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STOP! RUN! TELL! REPORT!

basic education
Department: Basic Education
REPUBLIC OF SOUTH AFRICA

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Rainbow WORKBOOKS

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MATHEMATICS IN ENGLISH
GRADE 8 – BOOK 2 • TERMS 3 & 4
ISBN 978-1-4315-0224-0
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14th Edition

MATHEMATICS IN ENGLISH – Grade 8 Book 2

ISBN 978-1-4315-0224-0

Revised and CAPS aligned

Grade 8

MATHEMATICS IN ENGLISH

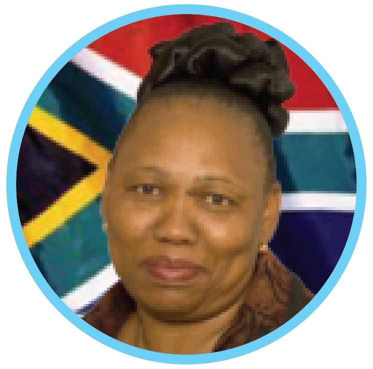
Book 2
Terms 3 & 4

Name:

Class:

basic education
Department: Basic Education
REPUBLIC OF SOUTH AFRICA

Contents



Mrs Angie Motshekga,
Minister of
Basic Education

Dr Reginah Mhaule,
Deputy Minister of
Basic Education

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, Dr Reginah Mhaule.

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.

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Rainbow WORKBOOKS

Grade 8

Mathematics

PART 3

WORKSHEETS
65 to 144

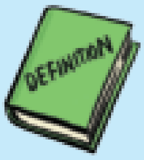
ENGLISH

Book 2

Name:

65 Add and subtract fractions

Term 3



$\frac{2}{4}$ ← numerator ← denominator

A fraction having the numerator less than the denominator is called a **proper fraction**. The value of the fraction is always less than one

An **improper fraction** is a fraction where the numerator (the top number) is greater than or equal to the denominator (the bottom number).

A **mixed number** is a number that has a whole number part and a fractional part.

$\frac{2}{6}$ $\frac{5}{2}$ $1\frac{2}{3}$

Match the fraction with the definition.

If $\frac{1}{2}$ is the simplest form of $\frac{2}{4}$; $\frac{3}{6}$; $\frac{4}{8}$; $\frac{5}{10}$ and $\frac{6}{12}$, what is the simplest form of the following?
$\frac{4}{6}$; $\frac{6}{8}$; $\frac{3}{9}$; $\frac{6}{12}$; $\frac{10}{15}$

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. $\frac{3}{4} + \frac{2}{4} =$ ______

d. $\frac{7}{10} + \frac{5}{10} =$

e. $\frac{5}{6} + \frac{3}{6} =$

f. $\frac{5}{7} + \frac{6}{9} =$

4. Calculate and simplify if necessary.

Example:

$\frac{1}{2} + \frac{1}{3}$

$= \frac{5}{6}$

Where does the 6 come from?

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. $\frac{1}{2} + \frac{1}{3} =$

5. Calculate and simplify.

Examples:

$2 + \frac{5}{6}$

$= \frac{2}{1} + \frac{5}{6}$

$= \frac{17}{6}$

$= 2\frac{5}{6}$

How did we get this mixed number?

$\frac{3}{4} + \frac{3}{2}$

$= \frac{3}{4} + \frac{6}{4}$

$= \frac{9}{4}$

$= 2\frac{1}{4}$

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. $2\frac{1}{6} + 1\frac{1}{5} =$

f. $7\frac{1}{2} - 1\frac{3}{4} =$

Sign:

Date:

Activity

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

15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

66 Multiply fractions

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: $\frac{6}{7} \times \frac{5}{6}$

$= \frac{30}{42}$

$= \frac{5}{7}$

Can we simplify this fraction?

Simplify.

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

$\frac{30 \div 6}{42 \div 6} = \frac{5}{7}$

The largest common factor of two or more numbers is called the **Highest Common Factor** (HCF) also called the **Greatest Common Factor** (GCF).

a. $\frac{1}{5} \times \frac{2}{3} =$ b. $\frac{2}{4} \times \frac{1}{3} =$ c. $\frac{1}{6} \times \frac{3}{7} =$

2. Solve the following:

Examples: ___ × ___ = $\frac{9}{12}$

$\frac{3}{3} \times \frac{3}{4} = \frac{9}{12}$

$\frac{1}{3} \times \frac{9}{4} = \frac{9}{12}$

$\frac{3}{2} \times \frac{3}{6} = \frac{9}{12}$

a. ___ × ___ = $\frac{4}{9}$ b. ___ × ___ = $\frac{8}{14}$ c. ___ × ___ = $\frac{6}{8}$

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. $11 \times \frac{3}{10} =$

Term 3

4. **Which whole number and fraction will give you the following answer?**

Example: ___ × ___ = $\frac{2}{3}$

$\frac{2}{1} \times \frac{1}{3}$

$= 2 \times \frac{1}{3}$

a. ___ × ___ = $\frac{4}{6}$

b. ___ × ___ = $\frac{9}{18}$

c. ___ × ___ = $\frac{3}{8}$

5. **Multiply and simplify if possible.**

Example: $\frac{1}{3} \times \frac{3}{4}$

$= \frac{3}{12} = \frac{3 \div 3}{12 \div 3}$ (3 is the HCF)

$= \frac{1}{4}$

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: $\frac{6}{4} \times \frac{5}{2}$

$= \frac{30}{8}$

$= 3\frac{6}{8}$

$= 3\frac{3}{4}$ (HCF is 2)

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?

Sign:

Date:

Divide common fractions

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

1

$3 \div \frac{3}{4}$

$= \frac{3}{1} \times \frac{4}{3}$

$= 4$

2

$4 \div \frac{8}{5}$

$= \frac{4}{1} \times \frac{5}{8}$

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

$= 2\frac{1}{2}$

3

$\frac{1}{2} \div \frac{1}{6}$

$= \frac{1}{2} \times \frac{6}{1}$

$= \frac{6}{2}$

$= 3$

4

$\frac{2}{3} \div \frac{3}{4}$

$= \frac{2}{3} \times \frac{4}{3}$

$= \frac{8}{9}$

5

$1\frac{1}{2} \div 2\frac{1}{4}$

$= \frac{3}{2} \div \frac{9}{4}$

$= \frac{3}{2} \times \frac{4}{9}$

$= \frac{2}{3}$

1. Calculate.

Example: $2 \div \frac{3}{4}$

$= \frac{2}{1} \times \frac{4}{3}$

$= \frac{8}{3}$

$= 2\frac{2}{3}$

a. $4 \div \frac{4}{5} =$

b. $7 \div \frac{7}{9} =$

c. $12 \div \frac{12}{15} =$

d. $9 \div \frac{9}{11} =$

e. $5 \div \frac{5}{6} =$

f. $10 \div \frac{10}{11} =$

2. Calculate.

Example: See the second example in the introduction.

a. $3 \div \frac{6}{7} =$

b. $6 \div \frac{18}{19} =$

c. $8 \div \frac{16}{18} =$

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

d. $2 \div \frac{8}{9} =$

e. $4 \div \frac{12}{16} =$

f. $7 \div \frac{21}{23} =$

3. Calculate.

Example: See the third and fourth example in the introduction.

a. $\frac{2}{3} \div \frac{1}{4} =$

b. $\frac{5}{9} \div \frac{1}{5} =$

c. $\frac{6}{7} \div \frac{1}{8} =$

d. $\frac{2}{8} \div \frac{4}{5} =$

e. $\frac{4}{5} \div \frac{2}{3} =$

f. $\frac{8}{10} \div \frac{6}{7} =$

4. Calculate.

Example: See the fifth example in the introduction.

a. $1\frac{1}{2} \div 2\frac{1}{4} =$

b. $1\frac{1}{2} \div 2\frac{3}{4} =$

c. $3\frac{2}{3} \div 4\frac{2}{3} =$

d. $3\frac{1}{3} \div 7\frac{1}{5} =$

e. $5\frac{2}{2} \div 2\frac{4}{5} =$

f. $5\frac{1}{4} \div 3\frac{2}{6} =$

Activity

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

Divide eight ninths by eighteen halves.

Sign:

Date:

68

Fractions of squares, cubes, square roots and cube roots

Work through examples 1–4 and discuss them.

1. $\left(\frac{3}{4}\right)^2 = \frac{3^2}{4^2} = \frac{9}{16}$

2. $\left(\frac{3}{4}\right)^3 = \frac{3^3}{4^3} = \frac{27}{64}$

3. $\sqrt{\frac{16}{25}} = \frac{\sqrt{16}}{\sqrt{25}} = \frac{4}{5}$

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. $\left(\frac{1}{4}\right)^2$

b. $\left(\frac{2}{7}\right)^2$

c. $\left(\frac{5}{6}\right)^2$

d. $\left(\frac{5}{8}\right)^2$

e. $\left(\frac{3}{4}\right)^2$

f. $\left(\frac{2}{5}\right)^2$

2. Revision: calculate.

Example: See the third example in the introduction.

a. $\sqrt{\frac{4}{9}}$

b. $\sqrt{\frac{49}{81}}$

c. $\sqrt{\frac{16}{100}}$

d. $\sqrt{\frac{36}{64}}$

e. $\sqrt{\frac{9}{16}}$

f. $\sqrt{\frac{81}{100}}$

3. Calculate.

Example: See the second example in the introduction.

a. $(\frac{1}{4})^3$

b. $(\frac{1}{3})^3$

c. $(\frac{6}{6})^3$

d. $(\frac{4}{8})^3$

e. $(\frac{2}{3})^3$

f. $(\frac{2}{7})^3$

4. Revision: calculate.

Example: See the fourth example in the introduction.

a. $\sqrt[3]{\frac{8}{125}}$

b. $\sqrt[3]{\frac{1}{64}}$

c. $\sqrt[3]{\frac{64}{125}}$

d. $\sqrt[3]{\frac{125}{64}}$

e. $\sqrt[3]{\frac{1}{1}}$

f. $\sqrt[3]{\frac{8}{125}}$

Activity

What is the square root of sixteen squared divided by the square root of twenty–five?

Sign:

Date:

69a Fractions, decimals and percentages

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

What is 60% of R105?

$\frac{60}{100} \times \frac{R105}{1}$

$= \frac{3}{5} \times \frac{R105}{1}$

$= \frac{R315}{5}$

= R63

I can write 60% as $\frac{60}{100}$.

$\frac{60}{100}$ simplified is $\frac{6}{10} = \frac{3}{5}$

What percentage is 40c of R3,20?

$\frac{40}{320} \times \frac{100}{1}\%$

$= \frac{4000}{320}\%$

$= \frac{100}{8}\%$

= 12,5%

$\frac{4000}{320}$ simplified is $\frac{100}{8}$.

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: $18\% = \frac{18}{100} = \frac{9}{50} = 0{,}18$

$= \frac{9}{50}$

$\frac{18}{100}$ simplified is $\frac{9}{50}$.

a. 37%

b. 25%

c. 83%

d. 9%

e. 56%

f. 3%

2. **Write the following as fractions in their simplest form.**

Percentage	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Fraction	$\frac{10}{100}$									
Simplest form	$\frac{1}{10}$									

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

Sign:

Date:

continued ☛

69b Fractions, decimals and percentages continued

4. Calculate the percentage.

Example: 60c of R4,80

$\frac{60}{480} \times \frac{100}{1}\%$

$= \frac{6000}{480}\%$

$= \frac{50}{4}\%$

$= 12,5\%$

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.

Sign:

Date:

70a Percentage problems

When solving a problem you can go through the following steps:

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

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

C **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?

Sign:

Date:

continued ☛

70b Percentage problems continued

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.

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

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

Problem solving

Investigate using different amounts and percentages to find expressions leading to calculating a percentage increase/decrease.

Sign:

Date:

71 Place value, ordering and comparing decimals

Revise the place value of decimal fractions.

units tenths hundredths thousandths

8,924

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 units + 8 tenths + 7 hundredths + 2 thousandths

a. 3,378 ______

b. 6,2914 ______

c. 2,588 ______

d. 2,037 ______

e. 2,003 ______

f. 14,030 ______

MATHS Gr8 B2 Theme 1.indd 18 2019/06/28 09:16:16

3. Write the following in the correct column.

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

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

Sign:

Date:

Problem solving

What would you do to change this decimal fraction from 9,768 to 9,008?

72 Round off rational numbers

Round off to the nearest **unit**.

3,7 ≈ 4 5,62 ≈ 6 7,321 ≈ 7

3,2 ≈ 3 5,18 ≈ 5 7,329 ≈ 7

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

Round off to the nearest **tenth**.

8,26 ≈ 8,3 3,765 ≈ 3,8 5,293 ≈ 5,3

8,21 ≈ 8,2 3,768 ≈ 3,8 5,224 ≈ 5,2

Round off to the nearest **hundredth**.

3,472 ≈ 3,47 8,925 ≈ 8,93

3,478 ≈ 3,48 7,342 ≈ 7,34

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≈ 7 6,③≈ 6

a. 9,2 ______ b. 4,5 ______ c. 4,8 ______

d. 6,4 ______ e. 5,68 ______ f. 5,999 ______

g. 3,34 ______ h. 7,82 ______ i. 9,321 ______

j. 100,383 ______

4. Round off to the nearest tenth.

Example: 5,8④ ≈ 5,8

a. 5,24 ______ b. 3,53 ______ c. 5,55 ______

d. 9,39 ______ e. 7,513 ______ f. 2,329 ______

g. 8,632 ______ h. 1,189 ______ i. 6,7631 ______

j. 8,9789 ______

5. Round off to the nearest hundredth.

Example: 8,95⑦ ≈ 8,96

a. 1,181 ______ b. 2,345 ______ c. 8,655 ______

d. 7,942 ______ e. 5,229 ______ f. 3,494 ______

g. 4,715 ______ h. 8,537 ______ i. 5,9676 ______

j. 8,6972 ______

6. Round off to the nearest thousandth.

Example: 18,257⑥ ≈ 18,258

a. 5,1272 ______ b. 2,7864 ______ c. 6,6628 ______

d. 5,2336 ______ e. 1,9813 ______ f. 3,3336 ______

g. 9,4581 ______ h. 7,7857 ______ i. 7,8176 ______

j. 8,6491 ______

Activity

In everyday life, why do we round off decimal numbers? Give five examples.

Sign:

Date:

73 Equivalence between common fractions and decimal fractions

Can you remember how to write decimal fractions as common fractions? Look at the following

- $0{,}5 = \frac{5}{10}$ — We say five–tenths
- $0{,}08 = \frac{8}{100}$ — We say eight–hundredths
- $0{,}007 = \frac{7}{1000}$ — We say seven–thousandths
- $0{,}287 = \frac{2}{10} + \frac{8}{100} + \frac{7}{1000}$

1. Write as a decimal fraction.

Example: $\frac{6}{100}$
$= 0{,}06$

a. $\frac{7}{10}$ ______ b. $\frac{6}{100}$ ______ c. $\frac{9}{1000}$ ______

d. $\frac{8}{10}$ ______ e. $\frac{3}{1000}$ ______ f. $\frac{1}{1000}$ ______

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

d. $\frac{28}{100}$ ______ 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. $\frac{92}{10}$ ______ b. $\frac{8476}{100}$ ______ c. $\frac{15}{10}$ ______

Term 3

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

d. $\frac{5600}{100}$

e. $\frac{374}{10}$

f. $\frac{8732}{100}$

g. $\frac{76599}{1000}$

h. $\frac{8732}{1000}$

i. $\frac{65}{10}$

j. $\frac{784}{100}$

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

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. $\frac{1}{2}$

d. $\frac{3}{5}$

e. $\frac{2}{4}$

f. $\frac{1}{25}$

g. $\frac{1}{50}$

h. $\frac{20}{25}$

i. $\frac{3}{20}$

j. $\frac{40}{50}$

Sign:

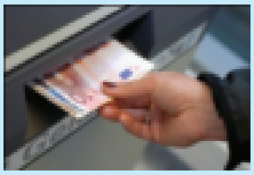
Date:

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?

74 Addition, subtraction and multiplication of decimal fractions

Where in everyday life will you use decimal fractions?




Remember that in South Africa we mainly use a decimal comma. Some people use a decimal point, which has the same function as the decimal comma.

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 = 0,06 | 0,02 × 0,3 = 0,006 | 0,02 × 0,03 = 0,0006

a. 0,3 x 0,4 =

b. 0,5 x 0,1 =

c. 0,7 x 0,8 =

d. 0,6 x 0,7 =

e. 0,04 x 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

+ – × Length	+ – × Weight	+ – × Capacity	+ – × Money

Sign:

Date:

15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

75 Dividing decimals

How quickly can you recall the answers?

8 ÷ 4 =		35 ÷ 7 =		42 ÷ 7 =	
55 ÷ 5 =		63 ÷ 9 =		12 ÷ 2 =	
30 ÷ 5 =		16 ÷ 4 =		81 ÷ 9 =	
121 ÷ 11 =		54 ÷ 6 =		42 ÷ 6 =	
35 ÷ 5 =		125 ÷ 25 =		144 ÷ 12 =	

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?

c. You need seven equal pieces from 28,7 m of rope. How long will each piece be?

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 ÷ 2 = 3, calculate 0,6 ÷ 2; 0,06 ÷2; 0,006 ÷2. What conclusion can you draw from your observations?

Sign:

Date:

76a Squares and rational numbers

Term 3

Look at all the examples and work through them.

What do you notice?

$(0{,}7)^2$
$= 0{,}7 \times 0{,}7$
$= 0{,}49$

or

$\left(\frac{7}{10}\right)^2$
$= \frac{7}{10} \times \frac{7}{10}$
$= \frac{49}{100}$
$= 0{,}49$

$\sqrt{0{,}0004}$
$= \sqrt{0{,}02 \times 0{,}02}$
$= 0{,}02$

or

$\sqrt{\frac{4}{10\,000}}$
$= \sqrt{\frac{2}{100} \times \frac{2}{100}}$
$= \frac{2}{100}$
$= 0{,}02$

$\sqrt{0{,}04}$
$= \sqrt{0{,}2 \times 0{,}2}$
$= 0{,}2$

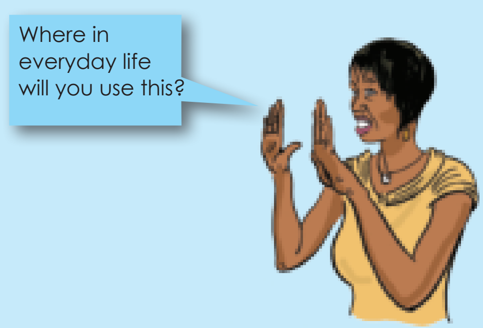
or

$\sqrt{\frac{4}{100}}$
$= \sqrt{\frac{2}{10} \times \frac{2}{10}}$
$= \frac{2}{10}$
$= 0{,}2$

$(0{,}04)^2$
$= 0{,}04 \times 0{,}04$
$= 0{,}0016$

or

$\left(\frac{4}{100}\right)^2$
$= \frac{4}{100} \times \frac{4}{100}$
$= \frac{16}{10\,000}$
$= 0{,}0016$



$(0{,}1)^3$
$= 0{,}1 \times 0{,}1 \times 0{,}1$
$= 0{,}001$

or

$\left(\frac{1}{10}\right)^3$
$= \frac{1}{10} \times \frac{1}{10} \times \frac{1}{10}$
$= \frac{1}{1\,000}$
$= 0{,}001$

$(0{,}01)^3$
$= 0{,}01 \times 0{,}01 \times 0{,}01$
$= 0{,}000001$

or

$\left(\frac{1}{100}\right)^3$
$= \frac{1}{100} \times \frac{1}{100} \times \frac{1}{100}$
$= \frac{1}{1\,000\,000}$
$= 0{,}000001$

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

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**.

You may use a calculator.

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.

Sign:

Date:

continued ☛

Squares and rational numbers 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?

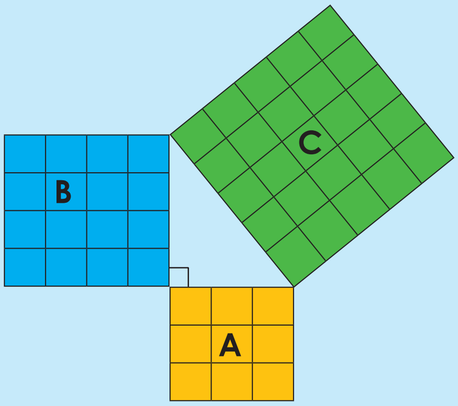
b. We can find $\sqrt[3]{-0,064}$. Can we find $\sqrt{-0,9}$? Why or why not?

c. If the height of a cube is 0,35 m, what is the volume of the cube?

Sign:

Date:

77 Pythagoras' theorem



What is the size of A? $3^2 = 3 \times 3$

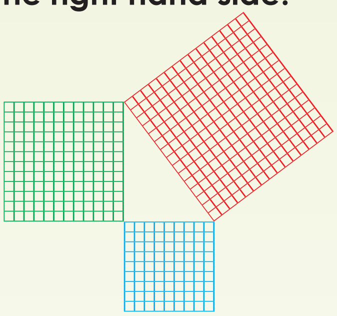
What is the size of B? $4^2 = 4 \times 4$

What is the size of C? $5^2 = 5 \times 5$

What do you notice?

$3^2 + 4^2 = 5^2$
$9 + 16 = 25$
$25 = 25$

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



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

	Side A	Side B	Side C
a.	6	8	10
b.	15	20	25
c.	27	36	45
d.	12	16	20
e.	21	28	35

a.

b.

c.

d.

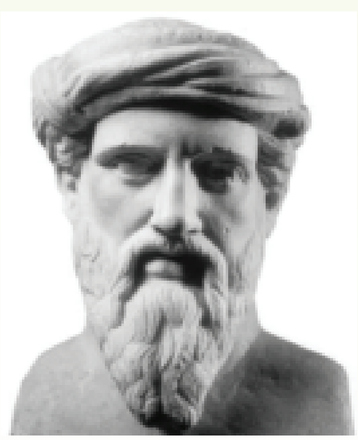
e.

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.



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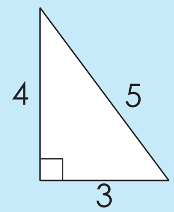
Activity

Give two examples of where we can use Pythagoras' theorem in everyday life.

78 Theorem of Pythagoras and some fun!

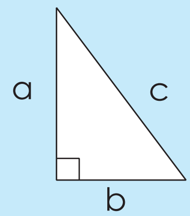
Look at the example and explain it.



$4^2 + 3^2 = 5^2$

$16 + 9 = 25$

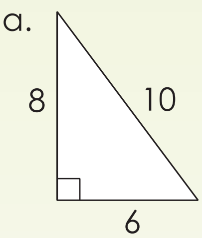
$25 = 25$



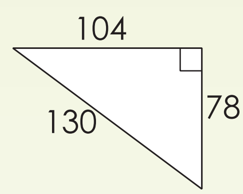
$a^2 + b^2 = c^2$

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

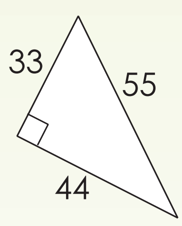
a.



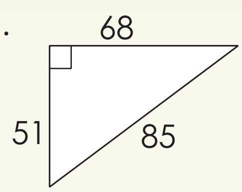
b.



c.

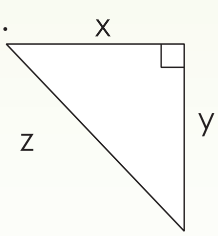


d.

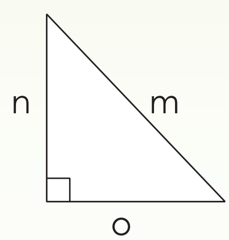


2. Write an equation for the following:

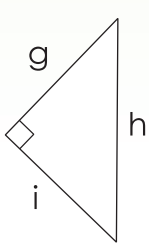
a.



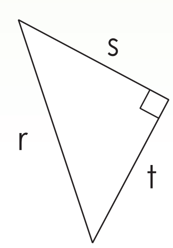
b.



c.

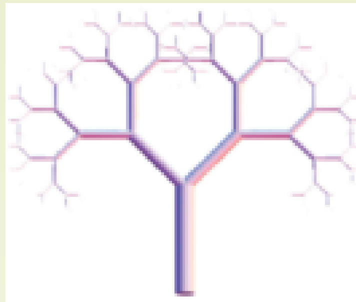


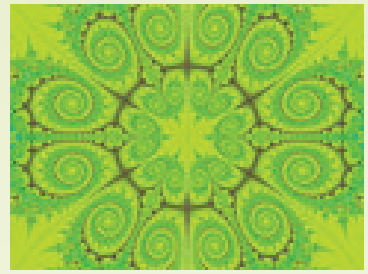
d.



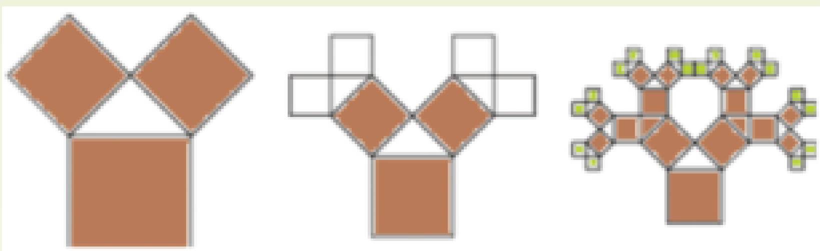
Term 3

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.

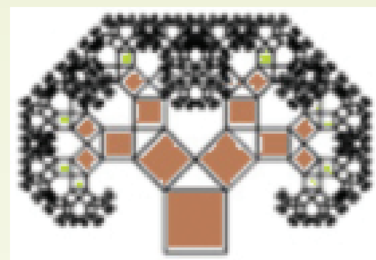




3. This is a fractal using the Theorem of Pythagoras. Copy and explain it.

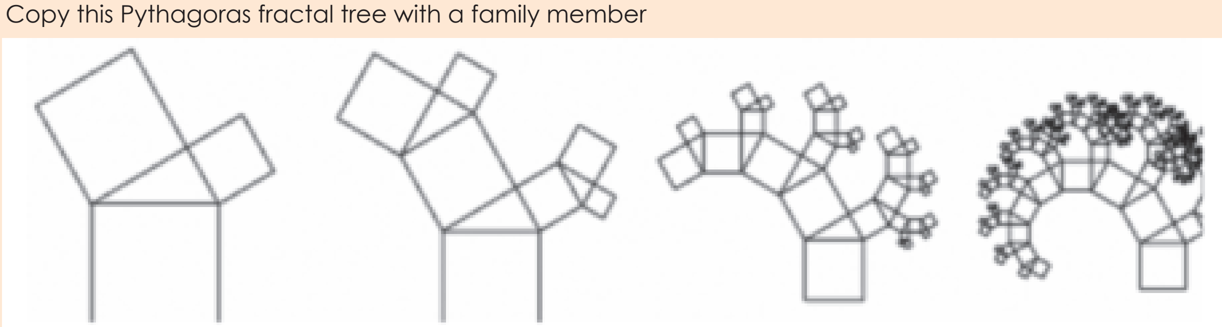


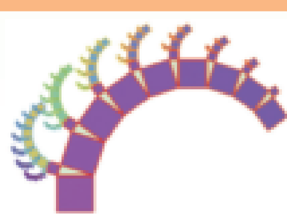
Now try to draw this.

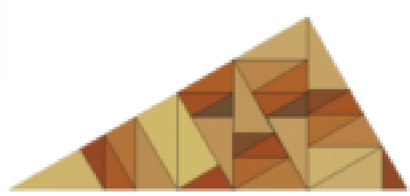


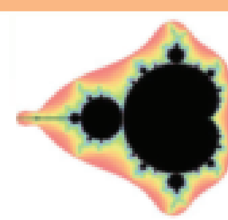
Pythagoras fractal tree fun

Copy this Pythagoras fractal tree with a family member









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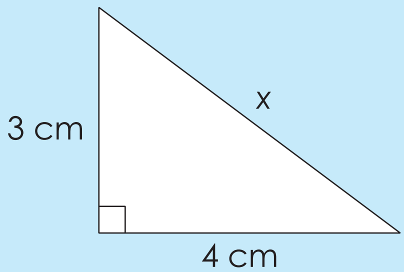
79 More on the Theorem of Pythagoras

What is the value of x?



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

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

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

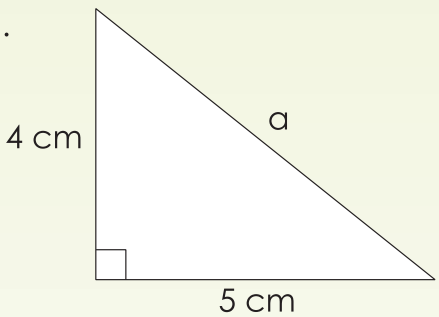
$x = 5\text{ cm}$

Remember the **hypotenuse** is the side opposite the right angle in a right–angled triangle.

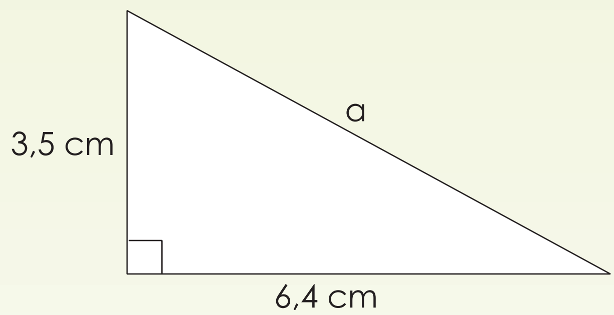
1. **Find the lengths of the unknown sides in the following right–angled triangles. You may use a calculator.**

Example: See introduction.

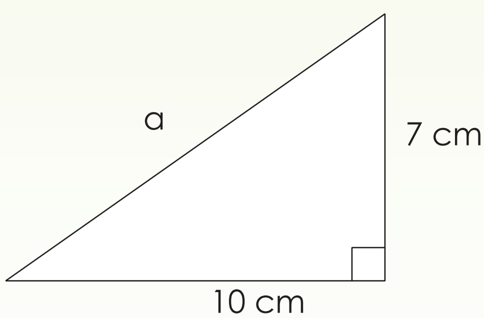
a.



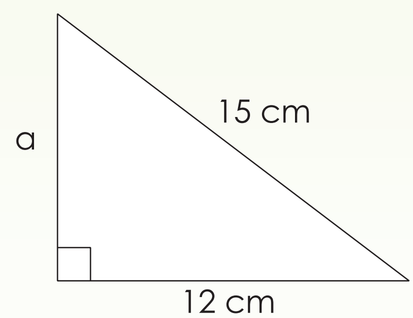
b.



c.



d.



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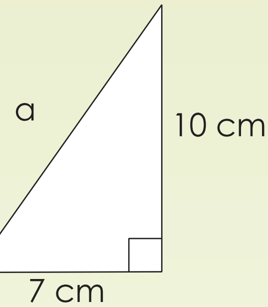
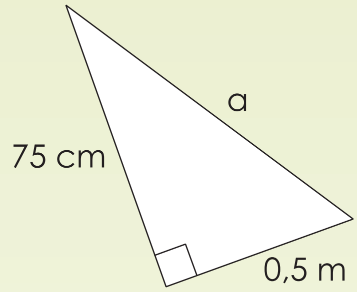
e.

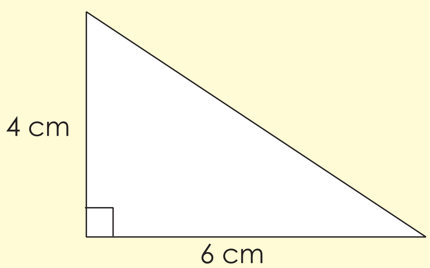


f.



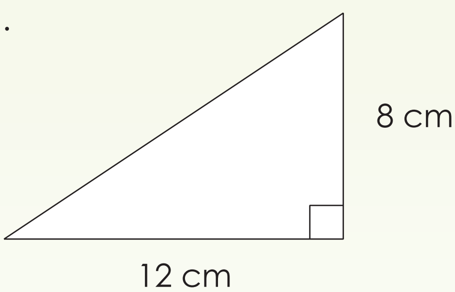
2. Find the length of the hypotenuse.

Example:

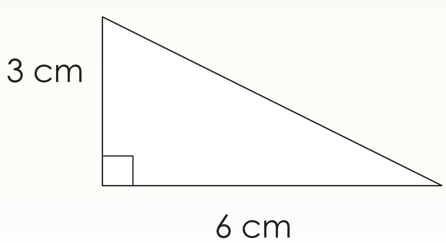


$$\begin{aligned} \textit{hypotenuse} &= \sqrt{4^2 + 6^2} \\ &= \sqrt{16 + 36} \\ &= \sqrt{52} \\ &= 7{,}2 \text{ cm} \end{aligned}$$

a.



b.



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.

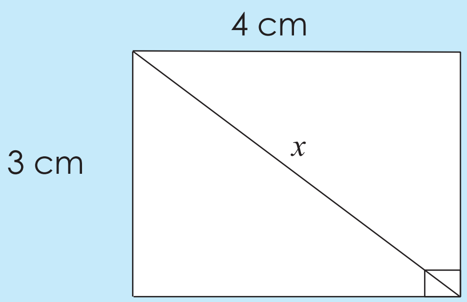
Sign:

Date:

80 Theorem of Pythagoras

Term 3

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



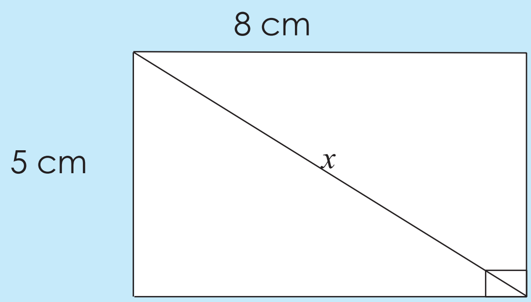
$x^2 = (3\text{ cm})^2 + (4\text{ cm})^2$

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

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

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

$x = 5\text{ cm}$



$x^2 = (5\text{ cm})^2 + (8\text{ cm})^2$

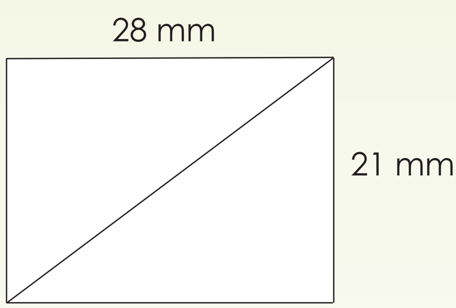
$x^2 = 25\text{ cm}^2 + 64\text{ cm}^2$

$x^2 = 89\text{ cm}^2$

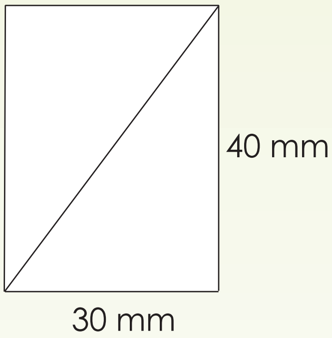
$x = 9{,}43\text{ cm}$

1. Calculate the lengths of the diagonal of the rectangles

a.



b.



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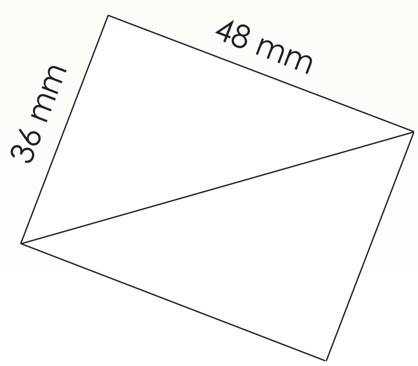
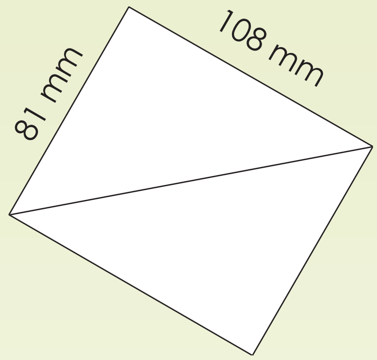
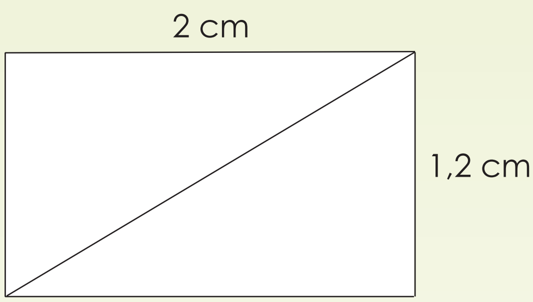


d.

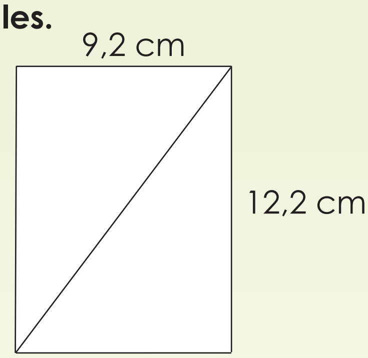


2. Calculate the lengths of the diagonal of the rectangles.

a.



b.



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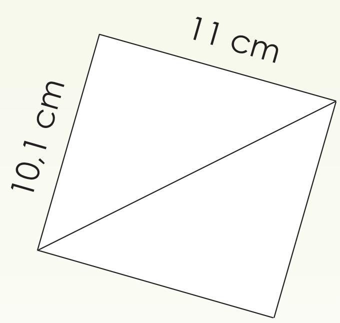

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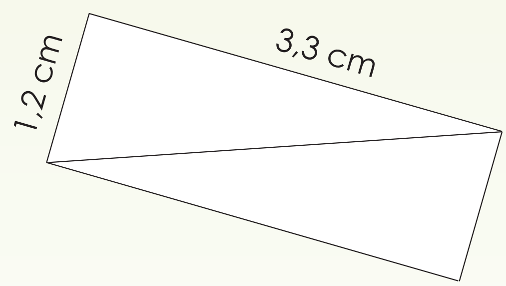


Problem solving

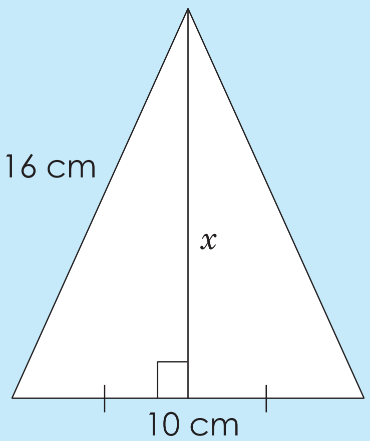
Create your own problem using the Theorem of Pythagoras problem.

Sign:

Date:

81 More Theorem of Pythagoras

Go through the example. Explain.



$(16\text{ cm})^2 = x^2 + (5\text{ cm})^2$

$256\text{ cm}^2 = x^2 + 125\text{ cm}^2$

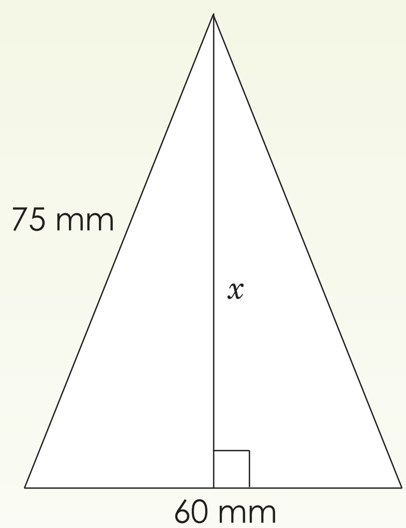
$x^2 = 131\text{ cm}^2$

$\sqrt{x^2} = \sqrt{131\text{ cm}^2}$

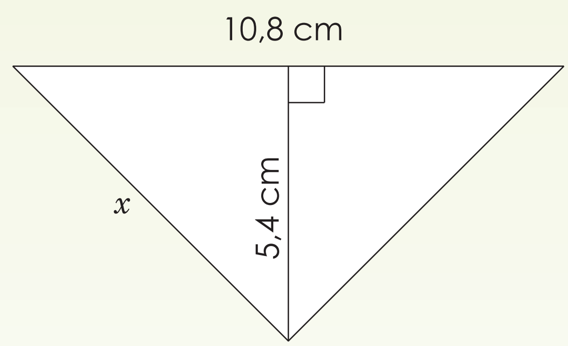
$x = 11{,}45\text{ cm}$

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

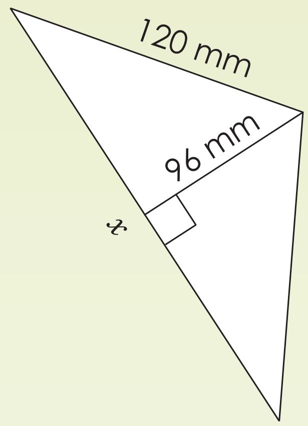
a.



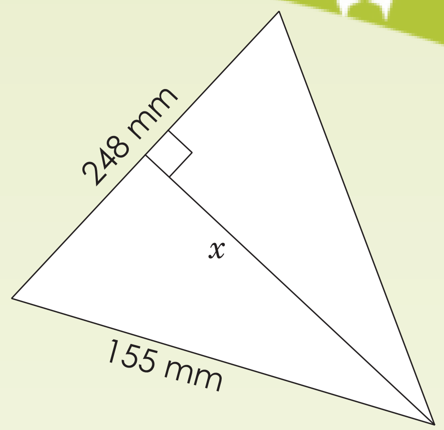
b.



c.



d.



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?**

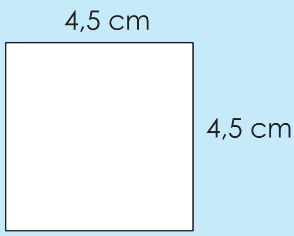
Problem solving

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?

Sign:

Date:

82a Area and perimeter of a square



What is the perimeter of a square?

What is the area of a square?

Perimeter	Area
$P = 4s$	$A = s^2$
= 4 (4,5 cm)	= 4,5 cm × 4,5 cm
= 18 cm	= 20,25 cm^2
Answers in mm	
= 4 (45 mm)	= 45 mm × 45 mm
= 180 mm	= 2 025 mm^2

If the area is 2 025 mm^2 what will the answer be in cm^2?

1 cm = 10 mm
1 cm^2 = 1 cm × 1 cm
1 cm^2 = 10 mm × 10 mm
1 cm^2 = 100 mm^2

$\therefore \frac{2\,025 \text{ mm}^2}{100}$

= 20,25 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.

Perimeter	**Area**
$P = 4s$	$A = s \times s$
= 4 (2,5 cm)	= 2,5 cm × 2,5 cm
= 10 cm	= 6,25 cm^2
Millimetre	
= 4 (25 mm)	= 25 mm × 25 mm
= 100 mm	= 625 mm^2
Metre	
= 4 (0,025)	= 0,025 m × 0,025 m
= 0,1 m	= 0,000625 m^2

Term 3

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

a. 4,1 cm

b. 0,4 m

c. 45 mm

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.

Sign:

Date:

continued ☛

15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

82b Area and perimeter of a square

continued

c.

d.

4. Write the following in mm²

Example: 1,44 cm^2
1,2 cm × 1,2 cm
12 mm × 12 mm
144 mm^2

$\sqrt{1,44}$
= 1,2

a. 3,24 cm^2

b. 5,29 cm^2

5. Write the following in cm²

Example: 256 mm^2

$\frac{256 \text{ mm}^2}{100}$

= 2,56 cm^2

a. 576 mm^2

b. 3 769 mm^2

c. 1 681 mm^2

6. **Write the following in m^2**

Example: 21 cm × 21 cm

= 441 cm^2

$= \frac{411\ cm^2}{10\ 000}$

= 0,0441 m^2

1 m = 100 cm
1 m^2 = 1 m × 1 m
1 m^2 = 100 cm × 100 cm
1 m^2 = 10 000 cm^2

21 cm × 21 cm

= 0,21 m × 0,21 m

= 0,0441 m^2

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 3m^2?

Sign:

Date:

83 Area and perimeter of a rectangle

What is the perimeter of a rectangle?

What is the area of a rectangle?

Perimeter

$P = 2\ (l + b)$

= 2 (3,8 cm + 2,1cm)

= 2 (5,9 cm)

= 11,8 cm

Area

$A = l \times b$

= 3,8 cm × 2,1 cm

= 7,98 cm^2

The area in mm^2 and m^2 are:

mm²

7,98 cm^2

= 7,98 × 100 mm^2

= 798 mm^2

1 cm = 10 mm
1 cm^2 = 1 cm × 1 cm
1 cm^2 = 10 mm × 10 mm
1 cm^2 = 100 mm^2

m²

7,98 cm^2

= $\frac{7,98}{10\ 000}$ m^2

= 0,000798 m^2

1 m = 100 cm
1 m^2 = 100 cm × 100 cm
1 m^2 = 10 000 cm^2

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 = $2\ (l + b)$

= 2 (2,1 cm + 1,8 cm)

= 7,8 cm

Millimetres

= 78 mm

Metres

= 0,078 m

Area = $l \times b$

= 2,1 cm × 1,8 cm

= 3,78 cm^2

= 3,78 × 100 mm^2

= 378 mm^2

= $\frac{3,78}{10\ 000}$ m^2

= 0,000378 m^2

Term 3

a. 0,9 cm × 1,5 cm

b. Length = 1,3 cm; breadth = 1,1 cm

c. 2,1 cm × 1,9 cm

b. Length = 2,8 cm; breadth = 1,7 cm

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

Example: Area = 4,14 cm^2 and breadth = 1,8cm

Area = $l \times b$

4,14cm^2 = l × 1,8 cm

$l = \frac{4,14cm^2}{1,8cm^2}$

l = 2,3 cm

Perimeter = 2(l + b)

= 2(2,3cm +1,8cm)

= 8,2cm

a. Area = 2,7m^2; breadth = 0,9m

b. Area = 24,9mm^2; length = 3mm

c. Area = 333,2m^2; length = 24,5m

d. Area = 46,92 m^2; breadth = 12cm

Problem solving

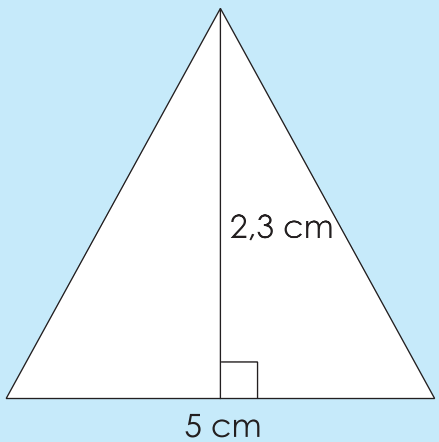
You need to tile the floor of a room with area of 4,2 m × 3,5 m. The tiles you want to buy are 45 cm × 45 cm. How many tiles do you need?

Sign:

Date:

84 Area of a triangle

Term 3



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 mm^2

$= 5{,}75 \times 100 \text{ mm}^2$

$= 575 \text{ mm}^2$

Answer in 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: $7{,}35\text{ cm}^2 = \frac{1}{2}(7\text{ cm}) \times h$

$7{,}35\text{ cm}^2 = 3{,}5\text{ cm} \times h$

$h = \frac{7{,}35\text{ cm}^2}{3{,}5\text{ cm}}$

$h = 2{,}1\text{ cm}$

a. Area = $16{,}2\text{ cm}^2$; base = 4cm

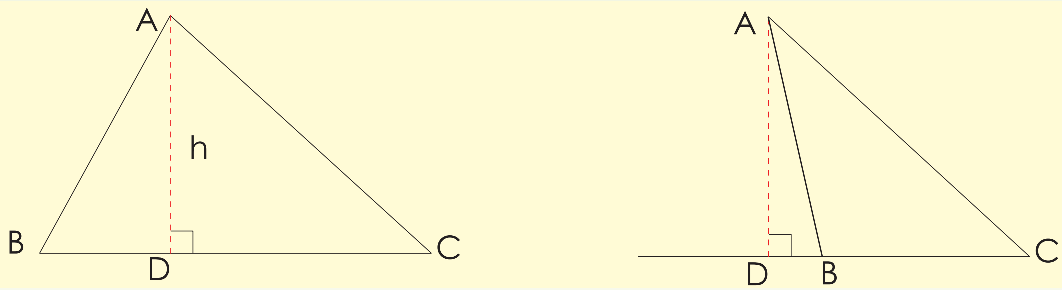
b. Area = $5{,}52\text{ cm}^2$; base = 10cm

c. Area = $33{,}12\text{ m}^2$; base = 12m

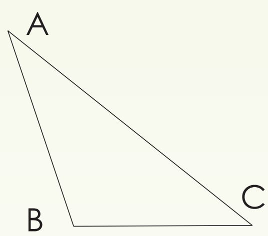
3. Draw the height of each triangle and calculate the area. You will need a ruler.

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

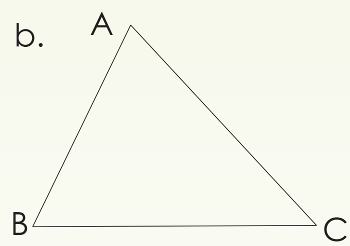
Example:



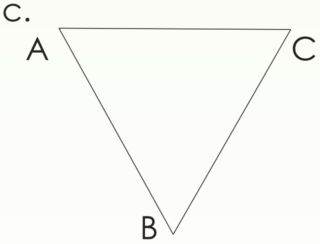
a.



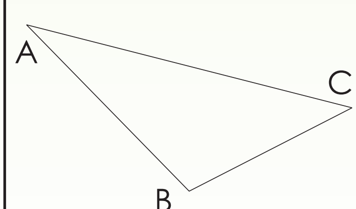
b.



c.



d.



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Problem solving

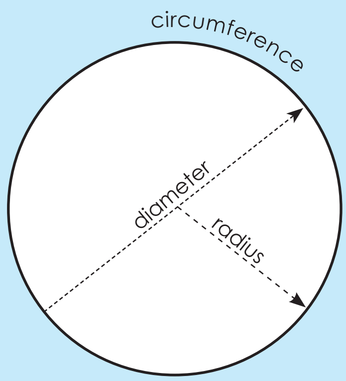
The triangular area is $10{,}53\text{ m}^2$. You have 2 025 cm² tiles. How many do you need to tile the area?

85 Area and perimeter of a circle

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.



π is an irrational number and is given as 3,141592654 to the 9th decimal place.

$$\frac{\text{circumference}}{\text{diameter}} = \pi = \frac{22}{7} = 3{,}14159$$

π represents the value of the circumference divided by the diameter.

$\frac{22}{7}$ or 3,14 are approximate rational values.

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 $A = \pi \times r^2$

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

Example: The radius of the circle is 3 cm

$A = \pi r^2$

$= (3{,}14159)\ (3^2)$

$= 28{,}27\ cm^2$

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 $A = \pi r^2$

$40{,}265$ cm = $(3{,}14159)(r^2)$

$r^2 = 16$

$r = 4$ cm

a. $12{,}566$ cm^2

b. $78{,}54$ cm^2

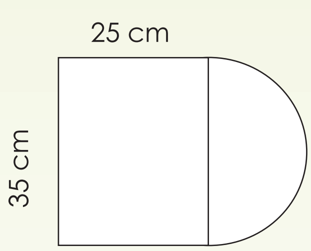
c. $113{,}098$ cm^2

d. $314{,}159$cm^2

Did you know that thousands of years ago the Egyptians developed rules for determining the areas of rectangles, triangles, trapeziums and circles?

3. Calculate the area of this figure.

a.



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?

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?

Sign:

Date:

86 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	πr^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	πd 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?

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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 m^2 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 π 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.

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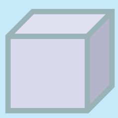
15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

87 Surface area, volume and capacity of a cube

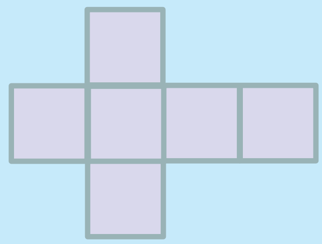
Volume of a cube

$V = s^3$



Surface area of a cube

A = 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 m*l* of water.
- An object with a volume of 1 m^3 will displace exactly 1 *kl* of water.

Term 3

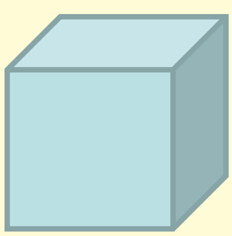
1. Calculate the volume, capacity and surface area of the following cubes:

Example:

Volume	Capacity	Surface area
Volume of a solid is the amount of space it occupies.	Capacity is the maximum amount of liquid or gas that a container can hold.	This is the total area of the surface of a geometric solid.

Volume

Length: 4 cm



$V = l^3$
$V = (4\ cm)^3$
$V = 64\ cm^3$

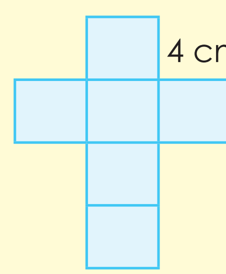
Capacity

Note: An object with a volume of 1 cm^3 will displace 1 ml of water.
∴ an object that is 64 cm^3 will displace 64 ml water or 0,064 *l*.

Cubic mm	Cubic cm	Cubic m	Litre
1 000 000 000	1 000 000	1	1 000
1 000 000	1 000	0,001	1
1 000	1	0,000001	0,001

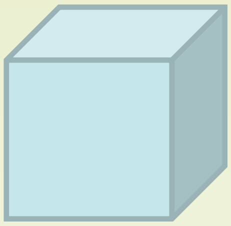
Surface area

Net of the cube: how many faces are there?

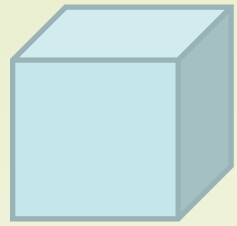


Surface area = sum of all the area of all the faces.
= 6 (area of a face)
= $6a^2$
= $6\ (4\ cm)^2$
= $6 \times 16\ cm^2$
= $96\ cm^2$

a. Length: 2 cm



b. Length: 3,2 cm



c. Length: 4,6 cm
Breadth: __________
Height: __________

d. Area of base: 25 cm^2
Height: __________

e. Length: __________
Breadth: __________
Height: 1,2 m

f. Area of base: 81cm^2
Height: __________

Prolem solving

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

Sign:

Date:

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88 Surface area, volume and capacity of a prism

Volume of a prism

$V = l \times b \times h$

Surface area of a prism

A = the sum of the area of all the 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.

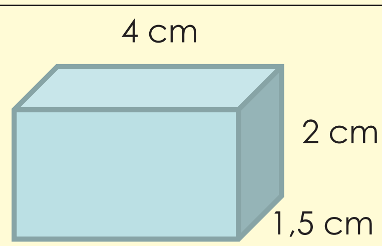
- If 1 cm = 10 mm, then 1 cm^2 = 100 mm^2
- If 1 m = 100 cm, then 1 m^2 = 10 000 cm^2
- If 1 cm = 10 mm, then 1 cm^3 = 1 000 mm^3
- If 1 m = 100 cm, then 1 m^3 = 1 000 000 cm^3 or 10^6 cm^3

Term 3

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

Example:

Volume



$V = l \times b \times h$

V = 4 cm × 2 cm × 1,5 cm

V = 12 cm^3

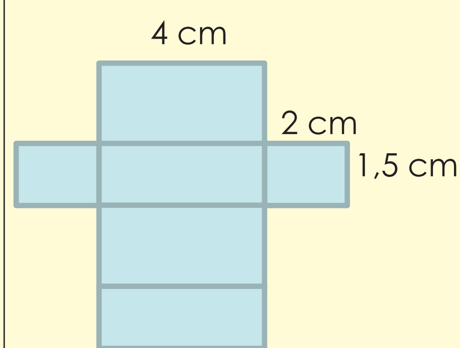
Capacity

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

∴ an object that is 12 cm^3 will displace 12 ml.

Surface area

Describe the faces.



Surface area:

$A = 2bl + 2lh + 2hb$

= 2 (1,5 cm × 4 cm) + 2 (4 cm × 2 cm) + 2(2 cm × 1,5 cm)

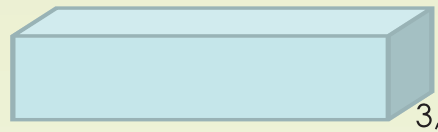
= 12 cm^2 + 16 cm^2 + 6cm^2

= 34 cm^2

Cubic mm	**Cubic** cm	**Cubic** m	**Litre**
1 000 000 000	1 000 000	1	1 000
1 000 000	1 000	0,001	1
1 000	1	0,000001	0,001

a.

b.



c. Length: 7,3 cm
Breadth: 5,5 cm
Height: 3,8 cm

d. Area of base: 24 cm^2
Height: 2,5 m

2. Give examples of where you would need to work out the volume and the surface area of a rectangular prism:

____

____

____

____

Prolem solving

A box has a square base with sides of 8 cm. What is the height of the box if its volume is 384 cm^3?

Sign:

Date:

89a Volume of triangular prisms

What geometric object is this A-frame house?

What will the geometric object's breadth be?

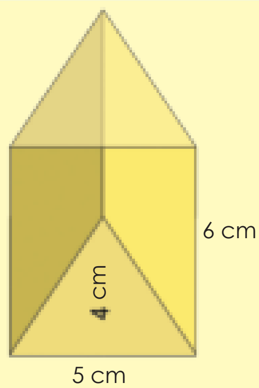
How many faces does the object have?

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:



$= (\frac{1}{2}\ b\ x\ h) \text{ x } H$

$= (\frac{1}{2} \text{ x 5 cm x 4 cm) x 6 cm}$

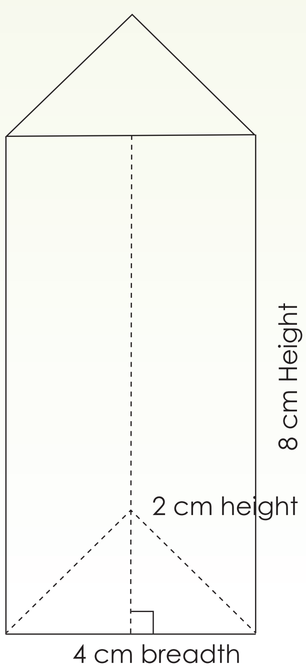
$= (\frac{5}{2} \text{ cm x } \frac{4}{1} \text{cm) x 6 cm}$

$= \frac{20}{2} \text{ cm}^2 \text{ x 6 cm}$

$= 10 \text{ cm}^2 \text{ x 6 cm}$

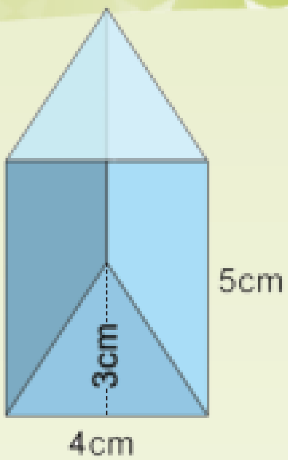
$= 60 \text{ cm}^3$

a.



Term 3

b.



2. Using the formula V = $\frac{1}{2}$ (b x h) x H, calculate the value of the unknown in each of the following:

a. H = 10cm; b =6cm and h = 4cm

b. V = 480m^3; b = 8m and h = 4m

c. V = 48mm^3; H = 3mm and h = 4mm

d. V = 63cm^3; b = 6cm and H = 7cm

Problem solving

A water tank has the shape of a triangular prism. The base of the tank has an area of 160cm^2. The height of the prism is 100cm. If the tank is filled to its $\frac{3}{4}$ mark, calculate its volume.

Sign:

Date:

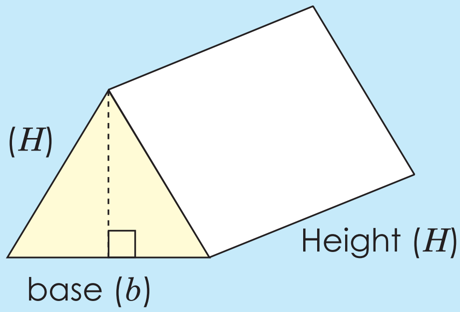
89b Surface area, volume and capacity of a triangular prism

Volume of a triangular prism

$V = \frac{1}{2}(b \times h) \times H$

Surface area of a rectangular prism

A = the sum of the area of all its faces.



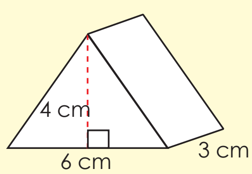
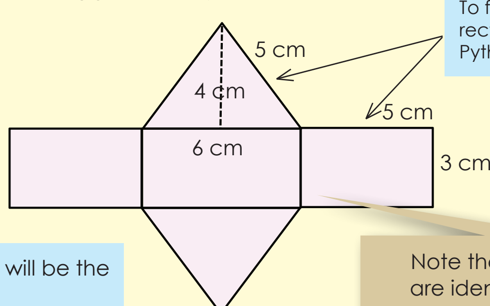
Capacity of a prism

- 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.

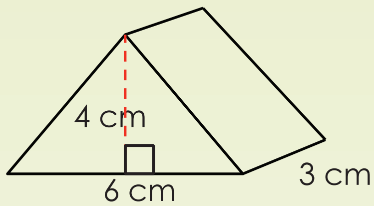
Revise

- 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 $cm^{3\,f}$

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

Volume	 $V = \frac{1}{2}(b \times h) \times H$ $V = \frac{1}{2}$ (6 cm) × 4 cm × 3 cm V = 3 cm × 4 cm × 3 cm V = 36 cm^3
Capacity	Note: An object with a volume of 1 cm^3 will displace 1 ml of water. ∴ an object that is 15 cm^3 will displace 15 ml of water.
Surface area	A = 2 (area of triangle) + (area of the three rectangles) **Area of triangles:** = 2 ($\frac{1}{2}$ (6 cm) x 4 cm) = 24 cm^2 Area of middle rectangle = base x length = 6 cm x 3 cm = 18 cm^2 Area of the other two rectangles = (length x side of triangle) x 2 = (3 cm x$\sqrt{4^2 + 3^2}$) x 2 = (3 cm x 5 cm) x 2 = 15 cm^2 x 2 = 30 cm^2 A = 24 cm^2 + 18 cm^2 + 30 cm^2 = 72 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.

a.



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:

Prolem 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?

Sign:

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90 Surface area, volume and capacity of cubes and prisms problems

Think of all the steps you will use in solving a problem.

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.

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 m^2. How many tins of paint will you need?

Problem solving

Create your own word problems to find the volume, capacity and surface area of a:

- cube
- rectangular prism
- triangular prism

Sign:

Date:

15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

Term 3

91 Surface area, volume: problems

Revise

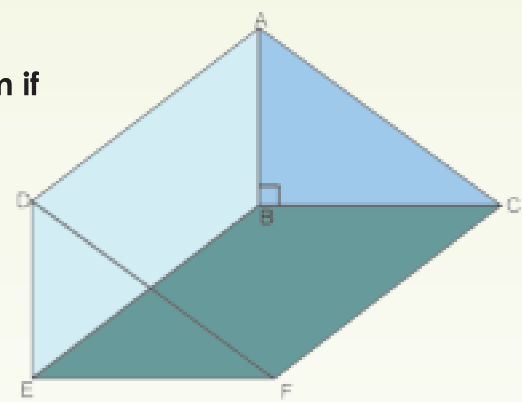
Volume of a cube	Volume of a rectangular prism	Volume of a triangular prism
$V = s^3$	$V = l \times b \times h$	$V = \frac{1}{2}(b \times h) \times H$

Surface area of a prism
A = the sum of the area of all its faces.

Volume
- 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

Capacity
- An object with a volume of 1 cm^3 will displace exactly 1 m*l* of water.
- An object with a volume of 1 m^3 will displace exactly 1 *kl* of water.

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

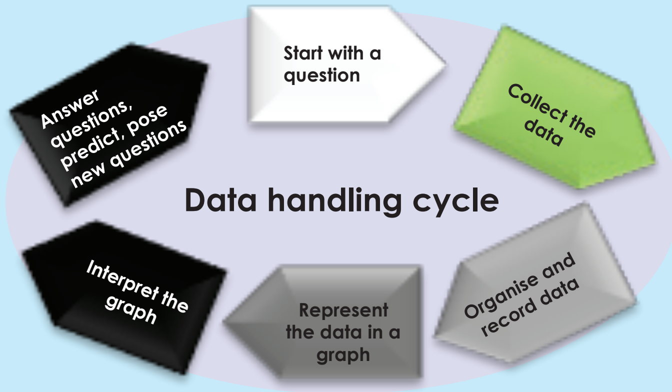
You want to collect rain water for your vegetable garden. The roof of your house is 100 m^2 and the average annual rainfall in South Africa is 500 mm. How big must the tank be if you want to collect all the water that falls on the roof?

Sign:

Date:

92a Data collection

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)

Grade 8	Grade 9	Grade 10	Grade 11	Grade 12

Gender? (tick the correct box)

Boy	Girl

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

Walk	Bicycle	Bus	Motorcar	Other

If other method, please specify:

Sign:

Date:

continued ☛

92b Data collection 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.

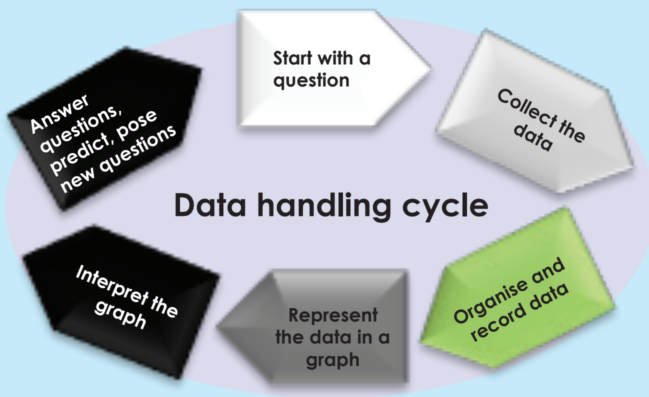
Will the choice of cold drink be discrete or continuous data?
What type of data will the consumption of cold drinks be?

Sign:

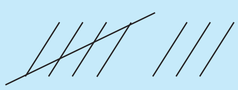
Date:

93a Organise data

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  **= 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:

28	122	217	130	120	86	80	90	120	140
70	40	145	187	113	90	68	174	194	170
100	75	104	97	75	123	100	82	109	120
81									

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 = 40 (round off to the next 10)

Now we can construct a table with three coulumns, 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.

Class interval	Tally	Frequency
0 – 39		
40 – 79		
80 – 119		
120 – 159		
160 – 199		
200 – 239		

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.

Class interval	Tally	Frequency
0 – 39	|	1
40 – 79	~~||||~~	5
80 – 119	~~||||~~ ~~||||~~ ||	12
120 – 159	~~||||~~ |||	8
160 – 199	||||	4
200 – 239	|	1

Sign:
Date:

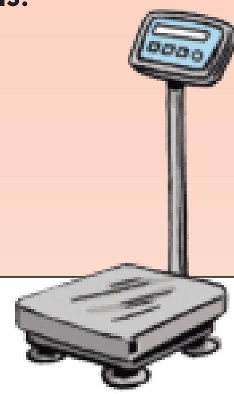
continued ☛

15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

93b Organise data 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.

55	70	57	73	55	59	64	72
60	48	58	54	69	51	63	78
75	64	65	57	71	78	76	62
49	66	62	76	61	63	63	76
52	76	71	61	53	56	67	71



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.

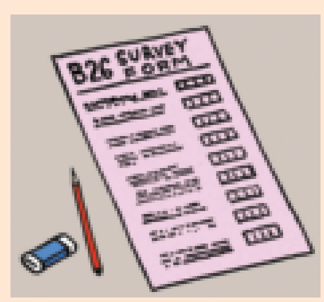
20	25	24	33	13
26	8	19	31	11
16	21	17	11	34
14	15	21	18	17

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: 53, 35, 67, 48, 63, 42, 48, 55, 33, 50, 46, 45, 59, 40, 47, 51, 66, 53.**
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.

58	68	60	71	53	62	64	72
63	46	61	52	67	54	63	78
78	62	68	55	69	81	76	62
52	64	65	74	59	66	63	76
55	74	74	59	51	59	67	71



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94a Summarise data

Read and discuss this table.

Measure	Definition	How to calculate	Example Data set: 2, 2, 3, 5, 5, 7, 8
Mean	The mean is the total of the numbers divided by how many numbers there are.	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.	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 ÷ 7 = 4,57... So the mean is 4,57.
Median	The median is the middle value that divides the data distribution into two halves.	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.	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.
Mode	The mode is the value that appears the most.	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.	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.
Range	The range is the difference between the biggest and the smallest number.	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.	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.

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

The **mean** average is not always a whole number.

Range	**Mean**
Median	**Mode**

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

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

Range	**Mean**
Median	**Mode**

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

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

Range	**Mean**
Median	**Mode**

2. **Use the data below and calculate:**

8	14	15	50	–6	19	3	37	12	10

a. The mean

b. The median

c. The mode

Sign:
Date:

94b Summarise data continued

d. Minimum value

e. Maximum value

f. The range

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.**

Age in years	Percentage of motor car owners
15–24	17,9
25–34	45,6
35–44	66,2
45–54	74,9

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?**

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Fruit sold	6	8	10	12	16	4	14

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 ____________________

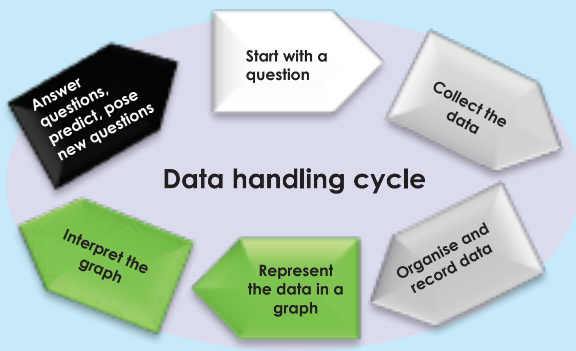
Remember:
We use the following as measures of central tendency:
- **mean**
- **median**
- **mode**

Sign:

Date:

95a Bar graphs

To record data one can use a bar graph.



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.**

Month	Cars sold
January	15
February	14
March	13
April	11
May	9
June	7
July	2
August	7
September	8
October	11
November	12
December	14

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?

Sign:

Date:

continued ☛

Bar graphs continued

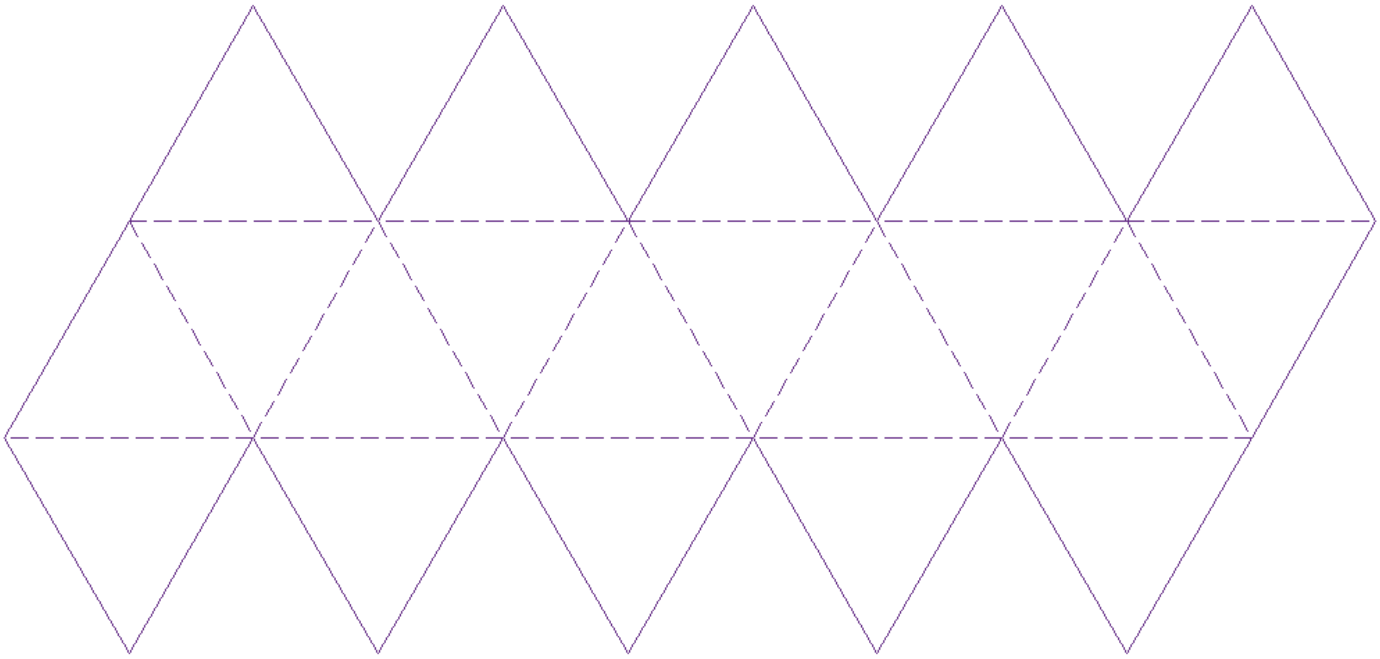
f. What is the data range?

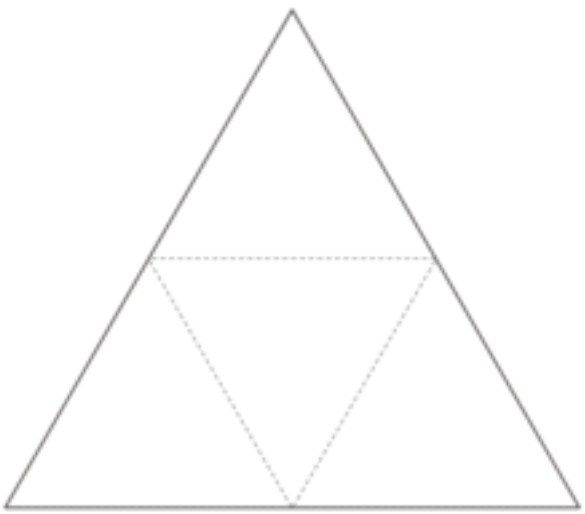
g. What can you tell from the range about the data?

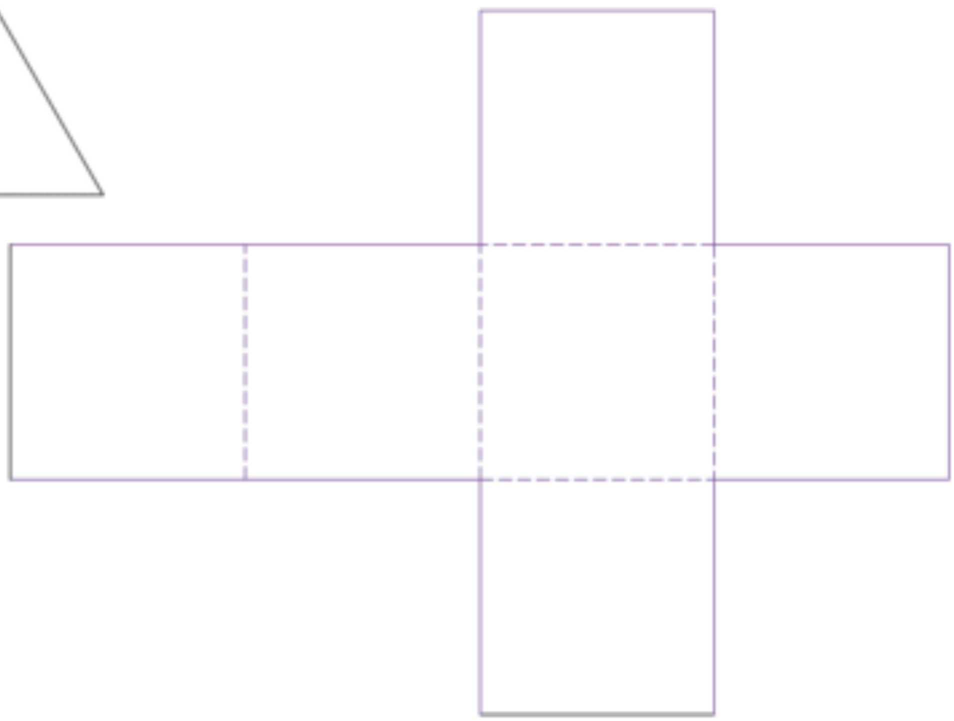
h. Is there any extreme data (very small or large data)? Why do you think this data varies so much from the mean?

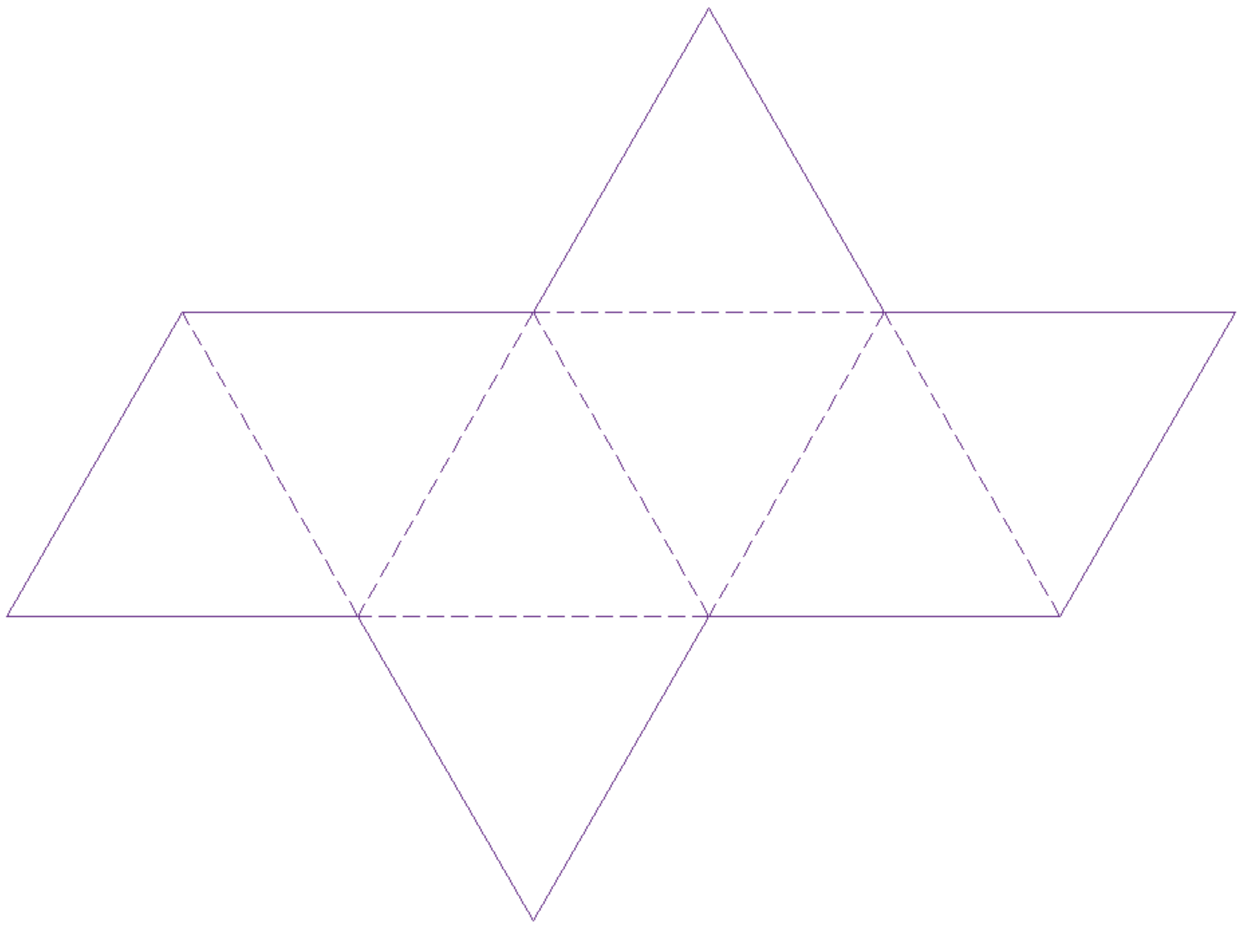
i. If you want to determine the sales for all second–hand car dealers, how will you go about doing that?

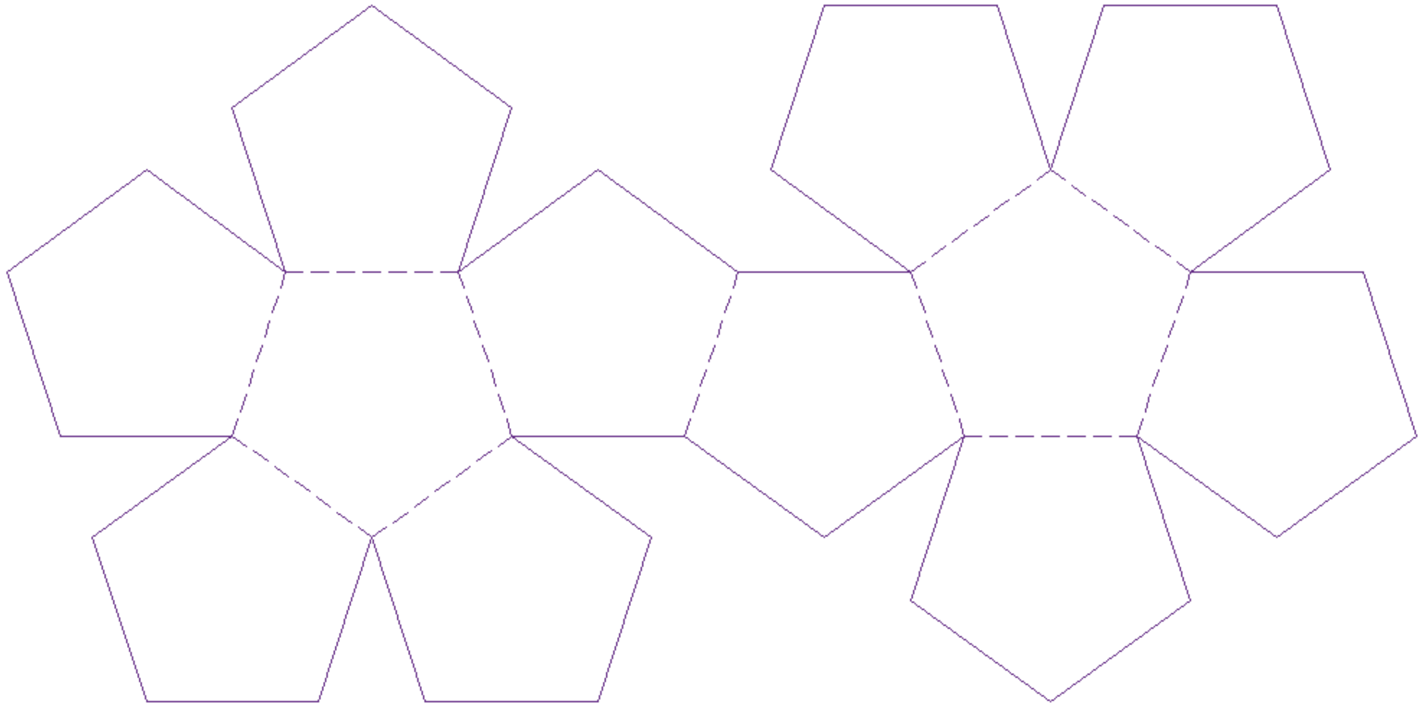
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15











j. How can you help avoid any bias in your data?

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?
   i. How can you avoid any bias in your data?

Name	Movie star	Name	Movie star
Denis	Johnny Depp	Elias	Julia Roberts
John	Julia Roberts	Simon	Nicolas Cage
Jason	Julia Roberts	Thabo	Will Smith
Matapelo	Denzil Washington	Susan	Julia Roberts
Ann	Brad Pitt	James	Johnny Depp
Opelo	Eddie Murphy	Ben	Brad Pitt
Lisa	Amanda Seifried	Lauren	Will Smith
Gugu	Jamie Foxx	Tefo	Denzil Washington
Sipho	Julia Roberts	Alicia	Johnny Depp
Lorato	Charlize Theron	Mandla	Julia Roberts

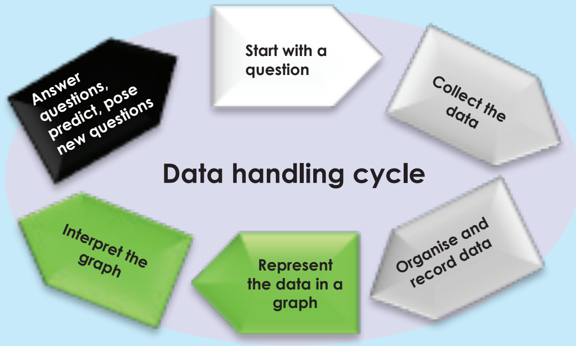
Sign:

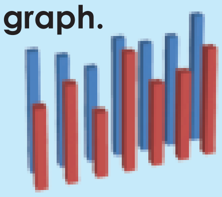
Date:

96a Double bar graphs

Term 3

To record data one can use a double bar graph.





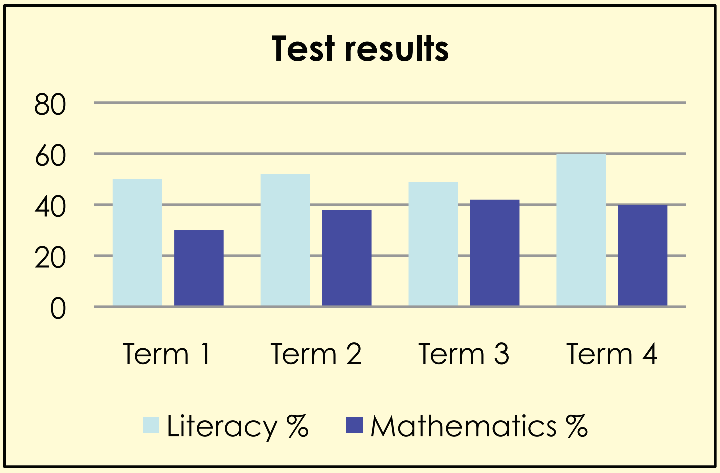
Double bar graph

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.



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

Expenditure per learner		
Year	Primary schools	High schools
1985	325	225
1990	361	240
1995	418	274
2000	425	277

Analyse the data and answer the following questions.

a. What is the independent variable?

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?

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.

	Households that recycle		
	Metal cans	Plastics	Paper
1994	56%	52%	58%
2006	81%	84%	83%

Draw a double bar graph to illustrate the increase.

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96b 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?

Year	**1940**	**1950**	**1960**	**1970**	**1980**	**1990**
Men	24,3	22,8	22,8	23,2	24,7	26,1
Women	21,5	20,3	20,3	20,8	22	23,9

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.

TV	0	0	1	1	1	1	1	1	1	1	1	1	2
Homework	1	0,5	1,5	2	1,5	1,5	2	2,5	0,5	0,25	0,25	0,25	1,5
TV	2	2	2	3	3	3	3	4	4	4	5	5	6
Homework	3	0,5	2,5	4	1,5	3,5	3	2,5	1,5	2	1,5	2	3

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.

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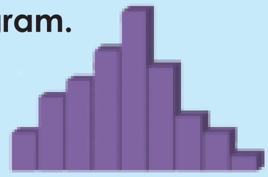
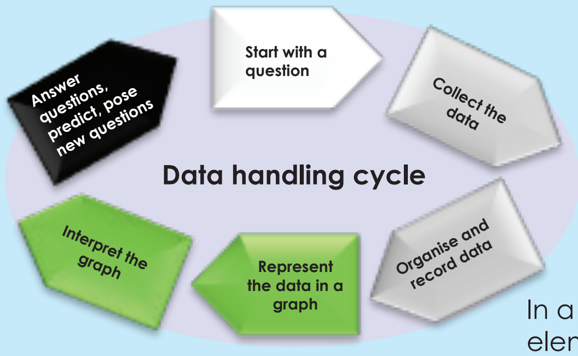
97a Histograms

To represent data one can use a histogram.





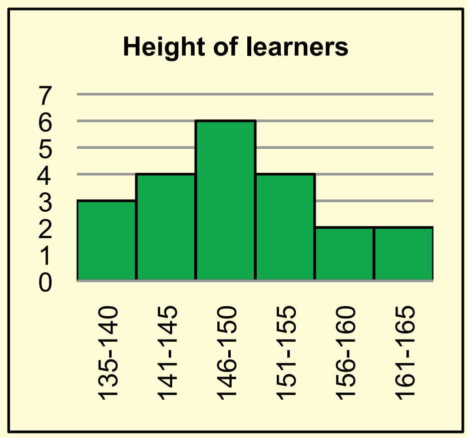
Histogram
A histogram is a particular kind of bar graph that summarises data points falling in various ranges.

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 histrogram
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.

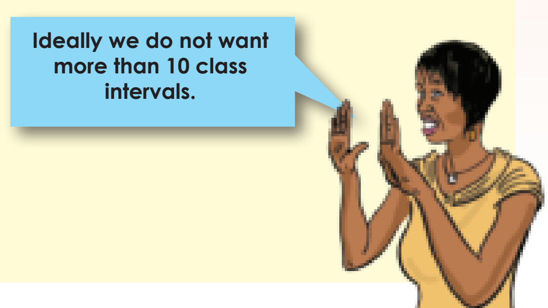
Look at the following example:

28	122	217	130	120	86	80	90	120	140
70	40	145	187	113	90	68	174	194	170
100	75	104	97	75	123	100	82	109	120
81									

Arranged from small to large, it will be:

28	40	68	70	75	75	80	81	82	86	90	90	97	100	100	104	109	113	120	120	120	122	123	130	140	145	170	174	187	194	217

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



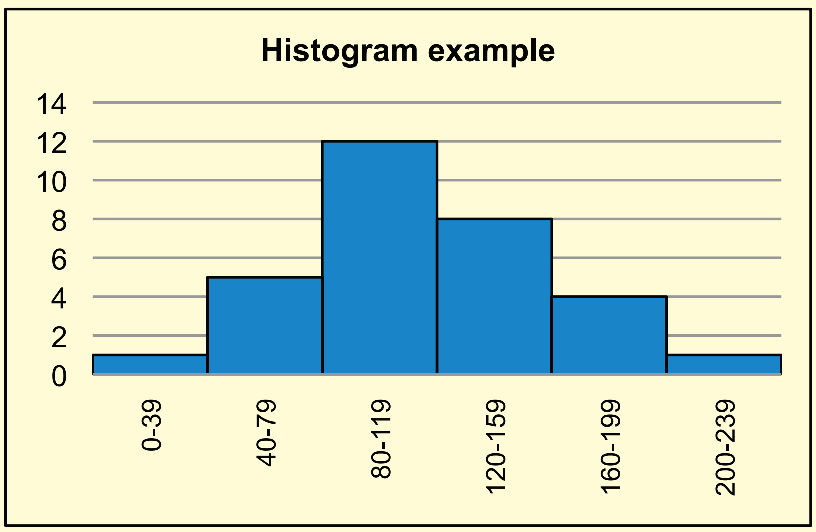
Now we decide that we want five class intervals.
Therefore: 37,8 = 40 (round up to the next 10)

Term 3

Once we have determined the range and the class intervals, we must organise the data into a frequency table.

Class interval	Tally	Frequency
0 – 39	/	1
40 – 79	~~////~~	5
80 – 119	~~////~~ ~~////~~ //	12
120 – 159	~~////~~ ///	8
160 – 199	////	4
200 – 239	/	1

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.

43	55	83	85	90	90	95	96	97	101	105	105	112	115	115	119
124	128	135	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.

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97b Histograms continued

Term 3

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.

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

2. Use the following data to draw a histogram.

33	35	73	65	80	70	85	76	87	81	95	85	102	95	105
114	108	125	115	125	117	128	125	145	140	175	169	192	189	222
16	28	56	58	63	63	68	69	70	74	78	78	85	88	88
92	97	101	108	108	108	110	111	118	128	133	158	162	175	182

Find the mean, the median and the mode.

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.

18,5	9,1	3,1	6,2	1,3	0,5	4,2	5,2	0,0	10,8
5,8	1,8	1,5	1,9	0,4	3,5	8,5	11,1	0,3	1,2
4,4	3,8	5,8	1,9	3,6	2,5	4,5	5,8	1,5	0,7
0,8	0,1	9,7	2,6	0,8	1,2	2,9	3,0	3,2	2,8
10,9	0,1	5,9	1,4	0,3	5,5	4,8	0,9	1,6	2,2

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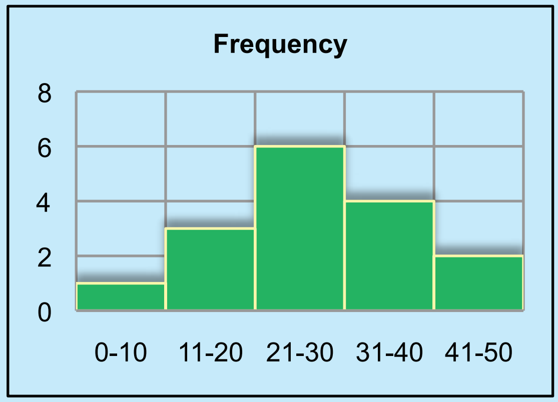
98a More on histograms

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.

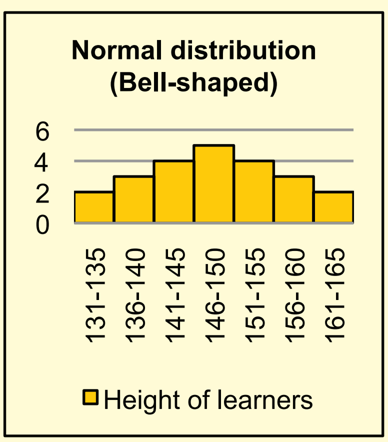


This plot represents data with a well–defined peak that is close to the median and the mean. While there are "outliers," they are of relatively low frequency. Thus it can be said that there is a low frequency of deviations in this data group .

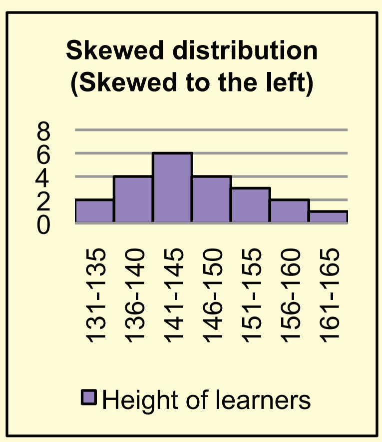
Example:

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.

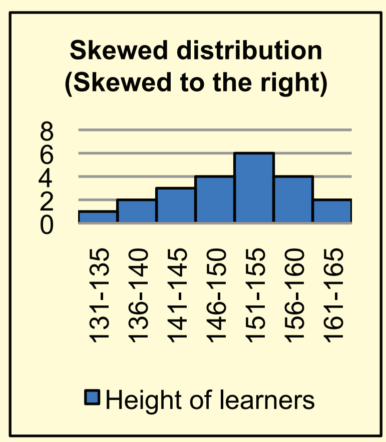
Histogram A



Histogram B



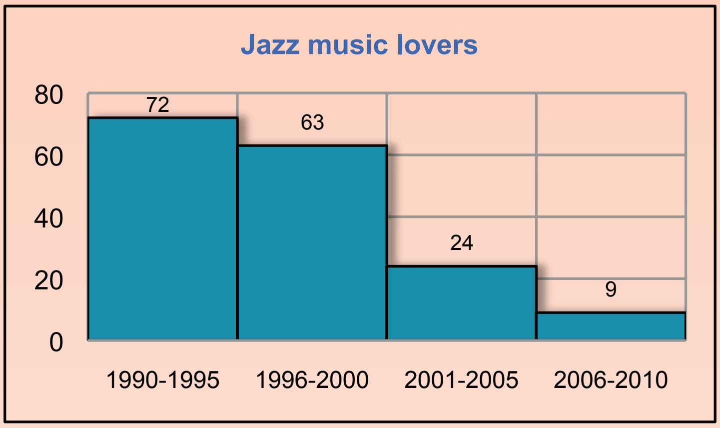
Histogram C



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.**



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?

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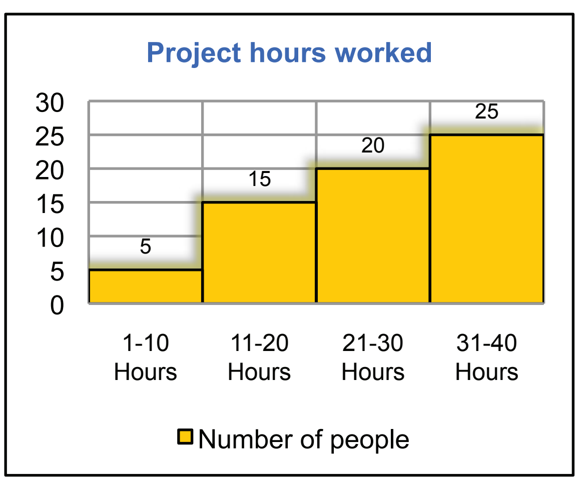
98b More on histograms continued

2. Answer the following questions about this histogram.



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?

Term 3

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

e. How many people worked for at least 31 to 40 hours?

f. How many people worked between 11 and 30 hours on the project?

Problem solving

Consider the following data set.

57	66	73	92	77
31	60	32	22	25
45	36	49	42	56
37	88	41	54	42
57	63	59	15	62
3	32	82	48	37
78	18	39	77	97

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.

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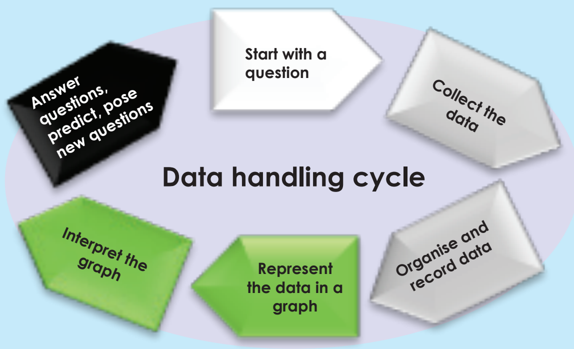
99a Pie charts

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.

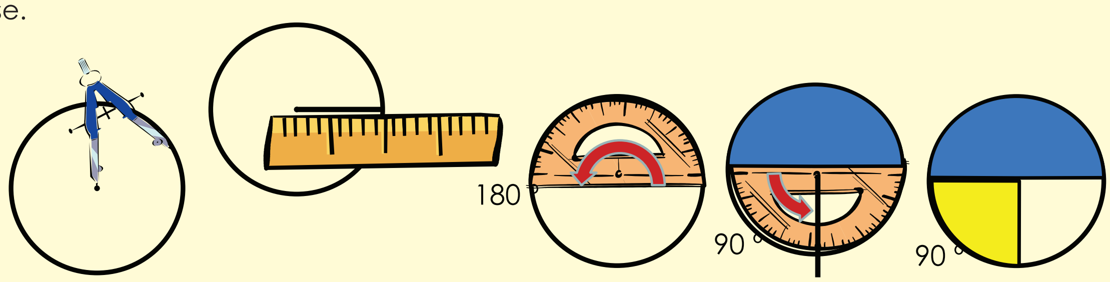
Each sector visually represents an item in a data set to match the amount of the item as a percentage or fraction of the total data set. (the whole circle)

Pie charts are useful to compare different parts of a whole amount.

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

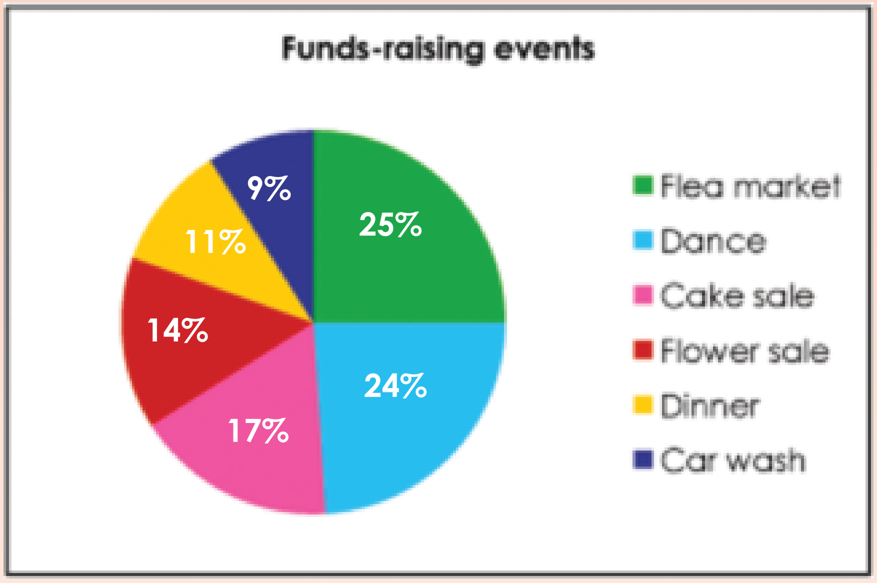
Steps:

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.



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?

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99b Pie charts 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.**

School A **School B**

3. **Your expenditure for the week is:**

Expense	Value
Rent	450,75
Food	220,50
Transport	77,88

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.

Category	Plastic waste generated per person per day (in grams)
PET	120
PVC	48
PS	24
HDPE	12
LDPE	31,2
PP	4,8

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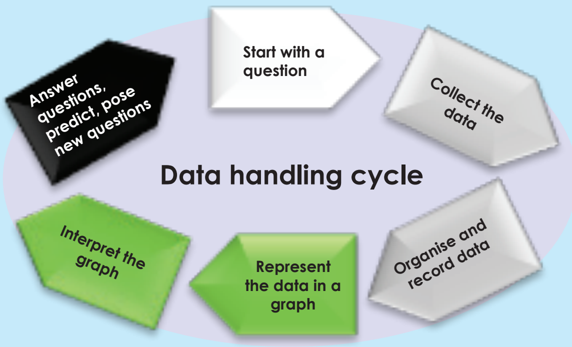
100a Broken line graph

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.



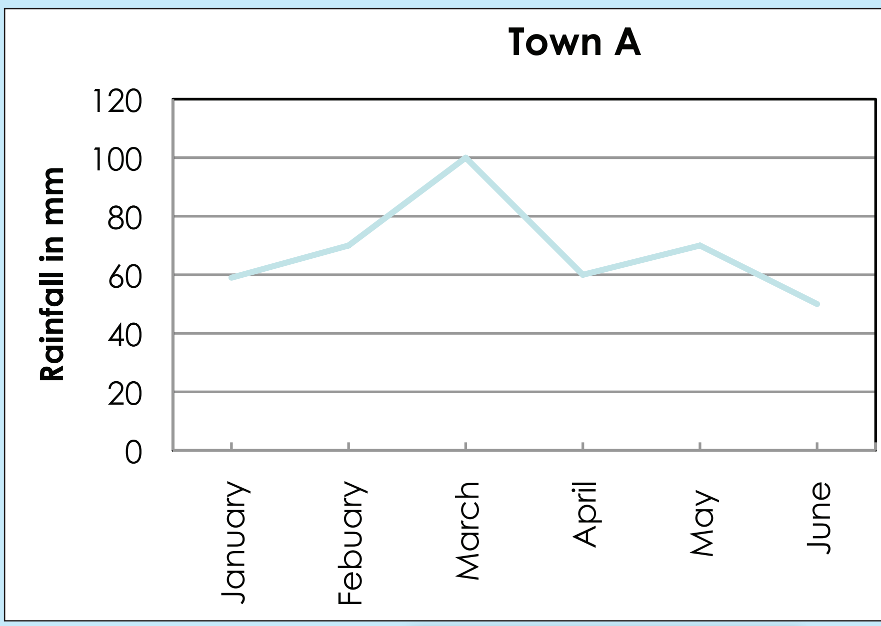
Meteorologist use line graphs to show monthly rainfall.

Businesses often use line graphs to show information about profits.

With some line graphs it might be possible to continue the line to show what might happen in the future.

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.

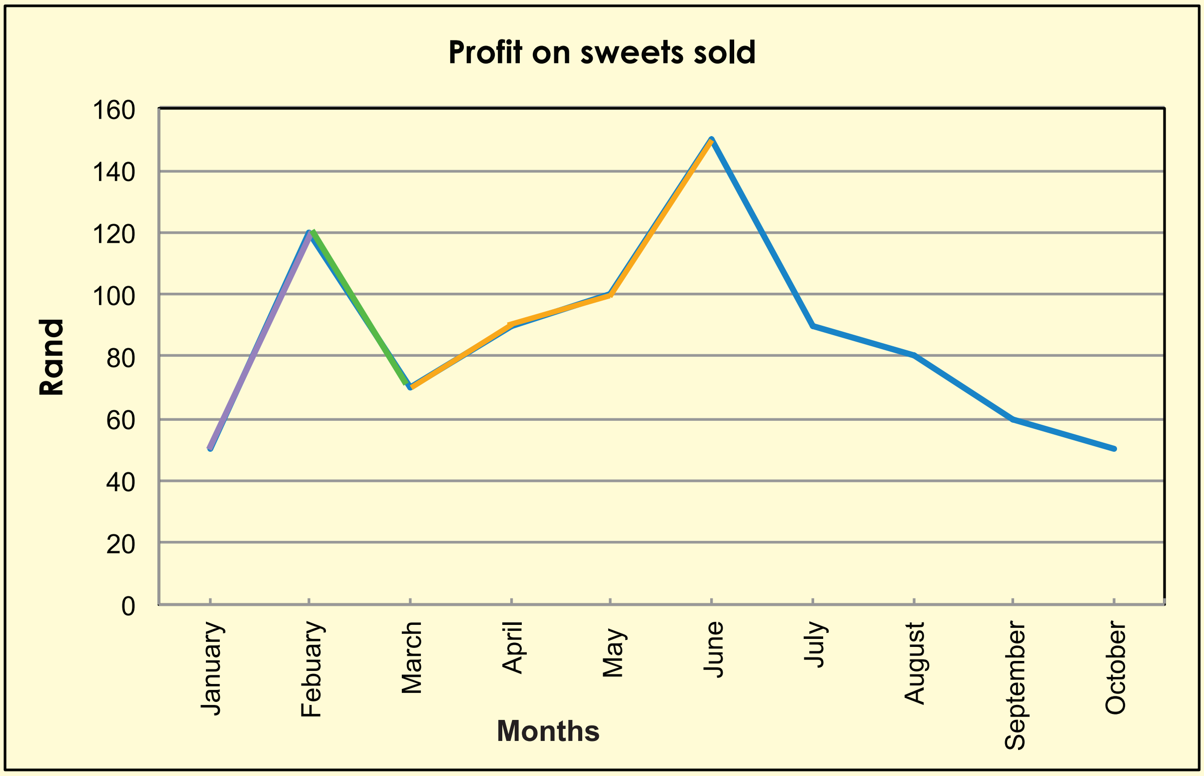


What happens in this graph?

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 shows profit **decreased** over these months.

The graph goes up and down showing profit **increase** and **decrease**.

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100b Broken line graph continued

1. **Draw a broken line graph of the pulse (heart beat) rate of a Grade 8 learner.**

Time of the day	Beats per minute
9:00	68
9:30	73
10:00	88
10:30	120
11:00	77
11:30	75
12:00	72
12:30	72
13:00	100

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.**

Time of the day	Beats per minute
9:00	
9:30	
10:00	
10:30	
11:00	
11:30	
12:00	
12:30	
13:00	

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.

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101 Select the right graph

Revise graphs. Make a simple drawing and give a short description of each graph you have learnt about so far.

Bar graph	Double bar graph	Histogram	Pie chart	Broken line graph

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.

Day	Glasses of water
Monday	6
Tuesday	7
Wednesday	9
Thursday	8
Friday	10
Saturday	12
Sunday	5

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?

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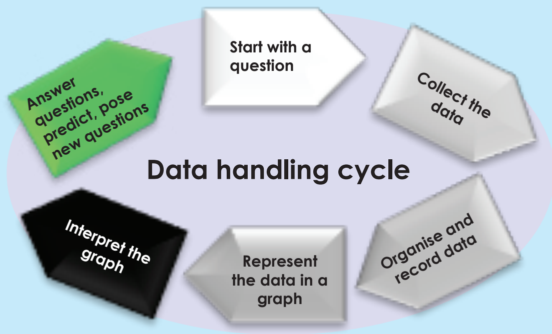
102a Report data



To report data you can use the following pointers:

- Aim
- Hypothesis
- Plan
- Analysis
- Interpretation
- Conclusion
- Appendices
- References

1. **Use the information from this favourite sport survey of 20 learners and write a report summarising the data and drawing conclusions.**

Name	Favourite sport	Name	Favourite sport
Denise	Tennis	Elias	Squash
John	Rugby	Simon	Soccer
Jason	Soccer	Edward	Rugby
Matapelo	Soccer	Susan	Rugby
Mandla	Rugby	Philip	Tennis
Opelo	Tennis	Ben	Squash
Lisa	Soccer	Lauren	Soccer
Gugu	Tennis	Tefo	Rugby
Sipho	Soccer	Alicia	Soccer
Lorato	Squash	Masa	Soccer

a. Aim

This is the general aim of the project.

b. Hypothesis

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.

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102b Report data continued

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?

____

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

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.

Name	Favourite subject	Name	Favourite subject
Denise	Maths	Elias	History
John	Art	Simon	Maths
Jason	History	Edward	Sciences
Matapelo	Sciences	Susan	History
Mandla	History	Philip	Art
Opelo	Maths	Ben	Maths
Lisa	History	Lauren	Language
Gugu	Art	Tefo	Maths
Sipho	Maths	Alicia	History
Lorato	Maths	Masa	Language

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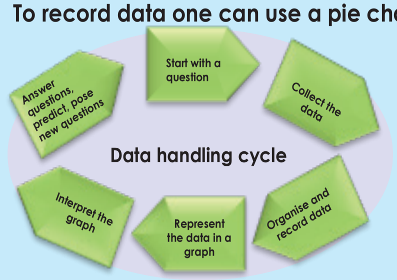
103 Data handling cycle

To record data one can use a pie chart.



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

2. What is the aim of you 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?

f. Why? Give reasons for the choices you made.

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:

Our revised plan is:

Preparing

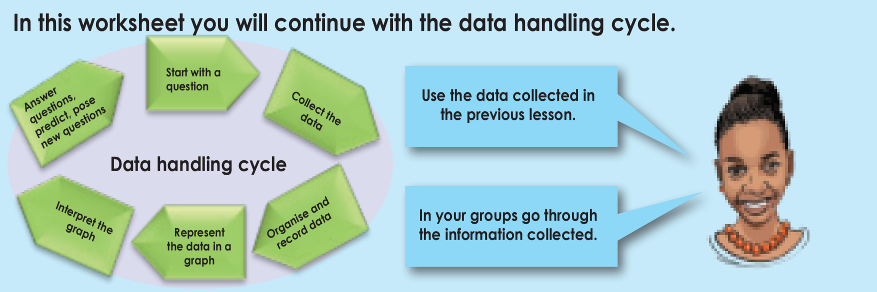
Now that your plans are submitted you should start collecting and recording the data you need.

Sign:
Date:

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

104 The data handling cycle continues

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 you 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

Sign:

Date:

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

105a 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.

–3, –7, –11, –15

"adding –4" or "counting in –4's" or "adding –4 to the previous number."

What is the **constant difference** between the consecutive terms?

2, –4, 8, –16, 32

You can describe this pattern as multiplying the previous number by –2.

What is the **constant ratio** between the consecutive terms?

1, 2, 4, 7, 11, 16

You can describe this as increasing the difference between consecutive terms by 1 each time or adding 1 more than what was added to get the previous number.

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; –200; 2 000; –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. 36; 108; 324; 972

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

Example:

Position	1	2	3	4	5	n	Rule
Value of the term	7	10	15	22	31	$n^2 + 6$	$n^2 + 6$

a.

Term	2	4	6	8	n
Value of the term	6	62	214	510	

What will the 20th term value be?______ Rule: __________

b.

Term	3	6	9	12	n
Value of the term	16	25	34		

What will the tenth term value be?______ Rule: __________

continued

Sign:
Date:

105b Patterns continued

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	4	9	16	25	36	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?

Sign:

Date:

106a Input and output values

In this worksheet we are going to describe the rule of a sequence in different ways.

4, 7, 10, 13...
- Description 1: add 3 to the previous term.
- Description 2: (3 x the position of the term)+ 1.

Term	1	2	3	4	10	n
Value of the term	4	7	10	13	31	

First term: 1 + 3
Second term: 1 + 3(2)
Third term: 1 + 3(3)
Fourth term: 1 + 3(4)
Tenth term: 1 +3(10)
n^{th} term: 1 + 3(n)

- Description 3: 3(n) + 1, where n is the position of the term and n is a natural number.

The first six terms of the sequence will be:

4 | 7 | 10 | 13 | 16 | 19

1. **Complete the tables using the information given below each table. Give the sequence to the 6th term.**

Example: 8 | 17 | 26 | 35 | 44 | 53

Term	1	2	3	4	18	n
Value of the term	8	17	26	35	161	9(n)–1

- 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. ___ ___ ___ ___ ___ ___

Term	1	2	3	4	17	n
Value of the term						

- 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. ___ ___ ___ ___ ___ ___

Term	1	2	3	4	22	n
Value of the term						

- 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. ___ ___ ___ ___ ___ ___

Term	1	2	3	4	41	n
Value of the term						

- 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. ___ ___ ___ ___ ___ ___

Term	1	2	3	4	42	n
Value of the term						

- Add $\frac{1}{2}$ to the previous position
- $\frac{1}{2}$ x the position of the term + 1
- $\frac{1}{2}$ (n) + 1 where n is the position of the term and n is a natural number.

Sign:
Date:

continued ☛

106b Input and output values continued

Term	1	2	3	4	18	n
Value of the term	8	17	26	35	161	$9n-1$

- 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

Here are three possible rules that helped with completing the table.

1. Complete the tables using the information given below each table.

a.

Term	1	2	3	4	18	n
Value of the term						

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

b.

Term	1	2	3	4	17	n
Value of the term	13	28				

- 15 x the position of the term –2
- $15(n)$ –2, where n is the position of the termand n is a natural number.

c.

Term	1	2	3	4	22	n
Value of the term						

- 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.

d.

Term	1	2	3	4	41	n
Value of the term						

- 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.

e.

Term	1	2	3	4	42	n
Value of the term						

- $\frac{1}{2}$ x the position of ther term + 1
- $\frac{1}{2}$ (n) + 1 where n is the position of the termand n is a natural number.

f.

Term	1	2	3	4	41	n
Value of the term						

- 10 x the position of the term – 1,25
- $10(n)$ – 1,25 where n is the position of the term and n is a natural number.

Prolem solving

If 3(–2) + 1 is the third term, what will the n^{th} term be?

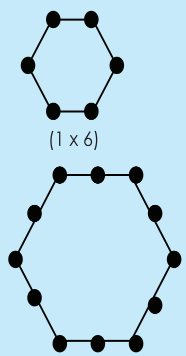
Sign:

Date:

107 Geometric patterns

Extend the drawing and write a rule.

Hexagon pattern:



(1 x 6)

(2 x 6)

First hexagon = 1 "section" per side 1 x 6 = 6

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

Second hexagon = 2 "sections" per side 2 x 6 = 12

Third hexagon = 3 "sections" per side 3 x 6 = 18
Fourth hexagon = 4 "sections" per side 4 x 6 = 24
Tenth hexagon = 10 "sections" per side 10 x 6 = 60
n^{th} hexagon = n x 6 =

We can also record it in a table.

Hexagon sections per side	1	2	3	4	5	6	10	n
Number of sections	6	12	18	24			60	n x 6

n is the position of the term.

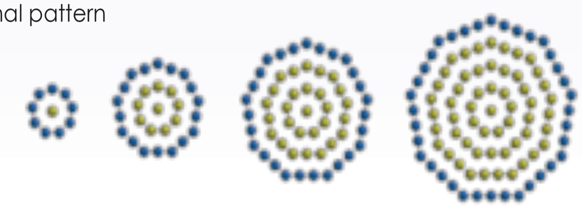
1. Complete the table and identify the rule.

Example: Pattern of square numbers.

Position of the term in the pattern	1	2	3	4	5	10	n
Number of sections	1	4	9	16	25	100	n^2

1 x 1 = 1	2 x 2 = 4	3 x 3 = 9	4 x 4 = 16	5 x 5 = 25	10 x 10 = 100	n x n = n^2

a. Nonagonal pattern



Position of the term in the pattern						n
Number of sections						

b. Triskaidecagon (polygon with 13 sides) pattern

Position of the term in the pattern						n
Number of sections						

c. Chiliagon (polygon with 1 000 sides) pattern

Position of the term in the pattern						n
Number of sections						

d. Pentacontagon (polygon with 50 sides) pattern

Position of the term in the pattern						n
Number of sections						

e. Enneadecagon (polygon with 19 sides) pattern

Position of the term in the pattern						n
Number of sections						

Prolem solving

What is the fifth term in a googolgon pattern?

Sign:
Date:

108 Numeric patterns

What are the next three terms in the sequence?

Example 1:

Term	1	2	3	4		10	n
Value	1	2	4	8		?	?

Value of the nth term $= 2^{(n-1)}$.

First term = 1 or 2^0
Second term = 2 x 1 or 2^1
Third term = 2 x 2 x 1 or 2^2
Fourth term = 2 x 2 x 2 x 1 or 2^3
Tenth term = 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x1 or 2^9
*n*th 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 ***n*** is one smaller than the term ***n***, i.e. ***n*–1.**

To the power of **9** is one smaller than the term **10.**

To the power of **3** is one smaller than the term **4.**

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

Example:

Term	1	2	3	4		*n*
Value	1	5	25	125		5^{n-1}

The rule is 5^{n-1} Therefore the sequence is 1, 5, 25, 125, …

a.

Term	1	2	3	4		17	*n*
Value	1	6	36	216			

Rule______________________________

b.

Term	1	2	3	4		32	*n*
Value	1	7	49	343			

Rule______________________________

c.

Term	1	2	3	4		47	*n*
Value	1	9	81	729			

Rule______________________________

d.

Term	1	2	3	4		22	*n*
Value	1	10	100	1000			

Rule______________________________

e.

Term	1	2	3	4		55	*n*
Value	1	13	169	2197			

Rule______________________________

f.

Term	1	2	3	4		7	*n*
Value	2197	729	243	81			

Rule______________________________

Prolem 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?

Sign:
Date:

109 More on input and output values

Look at the examples. Discuss.

Calculate the value of t for each value of p.

Rule: p x 3 + 1

p	t
0	1
–3	–8
–5	–14
–7	–20
–9	–26

(t = 0 x 3 + 1), (t = – 3 x 3 + 1),
(t = – 5 x 3 + 1), (t = – 7 x 3 + 1),
(t = – 9 x 3 + 1)

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

Rule: p x 1 x –3

p	t
0	–0
3	–9
5	–15
7	–21
9	–27

1. Complete the following flow diagrams.

a. Rule: p x 3 + 7

p	t
7	
14	
15	
16	
23	

b. Rule: p x 2 – 10

p	t
7	
10	
13	
16	
19	

c. Rule: p x 6 – 2

p	t
5	
6	
8	
14	
22	

d. Rule: p x 2 – 16

p	t
8	
14	
17	
22	
45	

e. Rule: p x 3 – 30

p	t
12	
9	
15	
7	
3	

2. Complete the following flow diagrams.

a. Rule:

p	t
8	44
12	60
20	92
36	156
68	284

b. Rule:

p	t
12	62
33	146
28	126
50	214
45	194

c. Rule:

p	t
38	256
14	112
35	238
22	160
49	322

d. Rule:

p	t
26	94
16	44
37	149
29	109
43	179

e. Rule:

p	t
48	325
15	94
19	122
27	178
36	241

Activity

If t = r x 3 –12, with t = –3, what is r?

Sign:

Date:

110 Tables

If the rule for finding y in the table below is $y = -3x - 1$, find y for the given x values.

x	0	1	2	5	10	50	100
y	–1	–4	–7	–16			

$y = -3x - 1$
$= -3(0) - 1$
$= 0 - 1$
$= -1$

$y = -3x - 1$
$= -3(1) - 1$
$= -3 - 1$
$= -4$

$y = -3x - 1$
$= -3(2) - 1$
$= -6 - 1$
$= -7$

$y = -3x - 1$
$= -3(5) - 1$
$= -15 - 1$
$= -16$

$y = -3x - 1$
$= -3(10) - 1$
$= -30 - 1$
$= -31$

$y = -3x - 1$
$= -3(50) - 1$
$= -150 - 1$
$= -151$

$y = -3x - 1$
$= -3(100) - 1$
$= -300 - 1$
$= -301$

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

a.

x	0	1	2	20	50	100
y	4	7	10	64	154	304

____

b.

x	15	30	45	60	75	90
y	73	148	223	298	373	448

____

c.

x	–2	–1	0	1	2	3
y	3	2	1	0	–1	–2

____

d.

x	12	14	16	20	60	110
y	6	7	8	10	30	55

____

e.

x	3	4	5	6	7	10
y	29	66	127	218	345	1 002

____

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.

x	–2	–1	0	m	2	3
y	28	24	n		12	8

$m =$
$n =$

b.

x	–3	–2	m	0	1	2
y	–4	–3		–1	0	n

$m =$
$n =$

c.

x	1	2	3	4	m	6
y	1	7	17	n		71

$m =$
$n =$

d.

x	3	m	11	15	19	23
y	–13		–37	–49	–61	n

$m =$
$n =$

e.

x	–8	m	–4	–2	0	2
y	43		23	13	n	–7

$m =$
$n =$

Activity

$y = -2x - 4$. Show this in a table with –3, –2, –1, 0, 1, 2.

Sign:
Date:

111 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:

$5 = 5$

$19 = 4 + 15$

$x = 9 \quad 9 = x$

$t + 5 = 8$

$3 \times n + 10 = 90$

$x^2 + 3 = 12$

1. Solve for x. Test your answer using substitution.

Example:

$x + 6 = -9$

$x + 6 - 6 = -9 - 6$

$x = -15$

Test:

$x + 6 = -9$

$-15 + 6 = -9$

$-9 = -9$

a. $x + 3 = 8$ b. $x - 7 = 9$ c. $x - 3 = 8$

d. $x + 4 = -4$ e. $x - 12 = 4$ f. $x - 18 = -9$

2. Solve for x. Test your answer using substitution.

Example:

Solve for x if $-2x = 8$

To solve the equation: divide both sides of the equation by -2

Left hand side = Right hand side

$-2x = 8$

$\frac{-2x}{-2} = \frac{8}{-2}$

$x = -4$

Test:

$-2x = 8$

$-2(-4) = 8$

$8 = 8$

a. $5x = 15$ b. $3x = 39$ c. $-2x = 16$

d. $9x = -27$ e. $-7x = 56$ f. $-11x = 66$

3. Solve for x. Test your answer using substitution.

Example:

$3x + 1 = 7$

$3x + 1 - 1 = 7 - 1$

LHS = RHS

$3x = 6$

Then divide both sides of the equation by 3.

$\frac{3x}{3} = \frac{6}{3}$

$x = 2$

a. $5x + 1 = 11$ b. $7x + 5 = 12$ c. $8x - 10 = 6$

d. $2x - 8 = -4$ e. $-2x - 6 = -2$ f. $3x - 6 = -6$

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 $4x$ cm and breadth $2x$ cm + 1cm.

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 $y = x^3 + 1$, 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?

Sign:

Date:

112 Algebraic equations: ordered pairs

Term 4

Complete the table below by determining the values of y for the equation $y = -3x + 2$. Plot each point (x,y) on the Cartesian plane (grid) and join the points.

x	–3	–1	0	1	2
y	11	5	2	–1	–4

These are ordered pairs.

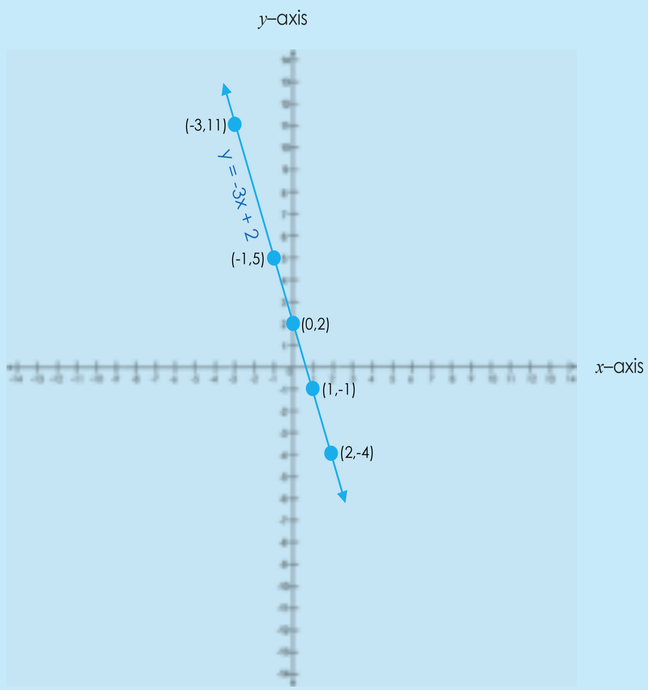
$y = -3(-3) + 2$
$= +9 + 2$
$= 11$

$y = -3(-1) + 2$
$= 3 + 2$
$= 5$

$y = -3(0) + 2$
$= 0 + 2$
$= 2$

$y = -3(1) + 2$
$= -3 + 2$
$= -1$

$y = -3(2) + 2$
$= -6 + 2$
$= -4$



1. Complete the tables below by determining the values of y for the each equation. Plot each point (x,y) on the Cartesian plane and join the points.

a. $y = 3x + 2$

x	–2	–1	0	1	2
y					

b. $y = 5x + 6$

x	–2	–1	0	1	2
y					

c. $y = 8x + 3$

x	–3	–1	0	2	4
y					

d. $y = -4x + 5$

x	–4	–1	0	1	3
y					

e. $y = -6x + 2$

x	–6	–5	0	5	6
y					

f. $y = -3x - 2$

x	–2	–1	0	1	2
y					

Activity

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

Sign:

Date:

113 More algebraic equations

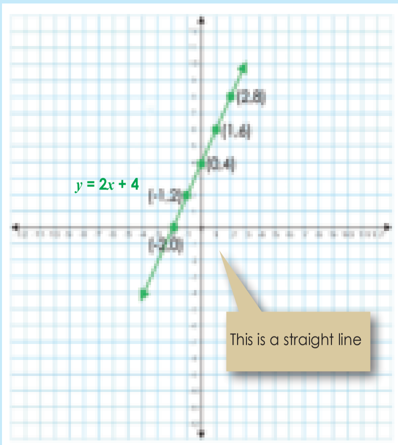
Compare the two graphs

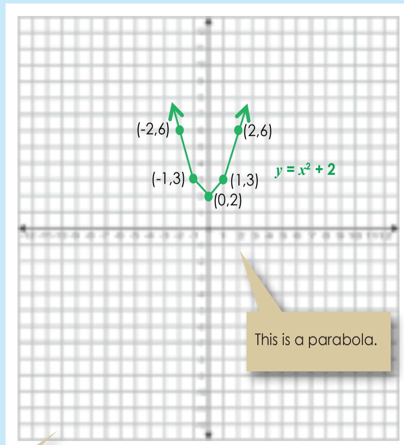
$y = 2x + 4$

x	−2	−1	0	1	2
y	0	2	4	6	8

$y = x^2 + 2$

x	−2	−1	0	1	2
y	6	3	2	3	6





What will a graph for $y = -x^2 + 2$ look like?

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					

b. $y = x^2 + 5$

x	−2	−1	0	1	2
y					

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: $y = x^2 - 1$; $y = -x^2 - 1$; $y = -x^2 + 1$; $y = x^2 + 1$

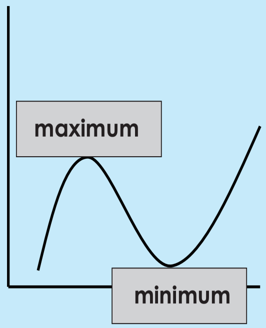
Sign:

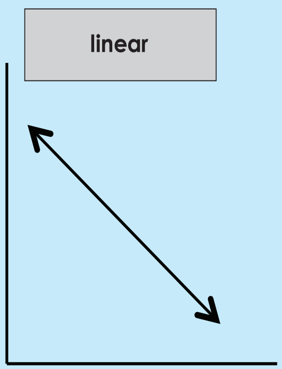
Date:

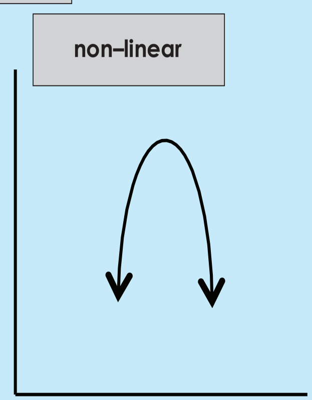
114a Interpreting and drawing graphs: temperature and time graphs

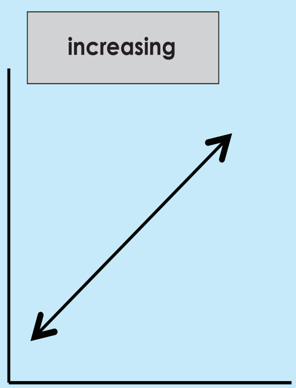
Look at the graphs. Discuss.

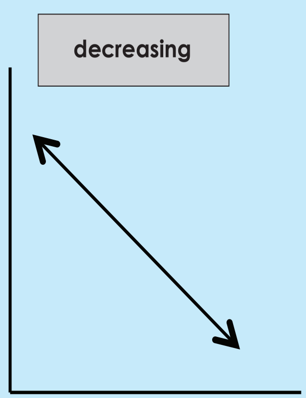
There are different words to describe graphs.







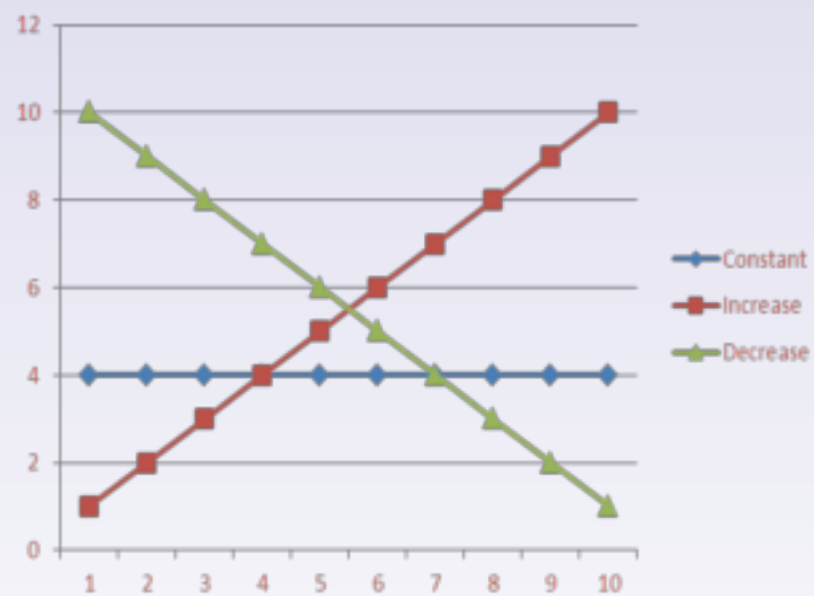




Constant: A line is constant when the y–value or the x–value remains the same while the x–value or the y–value increases.

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

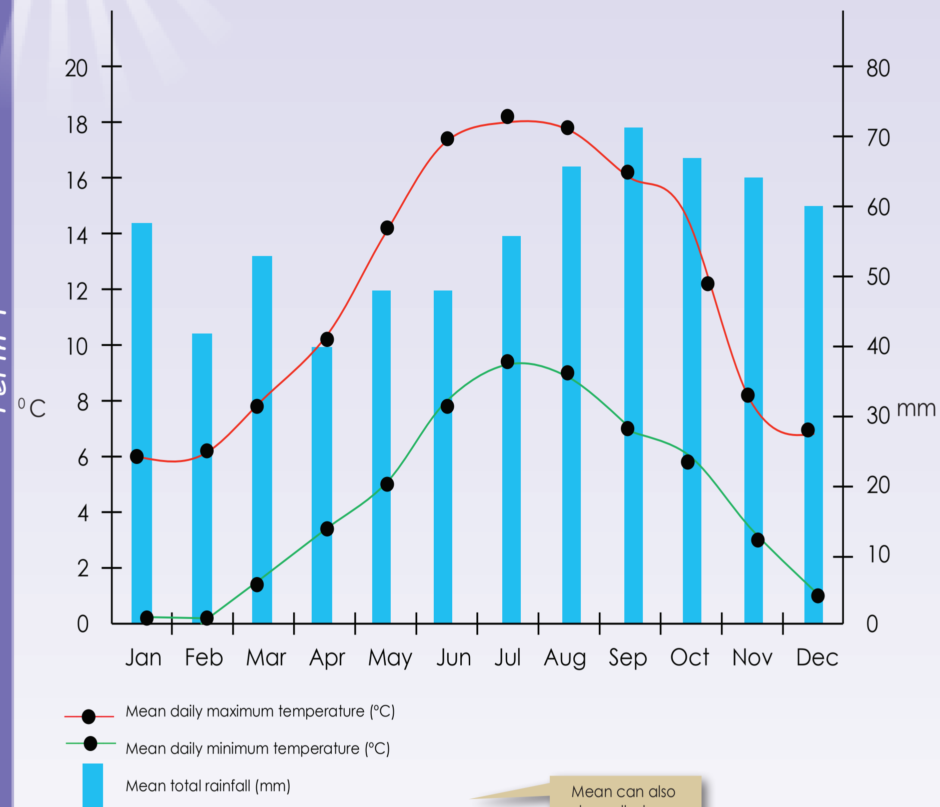
Decreasing: The slope of a line decreases when the y–value decreases as the x–value increases.



continued

114b Interpreting and drawing graphs: temperature and time graphs continued

1. Answer the questions below using this graph.



Mean can also be called an average

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? ______________________

f. Describe the graph using the following words: increasing, decreasing, linear and non–linear.

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

	Maximum temperature	Minimum temperature	Average rainfall
January			
February			
March			
April			
May			
June			
July			
Augustus			
September			
October			
November			
December			

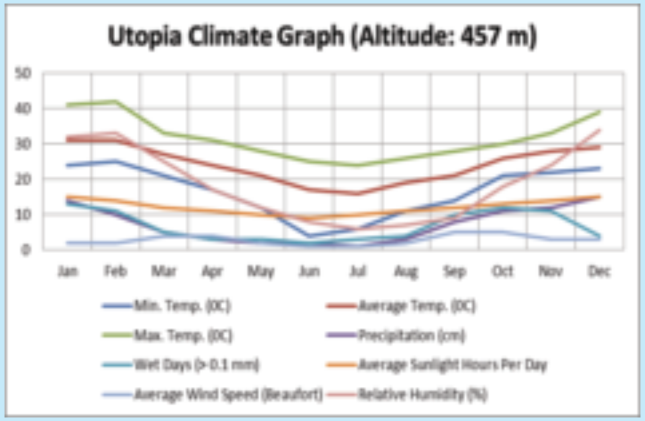
Problem solving

Draw a graph showing the maximum and minimum temperatures annually for any country in the southern and northern hemispheres.

Sign:
Date:

115 Interpreting and drawing graphs: rainfall and time graphs

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? ___________________________

Describe each of the following using:

linear non–linear
increasing decreasing
maximum minimum

a. Min. temp (°C)	**b. Max. temp (°C)**
c. Average temp (°C)	**d. Precipitation (cm)**
e. Wet days (>0,1 mm)	**f. Average sunlight hours per day**
g. Average wind speed (Beaufort)	**h. Relative humidity (%)**

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?

Sign:

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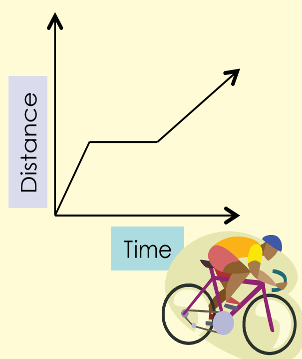
116 Interpreting graphs

Revise the words below by making a drawing of each.

Increase	Decrease	Constant	Linear	Non– linear

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

Example:

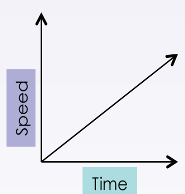


- This is a **non–linear** graph.
- Looking at the graph from left to right, you can see that as time **increases**, the distance travelled increases.
- The distance and time travelled then remain **constant** for a period of time.
- Then the time once again **increases** as the distance travelled **increases**.

Situation that corresponds to the graph.

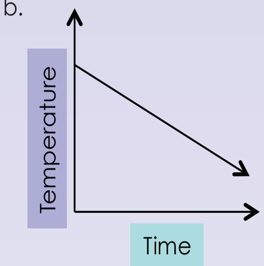
A possible situation that could correspond to this graph could be the distance that a cyclist rides on a bike. The cyclist rides, stops to rest, and then continues to ride.

a.

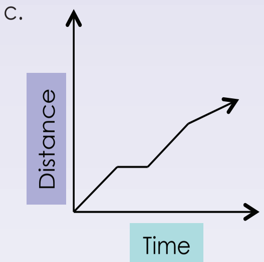


Draw or paste a picture here.

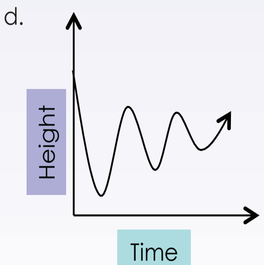
b.



c.



d.



Activity

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

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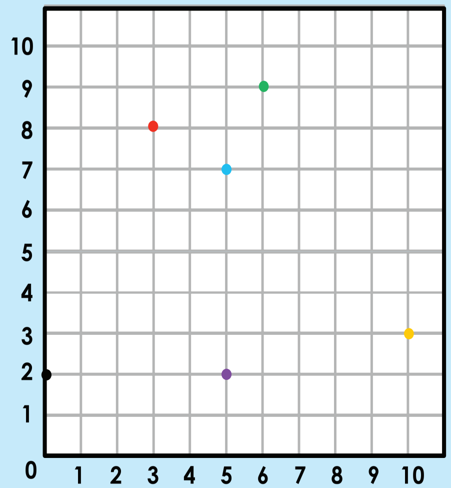
Date:

117a Revising and introducing the Cartesian plane

Revision: Look at the following and describe.



The point (5;7) is 5 units along, and 7 units up.

Do the other co–ordinates.

(3;8) is 3 units across, and 8 units up.

(6;9) is 6 units across, and 9 units up.

(5;2) is 5 units across, and 2 units up.

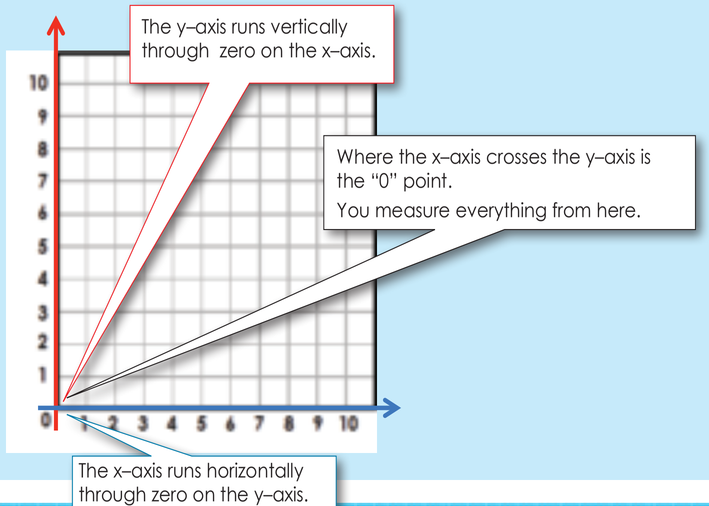
(10;3) is 10 units across, and 3 units up.

(0;2) is 0 units across, and 2 units up.

Y– and X–axis

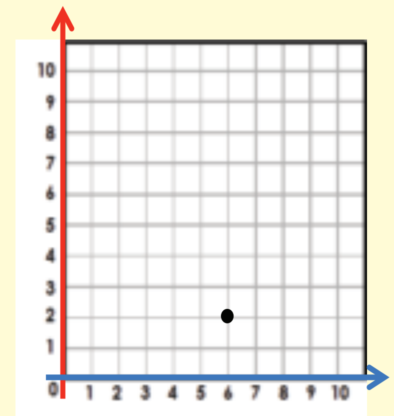
x–axis The left–right (horizontal) direction is called x.

y–axis The up–down (vertical) direction is called y.



1. **Plot the co–ordinates and describe them.**

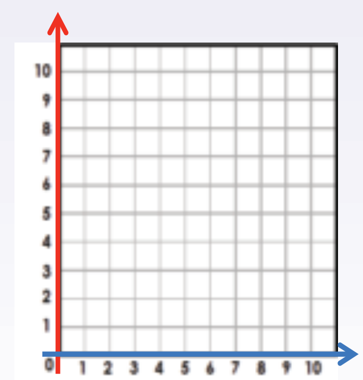
Example: (6;2)



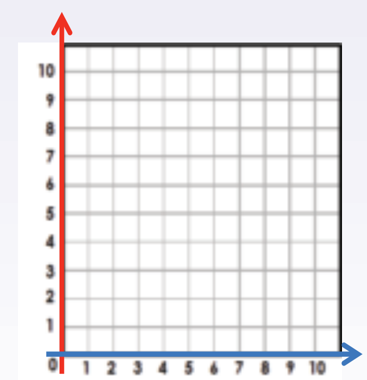
6 units along the x-axis

2 units up the y-axis

a. (5;8)



b. (7;3)



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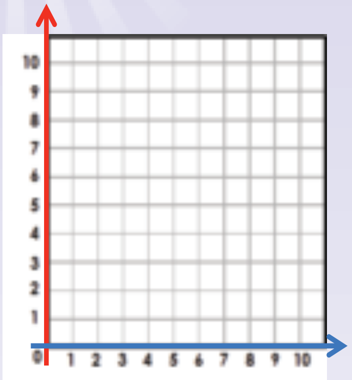
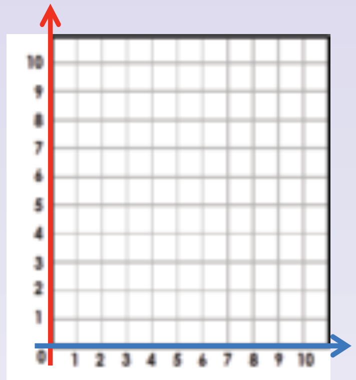
continued

117b Revising and introducing the Cartesian plane continued

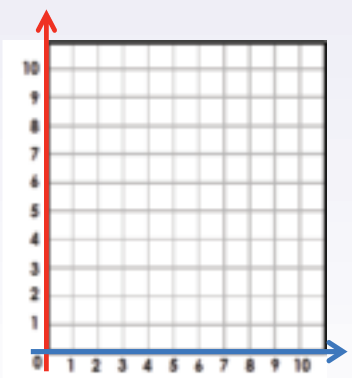
c. (0;9)



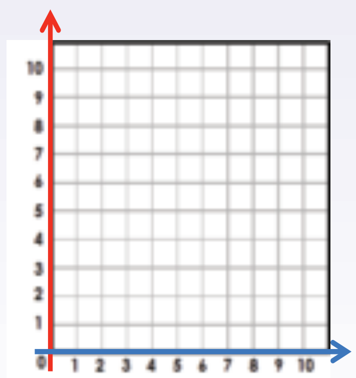
d. (5;0)



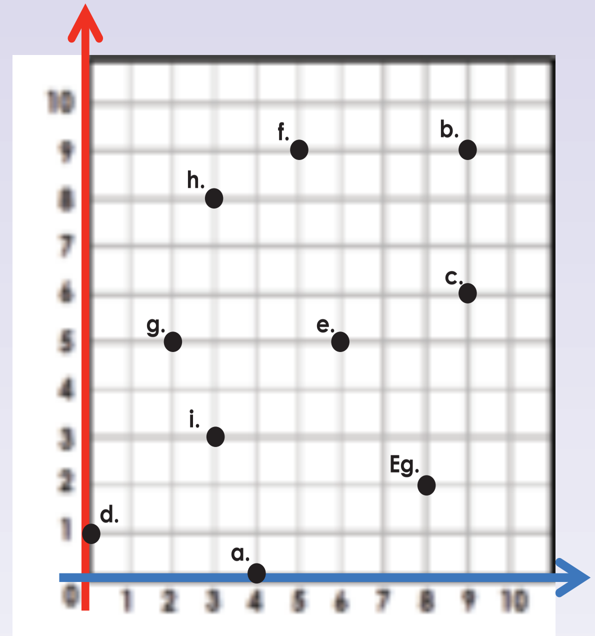
e. (1;1)



f. (2;4)



2. Write down the co-ordinates for the following:



Example:

Eg. (8;2)

a. ________

b. ________

c. ________

d. ________

e. ________

f. ________

g. ________

h. ________

i. ________

Prolem 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.

Sign:

Date:

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

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118 Ordered pairs

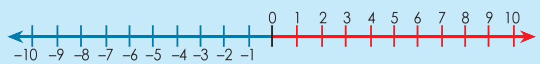
Read and discuss.

(3;5) is called an "ordered pair"

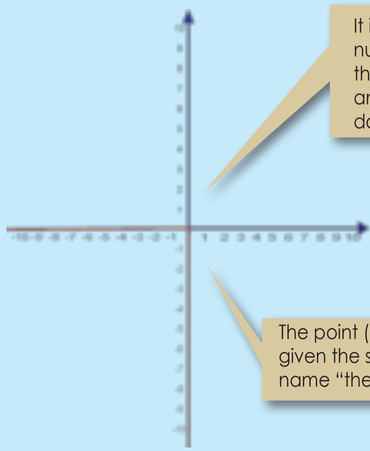
Parentheses are put around the numbers.

The numbers are separated by a comma. **(3;5)**

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

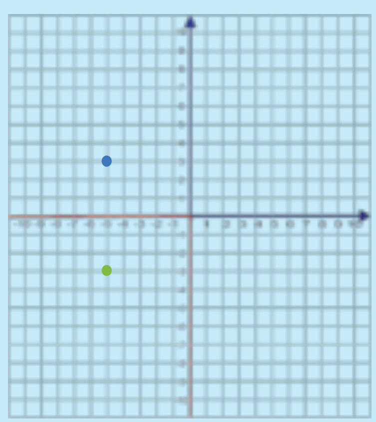


What do you see?



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".



For **negative numbers** we

- go **backwards** along the x–axis
- go down along the y–axis

Let us try:

(−5;3) means go back 5 along the x–axis and then go up 3 on the y–axis.

(−5;−3) means go back 5 along the x–axis and then go down 3 on the y=axis.

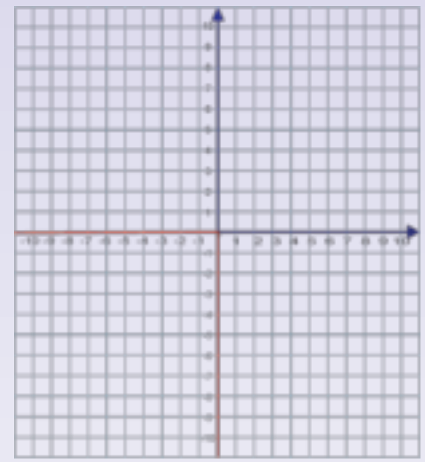
Describe each point in words.

- (2;3); (−2;3); (2;−3) and (−2;−3)
- (6;9); (−6;9); (6;−9) and (−6;−9)
- (7;4); (−7;4); (7;−4) and (−7;−4)

Term 4

1. **Plot on the y–axis and describe the following:**

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) ____________________

Prolem solving

Find these positions on the Cartesian plane:

- **Go back 4 units** along the x – axis 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.

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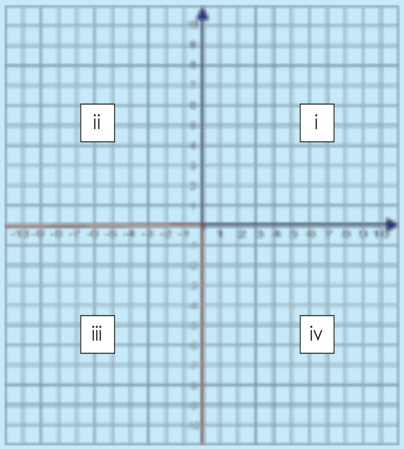
119 Cartesian plane: four quadrants



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.

Quadrant	x: (horizontal)	y: (vertical)	Five examples
i	Positive		
ii			(–8;6)
iii		Negative	
iv			

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.

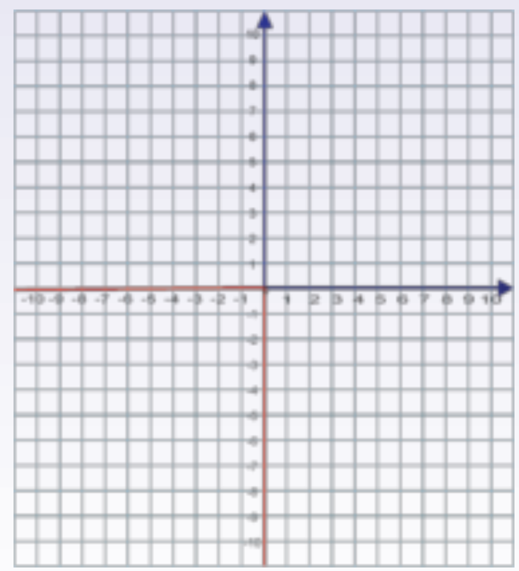
b. Only x is positive.

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?

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120 Drawing graphs by plotting points

Look and describe.

x	–4	–3	–2	–1	0	1	2	3	4
y	19	12	7	4	3	4	7	12	19

$y = (-4)^2 + 3$
$= 16 + 3$
$= 19$

$y = (-3)^2 + 3$
$= 9 + 3$
$= 12$

$y = (-2)^2 + 3$
$= 4 + 3$
$= 7$

$y = (-1)^2 + 3$
$= 1 + 3$
$= 4$

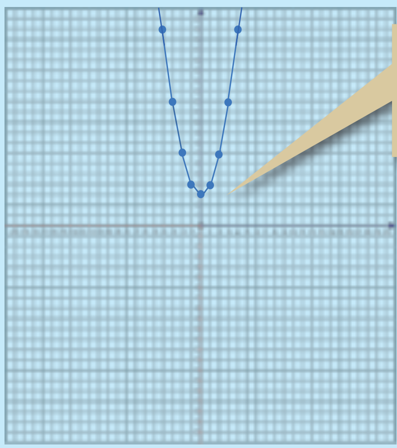
$y = 0^2 + 3$
$= 0 + 3$
$= 3$

$y = 1^2 + 3$
$= 1 + 3$
$= 4$

$y = 2^2 + 3$
$= 4 + 3$
$= 7$

$y = 3^2 + 3$
$= 9 + 3$
$= 12$

$y = 4^2 + 3$
$= 16 + 3$
$= 19$



The parabola has a minimum value of 3 at x = 0 (0,3). It opens upwards (u–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									

Give the: Minimum value

____

b. $y = x^2 + 2$

x	–4	–3	–2	–1	0	1	2	3	4
y									

Give the: Minimum value

____

c. $y = x^2 + 1$

x	–4	–3	–2	–1	0	1	2	3	4
y									

Give the: Minimum value

____

____

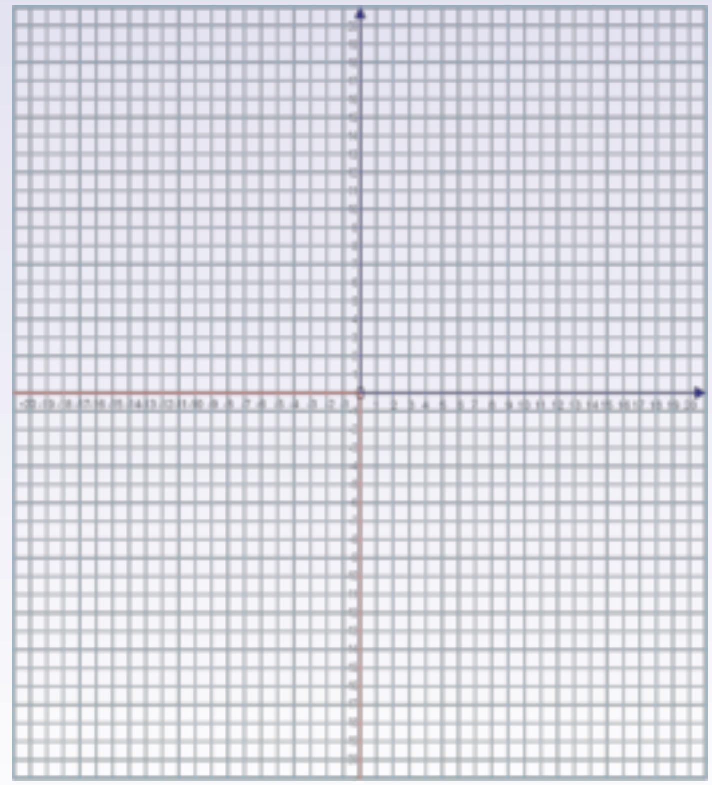
d. $y = x^2 + 3$

x	–4	–3	–2	–1	0	1	2	3	4
y									

Give the: Maximum point

____

____



Activity

Describe the graph $y = x^2 + 10$

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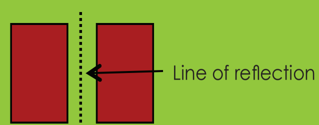
121 Transformation (revision)

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

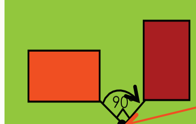
A transformation is what brings about the change. There are many kinds of geometric transformations that change the position, shape or size of objects. Common transformations are **translations, rotations, reflections,** and **enlargements**.

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.

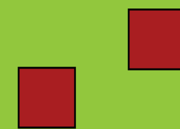
Reflection: a reflection is a transformation that has the same effect as a mirror.



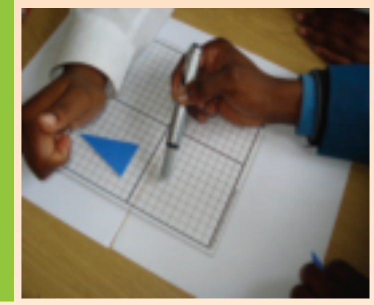
Rotation: a rotation is a transformation that moves points so that they stay the same distance from a fixed point, the centre of rotation.



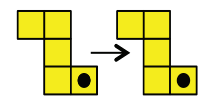
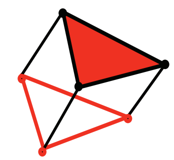
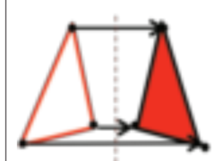
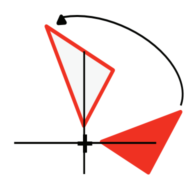
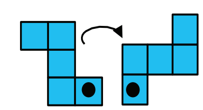
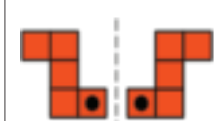
A translation is the movement of an object to a new position without changing its shape, size or orientation.



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



Give a transformation that represents the diagrams, word or pictures in the table below.

Every point makes a circle around the centre.			Every point of the shape must move the same distance and the same direction.
Every point is the same distance from the **centre line**.			**Flip** (Mirror)
	**Turning** around a **centre**.		The distance from the centre **to any point** on the shape stays the **same**.
It means **moving** without rotating, flipping or resizing.		It is a **flip** over a **line**.	It has the same **size** as the **original image**. The shape stays the **same**.

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Revision

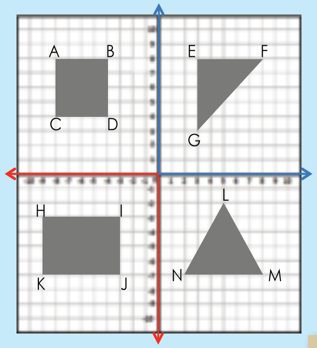
Plot the co-ordinates of the following:

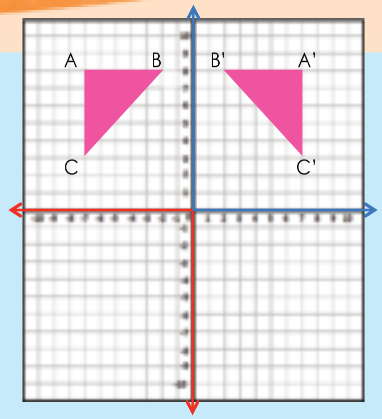
ABCD: (–8;8); (–4;8); (–4;4); (–8;4)

Δ EFG: (3;8); (8;8); (3;3)

HIJK: (–9;–3); (–3;–3); (–3;–7); (–9;–7)

Δ LMN: (5;–2); (8;–7); (2;–7)





Look at Δ ABC. What happened? Describe it using co-ordinates.

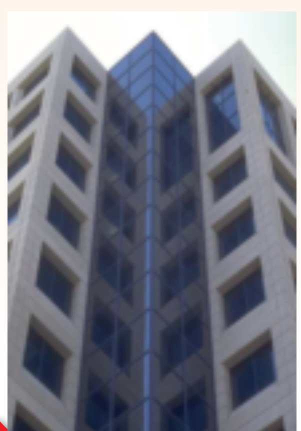
The co-ordinates of ABC are: (–6;8); (–2;8) and (–6;3).

ABC is reflected over the **x–axis** making the coordinates of **A'B'C'**. (6;8); (2;8) and (6;3)

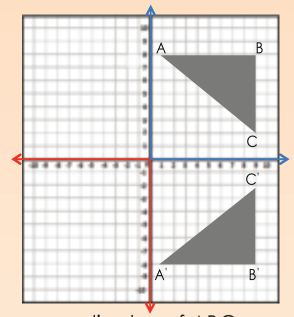
Note how **y co-ordinates** remain the same but the **x co-ordinates** change to their opposite integer (the signs change).

This is always the case with reflections over the **y–axis.** In which quadrant is the reflected image?

1. Look at the architectural design and describe it using the words symmetry or transformations.



2. Describe each reflection.

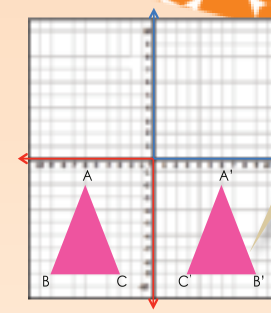


The co-ordinates of ABC are ____________

The co-ordinates of A'B'C' are ____________

ABC is reflected over the ___–axis.
Which co-ordinates remain the same? ____________

Which co-ordinates change? ____________



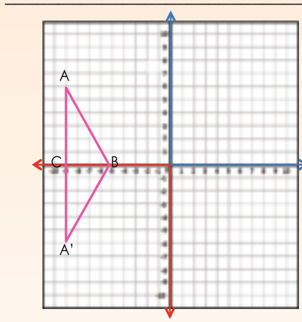
Note where angle B is.

The co-ordinates of ABC are ____________

The co-ordinates of A'B'C' are ____________

ABC is reflected over the ___–axis.
Which co-ordinates remain the same? ____________

Which co-ordinates change? ____________

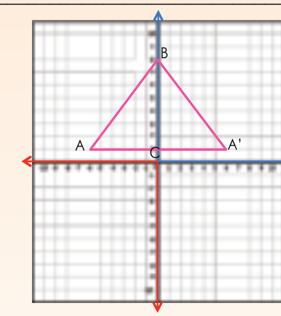


The co-ordinates of ABC are ____________

The co-ordinates of A'B'C' are ____________

ABC is reflected over the ___–axis.
Which co-ordinates remain the same? ____________

Which co-ordinates change? ____________



The co-ordinates of ABC are ____________

The co-ordinates of A'B'C' are ____________

ABC is reflected over the ___–axis.
Which co-ordinates remain the same? ____________

Which co-ordinates change? ____________

Activity

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.

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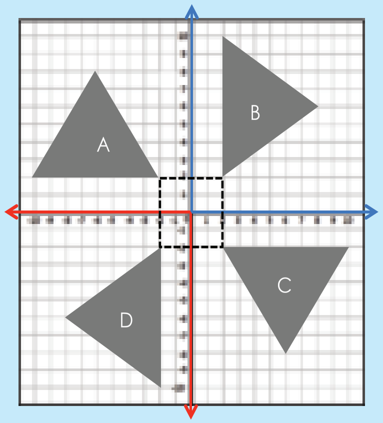
123 Rotation

Look at the diagram and the table. What do you notice? Why is there a dotted square in the middle?



The co–ordinates are:			
Triangle A	(–2;2)	(–10;2)	(–6;8)
Triangle B	(2;2)	(2;10)	(8;6)
Triangle C	(2;–2)	(10;–2)	(6;–8)
Triangle D	(–2;–2)	(–2;–10)	(–8;–6)
Note the pattern in the co–ordinates for corresponding vertices of the triangles.			

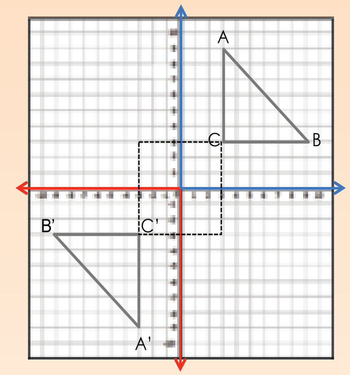
Triangle B: 90° rotation of triangle A about the origin.
Triangle C: 90° rotation of triangle B about the origin.
180° rotation of triangle A about the origin.
Triangle D: 90° rotation of triangle C about the origin.
180° rotation of triangle B about the origin.
270° rotation of triangle A about the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

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

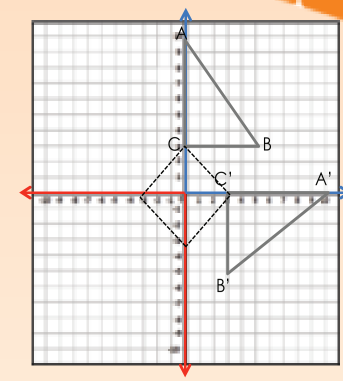
a.

b.

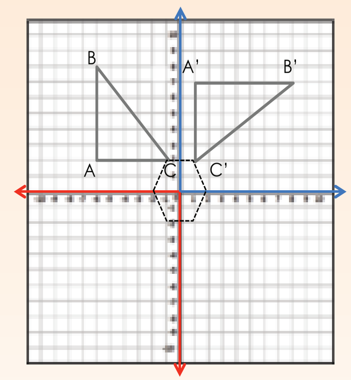
2. Complete the following.



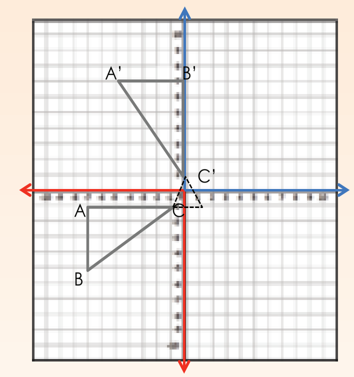
a. The co-ordinates of ABC are ___.
The co-ordinates of A'B'C' are ___.
Compare the corresponding vertices.



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 90°; 180°; 120°

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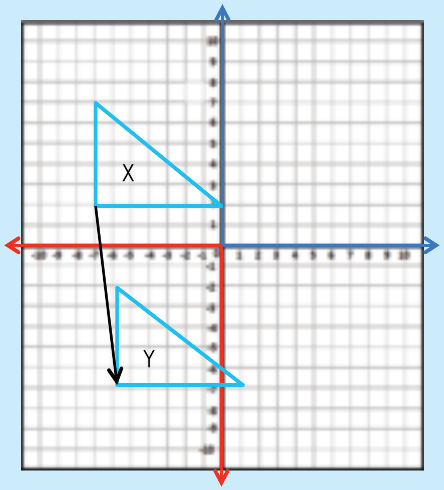
Term 4

124a Translations

Look at example 1 and 2. Discuss.



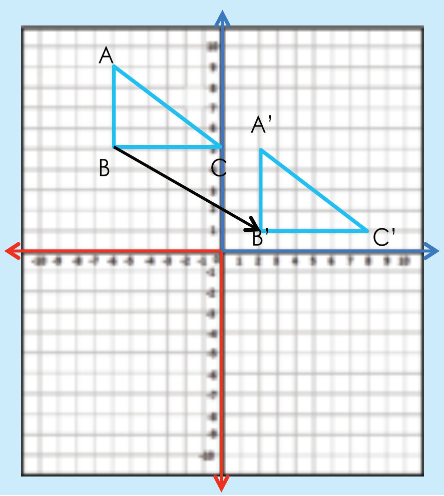
Example 1:

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.**

Underline the key words.



Example 2:

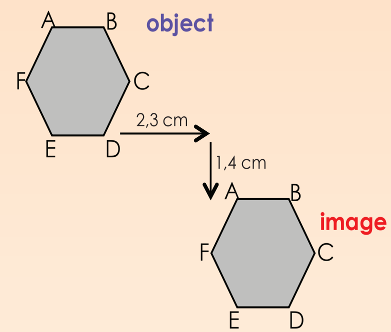
The co-ordinates of the triangle ABC are (–6,9); (–6,5); (0,5).

What are the co–ordinate pairs if the diagram was moved 8 units to the riight and 4 units down?

The new co-ordinates of
A' B' C': (2,5); (2,1); (8,1)
Explain how each diagram was moved using the given co-ordinates.
(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.

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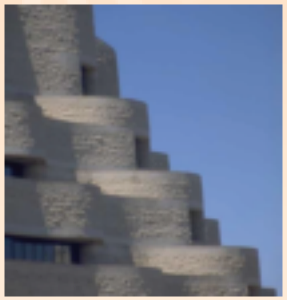
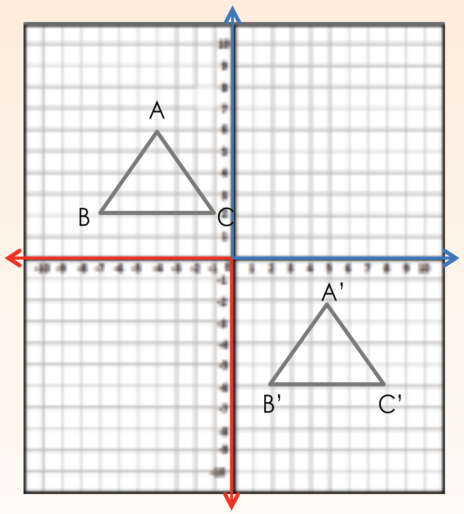
continued

124b Translations continued

2. Look at this architectural design and describe it using the words symmetry or transformations.



3. Complete the following:



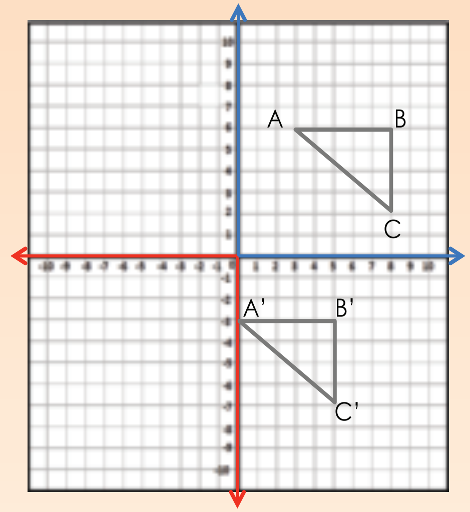
a. The co–ordinates of ABC are: ______.

The co-rdinates A¹ B¹ C¹ are: _______.

Explain how the diagram was translated.

____

____



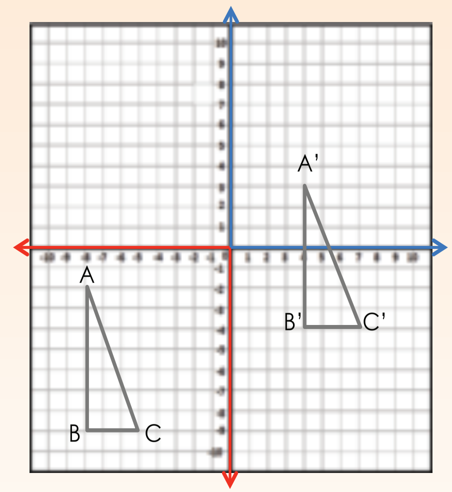
b. The co–ordinates of ABC are: ______.

The co-rdinates A¹ B¹ C¹ are: _______.

Explain how the diagram was translated.

____

____

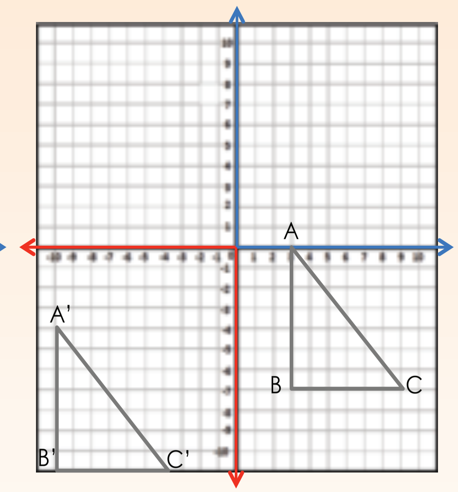


c. The co–ordinates of ABC are: ______.

The co-rdinates A¹ B¹ C¹ are: _______.

Explain how the diagram was translated.

____



d. The co–ordinates of ABC are: ______.

The co-rdinates A¹ B¹ C¹ are: _______.

Explain how the diagram was translated.

____

Activity

Plot ABC on any plane. Translate ABC 7 units to the right and 3 units down. What are the co-ordinates of the image?

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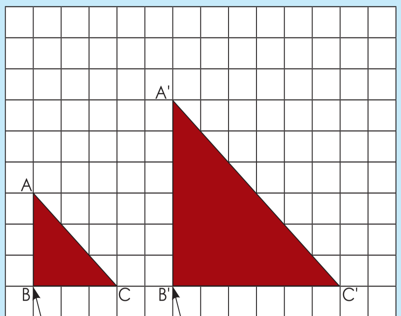
125a Enlargement and reduction

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

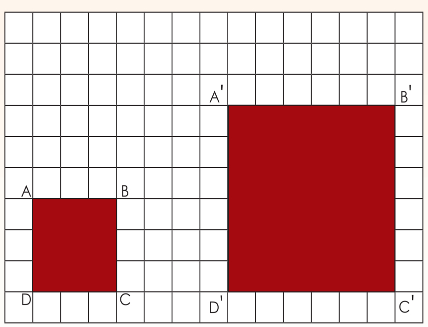
B' C' = 2 x BC

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) × AB 2 x 3 = 6

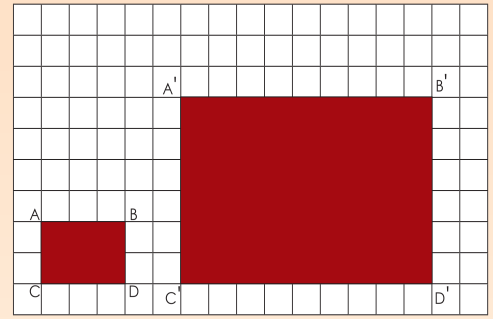
B'C' = (2) × BC ____ = ____

C'D' = (2) × CD ____ = ____

A'D' = (2) × AD ____ = ____

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

b.



A'B' = (3) × AB ____ = ____

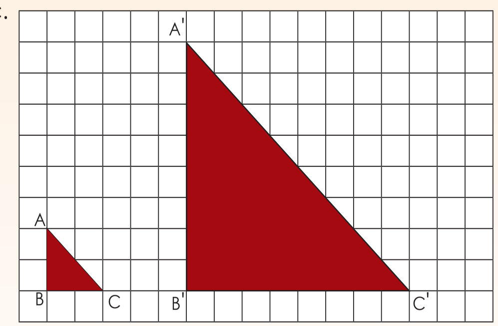
B'C' = (3) × BC ____ = ____

C'D' = (3) × CD ____ = ____

A'D' = (3) × AD ____ = ____

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

c.



A'B' = (4) × AB ____ = ___

B'C' = (4) × BC ____ = ___

A'C' = (4) × AC ____ = ___

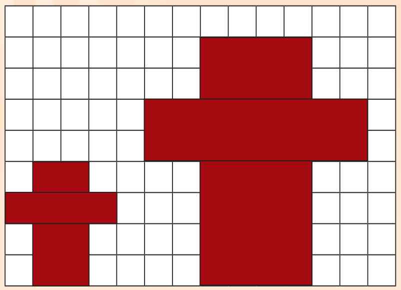
Therefore we say that the transformation is an **enlargement** with **scale factor (4).**

continued

Sign:
Date:

Enlargement and reduction continued

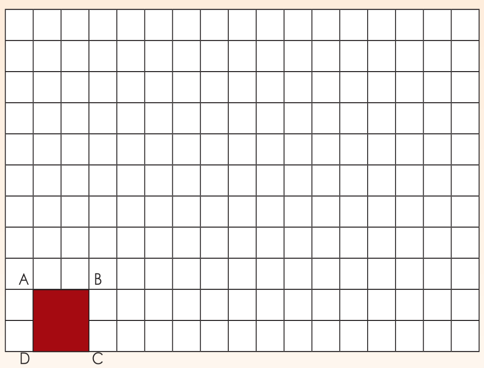
2. By what scale factor is the figure enlarged? ___________________



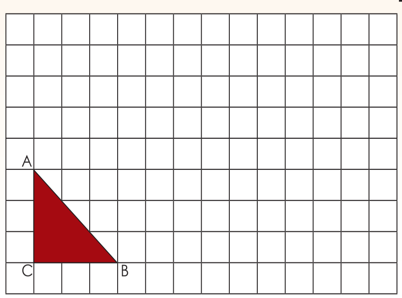
(An enlargement with scale factor 2).

3. Draw the enlargements.

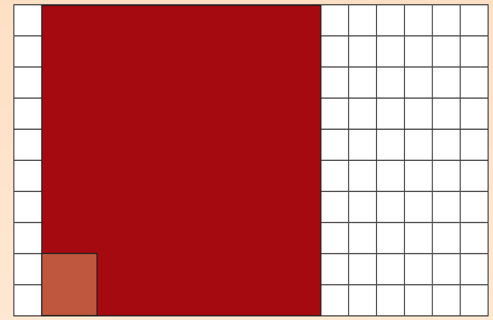
a. An **enlargement** with **scale factor 5**.



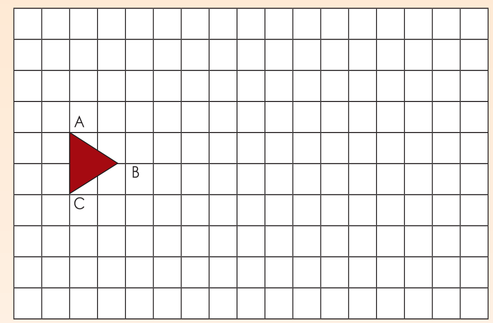
b. An **enlargement** with **scale factor 2** $.\frac{1}{2}$



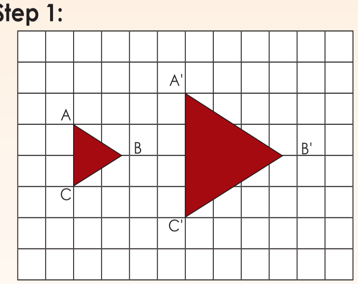
c. We can also draw an enlargement like this.



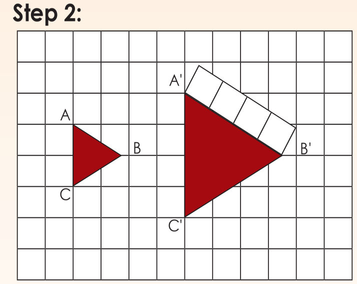
d. An **enlargement** with **scale factor 2**.



Step 1:



Step 2:



A'B' and B'C' should be the same length as A'C'. How would I measure this without using a ruler? (You can use a protractor, or you can cut four squares and measure A'B' and B'C'.)

____

____

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?

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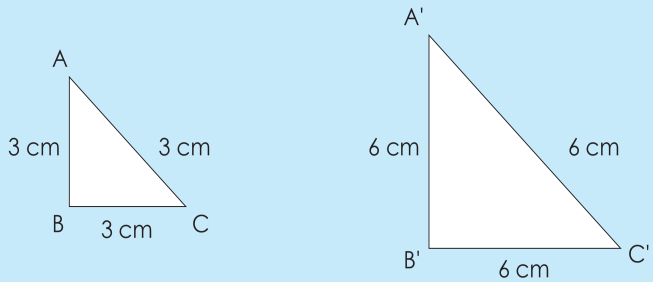
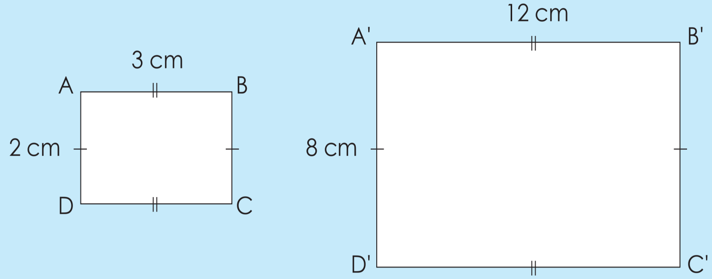
126 Enlargement and reduction problems

By what scale factor is each figure is enlarged by?



By what scale factor is each figure enlarged?



1. **Draw the outside perimeter of a small house. The floor plan must be 6 m x 6 m. After drawing this, enlarge the house by a scale factor of 2.**

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 the area of the second house?

____

ii. What is the perimeter and area after the enlargement?

____

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?

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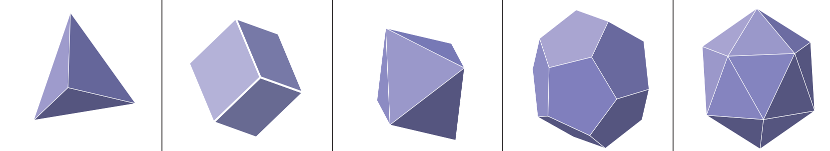
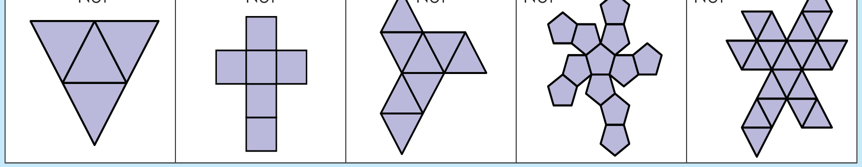
127 Platonic solids

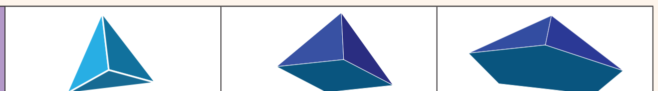
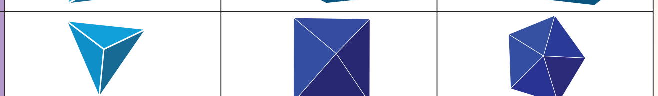
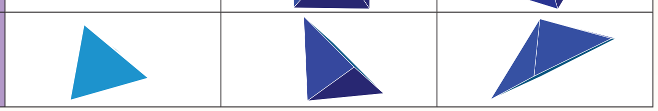
Use the Cut-out 2 and 3 to make the Platonic solids.

Tetrahedron	Cube	Octahedron	Dodecahedron	Icosahedron
Geometric solid	Geometric solid	Geometric solid	Geometric solid	Geometric solid
				
Net	Net	Net	Net	Net
				

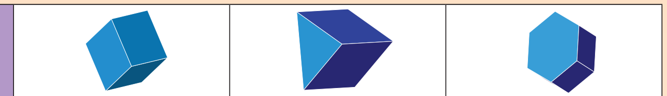
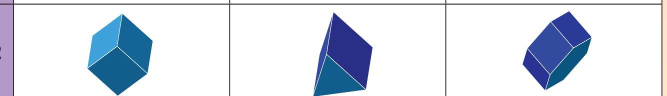
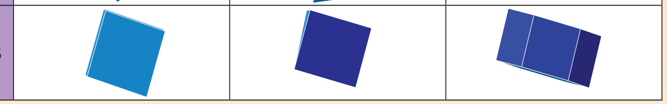
1. Describe each of the following:

Tetrahedron	Cube	Octahedron	Dodecahedron	Icosahedron

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

View 1			
View 2			
View 3			

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

View 1			
View 2			
View 3			

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

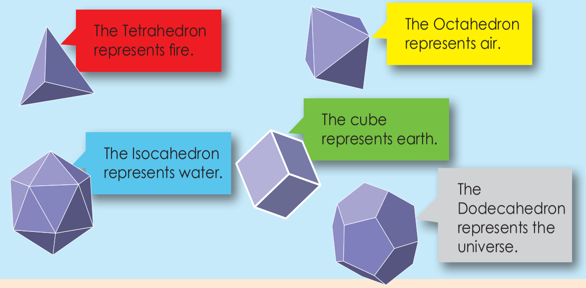
Make a geometric solid with more than 16 faces.

Sign:

Date:

128 Platonic solids again

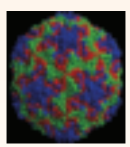
The five regular polyhedra were discovered by the ancient Greeks. The Pythagoreans knew of the tetrahedron, the cube, and the dodeahedron; the mathematician Theaetetus added the octahedrons and the icosahedrons. These shapes are also called the Platonic solids, after the ancient Greek philosopher Plato. Plato, who greatly respected the work of Theaetetus, speculated that these five solids were shapes of the fundamental components of the physical universe.



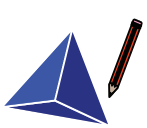
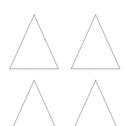
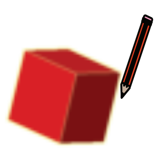
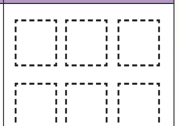
1. Match the Platonic solid with the life form.

2. Name the Platonic solid that looks like these crystals.


3. Identify and name the Platonic solid you see in
a. the radiolarian, a microscopic sea creature
b. a common cold virus.

4. Take each Platonic solid made previously and trace around each face, e.g.

Solid (tetrahedron)	Geometric figure four triangles	Solid (cube)	Geometric figure six squares
			

Solid	Geometric figure	Solid	Geometric figure	Solid	Geometric figure

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.

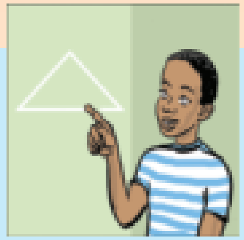
Activity

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?

Sign:
Date:

129 Presenting Platonic solids



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.

Sign:
Date:

130 Faces, vertices and edges

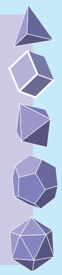
Revise:

Face: a plane surface enclosed by an edge or edges

Vertex (plural: vertices): a point where three edges meet (corner).

Edge: where two surfaces are joined.

A Platonic solid is a convex **regular polyhedron made up of faces that are all the same regular polygon,** and with the same number of faces meeting at all its vertices.



Convex means that something curves outwards.

Concave means that something curves inwards.

1. Label the following using objects using these words: face, edge and vertex.

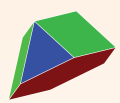
a. 
cube

b. 
tetrahedron

c. 
octahedron

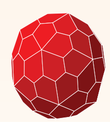
d. 
dodecahedron

e. 
icosahedron

f. 
triangular cupola

g. 
augmented hexagonal prism

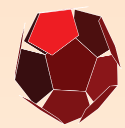
h. 
pentagonal deltohedron

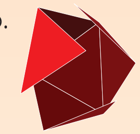
i. 
pentagonal hexecontahedron

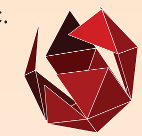
2. What do all these objects have in common?

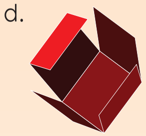
cube	icosahedron	dodecahedron	octahedron	tetrahedron
				

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

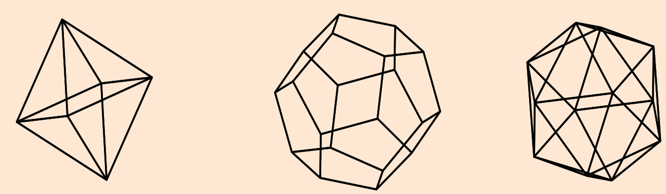
d. 
____
- ___ edges
- ___ vertices
- ___ faces

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

a.	b.	c.	d.	e.
				

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.



We call these skeletons in Mathematics.

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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.**

tetrahedron	cube	octahedron	dodecahedron	icosahedron

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**.

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

A geometric figure is regular if the sides are equal.

A geometric solid is regular if the faces are equal.

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.

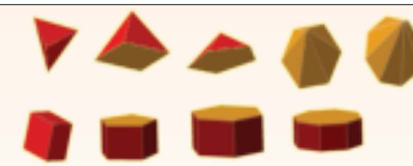
Shapes	Length of sides	Angle
Triangle		
Square		
Pentagon		
Hexagon		
Octagon		

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.



Activity

What should you do to the square pyramid to change it to an octahedron?

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132a Constructing a net: tetrahedron, triangular pyramid, triangular and rectangular prism

Revise the following. Write everything you remember on these geometric solids down.

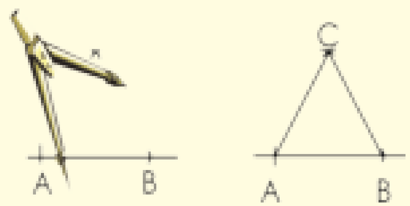
Tetrahedron	Triangular pyramid	Triangular prism	Rectangular prism

Words to guide: Faces; Edges; Vertices; Regular; Irregular; 2–D; 3–D

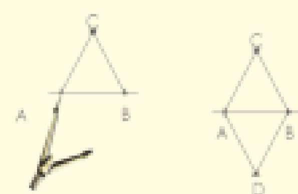
Term 4

1. Construct a tetrahedron net

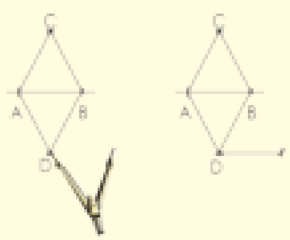
Step 1:
Construct an equilateral triangle. Label it ABC.



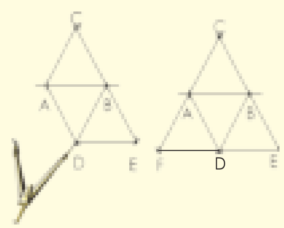
Step 2:
Construct another equilateral triangle with one base joined to base AB of the first triangle.



Step 3:
Construct another triangle using BD as a base.

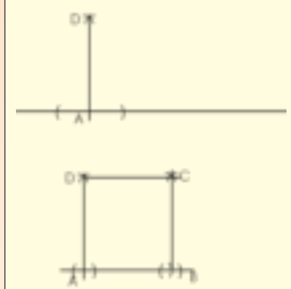


Step 4:
Construct another triangle using AD as a base.

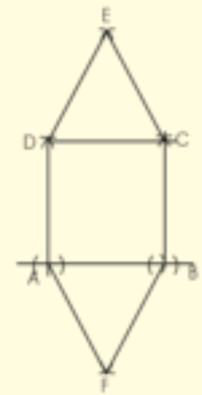


2. Construct a square pyramid net.

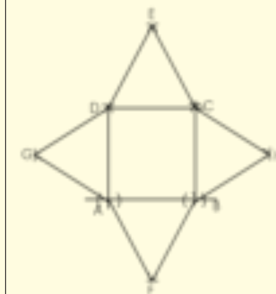
Step 1:
Construct two perpendicular lines. The lengths of AD and AB should be the same. Use your pair of compasses to measure them. From there, construct rectangle ABCD.



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.

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Date:

continued ☛

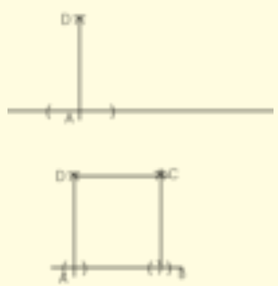
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

132b Constructing a net: tetrahedron, triangular pyramid, triangular and rectangular prism *continued*

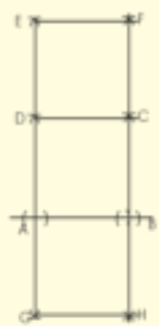
Term 4

3. Construct a triangular prism construction net.

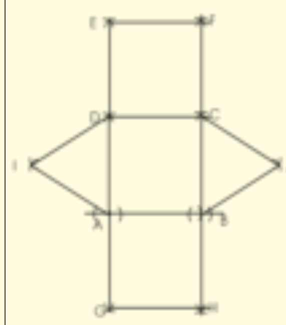
Step 1:
Construct two perpendicular lines. The lengths of AD and AB could be the same or one longer to form a rectangle. Use your pair of compasses to measure them). From there, construct rectangle ABCD.



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.

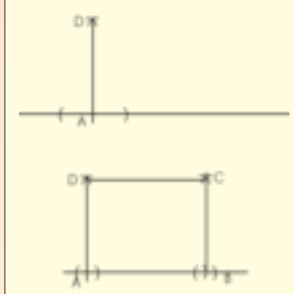


i) After you have constructed the triangular prism, answer the following questions:
- what difficulties did you have?
- what would you do differently next time?

ii) Now do the construction on cardboard, cut it out and make the triangular prism.

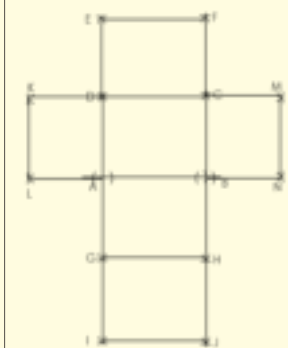
4. Construct a rectangular prism construction net.

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.



Making

Use the nets to make the geometric solids.

Sign:

Date:

133a Constructing a net: hexagonal prism and pyramid, octahedron

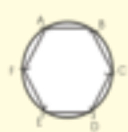
Revise the following. Write everything you remember on these geometric solids down.

Hexagonal prism	Hexagonal pyramid	Octahedron

Words to guide: Surfaces; Edges; Vertices; Regular; Irregular; 2–D; 3–D

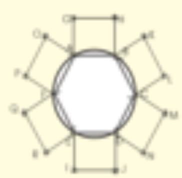
1. **Construct a hexagonal prism.**

Step 1:
Construct hexagon ABCDEF.

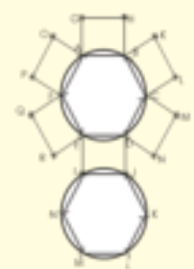


Step 2:
- Use AB as a base to construct a rectangle.
- Use BC as a base to construct a rectangle.
- Use CD as a base to construct a rectangle.
- Use DE as a base to construct a rectangle. Label it EDJI.
- Use EF as a base to construct a rectangle.
- Use FA as a base to construct a rectangle.

Note: The rectangles can also be squares.



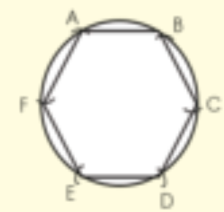
Step 3:
- Use IJ as a base to construct another hexagon.



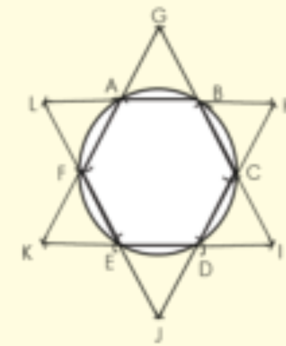
Now do the construction on cardboard, cut it out and make the hexagonal prism.

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.



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.

– ______________ – ______________ – ______________

– ______________ – ______________

Sign:

Date:

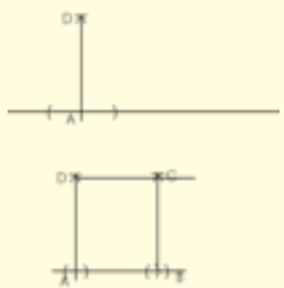
continued ☛

133b Constructing a net: hexagonal prism and pyramid, octahedron continued

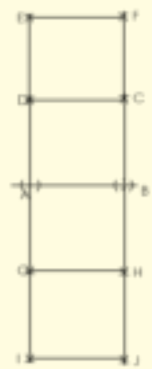
Term 4

4. Construct a net of a cube.

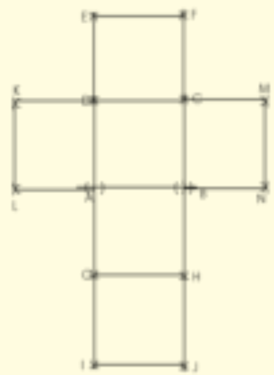
Step 1:
Construct two perpendicular lines. The length between A and B should be the same as D and A. Use your compass to measure them. From there, construct square ABCD.



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.

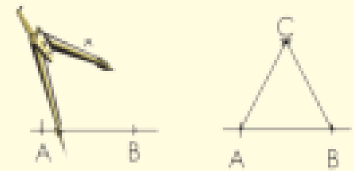


Step 3:
- Use DA as base to construct a square.
- Use CB as base to construct a square.

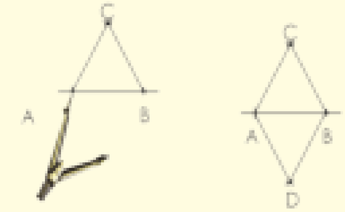


5. Construct an octahedron.

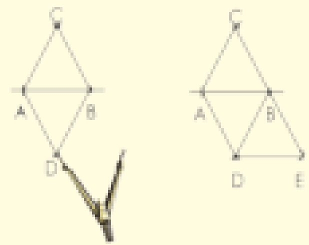
Step 1:
Construct an equilateral triangle. Label it ABC.



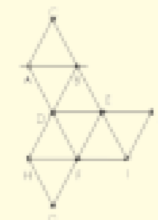
Step 2:
Construct another equilateral triangle with one base joined to base AB of the first triangle.



Step 3:
Construct another triangle using BD as a base.



Step 4:
Carry on constructing triangles until you complete the net.



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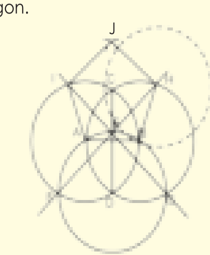
133c Constructing a net: hexagonal prism and pyramid, octahedron continued

6. Construct an octahedron net.

Do the same for the icosahedron as with the octahedron. You just carry on constructing more triangles.

Problem solving

Construct the net of a dodecahedron. Here are the two steps.

Step 1:	Step 2:
Construct a pentagon. 	Let H be the middle of the next circle, for constructing the next pentagon. 

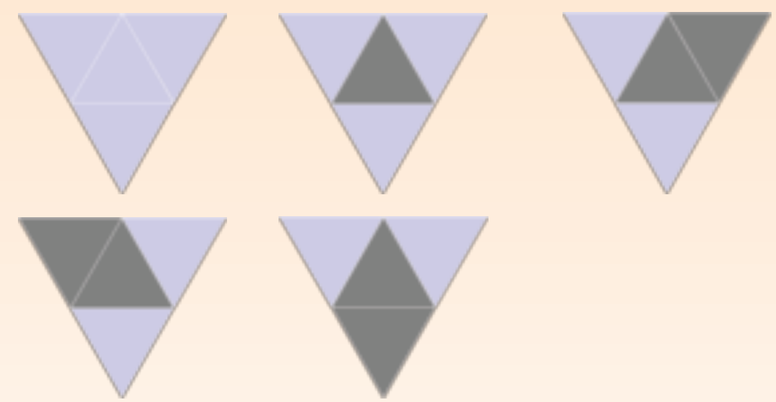
7. Project

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 to 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.



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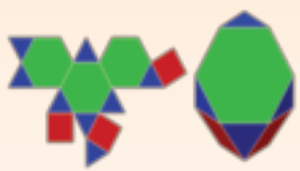
133d Constructing a net: hexagonal prism and pyramid, octahedron continued

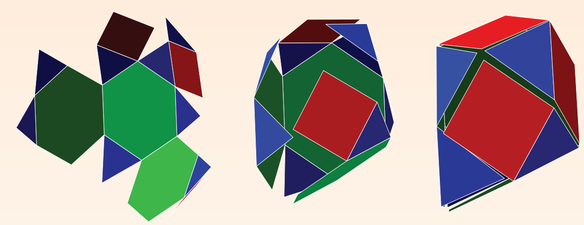
b. Describe the net you made in Question 8 in the same way you described the tetrahedron's net. Support what you say with some drawings of your net.

c. **Quick activity:** Look at this net of a Johnson solid.
Describe the faces in your own words.



d. Describe the shapes that make up your net in Question 8 in the same way as the example above.

Quick activity: Look what happens with the angles when the net is folded to form a geometric solid. Describe the vertices.



e. Describe the vertices of your created net.

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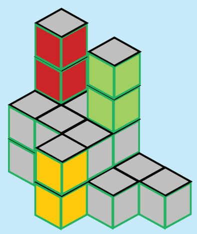
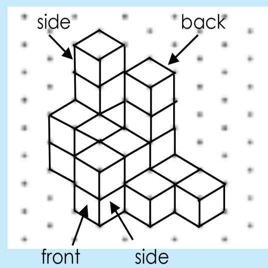
Date:

Look at the building made from 21 cubes.

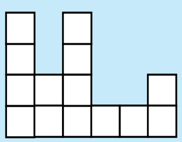


We can draw the building on isometric paper. It will look like this.

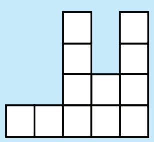


This is how the front, back and side views will look like.

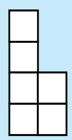
Front view



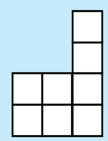
Back view



Side view

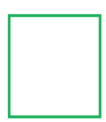
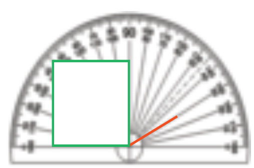
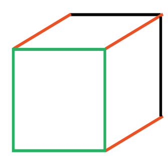


Side view

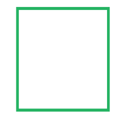
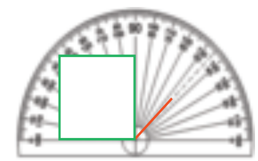
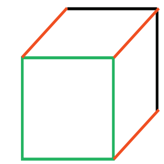


Let us learn about different ways of drawing 3–D object views.

1a. Draw a cube using a 30° oblique drawing. The steps below will guide you.

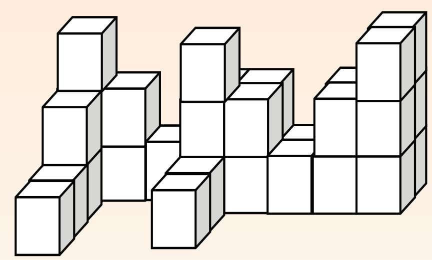
Step 1	Step 2	Step 1
Draw a square. 	Draw a 30° line from the bottom right vertex. 	Draw the rest of the cube.  Remember that the lines that are **parallel** in the real three–dimensional object remain parallel in the drawing.

b. Draw a cube using 45° oblique drawing.

Step 1	Step 2	Step 1
Draw a square. 	Draw a 45° line from the bottom right vertex. 	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°?

2. Take 30 cubes and create this building (you may want to use a seperate 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.

Sign:

Date:

135 Possible outcomes

Revision:

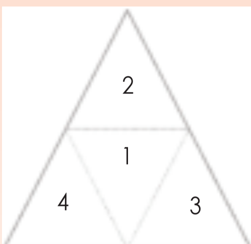
What are the possible outcomes for this die.

The possible outcomes are:1, 2, 3, 4, 5 and 6.

What are the possible outcomes if I have two dice?

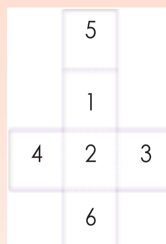
1. These are all the nets for the platonic solids. Determine the possible outcome of each if you use the net to make a dice.

a. Tetrahedron net



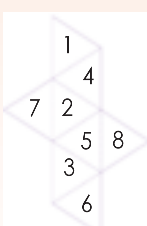
What is the probability to land on 3? Write it as a common fraction.

b. Cube net



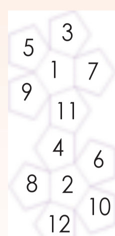
What is the probability to land on 6? Write it as a common fraction.

c. Octahedron net



What is the probability to land on 7? Write it as a common fraction.

d. Dodecahedron net



What is the probability to land on 6? Write it as a common fraction.

e. Icosahedron net

What is the probability to land on 6? Write it as a common fraction.

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 $\frac{1}{15}$ to land on 5.

d. The probability $\frac{1}{29}$ to land on 6.

3. Make your own dice that will have more than six possible outcomes.

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?

Sign:

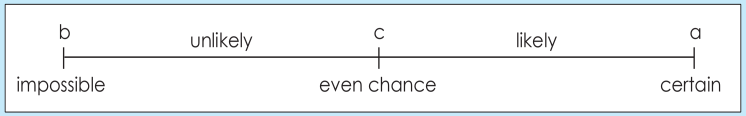
Date:

Term 4

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

136 Probability

Revision: The probability scale can look like this.



Where will you put these on the scale?

a. It will rain tomorrow.

b. I don't have to study much for my exams.

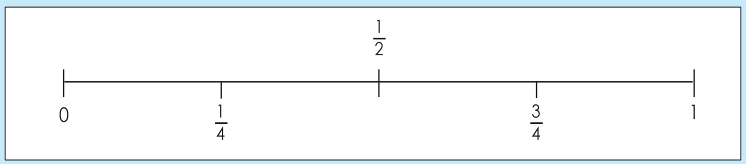
c. When I flip a coin it will land on heads.

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.

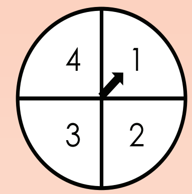


1. Put these words in the correct place on top of the probability line: certain, impossible, likely, unlikely, even chance.

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? _____________ an even number? _____________

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.

Activity

What is the probability of drawing three sweets of your choice from a bag of 15 different sweets. Write your answers in words and rational numbers.

Sign:

Date:

137 Relative frequency

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:

$$\text{Relative frequency} = \frac{\textit{number of successful trials}}{\textit{total number of trials}}$$

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.

Sign:
Date:

138 Probability and relative frequency

What is the difference between the probability and the relative frequency?

Probability

0 —— 25% —— 50% —— 75% —— 100%

What is the probability of landing on 2 on a six-sided dice?

$\frac{2}{6} = \frac{1}{3} = 33\%$

Relative frequency

You and your friend rollled a dice 100 times. It landed 27 times on 2. What is the relative frequency of it landing on 2?

$\frac{27}{100} = 27\%$

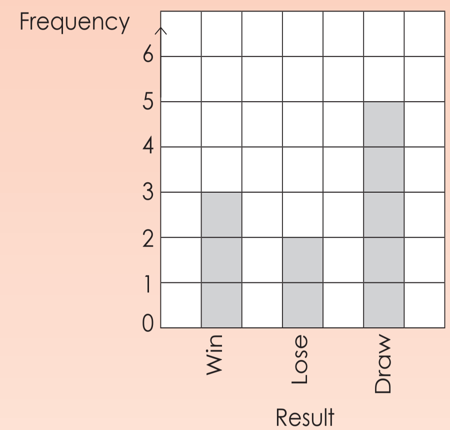
The difference between the **probability** and the **relative frequency** is 33% – 27% = 6%.

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.



Activity

What is the probability that your school's soccer/rugby team will win the next match?

Sign:
Date:

139a 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.**

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. What are you looking for in this problem?	Circle the key words. Here are some key words for multiplication: multiplied by, multiply, groups of, product, lots of, time table, times.	Circle key numbers and hidden numbers. What information should you remember about this problem?
Circle key numbers and hidden numbers. What information is not needed in solving this problem?	Circle key numbers and hidden numbers.	Circle key numbers and hidden numbers.
Circle key numbers and hidden numbers. Why did you choose this response?	Does your answer make sense? Try it out. After getting an answer, how can I check to see if it is correct?	

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.**

Tip: Use the tips on problems solving on the previous page.

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.**

Activity

Compare your methods of solving problems with you friends. Write down the similarities and differences.

Sign:

Date:

139b More problem solving

Revision: Summarise in your own words how you will solve a problem.

Do two friends always solve a problem in the same way? Why or why not?

Compare your answer with your friends.

1. Imagine only the answer is given to you. How will you create a word problem with the following answer 38,25 m^3? Give two possible word problems.

a. I will create it by ...

Tip: Change the context of the problem.

a. Possible word problem

b. Possible word problem

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 cm^3 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.

Sign:

Date:

140 Revision overview: part 1

Number, operations and relationships

Tick yes or no.

Number operations and relationship concepts	Worksheet numbers	Do you need support? Yes	Do you need support? No
Whole numbers	R1,45		
Exponents	R3,14,15,17,18,19,20,21,22,23,24, 25,26,76		
Integers	R4,11,12,13		
Fractions	**Common fractions:** R5,65,66,67,68,69,70 **Decimal fractions:** R6,71,72,73,74,75		
Multiples and factors	R2,3,4,5		
Properties of numbers	1,2		
Financial mathematics	R10,6,7,8,9,10		

My summary and notes.

1. Go through all the worksheets per topic above and make your own notes and summary.

Whole numbers	Exponents

Integers	Multiples and factors

Properties of numbers	Financial mathematics

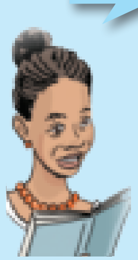
What do you understand now?

After doing this worksheet, share with your teacher and/or friends what you understand now that you didn't understand before.

Sign:

Date:

141 Revision overview: part 2



Tick yes or no.

This table will give you information on where to go and revise your work.	Worksheet numbers	Do you need support?	
		Yes	No
Functions and relationships	R7,29,106,107,108,109,110		
Numeric and geometric patterns	27,28		
Algebraic expressions	R8,29,30,31,32,33,34,35,36,37,39,40,41,42,43,44		
Algebraic equations	33,34,35,36,37,111,112,113		
Graphs	R9,R12,114,115,116,117,118,119,120		

My summary and notes.

1. Go through all the worksheets per topic above and make your own notes and summary.

Functions and relationships	Numeric and geometric patterns

Algebraic expressions and equations	Graphs

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.

Sign:

Date:

142 Revision overview: part 3

Shape and space (geometry)

In this worksheet we are going to revise shape and space (geometry)

This table will give you information on where to go and revise your work.

Tick yes or no.

Shape and space (geometry)	Worksheet numbers	Do you need support?	
		Yes	No
Construction of geometric figures	R11,56,57,58,59		
Geometry of 2–D shapes	60,61,62,63,64,65,66,67,68, 69,70,71		
Transformation geometry	R12,121,122,123,124,125, 126		
Geometry of 3–D objects	R13,127,128,129,130,131,1 32,133,134		
Geometry of straight lines	72,73,74,75		

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

Space to make some drawings.

Transformation geometry	Geometry of 3–D objects

Space to make some drawings.

Geometry of straight lines	2. Add some everyday life examples for each concept.

Space to make some drawings.

Sign:

Date:

143 Revision overview: part 4

Measurement

Tick yes or no.

Measurement	Worksheet numbers	Do you need support?	
		Yes	No
Area and perimeter of 2–D shapes	R14,77,78,79,80,81,82,83,84,85, 86,87,88,89,90,91		
Surface area and volume of 3–D objects	R15,87,88,89,90,91		

My summary and notes.

1. Go through all the worksheets per topic above and make your own notes and summary.

Area and perimeter of 2–D shapes

Space to make some drawings.

Surface area and volume of 3–D objects

Space to make some drawings.

2. Add some real life examples for each concept.

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.

Sign:

Date:

144 Revision overview: part 5

Data handling

Tick yes or no.

Data handling	Worksheet numbers	Do you need support? Yes	No
Collect, organize and summarise data	R16,92,93,102,103,104		
Represent data	94,95,96,97,98,99,100,101,102, 103,104		
Analyse, interpret and report data	94,95,96,97,99,100,101,103,104		
Probability	135,136,137,138.		

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

Space to make some drawings or more notes.

Analyse, interpret and report data	Probability

Space to make some drawings or more notes.

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.

Sign:

Date: