

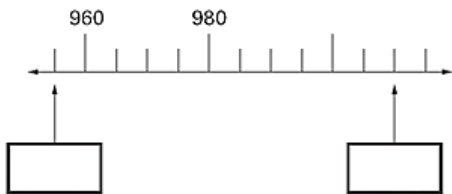
Stage 6 Exemplification

Examples of what children should be able to do, in relation to each (boxed) Programme of Study statement

Number and Place Value

read, write, order and compare numbers up to 10 000 000 and determine the value of each digit

Children should be able to determine the steps used in different scales, and so complete activities such as;



round any whole number to a required degree of accuracy

Children should be able to circle the best estimate of the answer to questions such as;

$$72.34 \div 8.91$$

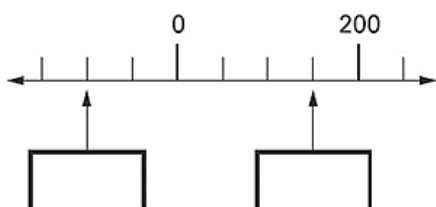
When given

6 7 8 9 10 11 as possible answers

Children should **estimate** the position of numbers on a number line. They should suggest which number lies about two-fifths of the way along a line from 0 to 1000, or a line from 0 to 1. They should be able to justify their decisions.

use negative numbers in context, and calculate intervals across zero

Children should be able to work with negative numbers in a similar way, determining values on a scale and estimating.



solve number and practical problems that involve all of the above

Children should be able to use rounding and inverse operations to estimate and check calculations such as;

The temperature inside an aeroplane is 20°C The temperatures outside the aeroplane is -30°C . What is the difference between these temperatures?

Addition and Subtraction

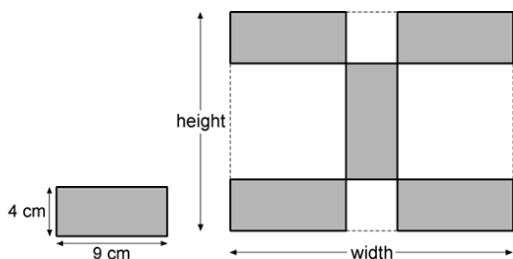
solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why

Two numbers have a difference of 1.583. One of the numbers is 4.728. What is the other? Is this the only answer?

solve problems involving addition, subtraction, multiplication and division

use estimation to check answers to calculations and determine, in the context of a problem, levels of accuracy

- Identify subtractions they can do without writing anything down
- Identify why it is possible to solve a calculation mentally, explain the clues they looked for and then solve it
- Peter has £10. He buys 3 kg of potatoes at 87p per kg and 750 g of tomatoes at £1.32 per kg. How much money does he have left?
- Each tile is 4 centimetres by 9 centimetres.



Calculate the width and height of the design.

Write down the calculations that you did

Multiplication and Division

multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication

- Look at long-multiplication calculations containing errors, identify the errors and determine how they should be corrected.
- Solve problems such as: Printing charges for a book are 3p per page and 75p for the cover. I paid £4.35 to get this book printed. How many pages are there in the book? Write down the calculations that you did. Seeds are £1.45 for a packet. I have £10 to spend on seeds. What is the greatest number of packets I can buy?

divide numbers up to 4 digits by a two-digit whole number using the formal written method of long division, and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate for the context

- Every day a machine makes 100 000 paper clips, which go into boxes. A full box has 120 paper clips. How many full boxes can be made from 100 000 paper clips?

Each paper clip is made from 9.2 centimetres of wire. What is the greatest number of paper clips that can be made from 10 metres of wire?

- A DJ has two different sized storage boxes for her CDs. Small boxes hold 15 CDs. Large boxes hold 28 CDs. The DJ has 411 CDs. How could the DJ pack her CDs?

solve problems involving multiplication and division

use estimation to check answers to calculations and determine, in the context of a problem, levels of accuracy

Children should be able to:

- Give the best approximation to work out 4.4×18.6 and explain why. Answer questions such as: roughly, what answer do you expect to get? How did you arrive at that estimate? Do you expect your answer to be greater or less than your estimate? Why?

perform mental calculations, including with mixed operations and large numbers

- Use mental strategies to calculate in their heads, using jottings and/or diagrams where appropriate. For example, to calculate 24×15 , they multiply 24×10 and then halve this to get 24×5 , adding these two results together. They record their method as $(24 \times 10) + (24 \times 5)$. Alternatively, they work out $24 \times 5 = 120$ (half of 24×10), then multiply 120 by 3 to get 360.

identify common factors, common multiples and prime numbers

- Children should be able to answer questions such as:
 - How can you use factors to multiply 17 by 12?
 - Start from a two-digit number with at least six factors, e.g. 72. How many different multiplication and division facts can you make using what you know about 72? What facts involving decimals can you derive?
 - What if you started with 7.2? What about 0.72?
 - Which three prime numbers multiply to make 231?
 - use their knowledge of the order of operations to carry out calculations involving the four operations
- Children should be able to find answers to calculations such as $5.6 \square = 0.7$ or 3×0.6 , drawing on their knowledge of number facts and understanding of place value. They should be able to approximate, use inverses and apply tests of divisibility to check their results.
- Children should know the square numbers up to 12×12 and derive the corresponding squares of multiples of 10, for example $80 \times 80 = 6400$.

Fractions (including decimals and percentages)

use common factors to simplify fractions; use common multiples to express fractions in the same denomination

Children should be able to recognise that a fraction such as $\frac{5}{20}$ can be reduced to an equivalent fraction of $\frac{1}{4}$ by dividing both numerator and denominator by the same number [cancelling] They should also be familiar with identifying fractions in different units. E.g. what fraction is 20 pence of two pounds? Of four pounds etc...

compare and order fractions, including fractions >1

Children should be able to:

- i] Position fractions on a number line; e.g. mark fractions such as $\frac{7}{5}$, $1\frac{1}{20}$, $1\frac{8}{12}$ on a number line graduated in tenths
- ii] Answer questions such as: What number is half way between $5\frac{1}{4}$ and $5\frac{1}{2}$?
- iii] Which is larger, $\frac{1}{3}$ or $\frac{2}{5}$? Explain how you know.

associate a fraction with division to calculate decimal fraction equivalents (e.g. 0.375) for a simple fraction (e.g. $\frac{3}{8}$)

Children should be able to find fractions of numbers and quantities;

- i] What fraction of £1 is 35p, ... 170p ?
- ii] Write $\frac{23}{100}$ of 4 kilogrammes in grams
- iii] What fraction of 1 litre is 413 ml?

Convert a fraction to a decimal using known equivalent fractions:

- i] $\frac{1}{4} = 0.25$
- ii] $\frac{2}{5} = 0.4$

add and subtract fractions with different denominators and mixed numbers, using the concept of equivalent fractions

Children should be able to solve practical problems such as;



Here is a chocolate bar.

This material is part of a comprehensive planning and resource tool produced by the National Centre for Excellence in the Teaching of Mathematics (www.ncetm.org.uk). The full tool can be found at www.ncetm.org.uk/resources/41211

William eats 3 pieces and Amber eats 2 pieces. What fraction of the chocolate bar remains?

Joe has some pocket money. He spends three-quarters of it. He has fifty pence left. How much pocket money did he have?

multiply simple pairs of proper fractions, writing the answer in its simplest form, (e.g. $\frac{1}{4} \times \frac{1}{2} = \frac{1}{8}$)

Children should be able to:

i] Recognise that $\frac{1}{4}$ of 12, $\frac{1}{4} \times 12$ and 12 divided by 4 are equivalent

ii] Use cancellation to simplify the product of a fraction and an integer

eg $\frac{1}{5} \times 15 = 3$

$\frac{2}{5} \times 15 = 2 \times \frac{1}{5} \times 15 = 2 \times 3 = 6$

ii] Work out how many $\frac{1}{2}$ s in 15, how many $\frac{2}{5}$ s in 15, how many $\frac{2}{5}$ s in 1 etc.

divide proper fractions by whole numbers (e.g. $\frac{1}{3} \div 2 = \frac{1}{6}$)

Children should be able to:

Decide whether they would prefer to share $\frac{1}{2}$ of a pizza with 2 people or $\frac{3}{4}$ of a pizza with 4 people and explain why.

associate a fraction with division and calculate decimal fraction equivalents (e.g. 0.375) for a simple fraction (e.g. $\frac{3}{8}$)

Children should be able to:

Explain how much pizza each person would get if they divided 4 pizzas between 5 people, as a fraction and a decimal

identify the value of each digit to three decimal places and multiply and divide numbers by 10, 100 and 1000 where the answers are up to three decimal places

Children should be able to identify the value of each digit in the number 17.036 and multiply and divide this by 10, 100 and 1000

multiply one-digit numbers with up to two decimal places by whole numbers

Children should be able to calculate the answer to questions such as;

What is 3.86 multiplied by nine?

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use written division methods in cases where the answer has up to two decimal places

Children should be able to calculate 601 divided by 36, to two decimal places

solve problems which require answers to be rounded to specified degrees of accuracy

Children should be able to solve problems such as;

Four friends win £48,623. The money is to be shared equally between them – how much will each person receive?

107 pupils and teachers need to be taken to the theatre. How many 15-seater minibuses will be required?

How many boxes of 60 nails can be filled from 340 nails?

recall and use equivalences between simple fractions, decimals and percentages, including in different contexts.

Children should be able to put a ring around the percentage that is equal to three-fifths;

20% 30% 40% 50% 60%

As well as circle the two fractions that are equivalent to 0.6.

$\frac{6}{10}$ $\frac{1}{60}$ $\frac{60}{100}$ $\frac{1}{6}$

Ratio and Proportion

solve problems involving the relative sizes of two quantities where missing values can be found by using integer multiplication and division facts

Answer problems such as:

- Here is a recipe for pasta sauce.

Pasta sauce

300 g tomatoes

120 g onions

75 g mushrooms

Sam makes the pasta sauce using 900 g of tomatoes. What weight of onions should he use? What weight of mushrooms?

- A recipe for 3 portions requires 150 g flour and 120 g sugar. Desi's solution to a problem says that for 2 portions he needs 80 g flour and 100 g sugar. What might Desi have done wrong? Work out the correct answer.
- This map has a scale of 1 cm to 6 km.

The road from Ridlington to Carborough measured on the map is 6.6 cm long. What is the length of the road in kilometres?

solve problems involving the calculation of percentages (e.g. of measures) such as 15% of 360 and the use of percentages for comparison

Find simple percentages of amounts and compare them. For example:

- A class contains 12 boys and 18 girls. What percentage of the class are girls? What percentage are boys?
- 25% of the apples in a basket are red. The rest are green. There are 21 red apples. How many green apples are there?

solve problems involving similar shapes where the scale factor is known or can be found

- Solve simple problems involving direct proportion by scaling quantities up or down, for example:

Two rulers cost 80 pence. How much do three rulers cost?

- Use the vocabulary of ratio and proportion to describe the relationships between two quantities solving problems such as:

Two letters have a total weight of 120 grams. One letter weighs twice as much as the other. Write the weight of the heavier letter.

The distance from A to B is three times as far as from B to C. The distance from A to C is 60 centimetres. Calculate the distance from A to B.



solve problems involving unequal sharing and grouping using knowledge of fractions and multiples

Relate fractions to multiplication and division (e.g. $6 \div 2 = \frac{1}{2}$ of 6 = $6 \times \frac{1}{2}$), simplify fractions by cancelling common factors, find fractions of whole-number quantities and solve problems such as:

- What fraction is 18 of 12

- What fraction is 500ml of 400ml?
- What is $\frac{14}{35}$ in its simplest form? $\frac{2}{5}$
- What $\frac{1}{3} \times 15$? What about $15 \times \frac{1}{3}$? How did you work it out?
- What is two thirds of 66?
- What is three quarters of 500?

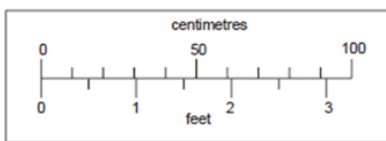
Measurement

solve problems involving the calculation and conversion of units of measure, using decimal notation up to three decimal places where appropriate

- Children should be able to draw a flow chart to help someone else convert between mm, cm, m and km.
- They should be able to answer questions such as: approximately how many litres are there in 3 gallons? Give your answer to the nearest litre.

use, read, write and convert between standard units, converting measurements of length, mass, volume and time from a smaller unit of measure to a larger unit, and vice versa, using decimal notation to up to three decimal places

This scale (not actual size) shows length measurements in centimetres and feet.



Look at the scale. Estimate the number of centimetres that are equal to $2\frac{1}{2}$ feet.

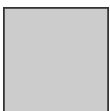
Estimate the difference in centimetres between 50 cm and 1 foot.

convert between miles and kilometres

- Pupils should know the approximate equivalence between commonly used imperial units and metric units:
 - e.g. 1 litre is approximately 2 pints (more accurately, $1\frac{3}{4}$ pints)
 - 4.5 litres is approximately 1 gallon or 8 pints
 - 1 kilogram is approximately 2 lb (more accurately, 2.2 lb)
 - 30 grams is approximately 1 oz
 - 8 kilometres is approximately 5 miles
- Children should be able to use conversion graphs that show miles/kilometres. They should be able to use it to estimate a distance of 95 miles in kilometres.

recognise that shapes with the same areas can have different perimeters and vice versa

The perimeter of a square is 72 centimetres.



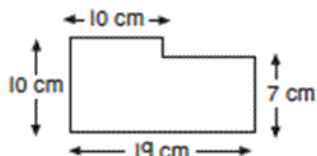
The square is cut in half to make two identical rectangles.



What is the perimeter of one rectangle?

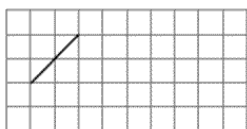
recognise when it is possible to use formulae for area and volume of shapes

Children should be able to calculate the perimeters of compound shapes that can be split into rectangles. For example,



calculate the area of parallelograms and triangles

This is a centimetre grid. Draw 3 more lines to make a parallelogram with an area of 10cm^2 . Use a ruler.

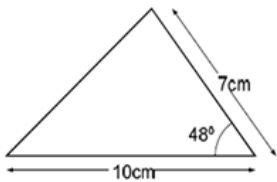


Geometry – properties of shapes

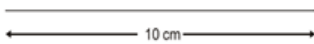
draw 2-D shapes using given dimensions and angles

Children should be able to construct a triangle given two sides and the included angle

Here is a sketch of a triangle. (It is not drawn to scale).



Draw the full size triangle accurately, below. Use an angle measurer (protractor) and a ruler. One line has been drawn for you.



recognise, describe and build simple 3-D shapes, including making nets

Children should be able to identify, visualise and describe properties of rectangles, triangles, regular polygons and 3-D solids; use knowledge of properties to draw 2-D shapes and identify and draw nets of 3-D shapes

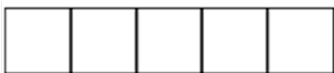
They should be able to respond accurately to questions such as;

'I am thinking of a 3D shape. It has a square base. It has four other faces which are triangles. What is the name of the 3D shape?'

'Which of these nets are of square based pyramids? How do you know?'



'Is this a net for an open cube?' How do you know?'



compare and classify geometric shapes based on their properties and sizes and find unknown angles in any triangles, quadrilaterals, and regular polygons

Children should be able to make and draw shapes with increasing accuracy and knowledge of their properties.

They should be able to carry out activities such as;

'Give me instructions to get me to draw a rhombus using my ruler and a protractor'

'On the grid below, use a ruler to draw a pentagon that has three right angles'

illustrate and name parts of circles, including radius, diameter and circumference and know that the diameter is twice the radius

They should know that:

- The circumference is the distance round the circle
- The radius is the distance from the centre to the circumference
- The diameter is $2 \times$ radius

recognise angles where they meet at a point, are on a straight line, or are vertically opposite, and find missing angles

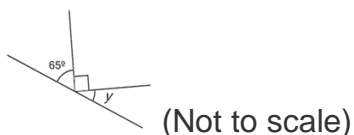
Children should be able to estimate angles, use a protractor to measure and draw them, on their own and in shapes. They should know that the angle sum of a triangle is 180° , and the sum of angles around a point is 360° .

They should be able to use this knowledge to respond accurately to questions such as;

'There are nine equal angles around a point. What is the size of each angle?'

'There are a number of equal angles around a point. The size of each angle is 24° . How many equal angles are there?'

Children should be able to calculate the size of angle 'y' in this diagram without using a protractor.

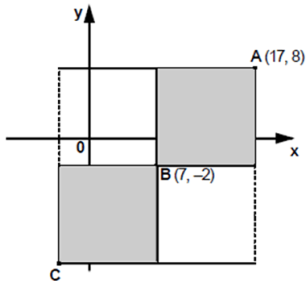


Geometry – position and direction

describe positions on the full coordinate grid (all four quadrants)

Children should be able to answer questions such as;

The two shaded squares below are the same size.



A is the point (17,8). B is the point (7,-2).

What are the co-ordinates of the point C?

draw and translate simple shapes on the coordinate plane, and reflect them in the axes

Children should be able to draw a shape with corners at given vertices, and describe the properties of the shape. Can they create the same shape where all of the coordinates will be positive? Negative?

They should be able to sketch the reflection of a simple shape in two mirror lines at right angles and find the coordinates of selected points.

Statistics

find pairs of numbers that satisfy number sentences with two unknowns
enumerate all possibilities of combinations of two variables.

Children should be confident to answer questions such as;

Here are five number cards:



A and B stand for two different whole numbers.

The sum of all the numbers on all five cards is 30.

What could be the values of A and B?

express missing number problems algebraically
use simple formulae

Children should be able to express a relationship in symbols, and start to use simple formulae.
For example:

- Use symbols to write a formula for the number of months m in y years.
- Write a formula for the cost of c chews at $4p$ each.
- Write a formula for the n th term of this sequence: 3, 6, 9, 12, 15...
- The perimeter of a rectangle is $2 \times (l + b)$, where l is the length and b is the breadth of the rectangle.
- What is the perimeter if $l = 8$ cm and $b = 5$ cm?
- The number of bean sticks needed for a row which is m metres long is $2m + 1$. How many bean sticks do you need for a row which is 60 metres long?
- Plot the points which show pairs of numbers with a sum of 9.

generate and describe linear number sequences

Children should experience activities such as;

A number sequence is made from counters.

There are 7 counters in the third number.



How many counters in the 6th number? the 20th...?

Write a formula for the number of counters in the n th number in the sequence.