National Curriculum for Mathematics 2014

Exemplification of the Programmes of Study for

YEAR 5

This document brings together the exemplification materials that are available on the NCETM website. Where there were gaps on the website, we have included other examples from past SATs papers and NCETM Mastery documents.

fluency, reasoning and problem-solving

Contents

Purpose of study

Mathematics is a creative and highly inter-connected discipline that has been developed over centuries, providing the solution to some of history's most intriguing problems. It is essential to everyday life, critical to science, technology and engineering, and necessary for financial literacy and most forms of employment. A high-quality mathematics education therefore provides a foundation for understanding the world, the ability to reason mathematically, an appreciation of the beauty and power of mathematics, and a sense of enjoyment and curiosity about the subject.

Aims

The national curriculum for mathematics aims to ensure that all pupils:

- become **fluent** in the fundamentals of mathematics, including through varied and frequent practice with increasingly complex problems over time, so that pupils develop conceptual understanding and the ability to recall and apply knowledge rapidly and accurately.
- **reason mathematically** by following a line of enquiry, conjecturing relationships and generalisations, and developing an argument, justification or proof using mathematical language
- can **solve problems** by applying their mathematics to a variety of routine and non-routine problems with increasing sophistication, including breaking down problems into a series of simpler steps and persevering in seeking solutions.

Mathematics is an interconnected subject in which pupils need to be able to move fluently between representations of mathematical ideas. The programmes of study are, by necessity, organised into apparently distinct domains, but pupils should make rich connections across mathematical ideas to develop fluency, mathematical reasoning and competence in solving increasingly sophisticated problems. They should also apply their mathematical knowledge to science and other subjects.

The expectation is that the majority of pupils will move through the programmes of study at broadly the same pace. However, decisions about when to progress should always be based on the security of pupils' understanding and their readiness to progress to the next stage. Pupils who grasp concepts rapidly should be challenged through being offered rich and sophisticated problems before any acceleration through new content. Those who are not sufficiently fluent with earlier material should consolidate their understanding, including through additional practice, before moving on.

The School Curriculum

The programmes of study for mathematics are set out year-by-year for key stages 1 & 2. Schools are, however, only required to teach the relevant programme of study by the end of the key stage. Within each key stage, schools therefore have the flexibility to introduce content earlier or later than set out in the programme of study.

YEAR 5 – Number and Place Value

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

read, write, order and compare numbers to at least 1 000 000 and determine the value of each digit

Explain what each digit represents in whole numbers and decimals with up to two places and partition, round and order these numbers.

Answer problems such as

- What is the value of the 7 in 3 274 105?
- Write in figures forty thousand and twenty.
- A number is partitioned like this:

  4 000 000 + 200 000 + 60 000 + 300 + 50 + 8

  Write the number. Now read it to me.

- A car costs more than £8600 but less than £9100. Tick the prices that the car might cost.

  £8569 ☐ £9090 ☐ £9130 ☐ £8999 ☐

count forwards or backwards in steps of powers of 10 for any given number up to 1 000 000

Count from any given number in powers of 10 and decimal steps extending beyond zero when counting backwards; relate the numbers to their position on a number line

Answer problems such as:

- Write the next number in this counting sequence: 110 000, 120 000, 130 000 …
- Create a sequence that goes backwards and forwards in tens and includes the number 190. Describe your sequence.
- Here is part of a sequence: 30, 70, 110, □, 190, □. How can you find the missing numbers?

interpret negative numbers in context, count forwards and backwards with positive and negative whole numbers, including through 0

Count from any given number in whole-number and decimal steps extending beyond zero when counting backwards; relate the numbers to their position on a number line.

round any number up to 1 000 000 to the nearest 10 100 1 000 10 000 and 100 000

Explain what each digit represents in whole numbers and decimals with up to two places and partition round and order these numbers and answer questions such as:

- What is 4773 rounded to the nearest hundred?

solve number problems and practical problems that involve all of the above

Partition decimals using both decimal and fraction notation for example recording 6.38 as $6 + \frac{3}{10} + \frac{8}{100}$ and as 6 + 0.3 + 0.08.

Write a decimal given its parts: e.g. record the number that is made from 4 wholes 2 tenths and 7 hundredths as 4.27. Apply understanding in activities such as:

- Find the missing number in $17.82 - \square = 17.22$
- Play ‘Zap the digit’: In pairs choose a decimal to enter into a calculator e.g. 47.25. Take turns to ‘zap’ (remove) a particular digit using subtraction. For example, to ‘zap’ the 2 in 47.25 subtract 0.2 to leave 47.05.
- The children explain how they work out calculations showing understanding of the place value that underpins written methods.

read Roman numerals to 1000 (M) and recognise years written in Roman numerals

Recognise Roman numerals in their historical context

Read and write Roman numerals to one thousand

YEAR 5 – Addition and Subtraction

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

add and subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction)

Use standard written methods for addition and subtraction,

e.g. calculate 14 136 + 3258 + 487 or 23 185 – 2078

Use written methods to find missing numbers in addition and subtraction calculations,

e.g. 6432 + $\square$ = 8025

Use written methods to add and subtract numbers with different numbers of digits,

e.g. Find all the different totals that can be made using any three of these five numbers:
14 721, 76, 9534, 788, 6

add and subtract numbers mentally with increasingly large numbers

Respond rapidly to oral or written questions, explaining the strategy used,

e.g. 750 take away 255, take 400 from 1360, 4500 minus 1050, subtract 3250 from 7600, 1800 less than 3300, 4000 less than 11 580

Derive quickly related facts,

e.g. 80 + 50 = 130, 130 – 50 = 80, 800 + 500 = 1300, 1300 – 800 = 500

Derive quickly number pairs that total 100 or pairs of multiples of 50 that total 1000,

e.g. 32 + 68 = 100 or 150 + 850 = 1000

Identify and use near doubles,

e.g. work out 28 + 26 = 54 by doubling 30 and subtracting first 2, then 4, or by doubling 26 and adding 2

Add or subtract the nearest multiple of 10, 100 or 1000 and adjust,

e.g. adding or subtracting 9, 19, 29 ... to/from any two-digit number

Work out mentally by counting up from a smaller to a larger number e.g. 8000 – 2785 is 5 + 10 + 200 + 5000 = 5215

Understand and use language associated with addition and subtraction, e.g. difference, sum, total

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

Use rounding to approximate and check e.g.

2593 + 6278 must be more than 2500 + 6200

2403 – 1998 is about 2400 – 2000

Write approximate answers to calculations, e.g. write an approximate answer for 516 ÷ (15 + 36)

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

Choose the appropriate operations to solve multi-step problems, decide whether the calculations can be done mentally or using a written method and explain and record how the problem was solved using numbers, signs and symbols.

- 13 502 people were at the match last week and there are 2483 more this week, how many more people need to attend to bring the total to the club's target of 20 000 people?

Identify and obtain the necessary information to solve the problem and determine if there is any important information missing,

- calculate total cost of a holiday for a family, given prices for adults and children and surcharges for particular resorts.

YEAR 5 – Multiplication and Division

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

identify multiples and factors, including finding all factor pairs of a number, and common factors of 2 numbers

know and use the vocabulary of prime numbers, prime factors and composite (non-prime) numbers

establish whether a number up to 100 is prime and recall prime numbers up to 19

Use the vocabulary factor, multiple and product.

Identify all the factors of a given number; for example, the factors of 20 are 1, 2, 4, 5, 10 and 20. Answer questions such as:

- Find some numbers that have a factor of 4 and a factor of 5. What do you notice?
- My age is a multiple of 8. Next year my age will be a multiple of 7. How old am I?

Recognise that numbers with only two factors are prime numbers and can apply their knowledge of multiples and tests of divisibility to identify the prime numbers less than 100.

Explain that 73 children can only be organised as 1 group of 73 or 73 groups of 1, whereas 44 children could be organised as 1 group of 44, 2 groups of 22, 4 groups of 11, 11 groups of 4, 22 groups of 2 or 44 groups of 1.

Explore the pattern of primes on a 100-square, explaining why there will never be a prime number in the tenth column and the fourth column.

multiply numbers up to 4 digits by a one- or two-digit number using a formal written method, including long multiplication for two-digit numbers

Develop and refine written methods for multiplication.

Move from expanded layouts (such as the grid method) towards a compact layout for HTU × U and TU × TU calculations.

Suggest what the approximate answer to be before starting a calculation and use this to check that the answer sounds sensible. For example, 56 × 27 is approximately 60 × 30 = 1800.

$$\begin{array}{rr} 56 & \\ \times\ 27 & \\ \hline 1000 & 50\times 20 = 1000 \\ 120 & 6\times 20 = 120 \\ 350 & 50\times 7 = 350 \\ 42 & 6\times 7 = 42 \\ \hline 1512 & \\ 1 & \end{array}$$

Answer: 1512

$$\begin{array}{rr} 56 & \\ \times\ 27 & \\ \hline 1120 & 56\times 20 \\ 392 & 56\times 7 \\ \hline 1512 & \\ 1 & \end{array}$$

Answer: 1512

multiply and divide numbers mentally, drawing upon known facts

Rehearse multiplication facts and use these to derive division facts, to find factors of two-digit numbers and to multiply multiples of 10 and 100, e.g. 40 × 50.

Use and discuss mental strategies for special cases of harder types of calculations, for example to work out 274 + 96, or 8006 – 2993, 35 × 11, 72 ÷ 3, 50 × 900. etc

Use factors to work out a calculation such as 16 × 6 by thinking of it as 16 × 2 × 3.

Record their methods using diagrams (such as number lines) or jottings and explain methods to each other. Compare alternative methods for the same calculation and discuss any merits and disadvantages.

divide numbers up to 4 digits by a one-digit number using the formal written method of short division and interpret remainders appropriately for the context

Extend written methods for division to include HTU ÷ U, including calculations with remainders. Suggest an approximate answer before starting a calculation and use this to check that the answer sounds sensible. Increase the efficiency of the methods being used. For example:

196 ÷ 6 is approximately 200 ÷ 5 = 40

3 2 r4 or 4/6 or 2/3 (as well as using short division methods)

Know that, depending on the context, answers to division questions may need to be rounded up or rounded down. Explain whether to round up or down to answer problems such as:

- Egg boxes hold 6 eggs. A farmer collects 439 eggs. How many boxes can he fill?
- Egg boxes hold 6 eggs. How many boxes must a restaurant buy to have 200 eggs?

multiply and divide whole numbers and those involving decimals by 10, 100 and 1,000

Recall quickly multiplication facts up to 10 × 10 and use them to multiply pairs of multiples of 10 and 100. Answer problems such as:

- the product is 400. At least one of the numbers is a multiple of 10. What two numbers could have been multiplied together? Are there any other possibilities?

recognise and use square numbers and cube numbers, and the notation for squared (^{2}) and cubed (^{3})

Solve problems involving multiplication and division, including using their knowledge of factors and multiples, squares and cubes

Use knowledge of multiplication facts to derive quickly squares of numbers to 12 × 12 and the corresponding squares of multiples of 10. They should be able to answer problems such as:

Tell me how to work out the area of a piece of cardboard with dimensions 30 cm by 30 cm

Find two square numbers that total 45

solve problems involving addition, subtraction, multiplication and division and a combination of these, including understanding the meaning of the equals sign

Use written methods to solve problems and puzzles such as:

275	382	81	174
206	117	414	262
483	173	239	138
331	230	325	170

Choose any four numbers from the grid and add them.

Find as many ways as possible of making 1000.

Place the digits 0 to 9 to make this calculation correct:

□□□□ – □□□ = □□□

Two numbers have a total of 1000 and a difference of 246. What are the two numbers?

solve problems involving multiplication and division, including scaling by simple fractions and problems involving simple rates

Children use multiplication and division as inverses to support the introduction of ratio in Year 6.

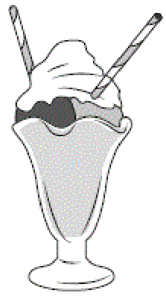
Cream cheese costs £3.60 per kilogram.

Bobby spends 90p on a pot of cream cheese.

How much cheese does Bobby buy?

Here are the ingredients for chocolate ice cream -

cream	400 ml
milk	500 ml
egg yolks	4
chocolate	120 g
sugar	100 g



Stefan only has 300ml of cream, how much chocolate should he use?

YEAR 5 - Fractions

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

compare and order fractions whose denominators are all multiples of the same number

Children should be able to circle the two fractions that have the same value, or choose which one is the odd one out and justify their decision.
$\frac{6}{10}$, $\frac{3}{5}$, $\frac{18}{20}$, $\frac{9}{15}$

recognise mixed numbers and improper fractions and convert from one form to the other. Write mathematical statements >1 as a mixed number

(e.g. $\frac{2}{5} + \frac{4}{5} = \frac{6}{5} = 1\frac{1}{5}$)

Put the correct symbol, < or >, in each box.

3.03 ☐ 3.3
0.37 ☐ 0.327

Order these numbers: 0.27 0.207 0.027 2.07 2.7

How many halves in: 1 ½ 3 ½ 9 ½ …?

How many quarters in 1 ¼ 2 ¼ 5 ¼ ….?

multiply proper fractions and mixed numbers by whole numbers

What is $\frac{3}{10}$ of: 50, 20, 100…?

What is $\frac{4}{5}$ of 50, 35, 100….?

read and write decimal numbers as fractions (e.g. 0.71 = $\frac{71}{100}$)

What decimal is equal to 25 hundredths?

Write the total as a decimal:

$4 + \frac{6}{10} + \frac{2}{100} =$

Children partition decimals using both decimal and fraction notation, for example, recording 6.38 as $6 + \frac{3}{10} + \frac{8}{100}$ and as 6 + 0.3 + 0.08.

recognise and use thousandths and relate them to tenths, hundredths and decimal equivalents

Recognise that

0.007 is equivalent to $^{7}/_{1000}$

6.305 is equivalent to $^{6305}/_{100}$

read, write, order and compare numbers with up to three decimal places

Write these numbers in order of size, starting with the smallest. 1.01, 1.001, 1.101, 0.11

solve problems involving numbers with up to three decimal places

$$\begin{array}{r} 72.8 \\ +\ \underline{54.6} \\ \underline{127.4} \\ 1\ \ \ \ \end{array}$$

8 tenths add 6 tenths makes 14 tenths, or 1 whole and 4 tenths. The 1 whole is 'carried' into the units column and the 4 tenths is written in the tenths column.

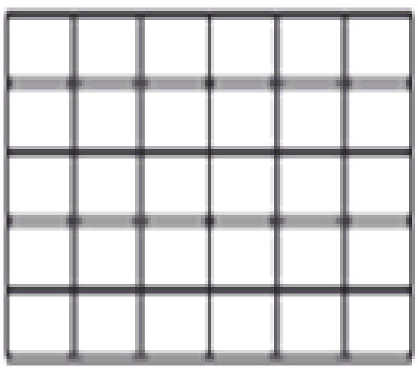
recognise the per cent symbol (%) and understand that per cent relates to ‘number of parts per hundred’

30% of 60 is ☐

30% of ☐ is 60

write percentages as a fraction with denominator 100, and as a decimal

Shade 10% of the grid below –



Which is bigger: 65% or ¾?
How do you know?

What percentage is the same as $^{7}/_{10}$?

Explain how you know?

What is $^{31}/_{100}$ as a percentage?

Which is a better mark in a test: 61%, or 30 out of 50? How do you know?

YEAR 5 - Measurement

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

convert between different units of metric measure (for example, kilometre and metre; centimetre and metre; centimetre and millimetre; gram and kilogram; litre and millilitre)

What is two hundred and seventy-six centimetres to the nearest metre?

How many millimetres are in 3 centimetres?

understand and use approximate equivalences between metric units and common imperial units such as inches, pounds and pints

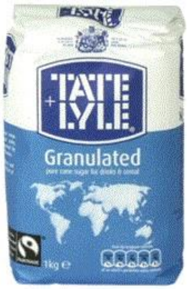
This bag of sugar weighs 1kg. Approximately how many pounds (lb) of sugar would fit into another empty bag of the same size as this one? Tick the correct answer.

20lb

14lb

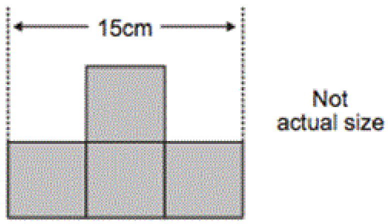
2lb

4lb

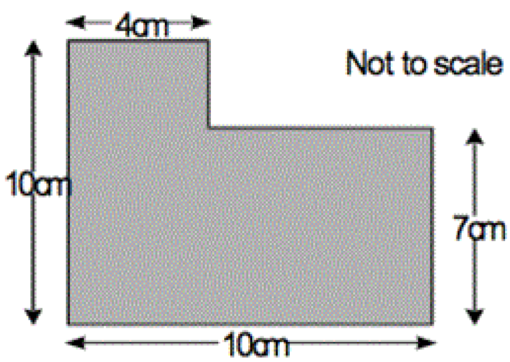


measure and calculate the perimeter of composite rectilinear shapes in centimetres and metres

This shape is made from 4 shaded squares



Calculate the perimeter of the shape



calculate and compare the area of rectangles (including squares), and including using

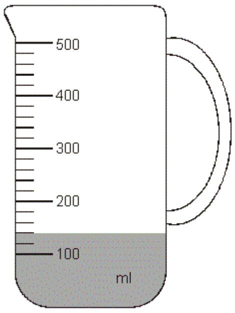
standard units, square centimetres (cm2) and square metres (m2) and estimate the area of irregular shapes

Calculate the area of a rectangle which is eleven metres long by 5 metres wide.

Which has the greatest area – a square with sides 6 cm long or a rectangle which is 7 cm long by 5 cm? How much greater is the area?

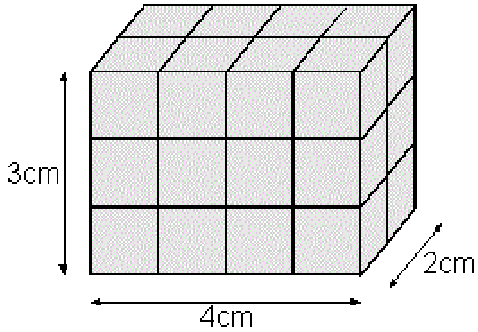
estimate volume - for example, using 1 cm3 blocks to build cuboids (including cubes) and capacity (for example, using water)

Mr Khan is making orange drink for a party. He pours the orange squash into a jug



How much water must he add to make 500ml of drink for the party?

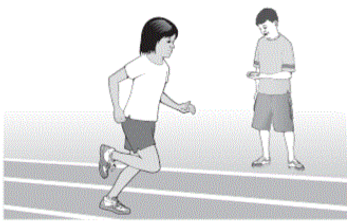
Here is a cuboid –



What is the volume of this cuboid?

solve problems involving converting between units of time

Kirsty ran a race in one and half minutes. Mina took ten seconds longer to finish.



How many seconds did Mina take?

Stefan's watch shows the time five minutes past nine.

Stefan's watch is 12 minutes fast. What is the correct time?

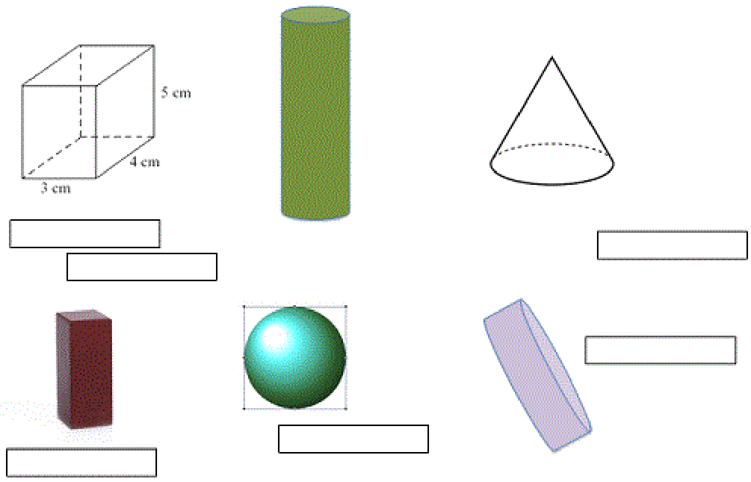
use all four operations to solve problems involving measure [for example, length, mass, volume, money] using decimal notation, including scaling

A day with Grandpa. (http://nrich.maths.org/5983) Is an engaging problem using imperial units that challenges children's understanding of the concept of area rather than simply requiring them to follow a rule for finding areas of rectangles. These calculations should also help learners to see the advantages of the metric system as well as understand it more fully!

YEAR 5 – Geometry: Properties of Shapes

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

Identify 3-D shapes, including cubes and other cuboids, from 2D representations



These are pictures of 3D shapes. Which 3D shapes are pictured here? Put the names in the boxes.

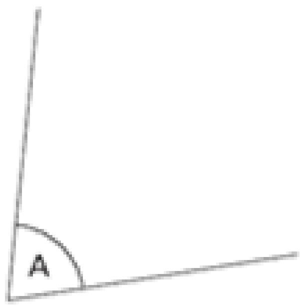
Know angles are measured in degrees: estimate and compare acute, obtuse and reflex angles

Look at these angles.

Label each angle acute, obtuse or reflex. List the 5 angles in order from smallest to largest.

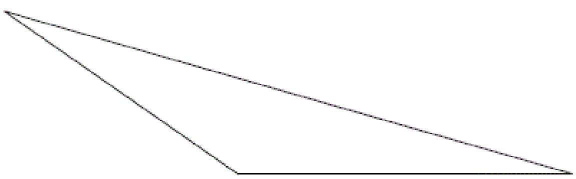
Draw given angles, and measure them in degrees (°)

Children become accurate in drawing lines with a ruler to the nearest millimetre and measuring with a protractor.
Children use conventional markings for parallel lines and right angles.



Measure A accurately. Use a protractor

Here is a triangle –



Measure the shortest side in cm

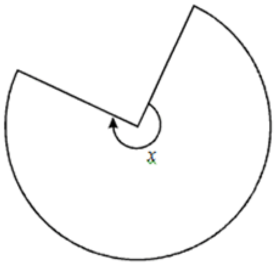
Measure the largest angle in degrees

Identify:

Angles at a point and one whole turn (total 360°)
Angles at a point on a straight line and a half turn (total 180°)
Other multiples of 90°

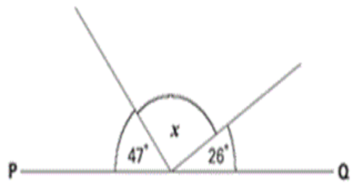
Children use angle sum facts and other properties to make deductions about missing angles and relate these to missing number problems.

This shape is three-quarters of a circle.

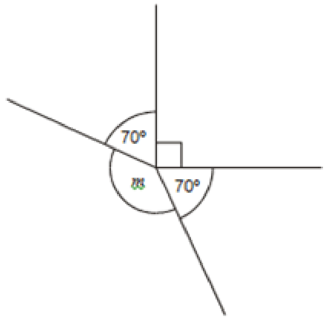


How many degrees is angle x?

PQ is a straight line. Not drawn accurately.



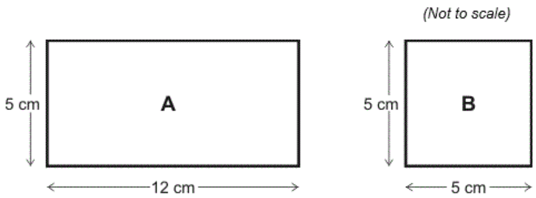
Calculate the size of angle x. Do not use a protractor



This diagram is not drawn accurately. Calculate the size of angle m

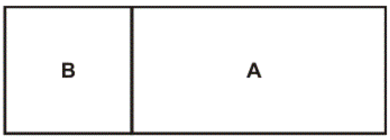
Use the properties of rectangles to deduce related facts and find missing lengths and angles

Ben has two rectangles -



What is the special name for rectangle B?

Ben puts the rectangles together –

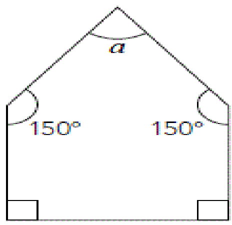


What is the length of the new rectangle?

Distinguish between regular and irregular polygons based on reasoning about equal sides and angles.

Here is a picture of a pentagon

Explain why this is not a regular pentagon

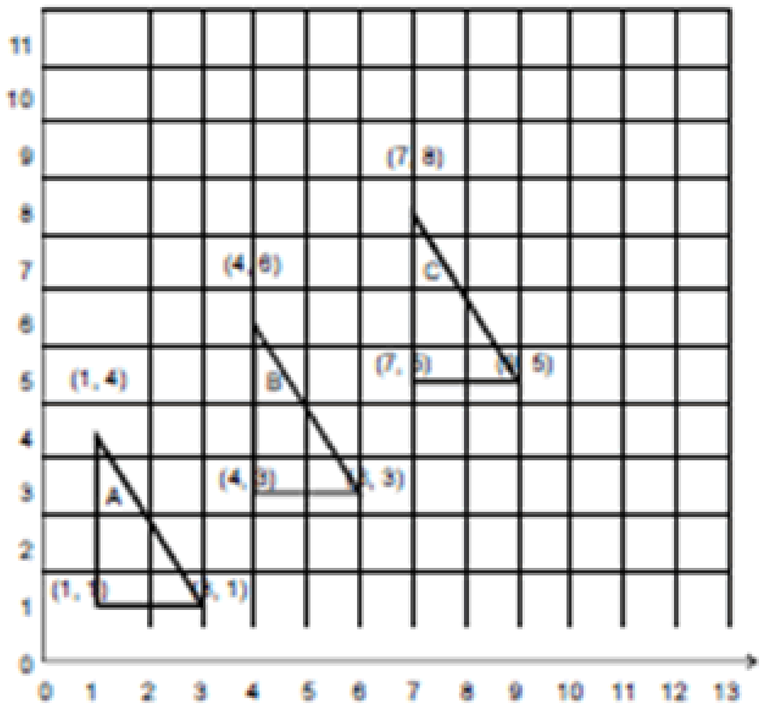


YEAR 5 – Geometry: Position and Direction

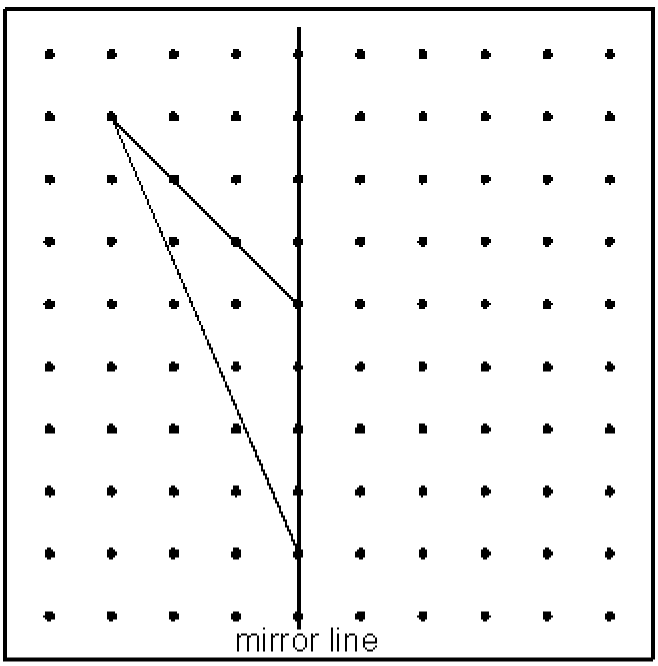
Examples of what children should be able to do, in relation to each (boxed) Programme of Study statement

identify, describe and represent the position of a shape following a reflection or translation, using the appropriate language, and know that the shape has not changed

Write the co-ordinates of the next triangle in this sequence.



Draw the reflection of this triangle in the mirror line.



YEAR 5 - Statistics

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

complete, read and interpret information in tables, including timetables

I can find the information in a table or graph to answer a question

		Hull	York	Leeds
Adult	single	£12.50	£15.60	£10.25
	return	£23.75	£28.50	£19.30
Child	single	£8.50	£10.80	£8.25
	return	£14.90	£17.90	£14.75

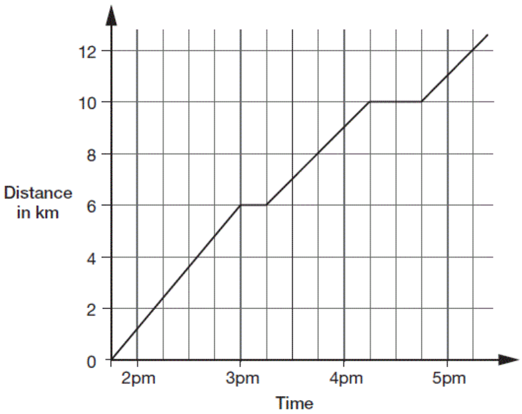
The table shows the cost of coach tickets to different cities.

What is the total cost for a return journey to York for one adult and two children?

Solve comparison, sum and difference problems using information presented in a line graph.

Begin to decide which representations of data are most appropriate and why.
Connect work on co-ordinates and scales to interpret time graphs.

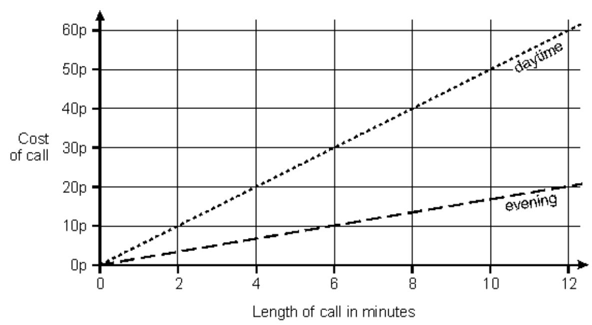
This graph shows how far Alfie and Chen walked one afternoon. They set off at 1.45pm and stopped twice.



How many Km did they walk between the two breaks?

What time did they start their second break?

This graph shows cost of phone calls during the day and evening.



How much does it cost to make a 9-minute call in the daytime?

How much **more** does it cost to make a 6-minute call during the day than in the evening?

Acknowledgements –

This resource has been collated by the North Yorkshire Mathematics Team using the exemplification of the 2014 National Curriculum which is freely available from NCETM website. The resource has been adapted and revised where there were gaps; errors or further clarification seemed appropriate.

Here is a list of other resources you may find useful –

NCETM Resource Tool -

https://www.ncetm.org.uk/resources/41211

NCETM Teaching for Mastery –

https://www.ncetm.org.uk/resources/46689

Nrich Curriculum Maps for KS1 and KS2

http://nrich.maths.org/8935

STEM centre resources

https://www.stem.org.uk/audience/primary#section--resources

SATs Papers -

http://www.sats-papers.co.uk/

http://satspapers.org/mathsKS2SATS.htm

Testbase -

http://www.testbase.co.uk/sec/index.php

White Rose Maths Hub Resources –

https://www.tes.com/teaching-resource/reasoning-and-problem-solving-questions-collection-ks1-and-ks2-11249968

http://www.trinitytsa.co.uk/maths-hub/free-learning-schemes/