Numeracy Policy

Definition of Numeracy

Being numerate means:

- having confidence and competence with numbers and measures,
- being able to understand the number system and mathematical concepts,
- applying knowledge to a range of contexts in order to solve a variety of problems.

Mathematical understanding is an integral part of life and everybody at Bournville School will work towards helping the students develop a positive, enthusiastic attitude towards numeracy. At Bournville it is our intention that no student develops a belief that they "can't do maths" but recognises that, with effort, they can overcome their difficulties, learn from mistakes and become a successful mathematician. This should also apply to all member of staff at Bournville School. This should be modelled by the staff at Bournville even though they might have found mathematics difficult when they were at school.

Implementation at Whole School Level

All teachers share responsibility for their students' development of numeracy. All teachers must be aware of the demands their learning area makes on their students' numeracy. Mathematics teachers lay the groundwork, all teachers provide opportunities every day for students to build upon it.

Numeracy should be promoted throughout all areas of the curriculum in a consistent and efficient manner. It should be noted that learning, teaching and assessment of numeracy should be appropriate to students' needs.

Roles and Responsibilities

Numeracy Co-ordinator

- Development of numeracy throughout the school;
- To carry out an audit of the numeracy requirements/provision in all areas of study;
- To help identify training needs of staff in relation to numeracy and ensure that these training needs are met;
- To liaise with all subject departments to ensure that numeracy is developed in a coherent and consistent manner throughout the school;
- To establish procedures to monitor and evaluate the numeracy provision for all pupils in the school;
- To establish procedures to monitor and review the implementation of the school's numeracy policy;
- To ensure all staff are aware of their responsibility that the acquisition of basic skills is a whole school issue, and not subject based.

Mathematics Department

- To provide students with the knowledge, skills and the understanding they need to be numerate;
- To use topics and examination questions from other subjects in mathematics lessons

Teachers across the school

- To use the same methods as the mathematics department when tackling mathematical problems in their lessons;
- To use the correct mathematical language, notation, conventions and techniques;
- To have high expectation of students and acknowledge the difficulties they may need to overcome to improve their numerical skills;

Parents

- Will encourage their children to use the mathematical concepts learnt in lessons rather than those they were taught whilst they were in school.

Students

- Will take increasing responsibility for recognising their own numeracy needs and making improvements.

Monitoring and Evaluation

Senior leaders, Associate Assistant Head teachers, Subject leaders and the Numeracy leads will monitor the progress in the school.

Approaches will include:

- Work Scrutiny – both students work and departmental schemes;
- Observations – student pursuit and numeracy teaching in lessons and form time.
- Meeting and line management minutes;
- Scrutiny of development plans;
- Encouraging departments to share good practise by exhibiting or exemplifying students work.

Cross-Curricular Numeracy Links

In…	Learners will…
Art and design	Apply number skills such as measurement, estimates, scale, proportion, pattern and shapes to develop, inform and resource their creative activities.
Computer Science	Use mathematical information and data presented numerically and graphically in data-handling software. They use number to collect and enter data for interpretation in spreadsheets and simulations and present their findings as graphs and charts, checking accuracy before processing.
Design and technology	Use mathematical information and data, presented numerically and graphically, to research and develop their ideas. They use number to measure and calculate sizes, fits and materials.
English	Develop skills in the application of number through activities which include number rhymes, ordering events in time, gathering information in a variety of ways, including questionnaires; accessing, selecting, recording and presenting data in a variety of formats.
Geography	Apply number skills in the classroom and in fieldwork to measure, gather and analyse data. They use mathematical information to understand direction, distances and scale and to determine locations when using plans, maps and globes.
History	Develop their number skills through developing chronological awareness, using conventions relating to time, and making use of data, *e.g. census returns and statistics*.
Modern foreign languages	Develop number skills through a range of activities in the target language. These can include number rhymes; ordering numbers; ordering events in time; using number in relevant contexts such as currency exchange; gathering information in a variety of ways, including questionnaires and recording and presenting results in a variety of formats.
Personal and social education	Select data from given information presented in a range of numerical and graphical ways. Gather information in a variety of ways, including simple questionnaires or databases to support understanding of PSE-related issues [and in KS3 access and select data from relevant information presented in a variety of ways and from different sources], [and in KS4 select from and interpret a variety of methods of presenting data, including pie charts, scatter graphs and line graphs] to support understanding of PSE-related issues.
Physical education	Develop their number skills by using mathematical information and data. They use the language of position (including co-ordinates and compass points) and movement, as well as data handling and measures in athletic and adventurous activities. They use scale in plans and maps. They measure and record performances, *e.g. time, distance and height*, and use the data to set targets and improve their performance.
Religious education	Develop skills in the application of number by using information such as ordering events in time, by measuring time through the calendars of various religions, by calculating percentages of tithing, and by considering the significance of number within religions. They interpret results/data and present findings from questionnaires, graphs and other forms of data in order to draw conclusions and ask further questions about issues relating to religion and the world.
Science	Work quantitatively to estimate and measure using non-standard and then standard measures, recording the latter with appropriate S.I. units. They use tables, charts and graphs to record and present information. With increasing maturity they draw lines of best fit on line graphs, use some quantitative definitions and perform scientific calculations.

Numeracy Guidance

The Mathematical Association recommend that teachers of mathematics and teachers of other subjects co-operate on agreed strategies. At Bournville we will create a consistent approach to teaching calculation methods.

The methods that are detailed below in this policy are the ones that are used in mathematics lessons. Each section gives a step by step guide of how to use the methods.

Section 1 – Number

Reading and writing numbers

Students must be encouraged to write numbers simply and clearly.

The symbol for zero with a line through it (Ø), ones which could be mistaken for 7 (1) and continental sevens (7) should be discouraged.

Decimal points should not be 'floating' they should be on the bottom of the line. The only exception is when you are using currency at which point it should be floating.

It is now common practice to use spaces rather than commas between each group of three figures. E.g. 270 047 **not** 270,047. The latter is still common place in many textbooks however care should be taken to express the numbers as shown.

Written Calculations

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

e.g. $3 \times 10 = 30 - 3 = 27 \div 9 = 3$ however 3 x 10 is not equal to 3, so the sentence is not true.

It is important that all teachers encourage students to write such calculations correctly. A good point to always make is that there should never be more than one equal sign on a line.

E.g. $3 \times 10 = 30$

$30 - 3 = 27$

$27 \div 9 \underline{= 3}$

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

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

$2\,400 - 400 = 2\,000$

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Multiplying and dividing numbers by powers of 10

When multiplying numbers by ..., 0.001, 0.001, 0.01, 1, 10, 100, 1000 etc. highlight that it is the numbers moving place not the decimal point. There should be no evidence of students moving the decimal point up or down the number.

Calculate 33 x 100

Step 1: Students highlight the unit.

T	U
3	**3**

Step 2: 100 times a unit, moves the unit to the *hundreds* column. The rest of the digits 'follow'

Th	H	T	U
		3	**3**
3	**3**		

Step 3: Students introduce place holders for the missing place value columns.

Th	H	T	U
		3	**3**
3	**3**	0	**0**

Therefore, 33 x 100 = 3 300

Calculate 33 x 0.1

Step 1: Students highlight the unit.

T	U
3	**3**

Step 2: 0.1 (a tenth) times a unit, moves the unit to the *tenths* column. The rest of the digits 'follow'

T	U	t

3	3 •	
	3 •	3

Step 3: Students introduce place holders for the missing place value columns (if needed).

Therefore, 33 x 0.1 <u>= 3.3</u>

Calculate 33 ÷ 1000

Step 1: This is asking how many thousands are there in 33. Students should begin by highlighting the *thousands* column and introducing place holders for the missing place value columns.

Th	H	T	U
0	0	3	3

Step 2: Students then need to move whatever is in the *thousands* column into the *units'* column. The rest of the digits 'follow'

Th	H	T	U	t	h	th
0	0	3	3			
			0	0	3	3

Therefore, 33 ÷ 1000 = 0.033

Calculate 33 ÷ 0.01

Step 1: This is asking how many *hundredths* are there in 33. Students should begin by highlighting the *hundredths* column and introducing place holders for the missing place value columns.

T	U	t	h
3	3	0	**0**

Step 2: Students then need to move whatever is in the *hundredths* column into the *units'* column. The rest of the digits 'follow'

		T	U	t	h
		3	3	0	**0**
3	3	0	0		

Therefore, 33 ÷ 0.01 = 3 300

Addition and Subtraction using the column method

Before completing any calculation, students 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.

Calculate 4591 + 731

Step 1: Estimate first, 5000 + 700 = 5 700

Step 2: Students set out the calculation in the place value columns.

$$\begin{array}{ccccc} & \textbf{Th} & \textbf{H} & \textbf{T} & \textbf{U} \\ & & & & \\ & 4 & 5 & 9 & 1 \\ + & & 7 & 3 & 1 \\ \hline & & & & \\ \hline \end{array}$$

Step 3: Students **add** the units together. Where the sum is more than 9 we carry. This carry, is identified as a 1 above the column to the left.

$$\begin{array}{ccccc} & \textbf{Th} & \textbf{H} & \textbf{T} & \textbf{U} \\ & & 1 & & \\ & 4 & 5 & 9 & 1 \\ + & & 7 & 3 & 1 \\ \hline & & & \mathbf{2} & \mathbf{2} \\ \hline \end{array}$$

Step 4: Students use their estimation to check whether their answer seems reasonable.

$$\begin{array}{ccccc} & \textbf{Th} & \textbf{H} & \textbf{T} & \textbf{U} \\ & 1 & 1 & & \\ & 4 & 5 & 9 & 1 \\ + & & 7 & 3 & 1 \\ \hline & \mathbf{5} & \mathbf{3} & \mathbf{2} & \mathbf{2} \\ \hline \end{array}$$

Step 5: Students write out the calculation and their final answer.

4591 + 731 = 5322

Calculate 62 – 37

Step 1: Students estimate an answer, 60 – 40 = 20

Step 2: Students set out the calculation in **place value** columns.

	T	U
	6	2
-	3	7

Step 3: Students subtract the units. In this case 2 – 7 would give a negative answer. Therefore we exchange one of the tens for ten units. In this example this is denoted by scoring out the 6 and writing a small 5. Put the figure 1 in front of the 2 units. You will now have 12 units and therefore will be able to subtract the units.

	T	U
	$^{5}\cancel{6}$	$^{1}2$
-	3	7
		5

Step 3: Students **subtract** the tens.

	T	U
	$^{5}\cancel{6}$	$^{1}2$
-	3	7
	2	**5**

Step 4: Students use their estimation to check whether their answer seems reasonable. Students write out the calculation and final answer.

62 - 37 = 25

Calculate 6.43 – 5.9

Step 1: Students estimate an answer, 6 – 6 = 0

Step 2: Students make the decimals the same length by introducing **place holders**.

	U	·	t	h
	6	·	4	3
-	5	.	9	0

Step 3: Students use the column method to complete the calculation.

	U	·	t	h
	6	·	$^{1}4$	3
-	$^{6}\cancel{5}$	.	9	0
	0	**.**	**5**	**3**

Step 4: Students use their estimation to check whether their answer seems reasonable. Students write out the calculation and final answer.

6.43 – 5.9 = 0.53

Multiplication using the Grid Method

Find the product of 234 and 17

Step 1: Estimate first, 200 x 20 = 4 000

Step 2: Students split the numbers that are to be **multiplied** into its hundreds, tens and units. These are then placed into the grid.

x	**200**	**30**	**4**
10			
7			

Step 3: Students use their knowledge of **place value** to **multiply** each part of the calculation.

x	**200**	**30**	**4**
10	2000	300	40
7	1400	210	28

Step 4: Students use the column **addition** method to sum the individual parts of the calculation.

	Th	**H**	**T**	**U**
	2	0	0	0
	1	4	0	0
		3	0	0
		2	1	0
			4	0
+			2	8
	3	**9**	**7**	**8**

Step 5: Students use their estimation to check whether their answer seems reasonable. Students write out the calculation and final answer.

234 x 17 = 3978

The grid method can be used to multiply decimals.

Calculate 3.6 x 0.123

Step 1: Estimate first, 4 x 0.1 = 0.4

Step 2: Students **multiply** each part of the calculation by the appropriate **power of 10**.

$$3.6 \times 10 = 36$$

$$0.123 \times 1000 = 123$$

Step 2: Students use the grid method to calculate the whole number **product** of the two numbers.

x	**100**	**20**	**3**
30	3000	600	90
6	600	120	18

The digits at the top of this column addition calculate are the digits carried over from the addition of the tens and hundred column.

	Th	**H**	**T**	**U**
	1	1		
	3	0	0	0
		6	0	0
		6	0	0
		1	2	0
			9	0
+			1	8
	4	**4**	**2**	**8**

Step 3: Students **divide** their answer by the appropriate **powers of 10** as determined in step 1.

$$4428 \div 10 \div 1000 = 0.4428$$

Step 4: Students use their estimation to check whether their answer seems reasonable. Students write out the calculation and final answer.

$$0.123 \times 3.6 = \underline{0.4428}$$

Division using short division

How many 3's go into 7323

Step 1: Students set out the calculation as shown below. Pupils commonly refer to this as the 'bus stop'.

$$\begin{array}{r|llll} 3 & 7 & 3 & 2 & 3 \end{array}$$

Step 2: Students work from left to right. Pupils work out how many times the **divisor** goes into the first digit. This is written above the 'bus stop', the **remainder** is carried over to the next number.

$$\begin{array}{r|llll} & \mathbf{2} & & & \\ \hline 3 & 7 & {}^{1}3 & 2 & 3 \end{array}$$

Step 3: Students continue to work from left to right until the calculation is complete.

$$\begin{array}{r|llll} & \mathbf{2} & \mathbf{4} & \mathbf{4} & \mathbf{1} \\ \hline 3 & 7 & {}^{1}3 & {}^{1}2 & 3 \end{array}$$

$$7323 \div 3 = \underline{2441}$$

Calculate 25 ÷ 4

Step 1: Students use the above to start the **division**.

$$\begin{array}{r|ll} & \mathbf{0} & \mathbf{6} \\ \hline 4 & 2 & {}^{2}5 \end{array}$$

Step 2: Students need to recognise that they need to introduce the relevant **placeholders** to carry on with the calculation.

$$\begin{array}{r|lllll} & \mathbf{0} & \mathbf{6} & \mathbf{.} & \mathbf{2} & \mathbf{5} \\ \hline 4 & 2 & {}^{2}5 & . & {}^{1}0 & {}^{2}0 \end{array}$$

$$25 \div 4 = \underline{6.25}$$

Calculate 0.46 ÷ 0.4

Step 1: Students write the calculation as a fraction.

$$\frac{0.46}{0.4}$$

Step 2: Students **multiply** the **numerator** and **denominator** to create an **equivalent fraction** so that the **denominator** is not a decimal.

$$\frac{0.46}{0.4} \times \frac{10}{10} = \frac{4.6}{4}$$

Step 3: Students then use the short **division** method to **divide** the **numerator** by the **denominator** to complete the calculation.

$$\frac{4.6}{4} = 1.15$$

Order of Operations

It is important that students follow the correct order of operation for arithmetic calculations. Students should be familiar with the mnemonic: BIDMAS (Brackets, Indices (Powers e.g. squares, cubes, etc.), Division, Multiplication, Addition and Subtraction)

This gives the order in which calculations should be completed.

5 + 3 x 4

Step 1: Work through BIDMAS to identify the first operation to be calculated.

B	I	D	M	A	S
x	x	x	/		

5 + 3 x 4 = 5 + 12

Step 2: Continue working through BIDMAS to complete the calculation.

B	I	D	M	A	S
x	x	x	/	/	

5 + 12 = 17

$5 + 6^2 \div 3 - 4$

Step 1: Work through BIDMAS to identify the first operation to be calculated.

B	I	D	M	A	S
x	/				

5 + 36 ÷ 3 – 4

Step 2: Continue working through BIDMAS to complete the calculation.

B	I	D	M	A	S
x	/	/	x	/	/

= 5 + 12 – 4

= 17 – 4

= 13

Care must be taken with subtraction

5 –12 + 4	but	5 –12 + 4
= -7 + 4		= 5 – 16
= -3 /		= -11 x

In this case it is important to remember that the addition is -12 + 4 = - 8 **NOT** 12 + 4.

Percentages

Students will be familiar with many operations involving percentages in mathematics. It is important to remember firstly that 'per cent' means 'out of 100' (think **cent**ury).

It is also important to remember that the majority of percentage questions can be solved using proportional reasoning. The following is a sample of what we would expect students to use in other areas, and the techniques we use in mathematics lessons to solve them.

Percentages of a quantity

It is important to identify a method that works in all cases, not just specific ones e.g. 50% is the same as a half. This consistent method will be used across all percentage problems and therefore robust.

Find 27% of 350

Step 1: Students should identify that the 350 at the moment is equivalent to 100%. The question then becomes how do we get from 100% to 27%?

Step 2: Students find 1% by ÷100 and then 27% by x 27.

Original	**÷100**		**x 27**	**New**
100%		1%		**27%**
350				

Step 3: Students then apply these steps to their original value.

Original	**÷100**		**x 27**	**New**
100%		1%		**27%**
350		3.5		94.5

Step 4: Students then write out the calculation and final answer.

27% of 350 <u>= 94.5</u>

Once this has been established, students should be encouraged to find 'shortcuts' if possible.

Find 30% of 350

Step 1: Students should identify that the 350 at the moment is equivalent to 100%. The question then becomes how can we get from 100% to 30%?

Step 2: Students could find 10% and then multiply by 3

Original	**÷10**		**x 3**	**New**
100%		10%		**30%**
350				

Step 3: Students then apply these steps to their original value.

Original	**÷10**		**x 3**	**New**
100%		10%		**30%**
350		35		105

Step 4: Students then write out the calculation and final answer.

30% of 350 <u>= 105</u>

Calculating the amount as a percentage

Using the same method we can express an amount as a percentage of the original amount

What is 15 as a percentage of 60?

Step 1: Students should identify that the 60 is equivalent to 100%. The question then becomes how can we get from 60 to 15

Step 2: Students should find 1 by dividing by 60 and then 15 by multiplying by 15

Original	÷ 60		x 15	New
100%				
60		1		15

Step 3: Students then apply these steps to their original value.

Original	÷ 60		x 15	New
100%		1.6…%		**25%**
60		1		15

Step 4: Students then write out their final answer.

15 is 25% of 60.

Percentages increase/decrease

Increase 350 by 40%

Step 1: Students should identify that the 350 at the moment is equivalent to 100%. Increasing 100% by 40% takes us to 140%.

Step 2: Students find 1% by ÷100 and then 140% by x 140.

Original	÷100		x 140	New
100%		1%		**140%**
350				

Step 3: Students then apply these steps to their original value.

Original	÷100		x 140	New
100%		1%		**140%**
350		3.5		490

Step 4: Students then write out the calculation and final answer.

Increasing 350 by 40% gives 490.

Once this has been established, students should be encouraged to find ‘shortcuts’ if possible.

Section 2 – Algebra

Students should be encouraged to write the letter 'x' as a curly 'x' rather than as a 'x'. This helps students distinguish between the multiplication symbol and the letter.

Formulae

The most common use of algebra across the curriculum will be in the use of formulae. When transforming formulae students will be taught to use the 'balancing' method.

Make b the subject of the formula, A = LB

Step 1: Students identify that making b the subject of the formula will result in the final answer being of the type 'b = '

Step 2: Students recognise that **A = LB** is the same as **A = L x B**

Step 3: Students recognise that as B is being multiplied by L, to get B on its own you need to divide by L. To balance the equation you then need to divide both sides by L.

A = L x B

÷ L **÷ L**

A ÷ L = B

Or

$\frac{A}{L}$ **= B**

Substitution

When substituting into formulae it is important to remember the order of operations.

Find the value of c when a = 4 and b = 3 into $c = 4a - 3b^2$

It is important to remember that 4a is the same as 4 x a.

Step 1: Write out the formula with all ‘hidden’ mathematical notation.

$c = 4 \times a - 3 \times b^2$

Step 2: Substitute the given values into the appropriate positions

$c = 4 \times 4 - 3 \times 3^2$

Step 3: Apply the rules of BIDMAS.

‘Are there any brackets? No’

‘Are there any indices (powers)? Yes’

$c = 4 \times 4 - 3 \times 9$

‘Are there any multiplications? Yes’

$c = 16 - 27$

‘Are there any divisions? No’

‘Are there any additions? No’

‘Are there any subtractions? Yes’

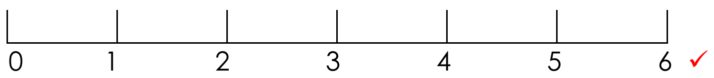
$\underline{c = -9}$

Plotting Coordinates

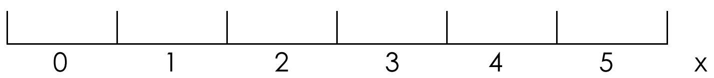
It is important to remember that we are plotting coordinates not points or values.

When drawing a diagram on which coordinates have to be plotted some students will need to be reminded that the numbers written on the axes must be on the lines not in the spaces.

e.g.



NOT



Axes

When drawing graphs to represent experimental data it is usual to use the horizontal axis for the variable which has a regular class interval.

e.g. In an experiment in which temperature is taken every 5 minutes the horizontal axis would be used for time and the vertical axis for temperature.

Having plotted coordinates pupils can sometimes be confused as to whether or not they should join them. If the results are from an experiment then a 'line of best fit' will usually be needed. Further details appear in the following section on Data Handling.

Section 3 – Data Handling

It is important that graphs and diagrams are drawn on the appropriate paper:

• bar charts and line graphs on squared or graph paper.

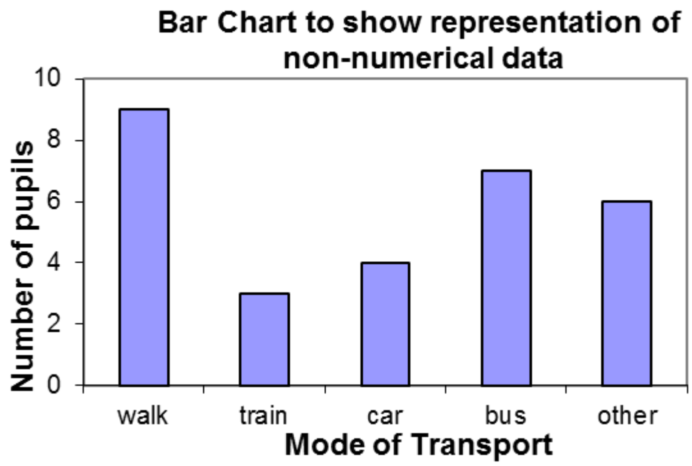
• pie charts on plain paper.

Bar Charts

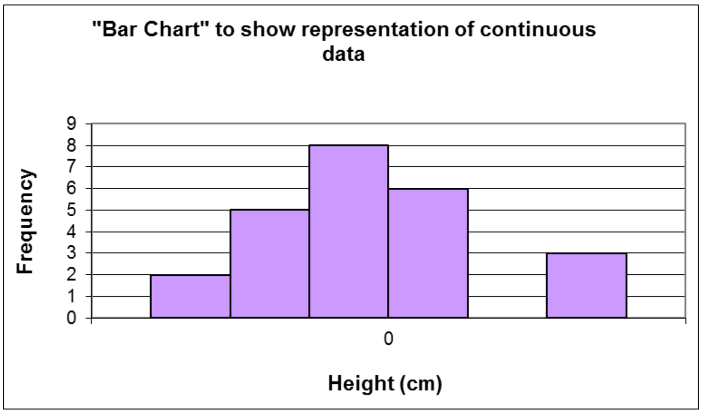
These are the diagrams most frequently used in areas of the curriculum other than mathematics. The way in which the graph is drawn depends on the type of data to be processed.

Graphs should be drawn with gaps between the bars if the data categories are not numerical (colours, makes of car, names of pop star, etc). There should also be gaps if the data is numeric but can only take a particular value – **discrete** data (shoe size, KS3 level, etc). In cases where there are gaps in the graph the horizontal axis will be labelled beneath the columns.

The labels on the vertical axis should be on the lines.

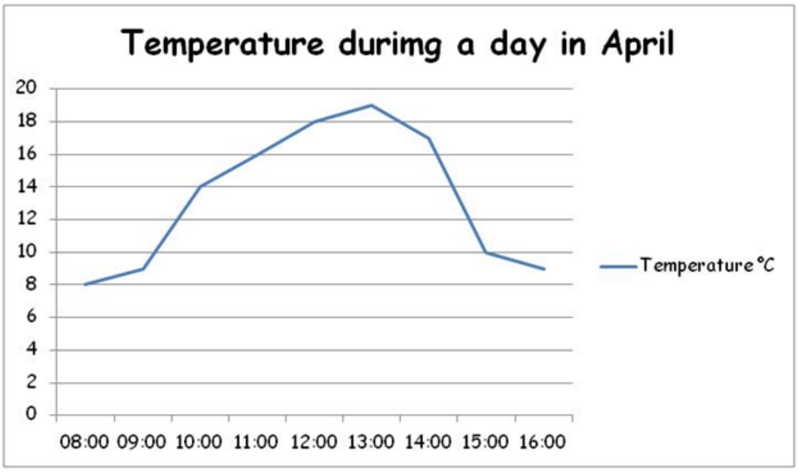


Where the data is **continuous**, e.g. lengths, the horizontal scale should be like the scale used for a graph on which points are plotted.



Line Graphs

Line graphs should only be used with data in which the order in which the categories are written is significant. Points are joined if the graphs shows a trend or when the data values between the plotted points make sense to be included.



Pie Charts

Pie charts should be used to show how the data is split up between the different categories. The area of the whole circle represents the total number of items.

Students are expected to use a similar method to that of percentages to find the angle of each part of the pie chart.

The following tables shows the results of a survey of 30 students travelling to school. Show this information on a pie chart.

Mode of Transport	Frequency
Walk	10
Train	3
Car	5
Bus	6
Other	6
Total	**30**

Step 1: Calculate the angles needed.

Walk:

Original	**÷30**		**x 10**	**New**
360°		12°		**120°**
30		1		10

Train:

Original	**÷30**		**x 3**	**New**
360°		12°		**36°**
30		1		3

Car:

Original	**÷30**		**x 5**	**New**
360°		12°		**60°**
30		1		5

Bus:

Original	**÷30**		**x 6**	**New**
360°		12°		**72°**
30		1		6

Car:

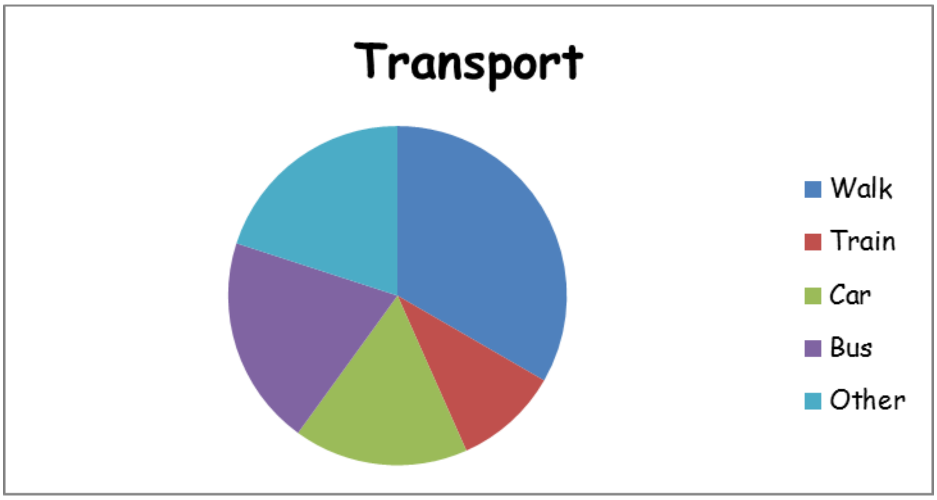
Original	÷30		x 6	New
360°		12°		**72°**
30		1		6

Step 2:

Care needs to be taken when using a pair of compasses. Students should hold the pivot (not the arms) when drawing a circle to ensure precision. The pencil must be level with the point of the compass.

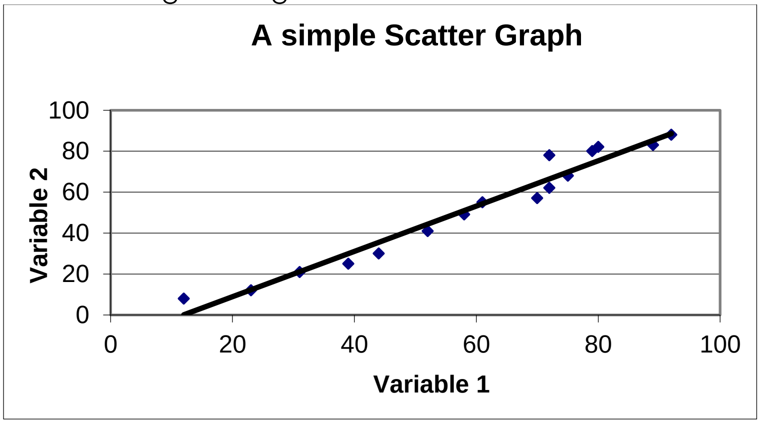
Ensure when using a protractor that students measure from 0°, not 180° (compare to a ruler – you wouldn't measure a line starting from 30cm!)

When drawing a new section on the pie chart, students should measure the angle from the line they have just drawn. This allows them to move 'around' the circle to complete the pie chart.



Scatter Graphs

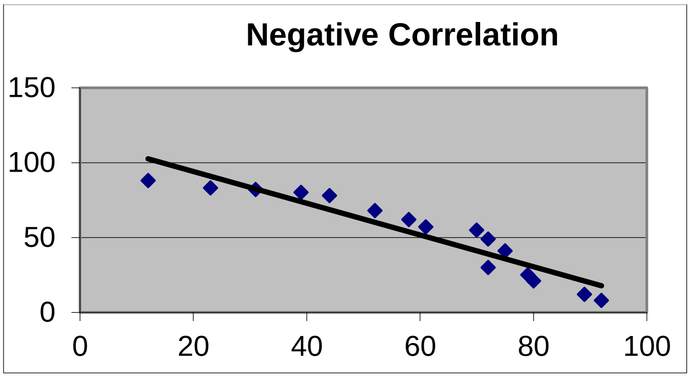
These are used to compare two sets of numerical data. The two values are plotted on two axes labelled as for continuous data. If possible a 'line of best fit' should be drawn. The line of best fit should be drawn so that there are an equal amount of coordinates plotted each side. The line of best fit does not have to go through both the minimum and maximum values.

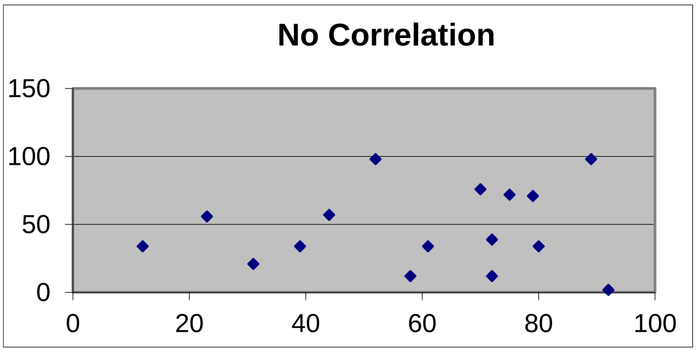


The degree of correlation between the two sets of data is determined by the proximity of the plotted points to the 'line of best fit'

The above graph shows a positive correlation between the two variables. However you need to ensure that there is a reasonable connection between the two, e.g. ice cream sales and temperature. Plotting use of mobile phones against cost of houses will give two increasing sets of data but are they connected?

Negative correlation depicts one variable increasing as the other decreases, no correlation comes from a random distribution of points. See diagrams below.





The range of a set of data is the difference between the highest and the lowest data values.

Consider the list 80%, 94%, 23%, 25%, 67%. Find the range of the list.

Step 1: Identify the highest and lowest values,

Highest is 94%.

Lowest is 23%

Step 2: Find the difference between them,

Range is 94% - 23% = 71%.

The range is always a single number, so it is not 23% - 94%.

Averages

Three different averages are commonly used:

- **Mean** – is calculated by adding up all the values and dividing by the number of values.
- **Median** – is the middle value when a set of values has been arranged in order.
- **Mode** - is the most common value. It is sometimes called the modal group.

Consider the list 80%, 94%, 23%, 25%, 67%. Find the averages of the list.

Mean – 57.8%

Step 1: Add up all of the values,

80% + 94% + 23% + 25% + 67% = 289%

Step 2: Identify the number of values in the list.

5

Step 3: Divide the sum by the number of values

289% ÷ 5 = 57.8%

Median – 67%

Step 1: Order the values,

23%, 25%, 67%, 80%, 94%

Step 2: Identify that 67% lies in the middle of the list.

Mode -23%, 25%, 67%, 80%, 94%

In this case as the values only appear once each. They are all the most common and hence are all the mode. There can never be a case where there is no mode.

Section 4: Shape, Space and Measure

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

2D Shapes

A polygon is a 2D shape consisting of 3 or more straight sides.

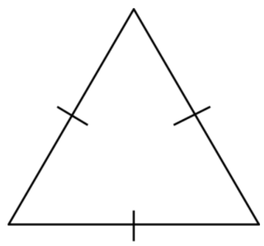
A regular polygon has all sides and angles the same size.

A circle or any shape with a curved side is not a polygon.

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

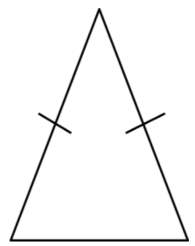
Triangles

Equilateral triangle



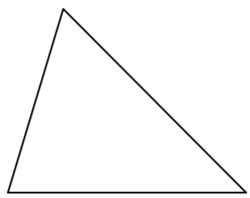
All sides and angles are equal.

Isosceles triangle



Two sides and two angles are equal.

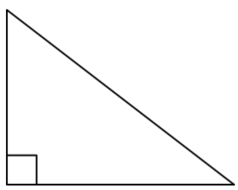
Scalene triangle



All sides and angles are different.

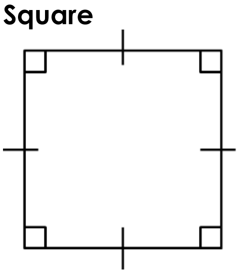
Right-angled triangle

One angle is a right angle (90°)



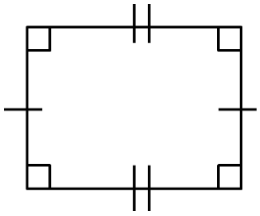
Quadrilaterals

Square



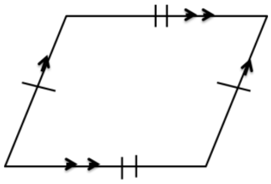
All sides are the same length and all angles are 90°

Rectangle



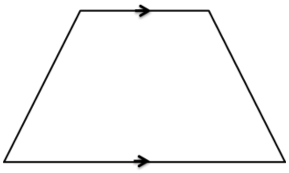
Opposite sides are the same length and all angles are 90°

Parallelogram



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

Trapezium



One pair of opposite sides are parallel.

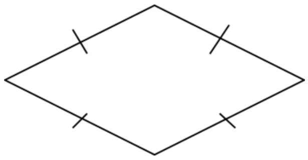
equal.

Kite

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

angles are equal.

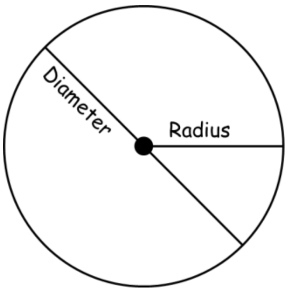
Rhombus (NOT diamond)



All sides are the same length.
Opposite angles are

Circle

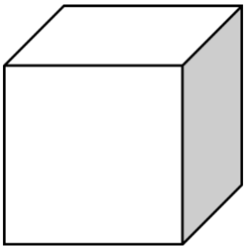
A circle has a radius which goes from the centre to the edge, and the diameter which is twice the length of the radius, and goes from side to side passing through the centre.



3D shapes

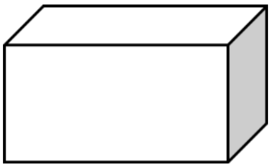
The flat surfaces of a 3D shape are called faces. The lines where two faces meet are called edges. The point (corner) at which edges meet is called a vertex. The plural of vertex is vertices. Some 3D shapes and their properties are below.

Cube



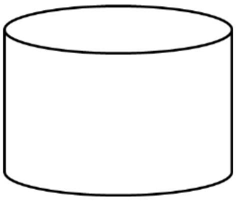
6 faces, 12 edges
and 8 vertices.

Cuboid



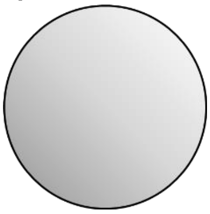
6 faces, 12 edges
and 8 vertices.

Cylinder



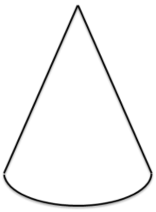
3 faces, 2 edges and
no vertices.

Sphere



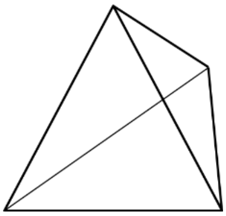
1 face, no edges
and no vertices.

Cone



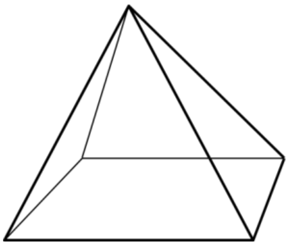
2 faces, 1 edge
and 1 vertex.

Tetrahedron



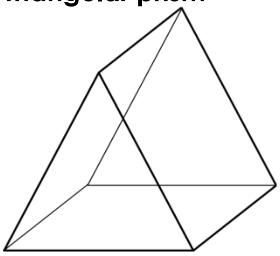
4 faces, 6 edges
and 4 vertices.

Square-based pyramid



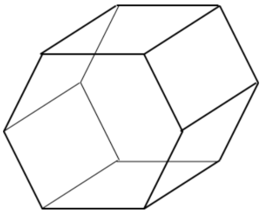
5 faces, 8 edges
And 5 vertices.

Triangular prism



5 faces, 9 edges
and 6 vertices.

Hexagonal prism

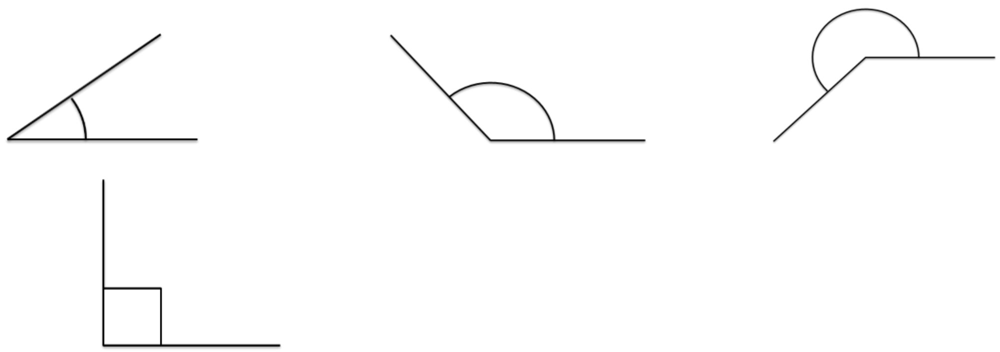


8 faces, 18 edges
and 12 vertices.

Angles

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

Acute **Obtuse** **Reflex** **Right angle**



Less than 90°

More than 90° but less than 180°

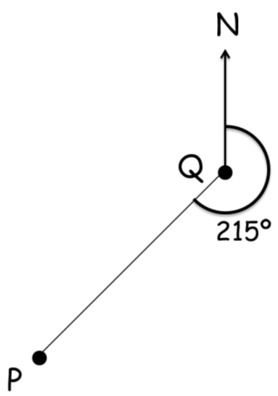
More than 180° but less than 360°

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 <u>clockwise</u>, from the <u>North</u> line and must have <u>3 digits</u>. For example 50° must be written as 050°.



Units of measure

The use of metric units of measure is encouraged. The metric system of measurement is based on powers of ten and uses the following prefixes:

- **Kilo-** meaning 1000
- **Centi-** meaning one hundredth
- **Milli-** meaning one thousandth
- **Micro-** meaning one millionth

These prefixes are then followed by a base unit:

- The base unit for length is **metre**
- The base unit for mass is **gram**
- The base unit for capacity is **litre**

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 units²
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, < ≤ ≥ >
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 4 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 2 or more amounts
Reciprocal – One of two numbers whose product is 1, ½ 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, 
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

Who wrote the policy	Kyle Gurney	Associate Assistant Headteacher
Who is responsible for making amendments	Kyle Gurney	Associate Assistant Headteacher
Version	Two	
Changes made	One	