Mintlaw Academy

Numeracy Booklet

A guide for pupils, parents and staff

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Introduction

Numeracy is a skill for life, learning and work. We are numerate if we have developed:

the confidence and competence in using number which will allow individuals to solve problems, analyse information and make informed decisions based on calculations.

This booklet has been produced to give guidance to pupils, parents and teachers on how numeracy topics are taught and used throughout the school. Using a consistent approach across all subjects will allow all pupils to make confident progress.

How can the booklet be used?

Pupils

The booklet includes Numeracy skills which you will use in many different subject areas, as well as in Mathematics. You should use the booklet to remind you how to carry out different processes and calculations. Your subject teacher will help you with this.

The method you use may be a mental strategy, paper-and-pencil or calculator.
You should aim to develop a variety of strategies so that you can select the most appropriate method for different problems.

Parents and teachers

If you are working with pupils in your class, or helping your child with homework, you can refer to the booklet to see what skills and methods are being taught across the school. Simply look up the relevant page for a step-by-step guide. Each skill includes some examples, and may have choices of different methods such as mental strategies or non-calculator methods.

Pupils are encouraged to develop a variety of strategies so that they can select the most appropriate method in any given situation. Where appropriate, the booklet indicates the preferred method which pupils should be encouraged to use.

Basic Numeracy Skills

At Mintlaw Academy we expect pupils to demonstrate, acquire and regularly revise some of the more basic number skills such as their times tables and simple addition or subtraction.

All pupils should know their times tables from 1 to 10, however it is well worth encouraging extra practice in the six, seven, eight and nine times tables.

Extra
Practice Required!

x	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	10
2	2	4	6	8	10	12	14	16	18	20
3	3	6	9	12	15	18	21	24	27	30
4	4	8	12	16	20	24	28	32	36	40
5	5	10	15	20	25	30	35	40	45	50
6	6	12	18	24	30	36	42	48	54	60
7	7	14	21	28	35	42	49	56	63	70
8	8	16	24	32	40	48	56	64	72	80
9	9	18	27	36	45	54	63	72	81	90
10	10	20	30	40	50	60	70	80	90	100

Place value is an important idea.

<u>Example</u>

hundreds	tens	units		tenths	hundredths
1	2	3	●	4	5

26.57 means
2 tens, 6 units, 5 tenths and 7 hundredths.

We say this as "twenty six point five seven"
NOT
"twenty six point fifty seven"

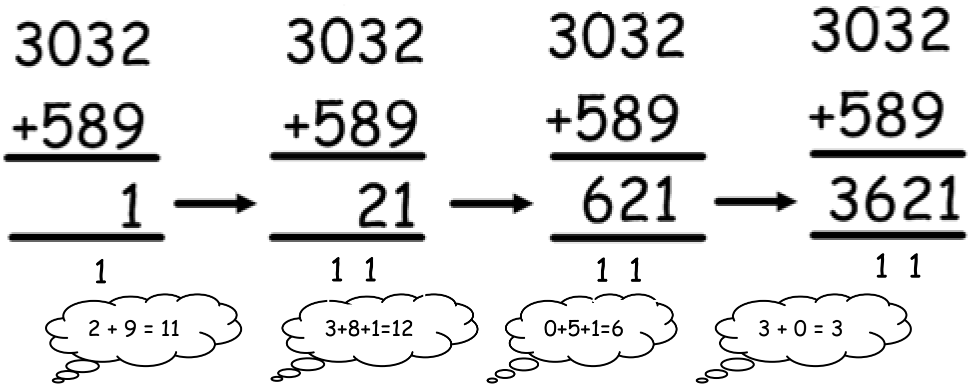
Addition

Written Method

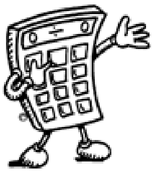
When adding numbers, ensure that the numbers are lined up according to place value.

Start at right hand side, write down units, and carry tens.

Example Add 3032 and 589



Mental strategies



There are a number of useful mental strategies for addition. Some examples are given below.

Example Calculate 54 + 27

Method 1 Add tens, then add units, then add together

50 + 20 = 70 4 + 7 = 11 70 + 11 = 81

Method 2 Split up the number to be added into tens and units and add separately.

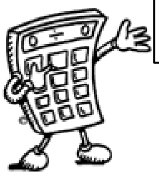
54 + 20 = 74 74 + 7 = 81

Method 3 Round up to nearest 10, then subtract

54 + 30 = 84 but 30 is 3 too many therefore subtract 3

84 - 3 = 81

Subtraction



We use decomposition as a written method for subtraction. Alternative methods may be used for mental calculations.

Written Method

Example 1 4590 – 386

Example 2 Subtract 197 from 2000

$$\begin{array}{ccccc} & 4 & 5 & {}^{8}\cancel{9} & {}^{1}0 \\ - & & 3 & 8 & 6 \\ \hline & 4 & 2 & 0 & 4 \\ \hline \end{array}$$

$$\begin{array}{ccccc} & {}^{1}\cancel{2} & {}^{9\cancel{1}}\cancel{0} & {}^{9\cancel{1}}\cancel{0} & {}^{1}0 \\ - & & 1 & 9 & 7 \\ \hline & 1 & 8 & 0 & 3 \\ \hline \end{array}$$

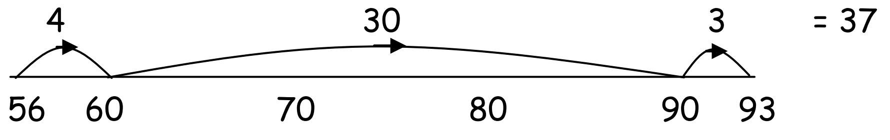
We DO NOT “borrow and pay back”

Mental Strategies

Example Calculate 93 - 56

Method 1 Count on

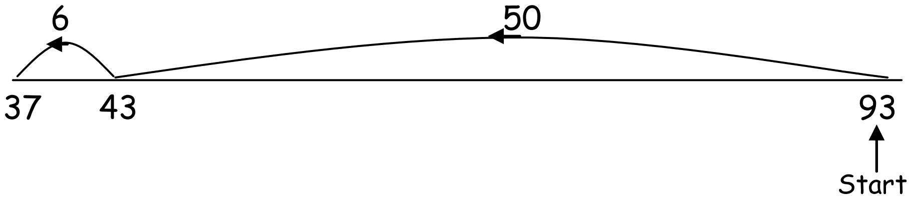
Count on from 56 until you reach 93. This can be done in several ways e.g.



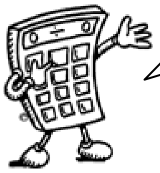
Method 2 Break up the number being subtracted

e.g. subtract 50, then subtract 6 93 - 50 = 43

43 - 6 = 37



Multiplication



It is essential that pupils know all of the multiplication tables from 1 to 10. These are shown in the tables square below.

x	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	10
2	2	4	6	8	10	12	14	16	18	20
3	3	6	9	12	15	18	21	24	27	30
4	4	8	12	16	20	24	28	32	36	40
5	5	10	15	20	25	30	35	40	45	50
6	6	12	18	24	30	36	42	48	54	60
7	7	14	21	28	35	42	49	56	63	70
8	8	16	24	32	40	48	56	64	72	80
9	9	18	27	36	45	54	63	72	81	90
10	10	20	30	40	50	60	70	80	90	100

7 x 2 = 14

Written Methods

When multiplying two numbers, ensure that the numbers are lined up according to place value.

Example 1 Find 39 x 6

$$\begin{array}{r} 39 \\ \times\ \underline{\ \ 6} \\ \underline{\ \ 4} \\ 5\ \end{array} \qquad \begin{array}{r} 39 \\ \times\ \underline{\ \ 6} \\ \underline{234} \\ 5\ \end{array}$$

6 x 9 = 54

6 x 3 = 18

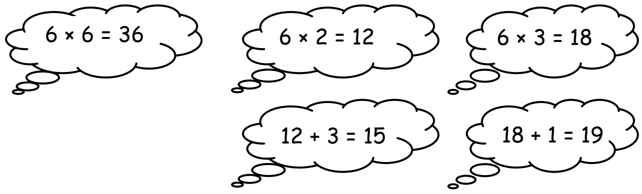
18 + 5 = 23

Multiplication

Example 2 Find 326 x 56

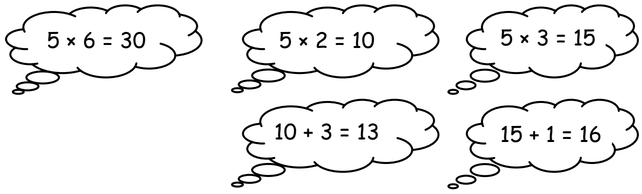
Step 1: Multiply by the 6 of the 56first

$$\begin{array}{r} 326 \\ \times\ \underline{\ \ 56} \\ 6 \end{array} \qquad \begin{array}{r} 326 \\ \times\ \underline{\ \ 56} \\ 56 \end{array} \qquad \begin{array}{r} 326 \\ \times\ \underline{\ \ 56} \\ 1956 \end{array}$$



Step 2: Multiply by the 5 of the 56. Placing a zero in the units column to signify that the 5 represents 5 tens.

$$\begin{array}{r} 326 \\ \times\ \underline{\ \ 56} \\ 1956 \\ 00 \end{array} \qquad \begin{array}{r} 326 \\ \times\ \underline{\ \ 56} \\ 56 \\ 300 \end{array} \qquad \begin{array}{r} 326 \\ \times\ \underline{\ \ 56} \\ 1956 \\ 16300 \end{array}$$



Step 3: Add the two lower numbers together to get the result of 326 × 56.

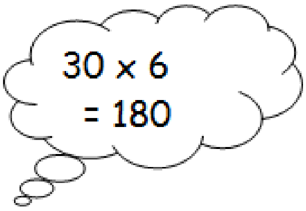
$$\begin{array}{r} 326 \\ \times\ \underline{\ \ 56} \\ 1956 \\ +\ \underline{16300} \\ \underline{18256} \\ 1\ \ \ \ \ \end{array}$$

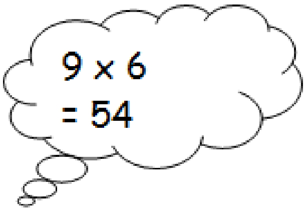
Multiplication

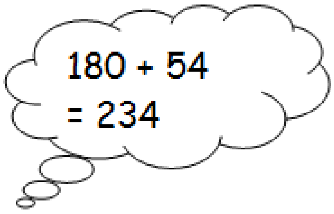
Mental Strategies

Example Find 39 x 6

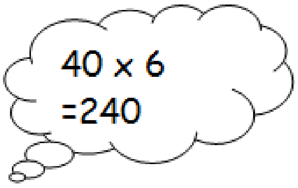
Method 1

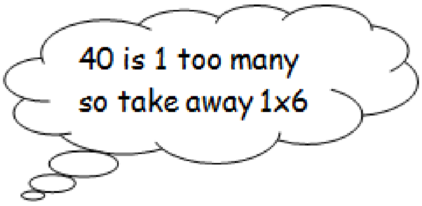


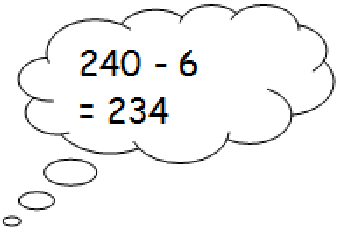




Method 2

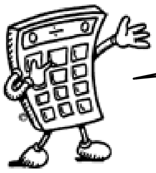






Division

Pupils should be able to divide by a single digit or by a multiple of 10 or 100 without a calculator.



Written Method

Example 1 There are 192 pupils in first year, shared equally between 8 classes. How many pupils are in each class?

$$\begin{array}{r|l} & 0\ 2\ 4 \\ \hline 8 & 1\ {}^{1}9\,{}^{3}2 \end{array}$$

There are 24 pupils in each class

Example 2 Divide 4.74 by 3

$$\begin{array}{r|l} & 1\ .\ 5\ 8 \\ \hline 3 & 4\ .\ {}^{1}7\,{}^{2}4 \end{array}$$

When dividing a decimal number by a whole number, the decimal points must stay in line.

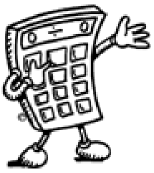
Example 3 A jug contains 2.2 litres of juice. The juice is poured evenly into 8 glasses, how much juice is in each glass?

$$\begin{array}{r|l} & 0\ .\ 2\ 7\ 5 \\ \hline 8 & 2\ .\ {}^{2}2\,{}^{6}0\,{}^{4}0 \end{array}$$

Each glass contains
0.275 litres

If you have a remainder at the end of a calculation, add a zero onto the end of the decimal and continue with the calculation.

Order of Calculation (BIDMAS)



Calculations which have more than one operation need to be done in a particular order. The order can be remembered by using the mnemonic **BIDMAS**

The **BIDMAS** rule tells us which operations should be done first. **BIDMAS** represents:

	Examples
(B)rackets	**(5 + 2) = 7**
(I)ndices	**5^3 = 5 × 5 × 5 = 125**
(D)ivision	**18 ÷ 6 = 3**
(M)ultiplication	**12 × 3 = 36**
(A)ddition	**5 + 2 = 7**
(S)ubraction	**18 – 12 = 6**

In a calculation that contains both Division and Multiplication these operations have equal priority.

Likewise if a calculation contains both Addition and Subtraction they also have equal priority.

Scientific calculators use this rule, some basic calculators may not, so take care in their use.

Example 1 6 × 3 + 2 BIDMAS tells us to MULTIPLY first then add

= 18 + 2

= 20

(Turn over for more examples)

Order of Calculation (BIDMAS) - continued

Example 2	$6 \times (3 + 2)$	BIDMAS tells us to work out the
	$= 6 \times 5$	brackets first then multiply
	$= 30$	

Example 3	$18 + 6 \div (5 - 2)$	Brackets first
	$= 18 + 6 \div 3$	then divide
	$= 18 + 2$	now add
	$= 20$	

Example 4	$3^2 + 5$	BIDMAS tells us to work out 3^2 (3×3)
	$= 9 + 5$	first then add
	$= 14$	

Example 5	$6 \times 3 + 16 \div 4$	BIDMAS tells us to Divide first
	$= 6 \times 3 + 4$	then Multiply
	$= 18 + 4$	now add
	$= 22$	

However since Division and Multiplication have equal priority we could have multiplied then divided to give the same answer.

$6 \times 3 + 16 \div 4$	Multiply first
$= 18 + 16 \div 4$	then Divide
$= 18 + 4$	now add
$= 22$	

Estimation - Rounding

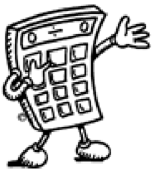
Numbers can be rounded to give an approximation

67**3**4 rounded to the nearest 10 is 6730

6**7**34 rounded to the nearest 100 is 6700

6734 rounded to the nearest 1000 is 7000

When rounding numbers 0 – 4 rounds down
5 – 9 rounds up
So 46**2**5 rounded to the nearest 10 is 46**3**0



In general, to round a number, we must first identify the place value to which we want to round. We must then look at the next digit to the right (the "check digit") - if it is 5 or more round up.

Example 1 Round 3 527 to the nearest thousand

3 is the digit in the thousands column - the check digit (in the hundreds column) is a 5, so round up.

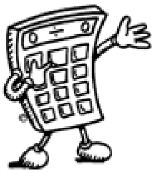
3527
= 4 000 to the nearest thousand

Example 2 Round 1.2439 to 2 decimal places

The second number after the decimal point is a 4 - the check digit (the third number after the decimal point) is a 3, so round down.

1.2439
= 1.24 to 2 decimal places

Estimation - Calculations



We can use numbers which have been rounded to give us an approximate answer to a calculation. This allows us to check that our answer is sensible.

Example 1
Tickets for a concert were sold over 4 days. The number of tickets sold each day was recorded in the table below. How many tickets were sold in total?

Monday	Tuesday	Wednesday	Thursday
486	205	197	321

Estimate = 500 + 200 + 200 + 300 = 1200 tickets

Calculate:

$$\begin{array}{r} 486 \\ 205 \\ 197 \\ +321 \\ \hline 1209 \\ \hline \end{array}$$

Answer = 1209 tickets

Example 2
A bar of chocolate weighs 42g. There are 48 bars of chocolate in a box. What is the total weight of chocolate in the box?

Estimate = 50 x 40 = 2000g

Calculate:

$\boxed{48}$ $\boxed{X}$ $\boxed{42}$ $\boxed{=}$ 2016g

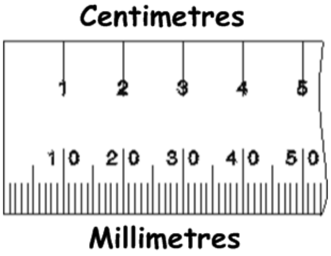
Measurement

At secondary school, pupils will work with a number of different units of measurement relating to lengths, weights, volumes etc.

In the Technology measurements are often in millimetres (mm).

There are 10 mm in 1 cm.

Rulers are marked in centimetres with small divisions showing the millimetres.



It is useful to be able to approximate sizes of familiar objects in millimetres.

Some examples

desk – 1200 mm wide

person – 1700 mm tall

computer keyboard – 450 mm wide

house – 8000 mm tall

In engineering and construction objects are still measured in millimetres even when they are very large, for example the height of a house.

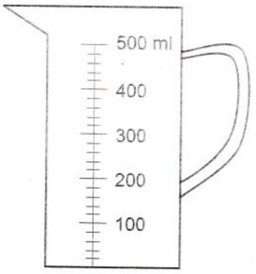
Pupils should be able to identify a suitable unit for measuring objects given their relative lengths, i.e.

Index finger	millimetres (mm)
Desk	centimetres (cm)
Football pitch	metres (m)
Aberdeen to Mintlaw	kilometres (km)

Measurement

In Home Economics, pupils will work with a wide range of measurements when dealing with quantities of food or liquids.

Liquids are measured in millilitres (ml) or litres (l).



Cooking ingredients can be measured in grams (g) and kilograms (kg).

In Mathematics, Science and Technology pupils learn how to convert units, and use correct unit symbols.

Length

10 millimetres (mm) = 1 centimetre (cm)

100 centimetres (cm) = 1 metre (m)

1000 metres (m) = 1 kilometre (km)

Volume

1 cubic centimetre (cm^3) = 1 millilitre (ml)

1000 millilitres (ml) = 1 litre (l)

Mass (Weight)

1000 grams (g) = 1 kilogram (kg)

1000 kilograms (kg) = 1 tonne (t)

Measurement

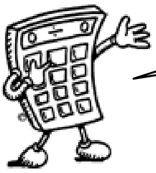
The tables below tell you how to convert between various units of measure.

Length		
mm	$\xrightarrow{\div 10}$ $\xleftarrow[\times 10]{}$	cm
cm	$\xrightarrow{\div 100}$ $\xleftarrow[\times 100]{}$	m
m	$\xrightarrow{\div 1000}$ $\xleftarrow[\times 1000]{}$	km
mm	$\xrightarrow{\div 1000}$ $\xleftarrow[\times 1000]{}$	m

Mass (Weight)		
g	$\xrightarrow{\div 1000}$ $\xleftarrow[\times 1000]{}$	kg
kg	$\xrightarrow{\div 1000}$ $\xleftarrow[\times 1000]{}$	t

Volume		
mm^3	$\xrightarrow{\div 1000000000}$ $\xleftarrow[\times 1000000000]{}$	m^3
cm^3	$\xrightarrow{\div 1000000}$ $\xleftarrow[\times 1000000]{}$	m^3

Time



Time may be expressed in 12 or 24 hour form.

12-hour clock

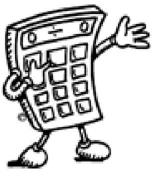
Time can be displayed on a clock face, or digital clock.

05: 15

These clocks both show fifteen minutes past five, or quarter past five.

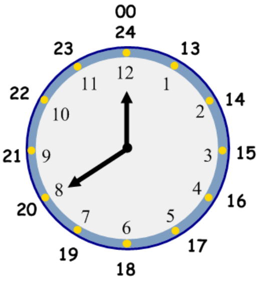
When writing times in 12 hour clock, we need to add a.m. or p.m. after the time.
a.m. is used for times between midnight and noon (morning)
p.m. is used for times between noon and midnight (afternoon / evening).

24-hour clock



In 24 hour clock notation, the hours are written as 4 digit numbers between 01:00 and 24:00.

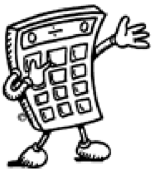
Midnight is expressed as 00:00 or 24:00.
After 12 noon, the hours are 13:00, 14:00, 15:00… etc.



Examples

12 hr		24hr
7.00 am	↔	07:00 hours
10.35 am	↔	10:35 hours
Noon	↔	12:00 hours
9.45 pm	↔	21:45 hours
Midnight	↔	24:00 or 00:00

Time



It is essential to know the number of months, weeks and days in a year, and the number of days in each month.

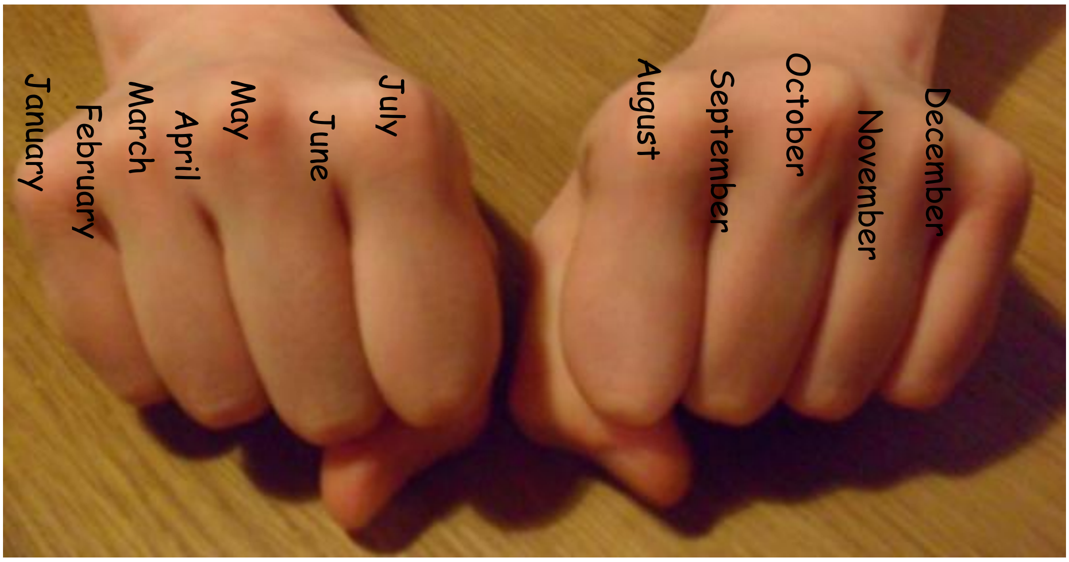
Time Facts

In 1 year, there are: 365 days (366 in a leap year)
52 weeks
12 months

The number of days in each month can be remembered using the rhyme:

"30 days hath September,
April, June and November,
All the rest have 31,
Except February alone,
Which has 28 days clear,
And 29 in each leap year."

Or by using your hands as follows. Starting at the outer knuckle with January, each month that lands on a knuckle has 31 days and all the rest have 30, except February which has only 28 (29 on a leap year). A leap year is any year that can be divided **exactly** by four.



Time

Distance, Speed and Time.

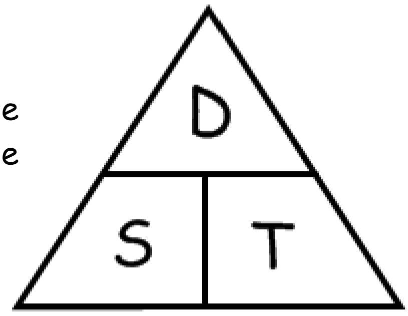
For any given journey, the distance travelled depends on the speed and the time taken. If speed is constant, then the following formulae apply:

$$\text{Distance} = \text{Speed} \times \text{Time} \quad \text{or} \quad D = S \times T$$

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}} \quad \text{or} \quad S = \frac{D}{T}$$

$$\text{Time} = \frac{\text{Distance}}{\text{Speed}} \quad \text{or} \quad T = \frac{D}{S}$$

To remember these formulae we use the DST triangle.

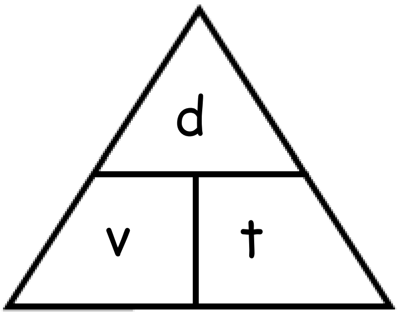


In Physics you will find that v is used to represent speed. So we have

$$\text{distance} = \text{speed} \times \text{time} \quad \text{or} \quad d = v \times t$$

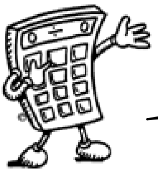
$$\text{speed} = \frac{\text{distance}}{\text{time}} \quad \text{or} \quad v = \frac{d}{t}$$

$$\text{time} = \frac{\text{distance}}{\text{speed}} \quad \text{or} \quad t = \frac{d}{v}$$



Both of these notations are accepted in Mathematics.

Fractions

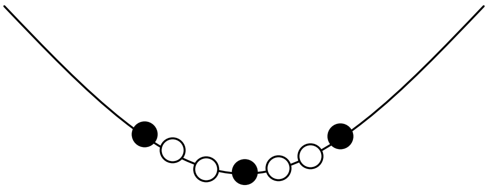


A fraction is part of a whole. Imagine a pizza cut into slices. All of the slices make 1 whole pizza. Each slice is a fraction of the whole pizza.

Understanding Fractions

Example

A necklace is made from black and white beads.

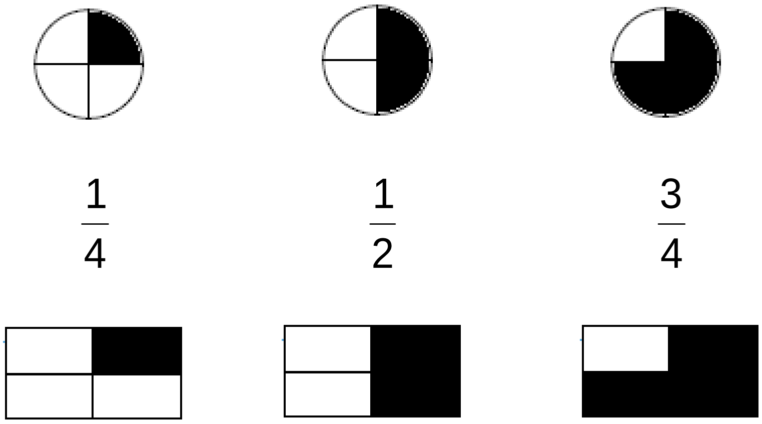


What fraction of the beads are black?

There are 3 black beads out of a total of 7, so $\frac{3}{7}$ of the beads are black.

Recognising Fractions

The diagrams below show ways that fractions can be represented using diagrams.

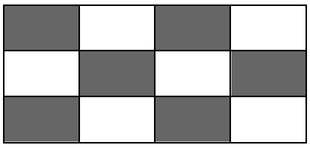


Fractions

Equivalent Fractions

Example

What fraction of the flag is shaded?

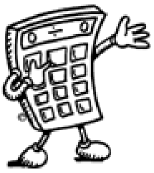


6 out of 12 squares are shaded. So $\frac{6}{12}$ of the flag is shaded.

It could also be said that $\frac{1}{2}$ the flag is shaded.

$\frac{6}{12}$ and $\frac{1}{2}$ are **equivalent fractions**.

Simplifying Fractions



The top of a fraction is called the **numerator**, the bottom is called the **denominator**.
To simplify a fraction, divide the **numerator** and **denominator** of the fraction by the same number.

Example 1

(a)

$$\frac{20}{25} \overset{\div 5}{\underset{\div 5}{=}} \frac{4}{5}$$

$\frac{20}{25}$ and $\frac{4}{5}$ are equivalent fractions

(b)

$$\frac{16}{24} \overset{\div 8}{\underset{\div 8}{=}} \frac{2}{3}$$

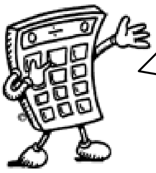
$\frac{16}{24}$ and $\frac{2}{3}$ are equivalent fractions

This can be done repeatedly until the numerator and denominator are the smallest possible numbers - the fraction is then said to be in its **simplest form**.

Example 2 Simplify $\frac{72}{84}$ $\quad \frac{72}{84} = \frac{36}{42} = \frac{18}{21} = \frac{6}{7}$ (simplest form)

Fractions

Calculating Fractions of a Quantity



To find the fraction of a quantity, divide the quantity by the denominator.

To find $\frac{1}{2}$ divide by 2, to find $\frac{1}{3}$ divide by 3, to find $\frac{1}{7}$ divide by 7 etc.

Example 1 Find $\frac{1}{5}$ of £150

$\frac{1}{5}$ of £150 = £150 ÷ 5

= £30

To find $\frac{1}{5}$ of a quantity divide by 5

Example 2 Find $\frac{3}{4}$ of 48

$\frac{1}{4}$ of 48 = 48 ÷ 4

= 12

so $\frac{3}{4}$ of 48 = 12 x 3

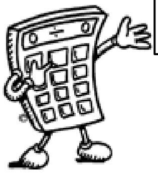
= 36

To find $\frac{3}{4}$ of a quantity,

start by finding $\frac{1}{4}$ of the quantity,

then multiply that quantity by 3.

Percentages



Percentage effectively means a fraction of a hundred. A percentage can be converted to an equivalent fraction or a decimal.

25% means $\frac{25}{100} = \frac{1}{4} = 1 \div 4 = 0.25$

$$4 \overline{\smash{)}\, 1\,.\,{}^{1}0\,{}^{2}0} \quad \overset{0\,.\,2\,5}{}$$

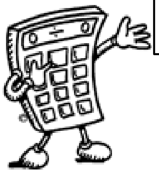
So 25% is equivalent to the fraction, $\frac{1}{4}$ and the decimal 0.25

Common Percentages

Some percentages are used very frequently. It is useful to know these as fractions and decimals.

Percentage	Fraction	Decimal
1%	$\frac{1}{100}$	0.01
10%	$\frac{1}{10}$	0.1
20%	$\frac{1}{5}$	0.2
25%	$\frac{1}{4}$	0.25
$33^1/_3$%	$\frac{1}{3}$	0.3333… $= 0.\dot{3}$
50%	$\frac{1}{2}$	0.5
$66^2/_3$%	$\frac{2}{3}$	0.6666… $= 0.\dot{6}$
75%	$\frac{3}{4}$	0.75
100%	$\frac{1}{1}$ (= 1)	1.0

Percentages



There are many ways to calculate percentages of a quantity. Some of the common ways are shown below.

Non-Calculator Methods

Method 1 Using Equivalent Fractions

Example Find 25% of £640

$$25\% \text{ of } £640 = \frac{1}{4} \text{ of } £640 = £640 \div 4 = £160$$

Method 2 Using 1%

In this method, first find 1% of the quantity (by dividing by 100), then multiply to give the required value.

Example Find 9% of 200g

$$1\% \text{ of } 200g = \frac{1}{100} \text{ of } 200g = 200g \div 100 = 2g$$

so 9% of 200g = 9 x 2g = 18g

Method 3 Using 10%

This method is similar to the one above. First find 10% (by dividing by 10), then multiply to give the required value.

Example Find 70% of £35

$$10\% \text{ of } £35 = \frac{1}{10} \text{ of } £35 = £35 \div 10 = £3.50$$

so 70% of £35 = 7 x 10% of £35 = 7 x £3.50 = £24.50

Percentages

Calculator Method

To find the percentage of a quantity using a calculator, change the percentage to a decimal, then multiply.

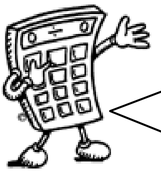
Example 1 Find 23% of £15 000

$$
\begin{aligned}
23\% \text{ of } £15\,000 &= \frac{23}{100} \text{ of } £15\,000 \\
&= 23 \div 100 \times 15\,000 \\
&= £3\,450
\end{aligned}
$$

OR

$23\% = 0.23$ since $23\% = \frac{23}{100} = 23 \div 100 = 0.23$

so 23% of £15 000 = 0.23 x £15 000 = £3 450



We **do not use** the % button on calculators. The methods taught in the mathematics department are all based on converting percentages to decimals.

Example 2 House prices increased by 19% over a one year period. What is the new value of a house which was valued at £236 000 at the start of the year?

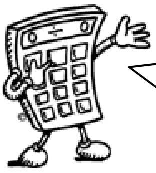
19% = 0.19 so Increase = 0.19 x £236 000
= £44 840

Value at end of year = original value + increase
= £236 000 + £44 840
= £280 840

The new value of the house is £280 840

Percentages

Finding the percentage



To find a percentage of a total, first make a fraction, then convert to a decimal by dividing the top by the bottom. This can then be expressed as a percentage by multiplying by 100.

Example 1 There are 30 pupils in Class 3A. 18 are girls.
What percentage of Class 3A are girls?

$\frac{18}{30} \times 100 = 18 \div 30 \times 100 = 60\%$

60% of 3A are girls
This also means that 40% of 3A are boys, since
60% + 40% = 100% which represents the whole class.

Example 2 James scored 36 out of 44 his biology test.
What is his percentage mark?

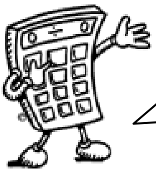
$$\text{Score} = \frac{36}{44} \times 100 = 36 \div 44 \times 100 = 81.818\ldots$$
$$= 81.818..\%$$
$$= 82\% \text{ (to nearest whole number)}$$

Example 3 In class 1M, 14 pupils had brown hair, 6 pupils had blonde hair, 3 had black hair and 2 had red hair.
What percentage of the pupils was blonde?

Total number of pupils = 14 + 6 + 3 + 2 = 25
6 out of 25 were blonde, so,
$\frac{6}{25} \times 100 = 6 \div 25 \times 100 = 24\%$

24% were blonde.

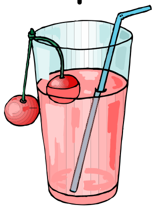
Ratio



When quantities are to be mixed together, the ratio, or proportion, of each quantity is often given.

Writing Ratios

Example 1



To make a fruit drink, 4 parts water is mixed with 1 part of squash.

The ratio of water to squash is 4 : 1 (said "4 to 1")

The ratio of squash to water is 1 : 4.

Order is important when writing ratios.

Example 2

In a bag of balloons, there are 5 red, 7 blue and 8 green balloons.

The ratio of red : blue : green is 5 : 7 : 8

Ratio

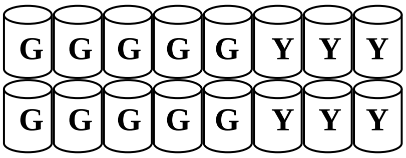
Simplifying Ratios

Ratios can be simplified in much the same way as fractions.

Example 1

A shade of paint can be made by mixing 10 tins of green paint with 6 tins of yellow. The ratio of green to yellow can be written as 10 : 6

It can also be written as 5 : 3, as it is possible to split up the tins into 2 groups, each containing 5 tins of green and 3 tins of yellow.



Green: Yellow
10 : 6
5 : 3

To simplify a ratio, divide each figure in the ratio by the same number.

Example 2

Simplify each ratio:
(a) 4:6 (b) 24:36 (c) 6:3:12

(a) 4:6
= 2:3

Divide each figure by 2

(b) 24:36
= 2:3

Divide each figure by 12

(c) 6:3:12
= 2:1:4

Divide each figure by 3

Example 3

Concrete is made by mixing 20 kg of sand with 4 kg cement. Write the ratio of sand : cement in its simplest form

Sand : Cement = 20 : 4
= 5 : 1

Ratio

Using ratios

Example 1

The ratio of fruit to nuts in a chocolate bar is 3 : 2.

If a bar contains 15g of fruit, what weight of nuts will it contain?

Fruit	Nuts
3	2
×5	×5
15	**10**

So the chocolate bar will contain 10g of nuts.

Example 2

Sue wins £84 in a prize draw. She decides to share her winnings with her friend, Fiona in the ratio 4:3. How much does each woman get?

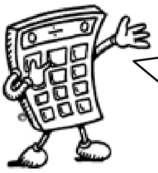
Total number of parts = 4 + 3
= 7

7 parts = £84
1 part = £84 ÷ 7
= £12

Sue gets 4 parts = 4 × £12
= £48

Fiona gets 3 parts = 3 × £12
= £36

Proportion



Two quantities are said to be in direct proportion to each other, if when one quantity doubles the other doubles.
We can use proportion to solve problems.

It is often useful to make a table when solving problems involving proportion.

Example 1
A car factory produces 1500 cars in 30 days. How many cars would they produce in 90 days?

	Days	Cars	
×3	30	1500	×3
	90	**4500**	

The factory would produce 4500 cars in 90 days.

Example 2
5 adult tickets for the cinema cost £27.50.
How much would 8 tickets cost?

Find the cost of 1 ticket →

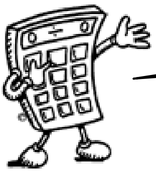
Tickets	Cost
5	£27.50
1	£5.50
8	£44.00

Working:

$$5\overline{)\,£27.50}\quad \text{£5.50} \qquad \begin{array}{r} £5.50 \\ \times\ 8 \\ \hline £44.00 \\ \hline 4 \end{array}$$

The cost of 8 tickets is £44

Information Handling : Tables



It is sometimes useful to display information in graphs, charts or tables.

Example 1 The table below shows the height of a sunflower plant over 40 days.

Time (days)	Height (cm)
0	0
10	15
20	60
30	100
40	140

Frequency Tables are used to count the number of each item in a sample.

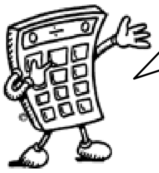
Example 2 Shoe sizes for a class of pupils in S1

9	8	7	8	9	8	8	6	6	10
5	8	9	7	10	8	5	7	6	9
9	8	7	5	10					

Size	Tally	Frequency
5	|||	3
6	~~|||~~	3
7	~~||||~~	4
8	|||| ||	7
9	||||	5
10	|||	3

Each shoe size is recorded in the table by a tally mark.
Tally marks are arranged in groups of five to make them easier to read and count.

Information Handling : Pictograms



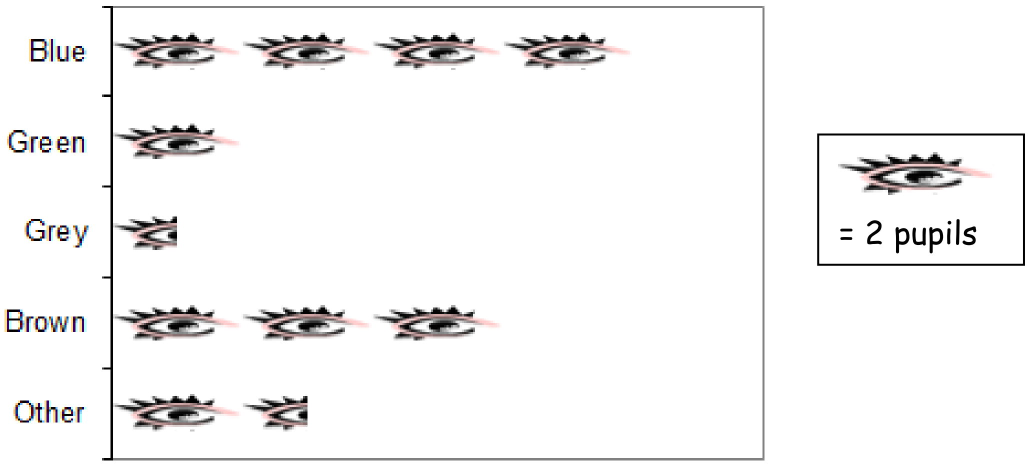
Pictograms are often used to display data. In a pictogram symbols/pictures are used to represent values.

Example 1 The table below show the results of a survey on eye colour.

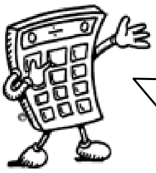
Eye colour	Number of Pupils
Blue	8
Green	2
Grey	1
Brown	6
Other	3

This can be displayed in a pictogram as shown below:

Eye Colour

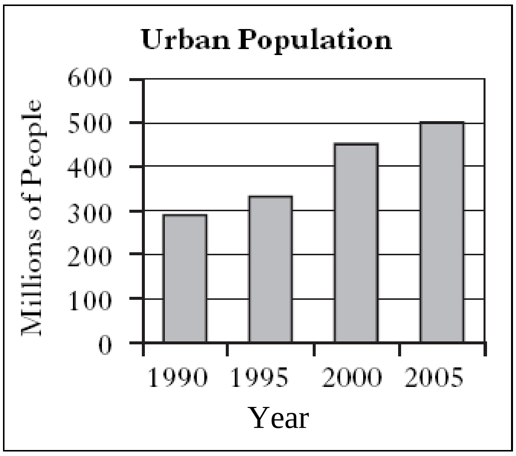


Information Handling : Bar Charts

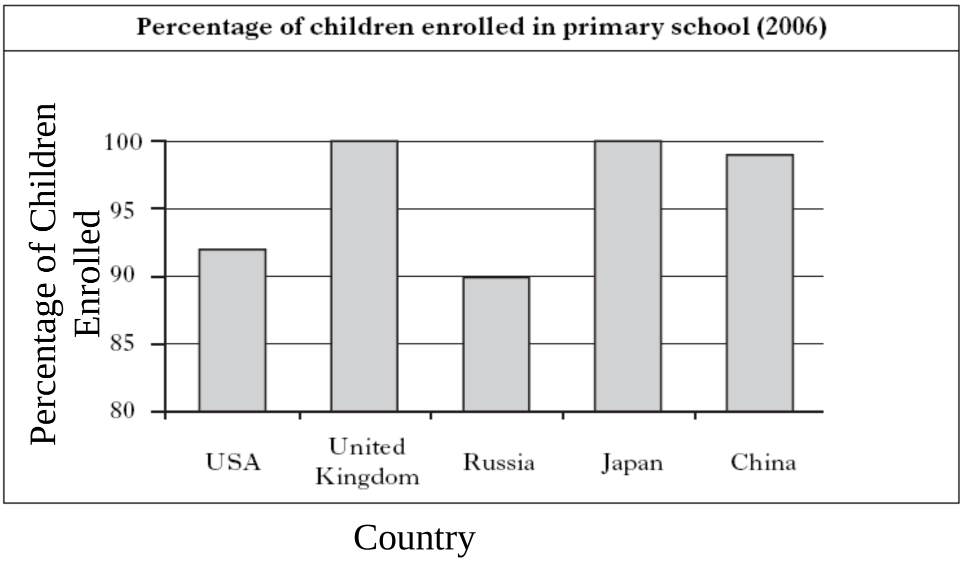


Bar charts are often used to display data. The horizontal axis should show the categories, and the vertical axis the frequency.
All bar charts should have a title, and each axis must be labelled.

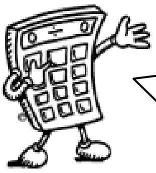
Example 1 The bar chart below shows urban populations as discussed in Modern Studies lessons.



Example 2 The bar chart below shows the school enrolment percentages for various countries.



Information Handling : Line Graphs

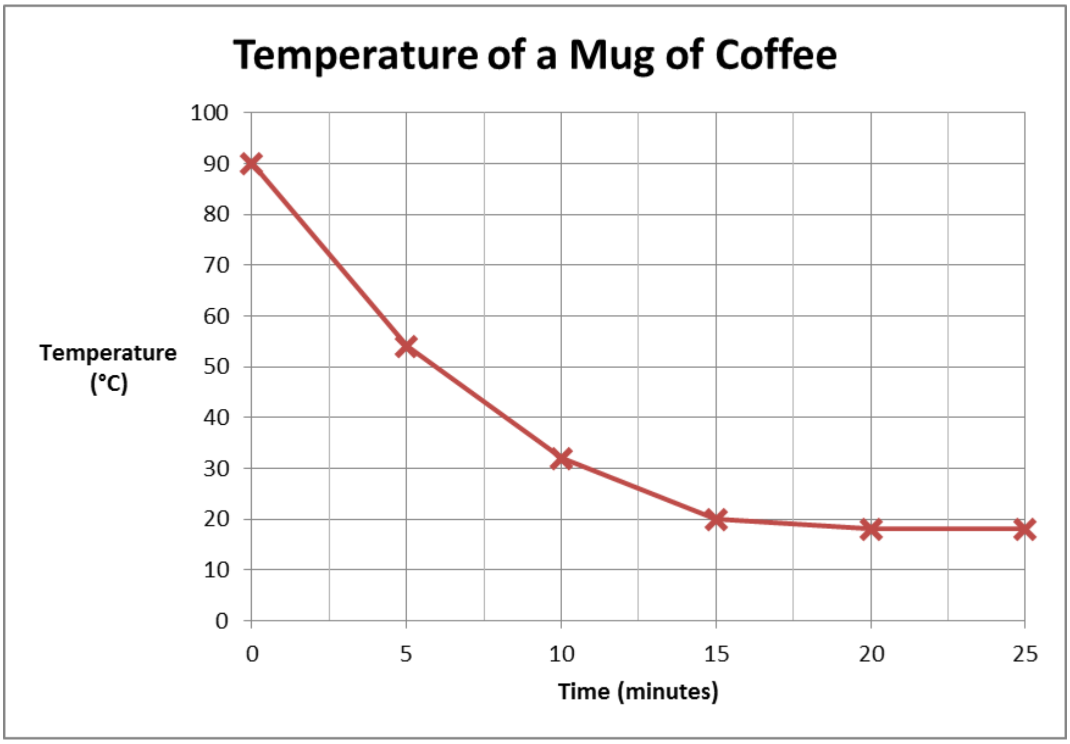


Line graphs consist of a series of points which are plotted. The points are joined by a line. All line graphs should have a title, and each axis must be labelled. The trend of a graph is a general description of it.

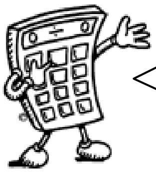
Example – Joe investigated how quickly a mug of coffee cooled down to room temperature.
His results are shown below.

Time (minutes)	**0**	**5**	**10**	**15**	**20**	**25**
Temperature (°C)	**90**	**54**	**32**	**20**	**18**	**18**

This can be displayed on a line graph. The column headings (including the units) will be used to label the axes.



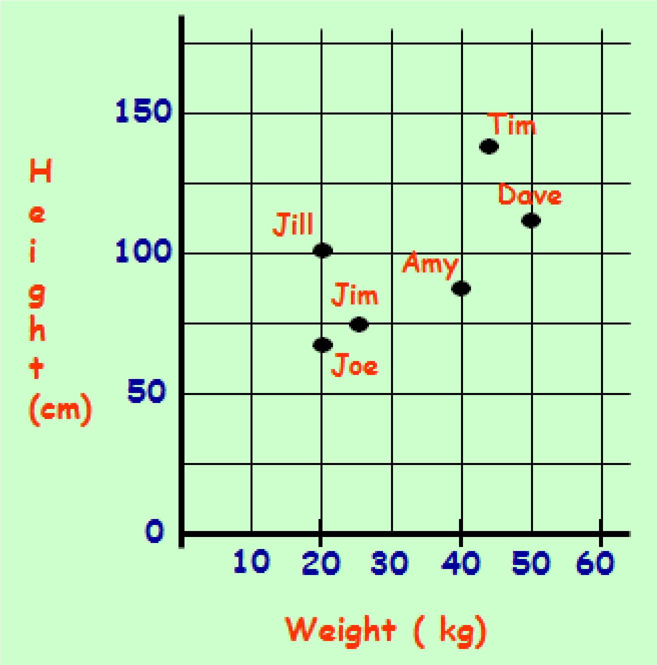
Information Handling : Scatter Graphs



A scatter graph is used to display the relationship between two variables.
A pattern may appear on the graph.
This is called a **correlation**.

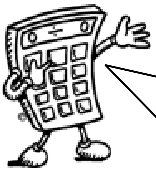
Example Six primary pupils had their height and weight checked by the school nurse.

Height and Weight of Pupils



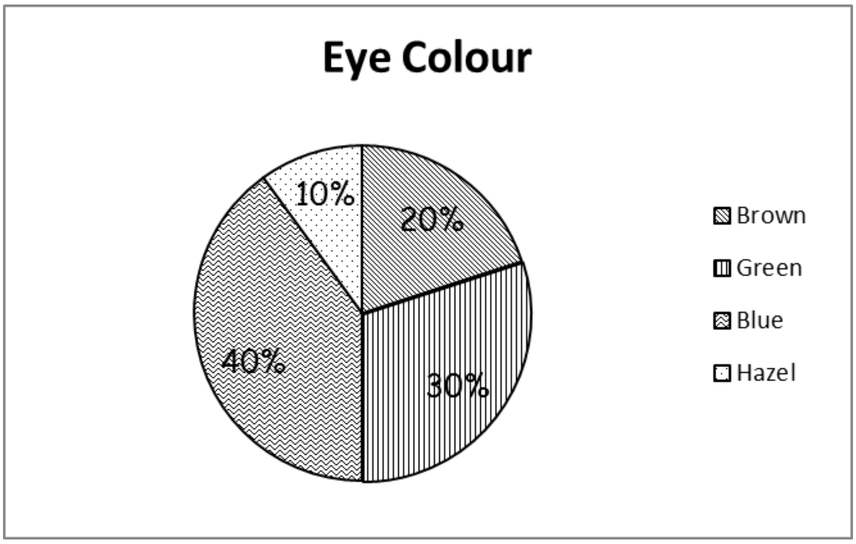
The graph illustrates that Jill weighs 20 kg and is 100 cm tall.

Information Handling : Pie Charts



A pie chart can be used to display information. Each sector (slice) of the chart represents a different category. The size of each category can be worked out as a fraction or as a percentage of the total.

Example 30 pupils were asked the colour of their eyes. The results are shown in the pie chart below.



How many pupils had brown eyes?

The slice representing brown eyes is 20% of the whole pie chart.

Number of pupils with brown eyes = 20% of 30

$= \frac{1}{5}$ of 30

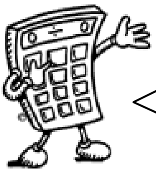
$= 30 \div 5$

$= 6$

The angle in the brown sector is 72° so the number of pupils with brown eyes = $\frac{72}{360} \times 30 = 6$ pupils.

If finding all of the values, you can check your answers - the total should be 30 pupils.

Information Handling : Averages



To provide information about a set of data, the average value may be given. There are 3 ways of finding the average value – the mean, the median and the mode.

Mean

The mean is found by adding all the data together and dividing by the number of values.

Median

The median is the middle value when all the data is written in numerical order (if there are two middle values, the median is half-way between these values).

Mode

The mode is the value that occurs most often.

Range

The range of a set of data is a measure of spread.

Range = Highest value – Lowest value

Example Class 1A4 scored the following marks for their homework assignment. Find the mean, median, mode and range of the results.

7, 9, 7, 5, 6, 7, 10, 9, 8, 4, 8, 5, 7, 10

Mean = $\dfrac{7+9+7+5+6+7+10+9+8+4+8+5+7+10}{14}$

= $\dfrac{102}{14} = 7.285...$ **Mean** = 7.3 to 1 decimal place

Ordered values: $4,\ 5,\ 5,\ 6,\ 7,\ 7,\ \boxed{7,\ 7,}\ 8,\ 8,\ 9,\ 9,\ 10,\ 10$

Median = $\dfrac{7+7}{2} = 7$

7 is the most frequent mark, so **Mode** = 7

Range = 10 – 4 = 6

Mathematical Dictionary (Key words)

Add; Addition (+)	To combine 2 or more numbers to get one number (called the sum or the total) Example: 12+76 = 88
a.m.	Meaning ante meridiem. Any time in the morning (between midnight and 12 noon).
Approximate	An estimated answer, often obtained by rounding to nearest 10, 100 or decimal place.
Average	A number used to describe data such as the mean, the mode or the median.
Calculate	Find the answer to a problem. It doesn't mean that you must use a calculator!
Data	A collection of information (may include facts, numbers or measurements).
Denominator	The bottom number in a fraction (the number of parts into which the whole is split).
Difference (-)	The amount between two numbers (subtraction). Example: The difference between 50 and 36 is 14
Division (÷)	Sharing a number into equal parts. 24 ÷ 6 = 4
Double	Multiply by 2.
Equals (=)	Makes or has the same amount as.
Equivalent fractions	Fractions which have the same value. Example $\frac{6}{12}$ and $\frac{1}{2}$ are equivalent fractions
Estimate	To make an approximate or rough answer, often by rounding.
Evaluate	To work out the answer.
Even	A number that is divisible by 2 (without remainder). Even numbers end with 0, 2, 4, 6 or 8.
Factor	A number which divides exactly into another number, leaving no remainder. The factors of 15 are 1, 3, 5, 15.
Frequency	How often something happens. In a set of data, the number of times a number or category occurs.
Greater than (>)	Is bigger or more than. Example: 10 is greater than 6. 10 > 6
Indices	Short hand method to display multiplies of the same number eg $3^2 = 3 \times 3 = 9$, $5^4 = 5 \times 5 \times 5 \times 5 = 625$
Least	The lowest number in a group (minimum).
Less than (<)	Is smaller or lower than. Example: 15 is less than 21. 15 < 21.

Maximum	The largest or highest number in a group.
Mean	The arithmetic average of a set of numbers (see p34)
Median	Another type of average - the middle number of an ordered set of data (see p34)
Minimum	The smallest or lowest number in a group.
Minus (-)	To subtract.
Mode	Another type of average – the most frequent number or category (see p34)
Most	The largest or highest number in a group (maximum).
Multiple	A number which can be divided by a particular number, leaving no remainder. Example Some of the multiples of 4 are 8, 16, 48, 72
Multiply (x)	To combine an amount a particular number of times. Example 6 x 4 = 24
Negative Number	A number less than zero. Shown by a minus sign. Example -5 is a negative number.
Numerator	The top number in a fraction.
Odd Number	A number which is not divisible by 2. Odd numbers end in 1 ,3 ,5 ,7 or 9.
Operations	The four basic operations are addition, subtraction, multiplication and division.
Order of operations	The order in which operations should be done. BIDMAS (see p11)
Place value	The value of a digit dependent on its place in the number. Example: in the number 1573.4, the 5 has a place value of 100.
p.m.	Meaning post meridiem. Any time in the afternoon or evening (between 12 noon and midnight).
Prime Number	A number that has exactly 2 factors (can only be divided by itself and 1). Note that 1 is not a prime number as it only has 1 factor.
Product	The answer when two numbers are multiplied together. Example: The product of 5 and 4 is 20.
Remainder	The amount left over when dividing a number.
Share	To divide into equal groups.
Simplest Form	When the highest common factor of a set of numbers is one.
Sum	The total of a group of numbers (found by adding).
Total	The final amount when a group of numbers are added.

NOTES

NOTES