</td>
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<td>53 °F</td>
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<td></td>
<td>75 °F</td>
<td>77 °F</td>
<td>74 °F</td>
<td>75 °F</td>
<td>78 °F</td>
<td>74 °F</td>
<td>70 °F</td>
<td>71 °F</td>
<td>74 °F</td>
<td>70 °F</td>
</tr>
</tbody>
</table>

**Disney World, Florida**

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</table>

**California**

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<thead>
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<td>56 °F</td>
<td>53 °F</td>
<td>48 °F</td>
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<td>73 °F</td>
<td>77 °F</td>
<td>67 °F</td>
<td>63 °F</td>
<td>66 °F</td>
<td>66 °F</td>
<td>65 °F</td>
<td>72 °F</td>
<td>72 °F</td>
<td>75 °F</td>
</tr>
</tbody>
</table>

**Key:**  
ST = Scattered Thunderstorms  
PC = Partly Cloudy  
IT = Isolated Thunderstorms  
MC = Mostly Cloudy  
MS = Mostly Sunny  
TS = Thunderstorms  
SH = Showers  
FS = Few Showers  
SU = Sunny
a) Complete the table using the information from the weather charts. Write all temperatures in °C, rounded off to the nearest whole number.

<table>
<thead>
<tr>
<th>Date</th>
<th>Destination</th>
<th>Weather forecast</th>
<th>Minimum Temp (°C)</th>
<th>Maximum Temp (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>21 Sept</td>
<td>Washington DC</td>
<td>Scattered thunderstorms</td>
<td>19 °C</td>
<td>24 °C</td>
</tr>
<tr>
<td>24 Sept</td>
<td>Washington DC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27 Sept</td>
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</tr>
<tr>
<td>29 Sept</td>
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</tr>
</tbody>
</table>

b) Where will Mandisa experience the hottest day?
c) Where will she experience the coldest night?
d) What is the difference between the minimum and maximum temperatures in Disney World on 26 September? Write your answer in °C.
e) When Mandisa left Johannesburg, the temperature was 22 °C. Convert 22° to °F.

Homework activity 2.3

1 In South Africa we measure temperature in °C. Here are the temperatures for Johannesburg, South Africa and Michigan and Florida, USA for the same day.

<table>
<thead>
<tr>
<th>Location</th>
<th>Temperature °C/°F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Johannesburg</td>
<td>9 °C</td>
</tr>
<tr>
<td>Michigan, USA</td>
<td>14 °F</td>
</tr>
<tr>
<td>Florida, USA</td>
<td>48 °F</td>
</tr>
</tbody>
</table>

a) If the South African Weather Service predicts a maximum temperature of 9 °C, will the day be hot or cold?
b) In Michigan the maximum temperature is 14 °F. What is the temperature in °C?
c) In Florida the maximum temperature is 48 °F. Is it hotter or colder in Florida than it is in Johannesburg?

2 This hint appears in a gardening magazine:
a) Rewrite the ingredients for the spray mixture in ml.
b) Now write the ingredients as a ratio in its simplest form.

To get rid of insects on your plants, mix three cups of water with one tablespoon of washing up liquid and two teaspoons of crushed garlic. Spray the mixture onto the leaves.

Do you remember the ratios? Go back to the conversion table in Unit 2!
In this lesson you will focus on calculations involving time.

Example
How many seconds are there in 1 day?

Solution
1 day = 24 hours

\[ 24 \text{ hours} = (24 \times 60) \text{ minutes} = 1440 \text{ minutes} \]

\[ 1440 \text{ minutes} = (1440 \times 60) \text{ seconds} = 86400 \text{ seconds} \]

There are 86400 seconds in 1 day.

Example
Write 721 days as years, months, weeks and days.

Solution
1 year = 365 days

\[ \frac{721}{365} = 1.975 \text{ This is less than 2 years.} \]

So, 721 days – 365 days = 356 days left over

There are \[ \frac{356}{30} = 11.87 \] months

11 months = (11 \times 30) = 330 days

356 – 330 = 26

There are 26 days left over.

\[ \frac{26}{7} = 3.714 \text{ weeks} \]

3 weeks = 21 days
26 – 21 = 5

There are 5 days left over.

∴ 721 days = 1 year 11 months 3 weeks and 5 days

You should know that there are:
60 seconds in 1 minute
60 minutes in 1 hour
24 hours in 1 day
7 days in 1 week
12 months in 1 year
±4 weeks in 1 month
±30 days in 1 month.

These calculations are estimates.
In a leap year there are 366 days.
Some months have 31 days and February has 28 days.
Example
How many minutes are there between 08:44 and 15:20?

Solution
From 08:44 to 15:20 is 6 hours 36 minutes
6 hours = 6 × 60 minutes
    = 360 minutes
From 08:44 to 15:20 = 360 + 16 + 20 minutes
    = 396 minutes

Example
Answer the questions relating to this calendar month.

<table>
<thead>
<tr>
<th>Mon</th>
<th>Tue</th>
<th>Wed</th>
<th>Thu</th>
<th>Fri</th>
<th>Sat</th>
<th>Sun</th>
</tr>
</thead>
<tbody>
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<td>25</td>
<td>26</td>
<td>27</td>
<td>28</td>
<td>29</td>
<td>30</td>
<td>31</td>
</tr>
</tbody>
</table>

a) Which month does this calendar page show?
b) How many days are there in the month?
c) On which day was the 28 February?
d) On which day is 1 April?
e) Lintel has a Maths Literacy test on the 7th and a History test on the 12th. How many days does Lintel have between the two tests?
f) What is the date and day of the week exactly two weeks after the 12th?

Solution
a) March
b) 31 days
c) Thursday (assuming this was not a a leap year)
d) Monday
e) 4 days
f) Tuesday the 26th
Example

Thoko is visiting her parents in Cape Town. Here is a copy of her itinerary.

<table>
<thead>
<tr>
<th>FLIGHT SAA 7031</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confirmation number</td>
</tr>
<tr>
<td>Depart Friday 5 November 06:05</td>
</tr>
<tr>
<td>Arrive Friday 5 November 08:03</td>
</tr>
<tr>
<td>Flight 7031</td>
</tr>
<tr>
<td>Class</td>
</tr>
</tbody>
</table>

Status: Confirmed

a) How long is the flight from Johannesburg to Cape Town?
b) The flight is delayed by 45 minutes.
   (i) What is the new departure time?
   (ii) What is the new arrival time?
c) Thoko misses her flight and has to wait for the next available flight $3\frac{1}{2}$ hours later. At what time is the next flight?

Solution

a) 1 hr 58 min
b) (i) 06:50
   (ii) 08:48
c) 09:35

Example

<table>
<thead>
<tr>
<th>Year</th>
<th>Age</th>
<th>Time</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>1977</td>
<td>21</td>
<td>06:45:00</td>
<td>45</td>
</tr>
<tr>
<td>1978</td>
<td>22</td>
<td>06:11:00</td>
<td>14</td>
</tr>
<tr>
<td>1979</td>
<td>23</td>
<td>05:51:15</td>
<td>3</td>
</tr>
<tr>
<td>1980</td>
<td>24</td>
<td>05:40:31</td>
<td>2</td>
</tr>
<tr>
<td>1981</td>
<td>25</td>
<td>05:37:28</td>
<td>1</td>
</tr>
<tr>
<td>2007</td>
<td>51</td>
<td>09:48:18</td>
<td>3866</td>
</tr>
<tr>
<td>2008</td>
<td>52</td>
<td>10:07:33</td>
<td>3710</td>
</tr>
<tr>
<td>2009</td>
<td>53</td>
<td>09:48:21</td>
<td>3818</td>
</tr>
<tr>
<td>2010</td>
<td>54</td>
<td>07:55:03</td>
<td>965</td>
</tr>
<tr>
<td>2011</td>
<td>55</td>
<td>07:30:31</td>
<td>488</td>
</tr>
</tbody>
</table>

Between 1977 and 2011, legendary marathon runner, Bruce Fordyce, ran the Comrades Marathon 29 times. Here are the times for his first and last five Comrades.
a) According to the table what was his fastest time?
b) Calculate the difference between his slowest and fastest time?
c) Bruce Fordyce ran his best Comrades Marathon in 1986. His time was 05:24:07.
   (i) Calculate the difference between 05:24:07 and the fastest time shown in the table.
   (ii) How old was Bruce Fordyce when he ran his best time ever?

**Solution**
a) 05:37:28
b) 4 hr 30 min 5 s
c) (i) 13 min 21 s
   (ii) 25 years old

**Example**

Mpho is training for a triathlon. He sets his stopwatch and goes for a run.

At the end of the run his stopwatch shows 1 hr 04 min 25 sec.

Immediately after his run, Mpho jumps into the pool and starts swimming. At the end of his swim the stopwatch shows 1 hr 42 min 18 s.

01:42:18

How long did Mpho swim for?

**Solution**

01:42:18 \hspace{5mm} \text{(Time at end of swim)}
01:41:78 \hspace{5mm} \text{(Change to subtract)}
– 01:04:25 \hspace{5mm} \text{(Time at start of swim)}
= 00:37:53 \hspace{5mm} \text{(Difference)}

Mpho swam for 37 min 53 s.
1. How many hours are there:
   a) in five days?
   b) in one week?
   c) between midday and midnight?

2. How many minutes are there:
   a) in 3 hours 12 minutes?
   b) in one day?
   c) between 3 o’clock and 6 o’clock?

3. How many seconds are there:
   a) in 5 minutes?
   b) in 1 1/2 hours?

4. Rewrite each one in years, months, weeks and days:
   a) 522 days
   b) 834 days

5. How many hours and minutes are there between:
   a) 06:22 and 13:40?
   b) 11:45 and 20:03?
   c) 3:15 p.m. and 11:10 a.m. the following day?

6. Study the calendar and then answer the questions.

<table>
<thead>
<tr>
<th></th>
<th>Mon</th>
<th>Tue</th>
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</tbody>
</table>

- a) Which month comes before August?
- b) How many days are in that month?
- c) On which day is 6 September?
- d) What is the date exactly one week after Thursday 8 August?
- e) Amara is flying to London on 29 August. She has to collect her visa three days before her departure date. On which day and date should she collect her visa?

7. Sibusiso and Thabo go for a run.
   Sibusiso finishes first.
   His stopwatch shows 1:52:27.
   When Thabo finishes, the stopwatch shows 2:07:11.
   How much longer did Thabo take than Sibusiso?
Two drag racers finish a race within 5 seconds of each other. The stopwatch showed 0:13:49 when the first drag racer finished.

a) Write down the time on the stopwatch when the second racer finished.
b) How long did the first racer take?
Write your answer in minutes and seconds.

Homework activity 2.4

1 How many days, hours and minutes are there from 8:15 am on Monday 13 May to 2:30 pm on Friday 17 May?

<table>
<thead>
<tr>
<th>May</th>
<th></th>
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</thead>
<tbody>
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</tbody>
</table>

2 Rewrite 600 days in years, months, weeks and days.

3 At the end of a cycle race Malik’s stopwatch said 3:24:05.
   a) How long did Malik cycle for?
   Write your answer in hours, minutes and seconds.
   b) If Sabal took 12 minutes 19 seconds longer than Malik, what was the time on the stopwatch when Sabal finished the race?
Success in life often depends on careful and sensible time planning and management. Effective time management depends on knowing when things are going to happen and planning your time sensibly.

Let’s look at this exam timetable for the control tests at the end of Term 1:

<table>
<thead>
<tr>
<th>WEEK 1</th>
<th>WEEK 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
<td>Subject</td>
</tr>
<tr>
<td>04 March</td>
<td>Home Language</td>
</tr>
<tr>
<td>05 March</td>
<td>Mathematics, Mathematical Literacy</td>
</tr>
<tr>
<td>06 March</td>
<td>History, Economics</td>
</tr>
<tr>
<td>07 March</td>
<td>Physical Sciences</td>
</tr>
<tr>
<td>08 March</td>
<td>Accounting</td>
</tr>
</tbody>
</table>

- The tests will be written over a period of two weeks.
- All learners will only write the tests for their own subjects.
- You can plan your study time based on when you will write each test.

Example

   a) List the dates for each of your tests.
   b) How many days do you have for study purposes between Economics and Business Studies?

2. These are the calendar pages for February and March:

<table>
<thead>
<tr>
<th>February</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mon</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>8</td>
</tr>
<tr>
<td>15</td>
</tr>
<tr>
<td>22</td>
</tr>
</tbody>
</table>
You need at least one day each to prepare for Home Language and Mathematical Literacy, and five days to prepare for Economics. Use the calendar to plan your studies for the three subjects.

**Solution**

1. a) 4, 5, 6, 12, 13 and 15 March.
   
   b) 7 days if you start studying on the 6th of March when you finish writing Economics 6 days if you start studying on the 7th of March.

2. | Date    | Time            | Subject/Topic    |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>25 Feb</td>
<td>17:00 – 18:30</td>
<td>Economics</td>
</tr>
<tr>
<td>26 Feb</td>
<td>18:00 – 20:30</td>
<td>Economics</td>
</tr>
<tr>
<td>27 Feb</td>
<td>18:00 – 19:00</td>
<td>Economics</td>
</tr>
<tr>
<td></td>
<td>20:30 – 22:00</td>
<td></td>
</tr>
<tr>
<td>28 Feb</td>
<td>17:30 – 19:30</td>
<td>Economics</td>
</tr>
<tr>
<td>2 Mar</td>
<td>10:00 – 12:00</td>
<td>Home Language</td>
</tr>
<tr>
<td></td>
<td>14:00 – 16:30</td>
<td>Economics</td>
</tr>
<tr>
<td></td>
<td>19:00 – 21:00</td>
<td>Math Literacy</td>
</tr>
<tr>
<td>3 Mar</td>
<td>12:00 – 13:00</td>
<td>Home Language</td>
</tr>
<tr>
<td></td>
<td>14:30 – 16:00</td>
<td>Math Literacy</td>
</tr>
<tr>
<td></td>
<td>17:00 – 18:30</td>
<td>Home Language</td>
</tr>
<tr>
<td>4 Mar</td>
<td>17:00 – 20:00</td>
<td>Math Literacy</td>
</tr>
<tr>
<td>5 Mar</td>
<td>15:00 – 16:30</td>
<td>Economics</td>
</tr>
<tr>
<td></td>
<td>17:00 – 19:00</td>
<td>Economics</td>
</tr>
</tbody>
</table>

There are many correct answers to this question. As long as you include enough time for each subject, you may use different dates or times.
Here are Siphiwe's school subjects. Study the exam timetable and then answer the questions that follow.

<table>
<thead>
<tr>
<th>Subject</th>
<th>Grade</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>English Home Language</td>
<td>10</td>
<td>08:30</td>
</tr>
<tr>
<td>isiXhosa First Additional Language</td>
<td>10</td>
<td>12:30</td>
</tr>
<tr>
<td>Mathematical Literacy</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Visual Arts</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Music</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Physical Sciences</td>
<td>11</td>
<td>08:30</td>
</tr>
<tr>
<td>Mathematics P1</td>
<td>11</td>
<td>08:30</td>
</tr>
<tr>
<td>Mathematic Literacy P1</td>
<td>11</td>
<td>12:30</td>
</tr>
<tr>
<td>History</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Afrikaans HL &amp; FAL P2</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Physical Sciences P2 (Chem)</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>isiXhosa FAL P2</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>English HL P2</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Music P1 (Theory)</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Physical Sciences P2 (Phys)</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>English HL P2</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Music P2 (Comprehension)</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Accounting</td>
<td>12</td>
<td>08:30</td>
</tr>
<tr>
<td>EGD P2</td>
<td>12</td>
<td>12:30</td>
</tr>
<tr>
<td>Visual arts</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Life Sciences P1</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Business Studies</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Geography P1 (Theory)</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Geography P2 (Mapwork)</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>isiXhosa FAL P1</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>English HL P1</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Afrikaans HL &amp; FAL P1</td>
<td>11</td>
<td></td>
</tr>
</tbody>
</table>

**WEEK 1**
- **Date 27/10**
  - **Time 08:30**
    - CAT P1 (Practical) (3 hrs)
  - **Time 12:30**
    - **English HL P3 (2,5 hrs)**

**WEEK 2**
- **Date 28/10**
  - **Time 08:30**
    - IT P1 (Practical) (3 hrs)
  - **Time 12:30**
    - **Mathematics P2 (3 hrs)**
    - **Mathematic Literacy P2 (3 hrs)**

**WEEK 3**
- **Date 31/10**
  - **Time 08:30**
    - IT P2 (Theory) (3 hrs)
  - **Time 12:30**
    - **Mathematics P1 (3 hrs)**
    - **Mathematic Literacy P1 (3 hrs)**

**WEEK 4**
- **Date 01/11**
  - **Time 08:30**
    - CAT P2 (Theory) (3 hrs)
  - **Time 12:30**
    - **History P1 (3 hrs)**

**WEEK 5**
- **Date 04/11**
  - **Time 08:30**
    - EGD P1 (2 hrs)
  - **Time 12:30**
    - **Afrikaans HL & FAL P3 (2,5 hrs)**

**WEEK 6**
- **Date 07/11**
  - **Time 08:30**
    - Physical Sciences P1 (Phys) (3 hrs)
  - **Time 12:30**
    - **Physical Sciences P2 (Chem) (3 hrs)**

**WEEK 7**
- **Date 08/11**
  - **Time 08:30**
    - Music P1 (Theory) (3 hrs)
  - **Time 12:30**
    - **Music P2 (Comprehension) (1,5 hrs)**

**WEEK 8**
- **Date 09/11**
  - **Time 08:30**
    - English HL P2 (2,5 hrs)
  - **Time 12:30**
    - **English HL P1 (2,5 hrs)**

**WEEK 9**
- **Date 11/11**
  - **Time 08:30**
    - History P2 (3 hrs)
  - **Time 12:30**
    - **Afrikaans HL & FAL P2 (2,5 hrs)**

**WEEK 10**
- **Date 14/11**
  - **Time 08:30**
    - Physical Sciences P2 (Chem) (3 hrs)
  - **Time 12:30**
    - **isiXhosa FAL P2 (2 hrs)**

**WEEK 11**
- **Date 15/11**
  - **Time 08:30**
    - Accounting (3 hrs)
  - **Time 12:30**
    - **EGD P2 (2 hrs)**

**WEEK 12**
- **Date 16/11**
  - **Time 08:30**
    - Visual arts (3 hrs)
  - **Time 12:30**
    - **Life Sciences P1 (2,5 hrs)**

**WEEK 13**
- **Date 17/11**
  - **Time 08:30**
    - **Business Studies (3 hrs)**

**WEEK 14**
- **Date 18/11**
  - **Time 08:30**
    - **Geography P1 (Theory) (3 hrs)**

**WEEK 15**
- **Date 21/11**
  - **Time 08:30**
    - Mathematics P3 (3 hrs)
  - **Time 12:30**
    - **Geography P2 (Mapwork) (1,5 hrs)**

**WEEK 16**
- **Date 22/11**
  - **Time 08:30**
    - Life Sciences P2 (2,5 hrs)
  - **Time 12:30**
    - **isiXhosa FAL P1 (2 hrs)**

**WEEK 17**
- **Date 23/11**
  - **Time 08:30**
    - **English HL P1 (2,5 hrs)**

**WEEK 18**
- **Date 24/11**
  - **Time 08:30**
    - **Afrikaans HL & FAL P1 (2,5 hrs)**
a) On which dates does Siphiwe start and complete his examination?

b) Write the dates and times of Siphiwe’s Mathematical Literacy examinations.

c) How many English Home Language papers must Siphiwe write? Write the date of each paper.

d) Siphiwe’s most difficult subject is Geography. When should he start studying for his Geography examinations?

This is Dembe’s school timetable:

<table>
<thead>
<tr>
<th>Period</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
<th>Saturday</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Eng HL</td>
<td>Math Lit</td>
<td>Economics</td>
<td>Afr FAL</td>
<td>Afr FAL</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Math Lit</td>
<td>Afr FAL</td>
<td>Eng HL</td>
<td>Math Lit</td>
<td>Eng HL</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Economics</td>
<td>Life Orientation</td>
<td>Business Studies</td>
<td>Economics</td>
<td>Business Studies</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Afr FAL</td>
<td>Economics</td>
<td>IT</td>
<td>Eng HL</td>
<td>IT</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Business Studies</td>
<td>Eng HL</td>
<td>Afr FAL</td>
<td>Business Studies</td>
<td>Math Lit</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>IT</td>
<td>Business Studies</td>
<td>Math Lit</td>
<td>Life Orientation</td>
<td>Economics</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hockey</td>
<td>Guitar</td>
<td></td>
<td>Afr tuition</td>
<td>Hockey match</td>
<td></td>
</tr>
</tbody>
</table>

a) Dembe wants to start driving lessons once a week. Which would be the best day for her to schedule lessons? Give a reason for your answer.

b) On which days does Dembe have Economics immediately after first break?

c) How many times a week does she have IT lessons?
Topic 2
Unit 6 Calculations with speed

The speed of a vehicle or person tells you how fast or slow they are moving.

You can calculate speed using the formula: \( \text{Speed} = \frac{\text{distance}}{\text{time}} \)

We measure distance in kilometres (km), time in hours (h) and speed in kilometres per hour (km/h).

To calculate the speed at which a vehicle is travelling, or the speed of a runner or cyclist, we need to consider two things:

1. **Distance** – how far did the person or vehicle travel?
2. **Time** – how long did they take?

**Example**

Bandhu travels from Richards Bay to Hluhluwe in 1 hour 12 minutes. The distance is 101 km.

What was his average speed, rounded off to the nearest whole number?

**Solution**

\[
\text{Speed} = \frac{\text{distance}}{\text{time}} = \frac{101}{1.2} = 84.16 \text{ km/h}
\]

Bandhu’s average speed was 84 km/h.

**Cool fact**

1 hour 12 minutes = \( 1 \frac{12}{60} \text{ hr} = 1.2 \text{ hr} \)

84.16 means 84,16666666666
Classwork activity 2.6

1. Franco lives in Pretoria and works in Rosebank. The distance is 52 km.
   a) His journey on the Gautrain takes 0.325 hours.
      Calculate the speed of the Gautrain.

   b) If Franco travels by car, the journey takes $\frac{1}{2}$ hour.
      Calculate his average driving speed.

   c) Once he cycled to work.
      The journey took 2 hours.
      How fast did he cycle?

   d) When training for a race, Franco ran to work.
      He took 4.8 hours to get there.
      What was his average running speed?
      Write your answer to the nearest km/h.

2. It takes Katleho $3\frac{1}{2}$ hr to travel 385 km from Retreat in Cape Town (A) to Lamberts Bay (B).
   Calculate Katleho’s average speed.
3 Ronel caught a flight from Cape Town to Johannesburg.  
The flight was $1\frac{3}{4}$ hr and the plane flew a distance of 1 400 km.  
Calculate the speed of the plane.

4 Neo is a long-distance runner. He ran the 112 km Transkei Wild Run from Kei Mouth to Hole in the Wall.  
a) He ran for 6 hours every day for 3 days.  
Calculate how many hours he ran.  
b) What was Neo’s average speed?  
Show your calculations.  
Give your answer correct to two decimal places.

5 Danisa sailed from Durban to Saldanha Bay.  
The trip took $3\frac{1}{2}$ days and the ship travelled a distance of 1 570 km.  
a) How many hours did the ship sail for?  
b) Calculate the ship’s speed.  
Give your answer correct to one decimal place.

6 A helicopter trip around Cape Town lasts $\frac{2}{3}$ hr.  
Calculate the speed of the helicopter if the total distance of the trip is 50 km.

Homework activity 2.5

1 Complete the table by calculating the speed of each animal.

<table>
<thead>
<tr>
<th>Animal</th>
<th>Distance in km</th>
<th>Time in minutes</th>
<th>Time in hours</th>
<th>Speed (km/h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bee</td>
<td>36</td>
<td>60</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cheetah</td>
<td>28,25</td>
<td>15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hyena</td>
<td>192</td>
<td>180</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elephant</td>
<td>30</td>
<td>45</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black mamba</td>
<td>64</td>
<td>120</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2 A yacht takes 770 hours to travel 10 000 km. If an albatross flies the same distance it would arrive 249 hours before the yacht.  
a) Calculate the average speed of the yacht.  
b) (i) How many hours would the albatross take to travel the 10 000 km? Show your calculations.  
(ii) Calculate the average speed of the albatross.  
(iii) How much faster is the bird than the yacht? Show your calculations.
### Summary practice exercise

1. Convert without using your calculator:
   
   a) 10 mm to cm  
   b) 50 cm to mm  
   c) 5 km to m  
   d) 2 004 m to km  
   e) 2 000 ml to ℓ  
   f) 55 ℓ to ml  
   g) 2,5 kl to ℓ  
   h) 10 mg to g  
   i) 2 kg to g  
   j) 980 g to kg  
   k) 1 200 kg to tonne

2. Convert:
   
   a) 3 minutes to seconds  
   b) 2 weeks to hours  
   c) 700 days to weeks  
   d) 730 days to years  
   e) (i) 921 days to years, months, weeks and days.  
       (ii) Explain why your answer is only an approximation.

3. Superbig vs Supersmall is a television programme in which two people compare their eating habits.
   
   a) Convert Philani and Sadiah’s mass to kilograms, correct to one decimal place.
   b) What is their difference in mass (kg)? Show your calculations and write your answer in kilograms. Round off your answer to the nearest whole number.
   c) After three months Sadiah put on 6 lb and Philani lost 22 lb.
      (i) Calculate their new mass in kilograms.
      (ii) What is the difference in mass now? Write your answer to the nearest kilogram.
   d) A healthy mass for Philani is 87 kg. How much mass must he still lose?
   e) A healthy mass for Sadiah is 59 kg. How much mass must she still gain?

4. The temperature at the North Pole at the coldest time of year is –15 °F in summer. Write the temperature in °C.

5. A rugby match started at 10:30 a.m.
   The first half of the match lasted 40 minutes, and was extended by 3 minutes of injury time.
   a) What time did the referee blow the whistle for half-time?
   b) Half-time lasted 10 minutes. What time did the second half start?
   c) The final whistle blew at 12:08. How long was the second half? Show your calculations.
Here is the fixture list for Pool D games that were played during the Rugby World Cup in New Zealand in 2011.

<table>
<thead>
<tr>
<th>Date</th>
<th>Time (NZ)</th>
<th>Pool</th>
<th>Match Details</th>
<th>Location</th>
<th>Stadium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sat Sept 17</td>
<td>18:00</td>
<td>D</td>
<td>South Africa vs Fiji</td>
<td>Wellington</td>
<td>Wellington Regional Stadium</td>
</tr>
<tr>
<td>Sun Sept 18</td>
<td>15:30</td>
<td>D</td>
<td>Wales vs Samoa</td>
<td>Hamilton</td>
<td>Waikato Stadium</td>
</tr>
<tr>
<td>Thurs Sept 22</td>
<td>20:00</td>
<td>D</td>
<td>South Africa vs Namibia</td>
<td>Auckland</td>
<td>North Harbour Stadium</td>
</tr>
<tr>
<td>Sun Sept 25</td>
<td>15:30</td>
<td>D</td>
<td>Fiji vs Samoa</td>
<td>Auckland</td>
<td>Eden Park</td>
</tr>
<tr>
<td>Mon Sept 26</td>
<td>19:30</td>
<td>D</td>
<td>Wales vs Namibia</td>
<td>New Plymouth</td>
<td>Stadium Taranaki</td>
</tr>
<tr>
<td>Fri Sept 30</td>
<td>20:30</td>
<td>D</td>
<td>South Africa vs Samoa</td>
<td>Auckland</td>
<td>North Harbour Stadium</td>
</tr>
<tr>
<td>Sun Oct 2</td>
<td>18:00</td>
<td>D</td>
<td>Wales vs Fiji</td>
<td>Hamilton</td>
<td>Waikato Stadium</td>
</tr>
</tbody>
</table>

a) On which dates did South Africa play matches?
b) When did Wales play against Namibia?
c) How many games were played at Waikato Stadium?
d) How many days were there between the South Africa vs Namibia match and the South Africa vs Samoa match?
e) At what time did the Wales vs Namibia game start?

The distance between Johannesburg and East London is 943 km. Calculate the average speed for each aeroplane. Write your answer to the nearest km/h.

<table>
<thead>
<tr>
<th>Aeroplane</th>
<th>Distance</th>
<th>Time</th>
<th>Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Airbus A320</td>
<td>943 km</td>
<td>1,12 hr</td>
<td></td>
</tr>
<tr>
<td>b) Cessna Citation</td>
<td>943 km</td>
<td>1 hr</td>
<td></td>
</tr>
<tr>
<td>c) Helicopter</td>
<td>943 km</td>
<td>4,2 hr</td>
<td></td>
</tr>
<tr>
<td>d) Cheetah Fighter Jet</td>
<td>943 km</td>
<td>24 min</td>
<td></td>
</tr>
<tr>
<td>e) Tiger Moth</td>
<td>943 km</td>
<td>5,4 hr</td>
<td></td>
</tr>
</tbody>
</table>
Word bank

average speed
no vehicle or person travels at exactly the same speed all the time. We might slow down and speed up, or stop at a stop street. Average speed means the average of the different speeds travelled over time.
drag racers
drivers who race their cars in a competition to be the first to cross a set finish line.
fixture
a sporting event that takes place on a particular date.
Gautrain
an 80 km mass rapid transit railway system in Gauteng, which links Johannesburg, Pretoria, and OR Tambo International Airport.
hurricane
a violent windstorm.
 imperial measurements
the system of measurement used in England.
itiinerary
a travel plan that shows transport and accommodation details.
long-distance runner
a runner who runs distances of 10 km or more.
Tiger Moth
a two-winged plane (biplane) first flown in 1931.
triathlon
a race that consists of contestants swimming, riding a bicycle and running a road race.
visa
an official document issued to travellers that gives them permission to be in the foreign country they are entering.
weather forecast
a prediction of what the weather may be like in days to come.

Topic summary

• We measure **length** in kilometres, metres, centimetres and millimetres.
• We measure **mass** in kilograms, grams and milligrams.
• We measure **capacity** in kilolitres, litres and millilitres.
• When we measure **time** we use years, months, weeks, days, hours, minutes and seconds.
• When we convert to a smaller unit we multiply, when we convert to a larger unit we divide.
• Different countries use different units of measurement.
• To calculate average speed, we divide distance by time.
Financial matters for a small business or home industry

What you will learn about in this topic

You will:
- identify and perform calculations involving income, expenditure and profit and loss values
- work with fixed, variable and occasional income values and fixed, variable, occasional, high priority and low priority expenditure values
- determine the cost of production or cost price of an item or service, with an understanding of the difference between these two costs
- decide on an appropriate selling price for an item or service based on an expected percentage profit.

Let’s talk about this topic

Unemployment is a big problem for school leavers. One way to earn a living is to start your own business. To run a successful business, you have to be organised and must carefully consider all the costs you might face.

In this topic you will look at several types of small businesses and the costs involved. You will also consider how to determine a sensible selling price that will ensure that you make a profit.
Financial matters for a small business or home industry

In a business you spend money and make money. The aim is to make more money than you spend so that the business can grow. It is essential to know what costs are involved and whether you will have enough money to pay for these costs. We call these costs expenditure. Income is the money that you make when you sell your product. Profit is the difference between expenditure and income.

Siviso makes hand-made paper for the tourist market. To make the paper he uses old newspaper, water and dye.

- He pays R150 per month to rent space. This includes water and electricity costs.
- He spends R270 on transport every month to collect old newspapers.
- Dye costs R18,45 per bottle and one bottle of dye makes 300 sheets of paper.

One month he has an order for 500 sheets of paper.

a) Calculate his expenses for the month with a breakdown between fixed and variable expenses.

b) Calculate his profits.
Unit 1 Cost of production and cost price

Many people earn a living by making products that they sell or by offering their services to others.

It is important to calculate the cost of making your product or what it costs to offer your service.

Some costs are **fixed**. You will have to pay these costs even if you have nothing to sell.

Here are some examples of fixed costs:

- You have to pay rent if you do not own the property from which you operate your business.
- You have to pay salaries if you employ other people. Even if you make no money, you still have to pay your employees.
- Whether your sales are big or small, you have to pay for transport.

Can you think of other fixed costs?

Some costs are **variable**. The amount you pay depends on how much of the product you make or how much of your service you sell.

Cost of production = Fixed costs + Variable costs

Consider this situation:
A supplier’s variable costs to manufacture an item are R5,50 per unit.
His fixed expenses are R3 000,00 per month.

To manufacture 10 items costs:
10 × R5,50 = R55,00
The table shows how the supplier’s cost of production increases as he manufactures more units.

<table>
<thead>
<tr>
<th>Total sold</th>
<th>1</th>
<th>10</th>
<th>50</th>
<th>100</th>
<th>250</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed expenses</td>
<td>3 000,00</td>
<td>3 000,00</td>
<td>3 000,00</td>
<td>3 000,00</td>
<td>3 000,00</td>
</tr>
<tr>
<td>Variable expenses</td>
<td>5,50</td>
<td>55,00</td>
<td>275,00</td>
<td>550,00</td>
<td>1 375,00</td>
</tr>
<tr>
<td>Cost of production</td>
<td>3 005,50</td>
<td>3 055,00</td>
<td>3 275,00</td>
<td>3 550,00</td>
<td>4 375,00</td>
</tr>
</tbody>
</table>

To calculate cost price: \[
\text{Cost price} = \frac{\text{cost of production}}{\text{number of units}}
\]

<table>
<thead>
<tr>
<th>Total sold</th>
<th>1</th>
<th>10</th>
<th>100</th>
<th>250</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of production</td>
<td>3 005,50</td>
<td>3 055,00</td>
<td>3 550,00</td>
<td>4 375,00</td>
</tr>
<tr>
<td>Cost price</td>
<td>\frac{3 005,50}{1} = R3 005,50</td>
<td>\frac{3 055,00}{10} = R305,50</td>
<td>\frac{3 550,00}{100} = R35,50</td>
<td>\frac{4 375,00}{250} = R17,50</td>
</tr>
</tbody>
</table>

This graph shows how the supplier’s expenditure increases as he produces more units:
- The graph cuts the vertical axis at (0; 3 000). At this point no units have been sold and there is no income. The fixed expenses amount to R3 000.
- The positive slope of the graph shows that as the number of units produced increases, the variable costs increase and therefore the cost of production increases.

**Example**

Bheka manufactures beaded key rings for a gift shop. He uses 5 beads on a metal ring to make one key ring. He packages the key ring in a gift packet.

These are Bheka’s costs:

- **Rent**  R1 800,00
- **Beads**  R10,00 per 2 500
- **Metal rings**  R50,00 per 140
- **Packets**  R80,00 per 400

**a)** (i) List Bheka’s fixed expenses.
   (ii) Calculate his fixed expenses.
b) 
(i) List Bheka’s variable expenses.
(ii) Calculate the cost of each of his variable expenses for one key ring. Show all your calculations and set out your work neatly.
(iii) What are Bheka’s total variable expenses for one key ring?

c) Complete the table:

<table>
<thead>
<tr>
<th>Number of units</th>
<th>1</th>
<th>50</th>
<th>100</th>
<th>200</th>
<th>400</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed costs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Variable costs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost of production</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost price</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Solution**

a) 
(i) Rent
(ii) R1 800,00

b) 
(i) Beads, metal rings, packets
(ii) Beads, R10,00 = 10 × 100 = 1000c, 25 beads cost 1000c

\[ \therefore \text{1 bead costs } \frac{1000}{2500} = 0,4c \]

\[ \therefore \text{5 beads } = 0,4c \times 5 = 20c \]

Metal rings, R50,00 = 50 × 100c = 5 000c

140 rings cost R50,00

\[ \therefore \text{1 ring costs } \frac{5000}{140} \times 35,71c = 36c \]

Packets, 1 packet costs = 20c

\[ \therefore \text{1 packet costs } \frac{8000}{400} = 20c \]

(iii) Total variable costs per unit = 20c + 36c + 20c = 76c

c) 

<table>
<thead>
<tr>
<th>Number of units</th>
<th>1</th>
<th>50</th>
<th>100</th>
<th>200</th>
<th>400</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed costs</td>
<td>1800,00</td>
<td>1800,00</td>
<td>1800,00</td>
<td>1800,00</td>
<td>1800,00</td>
</tr>
<tr>
<td>Variable costs</td>
<td>0,76</td>
<td>38,00</td>
<td>76,00</td>
<td>152,00</td>
<td>304,00</td>
</tr>
<tr>
<td>Cost of production</td>
<td>1800,76</td>
<td>1838,00</td>
<td>1876,00</td>
<td>1952,00</td>
<td>2104,00</td>
</tr>
<tr>
<td>Cost price</td>
<td>R1 800,76</td>
<td>R36,76</td>
<td>R18,76</td>
<td>R9,76</td>
<td>R5,26</td>
</tr>
</tbody>
</table>
Example

Ayanda bakes fancy muffins. She runs her business from home, so she does not pay rent. However, every month Ayanda has some fixed expenses:

<table>
<thead>
<tr>
<th>Fixed monthly expenses (R)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salary</td>
</tr>
<tr>
<td>Water</td>
</tr>
<tr>
<td>Cleaning materials</td>
</tr>
<tr>
<td>Transport</td>
</tr>
<tr>
<td>Miscellaneous costs</td>
</tr>
</tbody>
</table>

To make muffins, Ayanda has to spend money on ingredients:

<table>
<thead>
<tr>
<th>Baking expenses for 50 muffins (R)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flour</td>
</tr>
<tr>
<td>Sugar</td>
</tr>
<tr>
<td>Baking powder</td>
</tr>
<tr>
<td>Eggs</td>
</tr>
<tr>
<td>Oil</td>
</tr>
<tr>
<td>Chocolate chips/blueberries/nuts</td>
</tr>
</tbody>
</table>

Ayanda uses 7 units of electricity for every 50 muffins she makes. Electricity costs 95c per unit.

a) Calculate Ayanda’s fixed costs for an average month.
b) Calculate the cost of ingredients for 50 muffins.
c) Calculate the cost of electricity to make 50 muffins.
d) Calculate the variable costs to make 1 muffin. Set out your work clearly and show all calculations.
e) Copy and complete the table.

<table>
<thead>
<tr>
<th>Number of muffins</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed costs</td>
</tr>
<tr>
<td>Variable costs</td>
</tr>
<tr>
<td>Cost of production</td>
</tr>
<tr>
<td>Cost price</td>
</tr>
</tbody>
</table>

f) Describe the relationship between the number of units produced and the cost of production.
g) Draw a graph representing the relationship between the cost of production and the number of muffins.
Solution

a) \[ 4800,00 + 355,00 + 185,00 + 1400,00 + 500,00 = R7\,140,00 \]

b) \[ 10,60 + 12,50 + 0,15 + 11,00 + 7,00 + 11,00 = R52,25 \]

c) \[ 7 \times 0,95 = R6,65 \]

d) \[ \frac{52,25 + 6,65}{50} = \frac{58,90}{50} = 1,178 \]

e) 

<table>
<thead>
<tr>
<th>Number of muffins</th>
<th>1</th>
<th>100</th>
<th>500</th>
<th>1000</th>
<th>2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed costs</td>
<td>R7,140,00</td>
<td>R7,140,00</td>
<td>R7,140,00</td>
<td>R7,140,00</td>
<td>R7,140,00</td>
</tr>
<tr>
<td>Variable costs</td>
<td>1,18</td>
<td>117,80</td>
<td>589,00</td>
<td>1,178,00</td>
<td>2,356,00</td>
</tr>
<tr>
<td>Cost of production</td>
<td>R7,141,18</td>
<td>R7,257,80</td>
<td>R7,729,00</td>
<td>R8,318,00</td>
<td>R9,496,00</td>
</tr>
<tr>
<td>Cost price</td>
<td>R7,141,18</td>
<td>72,58</td>
<td>15,46</td>
<td>8,32</td>
<td>4,75</td>
</tr>
</tbody>
</table>

f) The cost price decreases as the number of units produced increases.

Classwork activity 3.1

1. A supplier’s variable costs to manufacture an item are R7,42 per unit. His fixed expenses are R3\,565,00 per month. Copy and complete the table.

<table>
<thead>
<tr>
<th>Total sold</th>
<th>1</th>
<th>10</th>
<th>50</th>
<th>100</th>
<th>250</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed expenses</td>
<td>R3,565,00</td>
<td>R3,565,00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Variable expenses</td>
<td>7,42</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost of production</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost price per unit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Ben runs a bin cleaning service. Every week, after the rubbish has been collected, Ben cleans his clients’ bins. His employees earn R5 for each bin they clean. He uses 80 ml of disinfectant and 8 ℓ of water to clean each bin. Ben budgets R100 per month to replace his cloths and brushes. He spends an average of R1 350 per month on transport. Ben budgets R500 per month for miscellaneous expenses.

a) The disinfectant costs R257,50 for 10 ℓ. Calculate the cost of disinfectant for 1 bin. Show your calculations.

b) His water tank holds 1 kl of water at a cost of R10,51. Calculate the cost of water for one bin.

c) Calculate Ben’s fixed costs.

d) Calculate his variable costs for one bin.

e) Copy and complete the table.

<table>
<thead>
<tr>
<th>Number of bins</th>
<th>1</th>
<th>10</th>
<th>14</th>
<th>20</th>
<th>50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed expenses</td>
<td>(R)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Variable expenses</td>
<td>(R)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total expenditure</td>
<td>(R)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost per cleaned bin</td>
<td>(R)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

f) Describe the relationship between the number of bins washed and the cost of the service.

g) Draw a graph representing the relationship between the number of bins and the total expenditure.
Indali runs a day-care facility. These are her average monthly expenses for 14 children:

<table>
<thead>
<tr>
<th>Fixed expenses (R)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rent</td>
</tr>
<tr>
<td>Electricity</td>
</tr>
<tr>
<td>Water</td>
</tr>
<tr>
<td>Staff (salaries)</td>
</tr>
<tr>
<td>Cleaning materials</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variable expenses (R)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Juice and snacks</td>
</tr>
<tr>
<td>Arts and crafts replacements</td>
</tr>
<tr>
<td>First-aid kit replacements</td>
</tr>
<tr>
<td>New toys, books, DVDs</td>
</tr>
</tbody>
</table>

a) What are Indali’s total fixed expenses for the month?
b) Indali’s variable expenses are for 14 children.
   (i) What are her total variable expenses for 14 children?
   (ii) Calculate the variable cost per child.
c) Complete the table.

<table>
<thead>
<tr>
<th>Number of children</th>
<th>1</th>
<th>10</th>
<th>15</th>
<th>20</th>
<th>50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed expenses (R)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Variable expenses (R)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total expenditure (R)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost per child (R)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Homework activity 3.1

Sinazo runs a hairdresser from home. This is an average month’s business:

a) Complete the statement: The ratio of Wash and Style : Wash and Cut : Colour treatment is _____ : 10 : _____.

b) This is Sinazo’s average monthly expenditure:

<table>
<thead>
<tr>
<th>General expenses</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity</td>
<td>1 190,00</td>
</tr>
<tr>
<td>Water</td>
<td>525,00</td>
</tr>
<tr>
<td>Shampoo assistant (part-time)</td>
<td>3 500,00</td>
</tr>
<tr>
<td>Miscellaneous costs</td>
<td>300,00</td>
</tr>
<tr>
<td>Hair products</td>
<td>2 840,00</td>
</tr>
</tbody>
</table>

Total

(i) Calculate her total general expenses, excluding hair products.

(ii) Divide the total general expenses across the different types of services Sinazo’s customers could have, in the correct ratio. Round up your answers to the next R10. The first calculation has been set out for you:

\[
\text{Wash and Style: } \frac{17}{32} \times \frac{2}{1} = ?
\]

(iii) Why do you think Sinazo used ratio and proportion to calculate her costs? Explain.

c) Complete the table that shows the cost of hair products for the different services.

<table>
<thead>
<tr>
<th>Wash and Style</th>
<th>Wash and Cut</th>
<th>Colour treatment</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hair products</td>
<td>85 \times R9,50</td>
<td>50 \times R8,00</td>
<td>25 \times R65,00</td>
</tr>
<tr>
<td>Cost</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rounded up to next R10</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

d) Use your answers in Questions a) to c) to copy and complete Sinazo’s expenses document.

<table>
<thead>
<tr>
<th>General expenses</th>
<th>Hair products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity</td>
<td>1 190,00</td>
</tr>
<tr>
<td>Water</td>
<td>525,00</td>
</tr>
<tr>
<td>Salary</td>
<td></td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>300,00</td>
</tr>
<tr>
<td>Total</td>
<td></td>
</tr>
<tr>
<td>Wash and Style</td>
<td>Wash and Cut</td>
</tr>
<tr>
<td>Number of customers</td>
<td>85</td>
</tr>
<tr>
<td>Ratio</td>
<td></td>
</tr>
<tr>
<td>General expenses</td>
<td></td>
</tr>
<tr>
<td>Hair products</td>
<td>810,00</td>
</tr>
<tr>
<td>Total cost per service</td>
<td>2 130,00</td>
</tr>
<tr>
<td>Cost per customer</td>
<td>44,00</td>
</tr>
</tbody>
</table>

e) From the document, write down the cost price of each of the following services:

(i) Wash and Style
(ii) Wash and Cut
(iii) Colour treatment