Number and place value; addition, subtraction, multiplication and division; fractions (including decimals and percentages); measurements

Year 6 Pitch and Expectations

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

In context.....

The population of Littletown in 2011 was 178 543. Two years later it had decreased by 40 000. What was the population in 2013?

Place the decreased population on the number line

178 543 78 543

Round any whole number to a required degree of accuracy

0 1000

Estimate the number on the number line indicted by the arrow. What fraction of the number line does it represent?

Circle the best estimate to the answer to the question:
72.34 ÷ 8.91

6 7 8 9 10 11

How do you know?

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

What are the mistakes in these calculations?

How could you correct the mistakes?

	2	4	7				1	2	8		
x		2	8		x		3	4			
1	9	7	6				4	1	2		
4	9	4				3	8	4	0		
2	4	7	0			4	2	5	2		

Write down the calculations you did to solve the problems.

Printing charges for a glossy colour poster are £2.45 for A3 and £1.24 for A4. How much would it cost for 16 A3 and 26 A4 posters?

Use their knowledge of the order of operations to carry out calculations involving the four operations

Use brackets and any operations to make the answer 22, using these 3 numbers:

4 7 2

What other answers can you get if you move the brackets? The biggest possible answer? The smallest?

Pupils explore the order of operations using brackets; for example, 2 + 1 x 3 = 5 and (2+1) x 3 = 9

Spot the mistake.....

$(4 \times 2) + 3^2 = 121$

In what order would you calculate?

Think about BODMAS/ BIDMAS. What went wrong?

Use negative numbers in context, and calculate intervals across zero

Here is part of a number line.
Write the missing numbers in the boxes.

0 200

Circle the two temperatures that have a difference of 2˚.

-1˚C -0.5˚C 0˚C 0.5˚C 1˚ 1.5˚C

What temperature is 4.5˚C higher than –0.4˚C?

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

Solve number and practical problems that involve all of the above (number and place value)

Multiply and divide numbers with up two decimal places by one-digit and two-digit whole numbers.

Find the missing digits in the calculation. How do you know those digits are missing?

What could the problem have been?

	2	□	9	
x		3	6	
1	7	9	4	
8	□	7	0	
1	0	7	6	4

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

	3	.	5	6	
x				9	
3	2	.	0	4	

Aisha paid for 9 magazines priced at £3.56 each with £30.00. Does she have enough to pay for them?

I can use my knowledge of multiplying and dividing decimals by 10, 100 and 1000 to use an alternative strategy.

3.56 x 10 = 35.60

35.60 - 3.56 = 32.04

Identify common factors, common multiples and prime numbers.

Which three prime numbers multiply to make 231?

If 8^2 is 64, what is 80^2?

Why did you order the factors in that way? Is there a more efficient order to calculate them?

Use factors to multiply 17 by 12:
17 x 2 x 3 x 2
34 x 3 x 2
102 x 2 = 204

Find the smallest number that can be added to or subtracted from 87.6 to make it exactly divisible by 8/7/18?

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

		1	6	.	6	9	
36	6	0	1	.	0	0	
	3	6	0				
	2	4	1				
	2	1	6				
		2	5		0		
		2	1		6		
			3		4	0	
			3		2	4	

Winnings from the weekly quiz were £601. It was shared between the 36 team members. How much do they each receive rounded to ten pence?

Each person would need to have £16.60. There would be £3.40 left over. If it was rounded up to £16.70, there would not be enough to go round.

Solve problems which require answers to be rounded to specified degrees of accuracy.

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

Interpret remainders….by rounding, as appropriate to the context.

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.

		0	2	3	.	8		
16	3	7	6	.	0			
	3	2						
	0	5	6					
		4	8					
				8	.	0		
				8	.	0		
				0	.	0		

Printing charges cost 13p per page and 75p for the cover. I paid £4.00 to get this book printed. How many pages are there in the book?

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

Where is the mistake? (decimal remainder) How would you correct it?

Solve problems involving addition, subtraction, multiplication and division.

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.

What is the value of the 3 in the number 17.036? Divide the number by 100. What is the value of the 1 now?

What would the dimensions of the garden be if it was 10 x bigger? 10 times smaller?

Pupils are introduced to the division of decimal numbers by one-digit numbers and, initially, in practical contexts involving measures and money.

	1	0	.	9	2
7	7	6	.	4	4

The total cost of 7 brochures for a show cost £76.44. How much is 1 brochure?

Multiply decimals by whole numbers, starting with the simplest cases, such as 0.4 x 2 = 0.8, and in practical contexts such as measures and money.

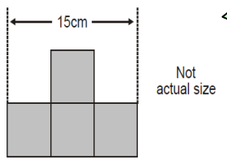
Use the fact:
0.7 x 9 = 6.3
To find the answers to:
6.3 ÷ □ = 9
□ x 18 = 6.3

Use estimation to check answers to calculations and determine, in the context of the problem, levels of accuracy.

Estimate
4.4 x 18.6

Do you expect your answer to be greater or less than your estimate? Why?

This shape is made from 4 shaded squares.



Calculate the perimeter of the shape.

Which parts of the problem can you solve without writing anything down?

Peter has £10. He buys 3kg of potatoes at 87p per kg and 750g of tomatoes at £1.32 per kg. How much money does he have left?

What told you that you could solve that part mentally? What clues were there?

Perform mental calculations, including with mixed operations and large numbers

Undertake mental calculations with increasingly large numbers and more complex calculations

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

Use factorising:
210 ÷ 15
210 ÷ 3 ÷ 5
70÷ 5 =14

Use factorising:
24 x 15 = 24 x 5 x 3
24 x 5 = 120 (half of 24 x 10)
120 x 3 = 360

Round numbers to a specified degree of accuracy.

659 + 259 = 918

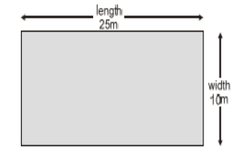
My answer will be roughly 920 because I know that 60 + 60 is 120. So 600 + 200 + 120 is 920.

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?

A shop sells notebooks and pens.
Hassan bought a notebook and a pen. He paid £1.10.
Kate bought a notebook and 2 pens. She paid £1.45.
Calculate the cost of a notebook.

A rectangular swimming pool is 25 metres long and 10 metres wide.



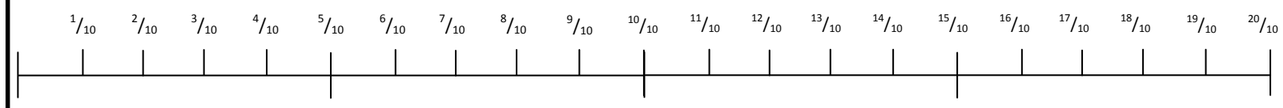
David swims 5 lengths.
Rosie swims 12 widths.
How much further does David swim than Rosie?

Which calculation strategy is the most efficient? Is there more than one way to solve this problem?

Compare and order fractions, including fractions >1

Which is larger? $^1/_3$ or $^2/_5$?

Give an example of a fraction that is greater than 1.2 and less than 1.5.



Place these fractions on the number line:

$^7/_5$ $^{11}/_{20}$ $^{18}/_{12}$ $^1/_{10}$ $^{20}/_{16}$

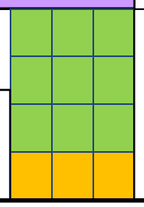
Are these fractions in the correct order? How do you know?

$^{33}/_5$ $^{23}/_3$ $^{45}/_7$

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

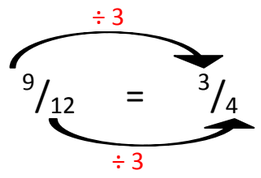
Pupils will be able to use the procedure for finding equivalent fractions once they have used visual representations to model the equivalence. They will be able to explain the process.

What fraction of £2 is 20p? Of £4?
What fraction of 500g is 100g?



What do you notice....?
$^8/_5$ of 25 = 40
$^5/_4$ of 16 = 20
$^7/_6$ of 36 = 42

Which is the odd one out? Why?
$^9/_{12}$ $^{18}/_{24}$ $^1/_5$ $^5/_{25}$
$^6/_{30}$ $^{24}/_{36}$ $^{15}/_{20}$



Associate a fraction with division and calculate decimal fraction equivalents (e.g. 0.375) for a simple fraction (e.g. $^3/_8$)

Use the fact:
$^2/_8$ = 0.25
To find the following:

I need to halve 0.25 to find $^1/_8$. I know that $^6/_8$ is equivalent to 0.75 so I can halve that to find $^3/_8$. I can add 0.125 to 1 to find $^9/_8$.

1/8	2/8	3/8	6/8	9/8
	0.25			

What is $^{23}/_{100}$ of 4kg in grams?

What fraction of a litre is 413ml?

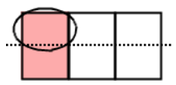
What fraction of a pizza would each person get if 4 pizzas were shared between 5 people?
4 ÷ 5 =
$^4/_5$ = $^8/_{10}$
= 0.8 of a pizza

Divide proper fractions by whole numbers (e.g. $^1/_3 \div 2 = {}^1/_6$)

I know this means.....
'One third shared between two'
'Half of a third'

$^1/_3 \div 2 = {}^1/_6$

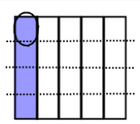
Two people share $^1/_3$ of a chocolate bar. How much do they each get?



I know this means...
'One fifth of a quantity shared equally between 4' 'Quarter of a fifth'

$^1/_5 \div 4 = {}^1/_{28}$

One fifth of a packet of seeds is used to plant 4 pots equally. How much of the packet is used in each pot?



Solve problems involving the calculation and conversion of units of measure, using decimal notation up to three decimal places.

A packet contains 1.5 kilograms of guinea pig food. Remi feeds her guinea pig 30 grams of food each day.

How many days does the packet of food last?

GHopson 2014

Add and subtract fractions with the same denominators and mixed numbers, using the concept of equivalent fractions

$^8/_{10}$ of a kg of potatoes were added to a shopping back containing $^2/_5$ of a kg of carrots. What does the shopping bag weigh?

$^8/_{10} + {}^2/_5$
$^8/_{10} + {}^4/_{10} = {}^{12}/_{10}$
$^{12}/_{10} = 1\ {}^2/_{10}$ of a kg.
1kg and 200g
1.2kg

Practise, use and understand the addition and subtraction of fractions with different denominators by identifying equivalent fractions with the same denominator.

$^7/_6 + {}^2/_5 =$
$1\,{}^1/_6 + {}^2/_5 =$
$1\,{}^5/_{30} + {}^{12}/_{30} =$
$1\,{}^{17}/_{30}$

I can find a common multiple of 6 and 5 to find a common denominator.

$^8/_{12}$ is equivalent to $^4/_6$, so.....
$^5/_6 - {}^4/_6$ leaves $^1/_6$.

Pupils should start to add and subtract with fractions where the denominator of one fraction is a multiple of the other (e.g. $^1/_2 + {}^1/_8 = {}^5/_8$) and progress to varied and increasingly complex problems.

There is $^5/_6$ of a chocolate bar left. Sid eats $^8/_{12}$ of it. How much is left?

Chen, Megan and Sam have parcels. Megan's weighs 1.2kg, Chen's is 1500g and Sam's is half the weight of Megan's. How much heavier is Megan's parcel than Chen's?

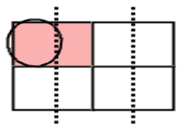
1 gallon = 4.5 litres. How many litres are there in 3 gallons?

Multiply simple pairs of proper fractions, writing the answer in its simplest forms (e.g. $^1/_4 \times {}^1/_2 = {}^1/_8$)

I know this means.....'
Half of a quarter'
'A quarter, halved'

$\frac{1}{2} \times \frac{1}{4} = {}^1/_8$

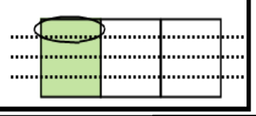
Jamal was given a quarter of a cake. He gave half of it to a friend. How much of the cake did he give away?



I know this means...
'A quarter of a third'
'A third, divided into 4'

$\frac{1}{4} \times {}^1/_3 = {}^1/_{12}$

A third of the tables in a restaurant were reserved for a party. A quarter of those tables had red tablecloths. What fraction of the tables in the restaurant had red table cloths?



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 up to three decimal places.

mm	cm	m	km
460			
		3700	

Draw a flow diagram to help someone convert between units of measure.

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

Which percentage is equivalent to $^3/_5$?
20% 30% 40% 50% 60%
How do you know?
Which percentage is equivalent to $^4/_{20}$?

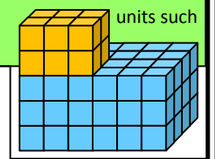
Order from smallest to largest:
23% $^5/_8$ $^3/_5$ 0.8

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

What percentage is the same as $^7/_{10}$? Explain how you know. Give another fraction that is equivalent.

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

Calculate, estimate and compare volume of cubes and cuboids using standard units, including cm cubed (cm^3) and cubic metres (m^3), and extending to other units such as mm^3 and km^3.

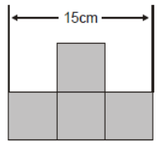


The dimensions of a fish tank are 90cm x 60cm x 40cm.
What is the volume of the fish tank?

Calculate the volume of this shape.

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

This shape is made from 4 shaded squares.



Not actual size

I know that the perimeter is 50cm and the area is $100cm^2$.

That means the area is twice the perimeter.

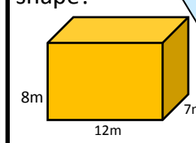
Is that always, sometimes or never true?

Calculate the perimeter of the shape.

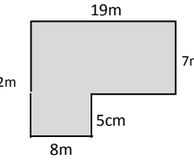
Calculate the area of the shape.
What is the difference between the area and perimeter?
Now create another shape to match this equation::
a = 2p

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

What formula would you use to find the volume of the shape?



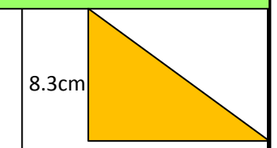
What if...there was an identical cuboid placed on top? What would the total volume be? What could the formula be?



What is the area of this shape?
How could you split the shape?
What formula would you use?

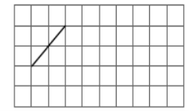
Calculate the area of parallelograms and triangles.

What is the area of this right-angled triangle?
What is the area to 2 decimal places?
Explain your method.



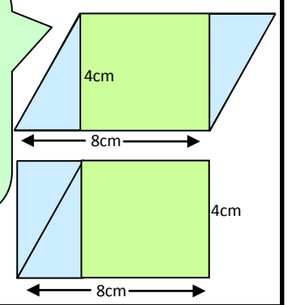
I can count squares to find the area.

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



I can explain why the formula for the area of a parallelogram is the same as for a rectangle.

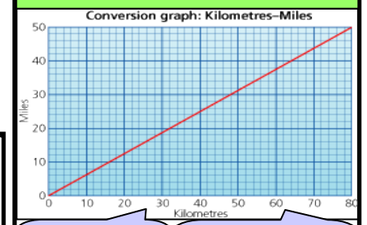
a = bh



Relate the area of rectangles to parallelograms and triangles, e.g. by dissection, and calculate their areas, understanding the formulae to do this.

Convert between miles and kilometres

Connect conversion (e.g. from km to miles) to a graphical representation as preparation for understanding linear/proportional graphs.



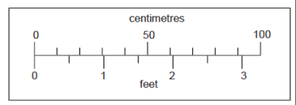
How many km is 38 miles?

Approximately how many miles is equivalent to 40km?

If a car travels at a constant speed of 20mph, how many km will the car travel in 1 hour?

Why is the graph a straight line?

This scale shows length measurements in centimetres and feet.



Not actual size

Look at the scale.
Estimate the number of centimetres that are equal to $2\ {}^1/_2$ feet.
Estimate the difference in centimetres between 50 cm and 1 feet.

Ratio and Proportion, Algebra

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

Recipe for pasta sauce:
- 300g tomatoes
- 120g onions
- 75g mushrooms

If Sam makes the recipe with 900g of tomatoes, what would the weight of the other ingredients be?

To make 6 portions:
- 240g of flour
- 3 eggs
- 180g sugar
- 90ml milk

To make 4 portions:
- 80g of flour
- 2 eggs
- 60g sugar
- 60ml milk

What is wrong with the recipe for 4 portions? Can you correct it?

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

A class contains 12 boys and 18 girls. What percentage of the class are girls?

I know that 18 is a multiple of 3, so I can divide 18.00 by 30. I may calculate this mentally or using a written division method.

```
      0 0 . 6 0
30 ) 1 8 . 0 0
```

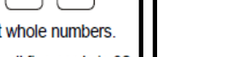
A t-shirt costing £45 is reduced by 15%. How much does it cost after reduction?

How much was saved?

I can find 10% of £45 and halve it to find the 5% and find the total.

I can relate this to multiplying with fractions….
$^{15}/_{100}$ x £45…… or
0.15 x £45
It's the same as saying….
0.15 'of' £45

25% of the apples in a basket are red. The rest are green. There are 21 red apples. How many are green?



I know that 25% is $^{1}/_{4}$. So the green apples make up 3 other parts, worth 21 each.

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

Three pens cost £1.50 altogether. How much would 7 pens cost?

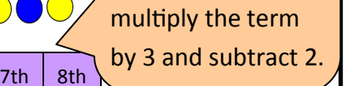
I could use the unitary method….Find the cost of 1 and multiply by 7.

Two plants have a total height of 2.4m. One is twice as tall as the other. What is the height of the shorter plant? Can you model this problem?

What if the taller plant was 3 times as tall?

I could double the groups of 3 and add the cost of 1.

I need to divide 2.4 by 3 to find the answer as there are 3 parts to the problem.



I can show the problem using a bar model to show the number of parts in a scaling problem.

Solve problems involving unequal quantities e.g. 'for every egg you need three spoonfuls of flour', '$^{3}/_{5}$ of the class are boys'.

Purple paint is made from red and blue paint in the ratio 3:5 (300ml:500ml).

To make 40 litres of purple paint, how much would I need of each colour?

3 : 5
6 : 10
9 : 15
12 : 20
15 : 25

If 900ml of red paint is used, how much blue paint is needed?

How much purple paint is made?

What if….you needed to make 80 litres of purple paint?

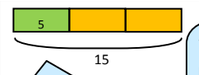
Consolidate their understanding of ratio when comparing quantities, sizes, and scale drawings by solving a variety of problems. They might use the notation a:b to record their work.

Solve problems involving unequal sharing and grouping using knowledge of fractions and multiples.

What fraction of 18 is 12?

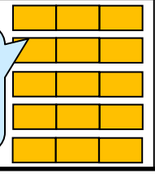
What fraction is 500ml of 400ml?

Relate fractions to multiplication and division.



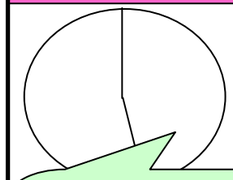
This is a third of 15. It's 15 divided by 3

This is 15 x $^{1}/_{3}$ or I could say there are 15 thirds. Five wholes.



What is $^{1}/_{3}$ of 15? What about 15 x$^{1}/_{3}$? How did you work them out? What do you notice?

Pupils link percentages of 360° to calculating angles of pie charts.



Sid scored $^{18}/_{40}$ on a spelling test. Plot the percentage of correct answers on the pie chart.

So….
45% 'of' 360˚ is the same as saying
0.45 x 360˚ = 162˚

I have worked out that $^{18}/_{40}$ as a percentage is 45% (as a decimal that's 0.45).

Find pairs of numbers that satisfy number sentences involving two unknowns.

☐ and ○ each stand for a different number.

☐ = 34

☐ + ☐ = ○ + ○ + ☐

What is the value of ○?

Express missing number problems algebraically.

Use simple formulae expressed in words.

Write a formula for c chews at 4p each.

Write a formula for the nth term in this sequence…

3, 6, 9, 12, 15….

If l-8 and b=6, what is the perimeter of the field using this formula?

p = 2(l + b)

Enumerate all possibilities of combinations of two variables

p and q both stand for whole numbers
p + q = 1000
P is 150 greater than q
Work out the values of p and q.

Here are five number cards.

A	A	A	B	B

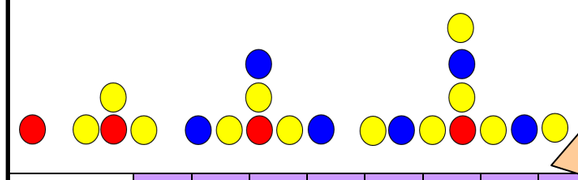
A and B stand for two different whole numbers.
The sum of all the numbers on all five cards is 30.
What could be the values of A and B?

m stands for a whole number greater than 10 and less than 20.
n stands for a whole number greater than 2 and less than 10.
What is the smallest number that $m \times n$ could be?
What is the largest number that $m - n$ could be?

k stands for a whole number.
$k + 7$ is greater than 100.
$k - 7$ is less than 90.
Find all the numbers that k could be.

Pupils will be introduced to the use of symbols and letter to represent variables and unknowns involving:
- *Missing numbers, lengths, coordinates and angles*
- *Formulae in maths and science*
- *Arithmetical rules (e.g. a + b = b + a)*
- *Generalisations of number patterns*
- *Number puzzles (e.g. what two numbers can add up to)*

Generate and describe linear number sequences



Term	1st	2nd	3rd	4th	5th	6th	7th	8th
No of counters	1	4	7	10				

How many counters in the 8th term?
Write a formula for the nth number in the sequence

I know that to find any term in the sequence, you multiply the term by 3 and subtract 2.

So the formula would be:
n = 3t - 2

GHopson 2014