These workbooks have been developed for the children of South Africa under the leadership of the Minister of Basic Education, Mrs Angie Motshekga, and the Deputy Minister of Basic Education, Mr Enver Surty.

The Rainbow Workbooks form part of the Department of Basic Education’s range of interventions aimed at improving the performance of South African learners in the first six grades. As one of the priorities of the Government’s Plan of Action, this project has been made possible by the generous funding of the National Treasury. This has enabled the Department to make these workbooks, in all the official languages, available at no cost.

We hope that teachers will find these workbooks useful in their everyday teaching and in ensuring that their learners cover the curriculum. We have taken care to guide the teacher through each of the activities by the inclusion of icons that indicate what it is that the learner should do.

We sincerely hope that children will enjoy working through the book as they grow and learn, and that you, the teacher, will share their pleasure.

We wish you and your learners every success in using these workbooks.
Grade 8

Mathematics

PART 3

WORKSHEETS 65 to 144

Name:
Add and subtract fractions

1. Revision: say whether it is a proper or improper fraction, or a mixed number.
   a. \( \frac{2}{4} \)
   b. \( \frac{6}{2} \)
   c. \( 1 \frac{1}{4} \)
   d. \( \frac{8}{5} \)
   e. \( \frac{1}{5} \)
   f. \( \frac{7}{4} \)

2. Write an equivalent fraction for:
   a. \( 1 \frac{1}{2} \)
   b. \( 3 \frac{2}{3} \)
   c. \( 4 \frac{1}{2} \)
   d. \( 6 \frac{1}{3} \)
   e. \( 2 \frac{3}{4} \)
   f. \( 2 \frac{4}{5} \)

3. Add up the following, write it as a mixed number and simplify if necessary.
   Example:
   \[
   \frac{1}{3} + \frac{4}{3} = \frac{5}{3} = 1 \frac{2}{3}
   \]
   5 divided by 3 is 1 remainder 2.
   a. \( \frac{2}{5} + \frac{4}{5} = \)
   b. \( \frac{5}{9} + \frac{6}{9} = \)
   c. \( \frac{3}{4} + \frac{2}{4} = \)
4. Calculate and simplify if necessary.

Example:
\[ \frac{1}{2} + \frac{1}{3} \]
\[ = \frac{5}{6} \]

Where does the 6 come from?

<table>
<thead>
<tr>
<th>Activity</th>
</tr>
</thead>
</table>

Add up any proper, improper and mixed numbers with different denominators.

5. Calculate and simplify.

Examples:
\[ 2 + \frac{5}{6} \]
\[ = \frac{12}{6} + \frac{5}{6} \]
\[ = \frac{17}{6} \]
\[ = 2 \frac{5}{6} \]

How did we get this mixed number?

| d. \( \frac{7}{10} + \frac{5}{10} = \) |
| e. \( \frac{5}{6} + \frac{3}{6} = \) |
| f. \( \frac{5}{7} + \frac{5}{9} = \) |

| a. \( \frac{1}{4} + \frac{1}{2} = \) |
| b. \( \frac{1}{5} + \frac{1}{10} = \) |
| c. \( \frac{1}{3} + \frac{1}{6} = \) |

| d. \( \frac{1}{8} + \frac{1}{4} = \) |
| e. \( \frac{1}{5} + \frac{1}{4} = \) |
| f. \( \frac{1}{2} + \frac{1}{3} = \) |

| a. \( 1 + \frac{1}{2} = \) |
| b. \( \frac{3}{2} + \frac{1}{4} = \) |
| c. \( 2 \frac{1}{4} + 8 = \) |

| d. \( 4 \frac{1}{2} - 3 \frac{1}{3} = \) |
| e. \( 2 \frac{1}{5} + 1 \frac{1}{2} = \) |
| f. \( 7 \frac{1}{2} - 1 \frac{3}{4} = \) |
Let us multiply fractions:
\[ \frac{1}{2} \times \frac{1}{4} = \]
Identify the numerators:
\[ \frac{1}{2} \times \frac{1}{4} = \]
and then the denominators:
\[ \frac{1}{2} \times \frac{1}{4} = \]
We first multiply the numerators and then the denominators.
\[ = \frac{1}{8} \]

1. Calculate.

Example:
\[ \frac{6}{7} \times \frac{5}{6} = \]
Can we simplify this fraction?

Factors of 30 = \{1, 2, 3, 5, 6, 10, 15, 30\}
Factors of 42 = \{1, 2, 3, 6, 7, 14, 21, 42\}
HCF (Highest Common Factor): 6

2. Solve the following:

Examples:
\[ \frac{3}{4} \times \frac{3}{4} = \frac{9}{12} \]
\[ \frac{1}{3} \times \frac{9}{4} = \frac{9}{12} \]
\[ \frac{3}{2} \times \frac{3}{6} = \frac{9}{12} \]

3. Calculate the following:

Example:
\[ 8 \times \frac{1}{4} = \frac{8}{1} \times \frac{1}{4} = \frac{8}{4} = 2 \]

a. \[ 2 \times \frac{3}{5} = \]
b. \[ 4 \times \frac{5}{6} = \]
c. \[ 11 \times \frac{3}{10} = \]
4. Which whole number and fraction will give you the following answer?

Example: \( \frac{2}{3} \times \frac{3}{2} = 2 \times \frac{1}{3} \)

a. \( \_ \times \_ = \frac{4}{6} \)  

b. \( \_ \times \_ = \frac{9}{18} \)  

c. \( \_ \times \_ = \frac{3}{8} \)

5. Multiply and simplify if possible.

Example: \( \frac{1}{3} \times \frac{3}{4} = \frac{3}{12} = \frac{3 + 3}{12 + 3} = \frac{1}{4} \)

a. \( \frac{1}{2} \times \frac{4}{8} = \)  

b. \( \frac{7}{7} \times \frac{3}{6} = \)  

c. \( \frac{8}{10} \times \frac{10}{12} = \)

6. Multiply and simplify.

Example: \( \frac{4}{4} \times \frac{5}{2} = \frac{30}{8} = 3 \frac{6}{8} = 3 \frac{3}{4} \)

a. \( \frac{3}{2} \times \frac{7}{6} = \)  

b. \( \frac{6}{3} \times \frac{6}{5} = \)  

c. \( \frac{8}{7} \times \frac{6}{4} = \)

Activity

What fraction is four months of 10 years?  
What fraction is 5 days of seven weeks?  
What fraction is 12 minutes of an hour?
Divide common fractions

Go step-by-step through the examples. Explain them to a friend.

1

3 ÷ \(\frac{3}{4}\)

= \(\frac{3}{1} \times \frac{4}{3}\)

= 4

2

4 ÷ \(\frac{8}{9}\)

= \(\frac{4}{1} \times \frac{9}{8}\)

= \(\frac{5}{2}\) (simplify)

= 2\(\frac{1}{2}\)

3

\(\frac{1}{2}\) ÷ \(\frac{1}{6}\)

= \(\frac{1}{2} \times \frac{6}{1}\)

= 3

4

\(\frac{2}{3}\) ÷ \(\frac{3}{4}\)

= \(\frac{2}{3} \times \frac{4}{3}\)

= \(\frac{8}{9}\)

5

1\(\frac{1}{2}\) ÷ 2\(\frac{1}{4}\)

= \(\frac{3}{2} \div \frac{9}{4}\)

= \(\frac{3}{2} \times \frac{4}{9}\)

= \(\frac{2}{3}\)

1. Calculate.

Example: 2 ÷ \(\frac{3}{4}\)

= \(\frac{2}{1} \times \frac{4}{3}\)

= \(\frac{8}{3}\)

= 2\(\frac{2}{3}\)

a. 4 ÷ \(\frac{5}{3}\) = 

b. 7 ÷ \(\frac{7}{9}\) = 

c. 12 ÷ \(\frac{12}{15}\) = 

d. 9 ÷ \(\frac{9}{11}\) = 

e. 5 ÷ \(\frac{5}{6}\) = 

f. 10 ÷ \(\frac{10}{11}\) = 

2. Calculate.

Example: See the second example in the introduction.

a. 3 ÷ \(\frac{5}{7}\) = 

b. 6 ÷ \(\frac{18}{9}\) = 

c. 8 ÷ \(\frac{14}{8}\) =
Activity

Write an expression for twelve divided by a hundred and eight tenths. Simplify it.

Divide eight ninths by eighteen halves.
Fractions of squares, cubes, square roots and cube roots

Work through examples 1–4 and discuss them.

1. \((\frac{3}{4})^2 = \frac{3^2}{4^2} = \frac{9}{16}\)
2. \((\frac{3}{4})^3 = \frac{3^3}{4^3} = \frac{27}{64}\)
3. \(\sqrt[3]{\frac{16}{25}} = \frac{\sqrt[3]{16}}{\sqrt[3]{25}} = \frac{4}{5}\)
4. \(\sqrt[3]{\frac{8}{27}} = \frac{\sqrt[3]{8}}{\sqrt[3]{27}} = \frac{2}{3}\)

1. Calculate.

Example: See the first example in the introduction.

a. \((\frac{1}{4})^2\)
   
   b. \((\frac{5}{7})^2\)
   
   c. \((\frac{5}{6})^2\)

   d. \((\frac{5}{8})^2\)
   
   e. \((\frac{3}{5})^2\)
   
   f. \((\frac{3}{7})^2\)

2. Revision: calculate.

Example: See the third example in the introduction.

a. \(\sqrt[4]{\frac{1}{9}}\)
   
   b. \(\sqrt[8]{\frac{9}{21}}\)
   
   c. \(\sqrt[10]{\frac{16}{100}}\)

   d. \(\sqrt[5]{\frac{32}{64}}\)
   
   e. \(\sqrt[12]{\frac{7}{16}}\)
   
   f. \(\sqrt[13]{\frac{81}{100}}\)
3. Calculate.

Example: See the second example in the introduction.

- (\frac{1}{4})^3
- (\frac{1}{2})^3
- (\frac{5}{6})^3
- (\frac{3}{8})^3
- (\frac{7}{12})^3
- (\frac{2}{7})^3

4. Revision: calculate.

Example: See the fourth example in the introduction.

- \sqrt[3]{\frac{8}{25}}
- \sqrt[3]{\frac{16}{24}}
- \sqrt[3]{\frac{24}{725}}
- \sqrt[3]{\frac{725}{24}}
- \sqrt[3]{125}
- \sqrt[3]{8}

Activity

What is the square root of sixteen squared divided by the square root of twenty-five?
### Fractions, decimals and percentages

#### Term 3

Look at each of the examples. Work through them and discuss.

<table>
<thead>
<tr>
<th>What is 60% of R105?</th>
<th>What percentage is 40c of R3,20?</th>
</tr>
</thead>
</table>
| \[
\frac{60}{100} \times \frac{105}{1} = \frac{3}{5} \times R105 = \frac{315}{5} = R63
\]                                      | \[
\frac{40}{320} \times \frac{100}{1} = \frac{100}{8} \text{ simplified is } \frac{25}{2}.
\] |

Calculate the **percentage increase** if the price of a bus ticket increases from R60 to R84.

The amount of the increase is R24.

\[
\frac{24}{60} \times \frac{100}{1} = \frac{2400}{60} = 40\%
\]

Calculate the **percentage decrease** if the price of petrol goes down from R10 a litre to R9.

The amount of the decrease is R1.

\[
\frac{1}{10} \times \frac{100}{1} = \frac{100}{10} = 10\%
\]

1. Write the following as a fraction and then as a decimal fraction.

| Example: 18% = \[
\frac{18}{100} = \frac{9}{50} = 0.18
\] |  |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a. 37%</td>
<td>b. 25%</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>d. 9%</td>
<td>e. 56%</td>
</tr>
</tbody>
</table>
2. Write the following as fractions in their simplest form.

<table>
<thead>
<tr>
<th>Percentage</th>
<th>10%</th>
<th>20%</th>
<th>30%</th>
<th>40%</th>
<th>50%</th>
<th>60%</th>
<th>70%</th>
<th>80%</th>
<th>90%</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fraction</td>
<td>1/10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Simplest form</td>
<td>1/10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. Calculate.

Example: 40% of R20

\[
\frac{40}{100} \times \frac{R20}{1} = \frac{R800}{100} = R8
\]

a. 20% of R24

b. 70% of R15

c. 60% of R95

d. 80% of R74

e. 30% of R90

f. 50% of R65

continued
4. Calculate the percentage.

Example: 60c of R4,80

\[
\frac{60}{480} \times 100 = \frac{6000}{480} \%
\]

\[
= \frac{50}{4} \%
\]

\[
= 12.5\%
\]

a. 30c of R1,80  b. 80c of R1,60  c. 40c of R8,40

d. 70c of R2,10  e. 50c of R7,00  f. 30c of R3,60
5. Calculate the percentage increase.

a. R50 to R70
b. R80 to R120
c. R15 to R18
d. R25 to R30
e. R100 to R120
f. R36 to R54

6. Calculate the percentage decrease.

a. R20 of R15
b. R50 of R45
c. R18 of R15
d. R24 of R18
e. R90 of R80
f. R28 of R21

Problem solving

a. A shirt costs R175. I got 25% discount. How much did I pay for it?
b. Calculate the percentage decrease if the price of petrol goes down from R10.35 to R10.15 per litre.
When solving a problem you can go through the following steps:

**Say:** Underline the important information. Put the problem in your own words.

**Ask:** Have I underlined the important information? Do I need more information? What is the question? What am I looking for?

**Check:** That the information you marked is what is needed to answer the question.

1. Solve the following.
   a. Find 80.6% of 110.
   b. What is 5.2% of 29?
   c. What percentage is 36 of 82?
   d. What percentage is 13 of 121?
   e. What percentage is 55 of 149?
   f. What is 86.6% of 44?
g. What percentage is 61 of 116?

h. 22.3% of a number is 123. What is the number?

i. 57.1% of a certain number is 115. What is the number?

j. What percentage is 143 of 146?

k. 81.8% of what number is 84?

l. What percentage is 22 of 26?
2. Solve the following.

a. The original price of a shirt was R200. The price was then decreased by R150. What is the percentage decrease of the price of this shirt?

b. Mary earns a monthly salary of R12 000. She spends R2 800 per month on food. What percentage of her monthly salary does she spend on food?

c. Calculate 60% of R105.

d. What percentage is 50c of R7.50?
e. Calculate the percentage increase if the price of a bus ticket is increased from R75 to R100.

\[
\text{Percentage Increase} = \left( \frac{R100 - R75}{R75} \right) \times 100
\]

f. Calculate the percentage decrease if the price of petrol goes down from R16.50 a litre to R15.75 per litre.

\[
\text{Percentage Decrease} = \left( \frac{R16.50 - R15.75}{R16.50} \right) \times 100
\]

g. Calculate how much a car will cost if its original price of R150 000 is reduced by 15%.

\[
\text{Final Price} = R150 000 \times (1 - 0.15)
\]

Problem solving

Investigate using different amounts and percentages to find expressions leading to calculating a percentage increase/decrease.
71 Place value, ordering and comparing decimals

Revise the place value of decimal fractions.

Example:

\[ 5,763 = 5 + 0.7 + 0.06 + 0.003 \]

How will you write this decimal fraction in expanded notation?

\[ 8,924 = 8 + 0.9 + 0.02 + 0.004 \]

1. Write the following in expanded notation:

Example: \[ 5.763 = 5 + 0.7 + 0.06 + 0.003 \]

a. 9,371  
b. 6,215  
c. 34,672  
d. 8,076  
e. 9,304  
f. 8,004  
g. 16,003  
h. 19,020  
i. 56,003  
j. 900,009

2. Write down the place value of each digit in words.

Example: \[ 5.872 = 5 \text{units} + 8 \text{tenths} + 7 \text{hundredths} + 2 \text{thousandths} \]

a. 3,378  
b. 6,2914  
c. 2,588  
d. 2,037  
e. 2,003  
f. 14,030
3. Write the following in the correct column.

<table>
<thead>
<tr>
<th></th>
<th>thousands</th>
<th>hundreds</th>
<th>tens</th>
<th>units</th>
<th>tenths</th>
<th>hundredths</th>
<th>thousandths</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>2,869</td>
<td></td>
<td>2</td>
<td>.</td>
<td>8</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>b</td>
<td>24,328</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c</td>
<td>18,003</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d</td>
<td>376,02</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e</td>
<td>8674,5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>f</td>
<td>2874,345</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>g</td>
<td>987,001</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>h</td>
<td>400,08</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i</td>
<td>2000,203</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4. Write down the value of the underlined digit.

Example: 3.476

= 0,07 or 7 hundredths

a. 6,857
b. 4,37

c. 3,809
d. 8,949
e. 85,080
f. 34,004

5. Write the following in ascending order.

a. 0,04; 0,4; 0,004
b. 0,1; 0,11; 0,011
c. 0,99; 0,9; 0,999
d. 0,753; 0,8; 0,82
e. 0,67; 0,007; 0,06
f. 0,899; 0,98; 0,99

6. Fill in <, >, =.

a. 0,4 _____ 0,04
b. 0,05 _____ 0,005
c. 0,1 _____ 0,10
d. 0,62 _____ 0,26
e. 0,58 _____ 0,85
f. 0,37 _____ 0,73

Problem solving

What would you do to change this decimal fraction from 9,768 to 9,008?
Round off rational numbers

Round off to the nearest **unit**.

- $3.7 \approx 4$
- $5.62 \approx 6$
- $7.321 \approx 7$
- $3.2 \approx 3$
- $5.18 \approx 5$
- $7.329 \approx 7$

Round off to the nearest **tenth**.

- $8.26 \approx 8.3$
- $3.765 \approx 3.8$
- $5.293 \approx 5.3$
- $8.21 \approx 8.2$
- $3.768 \approx 3.8$
- $5.224 \approx 5.2$

Round off to the nearest **hundredth**.

- $3.472 \approx 3.47$
- $8.925 \approx 8.93$
- $3.478 \approx 3.48$
- $7.342 \approx 7.34$

The symbol $\approx$ means **approximately** the same or about equal. It can be used for rounding of a number.

1. **What is a _____? Give an example of each.**
   - a. Natural number
   - b. Tenth
   - c. Hundredth
   - d. Thousandth

2. **What symbol can be used for rounding off? _____**

3. **Round off to the nearest natural number.**
   - **Examples:** $6.7 \approx 7$  $6.6 \approx 6$
   - a. $9.2$ _____
   - b. $4.5$ _____
   - c. $4.8$ _____
   - d. $6.4$ _____
   - e. $5.68$ _____
   - f. $5.999$ _____
In everyday life, why do we round off decimal numbers? Give five examples.
Can you remember how to write decimal fractions as common fractions? Look at the following:

- 0.5 = $\frac{5}{10}$
- 0.08 = $\frac{8}{100}$
- 0.007 = $\frac{7}{1000}$
- 0.287 = $\frac{2}{10} + \frac{8}{100} + \frac{7}{1000}$

We say five-tenths
We say eight-hundredths
We say seven-thousandths

1. Write as a decimal fraction.

Example: $\frac{6}{100}$ = 0.06

a. $\frac{7}{10}$

b. $\frac{1}{10}$

c. $\frac{9}{1000}$

d. $\frac{8}{10}$

e. $\frac{3}{1000}$

f. $\frac{3}{100}$

g. $\frac{9}{100}$

h. $\frac{8}{1000}$

i. $\frac{2}{100}$

j. $\frac{4}{1000}$

k. Use your calculator to convert between common and decimal fractions.

2. Write as a decimal fraction.

Example: $\frac{73}{100}$ = 0.73

a. $\frac{76}{100}$

b. $\frac{83}{100}$

c. $\frac{64}{100}$

b. $\frac{28}{100}$

e. $\frac{873}{1000}$

f. $\frac{92}{1000}$

g. $\frac{31}{1000}$

h. $\frac{74}{1000}$

i. $\frac{38}{1000}$

j. $\frac{784}{1000}$

k. Use your calculator to convert between common and decimal fractions.

3. Write as a decimal fraction.

Example: $\frac{51}{10}$ = 5.1

a. $\frac{22}{10}$

b. $\frac{8476}{100}$

c. $\frac{15}{10}$
4. Write as a common fraction.

Example: \(8.4 = \frac{84}{10}\)

a. 8.2
b. 18.19
c. 7.654

d. 4.73
e. 48.003
f. 12.75

g. 3.4
h. 62.38
i. 376.5

j. 8.476

5. Write the following as a decimal fraction.

Example: \(\frac{2}{5} = \frac{4}{10} = 0.4\)
\(\frac{1}{25} = \frac{4}{100} = 0.04\)

a. \(\frac{1}{5}\)
b. \(\frac{1}{4}\)
c. \(\frac{1}{10}\)

d. \(\frac{3}{5}\)
e. \(\frac{2}{4}\)
f. \(\frac{1}{5}\)

g. \(\frac{1}{10}\)
h. \(\frac{9}{25}\)
i. \(\frac{3}{20}\)

j. \(\frac{45}{100}\)

Problem solving

If the tenths digit is six and the units digit is three, what should I do to get an answer of 7,644?
Addition, subtraction and multiplication of decimal fractions

Where in everyday life will you use decimal fractions?

Where in everyday life will we add subtract multiply decimal fractions?

1. Calculate.

Example: 2,37 + 4,53 – 3,88
= (2 + 4 – 3) + (0,3 + 0,5 – 0,8) + (0,07 + 0,03 – 0,08)
= 3 + 0 + 0,02
= 3,02

a. 2,15 + 8,21 – 7,21 =

b. 5,34 + 7,42 – 6,38 =

c. 4,29 + 8,34 – 3,38 =

d. 9,77 + 5,14 – 9,53 =

2. Calculate.

Example: 0,2 × 0,3
= 0,02 × 0,3
= 0,006
= 0,0006

a. 0,3 × 0,4 =

b. 0,5 × 0,1 =

c. 0,7 × 0,8 =

d. 0,6 × 0,7 =

e. 0,04 × 0,02 =
3. Calculate.

Example: 0.2 × 10
= 2

a. 0.7 × 8 = ____  b. 0.4 × 9 = ____  c. 0.7 × 8 = ____
d. 0.03 × 8 = ____  e. 0.06 × 5 = ____

4. Calculate.

Example: 0.3 × 0.2 × 100
= 0.06 × 100
= 6

a. 0.3 × 0.5 × 10 =  

b. 0.9 × 0.02 × 10 =  

c. 0.3 × 0.4 × 100 =  

d. 0.8 × 0.04 × 100 =  

e. 0.3 × 0.2 × 100 =  

5. Calculate.

Example: 5.276 × 30
= (5 × 30) + (0.2 × 30) + (0.07 × 30) + (0.006 × 30)
= 150 + 6 + 2.1 + 0.18
= 150 + 6 + 2 + 0.1 + 0.1 + 0.08
= 158 + 0.2 + 0.08
= 158.28

a. 1.365 × 10 =  

b. 4.932 × 30 =  

c. 2.578 × 40 =  

d. 17.654 × 60 =  

e. 28.342 × 20 =  

Make your own decimal problems using the following guidelines

<table>
<thead>
<tr>
<th>+</th>
<th>−</th>
<th>×</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>Weight</td>
<td>Capacity</td>
</tr>
</tbody>
</table>
Dividing decimals

How quickly can you recall the answers?

<table>
<thead>
<tr>
<th>8 ÷ 4 =</th>
<th>35 ÷ 7 =</th>
<th>42 ÷ 7 =</th>
</tr>
</thead>
<tbody>
<tr>
<td>55 ÷ 5 =</td>
<td>63 ÷ 9 =</td>
<td>12 ÷ 2 =</td>
</tr>
<tr>
<td>30 ÷ 5 =</td>
<td>16 ÷ 4 =</td>
<td>81 ÷ 9 =</td>
</tr>
<tr>
<td>121 ÷ 11 =</td>
<td>54 ÷ 6 =</td>
<td>42 ÷ 6 =</td>
</tr>
<tr>
<td>35 ÷ 5 =</td>
<td>125 ÷ 25 =</td>
<td>144 ÷ 12 =</td>
</tr>
</tbody>
</table>

1. Calculate the following.

Example: 0.4 ÷ 2
= 0.2

a. 0.8 ÷ 4 = ______

b. 0.6 ÷ 3 = ______

c. 0.6 ÷ 2 = ______

d. 0.03 × 8 = _____

e. 0.06 × 5 = _____

2. Revision: round off your answers in question 1 to the nearest natural number.

a. __________ b. __________ c. __________ d. __________ e. __________

3. Revision: calculate the following.

Example: 0.25 ÷ 5
= 0.05

a. 0.81 ÷ 9 = _____

b. 0.35 ÷ 7 = _____

c. 0.63 ÷ 7 = _____

d. 0.54 ÷ 6 = _____

e. 0.12 ÷ 4 = _____

4. Round off your answers in question 3. to the nearest tenth.

a. __________ b. __________ c. __________ d. __________ e. __________

5. Solve the following problems.

a. I have R45,75. I have to divide it by five. What is the answer?
b. My mother bought 12.8 m of rope. She has to divide it into four pieces. How long will each piece be?

![Diagram](image)

6. Complete the flow diagrams.

a. R0,50
   Divide by 2.
   Round off to the nearest Rand.

b. 2,4 m
   Divide by 8.
   Round off to the nearest m.

c. 5,4 kg
   Divide by 9.
   Round off to the nearest kg.

d. R3,75
   Divide by 25.
   Round off to the nearest Rand.

e. 2,5 ℓ
   Divide by 5.
   Round off to the nearest litre.

f. 1,44 kg
   Divide by 12.
   Round off to the nearest kg.

Problem solving

Divide a decimal fraction (with two places after the decimal sign) by a natural number. If $6 \div 2 = 3$, calculate $0.6 \div 2; 0.06 \div 2; 0.006 \div 2$. What conclusion can you draw from your observations?
Squares and rational numbers

Look at all the examples and work through them.

What do you notice?

\[(0.7)^2 \quad \text{or} \quad \left(\frac{7}{10}\right)^2\]
\[= 0.7 \times 0.7 \quad = \frac{7}{10} \times \frac{7}{10}\]
\[= 0.49 \quad = \frac{49}{100}\]
\[= 0.49\]

\[\sqrt{0.0004} \quad \text{or} \quad \sqrt{\frac{4}{10000}}\]
\[= \sqrt{0.02 \times 0.02} \quad = \sqrt{\frac{2}{100} \times \frac{2}{100}}\]
\[= 0.02 \quad = \frac{2}{100}\]
\[= 0.02\]

\[(0.04)^2 \quad \text{or} \quad \left(\frac{4}{100}\right)^2\]
\[= 0.04 \times 0.04 \quad = \frac{4}{100} \times \frac{4}{100}\]
\[= 0.0016 \quad = \frac{16}{10000}\]
\[= 0.0016\]

\[(0.1)^3 \quad \text{or} \quad \left(\frac{1}{10}\right)^3\]
\[= 0.1 \times 0.1 \times 0.1 \quad = \frac{1}{10} \times \frac{1}{10} \times \frac{1}{10}\]
\[= 0.001 \quad = \frac{1}{1000}\]
\[= 0.001\]

\[(0.01)^3 \quad \text{or} \quad \left(\frac{1}{100}\right)^3\]
\[= 0.01 \times 0.01 \times 0.01 \quad = \frac{1}{100} \times \frac{1}{100} \times \frac{1}{100}\]
\[= 0.000001 \quad = \frac{1}{100000}\]
\[= 0.000001\]

Where in everyday life will you use this?
1. Calculate.

Example 1: \((0.8)^2\)
\[= 0.8 \times 0.8\]
\[= 0.64\]

Example 2: \((1.5)^2\)
\[= 1.5 \times 1.5\]
\[= 2.25\]

a. \((0.6)^2\)

b. \((0.2)^2\)

c. \((0.3)^2\)

d. \((0.1)^2\)

e. \((0.5)^2\)

f. \((0.4)^2\)

g. Add a, b, c and d.

2. Calculate.

Example 1: \((0.06)^2\)
\[= 0.06 \times 0.06\]
\[= 0.0036\]

Example 2: \((0.13)^2\)
\[= 0.0169\]

a. \((0.03)^2\)

b. \((0.05)^2\)

c. \((0.01)^2\)

d. \((0.04)^2\)

e. \((0.12)^2\)

f. \((0.16)^2\)

g. Add a and b and then subtract e from your answer.

continued
3. Calculate.

Example: \(\sqrt{0.04}\)
\[= \sqrt{0.2 \times 0.2}\]
\[= 0.2\]

a. \(\sqrt{0.9}\)  
b. \(\sqrt{0.1}\)  
c. \(\sqrt{0.25}\)

d. \(\sqrt{0.36}\)  
e. \(\sqrt{0.49}\)  
f. \(\sqrt{0.81}\)

4. Calculate.

Example: \(\sqrt{0.0004}\)
\[= \sqrt{0.02 \times 0.02}\]
\[= 0.02\]

a. \(\sqrt{0.0009}\)  
b. \(\sqrt{0.0016}\)  
c. \(\sqrt{0.0001}\)

d. \(\sqrt{0.0049}\)  
e. \(\sqrt{0.0004}\)  
f. \(\sqrt{0.0121}\)

5. Calculate.

Example: \((0.2)^3\)
\[= 0.2 \times 0.2 \times 0.2\]
\[= 0.008\]

a. \((0.3)^3\)  
b. \((0.1)^3\)  
c. \((0.4)^3\)
6. Calculate.

Example: \( (0.02)^3 \)
\[ = 0.02 \times 0.02 \times 0.02 \]
\[ = 0.000008 \]

a. \( (0.03)^3 \)

b. \( (0.02)^3 \)

c. \( (0.04)^3 \)

7. Calculate.

Example: \( \sqrt[3]{0.027} \)
\[ = \sqrt[3]{0.3 \times 0.3 \times 0.3} \]
\[ = 0.3 \]

a. \( \sqrt[3]{0.008} \)

b. \( \sqrt[3]{0.064} \)

c. \( \sqrt[3]{0.001} \)

8. Calculate.

Example: \( \sqrt[3]{-0.027} \)
\[ = \sqrt[3]{-0.3 \times -0.3 \times -0.3} \]
\[ = -0.3 \]

a. \( \sqrt[3]{-0.008} \)

b. \( \sqrt[3]{-0.064} \)

c. \( \sqrt[3]{-0.001} \)

Problem solving

a. If the side of a square tile is 0.6 m, what is the area of the tile?

b. We can find \( \sqrt[3]{0.064} \). Can we find \( \sqrt{-0.9} \)? Why or why not?

c. If the height of a cube is 0.35 m, what is the volume of the cube?
Pythagoras’ theorem

1. Write an equation for the following and verify whether the left hand side is equal to the right hand side:

   \[ 3^2 = 3 \times 3 \]
   \[ 4^2 = 4 \times 4 \]
   \[ 5^2 = 5 \times 5 \]
   \[ 3^2 + 4^2 = 5^2 \]
   \[ 9 + 16 = 25 \]
   \[ 25 = 25 \]

2. Draw right-angled triangles with the dimensions as given in the table below.

<table>
<thead>
<tr>
<th>Side A</th>
<th>Side B</th>
<th>Side C</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. 6</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>b. 15</td>
<td>20</td>
<td>25</td>
</tr>
<tr>
<td>c. 27</td>
<td>36</td>
<td>45</td>
</tr>
<tr>
<td>d. 12</td>
<td>16</td>
<td>20</td>
</tr>
<tr>
<td>e. 21</td>
<td>28</td>
<td>35</td>
</tr>
</tbody>
</table>

What is the size of A?
What is the size of B?
What is the size of C?
What do you notice?
3. What is the hypotenuse? Highlight it in all your drawings:

The Pythagorean Theorem states that in a right-angled triangle, the sum of the squares of the two right-angle sides will always be the same as the square of the hypotenuse. (The hypotenuse is always the longest side.)

\[ A^2 + B^2 = C^2. \]

4. Find out who Pythagoras was and write a paragraph about him.

### Activity

Give two examples of where we can use Pythagoras' theorem in everyday life.
Look at the example and explain it.

\[ \begin{align*}
4^2 + 3^2 &= 5^2 \\
16 + 9 &= 25 \\
25 &= 25
\end{align*} \]

\[ a^2 + b^2 = c^2 \]

1. Write an equation for the following and calculate each side:

   a. \[ \begin{align*}
   8^2 + 6^2 &= 10^2 \\
   64 + 36 &= 100 \\
   100 &= 100
   \end{align*} \]

   b. \[ \begin{align*}
   104^2 + 78^2 &= 130^2 \\
   10816 + 6084 &= 16900 \\
   16900 &= 16900
   \end{align*} \]

   c. \[ \begin{align*}
   33^2 + 44^2 &= 55^2 \\
   1089 + 1936 &= 3025 \\
   3025 &= 3025
   \end{align*} \]

   d. \[ \begin{align*}
   68^2 + 51^2 &= 85^2 \\
   4624 + 2601 &= 7225 \\
   7225 &= 7225
   \end{align*} \]

2. Write an equation for the following:

   a. \[ \begin{align*}
   x^2 + y^2 &= z^2 \\
   \end{align*} \]

   b. \[ \begin{align*}
   n^2 + m^2 &= o^2 \\
   \end{align*} \]

   c. \[ \begin{align*}
   g^2 + h^2 &= i^2 \\
   \end{align*} \]

   d. \[ \begin{align*}
   s^2 + r^2 &= t^2 \\
   \end{align*} \]
A fractal is a geometric shape all of the parts of which are similar to each other whatever the scale. If you split a fractal into parts each part is approximately a reduced-size copy of the whole.

3. This is a fractal using the Theorem of Pythagoras. Copy and explain it.

Pythagoras fractal tree fun

Copy this Pythagoras fractal tree with a family member
More on the Theorem of Pythagoras

What is the value of $x$?

$x^2 = (3 \text{ cm})^2 + (4 \text{ cm})^2$

$x^2 = 9 \text{ cm}^2 + 16 \text{ cm}^2$

$x = \sqrt{25 \text{ cm}^2}$

$x = 5 \text{ cm}$

1. Find the lengths of the unknown sides in the following right–angled triangles. You may use a calculator.

Example: See introduction.

a. $4 \text{ cm}$

b. $3.5 \text{ cm}$

c. $7 \text{ cm}$

d. $15 \text{ cm}$

Remember the hypotenuse is the side opposite the right angle in a right–angled triangle.
2. Find the length of the hypotenuse.

Example:

\[
\text{hypotenuse} = \sqrt{4^2 + 6^2} \\
= \sqrt{16 + 36} \\
= \sqrt{52} \\
= 7,2 \text{ cm}
\]

a. 12 cm 8 cm

b. 3 cm 6 cm

Investigation

The area of the semi-circle on the hypotenuse equals the sum of the areas of the semi-circles on the other two sides. Use any Pythagorean triplet to verify this.
Theorem of Pythagoras

Calculate the length of the diagonal of the rectangle. See the examples below.

3 cm
4 cm

\[ x^2 = (3\text{ cm})^2 + (4\text{ cm})^2 \]
\[ x^2 = 9\text{ cm}^2 + 16\text{ cm}^2 \]
\[ x^2 = 25\text{ cm}^2 \]
\[ x = \sqrt{25}\text{ cm} \]
\[ x = 5\text{ cm} \]

5 cm
8 cm

\[ x^2 = (5\text{ cm})^2 + (8\text{ cm})^2 \]
\[ x^2 = 25\text{ cm}^2 + 64\text{ cm}^2 \]
\[ x^2 = 89\text{ cm}^2 \]
\[ x = 9.43\text{ cm} \]

1. Calculate the lengths of the diagonal of the rectangles
   a. 28 mm
   b. 40 mm
   c. 36 mm

MATHS Gr8 B2 Theme 2.indd   38
2019/06/28   09:16:25
2. Calculate the lengths of the diagonal of the rectangles.

a. 2 cm

b. 9.2 cm

c. 11 cm

d. 3.3 cm

Problem solving

Create your own problem using the Theorem of Pythagoras problem.
Go through the example. Explain.

(16 cm)² = x² + (5 cm)²
256 cm² = x² + 125 cm²
x² = 131 cm²
\( \sqrt{x^2} = \sqrt{131} \text{ cm}^2 \)
x = 11.45 cm

1. Calculate the lengths of the unknown sides in each of the following isosceles triangles.

a. 

b. 

75 mm
60 mm
10.8 cm
5.4 cm
Problem solving

A truck is moving up a ramp. It is now 1 metre higher than the ground level. The distance from the beginning of the ramp to where the truck is now is 2 metres. How long is the ramp?

2. Solve the following: James and Lebo are meeting at the Corner Cafe on the corner of Park and Tree Street. Presently, James is on Park Street and is 8 kilometres away. Meanwhile, Lebo is on Tree Street 7 kilometres away. What is their direct (shortest) distance from each other?
Area and perimeter of a square

If the area is 2 025 mm² what will the answer be in cm²?

What is the perimeter of a square?

1 cm = 10 mm
1 cm² = 1 cm × 1 cm
1 cm² = 10 mm × 10 mm
1 cm² = 100 mm²

\[
\frac{2 025 \text{ mm}^2}{100} = 20.25 \text{ cm}^2
\]

1. Calculate.
   i. Area of a square.
   ii. Perimeter of a square.
   Give your answers in mm, cm and m.

Example: A square with side 2.5 cm.

<table>
<thead>
<tr>
<th>Perimeter</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>( P = 4s )</td>
<td>( A = s^2 )</td>
</tr>
<tr>
<td>= 4 (2.5 cm)</td>
<td>= 2.5 cm × 2.5 cm</td>
</tr>
<tr>
<td>= 10 cm</td>
<td>= 6.25 cm²</td>
</tr>
</tbody>
</table>

Millimetre

| = 4 (25 mm) | = 25 mm × 25 mm |
| = 100 mm    | = 625 mm²      |

Metre

| = 4 (0.025) | = 0.025 m × 0.025 m |
| = 0.1 m     | = 0.000625 m²      |

Answers in mm

\[
\begin{align*}
\text{Perimeter} & = 4 (45 \text{ mm}) \\
& = 180 \text{ mm} \\
\text{Area} & = 45 \text{ mm} \times 45 \text{ mm} \\
& = 2 025 \text{ mm}^2
\end{align*}
\]
2. Using the area of a square given below, calculate the length of one side and then calculate the perimeter.

Example: \( A = s^2 \)
\( \sqrt{s^2} = \sqrt{1.44cm^2} \)
\( s = 1.2cm \)

a. 6.76 m\(^2\)  

b. 102.01 cm\(^2\)  

c. 29.16 cm\(^2\)  

d. 51.84 m\(^2\)  

3. Draw each of the squares in question 2. Use a protractor and a ruler.

a.  

b.  

continued
### Area and perimeter of a square

**c.**

**d.**

#### 4. Write the following in mm\(^2\)

**Example:**

- 1.44 cm\(^2\)
- \(1.2 \text{ cm} \times 1.2 \text{ cm}\)
- 12 mm \(\times\) 12 mm
- 144 mm\(^2\)

\[\sqrt{1.44} = 1.2\]

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a. 3.24 cm(^2)</td>
<td>b. 5.29 cm(^2)</td>
</tr>
</tbody>
</table>

#### 5. Write the following in cm\(^2\)

**Example:**

- 256 mm\(^2\)
- \[
\frac{256 \text{ mm}^2}{100}
= 2.56 \text{ cm}^2
\]

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a. 576 mm(^2)</td>
<td>b. 3769 mm(^2)</td>
</tr>
</tbody>
</table>
c. 1 681 mm²

6. Write the following in m²

Example:

\[
\begin{align*}
21 \text{ cm} \times 21 \text{ cm} &= 441 \text{ cm}² \\
&= \frac{441}{10 000} \text{ m}² \\
&= 0.0441 \text{ m}²
\end{align*}
\]

a. 15 cm × 15 cm

b. 24 cm × 24 cm

Problem solving
I have 32 tiles of 30 cm × 30 cm. Will I be able to cover an area of 3m²?
The area in mm² and m² are:

\[
\begin{align*}
\text{mm}^2 &= 7,98 \text{ cm}^2 \\
&= 7,98 \times 100 \text{ mm}^2 \\
&= 798 \text{ mm}^2 \\
\text{m}^2 &= 7,98 \text{ cm}^2 \\
&= \frac{7,98}{10000} \text{ m}^2 \\
&= 0,000798 \text{ m}^2
\end{align*}
\]

1. Calculate.
   i. Area of a rectangle.
   ii. Perimeter of a rectangle.
   iii. Give your answers in mm, cm and m.

**Example:** 2,1 cm × 1,8 cm

**Perimeter**

\[P = 2 (l + b)\]
\[= 2 (2,1 \text{ cm} + 1,8 \text{ cm})\]
\[= 2 \times (3,9 \text{ cm})\]
\[= 7,8 \text{ cm}\]

**Area**

\[A = l \times b\]
\[= 2,1 \text{ cm} \times 1,8 \text{ cm}\]
\[= 3,78 \text{ cm}^2\]

**Millimetres**

\[= 78 \text{ mm}\]
\[= 3,78 \times 100 \text{ mm}^2\]
\[= 378 \text{ mm}^2\]

**Metres**

\[= 0,078 \text{ m}\]
\[= \frac{3,78}{10000} \text{ m}^2\]
\[= 0,000378 \text{ m}^2\]
Example: Area = 4.14 cm$^2$ and breadth = 1.8 cm

\[
\text{Area} = l \times b \\
4.14 \text{cm}^2 = l \times 1.8 \text{ cm} \\
l = \frac{4.14 \text{cm}^2}{1.8 \text{cm}^2} \\
l = 2.3 \text{ cm}
\]

\[
\text{Perimeter} = 2(l + b) \\
= 2(2.3 \text{ cm} + 1.8 \text{ cm}) \\
= 8.2 \text{ cm}
\]

2. Using the area of a rectangle and the side given below, calculate the unknown side. Hence, calculate the perimeter.

a. Area = 2.7 m$^2$; breadth = 0.9 m

b. Area = 24.9 mm$^2$; length = 3 mm

c. Area = 333.2 m$^2$; length = 24.5 m

d. Area = 46.92 m$^2$; breadth = 12 cm

Problem solving

You need to tile the floor of a room with area of 4.2 m $\times$ 3.5 m. The tiles you want to buy are 45 cm $\times$ 45 cm. How many tiles do you need?
Area of a triangle

**Area of a triangle**

\[ A = \frac{1}{2} b \times h \]

\[ = \frac{1}{2} (5 \text{ cm}) \times 2.3 \text{ cm} \]
\[ = 2.5 \text{ cm} \times 2.3 \text{ cm} \]
\[ = 5.75 \text{ cm}^2 \]

Answer in \text{mm}^2
\[ = 5.75 \times 100 \text{ mm}^2 \]
\[ = 575 \text{ mm}^2 \]

Answer in \text{m}^2
\[ = \frac{5.75}{10,000} \text{ m}^2 \]
\[ = 0.000575 \text{ m}^2 \]

1. **Calculate the area.**

Give your answers in mm, cm and m.

**Example:**
- **Base** = 6 cm
- **Height** = 2.6 cm

**Area** = \( \frac{1}{2} b \times h \)
\[ = \frac{1}{2} (6 \text{ cm}) \times 2.6 \text{ cm} \]
\[ = 3 \text{ cm} \times 2.6 \text{ cm} \]
\[ = 7.8 \text{ cm}^2 \]

**Millimetres:**
\[ = 7.8 \text{ cm}^2 \times 100 \]
\[ = 780 \text{ mm}^2 \]

**Metres:**
\[ = \frac{7.8 \text{ cm}^2}{10,000} \]
\[ = 0.00078 \text{ m}^2 \]

**a.** Base = 8 cm; Height = 1.5 cm

**b.** Base = 4.6 cm; Height = 2.9 cm

**c.** Base = 10 cm; Height = 7.3 cm

**d.** Base = 9.4 cm; Height = 2.25 cm
2. Use the area and the base of each triangle given below to calculate the height.

Example:  
Area = 7.35 cm² and the base = 7cm

Then:  \( \frac{1}{2} \) (7 cm) \( \times \) \( h \) = 7.35 cm²
7.35 cm² = 3.5 cm \( \times \) \( h \)
\( h = \frac{7.35 \text{ cm}^2}{3.5 \text{ cm}} \)
\( h = 2.1 \text{ cm} \)

a. Area = 16.2 cm²; base = 4cm
b. Area = 5.52 cm²; base = 10cm
c. Area = 33.12 m²; base = 12m

3. Draw the height of each triangle and calculate the area. You will need a ruler.

Note: the height of a triangle is the line segment drawn from any vertex perpendicular to the opposite side.

Example:

Problem solving

The triangular area is 10.53 m². You have 2,025 cm² tiles. How many do you need to tile the area?
Look at following and discuss.

Do you still remember:
- the radius is the distance from the centre of the circle to any point on its circumference.
- the diameter starts at the side of the circle, goes through the centre and ends on the other side.

Here are a few formulas to remember when working with circles.

The diameter of a circle: \( d = 2r \)

The circumference of a circle: \( c = \pi d \) or \( c = 2\pi r \)

The area of a circle is \( A = \pi r^2 \)

1. Calculate the area of the circle if the radius is equal to:

Example: The radius of the circle is 3 cm

\[
A = \pi r^2 \\
= (3.14159) (3^2) \\
= 28.27 \text{ cm}^2
\]

a. 4 cm  
b. 2.8 cm  
c. 3.7 cm  
d. 4.3 cm  
e. 5.9 cm  
f. 10.1 cm
2. Calculate the radius of the circle if the area is equal to:

Example: If \( A = \pi r^2 \)

- \( 40.265 \text{ cm}^2 = (3.14159) (r^2) \)
- \( r^2 = 16 \)
- \( r = 4 \text{ cm} \)

| a. 12,566 cm\(^2\) | b. 78.54 cm\(^2\) | c. 113,098 cm\(^2\) | d. 314,159 cm\(^2\) |

3. Calculate the area of this figure.

a. [Diagram of a rectangle and a semicircle]

b. 25 cm

c. 35 cm

d. [Area calculation]

4. Solve the following: A sprinkler that sprays water in a circular area can be adjusted to spray up to 10 m. To the nearest tenth, what is the maximum area of lawn that can be watered by the sprinkler?

- [Area calculation]

Problem solving

Mandla draws a circle with a diameter of 16 cm. He colours one half of the circle. What is the area of the shaded part?
Area and perimeter problem solving

Match the formulas to the words.

- Perimeter of a square: \( l \times b \)
- Perimeter of a rectangle: \( d = 2r \)
- Area of a square: \( \pi r^2 \)
- Area of a triangle: \( 4s \)
- Diameter of a circle: \( \frac{1}{2} (b \times h) \)
- Area of a rectangle: \( 2 (l + b) \) or \( 2l + 2b \)
- Circumference of a circle: \( \pi d \) or \( 2 \pi r \)
- Area of a circle: \( s^2 \)

1. Solve the following.

a. If the perimeter of a square is 52 cm, what is the length of each side?

b. If the area of a rectangle is 200 cm\(^2\), and its length is 50 cm, what is its breadth?
c. You live in a rectangular-shaped house that is 150 m long and 902 m wide. You want to plant shrubs around the house. You have to plant the shrubs 70 m apart. Approximately how many shrubs will you need to surround the house?

d. A room of which the area is 14,8044 m² has a length which is 100 cm longer than the width. What are the dimensions of the room?

e. Calculate the area of the circular fish pond with a diameter of 3m. Let \( \pi \) be 3.14.

Problem solving

Calculate the area of the circular sector of which the cord (3cm) is the side of the square inscribed in a circle with a radius of \( 3\sqrt{2} \) cm.
Surface area, volume and capacity of a cube

Volume of a cube
\[ V = s^3 \]

Surface area of a cube
\[ A = \text{the sum of the area of all the faces.} \]

Capacity of a cube
- An object with a volume of 1 cm\(^3\) will displace exactly 1 ml of water.
- An object with a volume of 1 m\(^3\) will displace exactly 1 kl of water.

1. Calculate the volume, capacity and surface area of the following cubes:

Example:

<table>
<thead>
<tr>
<th>Length: 4 cm</th>
<th>Volume</th>
<th>Capacity</th>
<th>Surface area</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ V = l^3 ]</td>
<td>( V = (4 \text{ cm})^3 )</td>
<td>( V = 64 \text{ cm}^3 )</td>
<td></td>
</tr>
</tbody>
</table>

Note: An object with a volume of 1 cm\(^3\) will displace 1 ml of water.
\[ \therefore \text{an object that is 64 cm}^3 \text{ will displace 64 ml water or 0,064 l.} \]

Net of the cube: how many faces are there?

Surface area = sum of all the area of all the faces.
\[ = 6 \text{ (area of a face)} \]
\[ = 6a^2 \]
\[ = 6 \times 16 \text{ cm}^2 \]
\[ = 96 \text{ cm}^2 \]
Problem solving

How much water can a container of 32 cm by 32 cm by 32 cm contain?

<table>
<thead>
<tr>
<th></th>
<th>How much</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>Length: 2 cm</td>
<td></td>
</tr>
<tr>
<td>b.</td>
<td>Length: 3.2 cm</td>
<td></td>
</tr>
<tr>
<td>c.</td>
<td>Length: 4.6 cm</td>
<td>Breadth: _______</td>
</tr>
<tr>
<td>d.</td>
<td>Area of base: 25 cm²</td>
<td>Height: _______</td>
</tr>
<tr>
<td>e.</td>
<td>Length: _______</td>
<td>Breadth: _______</td>
</tr>
<tr>
<td>f.</td>
<td>Area of base: 81 cm²</td>
<td>Height: _______</td>
</tr>
</tbody>
</table>
Surface area, volume and capacity of a prism

**Volume of a prism**

\[ V = l \times b \times h \]

**Surface area of a prism**

\[ A = \text{the sum of the area of all the faces.} \]

- If 1 cm = 10 mm, then 1 cm\(^2\) = 100 mm\(^2\)
- If 1 m = 100 cm, then 1 m\(^2\) = 10 000 cm\(^2\)
- If 1 cm = 10 mm, then 1 cm\(^3\) = 1 000 mm\(^3\)
- If 1 m = 100 cm, then 1 m\(^3\) = 1 000 000 cm\(^3\) or 10\(^6\) cm\(^3\)

**Example:**

\[
V = l \times b \times h \\
V = 4 \text{ cm} \times 2 \text{ cm} \times 1.5 \text{ cm} \\
V = 12 \text{ cm}^3
\]

Note: An object with a volume of 1 cm\(^3\) will displace exactly 1 ml of water.

**Capacity of a prism**

- An object with a volume of 1 m\(^3\) will displace exactly 1 kl of water.

1. Calculate the volume, capacity and surface area of the prisms.

<table>
<thead>
<tr>
<th>Volume</th>
<th>Capacity</th>
<th>Surface area</th>
</tr>
</thead>
</table>
| 4 cm   | Note: An object with a volume of 1 cm\(^3\) will displace exactly 1 ml of water. 
∴ an object that is 12 cm\(^3\) will displace 12 ml. |
| Describe the faces. |

\[
\text{Surface area}: \\
A = 2bh + 2hl + 2hb \\
= 2(1.5 \text{ cm} \times 4 \text{ cm}) + 2(4 \text{ cm} \times 1.5 \text{ cm}) \\
= 12 \text{ cm}^2 + 16 \text{ cm}^2 + 6 \text{ cm}^2 \\
= 34 \text{ cm}^2
\]

<table>
<thead>
<tr>
<th>Cubic mm</th>
<th>Cubic cm</th>
<th>Cubic m</th>
<th>Litre</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 000 000 000</td>
<td>1 000 000</td>
<td>1</td>
<td>1 000</td>
</tr>
<tr>
<td>1 000 000</td>
<td>1 000</td>
<td>0.001</td>
<td>1</td>
</tr>
<tr>
<td>1 000</td>
<td>1</td>
<td>0.000001</td>
<td>0.001</td>
</tr>
</tbody>
</table>
2. Give examples of where you would need to work out the volume and the surface area of a rectangular prism:

_______________________________________________________________________________
_______________________________________________________________________________
_______________________________________________________________________________
_______________________________________________________________________________

**Problem solving**

A box has a square base with sides of 8 cm. What is the height of the box if its volume is 384 cm³?
Volume of triangular prisms

What geometric object is this A-frame house?
What will the geometric object's breadth be?
How many faces does the object have?
Visualising the house, what do you think its dimensions are (area of base (the floor) and the height of the building)?

Volume of a triangular prism = the area of the triangle x Height (of the prism)
The area of a triangle is \( \frac{1}{2} \) the triangle base breadth x the triangle height. Volume of a triangular prism = the area of the triangle x Height (of the prism).

1. Calculate the volume:

Example:

\[
= \left( \frac{1}{2} \times b \times h \right) \times H \\
= \left( \frac{1}{2} \times 5 \text{ cm} \times 4 \text{ cm} \right) \times 6 \text{ cm} \\
= \left( \frac{1}{2} \times \frac{4}{1} \text{ cm} \right) \times 6 \text{ cm} \\
= \frac{20}{2} \text{ cm}^2 \times 6 \text{ cm} \\
= 10 \text{ cm}^2 \times 6 \text{ cm} \\
= 60 \text{ cm}^3
\]

a.

Volume of a triangular prism = the area of the triangle x Height (of the prism)
2. Using the formula $V = \frac{1}{2} (b \times h) \times H$, calculate the value of the unknown in each of the following:

a. $H = 10\text{cm}; \ b = 6\text{cm} \text{ and } h = 4\text{cm}$

b. $V = 480\text{m}^3; \ b = 8\text{m} \text{ and } h = 4\text{m}$

c. $V = 48\text{mm}^3; \ H = 3\text{mm} \text{ and } h = 4\text{mm}$

d. $V = 63\text{cm}^3; \ b = 6\text{cm} \text{ and } H = 7\text{cm}$

**Problem solving**

A water tank has the shape of a triangular prism. The base of the tank has an area of 160cm². The height of the prism is 100cm. If the tank is filled to its $\frac{3}{4}$ mark, calculate its volume.
Surface area, volume and capacity of a triangular prism

Volume of a triangular prism
\[ V = \frac{1}{2} (b \times h) \times H \]

Surface area of a rectangular prism
\[ A = \text{the sum of the area of all its faces.} \]

Capacity of a prism
- An object with a volume of 1 cm\(^3\) will displace exactly 1 ml of water.
- An object with a volume of 1 m\(^3\) will displace exactly 1 kl of water.

1. Calculate the volume, capacity and surface area of the triangular prisms.

<table>
<thead>
<tr>
<th>Volume</th>
<th>Capacity</th>
<th>Surface area</th>
</tr>
</thead>
</table>
| \[ V = \frac{1}{2} (b \times h) \times H \]  
\[ V = \frac{1}{2} (6 \text{ cm}) \times 4 \text{ cm} \times 3 \text{ cm} \]  
\[ V = 3 \text{ cm} \times 4 \text{ cm} \times 3 \text{ cm} \]  
\[ V = 36 \text{ cm}^3 \] | Note: An object with a volume of 1 cm\(^3\) will displace 1 ml of water.  
\[ \therefore \text{an object that is } 15 \text{ cm}^3 \text{ will displace } 15 \text{ ml of water.} \] | \[ A = 2 (\text{area of triangle}) + (\text{area of the three rectangles}) \]  
\[ \text{Area of triangles: } = 2 \left( \frac{1}{2} (6 \text{ cm}) \times 4 \text{ cm} \right) = 24 \text{ cm}^2 \]  
Area of middle rectangle = base \times length = 6 cm \times 3 cm = 18 cm\(^2\)  
Area of the other two rectangles = (length \times side of triangle) \times 2  
= (3 cm \times \sqrt{4^2 + 3^2}) \times 2 = (3 cm \times 5 cm) \times 2 = 15 cm^2 \times 2 = 30 cm^2\]  
\[ A = 24 \text{ cm}^2 + 18 \text{ cm}^2 + 30 \text{ cm}^2 = 72 \text{ cm}^2 \] | To find the length of two of the rectangles, we need to use Pythagoras theorem in a triangle.  
The two triangles will be the same size.  
Note that the two triangles are identical, but the three rectangles are different in size.
Problem solving

What is the volume, capacity and surface area of a triangular prism with a base rectangle of 16 cm and which is 4 cm long and 3 cm high?

b. Base of triangle: 3.4 cm
   Height of triangle: 2.9 cm
   Height of prism: 4.5 cm
   Draw:

c. Base of triangle: 7.5 cm
   Height of triangle: 5 cm
   Height of prism: 2 cm
   Draw:
1. Calculate the volume, capacity and surface area of each of the following prisms. Give your answers in mm, cm and m.

a. The length of one edge of a cube is 2,75 cm.

b. The length, breadth and height of a rectangular prism is 4,25 m, 3,75 m and 2,95 m respectively.
Problem solving

Create your own word problems to find the volume, capacity and surface area of a:
• cube
• rectangular prism
• triangular prism

c. The Height of a triangular prism is 4 cm, the triangles' height is 4 cm and the triangles' base is 6 cm.

2. You want to paint the walls and ceiling of a room that measures 3 m x 4 m and is 2.7 m high. One litre tin of paint will cover 8 m². How many tins of paint will you need?
1. Calculate the volume and surface area of a prism if AB = 6 cm, BC = 8 cm and CF = 16 cm.
2. What is the volume, capacity and surface area of this cubic water container? The length of one side is 1.2 m.

3. You want to wrap a box with brown paper. The box is 20 cm x 30 cm x 50 cm. How many rolls of paper do you need if a roll is 30 cm wide and there is 1 m on a roll?

Problem solving

You want to collect rain water for your vegetable garden. The roof of your house is 100 m² and the average annual rainfall in South Africa is 500 mm. How big must the tank be if you want to collect all the water that falls on the roof?
Data handling is a cycle. In the worksheet to follow we are going to learn about this cycle. The part that we are learning about will be in green with some notes.

Here are all the terms you need to know.

The **population** refers to the entire group of individuals or objects in which we are interested in getting data from or about.

If we are able to ask everybody (the whole population) then it is called a **census**.

If the group (population) is very large, we can ask some of the people – this is called a **sample** of the population.

The best way to prevent bias in a survey is to select the sample using a **random sampling method**.

A common method of collecting primary data for a survey is to use a **questionnaire**.

So if we want to know something, we need to start with **posing questions** for data (information) collection.

**Discrete data** is data that can only take certain values.

**Continuous data** is data that can take any value (within a range).
Example:
Classify the following examples as “continuous data” or “discrete data”.
• The number of men and women who attended an event (discrete)
• The mass of the children in your class. (continuous)
• The number of questions in a test (discrete)
• The length of hair-growth over a one-month period (continuous)

You think most people in your school get to school by bus. You want to investigate this by means of a survey. A tally chart can be used to record your data. Write a hypothesis for your survey.
Hypothesis: most learners from our school use the bus to get to school. Who will you use for your survey?
Answer: population – all learners of the school, or a sample – only a portion of them, randomly selected, say 20% per grade.

If the population is too big and you need to select a sample, how will you go about selecting a sample to eliminate bias?
To eliminate bias the sample must be randomly selected across the grades and across the possible transport methods. If we decided to only survey 20% of the population, it will be biased to stand at the bus stop and ask every fifth learner. It will also be biased if we only ask learners in the higher or lower grades. Instead, it will be less biased if we take an alphabetical list of all learners and select every fifth name to participate in the survey.

Design a simple questionnaire for your survey using multiple choice questions. Your data must also include:

a. Grade of learner
b. Gender
c. Means of transport

Transport survey for Georgetown High School
We want to determine the most popular means of transport used by learners to school. Please assist us by answering a few questions.
Which grade are you? (tick the correct box)

<table>
<thead>
<tr>
<th>Grade 8</th>
<th>Grade 9</th>
<th>Grade 10</th>
<th>Grade 11</th>
<th>Grade 12</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Gender? (tick the correct box)

<table>
<thead>
<tr>
<th>Boy</th>
<th>Girl</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Which transport means do you use MOSTLY to get to school? (only tick one box)

<table>
<thead>
<tr>
<th>Walk</th>
<th>Bicycle</th>
<th>Bus</th>
<th>Motorcar</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

If other method, please specify: ____________________________

continued
1. Classify the following data as either discrete data or continuous data.

a. The number of potatoes in a bag is noted by a restaurant cook over several weeks of work.

b. A quality technician records the length of material in a roll product for several products selected from a production line.

c. The number of times that a movement authority is sent to a train from a relay station is recorded for several trains over a two-week period. The movement authority, which is an electronic transmission, is sent repeatedly until a return signal is received from the train.

2. Do a survey of learners in your school to find out what their favourite movie is.

a. Write a hypothesis for your survey project.

b. Who will you ask? Define your population.

c. How will you select a sample from your population?
d. How will you ensure that your survey eliminates bias?

e. Design a simple questionnaire for your survey, using multiple choice questions to establish grade, gender, favourite movie type and favourite movie.

Apply your knowledge

Design the survey
In making a survey, it is very important to decide first what questions you want answered. Make sure that you are asking all the questions that interest you.

There won’t be time to go back to those surveyed to get more information.

Write a hypothesis for your survey.

Create a survey that lists all of the popular cold drinks. Be sure to create an "other" option.

Ask how many cold drinks each student drinks per day. You can define cold drink consumption around a common quantity such as millilitres.

Will the choice of cold drink be discrete or continuous data?
What type of data will the consumption of cold drinks be?
In the previous worksheet we looked at posing a question and collecting data. The next step in the data handling process is to organise data.

We can organise the data using

Tallies \( \text{HIT ///} = 8 \)

Tallying is a way of counting data to make it easy to display in a table. A tally mark is used to keep track of counting.

Frequency tables
A frequency table has rows and columns. When the set of data values is spread out, it is difficult to set up a frequency table for every data value as there will be too many rows in the table. So we group the data into class intervals (or groups) to help us organise, interpret and analyse the data.

Stem–and–leaf tables
Stem–and–leaf tables (plots) are special tables where each data value is split into “leaf” (usually the last digit) and a “stem” (the other digits). The “stem” values are listed down, and the “leaf” values go right (or left) from the stem values. The “stem” is used to group the scores and each “leaf” indicates the individual scores within each group.
Example:
The number of calls from motorists per day for roadside service was recorded for a month. The results were as follows:

<table>
<thead>
<tr>
<th></th>
<th>28</th>
<th>122</th>
<th>217</th>
<th>130</th>
<th>120</th>
<th>86</th>
<th>80</th>
<th>90</th>
<th>120</th>
<th>140</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>70</td>
<td>40</td>
<td>145</td>
<td>187</td>
<td>113</td>
<td>90</td>
<td>68</td>
<td>174</td>
<td>194</td>
<td>170</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>75</td>
<td>104</td>
<td>97</td>
<td>75</td>
<td>123</td>
<td>100</td>
<td>82</td>
<td>109</td>
<td>120</td>
</tr>
</tbody>
</table>

How will we group these numbers into class intervals? What do you suggest? Discuss with others.

Now look at this method.

Smallest value = 28
Highest value = 217
Difference = highest value – smallest value
= 217 – 28
= 189

Now we decide that we want five class intervals.

Therefore: \( \frac{189}{5} = 37.8 \approx 40 \) (round off to the next 10)

Now we can construct a table with three columns, and then write the date groups or class intervals in the first column.

The size of each group is 40.
So the groups will start at 0, 40, 80, 120, 160 and 200 to include all of the data.

<table>
<thead>
<tr>
<th>Class interval</th>
<th>Tally</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 39</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40 – 79</td>
<td></td>
<td></td>
</tr>
<tr>
<td>80 – 119</td>
<td></td>
<td></td>
</tr>
<tr>
<td>120 – 159</td>
<td></td>
<td></td>
</tr>
<tr>
<td>160 – 199</td>
<td></td>
<td></td>
</tr>
<tr>
<td>200 – 239</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: we need six groups (one more than we thought at first).

Next we can go through the list of data values. For the first data value in the list, 28, place a tally mark against the group 0–39 in the second column. For the second data value in the list, 122, place a tally mark against the group 120–159 in the second column. For the third data value in the list, 217, place a tally mark against the group 200–239 in the second column. Continue this process until all of the data values in the set are tallied.

<table>
<thead>
<tr>
<th>Class interval</th>
<th>Tally</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 39</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>40 – 79</td>
<td></td>
<td></td>
</tr>
<tr>
<td>80 – 119</td>
<td></td>
<td></td>
</tr>
<tr>
<td>120 – 159</td>
<td></td>
<td></td>
</tr>
<tr>
<td>160 – 199</td>
<td></td>
<td></td>
</tr>
<tr>
<td>200 – 239</td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

continued
1. The data shows the mass of 40 students in a class to the nearest kg. Draw a frequency table for the data using appropriate class intervals.

<table>
<thead>
<tr>
<th>55</th>
<th>70</th>
<th>57</th>
<th>73</th>
<th>55</th>
<th>59</th>
<th>64</th>
<th>72</th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
<td>48</td>
<td>58</td>
<td>54</td>
<td>69</td>
<td>51</td>
<td>63</td>
<td>78</td>
</tr>
<tr>
<td>75</td>
<td>64</td>
<td>65</td>
<td>57</td>
<td>71</td>
<td>78</td>
<td>76</td>
<td>62</td>
</tr>
<tr>
<td>49</td>
<td>66</td>
<td>62</td>
<td>76</td>
<td>61</td>
<td>63</td>
<td>63</td>
<td>76</td>
</tr>
<tr>
<td>52</td>
<td>76</td>
<td>71</td>
<td>61</td>
<td>53</td>
<td>56</td>
<td>67</td>
<td>71</td>
</tr>
</tbody>
</table>

2. The following table represents the time taken by a group of learners to answer mental maths questions (in seconds). Draw a frequency table for the data using an appropriate scale.

<table>
<thead>
<tr>
<th>20</th>
<th>25</th>
<th>24</th>
<th>33</th>
<th>13</th>
</tr>
</thead>
<tbody>
<tr>
<td>26</td>
<td>8</td>
<td>19</td>
<td>31</td>
<td>11</td>
</tr>
<tr>
<td>16</td>
<td>21</td>
<td>17</td>
<td>11</td>
<td>34</td>
</tr>
<tr>
<td>14</td>
<td>15</td>
<td>21</td>
<td>18</td>
<td>17</td>
</tr>
</tbody>
</table>
3. A researcher was interested in knowing how many telephone calls teenagers make in a month. He monitored the calls of 18 learners randomly selected from your school. The following data was recorded during the month:


Draw a frequency table for the data using an appropriate scale.

Activity

The following table represents the test scores of a class in mathematics.

Draw a frequency table for the data, using an appropriate scale.

<table>
<thead>
<tr>
<th>58</th>
<th>68</th>
<th>60</th>
<th>71</th>
<th>53</th>
<th>62</th>
<th>64</th>
<th>72</th>
</tr>
</thead>
<tbody>
<tr>
<td>63</td>
<td>46</td>
<td>61</td>
<td>52</td>
<td>67</td>
<td>54</td>
<td>63</td>
<td>78</td>
</tr>
<tr>
<td>78</td>
<td>62</td>
<td>68</td>
<td>55</td>
<td>69</td>
<td>81</td>
<td>76</td>
<td>62</td>
</tr>
<tr>
<td>52</td>
<td>64</td>
<td>65</td>
<td>74</td>
<td>59</td>
<td>66</td>
<td>63</td>
<td>76</td>
</tr>
<tr>
<td>55</td>
<td>74</td>
<td>74</td>
<td>59</td>
<td>51</td>
<td>59</td>
<td>67</td>
<td>71</td>
</tr>
</tbody>
</table>
# Summarise data

Read and discuss this table.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Definition</th>
<th>How to calculate</th>
<th>Example Data set: 2, 2, 3, 5, 5, 7, 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>The mean is the total of the numbers divided by how many numbers there are.</td>
<td>To find the mean, you need to add up all the data numbers, and then divide this total by the number of values in the data.</td>
<td>Adding up the numbers gives: (2 + 2 + 3 + 5 + 5 + 7 + 8 = 32). There are seven values, so you divide the total by 7: (32 \div 7 = 4.57)... So the mean is 4.57.</td>
</tr>
<tr>
<td>Median</td>
<td>The median is the middle value that divides the data distribution into two halves.</td>
<td>To find the median, you need to put the values in order, then find the middle value. If there are two values in the middle, then you find the mean of these two values.</td>
<td>The numbers in order: 2, 2, 3, (5), 5, 7, 8. The middle value is marked in brackets, and it is 5. So the median is 5.</td>
</tr>
<tr>
<td>Mode</td>
<td>The mode is the value that appears the most.</td>
<td>The mode is the value which appears most often in the data. It is possible to have more than one mode if there is more than one value which appears the most.</td>
<td>The data values: 2, 2, 3, 5, 5, 7, 8. The values that appear most often are 2 and 5. They both appear more times than any of the other data values. So the modes are 2 and 5.</td>
</tr>
<tr>
<td>Range</td>
<td>The range is the difference between the biggest and the smallest number.</td>
<td>To find the range, you first need to find the lowest and highest values in the data. The range is found by subtracting the lowest value from the highest value.</td>
<td>The data values: 2, 2, 3, 5, 5, 7, 8. The lowest value is 2 and the highest value is 8. Subtracting the lowest from the highest gives: (8 - 2 = 6). So the range is 6.</td>
</tr>
</tbody>
</table>
1. Use the data below and discuss the given answers.

   a. \((2,23,3,3,4)\)
      Answer:
      Range = 21
      Mean = 7
      Median = 3
      Mode(s) = 3

   b. \((1,22,20,29,29,29,24)\)
      Answer:
      Range = 28
      Mean = 22
      Median = 24
      Mode(s) = 29

   c. \((29,9,1,26,25)\)
      Answers:
      Range = 28
      Mean = 18
      Median = 25
      Mode(s) = none

   The mean average is not always a whole number.

Remember to start by arranging the data from small to big when looking at the median.

Note: if there is an even amount of numbers, the median will be the value that is halfway between the middle pair of numbers.

2. Use the data below and calculate:

\[
\begin{array}{cccccccc}
8 & 14 & 15 & 50 & -6 & 19 & 3 & 37 & 12 & 10 \\
\end{array}
\]

   a. The mean

   b. The median

   c. The mode
3. David made a frequency table to show the number of pets owned by 10 people. The range is 6. What might the total number of pets be? Explain.

4. The frequency table of a survey shows a minimum value of 43 and a maximum value of 336. What is the range?

5. Peter’s scores in six subjects are 72, 48, 72, 72, 72, and 84. What is his average score (mean)?
6. The following table represents the percentage of people in each of four age groups who own motor cars. Find the range of the given data.

<table>
<thead>
<tr>
<th>Age in years</th>
<th>Percentage of motor car owners</th>
</tr>
</thead>
<tbody>
<tr>
<td>15–24</td>
<td>17,9</td>
</tr>
<tr>
<td>25–34</td>
<td>45,6</td>
</tr>
<tr>
<td>35–44</td>
<td>66,2</td>
</tr>
<tr>
<td>45–54</td>
<td>74,9</td>
</tr>
</tbody>
</table>

7. The table shows the amount of fruit sold by a street vendor on seven consecutive days. Using the table, calculate the mean number of fruit sold per day. What is the minimum value, maximum value and range?

<table>
<thead>
<tr>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 3</th>
<th>Day 4</th>
<th>Day 5</th>
<th>Day 6</th>
<th>Day 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fruit sold</td>
<td>6</td>
<td>8</td>
<td>10</td>
<td>12</td>
<td>16</td>
<td>4</td>
</tr>
</tbody>
</table>

Problem solving

The scores of learners of four teams, A, B, C, and D, in their math tests were recorded. Each team reported a result of 90%.

Which of the measures of central tendency was used by each team to report its result?

Team A: 85, 81, 91, 96, 97 __________________________
Team B: 93, 92, 90, 90, 91 __________________________
Team C: 85, 81, 94, 93, 90 __________________________
Team D: 85, 89, 90, 90, 90 __________________________

Remember:
We use the following as measures of central tendency:
• mean
• median
• mode
Bar graphs

To record data one can use a bar graph.

A bar graph is a visual display used to compare the frequency of occurrence of different characteristics of data.

This type of display allows us to:
• compare groups of data
• make quick generalisations about the data.

1. The following table shows the sales of cars per month at a second-hand car dealership. Create a bar graph for the data.

<table>
<thead>
<tr>
<th>Month</th>
<th>Cars sold</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>15</td>
</tr>
<tr>
<td>February</td>
<td>14</td>
</tr>
<tr>
<td>March</td>
<td>13</td>
</tr>
<tr>
<td>April</td>
<td>11</td>
</tr>
<tr>
<td>May</td>
<td>9</td>
</tr>
<tr>
<td>June</td>
<td>7</td>
</tr>
<tr>
<td>July</td>
<td>2</td>
</tr>
<tr>
<td>August</td>
<td>7</td>
</tr>
<tr>
<td>September</td>
<td>8</td>
</tr>
<tr>
<td>October</td>
<td>11</td>
</tr>
<tr>
<td>November</td>
<td>12</td>
</tr>
<tr>
<td>December</td>
<td>14</td>
</tr>
</tbody>
</table>

Analyse and interpret your graph and answer the following questions.

a. Where do you think this data came from?
b. How can this data and graph be useful for the car dealer?

c. What scale did you use for your graph? Explain why.

d. Calculate the mean, median and mode for monthly sales.

e. What can you tell from these answers?
f. What is the data range?

---

g. What can you tell from the range about the data?

---

h. Is there any extreme data (very small or large data)? Why do you think this data varies so much from the mean?

---

i. If you want to determine the sales for all second-hand car dealers, how will you go about doing that?
Apply your knowledge

Use data collected from your class about their favourite movie star.

1. Compile a frequency table using tally marks.
2. Draw a bar graph using your frequency table.
3. Analyse and interpret your graph and answer the following questions.
   a. What is the independent variable?
   b. What is the dependent variable?
   c. What are we comparing in this graph?
   d. Who is the favourite movie star?
   e. Who is the least favourite movie star?
   f. What scale did you use for your graph? Explain why.
   g. Calculate the mean, median and mode.
   h. What can these answers tell you?
   i. What is the data range?
   j. What range can you deduce from the data?
   k. If you want to determine the most popular movie star in your school, how will you do that?
   l. How can you avoid any bias in your data?

<table>
<thead>
<tr>
<th>Name</th>
<th>Movie star</th>
<th>Name</th>
<th>Movie star</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denis</td>
<td>Johnny Depp</td>
<td>Elias</td>
<td>Julia Roberts</td>
</tr>
<tr>
<td>John</td>
<td>Julia Roberts</td>
<td>Simon</td>
<td>Nicolas Cage</td>
</tr>
<tr>
<td>Jason</td>
<td>Julia Roberts</td>
<td>Thabo</td>
<td>Will Smith</td>
</tr>
<tr>
<td>Matapelo</td>
<td>Denzil Washington</td>
<td>Susan</td>
<td>Julia Roberts</td>
</tr>
<tr>
<td>Ann</td>
<td>Brad Pitt</td>
<td>James</td>
<td>Johnny Depp</td>
</tr>
<tr>
<td>Opelo</td>
<td>Eddie Murphy</td>
<td>Ben</td>
<td>Brad Pitt</td>
</tr>
<tr>
<td>Lisa</td>
<td>Amanda Seifried</td>
<td>Lauren</td>
<td>Will Smith</td>
</tr>
<tr>
<td>Gugu</td>
<td>Jamie Foxx</td>
<td>Tefo</td>
<td>Denzil Washington</td>
</tr>
<tr>
<td>Sipho</td>
<td>Julia Roberts</td>
<td>Alicia</td>
<td>Johnny Depp</td>
</tr>
<tr>
<td>Lorato</td>
<td>Charlize Theron</td>
<td>Mandla</td>
<td>Julia Roberts</td>
</tr>
</tbody>
</table>
To record data one can use a double bar graph.

**Data handling cycle**
- Start with a question
- Collect the data
- Organise and record data
- Represent the data in a graph
- Interpret the graph
- Answer questions, predict, pose new questions

**Double bar graph**
A double bar graph is similar to a regular bar graph, but gives two pieces of related information for each item on the vertical axis, rather than just one.

This type of display allows us to compare two related groups of data, and to make generalisations about the data quickly.

**Example:**
Remember that the two sets of data on a double bar graph must be related.

### Test results

<table>
<thead>
<tr>
<th></th>
<th>Term 1</th>
<th>Term 2</th>
<th>Term 3</th>
<th>Term 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Literacy %</strong></td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td><strong>Mathematics %</strong></td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
</tbody>
</table>

1. The table below represents the expenditure per learner for primary and high schools. Draw a double bar graph.

<table>
<thead>
<tr>
<th></th>
<th>Expenditure per learner</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year</td>
<td>Primary schools</td>
</tr>
<tr>
<td>1985</td>
<td>325</td>
</tr>
<tr>
<td>1990</td>
<td>361</td>
</tr>
<tr>
<td>1995</td>
<td>418</td>
</tr>
<tr>
<td>2000</td>
<td>425</td>
</tr>
</tbody>
</table>

Analyse the data and answer the following questions.

a. What is the independent variable?
2. From 1994 to 2006, the percentage of households in this town that recycled their waste increased. Examine the table to see how many households are helping our environment.

<table>
<thead>
<tr>
<th></th>
<th>Households that recycle</th>
<th>Metal cans</th>
<th>Plastics</th>
<th>Paper</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994</td>
<td></td>
<td>56%</td>
<td>52%</td>
<td>58%</td>
</tr>
<tr>
<td>2006</td>
<td></td>
<td>81%</td>
<td>84%</td>
<td>83%</td>
</tr>
</tbody>
</table>

Draw a double bar graph to illustrate the increase.

b. What is the dependent variable?

c. What are we comparing with this graph?

d. In general, what can we say about the expenditure per learner?
Double bar graphs continued

Analyse your graph and answer the following questions.

a. Where do you think this data came from?

b. How can this data and graph be useful for recycling companies?

c. What scale did you use for your graph? Explain why.

d. Calculate the mean, median and mode.

e. Compare the mean, median and mode for 1994 to 2006.

f. What conclusions can you make from these answers?

g. What is the data range?
h. What does the range tell you about the data?

i. How can you avoid bias in your data?

3. The table shows the median age of men and women at the time of their first marriage. Create a double bar graph to represent this data. What conclusions can you draw?

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Men</td>
<td>24.3</td>
<td>22.8</td>
<td>22.8</td>
<td>23.2</td>
<td>24.7</td>
<td>26.1</td>
</tr>
<tr>
<td>Women</td>
<td>21.5</td>
<td>20.3</td>
<td>20.3</td>
<td>20.8</td>
<td>22</td>
<td>23.9</td>
</tr>
</tbody>
</table>

Applying your knowledge

Jerry asked 26 children in her class how many hours per day they watch TV and how much time they spend doing homework.

<table>
<thead>
<tr>
<th></th>
<th>TV</th>
<th>Homework</th>
<th>TV</th>
<th>Homework</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>1.5</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>3</td>
<td>1.5</td>
<td>2.5</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>2.5</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>3</td>
<td>3.5</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>1.5</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>2</td>
<td>3.5</td>
<td>1.5</td>
</tr>
</tbody>
</table>

a. Make a frequency table.
b. Make a bar graph.
c. Compare the mean, median and modes for watching TV and doing homework.
d. What conclusion can you make from this information? Explain.
To represent data one can use a histogram.

A histogram is a particular kind of bar graph that summarises data points falling in various ranges.

The main difference between a normal bar graph and a histogram is that a bar graph shows you the frequency of each element in a set of data, while a histogram shows you the frequencies of a range of data.

In a histogram the bars must touch, because the data elements we are recording are numbers that are grouped, and form a continuous range from left to right.

Revise the steps in constructing a histogram

Constructing a histogram
Step 1 – Count the number of data points.
Step 2 – Summarise on a tally sheet.
Step 3 – Compute the range.
Step 4 – Determine the number of intervals.
Step 5 – Compute the interval width.
Step 6 – Determine the interval starting points.
Step 7 – Count the number of points in each interval.
Step 8 – Plot the data.
Step 9 – Add a title and a legend.

Revise how to compute the interval width.

Look at the following example:

<table>
<thead>
<tr>
<th>Height of learners</th>
</tr>
</thead>
<tbody>
<tr>
<td>135-140</td>
</tr>
<tr>
<td>141-145</td>
</tr>
<tr>
<td>146-150</td>
</tr>
<tr>
<td>151-155</td>
</tr>
<tr>
<td>156-160</td>
</tr>
<tr>
<td>161-165</td>
</tr>
</tbody>
</table>

Data handling cycle

Answer question, predict, pose new questions
Collect the data
Interpret the graph
Organise and record data
Represent the data in a graph

Smallest value = 28
Highest value = 217
Difference = highest value – smallest value
= 217 – 28
= 189

Now we decide that we want five class intervals.
Therefore: \( \frac{37.8}{40} \) (round up to the next 10)
Once we have determined the range and the class intervals, we must organise the data into a frequency table.

<table>
<thead>
<tr>
<th>Class interval</th>
<th>Tally</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 39</td>
<td>/</td>
<td>1</td>
</tr>
<tr>
<td>40 – 79</td>
<td>/////</td>
<td>5</td>
</tr>
<tr>
<td>80 – 119</td>
<td>/////</td>
<td>12</td>
</tr>
<tr>
<td>120 – 159</td>
<td>/////</td>
<td>8</td>
</tr>
<tr>
<td>160 – 199</td>
<td>/////</td>
<td>4</td>
</tr>
<tr>
<td>200 – 239</td>
<td>/</td>
<td>1</td>
</tr>
</tbody>
</table>

With the data in a frequency table, it is easy to construct a histogram.

1. Draw a histogram based on the following set of numbers.

124 128 135 135 137 138 145 155 160 185 189 202 209 232 15
56 70 98 100 105 105 110 111 112 116 120 120 127 130 130 134

a. Compute the range.
b. Determine the number of intervals.

c. Compute interval width – show your calculations.

d. Determine interval starting points.

e. Count the number of points in each interval from the frequency table.

f. Plot the data.

g. Add a title and a legend.
Problem solving

A bank wants to improve its customer service. Before deciding to hire more workers, the manager decides to get some information on the waiting times customers currently experience. During a week, 50 customers were randomly selected, and their waiting times recorded. This is the data collected:

a. Draw a frequency table of the data.
b. Create a histogram.
c. Must she hire more people? Explain your reasoning.

<table>
<thead>
<tr>
<th>18.5</th>
<th>9.1</th>
<th>3.1</th>
<th>6.2</th>
<th>1.3</th>
<th>0.5</th>
<th>4.2</th>
<th>5.2</th>
<th>0.0</th>
<th>10.8</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.8</td>
<td>1.8</td>
<td>1.5</td>
<td>1.9</td>
<td>0.4</td>
<td>3.5</td>
<td>8.5</td>
<td>11.1</td>
<td>0.3</td>
<td>1.2</td>
</tr>
<tr>
<td>4.4</td>
<td>3.8</td>
<td>5.8</td>
<td>1.9</td>
<td>3.6</td>
<td>2.5</td>
<td>4.5</td>
<td>5.8</td>
<td>1.5</td>
<td>0.7</td>
</tr>
<tr>
<td>0.8</td>
<td>0.1</td>
<td>9.7</td>
<td>2.6</td>
<td>0.8</td>
<td>1.2</td>
<td>2.9</td>
<td>3.0</td>
<td>3.2</td>
<td>2.8</td>
</tr>
<tr>
<td>10.9</td>
<td>0.1</td>
<td>5.9</td>
<td>1.4</td>
<td>0.3</td>
<td>5.5</td>
<td>4.8</td>
<td>0.9</td>
<td>1.6</td>
<td>2.2</td>
</tr>
</tbody>
</table>

Find the mean, the median and the mode.
More on histograms

Read and discuss.

Part of the power of histograms is that they allow us to analyse extremely large data sets by reducing them to a single graph that can show primary, secondary and tertiary peaks in data as well as give a visual representation of the statistical significance of those peaks.

This plot represents data with a well-defined peak that is close to the median and the mean. While there are “outliers,” they are of relatively low frequency. Thus it can be said that there is a low frequency of deviations in this data group.

Example:

Histograms can come in different shapes. The two most common shapes are the bell-shaped curve also known as the “normal distribution,” and the skewed distribution.

Looking at these three histograms, what can you tell us about the height of the learners in the class?

- In histogram A, most learners are close to the average height, with a few learners taller and a few learners shorter.
- In histogram B, most learners are short with a few learners who are very tall.
- In histogram C, most learners are tall with a few learners who are very short.
1. Look at the following histogram and answer the questions.

![Histogram of Jazz Music Lovers]

- **a.** What shape is this histogram?
- **b.** Which year has maximum support for jazz music?
- **c.** Which year has the minimum number of jazz music lovers?
- **d.** What was the total number of jazz music lovers in 2000–2005?
- **e.** What was the total number of jazz lovers from 2000–2010?
- **f.** Which decade had the most jazz music lovers?
- **g.** What can you conclude about jazz music lovers if you look at this graph?

*continued*
2. Answer the following questions about this histogram.

![Histogram](image)

**Project hours worked**

- **1-10 Hours**
- **11-20 Hours**
- **21-30 Hours**
- **31-40 Hours**

Number of people

a. What is the shape of the graph?

b. How many hours did less than 10 people work?

c. How many hours did at least 20 people work?

d. How many people worked for at least 20 hours?
Consider the following data set.

<table>
<thead>
<tr>
<th>57</th>
<th>66</th>
<th>73</th>
<th>92</th>
<th>77</th>
</tr>
</thead>
<tbody>
<tr>
<td>31</td>
<td>60</td>
<td>32</td>
<td>22</td>
<td>25</td>
</tr>
<tr>
<td>45</td>
<td>36</td>
<td>49</td>
<td>42</td>
<td>56</td>
</tr>
<tr>
<td>37</td>
<td>88</td>
<td>41</td>
<td>54</td>
<td>42</td>
</tr>
<tr>
<td>57</td>
<td>63</td>
<td>59</td>
<td>15</td>
<td>62</td>
</tr>
<tr>
<td>3</td>
<td>32</td>
<td>82</td>
<td>48</td>
<td>37</td>
</tr>
<tr>
<td>78</td>
<td>18</td>
<td>39</td>
<td>77</td>
<td>97</td>
</tr>
</tbody>
</table>

a. Sort the data in increasing (ascending) order.
b. Make a histogram for this data with intervals 0–19, 20–39, 40–59, 60–79, and 80–99.
c. Make another histogram for this data with intervals 0–50 and 51–99.
d. Make a histogram for this data with intervals 0–4, 5–9, 10–14, 15–19, . . . , 85–89, 90–94, and 94–99.
e. Discuss the advantages and disadvantages of each of the histograms.
f. What do you learn from each?
g. Overall, which one is the most informative? Why? Write a short paragraph in which you discuss what your two histograms reveal.
To record data one can use a pie chart.

Pie chart
A pie chart is a circular chart in which the circle is divided into sectors.

Each sector visually represents an item in a data set to match the amount of the item as a percentage or fraction of the total data set. (the whole circle)
Pie charts are useful to compare different parts of a whole amount.

Revise the pie chart and how to draw a pie chart.

Steps:
1. Convert all of your data points to percentages of the whole data set.
2. Convert the percentages into angles. Since a full circle is 360 degrees, multiply this by the percentages to get the angle for each section of the pie.
3. Draw a circle on a blank sheet of paper, using a compass. While a compass is not necessary, using one will make the chart much neater and clearer by ensuring that the circle is even.
4. Draw a horizontal line, or radius, from the centre to the right edge of the circle, using a ruler or straight edge. This will be the first base line.
5. Measure the largest angle in the data with the protractor, starting at the baseline, and mark it on the edge of the circle. Use the ruler to draw another radius to that point.
6. Use this new radius as a base line for your next largest angle and continue this process until you get to the last data point. You will only need to measure the last angle to verify its value since both lines will already be drawn.
7. Label and shade the sections of the pie chart to highlight whatever data is important for your use.
1. Ahmed is the treasurer of the grade 8 class at the Langalibalele High School. His class raised money for activities through various events. The total amount raised was R2 440. Ahmed used a pie graph to show the amount of money each event raised.

Study the graph and answer the following questions.

![Funds-raising events pie chart]

a. What percentage of the total money was raised at the flea market?

b. How much money was raised at the flea market?

c. What percentage of the total money was raised at the car wash?

d. How much money was raised at the car wash?

continued
e. How much more money was raised at the flea market than at the car wash?

f. How much money was raised at the cake sale?


g. How much more money was raised at the dance than at the cake sale?


h. Calculate the difference between the money raised at the flower sale and at the dinner.


i. Ahmed offered a suggestion for next year. Since the flea market and dance raised about half of the total amount of money, he feels that the class should have two dances and two flea markets instead of the car wash and the dinner. Do you agree? Explain.
2. Look at the two pie charts below and say if you agree with this statement: ‘More grade 9 learners travel to school by car in school A than in school B’. Give reasons for your answer.

3. Your expenditure for the week is:

<table>
<thead>
<tr>
<th>Expense</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rent</td>
<td>450.75</td>
</tr>
<tr>
<td>Food</td>
<td>220.50</td>
</tr>
<tr>
<td>Transport</td>
<td>77.88</td>
</tr>
</tbody>
</table>

Draw a pie chart to display this information.

Problem solving

A sample shows that on average every person in South Africa generates 240 g of plastic waste per day.

This table shows the different categories of plastic waste and the amount in grams generated per day. Draw a pie chart to display this information.

<table>
<thead>
<tr>
<th>Category</th>
<th>Plastic waste generated per person per day (in grams)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PET</td>
<td>120</td>
</tr>
<tr>
<td>PVC</td>
<td>48</td>
</tr>
<tr>
<td>PS</td>
<td>24</td>
</tr>
<tr>
<td>HDPE</td>
<td>12</td>
</tr>
<tr>
<td>LDPE</td>
<td>31.2</td>
</tr>
<tr>
<td>PP</td>
<td>4.8</td>
</tr>
</tbody>
</table>
To represent data one can use a broken line graph. The data is plotted as a series of points that are joined by straight lines.

Line graphs are useful as they show trends and can easily be extended.

The line graph below shows rainfall measured over a period of six months for Town A.

A broken line graph is useful where the data values vary considerably as in the example where the rainfall goes up and down.
Example: Each step in drawing a broken line graph is described.
This example is a graph of the profit you made selling sweets over ten months.

In January a profit of R50 was made.
In February a profit of R120 was made.
The points are connected with a straight line that shows that the profit increased.

In March a profit of R70 was made.
The points, February and March, are connected with a straight line that shows that the profit decreased.

The profit in April was R90, in May it was R100 and in June it was R150.
The points, March, April, May and June, are connected with straight lines that show that the profit increased over these months.

The profit in July was R90, in August it was R70, September it was R60 and in October it was R50.
The points for July, August, September and October are connected with straight lines that show profit decreased over these months.

The graph goes up and down showing profit increase and decrease.
1. Draw a broken line graph of the pulse (heart beat) rate of a Grade 8 learner.

<table>
<thead>
<tr>
<th>Time of the day</th>
<th>Beats per minute</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:00</td>
<td>68</td>
</tr>
<tr>
<td>9:30</td>
<td>73</td>
</tr>
<tr>
<td>10:00</td>
<td>88</td>
</tr>
<tr>
<td>10:30</td>
<td>120</td>
</tr>
<tr>
<td>11:00</td>
<td>77</td>
</tr>
<tr>
<td>11:30</td>
<td>75</td>
</tr>
<tr>
<td>12:00</td>
<td>72</td>
</tr>
<tr>
<td>12:30</td>
<td>72</td>
</tr>
<tr>
<td>13:00</td>
<td>100</td>
</tr>
</tbody>
</table>

a. Describe the graph. Use words such as increase and decrease.

b. Say why you think the pulse rate increases at a certain time of the day.
2. Measure your pulse (heart beat) rate. Draw a graph. Compare it with the graph in question 1.

<table>
<thead>
<tr>
<th>Time of the day</th>
<th>Beats per minute</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:00</td>
<td></td>
</tr>
<tr>
<td>9:30</td>
<td></td>
</tr>
<tr>
<td>10:00</td>
<td></td>
</tr>
<tr>
<td>10:30</td>
<td></td>
</tr>
<tr>
<td>11:00</td>
<td></td>
</tr>
<tr>
<td>11:30</td>
<td></td>
</tr>
<tr>
<td>12:00</td>
<td></td>
</tr>
<tr>
<td>12:30</td>
<td></td>
</tr>
<tr>
<td>13:00</td>
<td></td>
</tr>
</tbody>
</table>

Activity

Find a broken line graph in a newspaper or the internet. Cut and paste it or redraw it in your exercise book and then describe it.
1. Choose which of the following graphs you would use to best represent your data in the following research projects.

A. Bar graph  
B. Histogram  
C. Pie chart

a. The body masses of 500 male learners.

b. The number of students studying History at the different universities in South Africa.

c. The proportion of seedlings in a forest destroyed by fungi, herbivores, pathogens, trampling or wilting.

d. The number of first class degrees in Zoology for each year between 1980 and 1990 at a university.
e. The average number of eggs laid by five varieties of chickens.

f. The number of learners who passed matric with Physical Science, and the number without Physical Science.

g. The size of farms found in the Karoo.

h. The frequency of students belonging to the Christian, Jewish, Islamic, Hindu and Buddhist faiths in South Africa.

---

### Problem solving

The following table shows the number of glasses of water you drink during the week.

<table>
<thead>
<tr>
<th>Day</th>
<th>Glasses of water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday</td>
<td>6</td>
</tr>
<tr>
<td>Tuesday</td>
<td>7</td>
</tr>
<tr>
<td>Wednesday</td>
<td>9</td>
</tr>
<tr>
<td>Thursday</td>
<td>8</td>
</tr>
<tr>
<td>Friday</td>
<td>10</td>
</tr>
<tr>
<td>Saturday</td>
<td>12</td>
</tr>
<tr>
<td>Sunday</td>
<td>5</td>
</tr>
</tbody>
</table>

a. What kind of graph would not be helpful in spotting general trends?

b. If you forgot to write down how many glasses of water you drank on Thursday, what kind of graph would be best to help you guess?

c. What kind of graph would be most helpful for quickly determining whether your water intake was the same for two or more days?
1. Use the information from this favourite sport survey of 20 learners and write a report summarising the data and drawing conclusions.

<table>
<thead>
<tr>
<th>Name</th>
<th>Favourite sport</th>
<th>Name</th>
<th>Favourite sport</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denise</td>
<td>Tennis</td>
<td>Elias</td>
<td>Squash</td>
</tr>
<tr>
<td>John</td>
<td>Rugby</td>
<td>Simon</td>
<td>Soccer</td>
</tr>
<tr>
<td>Jason</td>
<td>Soccer</td>
<td>Edward</td>
<td>Rugby</td>
</tr>
<tr>
<td>Matapelo</td>
<td>Soccer</td>
<td>Susan</td>
<td>Rugby</td>
</tr>
<tr>
<td>Mandla</td>
<td>Rugby</td>
<td>Philip</td>
<td>Tennis</td>
</tr>
<tr>
<td>Opelo</td>
<td>Tennis</td>
<td>Ben</td>
<td>Squash</td>
</tr>
<tr>
<td>Lisa</td>
<td>Soccer</td>
<td>Lauren</td>
<td>Soccer</td>
</tr>
<tr>
<td>Gugu</td>
<td>Tennis</td>
<td>Tefo</td>
<td>Rugby</td>
</tr>
<tr>
<td>Sipho</td>
<td>Soccer</td>
<td>Alicia</td>
<td>Soccer</td>
</tr>
<tr>
<td>Lorato</td>
<td>Squash</td>
<td>Masa</td>
<td></td>
</tr>
</tbody>
</table>

a. Aim

[Blank space for answer]

This is the general aim of the project.

b. Hypothesis

[Blank space for answer]

A specific statement or prediction that you can show to be true or false.
c. Plan

What data do you need?

Who will you get it from?

How will you collect it?

How will you record it?

How will you make sure the data is reliable?

Why? Give reasons for the choices you made.
d. Analysis

• This is where you do the calculations and draw charts.
• Compare groups with the mean and median.
• The range is a measure of how spread out the group is.
• Graphs are good for representing data visually.

e. Conclusions

Do your results agree with the hypothesis?

_____________________________________________________________________________

_____________________________________________________________________________

How confident are you?

_____________________________________________________________________________

_____________________________________________________________________________

What went wrong? How did you deal with it?

_____________________________________________________________________________

_____________________________________________________________________________

What would you do differently if you did the research again?

_____________________________________________________________________________
f. Appendices

It is good practice to include a copy of the questionnaire. The appendices may also include tables related to sample selection, instructions to interviewers, and so on.

g. References

If you used any secondary data or research you must acknowledge your sources here.

### Problem solving

**Hypothesis:** Boys prefer sciences and maths above art, history and languages.

Use the following data set and write a report on your findings. Include your frequency table, graphs and conclusions. Also compare the favourite subjects of boys to those of girls.

<table>
<thead>
<tr>
<th>Name</th>
<th>Favourite subject</th>
<th>Name</th>
<th>Favourite subject</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denise</td>
<td>Maths</td>
<td>Elias</td>
<td>History</td>
</tr>
<tr>
<td>John</td>
<td>Art</td>
<td>Simon</td>
<td>Maths</td>
</tr>
<tr>
<td>Jason</td>
<td>History</td>
<td>Edward</td>
<td>Sciences</td>
</tr>
<tr>
<td>Matapelo</td>
<td>Sciences</td>
<td>Susan</td>
<td>History</td>
</tr>
<tr>
<td>Mandla</td>
<td>History</td>
<td>Philip</td>
<td>Art</td>
</tr>
<tr>
<td>Opelo</td>
<td>Maths</td>
<td>Ben</td>
<td>Maths</td>
</tr>
<tr>
<td>Lisa</td>
<td>History</td>
<td>Lauren</td>
<td>Language</td>
</tr>
<tr>
<td>Gugu</td>
<td>Art</td>
<td>Tefo</td>
<td>Maths</td>
</tr>
<tr>
<td>Sipho</td>
<td>Maths</td>
<td>Alicia</td>
<td>History</td>
</tr>
<tr>
<td>Lorato</td>
<td>Maths</td>
<td>Masa</td>
<td>Language</td>
</tr>
</tbody>
</table>
Data handling cycle

To record data one can use a pie chart.

To record data one can use a pie chart.

Data handling cycle

Data handling
Data handling is a process of collecting, organising, representing, analysing and interpreting data.

The visual representation of data is of major importance.

This assignment will go over two worksheets.

The average number of steps of a grade 8 boy over a 100 metre distance is less than the average number of steps of a grade 8 girl over the same distance.

1. Choose your research team.

The names of your research team

<table>
<thead>
<tr>
<th>Name 1</th>
<th>Name 2</th>
<th>Name 3</th>
<th>Name 4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. What is the aim of your research?

3. What is your hypothesis?

4. Questions that might help you to plan:
   a. What data do you need?
   b. Who will you get it from?
   c. How will you collect it?
   d. How will you record it?

   e. How will you make sure the data is reliable?


The visual representation of data is of major importance.

Your group will get an opportunity to present your aim, hypothesis and plan to the rest of the class.

Once all the research teams have presented their plans, you will get the opportunity to change your plans based on what you heard from the other teams.

Our changes are:

<table>
<thead>
<tr>
<th>Change 1</th>
<th>Change 2</th>
<th>Change 3</th>
<th>Change 4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Our revised plan is:

Preparing

Now that your plans are submitted you should start collecting and recording the data you need.
In this worksheet you will continue with the data handling cycle.

The average number of steps of a grade 8 boy over a 100 metre distance is less than the average number of steps of a grade 8 girl over the same distance.

1. Use the data you collected and recorded to:
   a. Organise your data in a frequency table.
   b. Calculate the mean, the median and the mode.
   c. Calculate the data range.
   d. Draw a stem-and-leaf diagram.
   e. Represent your data in a graph. You may use more than one type of graph.

Interpreting your graphs

Interpret your graphs and tables and write a report under the following headings:
1. Aim
2. Hypothesis
3. Plan
4. Analysis
5. Interpretation
6. Conclusions
7. Appendices
8. References
### Patterns

Give a rule to describe the relationship between the numbers in a sequence. Use the rule to determine the next three numbers in the pattern.

1. **What is the constant difference between the consecutive terms?**
   - a. 6; 10; 14; 18
   - b. 12; 21; 30; 39
   - c. 15; 18; 21; 24
   - d. 15; 30; 45; 60
   - e. 8; 16; 24; 32
   - f. 2; –6; –14; –22

2. **What is the constant ratio between the consecutive terms?**
   - a. 20; 0; 2000; –20 000
   - b. 17; 34; 68; 136

3. **These patterns do not have a constant difference or ratio. How do you think they were generated?**
   - a. 31; 26; 16; 1
   - b. 49; 38; 28; 19
   - c. 27; 25; 21; 13
   - d. 18; –28; –48; –78
   - e. 35; 39; 45; 53
   - f. 43; 34; 16; –11

4. **What is the constant difference or constant ratio between the consecutive terms?**
   - a. 8; 32; 128; 512
   - b. 19; –95; 475; –2 375
   - c. 15; 8; 1; –6
   - d. –18; –28; –48; –78
   - e. 35; 39; 45; 53
   - f. 43; 34; 16; –11

5. **i. Complete the table.**
   **ii. State the rule.**
   **iii. Solve term values as asked.**

<table>
<thead>
<tr>
<th>Position</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>n</th>
<th>Rule</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value of the term</td>
<td>7</td>
<td>10</td>
<td>15</td>
<td>22</td>
<td>31</td>
<td>n² + 6</td>
<td></td>
</tr>
</tbody>
</table>

   **Example:**

   - a. 2 4 6 8 n
     - Value of the term | 2 | 4 | 6 | 8 | n |
     - Rule: ___________
     - Term | 6 | 214 | 510 |
     - Value of the term | 16 | 25 | 34 |
     - Rule: ___________
   
   - b. 3 6 9 12 n
     - Value of the term | 3 | 6 | 9 | 12 | n |
     - Rule: ___________
     - Term | 16 | 25 | 34 |
     - Value of the term | 16 | 25 | 34 |
     - Rule: ___________

   - a. What will the 20th term value be? ________ Rule: ___________
   - b. What will the tenth term value be? ________ Rule: ___________
6. i. Complete the table.
    ii. State the rule.
    iii. Determine term values as asked.

   a. 
      | Term | 5 | 15 | 25 | 35 | n |
      | Value of the term | 14 | 24 | 34 |   |
      What will the 55th term value be? ____  Rule: ___________

   b. 
      | Term | 1 | 2 | 3 | 5 | n |
      | Value of the term | 8 | 27 | 125 |   |
      What will the 10th term value be? ____  Rule: ___________

7. Complete the table:

   a. 
      | Term | 1 | 2 | 3 | 4 | 5 | n |
      | Value of the term | -39 | -52 | -65 |   |
      What will the 46th term value be? ____

   b. 
      | Term | 2 | 4 | 6 | 8 | 10 | n |
      | Value of the term | -20 | -30 | -50 |   |
      What will the 21st term value be? ____

8. Complete the table:

   a. 
      | Term | 1 | 2 | 3 | 4 | 5 | n |
      | Value of the term | 8 | 27 | 125 |   |
      What will the 6th term value be? ____

   b. 
      | Term | 1 | 2 | 3 | 4 | 5 | n |
      | Value of the term | 0.4 | 1.6 | 3.6 |   |
      What will the 10th term value be? ____

9. Complete the table:

   a. 
      | Term | 1 | 3 | 4 | n |
      | Value of the term | 4 | 12 | 16 |   |
      What will the 11th term value be? ____

   b. 
      | Term | 5 | 7 | 11 | 13 | n |
      | Value of the term | -3 | -1 | 1 |   |
      What will the 11th term value be? ____

Activity

If the constant ratio is -8, what could the sequence be?
1. Complete the tables using the information given below each table. Give the sequence to the 6th term.

**Example:**

<table>
<thead>
<tr>
<th>Term</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>18</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value of the term</td>
<td>8</td>
<td>17</td>
<td>26</td>
<td>35</td>
<td>161</td>
<td>9(n) - 1</td>
</tr>
</tbody>
</table>

- Add 9 to the previous position
- 9 x the position of the term - 1
- 9(n) - 1, where n is the position of the term and n is a natural number.

**a.**

<table>
<thead>
<tr>
<th>Term</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>17</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value of the term</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Add 15 to the previous position
- 15 x the position of the term - 2
- 15(n) - 2, where n is the position of the term and n is a natural number.

**b.**

<table>
<thead>
<tr>
<th>Term</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>22</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value of the term</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Add 6 to previous position
- 6 x the position of the term + 3
- 6(n) + 3, where n is the position of the term and n is a natural number.

**c.**

<table>
<thead>
<tr>
<th>Term</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>41</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value of the term</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Add 2 to the previous position
- 2 x the position of the term + 1.5
- 2(n) + 1.5 where n is the position of the term and n is a natural number.

**d.**

<table>
<thead>
<tr>
<th>Term</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>42</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value of the term</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Add 1/2 to the previous position
- 1/2 x the position of the term + 1
- 1/2 (n) + 1 where n is the position of the term and n is a natural number.
1. Complete the tables using the information given below each table.

a. Term 1 2 3 4 18 \( n \)
   
<table>
<thead>
<tr>
<th>Term</th>
<th>Value of the term</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>2</td>
<td>17</td>
</tr>
<tr>
<td>3</td>
<td>26</td>
</tr>
<tr>
<td>4</td>
<td>35</td>
</tr>
<tr>
<td>18</td>
<td>161</td>
</tr>
<tr>
<td>( n )</td>
<td>9n-1</td>
</tr>
</tbody>
</table>

- 9 \( n \) - 1, where \( n \) is the position of the term and \( n \) is a natural number.

b. Term 1 2 3 4 17 \( n \)
   
<table>
<thead>
<tr>
<th>Term</th>
<th>Value of the term</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>13</td>
</tr>
<tr>
<td>2</td>
<td>28</td>
</tr>
</tbody>
</table>

- 12 \( n \) - 1, where \( n \) is the position of the term and \( n \) is a natural number.

- 15 \( n \) - 2, where \( n \) is the position of the term and \( n \) is a natural number.

c. Term 1 2 3 4 22 \( n \)
   
<table>
<thead>
<tr>
<th>Term</th>
<th>Value of the term</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td></td>
</tr>
</tbody>
</table>

- 6 \( n \) + 3, where \( n \) is the position of the term and \( n \) is a natural number.

- 2 \( n \) + 1, where \( n \) is the position of the term and \( n \) is a natural number.

- \( \frac{1}{2} \) \( n \) + 1, where \( n \) is the position of the term and \( n \) is a natural number.

- 10 \( n \) - 1.25, where \( n \) is the position of the term and \( n \) is a natural number.

Problem solving

If \( 3(\cdot - 2) + 1 \) is the third term, what will the \( n \)th term be?
Geometric patterns

Extend the drawing and write a rule.
Hexagon pattern:
First hexagon = 1 "section" per side $1 \times 6 = 6$

What will the next pattern be?
The rule: add one new "section" to each side.

Second hexagon = 2 "sections" per side $2 \times 6 = 12$

Third hexagon = 3 "sections" per side $3 \times 6 = 18$

Fourth hexagon = 4 "sections" per side $4 \times 6 = 24$

Tenth hexagon = 10 "sections" per side $10 \times 6 = 60$

$n^{th}$ hexagon = $n \times 6$

We can also record it in a table.

<table>
<thead>
<tr>
<th>Hexagon sections per side</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>10</th>
<th>$n$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of sections</td>
<td>6</td>
<td>12</td>
<td>18</td>
<td>24</td>
<td>60</td>
<td></td>
<td>$n \times 6$</td>
<td></td>
</tr>
</tbody>
</table>

1. Complete the table and identify the rule.

Example: Pattern of square numbers.

<table>
<thead>
<tr>
<th>Position of the term in the pattern</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>10</th>
<th>$n$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of sections</td>
<td>1</td>
<td>4</td>
<td>9</td>
<td>16</td>
<td>25</td>
<td>100</td>
<td>$n^2$</td>
</tr>
</tbody>
</table>

| $1 \times 1 = 1$                      |
| $2 \times 2 = 4$                      |
| $3 \times 3 = 9$                      |
| $4 \times 4 = 16$                     |
| $5 \times 5 = 25$                     |
| $10 \times 10 = 100$                  |

$n \times n = n^2$

a. Nonagonal pattern

b. Triskaidecagon (polygon with 13 sides) pattern

c. Chiliagon (polygon with 1 000 sides) pattern
d. Pentacontagon (polygon with 50 sides) pattern
e. Enneadecagon (polygon with 19 sides) pattern

Problem solving

What is the fifth term in a googolgon pattern?
What are the next three terms in the sequence?

Example 1:

<table>
<thead>
<tr>
<th>Term</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>10</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>8</td>
<td>?</td>
<td>?</td>
</tr>
</tbody>
</table>

Term 1 = 1
Second term = 2 x 1 = 2
Third term = 2 x 2 x 1 = 4
Fourth term = 2 x 2 x 2 x 1 = 8
Tenth term = 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 1 = 2^9

Value of the nth term = 2^n–1

To the power of 1 is one smaller than the term 2.
To the power of 2 is one smaller than the term 3.
To the power of 3 is one smaller than the term 4.
To the power of 9 is one smaller than the term 10.

1. Write a rule for, and complete the table.

Example:

<table>
<thead>
<tr>
<th>Term</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>1</td>
<td>5</td>
<td>25</td>
<td>125</td>
<td>5^n–1</td>
</tr>
</tbody>
</table>

The rule is 5^n–1 Therefore the sequence is 1, 5, 25, 125, ...

a. | Term | 1 | 2 | 3 | 4 | 17 | n |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>1</td>
<td>6</td>
<td>36</td>
<td>216</td>
<td>?</td>
<td>?</td>
</tr>
</tbody>
</table>

Rule:______________________________

b. | Term | 1 | 2 | 3 | 4 | 32 | n |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>1</td>
<td>7</td>
<td>49</td>
<td>343</td>
<td>?</td>
<td>?</td>
</tr>
</tbody>
</table>

Rule:______________________________

c. |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Term</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Value</td>
<td>1</td>
<td>9</td>
<td>81</td>
<td>729</td>
</tr>
</tbody>
</table>

Rule:______________________________

d. |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Term</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Value</td>
<td>1</td>
<td>10</td>
<td>100</td>
<td>1000</td>
</tr>
</tbody>
</table>

Rule:______________________________

e. |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Term</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Value</td>
<td>1</td>
<td>13</td>
<td>169</td>
<td>2197</td>
</tr>
</tbody>
</table>

Rule:______________________________

f. |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Term</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Value</td>
<td>2197</td>
<td>729</td>
<td>243</td>
<td>81</td>
</tr>
</tbody>
</table>

Rule:______________________________

Problem solving

This sequence has a factor of 4 between each number, however as can be seen the sequence can work both by increasing as well as decreasing the value of numbers. The pattern is continued by dividing the last number by 4 each time. What could the sequence be?
More on input and output values

Look at the examples. Discuss.

Calculate the value of \( t \) for each value of \( p \).

Find the rule for calculating the output value for every given input value in the flow diagram.

1. Complete the following flow diagrams.

   a. \( p \times 3 + 1 \)
   b. \( p \times 1 \times -3 \)
   c. \( p \times 1 \times 3 \)
   d. \( p \times 2 - 10 \)
   e. \( p \times 2 - 16 \)

2. Complete the following flow diagrams.

   a. \( p \times 3 + 7 \)
   b. \( p \times 3 - 30 \)
   c. \( p \times 3 - 12 \)
   d. \( p \times 6 - 2 \)
   e. \( p \times 1 \times -3 \)

Activity

If \( t = r \times 3 - 12 \), with \( t = -3 \), what is \( r \)?
If the rule for finding \( y \) in the table below is \( y = -3x - 1 \), find \( y \) for the given \( x \) values.

<table>
<thead>
<tr>
<th>( x )</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>5</th>
<th>10</th>
<th>50</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )</td>
<td>-1</td>
<td>-4</td>
<td>-7</td>
<td>-16</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\[
\begin{align*}
\text{y} &= -3(0) - 1 \\
&= 0 - 1 \\
&= -1 \\
\text{y} &= -3(1) - 1 \\
&= -3 - 1 \\
&= -4 \\
\text{y} &= -3(10) - 1 \\
&= -30 - 1 \\
&= -31 \\
\text{y} &= -3(50) - 1 \\
&= -150 - 1 \\
&= -151 \\
\text{y} &= -3(100) - 1 \\
&= -300 - 1 \\
&= -301 \\
\text{y} &= -3(5) - 1 \\
&= -15 - 1 \\
&= -16 \\
\text{y} &= -3(10) - 1 \\
&= -30 - 1 \\
&= -31 \\
\end{align*}
\]

1. Describe the relationship between the numbers in the top row and those in the bottom row in the table.

a. 

<table>
<thead>
<tr>
<th>( x )</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>20</th>
<th>50</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )</td>
<td>4</td>
<td>7</td>
<td>10</td>
<td>64</td>
<td>154</td>
<td>304</td>
</tr>
</tbody>
</table>

b. 

<table>
<thead>
<tr>
<th>( x )</th>
<th>15</th>
<th>30</th>
<th>45</th>
<th>60</th>
<th>75</th>
<th>90</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )</td>
<td>73</td>
<td>148</td>
<td>223</td>
<td>298</td>
<td>373</td>
<td>448</td>
</tr>
</tbody>
</table>

c. 

<table>
<thead>
<tr>
<th>( x )</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>-1</td>
<td>-2</td>
</tr>
</tbody>
</table>

d. 

<table>
<thead>
<tr>
<th>( x )</th>
<th>12</th>
<th>14</th>
<th>16</th>
<th>20</th>
<th>60</th>
<th>110</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>10</td>
<td>30</td>
<td>55</td>
</tr>
</tbody>
</table>

2. Describe the relationship between the numbers in the top row and bottom row in the table. Then write down the values of \( m \) and \( n \).

a. 

\[
\begin{array}{cccc}
 x & -2 & -1 & 0 & m & 2 & 3 \\
 y & 28 & 24 & n & 12 & 8 \\
\end{array}
\]

\[
m = \frac{24}{28}, \quad n = \frac{8}{12}
\]

b. 

\[
\begin{array}{cccc}
 x & -3 & -2 & 0 & 1 & 2 \\
 y & -4 & -3 & -1 & 0 & n \\
\end{array}
\]

\[
m = \frac{-4}{-3}, \quad n = \frac{-1}{0}
\]

c. 

\[
\begin{array}{cccc}
 x & 1 & 2 & 3 & 4 & m & 6 \\
 y & 1 & 7 & 17 & n & 71 \\
\end{array}
\]

\[
m = \frac{1}{2}, \quad n = \frac{71}{17}
\]

d. 

\[
\begin{array}{cccc}
 x & 3 & m & 11 & 15 & 19 & 23 \\
 y & -13 & -37 & -49 & -61 & -n \\
\end{array}
\]

\[
m = \frac{3}{m}, \quad n = \frac{-13}{-15}
\]

e. 

\[
\begin{array}{cccc}
 x & -8 & m & -4 & -2 & 0 & 2 \\
 y & 43 & 23 & 13 & n & -7 \\
\end{array}
\]

\[
m = \frac{-8}{-4}, \quad n = \frac{-7}{-2}
\]
### Algebraic Equations

**What is an equation?**
An equation is a statement that two numbers or expressions are equal.

**Give some examples.**

- Equations are useful for relating variables and numbers.
- Many simple rules exist for simplifying equations.
- Many word problems can easily be written down as equations with a little practice.

**Examples of equations:**

<table>
<thead>
<tr>
<th>Equation</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>( 5 = 5 )</td>
<td></td>
</tr>
<tr>
<td>( 19 = 4 + 15 )</td>
<td></td>
</tr>
<tr>
<td>( x = 9 )</td>
<td>( 9 = x )</td>
</tr>
<tr>
<td>( x + 6 = -9 )</td>
<td>( -15 + 6 = -9 )</td>
</tr>
<tr>
<td>( x = -15 )</td>
<td></td>
</tr>
<tr>
<td>( x + 6 = -9 )</td>
<td>( -15 + 6 = -9 )</td>
</tr>
<tr>
<td>( x = -9 )</td>
<td>( -9 = -9 )</td>
</tr>
<tr>
<td>( x + 5 = 8 )</td>
<td></td>
</tr>
<tr>
<td>( 3x + 10 = 90 )</td>
<td></td>
</tr>
<tr>
<td>( x^2 + 3 = 12 )</td>
<td></td>
</tr>
</tbody>
</table>

### 3. Solve for \( x \). Test your answer using substitution.

**Example:**

\[ 3x + 1 = 7 \]

Test:

\[ 3x + 1 + 1 = 8 \]

\[ 3x = 6 \]

Then divide both sides of the equation by 3.

\[ \frac{3x}{3} = \frac{6}{3} \]

\[ x = 2 \]

**Activity**

- **a.** John has R95 to spend. How much more does he need to buy a computer game that costs R350? (R95 + \( x \) = R350).
- **b.** Calculate the area of a rectangle with length 4 cm and breadth 2 cm + 1 cm.
- **c.** If the area of a rectangle is \( (6x^2 - 12x) \) cm², and its breadth is 3x cm, what will its length be in terms of \( x \)?
- **d.** 3 times a number is 93. What is the number?
- **e.** 4 times a number, decreased by twenty, is 8. What is the number?
- **f.** If \( y = x^2 + 1 \), calculate \( y \) when \( x = -9 \).
- **g.** Thandi is 9 years older than Sophie. In 3 years’ time Thandi will be twice as old as Sophie. How old is Thandi now?
1. Complete the tables below by determining the values of $y$ for each equation. Plot each point $(x,y)$ on the Cartesian plane and join the points.

**Activity**

Compare the following graphs defined by: $y = 2x + 1$, $y = -2x + 1$, $y = 2x - 1$, $y = -2x - 1$

- **a.** $y = 3x + 2$
- **b.** $y = 5x + 6$
- **c.** $y = 8x + 3$
- **d.** $y = -4x + 5$
- **e.** $y = -6x + 2$
- **f.** $y = -3x - 2$

These are ordered pairs.
1. Use the equations below to determine the values of \( y \). Plot each point \((x, y)\) on the Cartesian plane and join the points.

- **a.** \( y = x^2 + 4 \)
  
  | \( x \) | \(-2\) | \(-1\) | 0 | 1 | 2 |
  | \( y \) | 0 | 2 | 4 | 6 | 8 |

- **b.** \( y = x^2 + 5 \)
  
  | \( x \) | \(-2\) | \(-1\) | 0 | 1 | 2 |
  | \( y \) | 2 | 3 | 6 | 3 | 6 |

- **c.** \( y = x^2 - 3 \)
  
  | \( x \) | \(-3\) | \(-1\) | 0 | 2 | 4 |
  | \( y \) | | | | | |

- **d.** \( y = x^2 - 5 \)
  
  | \( x \) | \(-4\) | \(-1\) | 0 | 1 | 3 |
  | \( y \) | | | | | |

- **e.** \( y = 2x^2 + 1 \)
  
  | \( x \) | \(-6\) | \(-5\) | 0 | 5 | 6 |
  | \( y \) | | | | | |

- **f.** \( y = 2x^2 - 1 \)
  
  | \( x \) | \(-2\) | \(-1\) | 0 | 1 | 2 |
  | \( y \) | | | | | |

**Activity**

Compare the following graphs defined by:
- \( y = x^2 - 1 \)
- \( y = -x^2 - 1 \)
- \( y = -x^2 + 1 \)
- \( y = x^2 + 1 \)
There are different words to describe graphs.

Constant: A line is constant when the y-value or the x-value remains the same while the x-value or the y-value increases.

Increasing: The slope of a line increases when the y-value increases as the x-value increases.

Decreasing: The slope of a line decreases when the y-value decreases as the x-value increases.

Look at the graphs. Discuss.

Constant: A line is constant when the y-value or the x-value remains the same while the x-value or the y-value increases.

Increasing: The slope of a line increases when the y-value increases as the x-value increases.

Decreasing: The slope of a line decreases when the y-value decreases as the x-value increases.
1. Answer the questions below using this graph.

a. What is written on your x-axis? ________________________________

b. What is written on your y-axis? ________________________________

c. What is the scale of the y-axis? ________________________________

d. What will the heading of your graph be? _______________________

e. What conclusion can you draw from this graph? __________________

2. Complete this table using the graph on the previous page.

<table>
<thead>
<tr>
<th>Month</th>
<th>Maximum temperature</th>
<th>Minimum temperature</th>
<th>Average rainfall</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>February</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>March</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>April</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>May</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>June</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>July</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>August</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>September</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>October</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>November</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>December</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

f. Describe the graph using the following words: increasing, decreasing, linear and non-linear.
You have decided to visit this country for a month. Which month will you visit and why?

1. Look at the graph and answer the following questions:
   a. What is the heading of the graph? ________________________________
   b. What is the x-axis telling us? ________________________________
   c. What is the y-axis telling us? ________________________________
   d. Which month/months have the highest temperature? ________________
   e. Which month/months have the highest rainfall? ________________
   f. Which month/months are windy? ________________________________

2. Find out what Beaufort in question 1g above means.

   ____________________________________________________________
   ____________________________________________________________

   Problem solving

Which town/city has the highest rainfall per year in the world? Why do you say so?
Interpreting graphs

Term 4

Activity

Create a graph making use of key words such as decrease, increase, constant, linear or non-linear.

1. Describe what is happening in each graph below. Then create a situation that corresponds to the graph.

Example:

- This is a non-linear graph.
- Looking at the graph from left to right, you can see that as time increases, the distance travelled increases.
- The distance and time travelled then remain constant for a period of time.
- Then the time once again increases as the distance travelled increases.

Situation that corresponds to the graph:
A possible situation that could correspond to this graph could be the distance that a cyclist rides on a bike. The cyclist rides, stops to rest, and then continues to ride.

Revise the words below by making a drawing of each.

Increase Decrease Constant Linear Non-linear

Temperature

Time

Distance

Time

Distance

Time

Speed

Time

Height

Time

Draw or paste a picture here.

b.

c.

d.
1. Plot the coordinates and describe them.

Example: (6;2)

The point (6;2) is 6 units along the x-axis and 2 units up the y-axis.

a. (5;8)

b. (7;3)
2. Write down the co-ordinates for the following:

- c. (0; 9)
- d. (5; 0)
- e. (1; 1)
- f. (2; 4)

Problem solving

Plot the following: eight units across and two units up. Write down four other points to form a zigzag pattern with this co-ordinate.
Ordered pairs

Read and discuss.

(3; 5) is called an “ordered pair” Parentheses are put around the numbers. The numbers are separated by a comma. 

What do you see?

It is as if we put two number lines together; the one going left-right and the other going down-up.

The point (0, 0) is given the special name “the origin”.

An ordered pair is a pair of numbers in a special order.

For negative numbers we
• go backwards along the x-axis
• go down along the y-axis

Let us try:

(-3, 5) means go back 3 along the x-axis and then go up 5 on the y-axis.

(-6, -3) means go back 6 along the x-axis and then go down 3 on the y-axis.

Describe each point in words.
• (2, 3); (-2, -3) and (-2, -3)
• (6, 9); (-6, -9) and (-6, -9)
• (7, 4); (-7, -4) and (-7, -4)

Problem solving

Find these positions on the Cartesian plane:
• Go back 4 units along the x-axis and then go up 7 units along the y-axis...
• Go forward 3 units along the x-axis then down 9 units along the y-axis.

Example: (-8, 5) means go back 8 along the x-axis and then go up 5 on the y-axis.

a. (1; 3)

b. (1; -3)

c. (-1; 3)

d. (-1; -3)

e. (-5; 2)

f. (-5; -2)

g. (5; 2)
h. (5; -2)
i. (0; -2)

j. (-2; 0)
k. (9; 3)
l. (9; -3)
m. (-9; -3)
n. (-9; 3)
o. (-2; 7)
p. (-7; -2)

q. (2; 7)
r. (-2; 7)
s. (0; -10)
t. (-10; 0)
Cartesian plane: four quadrants

Notice that when we include negative values, the x and y axes divide the space up into 4 pieces. We call these quadrants.

Label the quadrants. Explain each of these statements:

Quadrant I both x and y are positive. Example: (4;8)
Quadrant II x is negative and y is positive. Example: (–4;8)
Quadrant III both x and y are negative. Example: (–4;–8)
Quadrant IV x is positive and y is negative. Example: (4;–8)

In pairs give 5 more examples from each quadrant and then plot them on the Cartesian plane. You should explain each coordinate in words.

1. Complete the table.

<table>
<thead>
<tr>
<th>Quadrant</th>
<th>x (horizontal)</th>
<th>y (vertical)</th>
<th>Five examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Positive</td>
<td></td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>Negative</td>
<td>(–8;6)</td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>Negative</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>Positive</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Explain each co-ordinate in words. Plot it on a Cartesian plane. Note that you have to draw your own Cartesian plane on a piece of paper.

Example: (5,2) is 5 units along, and 2 units up.
Both x and y are positive, so the point is in “Quadrant 1”.

a. (9;3)  

b. (1;–7)  

c. (–8;5)  

d. (–6;–9)  

e. (1;0)  

f. (4;–8)  

3. Give an example of a co-ordinate for each of these: Plot each co-ordinate.

Example: x and y are negative
(–11;–9)

a. x and y are positive.  

b. Only x is positive.  

c. Only y is positive.  

d. Quadrant IV.  

e. Quadrant IV.  

f. Quadrant I.  

Activity
Plot co-ordinates in the first, second, third and fourth quadrant. Connect the co-ordinates. What polygon did you draw?
**Drawing graphs by plotting points**

Look and describe.

<table>
<thead>
<tr>
<th></th>
<th>x</th>
<th>-4</th>
<th>-3</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td>19</td>
<td>12</td>
<td>7</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>7</td>
<td>12</td>
<td>19</td>
<td></td>
</tr>
</tbody>
</table>

\[ \begin{align*}
  y &= (-4)^2 + 3 \\
  &= 16 + 3 \\
  &= 19 \\

  y &= (-3)^2 + 3 \\
  &= 9 + 3 \\
  &= 12 \\

  y &= (-2)^2 + 3 \\
  &= 4 + 3 \\
  &= 7 \\

  y &= (-1)^2 + 3 \\
  &= 1 + 3 \\
  &= 4 \\

  y &= 1^2 + 3 \\
  &= 1 + 3 \\
  &= 4
\]

The parabola has a minimum value of 3 at \( x = 0 \) \((0,3)\). It opens upwards \((u\text{-shaped})\).

1. Complete the table of ordered pairs for the equation, and then:
   - plot the co-ordinate points on the Cartesian plane on the next page.
   - join the points to form a graph.

   **a.** \( y = x^2 + 4 \)
   - x | -4 | -3 | -2 | -1 | 0  | 1  | 2  | 3  | 4  |
   - y | 19 | 12 | 7  | 4  | 3  | 4  | 7  | 12 | 19 |

   **Give the:** Minimum value

   **b.** \( y = x^2 + 2 \)
   - x | -4 | -3 | -2 | -1 | 0  | 1  | 2  | 3  | 4  |
   - y | 19 | 12 | 7  | 4  | 3  | 4  | 7  | 12 | 19 |

   **Give the:** Minimum value

Activity

Describe the graph \( y = x^2 + 10 \)
Transformation (revision)

**Transformation** is changing the form of something according to specific rules.

A transformation is what brings about the change. There are many kinds of geometric transformations that change the position, shape or size of objects. Common transformations are **translations, rotations, reflections, and enlargements**.

In this worksheet you are going to revise the definitions of **reflection**, **rotation** and **translation**. On the next page you will find various diagrams, words and pictures representing reflection, rotation and translation.

---

A translation is the movement of an object to a new position without changing its shape, size or orientation.

When a shape is transformed by sliding it to a new position, without turning, it is said to have been translated.

---

**Reflection**: a reflection is a transformation that has the same effect as a mirror.

Every point makes a circle around the centre.

Every point of the shape must move the same distance and the same direction.

It means moving without rotating, flipping or resizing.

---

**Rotation**: a rotation is a transformation that moves points so that they stay the same distance from a fixed point, the centre of rotation.

Every point is the same distance from the centre line.

The distance from the centre to any point on the shape stays the same.

It is a flip over a line.

---

**Enlargement**: an enlargement is increasing the size of an object by a scale factor, without changing its shape or orientation.

Every point on the shape must be the same distance from the centre line.

The shape must stay the same.

It has the same size as the original image.

---

**Table**

<table>
<thead>
<tr>
<th>Transformation</th>
<th>Example</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reflection</strong></td>
<td>Every point makes a circle around the centre.</td>
<td>Every point of the shape must move the same distance and the same direction.</td>
</tr>
<tr>
<td><strong>Rotation</strong></td>
<td>Every point is the same distance from the centre line.</td>
<td>It means moving without rotating, flipping or resizing.</td>
</tr>
<tr>
<td><strong>Enlargement</strong></td>
<td>Every point on the shape must be the same distance from the centre line.</td>
<td>The shape stays the same.</td>
</tr>
</tbody>
</table>

---

Give a transformation that represents the diagrams, word or pictures in the table below.
1. Look at the architectural design and describe it using the words symmetry or transformations.

The co-ordinates of \( ABC \) are: \( (-6;8); (-2;8) \) and \( (-6;3) \).

Note how the \( y \) co-ordinates remain the same but the \( x \) co-ordinates change to their opposite integer (the signs change).

ABC is reflected over the \( x \)-axis making the co-ordinates of \( A'B'C' \): \( (6;8); (2;8) \) and \( (6;3) \).

This is always the case with reflections over the \( y \)-axis.

2. Describe each reflection.

Reflection

Draw the following triangles on the Cartesian plane and then reflect each one over the given axis.

a. \((–2; –3); (–2; –7); (–6;–3)\) over the \( x \)-axis.

b. \((–2; –3); (–2;–7); (–6;–3)\) over the \( y \)-axis.

Activity

Plot the co-ordinates of the following:

- \( ABCD \): \((–8;8); (–4;8); (–4;4); (–8;4)\)
- \( \triangle EFG \): \((3;8); (8;8); (3;3)\)
- \( HIJK \): \((-9;–3); (–3;–3); (–3;–7); (–9;–7)\)
- \( \triangle LMN \): \((5;–2); (8;–7); (2;–7)\)
Look at the diagram and the table. What do you notice? Why is there a dotted square in the middle?

The co-ordinates are:

<table>
<thead>
<tr>
<th>Triangle</th>
<th>(x1, y1)</th>
<th>(x2, y2)</th>
<th>(x3, y3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triangle A</td>
<td>(-2, 2)</td>
<td>(-10, 2)</td>
<td>(-6, 8)</td>
</tr>
<tr>
<td>Triangle B</td>
<td>(2, 2)</td>
<td>(2, 10)</td>
<td>(8, 6)</td>
</tr>
<tr>
<td>Triangle C</td>
<td>(-2, -2)</td>
<td>(10, -2)</td>
<td>(6, -8)</td>
</tr>
<tr>
<td>Triangle D</td>
<td>(-2, -2)</td>
<td>(-10, -2)</td>
<td>(-8, -6)</td>
</tr>
</tbody>
</table>

Note the pattern in the co-ordinates for corresponding vertices of the triangles.

Triangle B: 90º rotation of triangle A about the origin.
Triangle C: 90º rotation of triangle B about the origin.
180º rotation of triangle A about the origin.
Triangle D: 90º rotation of triangle C about the origin.
270º rotation of triangle A about the origin.

1. Look at the following architectural designs and describe each one using symmetry or transformations.

a. 

b. 

c. The co-ordinates of ABC are ___.
The co-ordinates of A’B’C’ are ___.
Compare the corresponding vertices.

d. The co-ordinates of ABC are ___.
The co-ordinates of A’B’C’ are ___.
Compare the corresponding vertices.

e. How did the shape in the middle help you?

2. Complete the following.

a. The co-ordinates of ABC are ___.
The co-ordinates of A’B’C’ are ___.
Compare the corresponding vertices.

b. The co-ordinates of ABC are ___.
The co-ordinates of A’B’C’ are ___.
Compare the corresponding vertices.

c. The co-ordinates of ABC are ___.
The co-ordinates of A’B’C’ are ___.
Compare the corresponding vertices.

d. The co-ordinates of ABC are ___.
The co-ordinates of A’B’C’ are ___.
Compare the corresponding vertices.

e. How did the shape in the middle help you?

Activity

Rotate the following figure: (-2, -5); (-6, -5); (-2, -2) with each of 90º; 180º; 120º.
Look at example 1 and 2. Discuss.

Example 1:
Figure X is the pre-image. Figure Y is translated. What does this mean?
A figure is a translation if it is moved without rotation or a reflection.
This figure was translated nine units down and one unit to the right.

Example 2:
The coordinates of the triangle ABC are (-6,9); (-6,5); (0,5).
What are the coordinate pairs if the diagram was moved 8 units to the right and 4 units down?
The new coordinates of A'B'C': (2,5); (2,1); (8,1)
Explain how each diagram was moved using the given coordinates.
(2,4) two to the right and four up
(-2,4) two to the left and four up
(2,-4) two to the right and four down
(-2,-4) two to the left and four down

1. In mathematics the translation object is called its image.
a. Describe the translation below.

b. Draw your own translation and describe it in centimetres.
2. Look at this architectural design and describe it using the words symmetry or transformations.

3. Complete the following:

a. The co-ordinates of ABC are: _______.
The co-ordinates A'B'C' are: _______.
Explain how the diagram was translated.

b. The co-ordinates of ABC are: _______.
The co-ordinates A'B'C' are: _______.
Explain how the diagram was translated.

c. The co-ordinates of ABC are: _______.
The co-ordinates A'B'C' are: _______.
Explain how the diagram was translated.

d. The co-ordinates of ABC are: _______.
The co-ordinates A'B'C' are: _______.
Explain how the diagram was translated.
In this activity, you will consider how to use the scale factor and centre of enlargement to work out the measure of enlargement.

Discuss the following.

ABC  \(AB = 3, BC = 3, CA = 3\)
A'B'C'  \(A'B' = 6, B'C' = 6, C'A' = 6\)

We can also draw an enlargement like this as in question 3 c.

Centre of enlargement
A' B' = 2 x AB
B' C' = 2 x BC
A'C' = 2 x AC

Therefore, we say that the transformation is an enlargement with scale factor 2.

1. By what scale factor is the figure enlarged?

a.
A'B' = (2) x AB  2 x 3 = 6
B'C' = (2) x BC  _____ = _____
C'D' = (2) x CD  _____ = _____
A'D' = (2) x AD  _____ = _____

Therefore we say that the transformation is an enlargement with scale factor (2).

b.
A'B' = (3) x AB  _____ = _____
B'C' = (3) x BC  _____ = _____
C'D' = (3) x CD  _____ = _____
A'D' = (3) x AD  _____ = _____

Therefore we say that the transformation is an enlargement with scale factor (3).

c.
A'B' = (4) x AB  _____ = _____
B'C' = (4) x BC  _____ = _____
A'C' = (4) x AC  _____ = _____

Therefore we say that the transformation is an enlargement with scale factor (4).

continued
Problem solving

If I enlarge a triangle with sides that equal three units each by scale factor 4, what will the lengths of the sides be?
2. Draw a rectangular house (6 m x 8 m). After drawing this, enlarge the house by a scale factor of 3.

a. i. What is the perimeter and area of the first house?
   _______________________________________________________________
   ii. What is the perimeter and area after the enlargement?
      _______________________________________________________________

b. i. What is the perimeter and area of the second house?
    _______________________________________________________________
   ii. What is the perimeter and area after the enlargement?
      _______________________________________________________________

By what scale factor is each figure enlarged by?

<table>
<thead>
<tr>
<th>Enlargement and reduction problems</th>
</tr>
</thead>
<tbody>
<tr>
<td>By what scale factor is each figure enlarged by?</td>
</tr>
<tr>
<td>A</td>
</tr>
<tr>
<td>B</td>
</tr>
<tr>
<td>C</td>
</tr>
<tr>
<td>D</td>
</tr>
</tbody>
</table>

Problem solving

Enlarge the figure in your answer to Question 1 by a scale factor of 3.
Reduce the figure in your answer to Question 2 by a scale factor of 2.

What do you notice?
1. Describe each of the following:

<table>
<thead>
<tr>
<th>Tetrahedron</th>
<th>Cube</th>
<th>Octahedron</th>
<th>Dodecahedron</th>
<th>Icosahedron</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geometric solid</td>
<td>Geometric solid</td>
<td>Geometric solid</td>
<td>Geometric solid</td>
<td>Geometric solid</td>
</tr>
</tbody>
</table>

2. Identify the tetrahedron. Compare the tetrahedron with the other pyramids.

3. Identify the cube. Compare the cube with the other solids.

4. Take a square pyramid. Imagine you have a second square pyramid. Put them together so that their bases are touching. What solid do you get? Is the solid regular?

5. Look at these geometric solids and answer the questions.

a. Identify all the solids with eight faces.

b. Look at the faces of the dodecahedron; which word describes what kind of polyhedron this is?

c. Identify the icosahedron. How many faces does it have? Can you get a pyramid with 20 faces? A prism? Is it regular or irregular?

d. Identify the dodecahedron. How many faces does it have? Are they regular or irregular?

e. Write down everything you know about platonic solids. Try to write it down in a logical order.

Activity

Make a geometric solid with more than 16 faces.
The five regular polyhedra were discovered by the ancient Greeks. The Pythagoreans knew of the tetrahedron, the cube, and the dodecahedron; the mathematician Theaetetus added the octahedron and the icosahedron. These shapes are also called the Platonic solids, after the ancient Greek philosopher Plato, who greatly respected the work of Theaetetus. Plato, who greatly respected the work of Theaetetus, speculated that these five solids were shapes of the fundamental components of the physical universe.

The Tetrahedron represents fire.

The Octahedron represents air.

The Icosahedron represents water.

The Cube represents earth.

The Dodecahedron represents the universe.

Activity
Take 10 triangles and build a solid. We call this a pentagonal dipyramid. Make a drawing of the net before building it.

Why do you think we call it a pentagonal dipyramid if there are no pentagons making up the shape?

5. What is the difference between a geometric figure and solid object?
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

6. Give an answer to the statement.
   a. This solid is made of eight equilateral triangles.
   b. This solid is made of four equilateral triangles.
   c. This solid is made of 12 pentagons.
   d. This solid is made of six squares.
   e. This solid is made of 20 equilateral triangles.

7. What can you tell about the platonic solids. Make use of words such as: geometric solid, geometric figures, face, etc.
Presentation tips
Go through these presentation tips.
When presenting you should:
• look at the people you are presenting to throughout the presentation
• start by explaining what the content of the presentation is about
• use natural hand gestures to demonstrate
• stand up straight with both feet firmly on the ground
• demonstrate a strong, positive feeling about the topic during the entire presentation
• stay within the required time frame
• use visual aids to enhance the presentation
• explain all points thoroughly
• organise your presentation well and maintain the interest level of the audience

In this activity you are going to plan for a presentation on Platonic solids.

Part 1
Make various Platonic solids: hexahedron, tetrahedron, dodecahedron, icosahedron and octahedron. Make use of waste products. Use your Platonic solids to create “buildings of the future”. You must use all the Platonic solids given in the list above.

What waste products are you going to use? Why?
_____________________________________
_____________________________________
_____________________________________
_____________________________________
_____________________________________
_____________________________________

Make a rough drawing of what you think the building will look like.

Part 2
Write how you created each Platonic solid, focusing on the shapes of faces and how you have joined them together. You may include drawings.

Now write a description of how you built the “buildings of the future”. Give reasons why you have used certain solids for certain buildings.

Part 3
Present your work in the class.

Presentations
Make notes on how you will improve your presentation next time.
1. Label the following using objects using these words: face, edge and vertex.

a. cube
b. tetrahedron
c. octahedron
d. dodecahedron
e. icosahedron
f. triangular cupola
g. augmented hexagonal prism
h. pentagonal deltohedron
i. pentagonal hexecontahedron

2. What do all these objects have in common?

<table>
<thead>
<tr>
<th>cube</th>
<th>icosahedron</th>
<th>dodecahedron</th>
<th>octahedron</th>
<th>tetrahedron</th>
</tr>
</thead>
</table>

3. Label the following objects using these words: face, edge and vertex. Also write down which geometric object each one will form and how many edges, vertices and faces it has.

a. __________ edges
   ________ vertices
   ________ faces
b. __________ edges
   ________ vertices
   ________ faces
c. __________ edges
   ________ vertices
   ________ faces
d. __________ edges
   ________ vertices
   ________ faces

4. Identify the vertices of the following Platonic solids and compare them in terms of their vertices.

a. b. c. d.

Activity

A friend has made these frame (skeleton) structures. He needs to change them to shell (surface) structures. Help him to first work out how many geometric faces he needs for each.
Regular and irregular

Compare the Platonic solids. Show the different features on the Platonic solids.

- They all have a different number of edges.
- They all have a different number of vertices.
- They all have a different number of faces.

<table>
<thead>
<tr>
<th>Tetrahedron</th>
<th>Cube</th>
<th>Octahedron</th>
<th>Dodecahedron</th>
<th>Icosahedron</th>
</tr>
</thead>
</table>

Each of the faces of a Platonic solid is the same.

The sides of the faces (geometric figures) are equal.

This means they are regular.

A geometric figure is regular if the sides are equal.

A geometric solid is regular if the faces are equal.

What do you notice if you look at a Platonic solid’s faces?

1a. Draw the following regular geometric figures: triangle, hexagon, octagon, square and pentagon. Label them.

b. Measure all the sides of each shape and write them down in a table. (Make sure that all the sides of each shape are equal.) Use a protractor to measure the angles of each shape.

<table>
<thead>
<tr>
<th>Shapes</th>
<th>Length of sides</th>
<th>Angle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triangle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Square</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pentagon</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hexagon</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Octagon</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

c. All the angles in each shape are equal. What does this mean?

d. What do we say when all the sides of a geometric figure are not equal?

e. Why/how are Platonic solids different from the pyramids and prisms? Give examples.

f. Circle the regular Platonic solids.

g. Name three more regular solids.

What do you notice if you look at a Platonic solid’s faces?

Activity

What should you do to the square pyramid to change it to an octahedron?
1. Construct a tetrahedron net

Step 1:
Construct an equilateral triangle. Label it ABC.

Step 2:
Construct another equilateral triangle with one base joined to base AB of the first triangle.

Step 3:
Construct another triangle using BD as a base.

Step 4:
Construct another triangle using AD as a base.

2. Construct a square pyramid net.

Step 1:
Construct two perpendicular lines. The lengths of AD and AB should be the same. Use your pair of compasses to measure them. From there, construct rectangle ABCD.

Step 2:
• Using AB as a base, construct a triangle.
• Using DC as a base, construct a triangle.

Step 3:
• Using DA as a base, construct a triangle.
• Using BC as a base, construct a triangle.

i) After you have constructed the square-based pyramid, answer the following questions:
   • what difficulties did you have?
   • what would you do differently next time?

ii) Now do the construction on cardboard, cut it out and make the square pyramid.
Constructing a net: tetrahedron, triangular pyramid, triangular and rectangular prism continued

3. Construct a triangular prism construction net.

**Step 1:** Construct two perpendicular lines. The lengths of AD and AB could be the same or one longer to form a rectangle. Use your pair of compasses to measure them. From there, construct rectangle ABCD.

**Step 2:**
- Using AB as a base, construct another square (or rectangle).
- Using DC as a base, construct a square (or rectangle).

**Step 3:**
- Using DA as a base, construct a triangle.
- Using BC as a base, construct a triangle.

---

4. Construct a rectangular prism construction net.

**Step 1:**
- Construct two perpendicular lines. The length between A and B should be longer than that between D and A. Use your compass to measure them. From there, construct rectangle ABCD.

**Step 2:**
- Use DC as base to construct another rectangle above.
- Use AB as base to construct another rectangle below. Label the new points G and H.
- Use GH as base to construct another rectangle.

**Step 3:**
- Use DA as base to construct a square.
- Use CB as base to construct a square.

---

i) After you have constructed the triangular prism, answer the following questions:
- what difficulties did you have?
- what would you do differently next time?

ii) Now do the construction on cardboard, cut it out and make the triangular prism.
Constructing a net: hexagonal prism and pyramid, octahedron

1. Construct a hexagonal prism.

Step 1:
- Construct hexagon ABCDEF.

Step 2:
- Use AB as a base to construct a rectangle.
- Use BC as a base to construct a rectangle.
- Use CD as a base to construct a rectangle.
- Use DE as a base to construct a rectangle.
- Use EF as a base to construct a rectangle.
- Use FA as a base to construct a rectangle.

Note: The rectangles can also be squares.

Step 3:
- Use IJ as a base to construct another hexagon.

Now do the construction on cardboard, cut it out and make the hexagonal prism.

Words to guide: Surfaces; Edges; Vertices; Regular; Irregular; 2-D; 3-D

2. Construct a hexagonal pyramid.

Step 1:
- Construct hexagon ABCDEF.

Step 2:
- Use AB as a base to construct a triangle.
- Use BC as a base to construct a triangle.
- Use CD as a base to construct a triangle.
- Use DE as a base to construct a triangle.
- Use EF as a base to construct a triangle.
- Use FA as a base to construct a triangle.

Step 3:
- Use IJ as a base to construct another hexagon.

Now do the construction on cardboard, cut it out and make the hexagonal pyramid.

3. Can you still remember the names of the Platonic solids? Write them down.

- _______________  - ________________  - _______________
- _______________  - ________________

Now do the construction on cardboard, cut it out and make the hexagonal prism.

Revised construction:

Hexagonal prism | Hexagonal pyramid | Octahedron
---|---|---

The rectangles can also be squares.

Words to guide: Surfaces; Edges; Vertices; Regular; Irregular; 2-D; 3-D

Step 1:
Construct two perpendicular lines. The length between A and B should be the same as D and A. Use your compass to measure them. From there, construct square ABCD.

Step 2:
• Use DC as base to construct another square.
• Use AB as base to construct another square. Label the new points G and H.
• Use GH as base to construct another square.

Step 3:
• Use DA as base to construct a square.
• Use CB as base to construct a square.

5. Construct an octahedron.

Step 1:
Construct an equilateral triangle. Label it ABC.

Step 2:
Construct another equilateral triangle with one base joined to base AB of the first triangle.

Step 3:
Construct another triangle using BD as a base.

Step 4:
Continue constructing triangles until you complete the net.
6. Construct an octahedron net.
Do the same for the icosahedron as with the octahedron. You just carry on constructing more triangles.

7. Project
You have had various opportunities to work through constructions step-by-step. In this activity, you are going to choose your own geometric solid and design a net for it. Do not choose solids that are too difficult or very easy to construct. You should:
• design and construct the net
• trace it on cardboard and cut it out
• fold it to make a solid.

8. Quick activity
Look at the net of the tetrahedron. In this activity, you will use transformation to describe how a tetrahedron’s net looks.
c. **Quick activity:** Look at this net of a Johnson solid. Describe the faces in your own words.

![Johnson solid net]

Quick activity: Look what happens with the angles when the net is folded to form a geometric solid. Describe the vertices.

Quick activity: Look at this net of a Johnson solid. Describe the faces in your own words.

![Johnson solid net]

d. Describe the shapes that make up your net in Question 8 in the same way as the example above.

![Net of a Johnson solid]

e. Describe the vertices of your created net.

![Net of a Johnson solid and its folded form]
Look at the building made from 21 cubes.

This is how the front, back and side views will look like.

Front view  Side view  Back view

We can draw the building on isometric paper; it will look like this.

Activity

Use the nets to make the geometric solids.

1. Draw a cube using a 30° oblique drawing. The steps below will guide you.

Step 1
Draw a square.

Step 2
Draw a 30° line from the bottom right vertex.

Step 1
Draw the rest of the cube.

Remember that the lines that are parallel in the real three-dimensional object remain parallel in the drawing.

C. What will happen if the angles are smaller than 30°?

b. Draw a cube using 45° oblique drawing.

c. What will happen if the angles are smaller than 30°?

2. Take 30 cubes and create this building (you may want to use a separate piece of paper.

a. Make an oblique drawing of the building. Note that you are not using isometric paper, but should use a protractor for your drawings.

b. Remove some of the lines so that it looks more like a building, and not as if it is made out of blocks.

c. What view of the building is this?

Activity

Use the nets to make the geometric solids.

1. Draw a cube using a 30° oblique drawing. The steps below will guide you.

Step 1
Draw a square.

Step 2
Draw a 30° line from the bottom right vertex.

Step 1
Draw the rest of the cube.

Remember that the lines that are parallel in the real three-dimensional object remain parallel in the drawing.

C. What will happen if the angles are smaller than 30°?

b. Draw a cube using 45° oblique drawing.

c. What will happen if the angles are smaller than 30°?

2. Take 30 cubes and create this building (you may want to use a separate piece of paper.

a. Make an oblique drawing of the building. Note that you are not using isometric paper, but should use a protractor for your drawings.

b. Remove some of the lines so that it looks more like a building, and not as if it is made out of blocks.

c. What view of the building is this?
1. These are all the nets for the platonic solids. Determine the possible outcome of each if you use the net to make a dice.

   a. Tetrahedron net
   b. Cube net
   c. Octahedron net
   d. Dodecahedron net
   e. Icosahedron net

   What are the possible outcomes for this die.
   The possible outcomes are: 1, 2, 3, 4, 5 and 6.

   Problem solving
   If a die with six faces is numbered 1, 1, 2, 2, 3, 3, what is the probability that it will land on 2?

2. How many faces will your dice have if your possible outcomes are the following?

   a. 2, 4, 6, 8, 10, 12, 14, 16
   b. 5, 10, 15, 20
   c. The probability to land on 5.
   d. The probability to land on 6.

   What is the probability to land on 6?
   Write it as a common fraction.

3. Make your own dice that will have more than six possible outcomes.

Revision:
What are the possible outcomes for this die.

The possible outcomes are: 1, 2, 3, 4, 5 and 6.

What are the possible outcomes if I have two dice?

The possible outcomes are: 1, 2, 3, 4, 5 and 6.

What is the probability to land on 3?
Write it as a common fraction.

What is the probability to land on 7?
Write it as a common fraction.

What is the probability to land on 6?
Write it as a common fraction.

What is the probability to land on 6?
Write it as a common fraction.

What is the probability to land on 6?
Write it as a common fraction.
Revision: The probability scale can look like this.

<table>
<thead>
<tr>
<th>Impossible</th>
<th>Unlikely</th>
<th>Even Chance</th>
<th>Likely</th>
<th>Certain</th>
</tr>
</thead>
</table>

Where will you put these on the scale?

- It will rain tomorrow.
- I don’t have to study much for my exams.
- When I flip a coin it will land on heads.

Look at a–c. Where will it fit on the fraction probability line below?

When I flip a coin the probability is $\frac{1}{2}$, 0.5 or 50% to land on heads or tails. What does this mean?

We can use words, fractions and/or decimals to show the probability of something happening.

A fraction probability line is shown like this.

1. Put these words in the correct place on top of the probability line:
certain, impossible, likely, unlikely, even chance.

2. Put these numbers in the correct place on the probability line:
50%, 75%, 25%, 100% and 0%

Remember that the probability is always expressed as a fraction, percentage or decimal between 0 and 1, e.g. $\frac{1}{4}$, 25% or 0.25.

3. What is the probability of landing on each number on the spinner?

   - 1 = ______
   - 2 = ______
   - 3 = ______
   - 4 = ______

   a. What number has the smallest chance to land on? _______________
   b. What are the chances of landing on an odd number? _______________

4. On a single dice, what are the chances of rolling...

   a. 6? _______________
   b. What are the chances of scoring the following on a pair of dice?

   - 1 = _______________
   - 6 = _______________
   - 12 = _______________
   - 13 = _______________

5. Show the following on the probability scale. Give your answers in fractions, decimals and percentages.

   a. The probability of landing on 5 on a die.

   b. The probability of drawing one block from a bag of ten blocks.

   c. The probability of spinning 2 on a spinner with five equal sections.

   d. The probability of drawing two sweets from a packet of 12 sweets.

   e. The probability of landing on 8 on a 12-sided die.

   a. 6? _______________
   b. What are the chances of scoring the following on a pair of dice?

   - 1 = _______________
   - 6 = _______________
   - 12 = _______________
   - 13 = _______________
Read and discuss the following:

The **relative frequency** of an event happening is the number of times the event happens divided by the number of trials made.

Some probabilities cannot be calculated by just looking at the situation.

For example, you cannot work out the probability of winning a soccer match by assuming that win, lose and draw are equally likely, but we can look at previous results in similar matches and use these results to estimate the probability of winning are carried out.

### Example 1:
The Warriors and Lions teams have played against each other 50 times. The Warriors have won 10 times, the Lions have won 35 times, and the teams have drawn five times.

We want to estimate the probability that the Lions will win the next match. So far, the Lions have won 35 of the 50 matches. We can write this as a fraction, which is $\frac{35}{50} = \frac{7}{10}$.

This fraction is not the actual probability of Lions winning, but it is an estimate of the probability.

We say that the relative frequency of the Lions winning is $\frac{7}{10}$.

**Relative Frequency**
We calculate the relative frequency of an outcome using this formula:

\[
\text{Relative frequency} = \frac{\text{number of successful trials}}{\text{total number of trials}}
\]

We can estimate the probability of a particular outcome by calculating the relative frequency.

The estimate of probability becomes more accurate if more trials are carried out.

### 1. Peter decides to try and estimate the probability that toast lands buttered side down when dropped. He drops a piece of buttered toast 50 times and observes that it lands buttered side down 20 times.

The relative frequency of the toast landing buttered side down, is $\frac{20}{50}$.

He could therefore estimate that the probability of the toast landing buttered side down is $\frac{2}{5}$.

Write this as a percentage.

### 2. Answer the following questions.
Lerato tosses a coin 100 times. She gets 65 heads and 35 tails. Using her results, estimate the probability of obtaining
- head when the coin is tossed.
- tail when the coin is tossed.

Write it as a percentage.

### 3. A drawing pin can land “point up” or “point down” when dropped.
John drops a drawing pin 100 times and it lands “point up” 25 times. Estimate the probability of the drawing-pin landing “point up”.

Write it as a percentage.

### 4. A six-sided die was rolled 150 times.
The 4 occurred 25 times.

Estimate the probability of getting 4 on this die.

Write it as a percentage.

### 5. Joan asked 50 people whether they were left-handed or right-handed.
Four people said they were left-handed.

Estimate the probability of any person chosen at random being left-handed.

Write it as a percentage.

### Activity
It rained on 10 days in November last year. Estimate the probability that it will rain on in November next year.

Write it as a percentage.
What is the difference between the probability and the relative frequency?

<table>
<thead>
<tr>
<th>Probability</th>
<th>Relative frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>25%</td>
</tr>
<tr>
<td>25%</td>
<td>50%</td>
</tr>
<tr>
<td>50%</td>
<td>75%</td>
</tr>
<tr>
<td>75%</td>
<td>100%</td>
</tr>
</tbody>
</table>

What is the probability of landing on 2 on a six-sided dice?

\[ \frac{2}{6} = \frac{1}{3} = 33\% \]

The difference between the **probability** and the **relative frequency** is 33\% – 27\% = 6\%.

a. You dropped a piece of buttered toast 80 times. It landed on the buttered side 39 times. What was the relative frequency?

b. I tossed a coin 120 times. It landed on tails 52 times. Do this activity and compare your results.

c. You rolled a six-sided die 150 times. It landed 28 times on 6. Do this activity and compare your results.

2. David draws a bar chart to show the season’s results for his soccer team so far. Estimate the probability that his team will win their next match.

- **Win**
- **Lose**
- **Draw**

Activity

What is the probability that your school's soccer/rugby team will win the next match?
Problem solving

Look at the pictures and say how you feel when you get a problem to solve.

After doing this activity, say how you should feel if you want to do well in mathematics.

In worksheet 155 and 156 you will solve some problems.

1. **Write down steps on how you will solve a problem.**

After doing this activity, say how you should feel if you want to do well in mathematics.

Go through this summary on solving problems. The questions may help you find a way to solve problems. After reading this look back at your answer in 1. Compare it with your answer.

- **Read and underline the question.**
- **Circle the key words.**
- **Circle key numbers and hidden numbers.**
- **What are you looking for in this problem?**
- **What information is not needed in solving this problem?**
- **After getting an answer, how can I check to see if it is correct?**
- **Does your answer make sense? Try it out.**

**Activity**

Compare your methods of solving problems with your friends. Write down the similarities and differences.

---

2. Richard learns two new concepts each week of mathematics lessons. Write an equation that shows the relationship between the weeks of lessons x and the total number of new concepts learned y.

Write your answer as an equation with y first, followed by an equals sign.

3. Sipho played 30 consecutive games of rugby without being taken off the field. Then he injured himself and missed playing one single game. He then played another 15 consecutive games. What is the percentage decrease in the number of consecutive games he played?

4. After doing the two new problems, write down a few more tips on problem solving.

**Tip:** Use the tips on problems solving on the previous page.

---

**Term 4**

- What information should you remember about this problem?
- What information is not needed in solving this problem?
Revision: Summarise in your own words how you will solve a problem.

Compare your answer with your friends.

Do two friends always solve a problem in the same way? Why or why not?

1. Imagine only the answer is given to you. How will you create a word problem with the following answer 38.25 m³? Give two possible word problems.
   a. I will create it by ...
   ______________________________________________________________________________
   ______________________________________________________________________________
   ______________________________________________________________________________
   ______________________________________________________________________________

2. Create two word problems when given the statement: $2x + 2b$
   a. Possible word problem
   b. Possible word problem

3. Create two word problems when given the statement: An object that is 64 cm³ will displace 64 ml water or 0.064 ℓ.
   a. Possible word problem
   b. Possible word problem

Problem solving skills

Compare your methods of creating a word problems with you friends. Write down the similarities and differences.
### Revision overview: part 1

#### Number, operations and relationships

In this worksheet we are going to revise number, operations and relationships.

<table>
<thead>
<tr>
<th>Number operations and relationship concepts</th>
<th>Worksheet numbers</th>
<th>Do you need support?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whole numbers</td>
<td>R1,45</td>
<td></td>
</tr>
<tr>
<td>Exponents</td>
<td>R3,14,15,17,18,19,20,21,22,23,24,25,26,76</td>
<td></td>
</tr>
<tr>
<td>Integers</td>
<td>R4,11,12,13</td>
<td></td>
</tr>
<tr>
<td>Fractions</td>
<td>Common fractions: R5, 65, 66, 67, 68, 69, 70</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Decimal fractions: R6, 71, 72, 73, 74, 75</td>
<td></td>
</tr>
<tr>
<td>Multiples and factors</td>
<td>R2,3,4,5</td>
<td></td>
</tr>
<tr>
<td>Properties of numbers</td>
<td>1,2</td>
<td></td>
</tr>
<tr>
<td>Financial mathematics</td>
<td>R10,6,7,8,9,10</td>
<td></td>
</tr>
</tbody>
</table>

#### My summary and notes.

1. Go through all the worksheets per topic above and make your own notes and summary.

<table>
<thead>
<tr>
<th>Whole numbers</th>
<th>Exponents</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

#### What do you understand now?

After doing this worksheet, share with your teacher and/or friends what you understand now that you didn’t understand before.
### Revision overview: part 2

#### Tick yes or no.

<table>
<thead>
<tr>
<th>This table will give you information on where to go and revise your work.</th>
<th>Worksheet numbers</th>
<th>Do you need support?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functions and relationships</td>
<td>R7, 29, 106, 107, 108, 109, 110</td>
<td>Yes</td>
</tr>
<tr>
<td>Numeric and geometric patterns</td>
<td>27, 28</td>
<td>Yes</td>
</tr>
<tr>
<td>Algebraic expressions</td>
<td>R8, 29, 30, 31, 32, 33, 34, 35, 36, 37, 39, 40, 41, 42, 43, 44</td>
<td>Yes</td>
</tr>
<tr>
<td>Algebraic equations</td>
<td>33, 34, 35, 36, 37, 111, 112, 113</td>
<td>Yes</td>
</tr>
<tr>
<td>Graphs</td>
<td>R9, R12, 114, 115, 116, 117, 118, 119, 120</td>
<td>Yes</td>
</tr>
</tbody>
</table>

#### My summary and notes.

1. Go through all the worksheets per topic above and make your own notes and summary.

<table>
<thead>
<tr>
<th>Functions and relationships</th>
<th>Numeric and geometric patterns</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

#### What do you understand now?

After revising this lesson, share with your teacher and/or friends what you understand now that you didn’t understand before.
## Revision overview: part 3

### Shape and space (geometry)

<table>
<thead>
<tr>
<th>Shape and space (geometry)</th>
<th>Worksheet numbers</th>
<th>Do you need support?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction of geometric figures</td>
<td>R11,56,57,58,59</td>
<td></td>
</tr>
<tr>
<td>Geometry of 2-D shapes</td>
<td>60,61,62,63,64,65,66,67,68,69,70,71</td>
<td></td>
</tr>
<tr>
<td>Transformation geometry</td>
<td>R12,121,122,123,124,125,126</td>
<td></td>
</tr>
<tr>
<td>Geometry of 3-D objects</td>
<td>R13,127,128,129,130,131,132,133,134</td>
<td></td>
</tr>
<tr>
<td>Geometry of straight lines</td>
<td>72,73,74,75</td>
<td></td>
</tr>
</tbody>
</table>

**My summary and notes.**

1. Go through all the worksheets per topic above and make your own notes and summary.

### Constructions of geometric figures

- [ ]

### Geometry of 2-D objects

- [ ]

### Transformation geometry

- [ ]

### Geometry of 3-D objects

- [ ]

### Geometry of straight lines

- [ ]

2. Add some everyday life examples for each concept.

**Space to make some drawings.**
**Revision overview: part 4**

**Measurement**

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Worksheet numbers</th>
<th>Do you need support?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area and perimeter of 2-D shapes</td>
<td>R14,77,78,79,80,81,82,83,84,85,86,87,88,89,90,91</td>
<td>Yes No</td>
</tr>
<tr>
<td>Surface area and volume of 3-D objects</td>
<td>R15,87,88,89,90,91</td>
<td></td>
</tr>
</tbody>
</table>

**Tick yes or no.**

In this worksheet we are going to revise measurement.

This table will give you information on where to go and revise your work.

**Area and perimeter of 2-D shapes**

My summary and notes.

1. Go through all the worksheets per topic above and make your own notes and summary.

2. Add some real life examples for each concept.

**Surface area and volume of 3-D objects**

What do you understand now?

After revising this lesson, share with your teacher and/or friends what you understand now that you didn’t understand before.
Revision overview: part 5

Data handling

Tick yes or no.

<table>
<thead>
<tr>
<th>Data handling</th>
<th>Worksheet numbers</th>
<th>Do you need support?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collect, organize and summarise data</td>
<td>R16,92,93,102,103,104</td>
<td></td>
</tr>
<tr>
<td>Represent data</td>
<td>94,95,96,97,98,99,100,101,102,103,104</td>
<td></td>
</tr>
<tr>
<td>Analyse, interpret and report data</td>
<td>94,95,96,97,99,100,101,103,104</td>
<td></td>
</tr>
<tr>
<td>Probability</td>
<td>135,136,137,138</td>
<td></td>
</tr>
</tbody>
</table>

Collect, organize and summarise data

Represent data

My summary and notes.

1. Go through all the worksheets per topic above and make your own notes and summary.

Collect, organize and summarise data

Represent data

2. Add some everyday life examples of data handling.

What do you understand now?

After revising this lesson, share with your teacher and/or friends what you understand now that you didn’t understand before.