Year 6 SATs Reasoning Revision
GUIDANCE FOR PARENTS & CARERS

The KS2 Reasoning Test

Children are asked to answer about 25 questions in forty minutes for each of the KS2 Reasoning Tests. The questions cover areas of the mathematics national curriculum (2014) that would be regarded as reasoning. The curriculum can be found at:

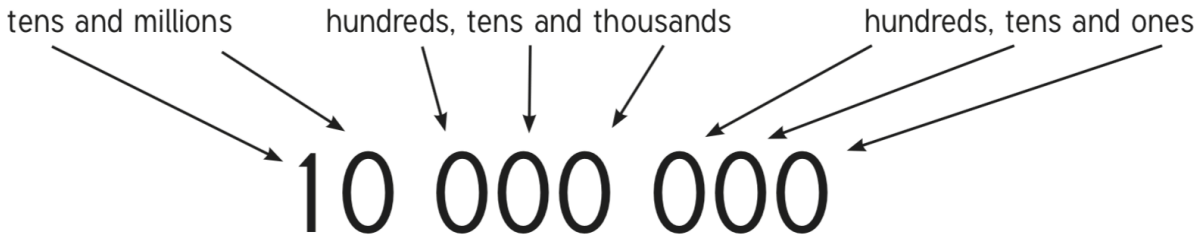
www.gov.uk/government/publications/national-curriculum-in-england-mathematics-programmes-of-study

The national curriculum is expected to be taught over the four years of Key Stage 2. Therefore the questions in the test are based on most of the objectives from the KS2 national curriculum (and not just what they learn in Year 6).

The questions are written in a variety of styles.

1. Reading and Writing Numbers up to 10,000,000

Practise reading and writing numbers in numerals/figures and words.



7 923 674 is seven million, nine hundred and twenty-three thousand, six hundred and seventy-four.

2. 10, 100 and 1000 More or Less Than a Number

Practise counting in steps of 10, 100 and 1000 from any number. Look at the digits that change and how the number crosses the next hundred, thousand or ten thousand.

367, 377, 387, 397, 407

6872, 6972, 7072, 7172

43 500, 42 500, 41 500, 40 500, 39 500

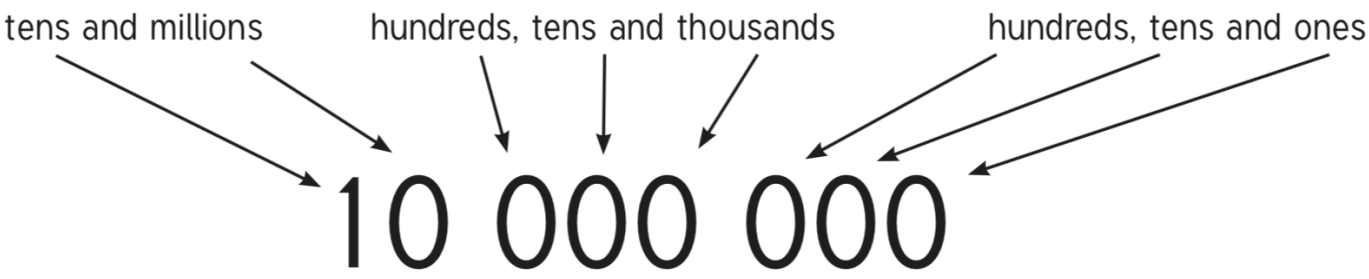
When confident, add or subtract multiples of 10, 100, 1000 such as 30, 400 or 2000.

3. Order and Compare Numbers

Order and compare numbers by looking at the place value. Questions will either include larger numbers or decimals. 34 000 is larger than 7 000 because the first number has ten thousands, which the second number does not, even though the first digit is larger in the second number. When practising, ask children to explain their reasoning.

4. Place Value

Make sure children can recognise the different digits in any number.



5. Roman Numerals

Using the following, children can practise reading and writing numbers in Roman Numerals:

Roman Numeral	M	D	C	L	X	V	I
Represents	1000	500	100	50	10	5	1

The Roman numerals are combined to make numbers.

Usually, up to three of each letter is used, so III is 3, XXX is 30, CCC is 300.

Combined with V, L and D gives 8, 80 and 800: VIII, LXXX, DCCC.

The numbers one before 5 and 10, ten before 50 and 100, 100 before 500 and 1000 are expressed as one, ten or hundred before so: 4 is IV, 9 is IX, 40 is XL, 90 is XC, 400 is CD, 900 is CM.

6. Rounding

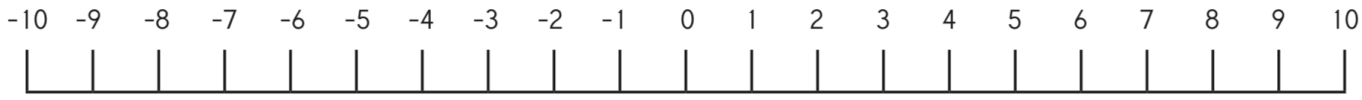
Rounding a number to the nearest 10 means finding the nearest ten to which the number is closer. A number ending in 1, 2, 3, or 4 is rounded down. A number ending in 6, 7, 8 or 9 is rounded up. By convention, a number ending in 5 is also rounded up.

The same rule is applied to rounding to 100. Numbers ending in 1 to 49 are rounded down, 50 to 99 are rounded down. To the nearest 1000, 1 to 499 is rounded down; 500 to 999 is rounded up.

7. Negative Numbers

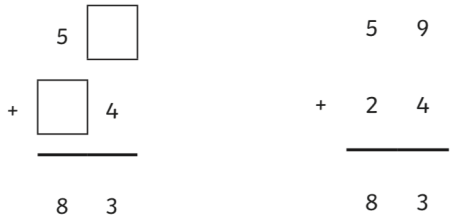
Practise counting backwards and forwards through zero and then finding intervals between positive and negative numbers.

Draw a number line if it helps.



8. Missing Number Questions

Missing number questions assess understanding of formal calculation methods.
In this simple example:



A number added to 4 gives an answer that ends in 3, so _ + 4 = 13, so the missing number is 9.

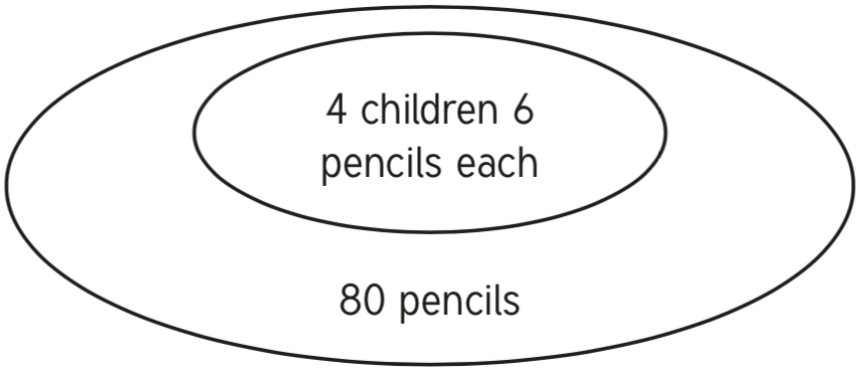
5 added to a number add the regrouped 1 (ten) gives the answer 8, so the missing number is 2.

9. Word Questions

There are two parts to solving word questions. Firstly, to understand the question and decide the calculations needed, and secondly to complete the required calculations.

Sometimes it can help to visualize the question.

For example:



There are 80 pencils. From these 80 pencils, 4 lots of 6 pencils are taken.

The calculation could be written $80 – 6 \times 4$, solved as $80 – 24 = 56$.

Children don't need to write the calculation in the above form, but they need to calculate that there are 24 pencils given to the 4 children and the answer is $80 – 24 = 56$.

There are also questions where the answer can be found by reversing the calculations to find the starting number.

The question starts with an unknown number:

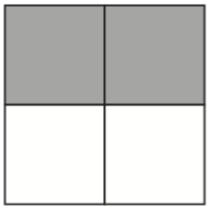
The number is halved and 15 is added. The result is divided by 3, giving an answer of 19.

Reversing gives: $19 \times 3 = 57$, $57 – 15 = 42$, $42 \times 2 = 84$

Full marks are given for the correct answer, but sometimes a mark will be given for a correct method where a mistake is made in the calculating. It is therefore important for children to show how they have calculated an answer.

10. Equivalent Fractions

The basis of equivalent fractions is that all fractions can be expressed in different ways.



This diagram shows that $\frac{1}{2}$ is equivalent to $\frac{2}{4}$. Equivalents fractions can also be found by multiplying or dividing the numerator and denominator by the same number.

$\frac{2}{3} = \frac{8}{12}$: multiply numerator and denominator by 4.

11. Ordering Fractions

There are 2 main ways to order fractions with different denominators. One is to find the equivalent fractions with the same denominator. The other is to convert the fractions into decimals.

For example:

$\frac{2}{3}$ $\frac{5}{6}$ $\frac{7}{12}$

With these fractions the denominators are all multiples of 3. In this case question, converting 3 of the fractions to twelfths is a good option.

$\frac{2}{3} = \frac{8}{12}$, $\frac{5}{6} = \frac{10}{12}$, $\frac{7}{12}$ These can be ordered as follows: $\frac{7}{12} < \frac{2}{3} < \frac{5}{6}$

Converting to decimals can be done using division or can rely upon knowledge of common fractions and decimal equivalents.

$\frac{2}{3} = 0.667$, $\frac{5}{6} = 0.833$, $\frac{5}{9} = 0.556$, giving $\frac{5}{9} < \frac{2}{3} < \frac{5}{6}$

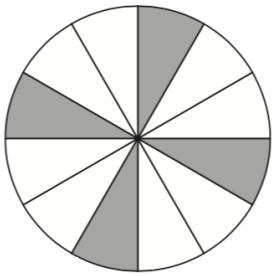
12. Fraction Problems

Fraction problems can take many forms and children need to be confident in using fractions in many different contexts. Many rely upon finding fractions of amounts.

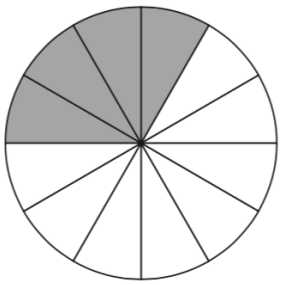
Visual Representations

Younger children will be asked to shade the fraction of a shape where the number of equal parts of the shape is equal to the denominator of the fraction. However, at KS2, the number of parts of the shape will be a multiple of the denominator.

Shading $\frac{1}{3}$ of a shape of 12 equal parts can be done by shading every third part,



or by calculating that $\frac{1}{3}$ of 12 = 4, so 4 parts need to be shaded.



13. Fraction Word Questions

With fraction word questions, as with calculation word questions, there are 2 main parts. Firstly, to understand which calculations are needed, and secondly to perform the calculations accurately.

For example:

At the beginning of the day, Hasim counted his money. He gave his brother $\frac{1}{3}$ of his money. He spent £12 on a present for his sister. He then counted what he had left, and it was half what he had at the beginning of the day. How much did he give his brother?

One way to visually represent this is by using a bar to represent all the money and divide the bar into the different amounts and fractions.

$\frac{1}{3}$ to the brother	£12 gift	$\frac{1}{2}$ is left over
$\frac{2}{6}$	$\frac{1}{6}$	$\frac{3}{6}$

Using equivalent fractions, the £12 gift is $\frac{1}{6}$ of the money. Therefore, the money given to the brother is twice this, £24.

14. Decimal Number Problems

Decimal problems can often involve calculations where it is important to recognise the place value of the decimal numbers.

For example: Circle two numbers that add together to equal 0.75. 0.03 0.7 0.72 0.07

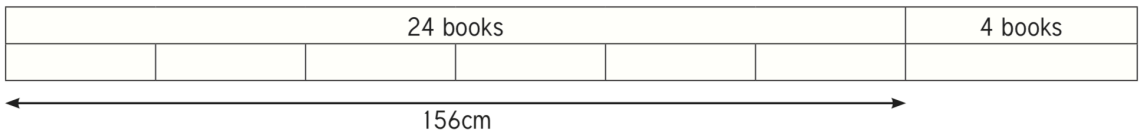
Children need to recognise that when adding 0.03 and 0.72, the 3 and 2 are both hundredths, so the total is 0.75.

Rounding decimals uses the same principals as rounding whole numbers, where the number is rounded to the nearest whole, number, tenth or hundredth, and a 5 is always rounded up. 1.5 rounded to the nearest whole number is 2, because the 5 tenths is rounded up. 1.367 rounded to the nearest tenth is 1.4, because the 6 hundredths is rounded up. In this case, the 7 thousandths is not used in rounding to tenths.

15. Ratio

Ratio questions can be similarly expressed using a bar.

For example: there are 24 books, and 4 more are added.



This bar shows how the 24 books can be divided into 6 sets of 4 books. Therefore, 4 books will measure 156 ÷ 6 = 26cm. The new width will be 156 + 26 = 182cm.

16. Algebra

To calculate 3n – 15 when n = 24, place 24 in the place of n.

3n = 3 × n = 3 × 24 = 72

3n – 15 = 72 – 15 = 57

To calculate the value of t in 28 – 3t = 10, there are various methods.

One is to calculate the value of 3t by calculating what is subtracted from 28 to make 10. 3t = 18.

If 3t = 18, calculate what is multiplied by 3 to give 18. So t = 6.

17. Time

Children are expected to read analogue and digital clocks and watches in 12 and 24 hour time, up to 1 minute intervals. Analogue clocks use both numbers and Roman numerals.

Children are also expected to convert measurements of time, such as minutes into hours and minutes.

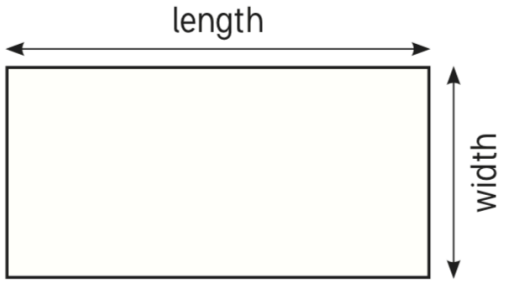
Practise using clocks at home.

18. Money

Children need to be able to combine coins to make amounts of money and calculate totals and change.

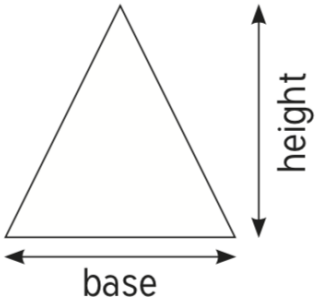
19. Area and Perimeter

Children need to know that the area of rectangles can be calculated by multiplying the length and width.

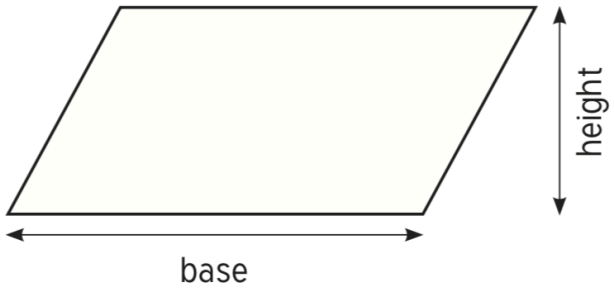


This is then applied to finding the area of triangles and parallelograms.

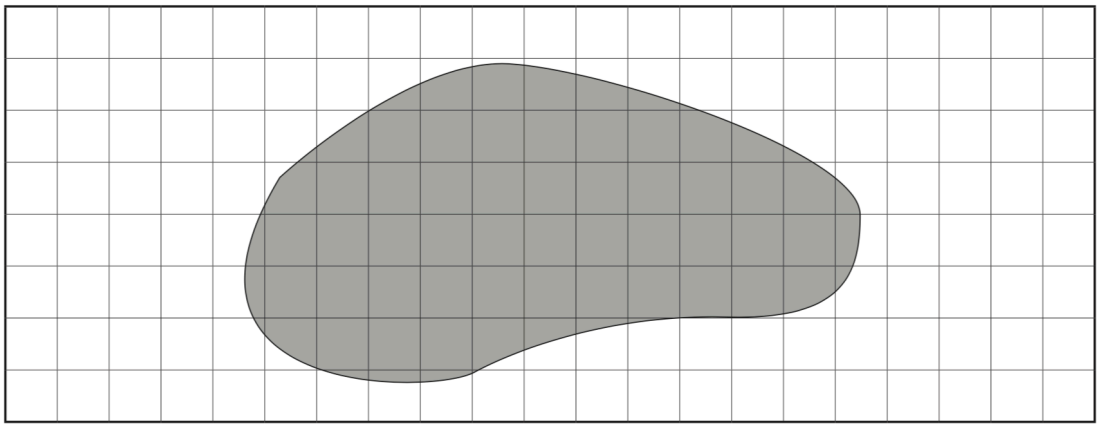
The area of a triangle is the length of the base × the height ÷ 2



The area of a parallelogram is the length of the base × the height.

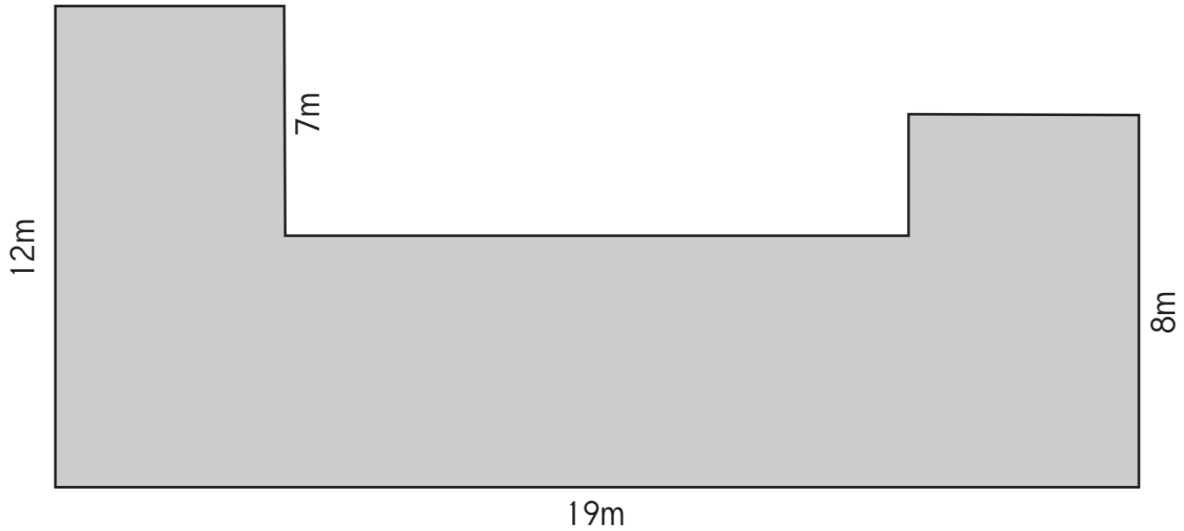


Children will also need to estimate the area of irregular shapes.



Children should count the whole squares and then those more than half shaded.

To calculate the perimeter of rectilinear shapes (rectilinear shapes have all angles as right angles), children need to calculate the lengths of all the sides, or the combined length of all sides.



With this example the length of the 3 horizontal sides at the top will be 19m. There is one unknown vertical side. Because 7m + 8m is 3m longer than the 12m on the left-hand side, the unknown vertical side is 3m. These measurements can be used to calculate the whole perimeter as 68m.

20. Measurement

Children are expected to calculate and convert grams and kilograms as part of a question.

For example: Divide 1kg of apples by 8.

1kg = 1000g, so divide 1000g by 8 to give 125g.

Children are expected to use scales on jugs and other capacity measuring containers.

Children will need to measure to the nearest millimeter with a ruler. Remember to start at 0.
As with mass, some questions may involve converting from ml to litres and mm to cm to metres to km.

21. Symmetry

Children are expected to be able to recognise symmetry and draw symmetrical shapes, usually by being given a shape to complete across a mirror line. Sometime, children find tracing paper helpful. However, children should also be encouraged to hold symmetrical drawings up in front of them with the mirror line vertical in order to see the symmetry. Sometimes this will mean rotating the drawing, as with Q1 above.

22. Properties of Shape

Children are expected to recognise and name 2D and 3D shapes, describe their properties and sort shapes according to these properties.

There is no definitive list of shapes, although it can reasonably be expected that children need to know the following:

2D Shapes

Number of sides	Shape type*	Shape name		Main feature
3	triangle	equilateral triangle		all sides and angles equal
		isosceles triangle		two sides and angles equal
		scalene triangle		no sides and angles equal
		right-angled triangle		one angle is a right angle
4	quadrilateral	square		all sides equal and all angles right angles
		rectangle		opposite sides equal and all angles right angles
		rhombus		all sides equal

	quadrilateral	parallelogram		opposite sides equal
		trapezium		one pair of opposite sides parallel
		kite		two pairs of adjacent sides equal
5	regular and irregular polygons (regular polygons have equal sides and angles)	pentagon		five sides
6		hexagon		six sides
7		heptagon		seven sides
8		octagon		eight sides
9		nonagon		nine sides
10		decagon		ten sides
12		dodecagon		twelve sides
1	one curved side	circle		all points of the line are the same distance from the centre
		ellipse		

*The shape type is a helpful category. In fact all 2D shapes are polygons.

3D shapes

Shapes	2D image	Brief description
sphere		The shape of a ball. Has one curved surface.
cube		6 square faces, similar to a dice.
cuboid		6 rectangular faces.
cone		One flat circular face and a curved surface ending in a point, similar to an ice cream cone.
cylinder		2 flat circular faces and one curved surface, similar to a tin can.
tetrahedron		4 triangular faces, similar to pyramid with a triangular base.
square-based pyramid		Square base with 4 triangular faces, similar to the Egyptian pyramids.
prisms		The same shape at either end, joined by a number of rectangles equal to the number of sides of the end shapes. The shape at each end defines the name of the shape, e.g. hexagonal prism.

Shapes are often sorted using Carroll Diagrams or Venn Diagrams.

Children will also be expected to accurately draw some of these shapes according to certain criteria. They also need to know the language of perpendicular, parallel, horizontal and vertical.

23. Coordinates

Children need to use coordinates in all 4 quadrants, which means using negative numbers as well as positive numbers. The quadrants are the 4 areas divided up by the axes, the lines. Most questions ask children to calculate the coordinates of a given shape or shapes using some given coordinates. Often the shape has been translated (moved and kept the same size) or reflected. The numbers are not usually large.

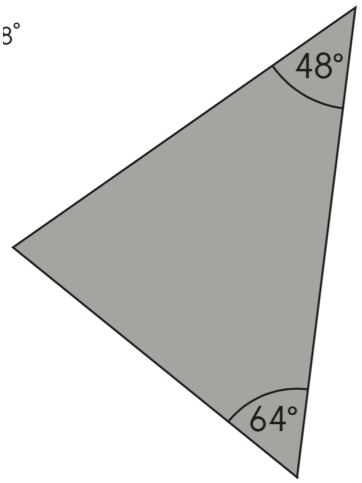
24. Angles

Children are expected to estimate, measure, draw and calculate angles. Estimation is important in giving children an understanding of the approximate size of angles. It is very helpful to estimate angles to the nearest 10° – 20°.

Children will measure and draw using a protractor or angle measurer. The most important aspects of doing this is getting the centre of the protractor or angle measurer on the angle and measuring the correct angle as most protractors and angle measurer's have two set of numbers, one for each direction.

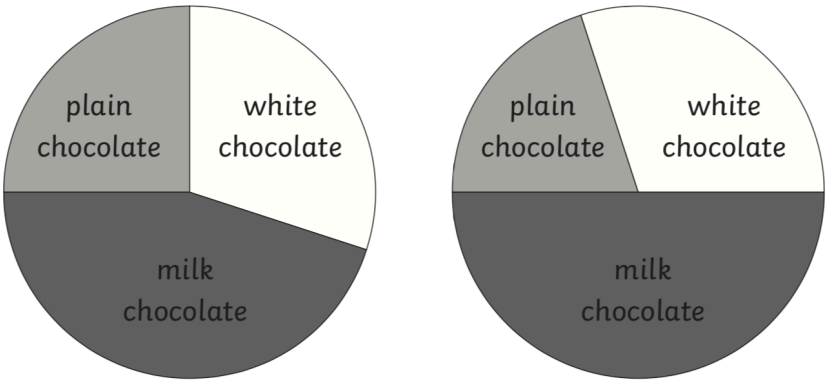
Calculating angles relies upon knowing that there are 180° in a straight line and a triangle, and 360° in a circle.

Missing angle = 180° – 48°+ 64° = 180° – 112° = 68°



25. Pie Charts

Pie charts are circles divided up into pieces of pie, which represent different values of data.
In the example question, there are 2 pies. One represents twice as many children as the other.



100 girls 50 boys

$\frac{1}{4}$ or 25% of the pie chart representing 100 girls represents 25 girls who like plain chocolate.

$\frac{1}{2}$ or 50% of the pie chart representing 50 boys represents 25 boys who like milk chocolate.

Children need to calculate and compare these pie charts. It can be helpful to estimate the numbers of boys and girls who liked the other chocolates best. Do the totals add up to 100 girls and 50 boys?

26. Bar Charts

Bar charts for Year 6 may take a different form to the traditional bar chart used by younger children, which has one bar for each set of data. Children have to calculate how much each section of the bar represents using the measurement at the beginning and end of each section.

27. Mean Average

The average mean is calculated by adding all the values of a set of data and dividing by the number of values. It is the mathematical process of sharing data equally.