Year 6

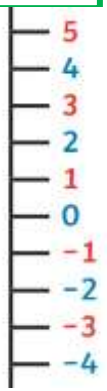
UPPER KEY STAGE 2

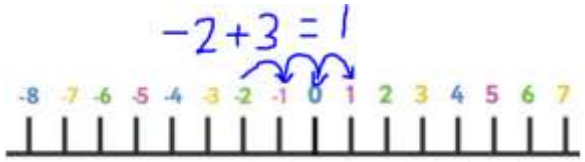
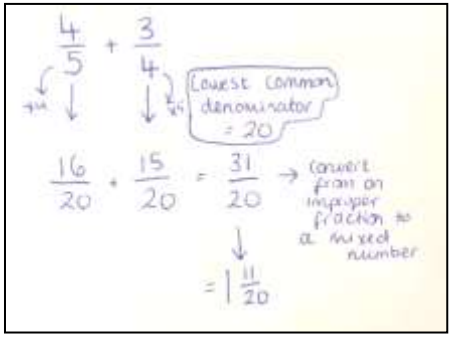
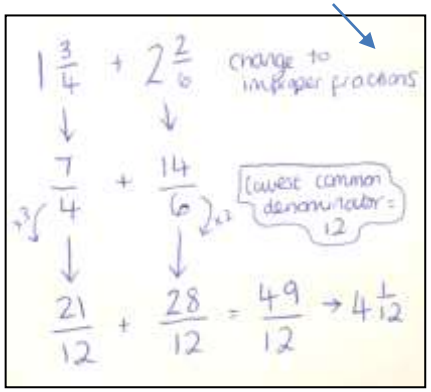
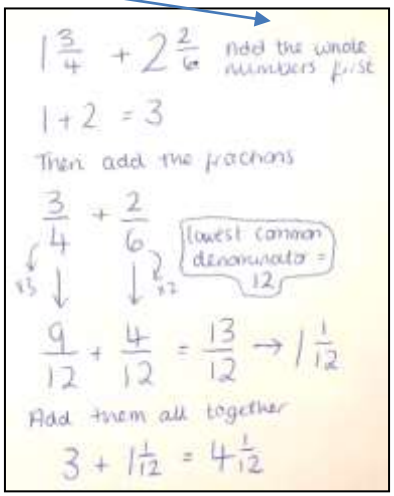
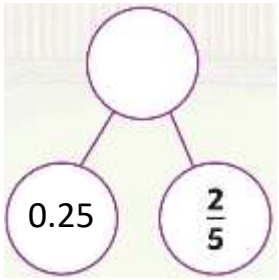
Children move on from dealing mainly with whole numbers to performing arithmetic operations with both decimals and fractions. By the end of year 6, pupils should be fluent in written methods for all four operations, including long multiplication and division, and in working with fractions, decimals and percentages.

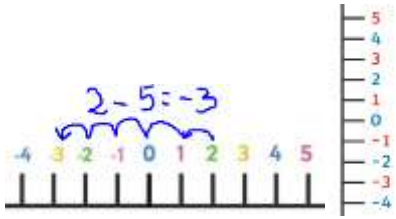
Addition and subtraction: Children will consolidate their use of written procedures in adding and subtracting whole numbers with up to 6 digits and also decimal numbers with up to 3 decimal places. Mental strategies for adding and subtracting increasingly large numbers will also be taught. These will draw upon children's robust understanding of place value and knowledge of number facts. Negative numbers will be added and subtracted.

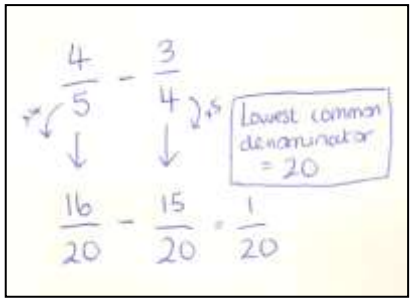
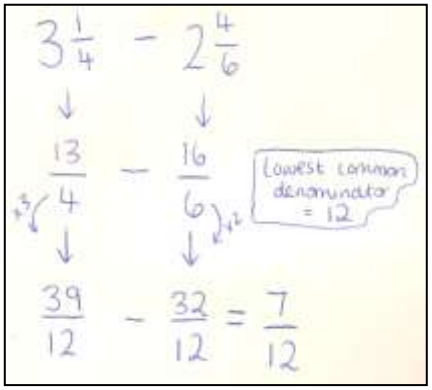
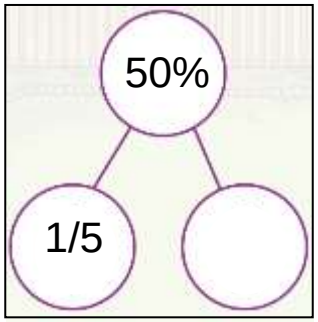
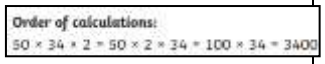
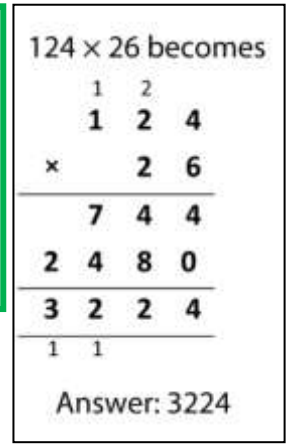
Multiplication and division: Efficient and flexible strategies for mental multiplication and division are taught and practised, so that children can perform appropriate calculations even when the numbers are large, such as 40 000 × 6 or 40 000 ÷ 8. In addition, it is in Years 5 and 6 that children extend their knowledge and confidence in using written algorithms for multiplication and division.

Fractions, decimals and percentages: Fractions and decimals are also added, subtracted, divided and multiplied, within the bounds of children's understanding of these more complicated numbers. Children will also calculate percentages and ratios.

	National Curriculum Objectives	Mental Calculation	Written Calculation- including concrete, pictorial and abstract methods
Y6 +	**<u>Undertake mental calculations with increasingly large numbers and more complex calculations</u>**	Have a focus on quick and accurate recall of number bonds to 100 (in ones and fives) and to 1000 (in hundreds and tens) and be able to apply these to larger numbers e.g. 51+49=100 so 510 +490 =1000 and therefore 5100 + 4900 = 10,000 etc. Encourage children to look for ways to simplify problems e.g. Money: £8.99 + £3.49 = £12.48 Use £9 + £3.50 = £12.50 and subtract 2p Children will be taught	**<u>Column method for addition including regrouping</u>.** Children will be working with place value of numbers up to 10,000,000 in year 6 and will continue to build upon the column addition skills they have worked on in Y5 by calculating with numbers up to 6 digits 4 5 8 6 4 + 2 3 4 9 7 6 9 3 6 1 1 1 1 Starting with the ones, add each column in turn. Regroup tens, hundreds, thousands, ten thousands as required.  N.B. Children are encouraged to put their regrouped digit wherever they feel suits them best. They are shown different ways and are allowed to choose Children will also use this method to add numbers that have up to 3 decimal places N.B. Children are given problems which involve adding numbers with differing place value and involving whole numbers added to numbers with decimal places. We teach children to use place holders to help them to line their digits up with the correct place value. **<u>Calculating negative numbers pictorially</u>**- 

	Use negative numbers in context and calculate intervals across zero.	to count on from a negative number up through zero in ones and to do this with problems in context.	Children are encouraged to draw number lines to help them to calculate intervals through zero. They are shown number lines both horizontally and vertically, also in context using thermometers. They can then use these number lines to make 'jumps' as they have done in previous year groups so help them to see the changes as they cross zero. 
	Add and subtract fractions with different denominators and mixed numbers, using the concept of equivalent fractions	Use common factors to simplify fractions mentally	**Adding fractions** Children are taught to change the fractions to an alternate equivalent fraction so that they both have the same denominator, add the numerators and then simplify or change to a mixed number if needed e.g. When adding mixed numbers, we teach the children these two methods.     **Use of the part-whole model for adding fractions, decimals and percentages** Children have use part-whole models all

			through school. We use them in many different contexts in year 6, here is one example- we use them to get the children to practise converting decimals, fractions and percentages to the same thing and then adding them. They choose the best way to convert before adding. Missing number problems are used to help support reasoning and problem solving
Y6 -	**<u>Use negative numbers in context and calculate intervals across zero.</u>** **<u>Subtract fractions with different</u>**	Children will be taught to <u>count back</u> through zero in ones and to do this with problems in context. Use common factors to simplify fractions mentally	**<u>Calculating negative numbers pictorially</u>-** Children are encouraged to draw number lines to help them to calculate intervals through zero. They are shown number lines both horizontally and vertically, also in context using thermometers. They can then use these number lines to make 'jumps' as they have done in previous year groups so help them to see the changes as they cross zero.  **<u>Column method for subtraction including exchanging.</u>** Children will be working with numbers up to 10,000,000 in year 6 and will continue to build upon the column subtraction skills they have worked on in Y5 by calculating with numbers containing up to 6 digits  Starting with the ones, subtract each column in turn. Exchange tens, hundreds, thousands and/or ten thousands as required. N.B. Children are also exposed to tricky calculations where the larger number is a multiple of 10,000 so they have to use and apply their knowledge of exchanging to solve it. **<u>Subtracting Fractions</u>** Children are taught to change the fractions to an alternate equivalent fraction so that they both have the

	denominators and mixed numbers, using the concept of equivalent fractions		same denominator, subtract the numerators and then simplify or change to a mixed number if needed e.g.  When subtracting with mixed numbers, we teach the children to convert the mixed numbers to improper fractions first and then subtract as they can't always subtract the whole numbers first.  **Use of the part-whole model for subtracting fractions, decimals and percentages**  Children have use part-whole models all through school. We use them in many different contexts in year 6, here is one example- we use them to get the children to practise converting decimals, fractions and percentages to the same thing and then subtracting them. They choose the best way to convert before subtracting.
Y6 ×	**Perform mental calculations, including with mixed operations and large numbers** **Multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication**	Encourage children to think about the order in which they calculate, e.g.  Order of calculations: 50 × 34 × 2 = 50 × 2 × 34 = 100 × 34 = 3400	**Long Multiplication method**  Start with the ones. 154 × 6 = 924 154 × 20 = 3080 3080 + 924 = 4004 N.B. This method has been introduced in year 5 so they should be familiar with it. We focus on SATs style arithmetic questions and making sure children check their working by repeating the calculation to check they get the same answer or doing the inverse.  N.B. Children are encouraged to use different colour pens for each line of working out if they struggle. See diagram for example of how colour can be used to show which digit the lines of working out relate to.

Multiply simple pairs of proper fractions, writing the answer in its simplest form

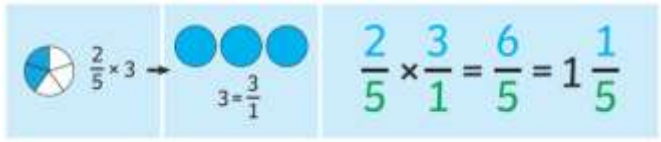
N.B. Children are taught that **of** and **x** are interchangeable in these types of calculations e.g. 2/5 **x** 3 is the same as 2/5 **of** 3

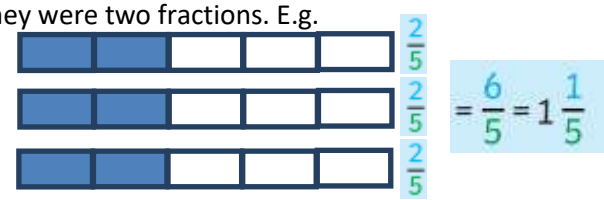
Multiplying Fractions

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

Multiply the numerators together, multiply the denominators together, simplify or change to a mixed number if needed

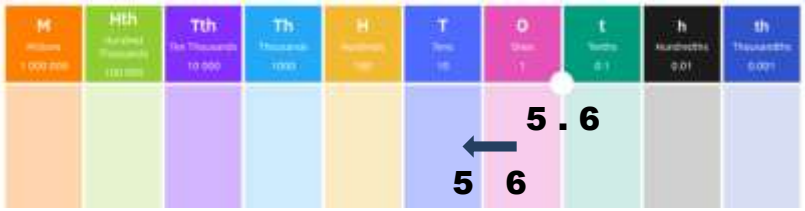
Children will also multiply proper fractions by whole numbers. We teach the children to change the whole number to become a fraction over 1 and multiply as if they were two fractions. E.g.





We use bar models and diagrams like the ones above to support the teaching of this. The bar model and diagrams support the repeated addition of the fractional parts.

Multiplication by 10, 100 and 1000



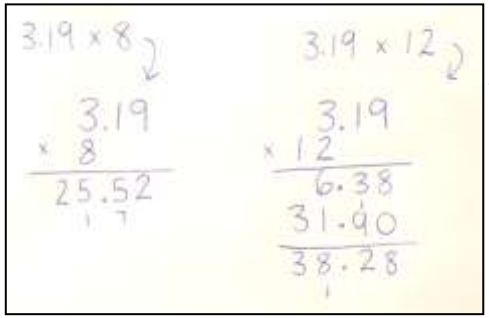
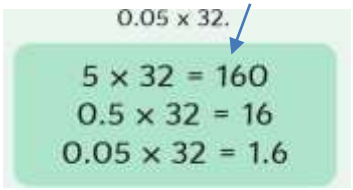
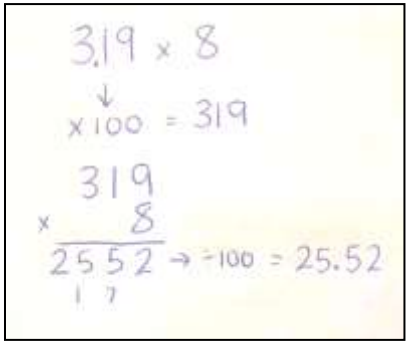
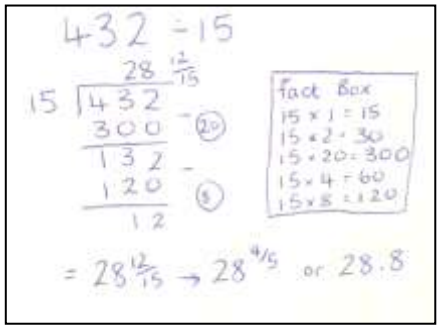
Children are provided with a laminated version of this grid to practise moving the digits when multiplying by 10, 100 and 1000. The majority of children will move on to drawing their own grid on their whiteboard in their book to support their calculations and then to complete the calculations mentally.

Move 1 place to the left for x10
Move 2 places to the left for x100
Move 3 places to the left for x1000

N.B. We continue to reiterate here that children **cannot** simply add a zero. When we work with numbers with decimal places, this becomes really apparent as the place value doesn't change, e.g. 5.6 is the same value as 5.60. The example in the table demonstrates the correct working

Identify the value of each digit in numbers given to three decimal places and multiply numbers by 10, 100 and 1000 giving answers

Children will often use

	up to three decimal places **Multiply one-digit numbers with up to two decimal places by whole numbers** **Use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy.**	estimation to check the reliability of their answers for multiplication and division. We encourage children to estimate the answers first by rounding, so 3.19 x 12, they would round the decimal number to the nearest whole, 3x12=36. They also need to check that their decimal point in their answer box lines up with the one in the question.	**Short and long multiplication of one-digit numbers with up to two decimal places and whole numbers**  Children will use the same method of short or long multiplication as they would with whole numbers and will also use place value to make sure the digits are lined up correctly. Children can use multiplication facts to help them e.g.   Children can also multiply the number out to get a whole number and work the calculation through, then divide the answer by the same amount.
Y6 ***÷***	**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**	**Perform mental calculations, including with mixed operations and large numbers** Children are encouraged to use their knowledge of division facts to help them with calculating with larger numbers e.g. For 5400 ÷ 6, they can use 54÷6=9 540÷6=90	**Long Division- Chunking** In year 6, children are taught to show remainders of division calculations as **fractions** or **decimals**.  Children create a fact box for the divisor. They don't need to include every multiple of that number, only ones that are relevant to the calculation. It is sometimes easier to create the fact box as they are going along. These chunks are then subtracted from the dividend until they can no longer remove a whole chunk or get to zero. Any amount left over is the remainder. This remainder then needs to be interpreted as a fraction or decimal.

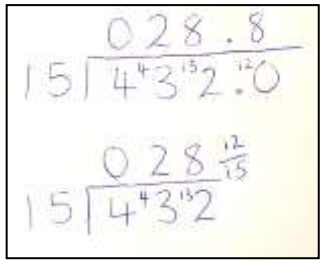
Use written division methods in cases where the answer has up to two decimal places

Divide numbers up to 4 digits by a two-digit number using the formal written method of short division where appropriate, interpreting remainders according to the context

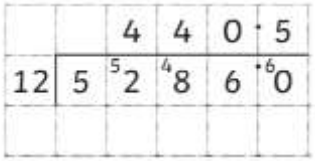
Identify the value of each digit in numbers given to three decimal places and divide numbers by 10, 100 and 1000 giving answers up to three decimal place

So 5400÷6=900

Short Division

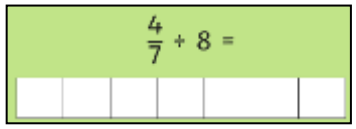


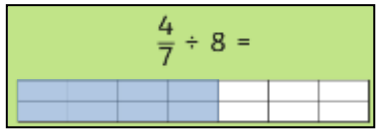
Children may still choose to create a fact box depending on the size of the dividend and divisor. They use the short method of division starting from the highest value digit in the divisor. If the child is interpreting the remainder as a fraction.

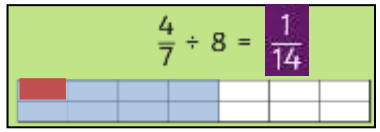


Divide proper fractions by whole numbers

We begin by using bar models and diagrams to show how the fraction is divided

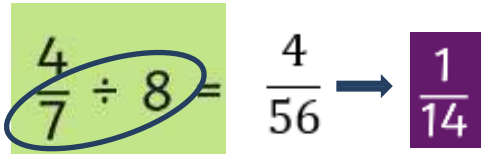






Once the children understand how the fractional part is divided, we use an abstract method to allow them to reach the answer more quickly and efficiently.

1. Keep the numerator the same
2. Multiply the denominator by the whole number to become the new denominator
3. Simplify if needed

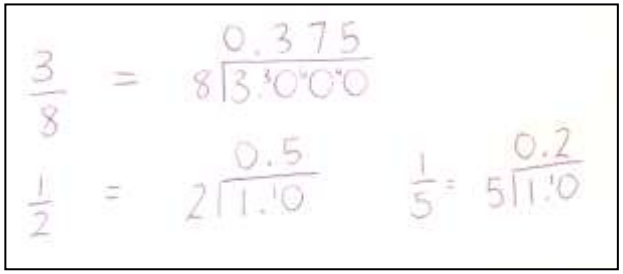
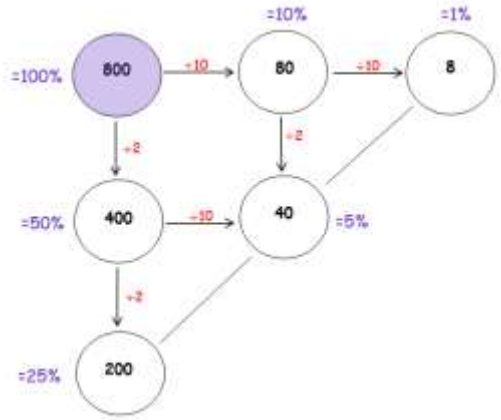


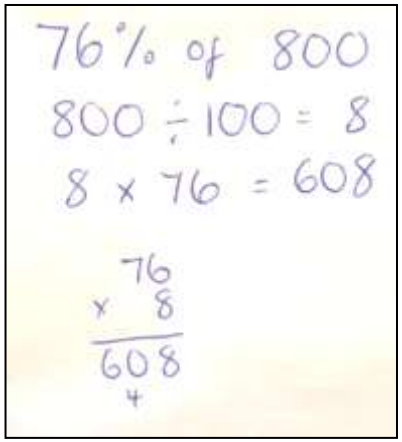
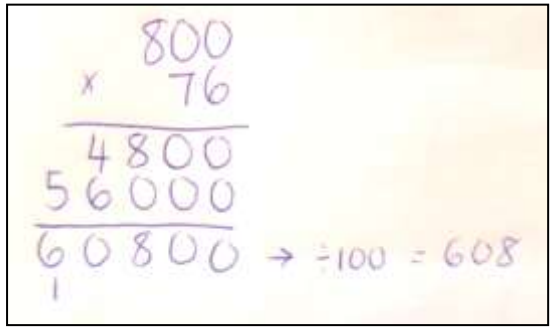
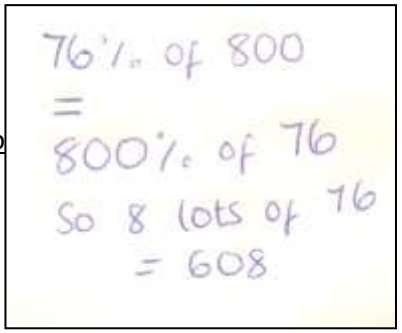
Division by 10, 100 and 1000

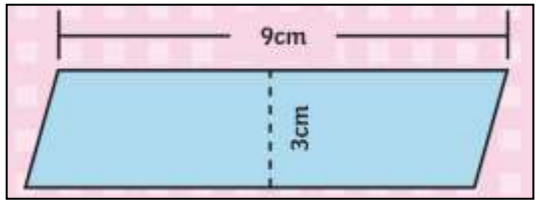
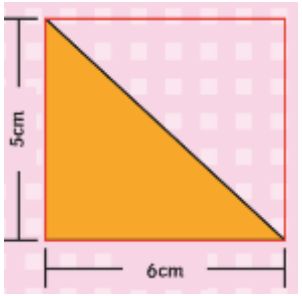
Children are provided with a laminated version of this grid to practise moving the digits when dividing by 10, 100 and 1000. The majority of children will move on to drawing their own grid on their whiteboard in their book to support their calculations and then to complete the calculations mentally.

Move 1 place to the right for ÷10
Move 2 places to the right for ÷100
Move 3 places to the right for ÷1000

N.B. We continue to reiterate here that children **cannot** simply remove zeros. Many of the numbers the children work with aren't multiples of 10 or 100 so they need to have the concept of the digits moving on the place value grid

	Associate a fraction with division and calculate decimal fraction equivalents		**Relating division to fractions** Show children that the division symbol is actually very similar to a fraction but without numbers as numerator and denominators. Children need to understand that fractions are related to division e.g. ½ is the same as 1÷2 
	Use their knowledge of the order of operations to carry out calculations involving the four operations (BODMAS)		 N.B. The O in BODMAS is also referred to as 'of' as in 'powers of' and an I for indices. Pupils explore the order of operations using brackets; for example, 2 + 1 x 3 = 5 and (2 + 1) x 3 = 9.
%	**Solve problems involving the calculation of percentages [for example, of measures, and such as 15% of 360] and the use of percentages for comparison**		**The Bubble Method**  **To find a percentage of any number:** Children fill in the value of each circle, beginning with the main number in the shaded area. They then work their way through all 6 circles by following the actions on each arrow. They can then use the information in each circle to find any percentage. **e.g. 76% of 800, you would add** **50%= 400** **25%=200** **1%=8** **76% = 608**

			Divide by 100 and then multiply by the percentage  **Flip the values** (if it easier to do so- some values it wouldn't make sense to do this) N.B. Children are taught all 4 methods and then they choose the method that they are most comfortable with to solve calculations **Multiply by the percentage and divide by 100**  
Shape and Measure	**Convert between miles and kilometres**		5 miles ≈ 8 kilometres Children are taught that 1 mile is approximately 1.6km. The whole number equivalent is 5 miles approximately equals 8km. Miles to Kilometres- Multiply by 8 then divide by 5 Kilometres to miles- Multiply by 5 then divide by 8 Alternatively, children can multiply or divide by 1.6 if they are confident.

	Calculate the area of parallelograms and triangles		**Area of parallelograms and triangles** Area of a parallelogram = length × perpendicular height  9cm x 3cm = 27cm^2 Area of a triangle = (base × height) ÷ 2  6cm x 5cm = 30cm ÷ 2 = 15cm^2