Year 5

Number and Place Value

I can statements:

- read, write, order and compare numbers to at least 1 000 000 and determine the value of each digit
- count forwards or backwards in steps of powers of 10 for any given number up to 1 000 000
- interpret negative numbers in context, count forwards and backwards with positive and negative whole numbers, including through zero
- round any number up to 1 000 000 to the nearest 10, 100, 1000, 10 000 and 100 000
- solve number problems and practical problems that involve all of the above
- read Roman numerals to 1000 (M) and recognise years written in Roman numerals.

Exemplification

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. They write a decimal given its parts: e.g. they record the number that is made from 4 wholes 2 tenths and 7 hundredths as 4.27. They apply their understanding in activities such as:
    - Find the missing number in 17.82 – □ = 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

Activities

Programme of Study statements	Activities					
	A	B	C	D	E	F
read, write, order and compare numbers to at least 1 000 000 and determine the value of each digit	●					
count forwards or backwards in steps of powers of 10 for any given number up to 1 000 000		●				
interpret negative numbers in context count forwards and backwards with positive and negative whole numbers including through			●			
round any number up to 1 000 000 to the nearest 10, 100, 1000, 10 000 and 100 000				●		
solve number problems and practical problems that involve all of the above					●	
read Roman numerals to 1000 (M) and recognise years written in Roman numerals						●

Activity set A

It is important that the children understand the place value of different digits. Conceptually, place value is complex and difficult for children to learn. Sometimes we assume children understand this concept if they can partition, say, 1345 into 1000 + 300 + 40 + 5. This isn't necessarily so. Place value needs to be understood in four important ways: 'positional' 'multiplicative' additive' and 'base 10'.

Display a grid similar to this on the board:

1 000 000	100 000	10 000	1000	100	10	1	.	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$
6	8	2	4	2	5	7	.	9	3	5

Ask the children to explain what each digit is. For example the 2 is in the 10 000 column (positional) to find the number it represents we multiply it by 10 000 to give 20 000 (multiplicative). The 7 is in the ones column (positional); to find what the number 7 represents we multiply by one to give 7 (multiplicative). The 3 is in the hundredths column (positional) to find the number it represents we multiply it by one hundredth to give 3/100 (multiplicative). When we put the digits together to give the total value we must add the values represented in each of the columns together to know the total value represented 6 824 157 . 935 (additive). Each digit represents a number that is either 10 times larger or 10 times smaller than the values in adjacent columns (base 10).

You could give the children a set of digit cards and ask them to make and read large numbers following instructions that you call out such as these: make 34 now 234 now 2348, 23 487, 123 487, 9 123 487. Show the cards that show how many hundreds, tens, millions, thousands etc. there are .

They could then swap different digits and say whether the number is now bigger or smaller and by roughly how much- for example, 9 123 487 swap the 2 and 8: the number is bigger by roughly 60 thousand.

They could select four, five or six digit cards and make the highest and lowest number and the one closest to 5000.

The children could do a similar activity on their whiteboards. This has the added bonus of writing the numbers as well.

You could give the children problems such as:

- Freddy scored 28 456 points on the computer game. His friend Hugh scored 5000 points more than Freddy. How many points did Hugh score?
- There were 85 356 people at the Liverpool match. There were 40 000 fewer people at the Manchester United match. How many people were at the Man U match?
- A London post office delivered 1 750 000 Christmas cards on the Monday before Christmas and 300 000 more on the Tuesday. How many did the post office deliver on the Tuesday?

You could explore place value with a calculator. Ask the children to key in a six digit number for example 234 568. Next give them instructions such as ‘change the 4 into a 9’, ‘change the 2 into a 7’. Each time. ask them to explain what they did (take 4000 and add 9000 or add 5000 take 200 000 away and add 700 000 or add 500 000)

Activity set B

The children could write numbers on their whiteboards and then make them 10, 100, 1000 times larger.

You could use a pendulum (easily made from three multilink cubes and a (long) piece of string) to mark time while children practise counting on or back in steps of different 10, 100, 1000 and 1million from and to a given number e.g. from 75 to 175/1075/10 075 etc. You could also do this for tenths, hundredths and thousandths.

You could use a counting stick and count forwards and backwards in steps of thousandths, hundredths, tenths 10 100 1000 etc. You could start by telling them that zero is at one end and for example 10 000 at the other. The children then need to work out what equal steps they need to count in to get from one end to the other. Be sure to jump around the counting stick to keep the children on their toes!

You could ask questions as if the counting stick was a number line; for example, what would go on this division what about half way between each end?

You could give the children this Nrich activity **The Thousands Game**

Activity set C

You could show the ITP (Interactive Teaching Programme from National Strategies) Thermometer. Set the maximum temperature at 500, the minimum at -300 and the interval at 2. You could then ask volunteers to show different temperatures. The children could work out differences between: two negative temperatures; a negative and a positive temperature; and two positive temperatures.

Discuss in which countries or regions of the world negative temperatures are found and how cold it can get in these places. You can find some information on this in a feature on **Polar Regions** in the Primary Magazine.

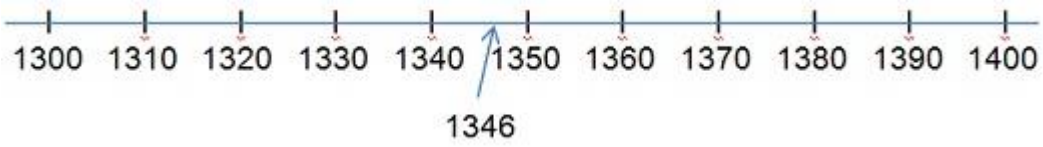
Activity D

Ask the children to draw different number lines that would enable them to identify a number that would be rounded to 10 100 1000 10 000 or 100 000. For example:

Round 1346 to the nearest 10

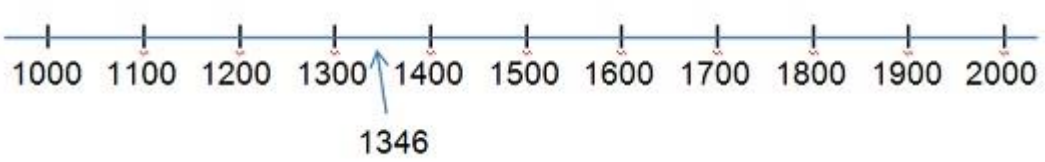
1346 is closest to 1350.

Round 1346 to the nearest 100



1346 is closest to 1300.

Round 1346 to the nearest 1000



1346 is closest to 1000.

Activity set E

You could ask the children problems which involve approximate answers that can be found by rounding, for example:

- Becky wanted to buy some clothes. The jeans she wanted cost £48.75, the sweat shirt cost £29.99, the trainers cost £59.80. She has saved up £150. Does she have enough money to buy the clothes?
- Sam was taking a survey of the number of cars being driven down the High Street over a four hour period. These were his results: 1st hour 219 cars 2nd hour 498 cars 3rd hour 314 cars 4th hour 189 cars. To the nearest hundred how many cars did he record?

You could ask the children problems involving positive and negative numbers for example:

- The temperature in Reykjavik at 6am was -12°C. During the day the temperature rose by 18 degrees. What was the new, higher temperature?
- The average annual temperature in the Antarctica is -57°C. The average annual temperature in the Maldives is 27°C. What is the difference between these two averages?

Activity set F

You could give the children a table showing the basic Roman numerals follow a pattern:

Units	I	II	III	IV	V	VI	VII	VIII	IX
Tens	X	XX	XXX	XL	L	LX	LXX	LXXX	XC
Hundreds	C	CC	CCC	CD	D	DC	DCC	DCCC	CM
Thousands	M	MM	MMM	$\overline{IV}$	$\overline{V}$	$\overline{VII}$	$\overline{VII}$	$\overline{VIII}$	$\overline{IX}$

Ask the children to use the table to make up different 4 digit Roman numbers for example 2365 or the year they were born or the year we are in now.

You could write some of these on the board and ask the children to convert them to ‘our’ numbers for example MCDLXIV.

A Little Bit of History in issue 2 of the Primary Magazine gives details of how to write Roman Numerals.

Addition and Subtraction

I can statements:

- add and subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction)
- add and subtract numbers mentally with increasingly large numbers
- use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy
- solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why.

Exemplification

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)

Children should be able to 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 + □ = 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

Children should be able to 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

Children should be able to 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

Children should be able to 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.

e.g. 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,

e.g. calculating total cost of a holiday for a family, given prices for adults and children and surcharges for particular resorts.

Activities

Programme of Study statements	Activities				
	A	B	C	D	E
Add and subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction)	●				
Add and subtract numbers mentally with increasingly large numbers		●			
Use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy			●	●	
Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why					●

Activity A – Two and Two

Challenging activity which requires finding the numbers which each letter stands for in an alphanumeric question

Activity B- Reach 100 NRICH

A challenging activity from Nrich requiring the children to place digits in a 2x2 grid so that the four 2-digit numbers made, total 100. Can they extend it to a 3x3 grid? What might their total be? What about a 4x4 grid? Can their reach a total that is a multiple of 1000?

Activity C- Rounding Spreadsheets NRICH

'Rounding' and 'Rounding Decimals' are two spreadsheets from this wider set, produced by the National Strategies, and now hosted in the STEM Centre E-library. They allow a number of a given size to be generated and a level or accuract for the number to be rounded to. The rounded number can then be revealed. Teachers' notes are also included.

Activity D- Ordering the Problems

Children could be provided with a variety of one and two-step problems. They can be asked to estimate the answers to each, then order the problems according to their estimates.

Activity E-CIMT Problems (pdf) can be found at http://www.cimt.plymouth.ac.uk/projects/mepres/primary/pb4a_3.pdf

Pages 70 – 75 of this workbook contain a variety of multi-step problems

Write the Problems

Children could be given written calculations such as 23 456 + 46 019. They could be asked to write an imaginative problem that would require this calculation. Can they extend their problem to make it a multi-step problem?

As a variation of this, give children a selection of cards. Some should contain word problems and others should contain the corresponding calculations. Children should match the problems to the appropriate calculation.

Other problem solving opportunities

Wherever possible, try to link problems to cross-curricular topics, so that children get used to solving problems with a real-life context.

Display a ‘problem of the week’ in the classroom, with an opportunity for pupils to respond, perhaps by posting their answer into a box or container.

Multiplication and Division

I can statements:

identify multiples and factors:

- 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
- 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
- multiply and divide numbers mentally, drawing upon known facts
- 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
- multiply and divide whole numbers and those involving decimals by 10, 100 and 1,000
- 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
- solve problems involving addition, subtraction, multiplication and division and a combination of these, including understanding the meaning of the equals sign
- solve problems involving multiplication and division, including scaling by simple fractions and problems involving simple rates

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Exemplification

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

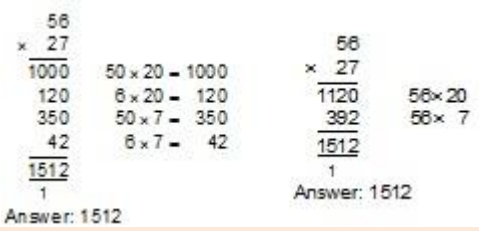
- Use the vocabulary factor, multiple and product. They identify all the factors of a given number; for example, the factors of 20 are 1, 2, 4, 5, 10 and 20. They answer questions such as:
    - Find some numbers that have a factor of 4 and a factor of 5. What do you notice?
    - My age is a multiple of 8. Next year my age will be a multiple of 7. How old am I?
- They 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. They 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. They 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 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. They use and discuss mental strategies for special cases of harder types of calculations, for example to work out 274 + 96,< 8006 – 2993, 35 × 11, 72 ÷ 3, 50 × 900. They use factors to work out a calculation such as 16 × 6 by thinking of it as 16 × 2 × 3. They record their methods using diagrams (such as number lines) or jottings and explain their methods to each other. They compare alternative methods for the same calculation and discuss any merits and disadvantages.

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. They move from expanded layouts (such as the grid method) towards a compact layout for HTU × U and TU × TU calculations. They suggest what they expect the approximate answer to be before starting a calculation and use this to check that their answer sounds sensible. For example, 56 × 27 is approximately 60 × 30 = 1800.



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. They should be able to 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

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. They suggest what they expect the approximate answer to be before starting a calculation and use this to check that their answer sounds sensible. They increase the efficiency of the methods that they are using. For example:

196 ÷ 6 is approximately 200 ÷ 5 = 40

3 2 r4 or 4/6 or 2/3

6 196

Children know that, depending on the context, answers to division questions may need to be rounded up or rounded down. They explain how they decided 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?

Solve problems involving addition, subtraction, multiplication and division and a combination of these, including understanding the meaning of the equals sign
solve problems involving multiplication and division, including scaling by simple fractions and problems involving simple rates

- 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?

Activities

Programme of Study statements	Activities							
	A	B	C	D	E	F	G	H
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		●						
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			●					
multiply and divide numbers mentally, drawing upon known facts			●					
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			●					
multiply and divide whole numbers and those involving decimals by 10, 100 and 1,000				●				
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						●		

solve problems involving addition, subtraction, multiplication and division and a combination of these, including understanding the meaning of the equals sign							●	
solve problems involving multiplication and division, including scaling by simple fractions and problems involving simple rates								●

Activity set A

You could write a number on the board, such as, 6 and ask the children to write down as many multiples of six as they can in one or two minutes. Encourage them to think of multiples that come in the multiplication table for 6 and others, for example, 720, 360, 1440. Once they have done this ask them to look at what they wrote and to identify other numbers that these are multiples of so finding common multiples.

You could do something similar for factors. Write a number, such as 144 on the board and give the children two minutes to find all the factors they can of 144. Once they have done this, ask them to look at the factors and to find another number that each is a factor of.

Take a look at the Nrich problem **'Factors and multiples puzzle'**. It is quite challenging as it stands but can be adapted to suit most attainment levels, for example, you might like to provide a list of numbers for children to put into the correct cells in the table:

80, 21, 1, 40, 6, 8, 30, 2, 3, 12, 36, 48, 25, 60, 18, 24

	Multiple of 3	Factor of 24	Multiple of 5	Factor of 72
Even Number				
Odd Number				
Multiple of 8				
Factor of 120				

You could then ask the children to think of other numbers to add to each section.

Activity set B

Remind the children that a prime number is a number that can only be divided by one and itself. So a prime number has two factors. You could give the children a 100 square and ask them to shade the numbers from 1to10 that are not prime numbers (1, 4, 6, 8, 10). They then shade all the multiples of 2, 3, 4, 5, 6, 7, 8, 9 and 10. The numbers that are left unshaded are all primes. You could ask them what they notice about these (they are mostly either side of multiples of six).

You could write some single and 2-digit numbers on the board and ask the children to break these down as much as they can. What do they notice? If they have broken them down as far as

possible they will end up with prime factors. Here is an example: 24 – factors include 2 and 12, 2 is a prime factor. Factors of 12 include 3 and 4, 3 is a prime. Factors of 4 include 2 and 2, both of which are prime factors. So, the prime factors of 24 are 2, 2, 2 and 3.

You could carry out similar activities for composite numbers.

Activity set C

You could display a variety of multiplication and division calculations on the board and ask the children to decide which strategy they would use to answer them. They could then discuss their thinking with a partner. Encourage them to look at the numbers and decide whether they can use a mental calculation strategy, jottings or a written method. Here are some examples of questions you could use and some possible appropriate strategies:

- 24 x 50 (x 100 and halve)
- 52 x 4 (double and double again)
- 12 x 15 (x 10, halve and total x10 and half x10)
- 136 x 9 (partitioning, x10 and take away 136 or column method)
- 245 x 1.6 (grid method or the column method or x1, x half, x tenth and add together)
- 123 x 3 (re-partition number into 120 and 3, 4 x 3 = 12 so 40 x 3 = 120 (so 120 ÷ 3 = 40), 3 ÷ 3 = 1, answer 41)
- 165 x 10 (make number ten times smaller)
- 325 x 25 (use knowledge that there are four 25s in 100)
- 408 x 17 (grouping in 17s, 20 groups make 340, 4 groups make 68 so answer is 24)
- 623 x 9 (short method)

You could try **'All the digits'** NRICH. The multiplication given uses each of the digits 0 - 9 once and once only. Using the information given, the children need to replace the stars in the calculation with figures.

You could give the children a set of calculations which have been answered using column method and ask them to look at them and decide which are easy and which are difficult and why.

Activity set D

Give the children place value grids similar to the one below and a set of digit cards with some extra zeros:

1000	100	10	1	.	10th	100th

Ask them to make a three digit number, such as 34.8, and place it in the grid. They can then multiply the number by 10 and 100 using zeros as place holders and describe what is happening: the number is becoming 10/100 times bigger, the digits are moving to the left.

They could then divide their number by 10, 100 and 1000 and describe what is happening: the number is becoming 10/100/1000 times smaller, the digits are moving to the right.

Activity set E

You could give the children centimetre squared paper and ask them to explore square numbers by drawing squares 1 x 1, 2 x 2, 3 x 3 etc. Ask them what they notice. Encourage them to notice that

a square is made with sides of equal lengths and that to find the area they multiply the length by the width so giving 1^2, 2^2, 3^2 and so on. These are known as square numbers. Can they work out the formula for the area of a square: n^2. Give them a variety of numbers to represent 'n'.

Ask the children to list as many square numbers as they can in ascending order in two minutes.

Give the children a centimetre cube. Ask them to work out the volume by multiplying the length, width and height. Next, ask them to build another cube with three dimensions of 2cm. They work out the volume of this and then explore other cubes. What do they notice? Encourage them to notice that each cube has three dimensions of the same size. When multiplied they produce cubed numbers: 1^3 is 1 x 1 x 1 = 1, 2^3 is 2 x 2 x 2 = 8, 3^3 is 3 x 3 x 3 = 27 and so on.

Ask the children to list as many cubed numbers as they can in ascending order in two minutes.

Stand a container (tank or bowl or bucket) inside another container (a larger bowl or a tray with sides at least a few centimeters high). Fill the container to the brim with water. Place the 1000 Dienes cube (or equivalent) into the container. Catch and measure the volume of water that overflows (is displaced). What do you notice?

Activity set F

You could ask the children to solve problems such as:

- Sally was asked to find all the factors of 48. She found 8. These were, 1, 48, 2, 24, 3, 16, 4, 12. Did she find them all? How do you know?
- Bobby was asked to find all the multiples of 12. He said that it was impossible because there were an infinite number. Was he correct? Explain your thinking.
- Farmer Giles bought a plot of land. It was a square shape with a perimeter of 48m. What was its area? He paid £56 for each square metre. How much did he pay in total?
- Fatima bought a microwave for her kitchen. It was cube shaped and had a length of 30cm. How much space did it take up?

Activity set G

Give the children algebraic type problems that involve balancing to help them understand the meaning of the equals sign. For example:

- 2n + 10 = 36 (take 10 from each side to give 2n = 26, divide each side by 2 to give n = 13
- 7 = 2x ÷ 6 (multiply each side by 6 to give 7 x 6 = 2x which is 42 = 2x, divide each side by 2 to give 21 = x

You could also give problems such as:

- Sharon and Tim each had a collection of football stickers. Tim had 5 times as many as Sharon. He had 150. How many did they have altogether?

  You could encourage the children to use the bar model to solve this:

  Sharon 

  Tim 

Tim has 150 stickers, so each square represents 30 stickers. Therefore Sharon has 30 and altogether they have 180.

- Tina had a cupboard in her bedroom on which she kept her books. There were 15 books on each of 8 shelves. A friend gave her another 24 books which she put equally onto the 8 shelves. How many books were on each shelf?

Activity set H

You could show photographs of some famous buildings or the children to illustrate how objects or people are scaled down. Explain that, to describe how much something has been scaled down, we often use ratio or simple fractions.

You could set this problem: A tennis court is 7m wide and 24m long. A scale plan of it is drawn with a width of 3.5cm. What is its length? Agree that 7m has been divided by 100 to become centimetres and then halved. The same must therefore be done with 24m to give 12cm. You could repeat this type of problem with other similar scenarios.

The children could work in a small group to make 2D drawings of objects in the classroom. They measure heights and widths of their objects and then scale them down. They decide their own ratio for scaling down, for example, 1:2 (half the size) or 1:3 (one third of the size). Make the point that scaling down is the same as multiplying by a value less than 1.

Fractions

I can statements:

- compare and order fractions whose denominators are all multiples of the same number
- identify, name and write equivalent fractions of a given fraction, represented visually, including tenths and hundredths
- recognise mixed numbers and improper fractions and convert from one form to the other and write mathematical statements >1 as a mixed number[for example, $\frac{2}{5}+\frac{4}{5}=\frac{6}{5}=1\frac{1}{5}$]
- add and subtract fractions with the same denominator and denominators that are multiples of the same number
- multiply proper fractions and mixed numbers by whole numbers, supported by materials and diagrams
- read and write decimal numbers as fractions [for example, $0.71 = \frac{71}{100}$]
- recognise and use thousandths and relate them to tenths, hundredths and decimal equivalents
- round decimals with two decimal places to the nearest whole number and to one decimal place
- read, write, order and compare numbers with up to three decimal places
- solve problems involving number up to three decimal places
- recognise the per cent symbol (%) and understand that per cent relates to 'number of parts per hundred', and write percentages as a fraction with denominator 100, and as a decimal
- solve problems which require knowing percentage and decimal equivalents of $\frac{1}{2}$, $\frac{1}{4}$,$\frac{1}{5}$, $\frac{2}{5}$ and those fractions with a denominator of a multiple of 10 or 25

Exemplification

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

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

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

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 $\frac{7}{1000}$
6.305 is equivalent to $\frac{6305}{1000}$

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

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

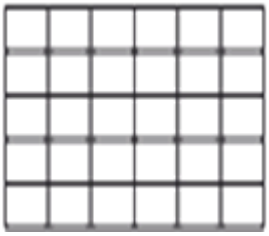
8 tenths add 6 tenths makes 14 tenths, or 1 whole and 4 tenths. The 1 whole is 'carried' into the units column and the 4 tenths is written in the tenths column

Recognise the per cent symbol (%) and understand that per cent relates to 'number of parts per hundred'

Write in the missing numbers. 30% of 60 is ☐
30% of ☐ is 60

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

Shade 10% of this grid.



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

What percentage is the same as $\frac{7}{10}$? Explain how you know?

What is $\frac{31}{100}$ as a percentage?

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

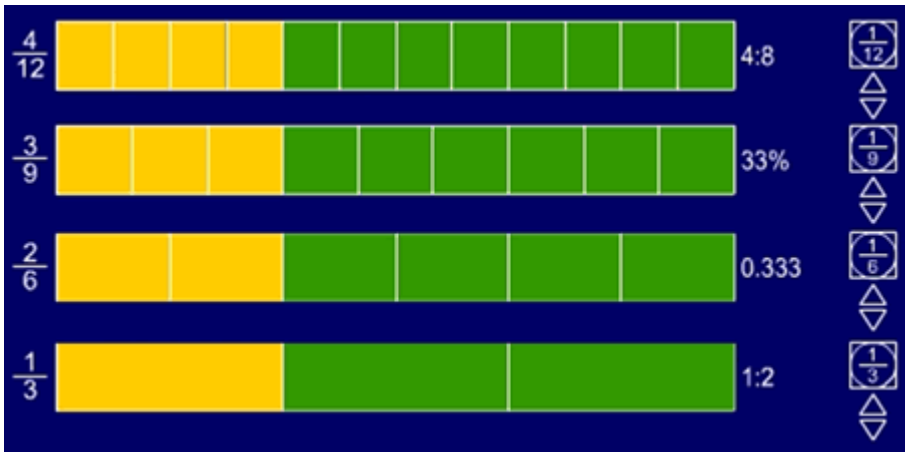
Activities

Programme of Study statements	Activities					
	A	B	C	D	E	F
compare and order fractions whose denominators are all multiples of the same number	●	●	●	●		
recognise mixed numbers and improper fractions and convert from one form to the other		●				
add and subtract fractions with the same denominator and related fractions	●	●				
multiply proper fractions and mixed numbers by whole numbers		●	●	●		
read and write decimal numbers as fractions (e.g. 0.71 = 71/100)	●			●	●	●
recognise and use thousandths and relate them to tenths, hundredths and decimal equivalents				●		
read, write, order and compare numbers with up to three decimal places	●			●	●	
Solve problems involving numbers with up to three decimal places						
recognise the per cent symbol (%) and understand that per cent relates to “number of parts per hundred” and write				●		●

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

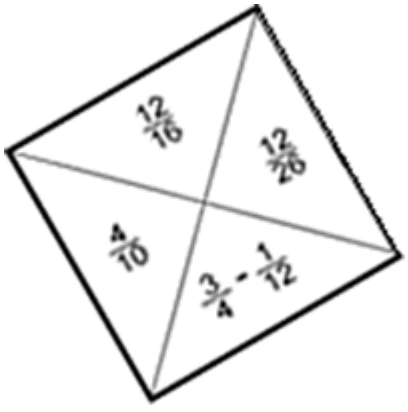
Activity A - Fractions ITP

An interactive program that allows you to model part-whole relationships using a strip divided in to equal parts. Relationships can be shown as fractions, decimals (to three places) or percentages.



Activity B - Fractions Jigsaw NRICH

A jigsaw-based activity that requires children to add and subtract fractions with the same and different denominators. Pieces must be matched to an answer that may be expressed in equivalent forms. It also includes multiplying fractions by a whole number.



Activity C - Peaches today, Peaches tomorrow… NRICH

A problem solving activity that requires children to find fractions of whole numbers. It provides plenty of practice and has many extension opportunities.

Activity D - Metre sticks and metre strips

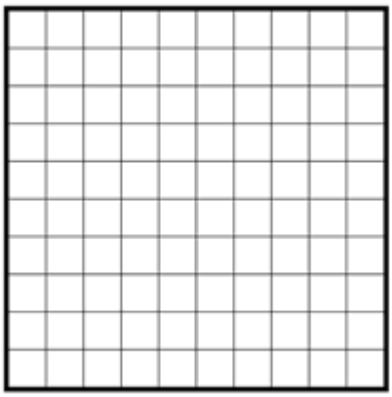
Use classroom metre sticks/rulers and I metre long strips of paper to model relationships between a whole, tenths, hundreds and thousandths. Children can explore the size of 1, 2 and 3 decimal places and how they link to units of measurement. Labelling points with decimal, fraction and percentage equivalents can help to reinforce links between all three.

Activity E - Matching fractions, decimals and percentages NRICH

A pelmanism-style activity matching pairs of equivalent fractions, decimals and percentages. Points are awarded for correct answers and deducted for turning over cards without success.

Activity F - Using blank hundred squares

Use blank hundred squares to model and explore percentages, tenths and hundredths. Decimals, fractions and percentages can be represented by colouring in blank hundred squares which children can use to support addition and subtraction.



Useful Resources

- **Moving digits ITP**
- Maths rods
- Clock faces to model different fractions
- **Area ITP**
- **Fractions ITP**

Measurement

I can statements:

- convert between different units of metric measure (for example, kilometre and metre; centimetre and metre; centimetre and millimetre; gram and kilogram; litre and millilitre)
- understand and use approximate equivalences between metric units and common imperial units such as inches, pounds and pints
- measure and calculate the perimeter of composite rectilinear shapes in centimetres and metres
- calculate and compare the area of rectangles (including squares), and including using standard units, square centimetres (cm^2) and square metres (m^2) and estimate the area of irregular shapes
- estimate volume [for example, using 1 cm^3 blocks to build cuboids (including cubes)] and capacity [for example, using water]
- solve problems involving converting between units of time
- use all four operations to solve problems involving measure [for example, length, mass, volume, money] using decimal notation, including scaling

Exemplification

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

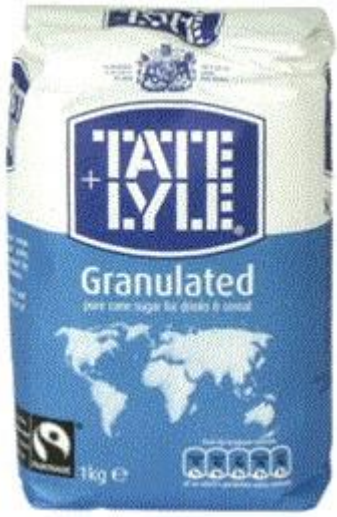
This bag of sugar weighs 1kg. Approximately how many pounds (lb) of sugar would fit into another empty bag of the same size as this one? Tick the correct answer.

20lb

14lb

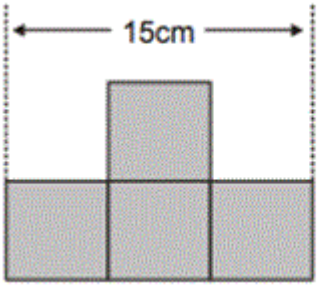
2lb

4lb



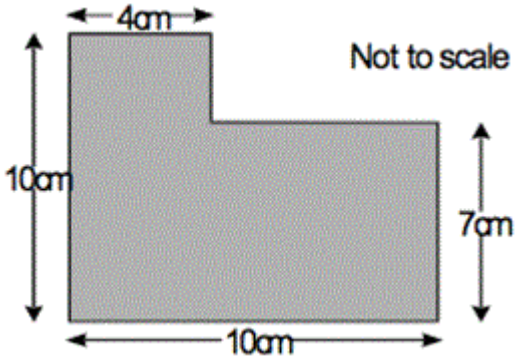
Measure and calculate the perimeter of composite rectilinear shapes in centimetres and metres

This shape is made from 4 shaded squares



Not actual size

Calculate the perimeter of the shape



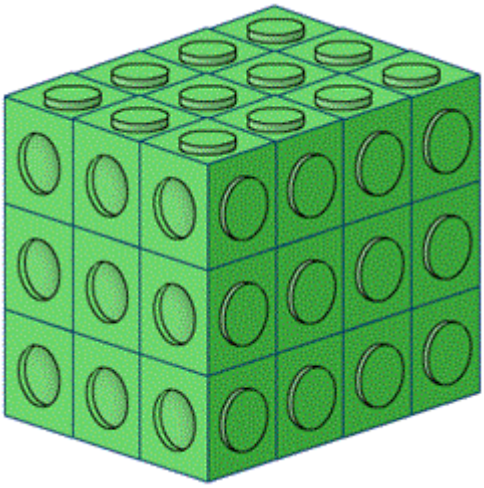
Calculate and compare the area of rectangles (including squares), and including using standard units, square centimetres (cm2) and square metres (m2) and estimate the area of irregular shapes

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]

Fitting it in is an activity to fill cuboid shapes with multilink cubes. It ends with a 'create' challenge that will test children's knowledge in this area



Solve problems involving converting between units of time

5 on the clock is a problem that requires children to be able to convert between 12 and 24 hour clocks confidently.

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

A day with Grandpa.- NRICH 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!

Activities

Programme of Study statements	Activities				
	A	B	C	D	E
convert between different units of metric measure (e.g. kilometre and metre; centimetre and metre; centimetre and millimetre; gram and kilogram; litre and millilitre)				●	
understand and use equivalences between metric units and common imperial units such as inches, pounds and pints	●				●
measure and calculate the perimeter of composite rectilinear shapes in centimetres and metres			●		
calculate and compare the area of rectangles (including squares) and including using standard units, square centimetres (cm^2) and square metres (m^2) and estimate the area of irregular shapes		●	●		

Activity A - If the world were a village NRICH

This activity involves 'shrinking' the world population to a group of just 100, and focusing on the different proportions that emerge and the ways in which the data can be presented

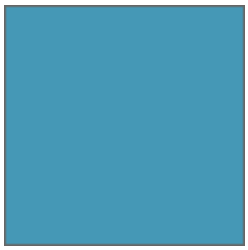
Watch a video about this activity

Activity B - Numerically equal NRICH

Find shapes that have a numerical equal area and perimeter.

Activity C-Area and Perimeter NRICH

Draw shapes according to the rules of area and perimeter.



Activity D - Converting between metric units NRICH

A useful jigsaw-style activity, where the children use their knowledge of conversion of different units of measure to match pieces together.

Activity E- Converting between metric and imperial NRICH

A worksheet.

Useful Resources

- Sets of 2D shapes
- Sets of 3D shapes
- Mirrors
- Construction Kits
- Rulers
- Pairs of compasses
- Protractors
- Angle measurers
- Measuring equipment for length
- Measuring equipment for mass
- Measuring equipment for capacity
- Measuring equipment for time
- Money
- Mirrors

Geometry: Properties of Shapes

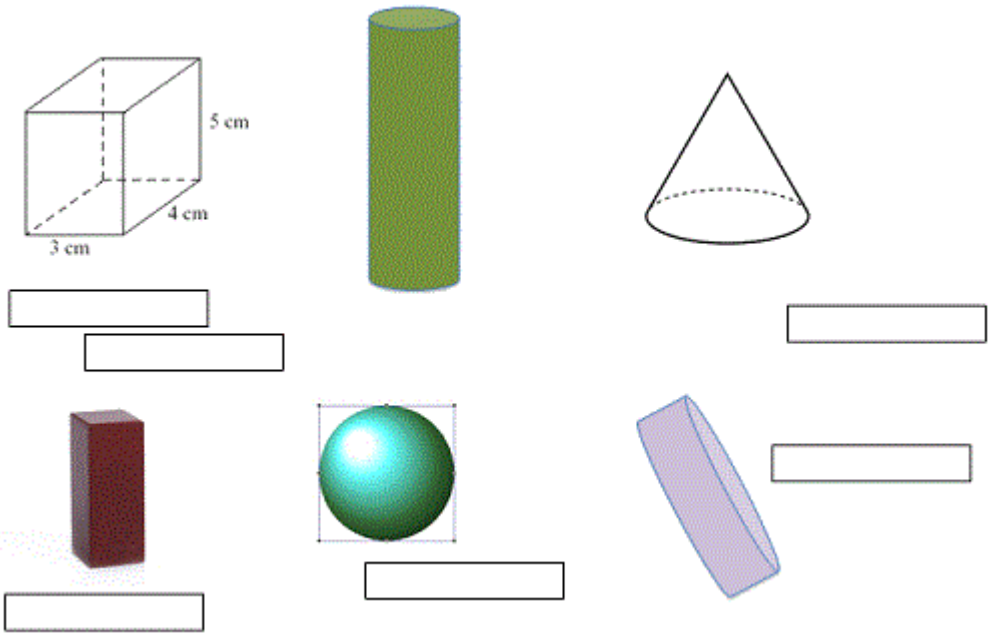
I can statements:

- identify 3-D shapes, including cubes and other cuboids, from 2-D representations
- know angles are measured in degrees: estimate and compare acute, obtuse and reflex angles
- draw given angles, and measure them in degrees (°)
- identify:
    - angles at a point and one whole turn (total 360°)
    - angles at a point on a straight line and ½ a turn (total 180°)
    - other multiples of 90°
- use the properties of rectangles to deduce related facts and find missing lengths and angles
- distinguish between regular and irregular polygons based on reasoning about equal sides and angles

Exemplification

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

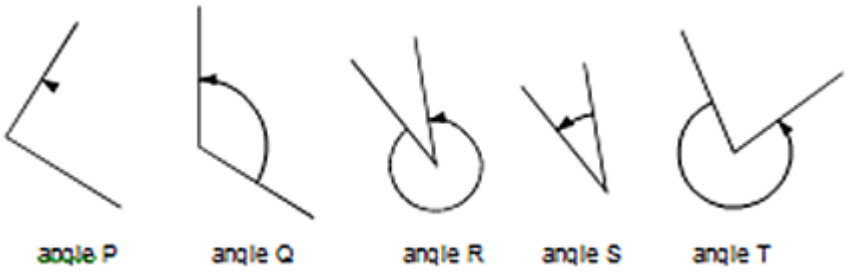
Identify 3-D shapes, including cubes and other cuboids, from 2D representations



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

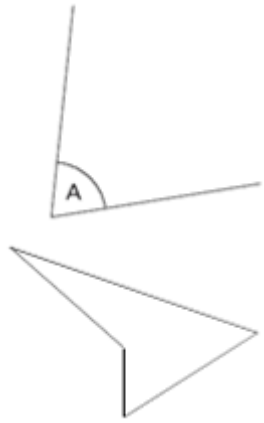
Look at these angles.



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

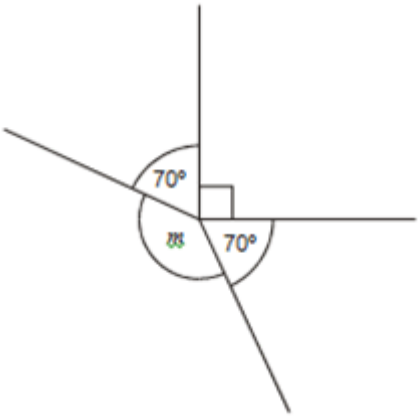
Draw given angles, and measure them in degrees (°)

Measure A accurately. Use a protractor (angle measurer).



Measure accurately the smallest angle in the above shape. Use a protractor (angle measurer).

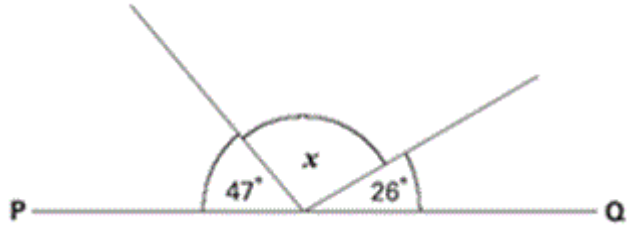
This diagram is not drawn accurately. Calculate the size of angle m



Identify:

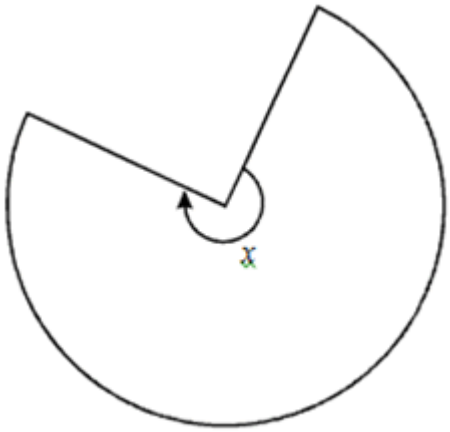
- Angles at a point and one whole turn (total 360°)
- Angles at a point on a straight line and ½ a turn (total 180°)
- Other multiples of 90°

PQ is a straight line. Not drawn accurately.



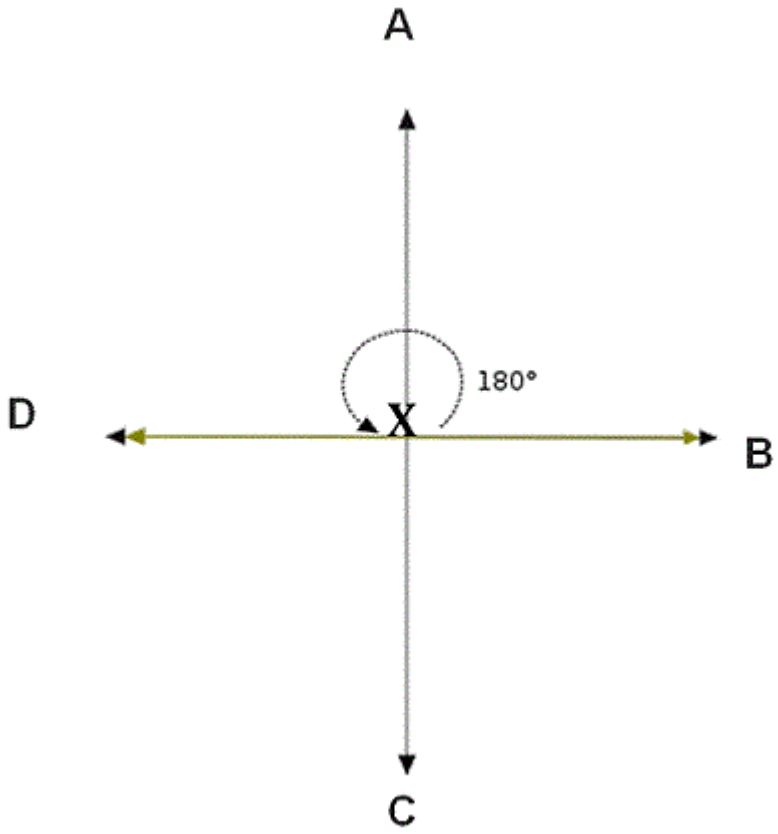
Calculate the size of angle x. Do not use a protractor (angle measurer).

This shape is three-quarters of a circle.



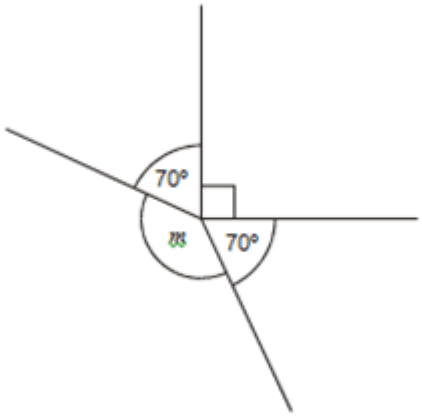
How many degrees is angle x?

In the diagram below, if you were standing at X, facing A, what angle would you turn through if you turn and face C?



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

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



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

Activities

Programme of Study statements	Activities				
	A	B	C	D	E
identify 3-D shapes, including cubes and other cuboids, from 2-D representations		●			
know angles are measured in degrees: estimate and compare acute, obtuse and reflex angles	●		●	●	
draw given angles, and measure them in degrees (°)	●		●	●	
identify: • angles at a point and one whole turn (total 360°) • angles at a point on a straight line and half a turn (total 180°) • other multiples of 90°	●		●	●	
use the properties of rectangles to deduce related facts and find missing lengths and angles			●		●
distinguish between regular and irregular polygons based on reasoning about equal sides and angles				●	

Activity A: Logo Challenge 1 – Star Square NRICH

Use 'Logo' to draw the design shown. This requires using knowledge of angle properties of 2D shapes.

Activity B: Cuboids

How many different cuboids can you make with 12, 24, 36… linking cubes?

Challenge the children to draw their formed shapes on isometric paper. In how many different ways can a single cuboid be represented? Does the number of cubes need to be even?

Activity C: Equal angles

Fold along the diagonals of a square piece of paper. Unfold and mark all the angles of the same size. Fold along the lines of symmetry of a square piece of paper. Unfold and mark all angles of the same size.

Repeat for a rectangle. Repeat for other quadrilaterals. Are there the same number of equal angles each time? Why/not?

What if the starting shape was a regular pentagon? Hexagon?

Activity D: Sorting triangles

Cut out a set of a variety of triangles including equilateral, isosceles and scalene and those whose greatest angle is acute, right and obtuse. Ensure there is a set of at least twenty triangles per group. Invite children to find as many ways as possible to sort the triangles.

Summarise by introducing classification by side length: equilateral, isosceles, scalene and classification by greatest angle: acute-angles, right-angles and obtuse-angled. Complete the table, by placing triangles in the space – children could construct their own examples. They must justify any gaps…

	equilateral	**isosceles**	**scalene**
acute-angled			
right-angled			
obtuse-angled			

Activity E: Shape Perimeter

How many shapes can you make with a perimeter of 12cm?

This can be extended to asking about the area of the shapes made and challenging the misconception that a fixed perimeter implies a fixed area.

Useful Resources

- Squared, plain and dotty papers

- Logo
- Dynamic geometry
- Practical materials for shape

Geometry: Position and Direction

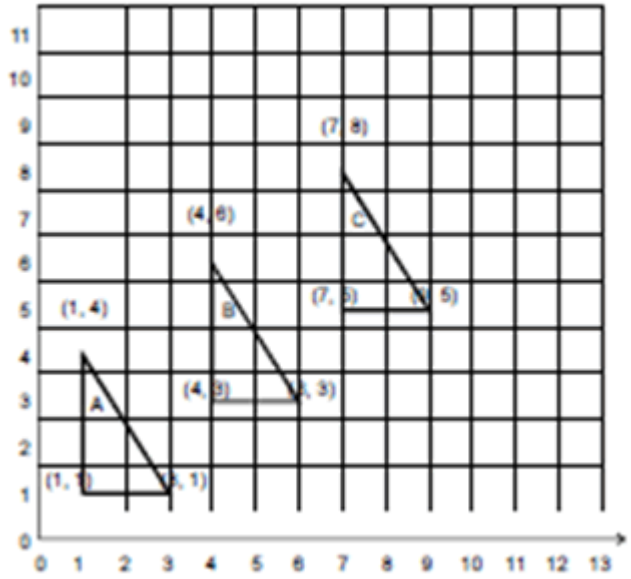
I can statements:

- 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.

Exemplification

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 the sequence.

Activities

Programme of study statement	Activity A
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	●

Activity A - Translation or Destination 2

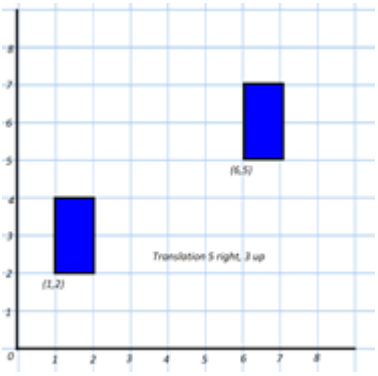
Resources – large grids or chess boards numbered on two axes, pre-cut or plastic shapes, two dice, Counter with T (translation) on one side and D (destination) on the other.

Children work in pairs using a large grid or chess board and pre-cut shapes or plastic shapes.

They roll the dice to get starting coordinates and place one vertex of one shape on the board at the starting coordinates. Roll the dice again. Toss the coin.

If T, then use dice to give the translation up/down and left/ right. Children establish which directions are possible given the size of the board. Place a copy of the first shape with the same vertex at the new coordinates. Extension: Record / relate remaining coordinates of shape.

If D, then use the second roll of the dice as the new coordinates and children describe the translation taking place.



Useful Resources

Battleships - this can be played using squared paper and pencils or using ICT.

Statistics

I can statements:

- solve comparison, sum and difference problems using information presented in a line graph
- complete, read and interpret information in tables, including timetables.

Exemplification

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

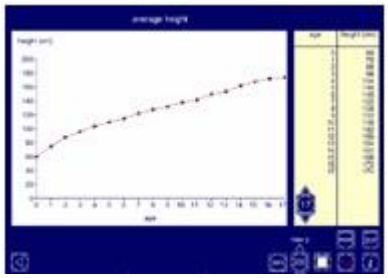
I can find the information in a table or graph to answer a question

		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.



What is the average height of children of different ages?

Are there differences for boys and girls?

This screen shot is from the Interactive Teaching Programme ‘Data Handling’, using the ‘Average Height’ data set.

Activities

Programmes of study statements	Activities		
	A	B	C
solve comparison, sum and difference problems using information presented in a line graph			●
complete, read and interpret information in tables, including timetables	●	●	

Activity A - If the world were a village NRICH

There is a **video** available about this activity

Imagine the world's population shrunk to just 100 people. How many people would be European? How many would own a car? This activity explores the wide range of data available and considers how best to present it.

Activity B – Presenting the project NRICH

A good quality, engaging activity requiring the children to use their reasoning skills whilst reading a range of data charts and diagrams. Can they work out whose birthday it is?

Activity C – The mathematics of Mountains NRICH

Some lovely ideas from the NCETM Primary magazine to create and interpret data from line graphs, using nature as inspiration.

Useful Resources

- Real life examples of timetables
- Rulers
- Dice
- Access to a variety of data