THE PAINSLEY CATHOLIC ACADEMY

Numeracy Booklet

A guide for pupils, parents and staff

The aim of this booklet is to ensure that there is a consistent approach throughout the academy and at home on basic mathematical concepts

Consistency of Practice

The Mathematical Association recommend that teachers of mathematics and teachers of other subjects co-operate on agreed strategies.
In particular that:

Teachers of mathematics should:

1. Be aware of the mathematical techniques used in other subjects and provide assistance and advice to other departments, so that a correct and consistent approach is used in all subjects.

2. Provide information to other subject teachers on appropriate expectations of students and difficulties likely to be experienced in various age and ability groups.

3. Through liaison with other teachers, attempt to ensure that students have appropriate numeracy skills by the time they are needed for work in other subject areas.

4. Seek opportunities to use topics and examination questions from other subjects in mathematics lessons

Teachers of subjects other than mathematics should:

1. Ensure that they are familiar with correct mathematical language, notation, conventions and techniques, relating to their own subject, and encourage students to use these correctly.

2. Be aware of appropriate expectations of students and difficulties that might be experienced with numeracy skills.

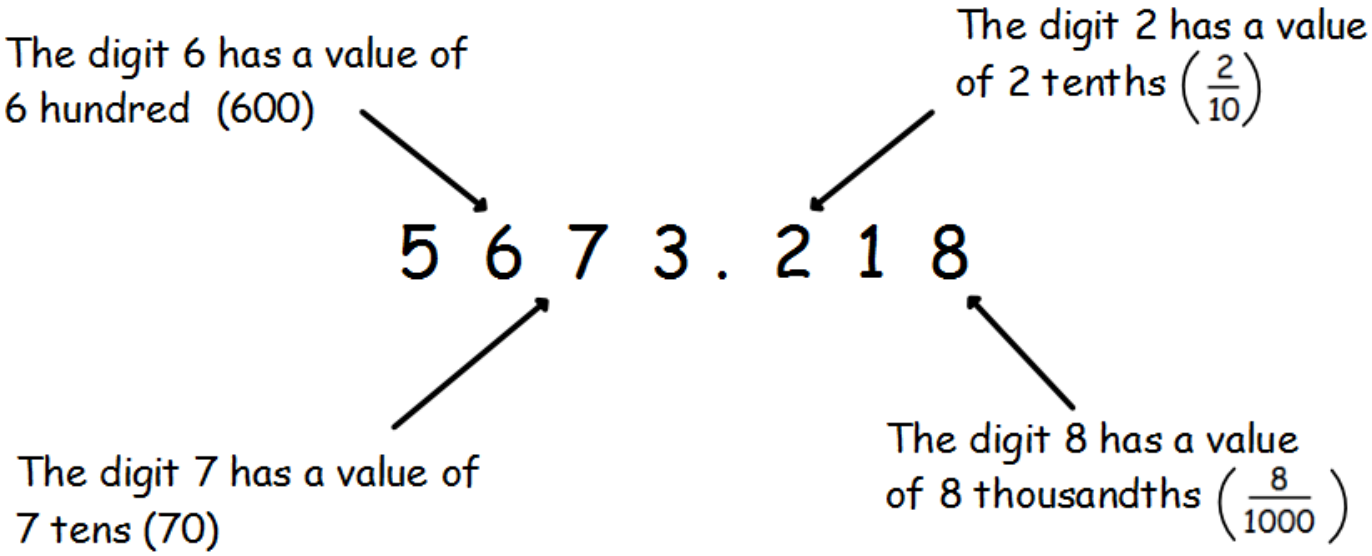
3. Provide information for mathematics teachers on the stage at which specific numeracy skills will be required for particular groups.

4. Provide resources for mathematics teachers to enable them to use examples of applications of numeracy relating to other subjects in mathematics lessons

Place Value

Thousands (1000)	Hundreds (100)	Tens (10)	Ones (1)		Tenths	Hundredths	Thousandths

The position of the digit within the number gives the value of that digit.



Calculators

Some pupils are over-dependent on the use of calculators for simple calculations. **Wherever possible, pupils should be encouraged to use mental or written methods**. It is, however, necessary to give consideration to the ability of the pupil and the objectives of the task in hand. In order to complete a task successfully, it may be necessary for pupils to use a calculator for what you perceive to be a relatively simple calculation. This should be allowed if progress within the subject area is to be made. **Before completing the calculation, pupils should be encouraged to make an estimate of the answer**. Having completed the calculation on the calculator, they should consider whether the answer is reasonable in the context of the question

Mental Calculations

Most pupils should be able to carry out the following processes mentally though the speed with which they do it will vary considerably.

- recall addition and subtraction facts up to 20

- recall multiplication and division facts for tables up to 12 x 12.

Pupils should be encouraged to carry out other calculations mentally using a variety of strategies but there will be significant differences in their ability to do so. It is helpful if teachers discuss with pupils how they have made a calculation. Any method which produces the correct answer is acceptable.

e.g. $53 + 19 = 53 + 20 - 1$

$284 - 56 = 284 - 60 + 4$

$32 \times 8 = 32 \times 2 \times 2 \times 2$

$76 \div 4 = (76 \div 2) \div 2$

Written Calculations

Pupils often use the ' = ' sign incorrectly. When doing a series of operations they sometimes write mathematical sentences which are untrue.

e.g. $5 \times 4 = 20 + 3 = 23 - 8 = 15$ since $5 \times 4 \neq 15$

It is important that all teachers encourage pupils to write such calculations correctly.

e.g. $5 \times 4 = 20$
$20 + 3 = 23$
$23 - 8 = \underline{15}$ ✓

The ' = ' sign should only be used when both sides of an operation have the same value. There is no problem with a calculation such as:

$43 + 57 = 40 + 3 + 50 + 7 = 90 + 10 = \underline{100}$ ✓

since each part of the calculation has the same value.

The ' ≈ ' (approximately equal to) sign should be used when estimating answers.

e.g. $2\,378 - 412 \approx 2\,400 - 400$

$2\,400 - 400 = \underline{2\,000}$ ✓

All pupils should be able to use some pencil and paper methods involving simple addition, subtraction, multiplication and division. Some less able pupils will find difficulty in recalling multiplication facts to complete successfully such calculations. In these circumstances, it may be more useful to use a calculator in your subject to complete the task.

Before completing any calculation, pupils should be encouraged to estimate a rough value for what they expect the answer to be. This should be done by rounding the numbers to one significant figure and mentally calculating the approximate answer.

After completing the calculation, they should be asked to consider whether or not their answer is reasonable in the context of the question.

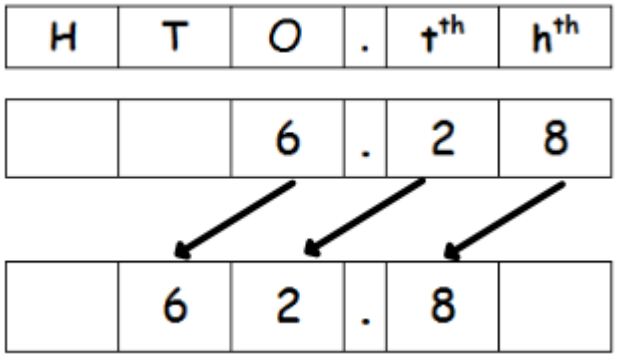
Multiplication and division by 10, 100, 1000

To multiply by **10**, move every digit **one** place to the left

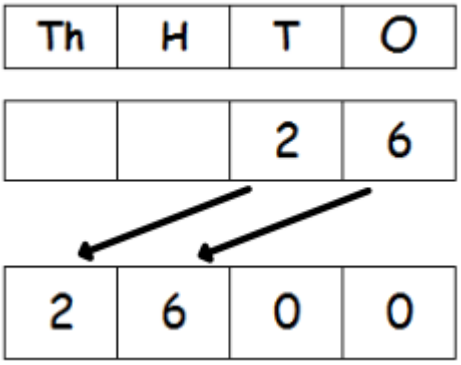
To multiply by **100**, move every digit **two** places to the left

Any empty columns to the left of the decimal point are filled with zeros so that place value is maintained.

e.g. 1 6.28 x 10



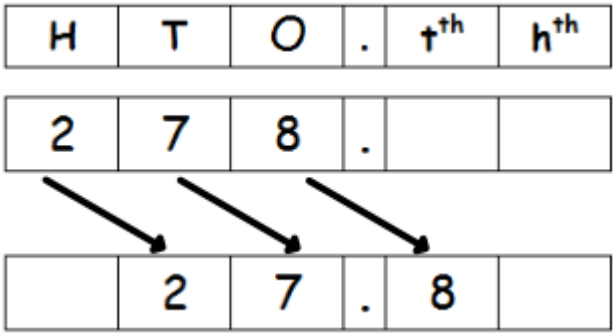
e.g. 2 26 x 100



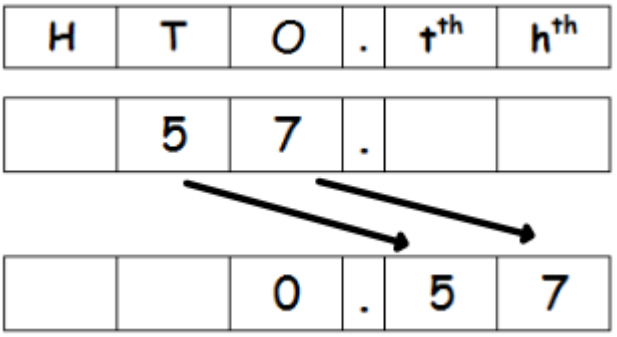
To divide by **10**, move every digit **one** place to the right

To divide by **100**, move every digit **two** places to the right

e.g. 1 278 ÷ 10



e.g. 2 57 ÷ 100



Multiplication by multiples of 10 and 100

e.g. 1 26 x 30

To multiply by 30

- First multiply by 3 26 x 3 = 78
- Then multiply by 10 78 x 10 = 780

So 26 x 30 = **780**

e.g. 2 24 x 600

To multiply by 600

- First multiply by 6 24 x 6 = 144
- Then multiply by 100 144 x 100 = 14400

So 24 x 600 = **14400**

e.g. 3 2.18 x 40

To multiply by 40

- First multiply by 4 2.18 x 4 = 8.72
- Then multiply by 10 8.72 x 10 = 87.2

So 2.18 x 40 = **87.2**

Addition and subtraction

The column method

Addition

Example 3729 + 635

Place the digits in the correct 'place value' columns with the numbers under each other

Begin by adding the units.
9 + 5 = 14
Write 4 in the units column
Carry the 1 ten to the next column
Remember to add the number carried in the next column

Then continue working from right to left.

	Th	H	T	U
	3	7	2	9
+	^{1}	6	^{1}3	5
	4	3	6	4

Subtraction

Example 3462 – 2635

Place the digits in the correct 'place value' columns with the numbers under each other

Begin by subtracting the ones.
You can't subtract 5 from 2 so exchange 1 ten for 10 ones.
So there is now 12 ones and 5 tens
12 - 5 = 7

Then continue working from right to left.
Note that 1 thousand has also been exchanged for 10 hundreds.
So there is 2 thousands and 14 hundreds

	Th	H	T	O
	^{2}~~3~~	^{1}4	^{5}~~6~~	^{1}2
-	2	6	3	5
		8	2	7

Multiplication

Example 473 x 56

Estimation: 473 x 56 ≈ 500 x 60 = 30 000

Long multiplication

$$
\begin{array}{rrrr}
 & 4 & 7 & 3 \\
\times & & 5 & 6 \\
\hline
 & 2 & 8_{4} & 3_{1}\ 8 \\
2 & 3_{3} & 6_{1} & 5\ 0 \\
\hline
2 & 6 & 4 & 8\ 8 \\
\hline
 & 1 & &
\end{array}
\quad \longleftarrow \ 6 \times 473
\quad \longleftarrow \ 50 \times 473
$$

Multiplying decimals

- First, estimate the answer.
- Complete the calculation as if the **decimal points** are not there.
- The number of **decimal places** in the answer is the **same** as the **total** number of decimal places in the question
- Check to see if the answer is reasonable

Example 3.42 x 2.7

Estimation: 3.42 x 2.7 ≈ 3 x 3 = 9

Ignoring the decimal points, work out 342 x 27

$$\begin{array}{r} 342 \\ \times\ 27 \\ \hline 2394 \\ 6840 \\ \hline 9234 \\ \hline {\scriptstyle 1\ \ 1} \end{array}$$

← 7 x 342

← 20 x 342

3.42 has two decimals places.

2.7 has one decimal place.

So the total number of decimal places in the question is three

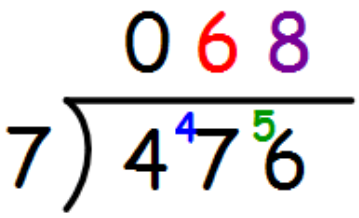
So there are also three decimal places in the answer.

So, 3.42 x 2.7 = **9.234**

Division

Short division – the 'bus shelter' method

Example 476 ÷ 7



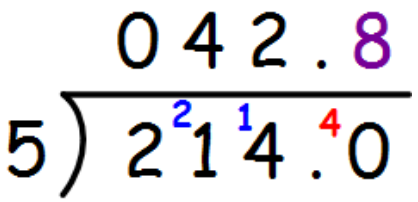
4 ÷ 7 = 0 remainder 4
so write 0 above the 4 and put the remainder (4) in front of the 7.
47 ÷ 7 = 6 remainder 5
so write 6 above the 7 and put the remainder (5) in front of the 6
56 ÷ 7 = 8, so write 8 above 6

So, 476 ÷ 7 = **68**

Decimal answer

Example 214 ÷ 5

Set out the division in the same way, but write a decimal point and 0 in the next column of the number in the 'bus shelter'
Follow the same method, then write the remainder (4) in front of the 0.
40 ÷ 5 = 8, so write 8 above the 0

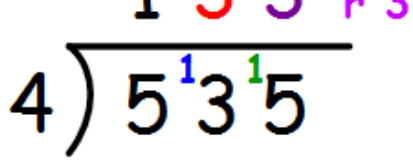


So, 214 ÷ 5 = **42.8**

Fractional answer

Example 523 ÷ 4

Set out the division in the same way. Follow the same method,



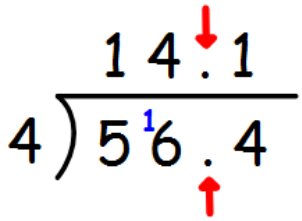
5 ÷ 4 = 1 remainder 1
so write 1 above the 5 and put the remainder (1) in front of the 3.
13 ÷ 4 = 3 remainder 1
so write 3 above the 3 and put the remainder (1) in front of the 5
15 ÷ 4 = 3 remainder 3

523 ÷ 4 = 133 remainder 3 = $133\frac{3}{4}$

Dividing a decimal number by a whole number

Example 56.4 ÷ 4

Ensure the decimal points are lined up directly above each other



So, 56.4 ÷ 4 = **14.1**

Order of operations (BODMAS or BIDMAS)

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

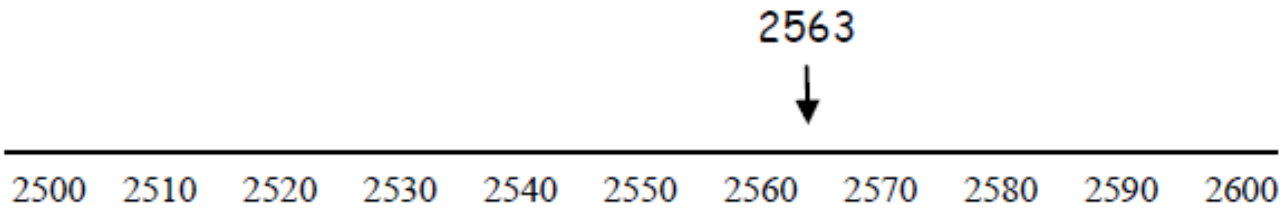
Brackets	**B**rackets
p**O**wers	**I**ndices
Divide	**D**ivide
Multiply	**M**ultiply
Add	**A**dd
Subtract	**S**ubtract

For example, multiplication is always done before addition.

Example 1		$15 - 12 \div 4$	Divide first
	=	$15 - 3$	then subtract
	=	**12**	
Example 2		$9 \div 3 + (7 - 2)$	Brackets first
	=	$9 \div 3 + 5$	then divide
	=	$3 + 5$	then add
	=	**8**	
Example 3		$5 \times 3^2 + (8 \div 2)$	Brackets first
	=	$5 \times 3^2 + 4$	then powers
	=	$5 \times 9 + 4$	then multiply
	=	$45 + 4$	then add
	=	**49**	

Rounding

Numbers can be rounded to give an approximation.



2563 rounded to the nearest 10 is 2560.
2563 rounded to the nearest 100 is 2600.
2563 rounded to the nearest 1000 is 3000.

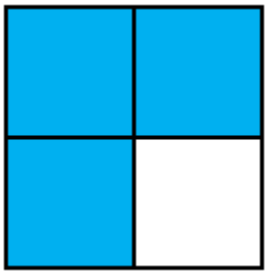
To round a decimal number to a particular number of decimal places, follow these steps

- Identify the digit in the place value that you want to round
- Look at the next digit to the right
- If this value is less than 5, just remove the unwanted places
- If this value is 5 or more, add 1 onto the digit in the place value that you want to round then remove the unwanted places

Example 1	Round 6.8234 to 1 decimal place
6.8234	8 is the 1st digit after the decimal point
6.8234	the next digit to the right is 2
6.8~~234~~	so leave 8 as it is and remove other places
	6.8 to 1 decimal place

Example 2	Round 15.35187 to 2 decimal places
15.13518	3 is the 2nd digit after the decimal point
15.13518	the next digit to the right is 5
15.14~~518~~	add 1 more to 3, the remove other places
	15.14 to 2 decimal places

Fractions



Three out of four squares are shaded.

So $\frac{3}{4}$ of the squares are shaded.

The top of the fraction is called the numerator → $\frac{3}{4}$ ← The bottom of the fraction is called the denominator

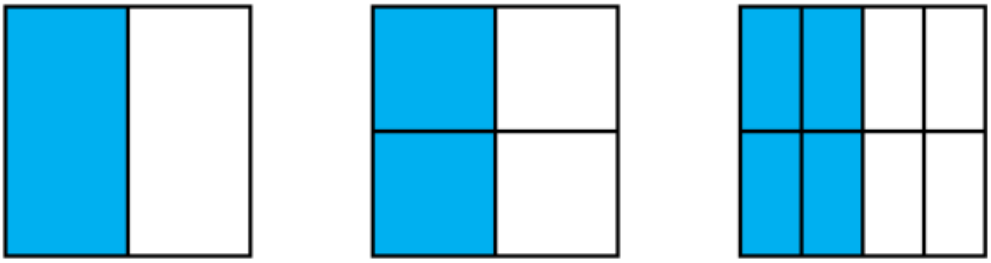
A fraction with the numerator smaller than the denominator is called a **proper fraction**. $\frac{2}{3}$

A fraction with the numerator larger than the denominator is called an **improper fraction**.
It is also sometimes called a **top-heavy fraction**. $\frac{9}{7}$

A mixed number is made up of a whole numberand a proper fraction $2\frac{5}{6}$

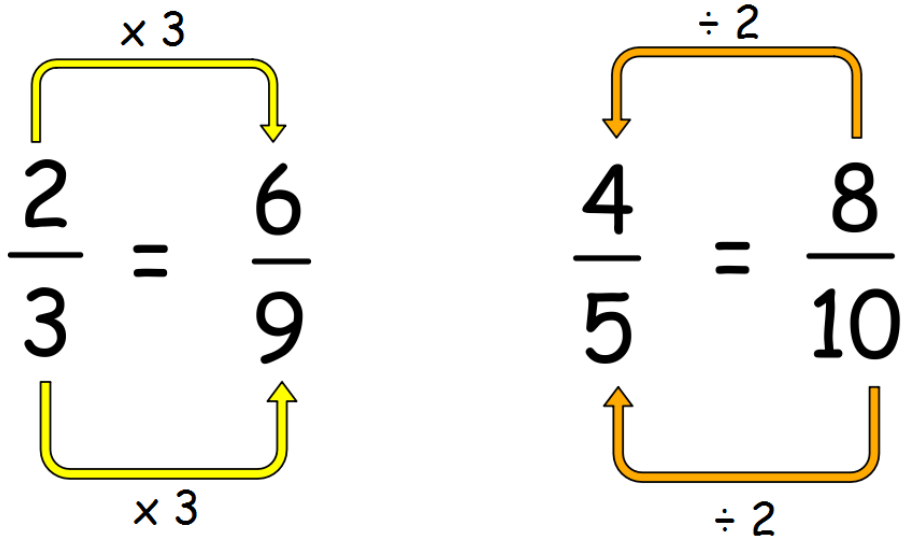
Equivalent fractions

All of the fractions below represent the same proportion. They are called **equivalent fractions**.

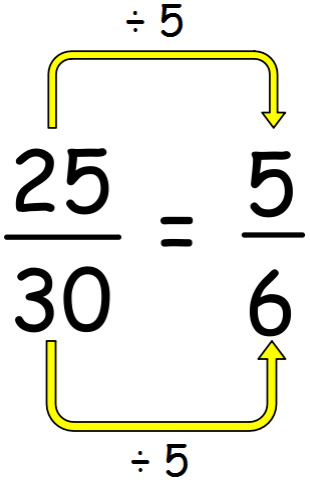


$\frac{1}{2}$ $\frac{2}{4}$ $\frac{4}{8}$

To find an equivalent fraction, multiply or divide the numerator and denominator by the **same** number.



A fraction is in its **simplest form**, when the numerator and denominator cannot be divided any further.



Adding and subtracting fractions

To add and subtract fractions they must have the **same denominator**.

$$\frac{2}{7} + \frac{3}{7} = \frac{5}{7}$$

2 sevenths + 3 sevenths = 5 sevenths

Different denominators

Example $\frac{2}{5} + \frac{3}{7}$

Find equivalent fractions with the same denominator.
The lowest multiple of 5 and 7 is 35, so write both fractions as equivalent fractions with denominator of 35.

$$\frac{2}{5} \overset{\times 7}{=} \frac{14}{35}$$

$$\frac{3}{7} \overset{\times 5}{=} \frac{15}{35}$$

So,

$$\frac{2}{5} + \frac{3}{7}$$

$$= \frac{14}{35} + \frac{15}{35} = \frac{29}{35}$$

Multiplying fractions

To multiply fractions, multiply the numerators together and multiply the denominators together.

Example $\frac{2}{3} \times \frac{4}{7} = \frac{8}{21}$

multiply the numerators

multiply the denominators

Dividing fractions

Turn the second fraction into a reciprocal (turn it upside down) and apply the inverse operation (multiply)

Example $\frac{3}{4} \div \frac{2}{5}$

keep this fraction the same

change to multiply

write this fraction as a reciprocal

then **multiply** as normal

$$\frac{3}{4} \times \frac{5}{2} = \frac{15}{8} = 1\frac{7}{8}$$

Fractions, decimals and percentages

PERCENT means "out of 100"

Useful equivalent fractions, decimals and percentages

Percentage	Fraction (in simplest form)	Decimal
1%	$\frac{1}{100}$	0.01
10%	$\frac{10}{100} = \frac{1}{10}$	0.1
20%	$\frac{20}{100} = \frac{1}{5}$	0.2
25%	$\frac{25}{100} = \frac{1}{4}$	0.25
30%	$\frac{30}{100} = \frac{3}{10}$	0.3
50%	$\frac{50}{100} = \frac{1}{2}$	0.5
75%	$\frac{75}{100} = \frac{3}{4}$	0.75
100%	$\frac{100}{100}$	1

Writing one quantity as a percentage of another

Write first as a fraction then multiply by 100

For example, what is 13 as a percentage of 40?

$$\frac{13}{40} \times 100 = 32.5\%$$

Changing a fraction into a decimal

Divide the numerator by the denominator

For example, write $\frac{5}{8}$ as a decimal

Work out 5 ÷ 8

$$8\overline{)5.^{5}0^{2}0^{4}0} \quad 0.625$$

So, $\frac{5}{8}$ = **0.625**

Changing a fraction into a percentage

Divide the numerator by the denominator, then multiply by 100

For example, write $\frac{3}{8}$ as a decimal

First work out 3 ÷ 8

$$8\overline{)3.^{3}0^{6}0^{4}0} \quad 0.375$$

Then, $\frac{3}{8}$ = 0.375 x 100 = **37.5%**

Or, if the denominator is a factor of 100, then multiply the numerator and denominator to make the denominator 100, then the numerator is the percentage, for example

$$\frac{3}{20} \overset{\times 5}{=} \frac{15}{100} = 15\%$$

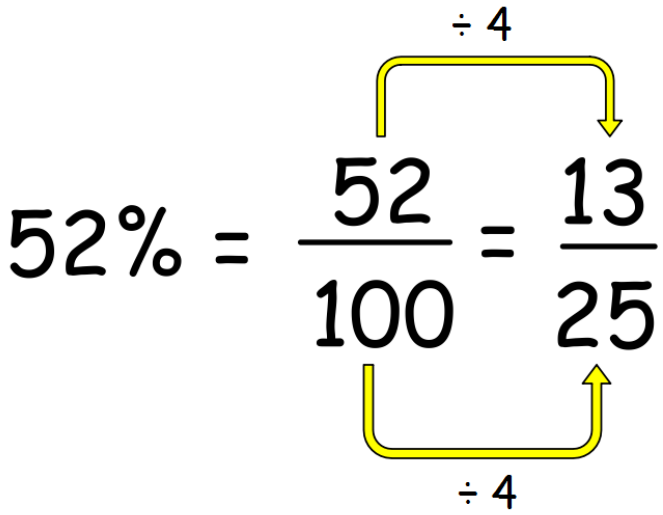
Changing a percentage into a decimal

Divide the percentage by 100, for example

$$52\% = 52 \div 100 = 0.52$$

Changing a percentage into a fraction

Make the percentage into a fraction with a denominator of 100 and simplify by dividing the numerator and denominator by the same number until they cannot be simplified any further, for example



Changing a decimal into a percentage

Multiply the decimal by 100, for example

$0.73 = 0.73 \times 100 = \mathbf{73\%}$

Changing a decimal into a fraction

If the decimal has 1 decimal place, put it over a denominator of 10, then simplify the fraction

For example,

$$0.8 = \frac{8}{10} = \frac{4}{5}$$

(÷ 2 above $\frac{8}{10}$; ÷ 2 below $\frac{8}{10}$)

If the decimal has 2 decimal places, put it over a denominator of 100, then simplify the fraction

For example,

$$0.24 = \frac{24}{100} = \frac{6}{25}$$

(÷ 4 above $\frac{24}{100}$; ÷ 4 below $\frac{24}{100}$)

Finding the fraction of a quantity (Non-calculator)

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

For example,

To find $\frac{1}{2}$ divide by 2 or to find $\frac{1}{8}$ divide by 8.

So, $\frac{1}{8}$ of 24 = 24 ÷ 8 = 3

To find a fraction of a quantity, divide the quantity by the denominator, then multiply by the numerator

For example,

To find $\frac{3}{4}$,

First divide by 4 to find $\frac{1}{4}$, then multiply by 3 to find $\frac{3}{4}$

So, to find $\frac{3}{4}$ of 60

$\frac{1}{4}$ of 60 is 60 ÷ 4 = 15

$\frac{3}{4}$ of 60 is 15 x 3 = **45**

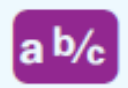
Finding the fraction of a quantity (Calculator)

Example find $\frac{3}{4}$ of £196

- Press the following sequence of buttons on the calculator,

= £47

OR

- Use the fraction button 

= £47

Remember: In maths 'of' is interpreted as x (multiply)

Finding the percentage of a quantity (Non-calculator)

Remember the equivalent fractions and percentages

Percentage	Fraction
1%	$\frac{1}{100}$
10%	$\frac{1}{10}$
25%	$\frac{1}{4}$
50%	$\frac{1}{2}$

So,

To find 1% of a quantity divide by 100

To find 10% of a quantity divide by 10

To find 25% of a quantity divide by 4

To find 50% of a quantity divide by 2

For example,

1% of 250 = 250 ÷ 100 = 2.5

25% of 68 = 68 ÷ 4 = 17

To find other percentages, use combinations of the simpler percentages.

For example,

To find 30% of a quantity, find 10% then multiply by 3

30% of 200 10% of 200 is 200 ÷ 10 = 20

30% of 200 is 20 x 3 = 60

To find 15% of a quantity, find 10% and 5% and then add

15% of 80 10% of 80 is 80 ÷ 10 = 8

5% of 80 is 8 ÷ 2 = 4 (5% is $\frac{1}{2}$ of 10%)

15% of 80 = 8 + 4 = 12

Finding the percentage of a quantity (Calculator)

For more complex percentages, students are expected to use a calculator

Remember: In maths 'of' is interpreted as x (multiply)

PERCENT means **"out of 100"**

For example, calculate 37% of 360

$$\frac{37}{100} \times 360 = 133.2$$

37% — $\frac{37}{100}$ — of — 360

- Press the following sequence of buttons on the calculator,

37	÷	100	x	360	=	133.2

Finding the percentage of a quantity (Calculator – using a multiplier)

For more complex percentages, students are expected to use a calculator

Remember: In maths 'of' is interpreted as x (multiply)

PERCENT means **"out of 100"**

$$14\% = \frac{14}{100} = 0.14$$

14% - the equivalent multiplier is **0.14**

Example, find 14% of 84

$$84 \times 0.14 = 8.96$$

of

multiplier for 14%

Increase or decrease a quantity by a percentage (Calculator)

Work out the **increase** and **add** it to the original amount

For example,

Increase £6 by 5%

Work out 5% of £6

$$\frac{5}{100} \times 6 = £0.30$$

Add £0.30 to the original amount:

£6 + £0.30 = **£6.30**

Work out the **decrease** and **subtract** it from the original amount

For example,

Decrease £15 by 3%

Work out 3% of £15

$$\frac{3}{100} \times 15 = £0.45$$

Subtract £0.45 from the original amount:

£15 - £0.45 = **£14.55**

Increase or decrease a quantity by a percentage (Calculator – using a multiplier)

An increase of 6% is equivalent to the original 100% plus 6%

This is 106% $= \frac{106}{100}$

This is equivalent to a multiplier of 1.06

12% increase use multiplier of 1.12

13% decrease use multiplier of 0.87

Percentage increase or decrease

Example 1
Increase £12 by 6%

12 x 1.06 = £12.72

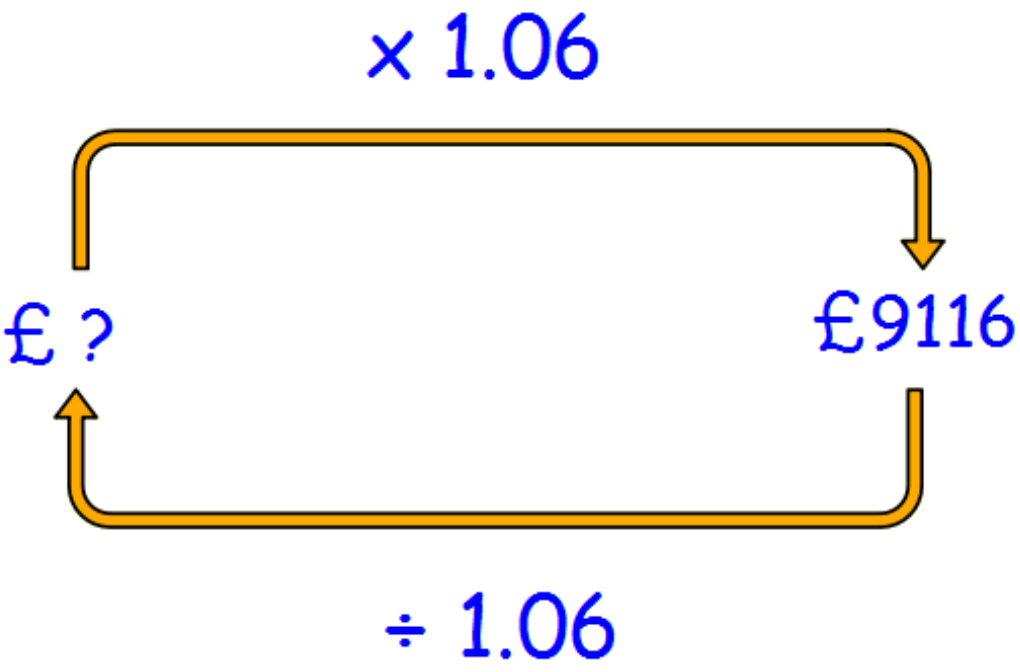
Example 2
Decrease 8.6 kg by 5%

8.6 x 0.95 = 8.17 kg

Reverse percentages

Example

The price of a car increased by 6% to £9116.
Work out the price before the increase.
An increase of 6% gives a multiplier of 1.06



To find the original price before the increase, divide the new amount by the multiplier

9116 ÷ 1.06 = £8600

Repeated percentage change

Compound interest - interest is added to the initial amount each year and then interest is calculated with the new amount.

Example

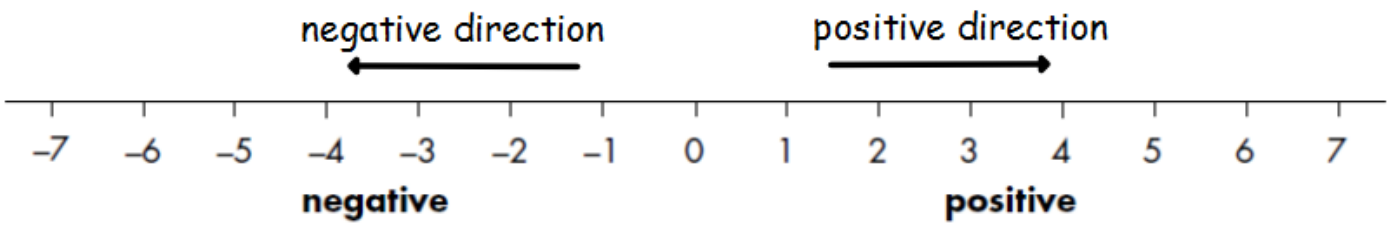
£2000 is invested at 6% compound interest for 3 years.
What is the amount in the account at the end of the period?

After 3 years

$$\text{Total} = £2000 \times 1.06^3 = £2382.03$$

Directed numbers

Number line



Notice that the **negative** numbers are to the **left** of 0 and the **positive** numbers are to the **right** of 0.

The negative sign (-) indicates that the number is below 0.

2 is **smaller** than 5 because 2 is to the **left** of 5

This can be written as $2 < 5$

-3 is **smaller** than 2 because -3 is to the **left** of 2

This can be written as $-3 < 2$

6 is **bigger** than 1 because 6 is to the **right** of 1

This can be written as $6 > 1$

-2 is **bigger** than -7 because -2 is to the **right** of -7

This can be written as $-2 > -7$

Reminder:

< means 'is less than'

> means 'is greater than'

Adding and subtracting directed numbers

Method – use the number line

Start at the first number in the calculation

\+ means move UP the number line

\- means move DOWN the number line

Double signs

\+ − = − or − + = −

For example, 7 + − 2 = 7 − 2 = 5

-3 + − 4 = -3 − 4 = -7

(Note the - in front of the 3, doesn't change as it is on its own)

− − = +

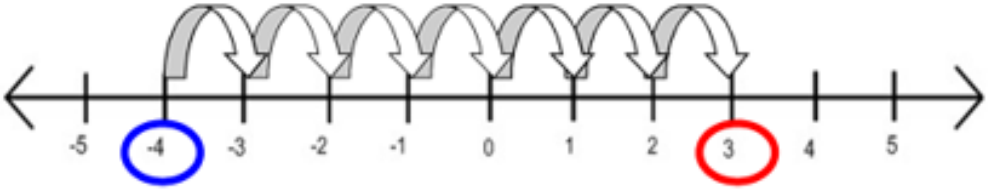
For example, 7 − − 2 = 7 + 2 = 9

-3 − − 4= -3 + 4 = 1

Using a number line

5+-3 = 5 - 3 =2

-4--7=-4 + 7=3



Multiplying and dividing directed numbers

Multiply and divide the numbers in the usual way, then work out the 'sign' of the answer using the following rules:

When the two signs are the SAME -> POSITIVE answer

When the two signs are the DIFFERENT -> NEGATIVE answer

×	+	−
+	+	−
−	−	+

÷	+	−
+	+	−
−	−	+

Remember, if there is no sign the number is positive

Examples,

6 x -4 = -24 (two different signs give a negative answer)

-2 x -9 = 18 (two signs the same give a positive answer)

30 ÷ -5 = -6 (two different signs give a negative answer)

-32 ÷ -4 = 8 (two signs the same give a positive answer)

Measurement

Metric units of length

Millimetre **mm**	10 mm = 1 cm
Centimetre **cm**	100 cm = 1 m
Metre **m**	1000 m = 1 km
Kilometre **km**	

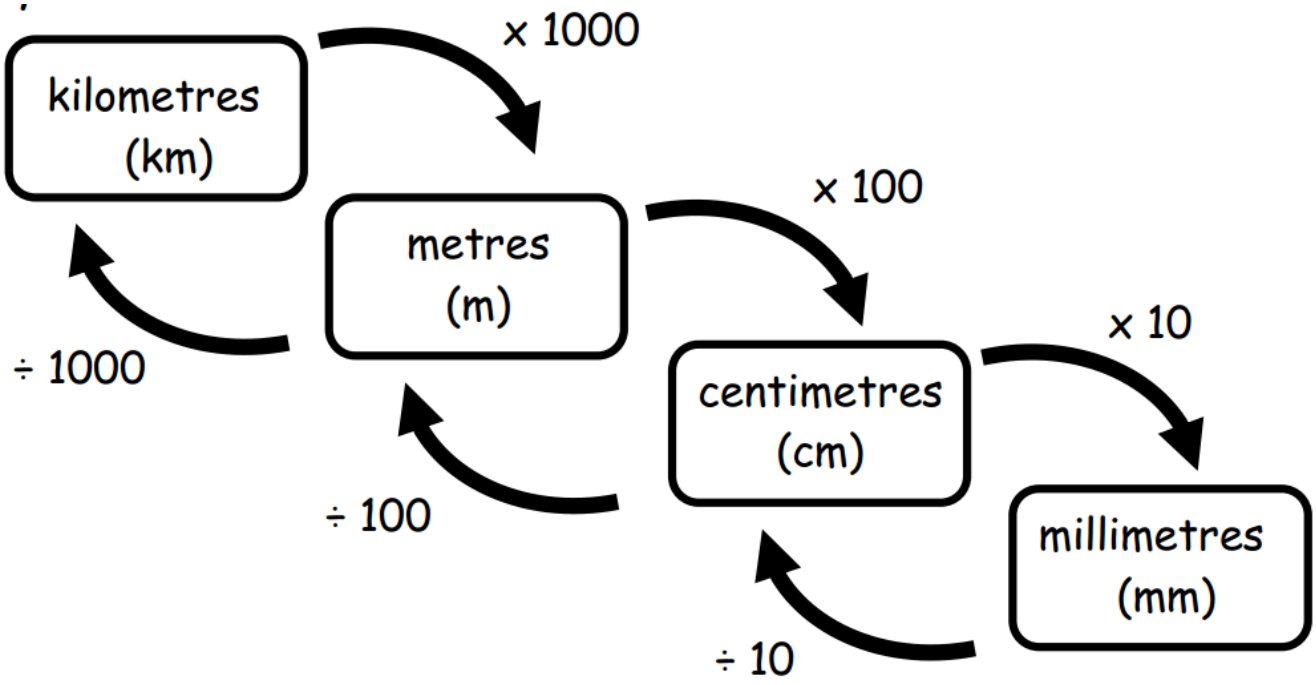
Metric units of mass

Milligram **mg**	1000 mg = 1 g
Gram **g**	1000 g = 1 kg
Kilogram **kg**	1000 kg = 1 t
Tonne **t**	

Metric units of capacity

Millilitre **ml**	1000 ml = 1 l
Litre **l**	1 ml = 1 cm^3

Diagram to illustrate metric unit conversions



Measurement

Converting between imperial and metric units

Length

1 inch	≈	2.5 cm
1 foot	≈	30 cm
1 mile	≈	1.6 km
5 miles	≈	8 km

Mass

1 pound	≈	454 g
2.2 pounds	≈	1 kg
1 ton	≈	1 metric tonne

Volume/Capacity

1 gallon	≈	4.5 litre
1 pint	≈	0.6 litre (568 ml)
$1\frac{3}{4}$ pints	≈	1 litre

Examples

5 gallons	≈	5 x 4.5	=	22.5 litres
45 miles	≈	45 x 1.6	=	72 litres
5 pounds	≈	5 ÷ 2.2	=	2.3 kg (to 1 decimal place)

Pie charts

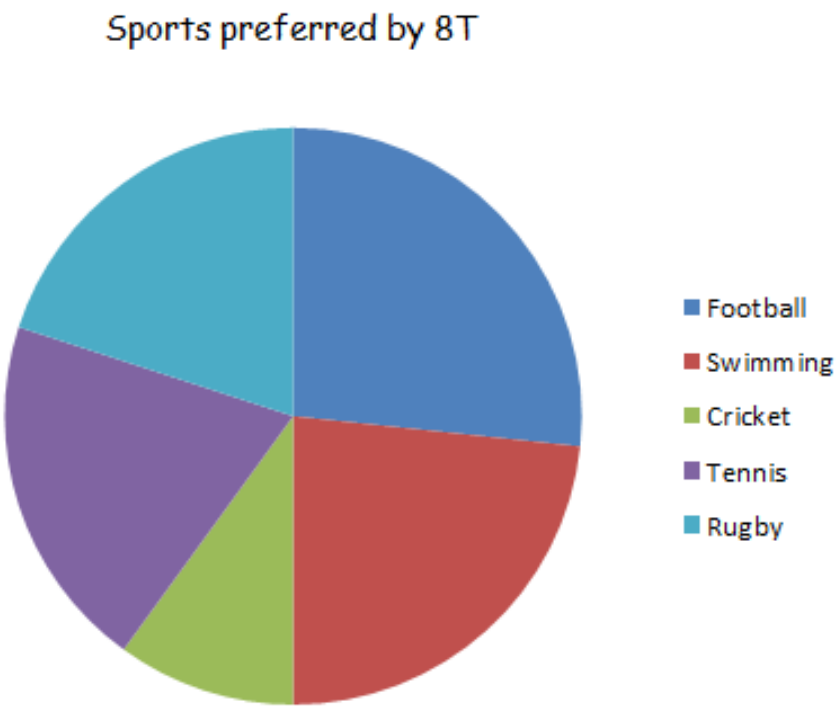
The complete circle represents the total frequency. The angles for each sector are calculated as follows

Method

There are 30 pupils in the survey and 360° in a full pie chart.
Each pupil is therefore represented by 360° ÷ 30 = 12°

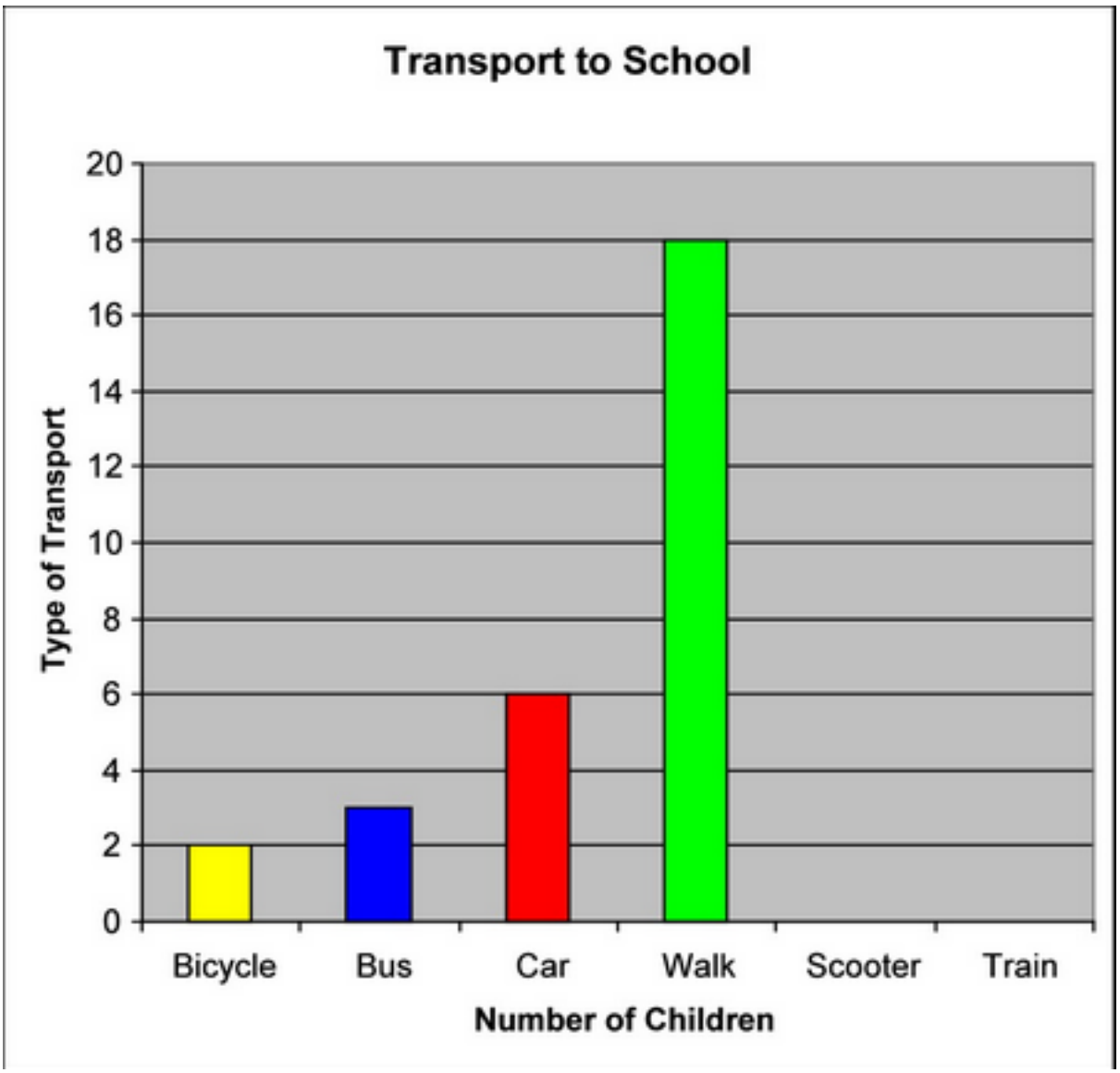
Sport	No of pupils	Working	Angle
Football	8	8 × 12°	96°
Swimming	7	7 × 12°	84°
Cricket	3	3 × 12°	36°
Tennis	6	6 × 12°	72°
Rugby	6	6 × 12°	72°
Total	30		360°

Remember to check that the angles of the sectors add up to 360°



Bar charts

The height of each bar represents the frequency.
All the bars must be the same width and have the same gap between them.
The scale on the y-axis is the frequency and is constant.



Remember to label both axes and give the chart a title

Standard form

Standard form is a way of writing very large and very small numbers using powers of 10.

2×10^{15} and 1.5×10^{-12} are examples of a number written in **standard form**.

Numbers written in **standard form** have two parts:

$$A \times 10^{n}$$

A number between 1 and 10 (Not including 10)

A power of ten

For example, the mass of the planet earth is about 5 970 000 000 000 000 000 000 000 kg.

$$5.97 \times 10^{24} \text{ kg}$$

A number between 1 and 10

A power of ten

For example, the width of this shelled amoeba is 0.00013 m

$$1.3 \times 10^{-4} \text{ m}$$

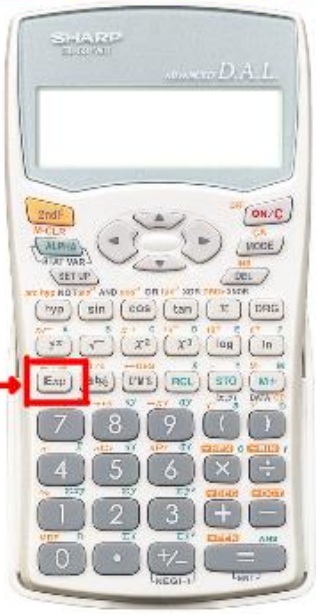
A number between 1 and 10

A negative power of 10

Standard form calculations with a calculator

2.46×10^{12}

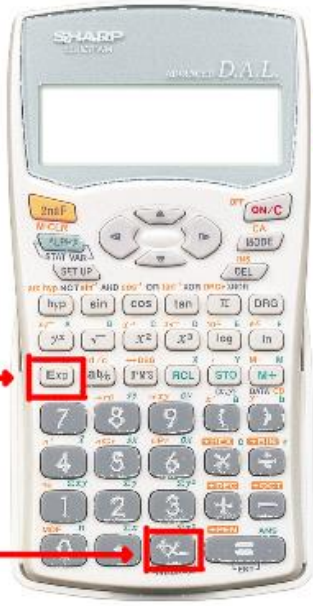
2 • 4 6 EXP 1 2



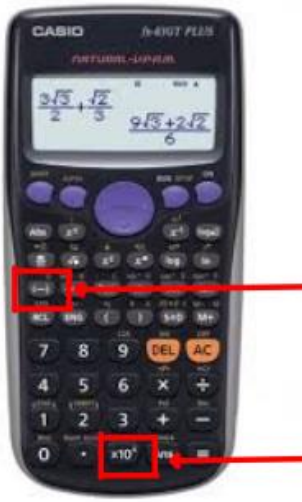
2 • 4 6 ×10ˣ 1 2

3.512×10^{-3}

3 • 5 1 2 EXP +/- 3



3 • 5 1 2 ×10ˣ (-) 3



Shape, Space and Measure

Shapes

It is important to use correct names of shapes. 2D and 3D shapes and their properties are below.

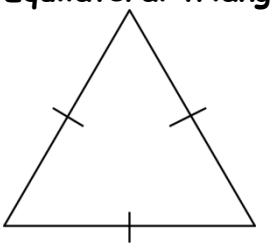
2D Shapes

A polygon is a 2D shape consisting of 3 or more straight sides. A regular polygon has all sides and angles the same size. Specific names of polygons are shown below the table.

Number of sides	Name of polygon
3	Triangle
4	Quadrilateral
5	Pentagon
6	Hexagon
7	Heptagon
8	Octagon
9	Nonagon
10	Decagon

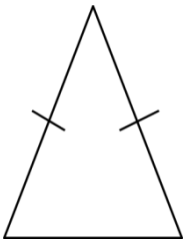
Some triangles have special names:

Equilateral triangle



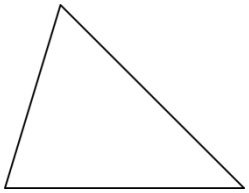
All sides and angles are equal.

Isosceles triangle



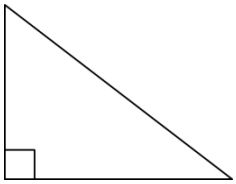
Two sides and two angles are equal.

Scalene triangle



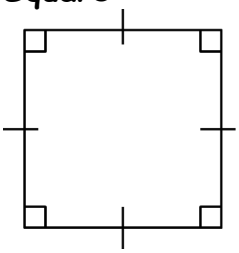
All sides and angles are different.

Right-angled triangle
One angle is a right angle (90°)



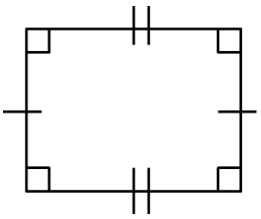
Some quadrilaterals have special names:

Square



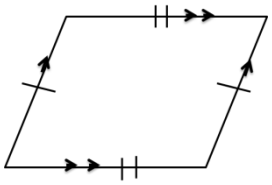
All sides are the same length and all angles are 90°

Rectangle



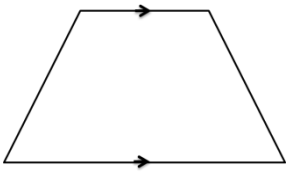
Opposite sides are the same length and all angles are 90°

Parallelogram



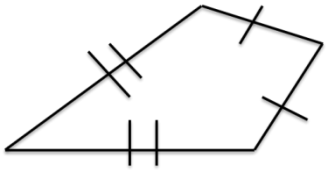
Opposite sides are parallel and the same length.
Opposite angles are the same.

Trapezium



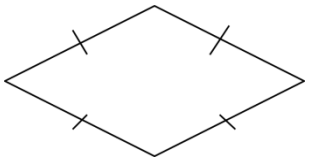
One pair of opposite sides are parallel.

Kite



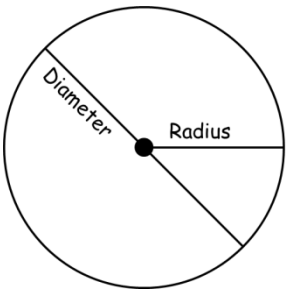
Two pairs of adjacent sides are equal.
One pair of opposite angles are equal.

Rhombus (NOT diamond)



All sides are the same length.
Opposite angles are equal.

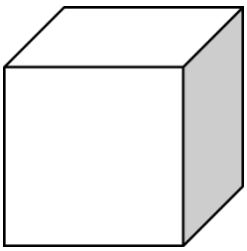
A **circle** has a radius which goes from the centre to the edge, and the diameter which is twice the length of the radius, and goes from side to side passing through the centre.



3D shapes

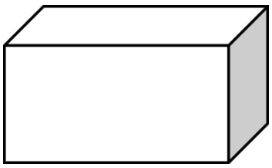
The flat surfaces of a 3D shape are called faces. The lines where two faces meet are called edges. The point (corner) at which edges meet is called a vertex. The plural of vertex is vertices. Some 3D shapes and their properties are below.

Cube



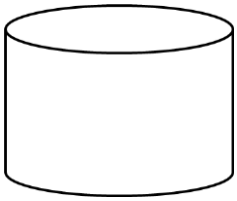
6 faces, 12 edges and 8 vertices.

Cuboid



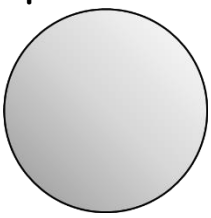
6 faces, 12 edges and 8 vertices.

Cylinder



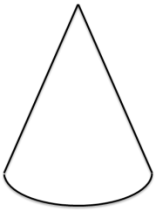
3 faces, 2 edges and no vertices.

Sphere



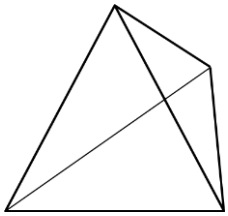
1 face, no edges and no vertices.

Cone



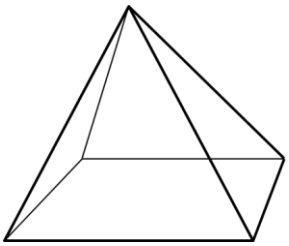
2 faces, 1 edge and 1 vertex.

Tetrahedron



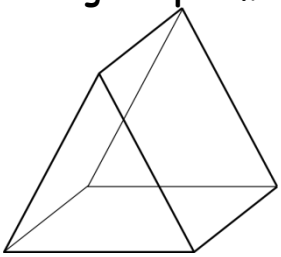
4 faces, 6 edges and 4 vertices.

Square-based pyramid



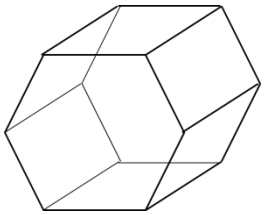
5 faces, 8 edges And 5 vertices.

Triangular prism



5 faces, 9 edges and 6 vertices.

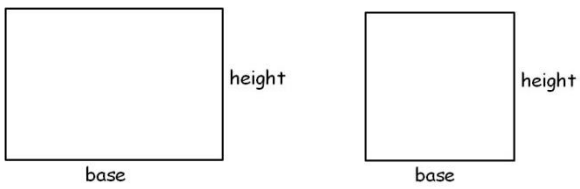
Hexagonal prism



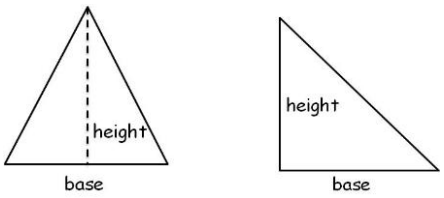
8 faces, 18 edges and 12 vertices.

Area

Area of Squares and Rectangles
= base x height

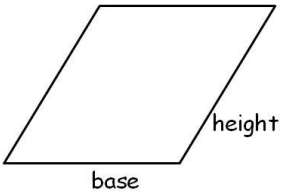


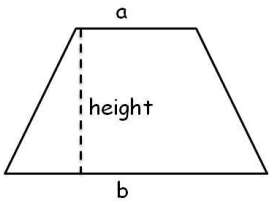
Area of Triangles
= $\frac{1}{2}$ x base x height



Area of Parallelograms
= base x height

Area of Trapeziums
= $\frac{1}{2}$ x (a + b) x height



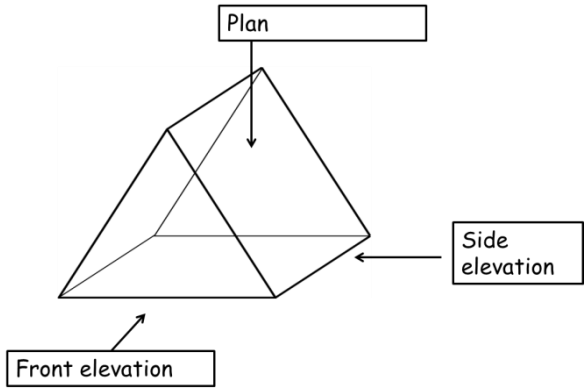


Surface Area

Surface area is the area of the surface of a 3D shape. To calculate the surface area, calculate the area of every face of the shape, then add those areas together.

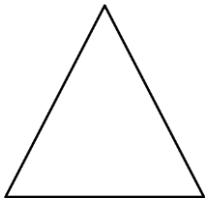
Plans/elevations

Plans and elevations can be drawn for any 3D shape.

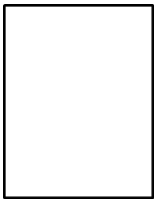


The view from above is called the plan:

The view from the front is called the front elevation:



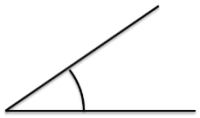
The view from the side is called the side elevation:



Angles

An angle is a measure of a turn. They are measured in degrees, for example, 60°. There are different types of angle.

Acute

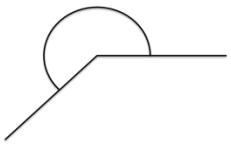


Less than 90°

Obtuse

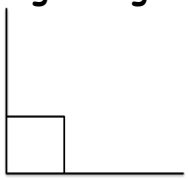
More than 90° but less than 180°

Reflex



More than 180° but less than 360°

Right angle

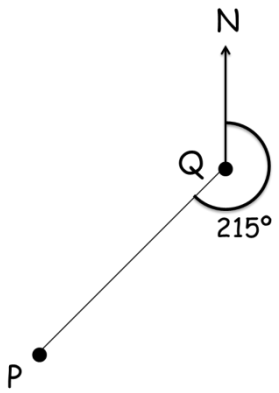


Exactly 90°

Angles are measured using a protractor. It is important to emphasise that you measure from zero.

Bearings

Bearings are used to describe directions with angles. They are more precise than using North, South, East and West. Bearings are always measure clockwise, from the North line and must have 3 digits. For example 50° must be written as 050°.



Scale drawing

Maps and plans are accurate drawings from which measurements can be made. A scale is a ratio which shows the relationship between the length of the drawing (or model) and the length in real life.

Maths Glossary

Acute angle – An angle measuring less than 90°
Add/addition – To join two or more quantities to get the sum or total
Adjacent – Next to
Algebra – An area of maths where unknown quantities are represented by letters
Alternate angles – Equal angles within parallel lines that are identified by a Z shape
Angle – The amount of turning between two lines meeting at the same point
Anti-clockwise – The opposite direction to which hands move round a clock
Approximate – To estimate a number, usually through rounding
Arc – A section of the circumference of a circle
Area – The size of the space a surface takes up, measured in units^2
Ascending – Going up
Average – A summary of a set of data, either mode, median and mean
Axis – Reference lines on a graph
Bar graph – A graph using bars to show quantities for easy comparison
Bisect – To divide into two equal sections
Box plot – A diagram that uses a number line to show the distribution of data through the minimum, lower quartile, median, upper quartile and maximum
Brackets – Symbols used to enclose an expression, ( )
Calculate – Work out, find the value of
Calculator – A device that performs mathematical operations
Capacity – The amount a container can hold
Centimetre – A metric unit for measuring length (10 millimetres)
Centre – The middle
Certain – Inevitable, will definitely happen
Chance – The likelihood that a particular outcome will occur
Circle – A 2D shape whose edge is always the same distance from the centre
Circumference – The perimeter of the circle

Chord – A straight line joining two points at the edge of the circle, not through the centre
Clockwise - The direction which hands move round a clock
Common denominator – A denominator which is a multiple of the other denominators
Compasses (pair of) – A mathematical instrument used to draw circles
Cone – A 3D shape with a circular base which tapers to a single vertex at the top
Congruent – Having the same shape and the same size
Continuous data – Data which could have an infinite number of values with a particular range
Coordinates – Pairs of numbers used to show a position of a graph with axes, eg (2,-4)
Corresponding angles– Equal angles within parallel lines that are identified by a F shape
Cross section – The face that results from slicing through a prism
Cube – A 3D shape with 6 square faces
Cuboid A 3D with 3 pairs of rectangular faces
Cube number – A number found by multiply a number by itself 3 times, eg $4^3 = 4 \times 4 \times 4 = 64$
Cylinder – A prism whose cross section is a circle
Data – A collection of information
Decagon – A 2D shape with 10 sides
Decimal – A part of a number or a whole, 0.4 or 3.279
Decrease – To make smaller
Degree – The unit with which angles are measured, eg 67°
Denominator – The bottom number of a fraction
Density - The degree of compactness of a substance, found by mass ÷ volume
Descending – Going down
Diagonal – A straight line joining two non-adjacent vertices
Diameter – A line going through a circle edge to edge that passes through the centre
Dice – A cube marked with dots or numbers
Digit – A symbol used to show a number, 1 2 3...
Discrete data - Data which has only a finite number of values
Divide/division – To share equally, ÷
Double – To multiply by 2
Edge – The part of a 3D shape where 2 faces meet
Equal to/equals – To have the same value, =
Equation - Two expressions that are equal to each other
Equilateral triangle – A triangle with 3 equal sides and 3 equal angles
Equivalent fractions – Two fractions representing the same proportion
Estimate – To find a close answer by rounding
Even number – A number in the 2x table
Even chance – An outcome shares the same probability of occurring with another
Expression (algebraic) – Made up of terms and operations (algebra)
Exterior angle – The angle formed outside a polygon when a side is extended
Face – The flat part of a 3D shape
Factor – A number that divides exactly into another
Formula – A mathematical rule to describe a relationship between quantities
Fraction – A part of a number or a whole, $\frac{3}{4}$
Frequency – The number of times a particular value appears in a set of data
Gradient – The slope of a line

Gram – A metric unit for measuring mass
Graph – A drawing or diagram used to record information
Half – To divide by 2
Hexagon – A 2D shape with 6 sides
Heptagon – A 2D shape with 7 sides
Highest common factor – The greatest of all the factors shared by a pair of numbers
Horizontal – A straight line parallel to the horizon
Hypotenuse – The longest side of a right-angled triangle
Impossible – Will not happen
Improper fraction – A fraction with a larger numerator than denominator
Increase – To make bigger
Index/indices – Numbers or letters raised to a power, 4^2 or a^6
Inequality – Two amounts not equal to each other, $< \leq \geq >$
Infinite/infinity – Unlimited, goes on forever
Integer – A whole number
Interior angle – An angle inside a polygon
Intersect – The point where two lines cross
Inverse operations – Opposite operations, + inverse to -, x inverse to ÷
Irregular (polygon) – A polygon with different sized sides and angles
Isometric (paper) – equal dimensions between dots
Isosceles triangle – A triangle with 2 equal sides and 2 equal angles
Kilogram – A metric unit for measuring mass (1000 grams)
Kilometre – A metric unit for measuring length (1000 metres)
Kite – A 2D shape with two pairs of equal sides and one pair of opposite angles that are equal
Line of symmetry – Divides a shape into two congruent sides
Linear – Has one dimension
Litre – A metric unit for measuring capacity (1000 millilitres)
Lowest common multiple - The smallest of all the multiples shared by a pair of numbers
Maximum – The greatest possible value
Mean – An average found by finding the sum of the data and dividing by the number of values
Median – An average found by locating the middle value of an ordered set of data
Metre – A metric unit for measuring length (100 centimetres, 1000 millimetres)
Midpoint – The middles point between 2 values or 2 coordinates
Millilitre – A metric unit for measuring capacity
Millimetre – A metric unit for measuring length
Minimum – The smallest possible value
Minus - Negative
Mixed number – A number comprised of an integer and a fraction
Mode – An average found by identifying the value with the highest frequency
Multiply/multiplication – A number is added to itself a number of times, x
Multiple – A number in another number's times table
Negative – Below/less than zero/0, -4
Net – A 2D shape that can be folded into a 3D shape
Nonagon – A 2D shape with 9 sides
Number line – A line marked with numbers
Numerator – The top number of a fraction

Obtuse angle - An angle measuring more than 90° but less than 180°
Octagon – A 2D shape with 8 sides
Odd number – A number not in the 2x table
Operations – Add, subtract, multiply, divide
Opposite angles – A pair of equal angles directly opposite each other formed by the intersection of 2 straight lines
Origin – Coordinate (0,0)
Outcome – One of the possible results of a probability experiment
Outlier – A value far away from the others in a set of data (also called anomaly)
Parallel – Lines that are the same distance apart
Parallelogram – A 2D shape with 2 pairs of parallel lines
Pentagon – A 2D shape with 5 sides
Percent/percentage – A part of a number or a whole. Per cent means out of 100, 46%
Perimeter – The distance around the edge of a 2D shape
Perpendicular – Two lines meeting at a right-angle
Pi – Ratio of the circumference to a circle's diameter, π, 3.141592...
Pictogram – A graph using pictures to represent frequency
Pie chart – A graph using a divided circle where each section represents a part of the total
Place value – The value of a digit depending on its place in the number
Plan – A diagram showing the view from directly above
Plane – A flat surface
Polygon – A 2D shape with straight sides
Population – Whole set from which a sample is taken
Positive – Above/greater than zero/0
Prime – a number with only two factors, 1 and itself
Prime factor – A number which is both a factor of something and a prime
Prism – A 3D shape with a constant cross section throughout
Probability – The chance that a particular outcome will occur
Product – The result of multiplying
Proportion – A part to whole comparison
Protractor – An instrument used to measure the size of angles
Pyramid - A 3D shape with a polygon base which tapers to a single vertex at the top
Pythagoras – In any right-angled triangle where c is the hypotenuse, $a^2 + b^2 = c^2$
Quadrant – Any quarter of a plane divided by an x- and y-axis
Quadrilateral – A 2D shape with four sides
Qualitative data – Non-numerical data
Quantitative data – Numerical data
Quantity – A number of something
Radius – The distance from the centre of a circle to its edge
Random – A chance pick from a number of items
Range – The smallest value subtracted from the greatest value
Ratio – Comparative value of two or more amounts
Reciprocal – One of two numbers whose product is 1, $\frac{1}{2}$ and 2
Rectangle – A quadrilateral with two pairs of parallel sides with different lengths and all vertices are right-angles
Recurring decimal – A decimal which has repeating digits or a repeating pattern of digits

Reflection – A mirror view
Reflex angle – An angle measuring more than 180° and less than 360°
Regular polygon – A polygon with all sides and angles equal
Remainder – The remaining amount after dividing a quantity by a number that is not a factor
Rhombus – A parallelogram with all sides equal
Right-angle – An angle measuring exactly 90°
Right-angled triangle – A triangle with one right-angle
Rotation – To turn an object
Rotational symmetry – When a turning shape has the same outline as the original shape
Round/rounding – Change the number to a more convenient value
Sample – A part of the population to be used
Scale factor – The ratio of two corresponding edges on a scaled drawing
Scalene triangle – A triangle with all different sides and all different angles
Scatter diagram – A diagram with coordinates plotted to show the relationship between two variables
Sector – A section of a circle bounded by two radii and an arc
Segment – A section of a circle bounded by a chord and an arc
Semi-circle – Half a circle
Sequence – An ordered set of numbers or objects arranged according to a rule
Set (of data) – A collection of items
Similar - Having the same shape but a different size
Simplify (algebra) – To remove brackets, unnecessary terms and numbers
Simplify (fractions) – To reduce the numerator and denominator in a fraction to the smallest numbers possible
Solve/solution – To work out the answer
Sphere – A 3D shape that is perfectly round, a ball
Square – A 2D shape with all equal sides and all angles 90°
Square number – A number that results by multiplying another number by itself
Square root – The opposite of squaring a number
Subtract/subtraction – To take one quantity away from another, -
Sum – The result of adding
Surface area – The area of the surface of a 3D shape
Symmetry – An object is symmetrical when one half is a mirror image of the other
Tally – Use of sets of 5 marks to record a total, 𝍸
Term (n^{th}) – One of the numbers in a sequence
Tessellation – Patterns of shapes that fit together without any gaps
Tetrahedron – A 3D shape with four triangular faces, a triangular-based pyramid
Three-dimensional (3D) – Having three dimensions, length, width and height
Transformation – A change in position or size
Translation – To move an item in any direction without rotating it
Trapezium – A 2D shape with four sides, two of them being parallel
Tree diagram – A diagram used to display the probability of different outcomes with each branch representing one possible outcome
Triangle – A 2D shape with three sides
Triple/treble – To multiply by three
Two-dimensional (2D) - Having two dimensions, length and width

Unit - One
Unit of measure – Standard amount or quantity
Variable – Something that varies, represented by a letter in algebra
Venn diagram – A diagram using circles to show relationships between sets
Vertex/vertices – The point where two sides meet, or three or more faces
Vertical – Perpendicular to the horizon
Volume – The amount of space occupied by a 3D object
X-axis – The horizontal axis on a graph
Y-axis – The vertical axis on a graph
Y-intercept – Where a line intersects the y-axis