Heptonstall Primary School

Calculation Policy
Year 1 and 2

This booklet contains the calculation methods used in year 1 and 2 for each of the four operations – addition, subtraction, multiplication and division.

Please use this document as a tool to support your child at home. The methods we use in school may or may not be familiar to you. Children can become confused when they seek support from an adult at home because often, the adult will teach the method they themselves were taught.

Knowing how the methods in this booklet work will help you to help your child. All staff in school use this document so that we can ensure consistency in our approach.

Year 1

Year 1

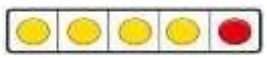
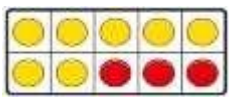
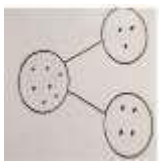
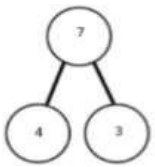
Key Stage 1

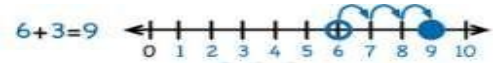
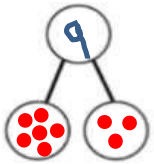
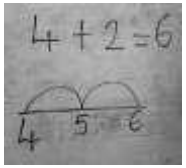
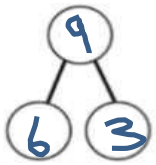
Children in Years 1 and 2 will be given a really solid foundation in the basic building blocks of mental and written arithmetic. Through being taught place value, children will develop an understanding of how numbers work, so that they are confident with 2-digit numbers and beginning to read and say numbers above 100. A CPA approach will be used throughout each unit, ensuring a range of manipulative and representations are used to support children's learning.

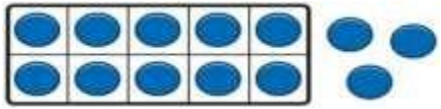
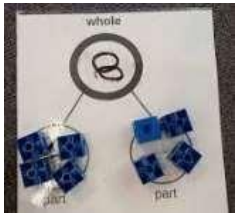
Addition and Subtraction: A focus on number bonds, first via practical hands- on experiences and subsequently using memorisation techniques, enables a good grounding in these crucial facts, and ensures that all children leave Year 2 knowing the pairs of numbers which make all the numbers up to 10 at least. Children will also have experienced and been taught pairs to 20. Children's knowledge of number facts enables them to add several 1-digit numbers, and to add/subtract a 1-digit number to/from a 2-digit number. Another important conceptual tool is the ability to add/subtract 1 or 10, and to understand which digit changes and why. This understanding is extended to enable children to add and subtract multiples of 10 to and from any 2-digit number. The most important application of this knowledge is the ability to add or subtract any pair of 2-digit numbers by counting on or back in 10s and 1s. Children will then extend this knowledge by learning the written method of column addition and subtraction (with regrouping and exchanging) with emphasis on the place value of each digit.

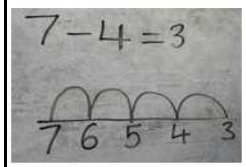
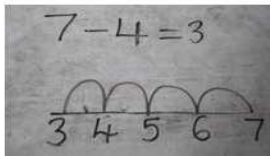
Multiplication and Division: Children will be taught to count in 2s, 3s, 5s and 10s, and will relate this skill to repeated addition. Children will learn the associated ×2, ×3, ×5 and ×10 tables.
Engaging in a practical way with the concept of repeated addition and the use of arrays enables children to develop a preliminary understanding of multiplication and asking them to consider how many groups of a given number make a total will introduce them to the idea of division. Children will also be taught to double and halve numbers and will thus experience scaling up or down as a further aspect of multiplication and division.

Fractions: Fractions will be introduced as numbers and as operators, specifically in relation to halves, quarters and thirds. Children will learn how to find halves and quarters of shapes and amounts, linking to their learning of division, using the same skills and methods.

	National Curriculum Objectives	Mental Calculation	Written Calculation
Y1 +	Read, write and interpret mathematical statements involving addition (+), subtraction (–) and equals (=) signs Represent and use number bonds and related subtraction facts within 20 Add one-digit and two-digit numbers to 20, including zero Solve one-step problems that involve addition, using concrete objects and pictorial representations, and missing number problems such as 7 = 4 + ☐	Place the larger number in your head and count on the smaller number to find your answer. 9 + 4 = 13 E.g. If I am at 9, how many more do I need to make 13. How many more do I add on now? Learn number bonds to 10	**Combining two parts to make a whole- (Including number bonds)** **Concrete** (use other resources too e.g. counters, teddy bears, cars and demonstrate on a number frame)  *4 + 3 = 7*  *4 + 1 = 5*  *7 + 3 = 10* **Children to represent the concrete objects using dots or crosses on a part whole model**  **Pictorial**  **Abstract** *4 + 3 = 7 Four is a part, 3 is a part and the whole is seven.*

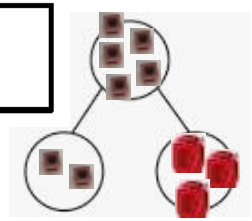
		Place the larger number in your head and add the smaller number by counting on to find your answer. 2 + 14 = Put 14 in your head and count on another 2 to find the answer of 16.	**Starting at the bigger number and counting on** **Concrete** Start with the larger number on the bead string and then count on to the smaller number 1 by 1 to find the answer.  *12 + 5 = 17* **Pictorial**  Circle the biggest number and jump forwards the smaller number in the number line.  6+3=9 Draw counters to add each part to the part sections of the whole part model. Count the total to find the sum. **The abstract number line** *What is 2 more than 4? What is the sum of 2 and 4?* *What is the total of 4 and 2? 4 + 2 =*  **The abstract part whole model**  **Understanding teen numbers as a complete 10 and some more Concrete** Complete a group of 10 objects and count more.  *13 is 10 and 3 more. 10 + 3 = 13*

			Pictorial Use a ten frame to support understanding of a complete 10 for teen numbers.  *13 is 10 and 3 more.* **Abstract** *1 ten and 3 ones equal 13.* *10 + 3 = 13* **Finding a missing part Concrete** Use a part, whole model to find the missing part. Add the part we already have using cubes or counters. Count on until we get to the whole using the counters or cubes.  **Pictorial** As above using a whiteboard and pen. Draw counters for the parts.

Y1 –	Read, write and interpret mathematical statements involving subtraction (-) and equals (=) signs Represent and use number bonds and related subtraction facts within 20 Subtract one-digit and two-digit numbers to 20, including zero Solve one-step problems that involve subtraction, using concrete objects and pictorial representations, and missing number problems such as 7 = ? – 9.	Place the larger number in your head and count back the smaller number to find your answer. 13 – 4 = 9 E.g. If I am at 13, how many do I need to count back to get to 9? Learn number bonds to 10 and related subtraction sentences	**Counting back and taking away** **Concrete** Children arrange objects and remove to find how many are left. 1 less than 6 is 5. 6 subtract 1 is 5. 6- 1 = 5  Move the beads along the bead string as you count backwards.  13- 4 = 9 **Pictorial** Cross out drawn objects to show what has been taken away. 5- 3 = 2  Children count back to take away and use a number line or number track to support the method.   8 – 3 = 5 **The abstract number line** What is 4 less than 7? What is 7 subtract 4? 7 – 4 =  

Finding a missing part, given a whole and a part

5 - ? = 2
inverse
2 + ? = 5



Concrete

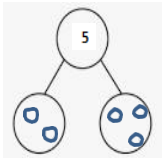
Given a missing number subtraction number sentence, we first of all find the inverse.
We then use a whole, part model and cubes or counters
We put the whole number in the whole section.
We put the part we know in the part section.
We count on from the part we know using cubes until we get to the whole number.

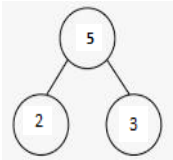
Pictorial

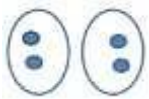
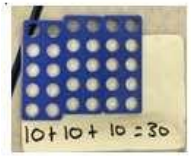
We find the inverse of the number sentence.
We draw a whole part model.
We write the whole number in the whole section.
We draw the part we know in the part section.
We count on from the part we know by drawing counters and stopping when we get to the whole.

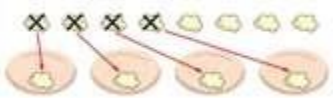
Abstract

We find the inverse of the number sentence.
We draw a whole, part model.
We write the whole number in the whole section.
We write the part in the part section.
We count on from the part until we get to the whole and write the missing part.





Y1 x	Solve one-step problems involving multiplication and division, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher	Count in 2s, 5s and 10s Begin to say what three 5s are by counting in 5s, or what four 2s are by counting in 2s, etc. Double numbers to 10	**Multiplication** **Recognising and making equal groups** **Concrete** Children arrange objects in equal and unequal groups and understand how to recognise whether they are equal.  **Pictorial** Children draw and represent equal groups.  Describe equal groups using words e.g. there are 3 equal groups of 5 NB: This method also to be used when finding doubles of amounts. 2 lots of 4 is the same as double 4  **Finding the total of equal groups by counting in 2s, 5s and 10s** **Concrete**  **Repeated addition** Use different objects and pictures to add equal groups. Write addition sentences to describe objects and pictures.    Number squares to support counting in 2s, 5s and 10s.

Y1 **÷**	Solve one-step problems involving multiplication and division, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher	Begin to count in 2s, 5s and 10s Find half of even numbers to 12 Find half of even numbers by sharing	**<u>Division</u> <u>Grouping</u>** **<u>Concrete</u>** Learn to make equal groups from a whole and find how many equal groups of a certain size can be made. Sort a whole set people and objects into equal groups.  ***There are 10 children altogether.*** ***There are 2 in each group.*** ***There are 5 groups.*** **<u>Pictorial</u>** Represent a whole and work out how many equal groups.  There are 10 in total. There are 5 in each group. There are 2 groups. **<u>Sharing</u>** Share a set of objects into equal parts and work out how many are in each part**.**  Sketch or draw to represent sharing into equal parts. This may be related to fractions.  10 shared into 2 equal groups gives 5 in each group.  $\frac{1}{2}$ of 10 is 5 NB: This method also to be used when finding fractions of amounts.

Year 2

Year 2

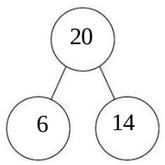
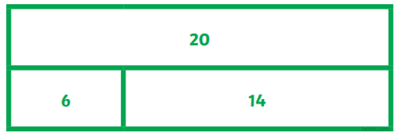
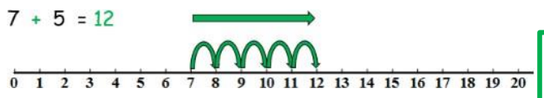
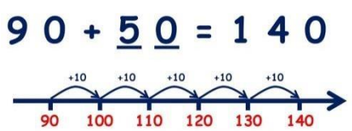
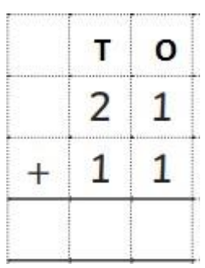
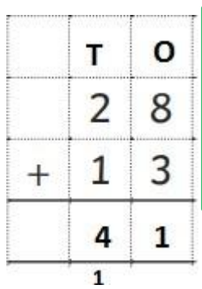
Key Stage 1

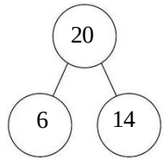
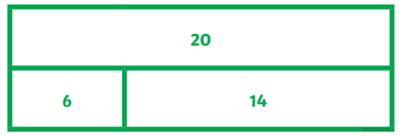
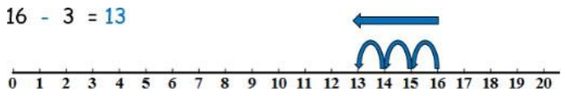
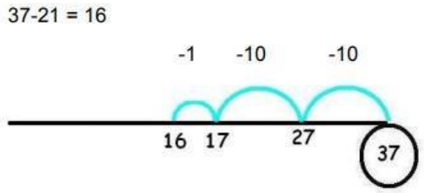
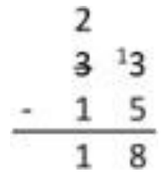
Children in Years 1 and 2 will be given a really solid foundation in the basic building blocks of mental and written arithmetic. Through being taught place value, children will develop an understanding of how numbers work, so that they are confident with 2-digit numbers and beginning to read and say numbers above 100. A CPA approach will be used throughout each unit, ensuring a range of manipulative and representations are used to support children's learning.

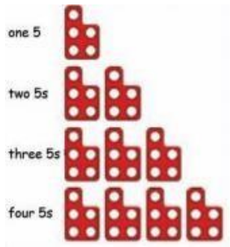
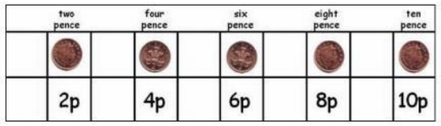
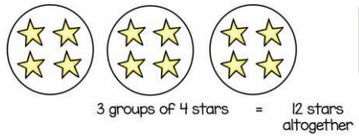
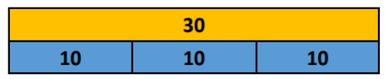
Addition and Subtraction: A focus on number bonds, first via practical hands-on experiences and subsequently using memorisation techniques, enables a good grounding in these crucial facts, and ensures that all children leave Year 2 knowing the pairs of numbers which make all the numbers up to 10 at least. Children will also have experienced and been taught pairs to 20. Children's knowledge of number facts enables them to add several 1-digit numbers, and to add/subtract a 1-digit number to/from a 2-digit number. Another important conceptual tool is the ability to add/subtract 1 or 10, and to understand which digit changes and why. This understanding is extended to enable children to add and subtract multiples of 10 to and from any 2-digit number. The most important application of this knowledge is the ability to add or subtract any pair of 2-digit numbers by counting on or back in 10s and 1s. Children will then extend this knowledge by learning the written method of column addition and subtraction (with regrouping and exchanging) with emphasis on the place value of each digit.

Multiplication and Division: Children will be taught to count in 2s, 3s, 5s and 10s, and will relate this skill to repeated addition. Children will learn the associated ×2, ×3, ×5 and ×10 tables.
Engaging in a practical way with the concept of repeated addition and the use of arrays enables children to develop a preliminary understanding of multiplication, and asking them to consider how many groups of a given number make a total will introduce them to the idea of division. Children will also be taught to double and halve numbers, and will thus experience scaling up or down as a further aspect of multiplication and division.

Fractions: Fractions will be introduced as numbers and as operators, specifically in relation to halves, quarters and thirds. Children will learn how to find halves and quarters of shapes and amounts, linking to their learning of division, using the same skills and methods.

	National Curriculum Objectives	Mental Calculation	Written Calculation
Y2 +	Add numbers using concrete objects, pictorial representations, and mentally, including: a two-digit number and ones; a two-digit number and tens; two two-digit numbers; three one-digit numbers.	Use place value knowledge to find one more and ten more than any 2-digit number up to 100. Count on in multiples of 10, 5, 2 and 3 and in tens from any number. Use patterns of known facts. Eg. 7 + 2 = 9 so 27 + 2 = 29 Use number bonds to 10 knowledge when adding three or more single digit numbers. Eg. 8 + 4 + 2 as 10 + 4	***Part Whole Models and Bar Models to visualise number bonds and simple addition calculations***  6 + 14 = 20 14 + 6 = 20 20 = 14+6 20 = 14 + 6  ***Number lines for 2-digit add 1 digit and for adding multiples of 10***   NB: When initially introducing written strategies, simpler calculations (which would normally be solved mentally) may be used to demonstrate the method before progressing onto more challenging calculations. ***Column Addition for adding two 2-digit numbers***   NB: Emphasis to be made on the place value of each digit so children do not think it is 2 +1. Ask questions such as 'What is the value of 2 in this calculation?', 'Can you show me this number partitioned?'

Y2 –	Subtract numbers using concrete objects, pictorial representations, and mentally, including: a two digit number subtract ones; a two digit number subtract tens; two-digit numbers subtract two-digit.	Use place value knowledge to find one more and ten more than any 2-digit number up to 100. Count back in multiples of ten from 100. Using concrete initially, moving on to 100 square and then mentally. Use patterns of known facts. Eg. 5 – 2 = 3 so 25 – 2 = 23	***Continue to use part whole models and bar models to represent related addition and subtraction facts.***  6 + 14 = 20 14 + 6 = 20 **So…** 20 – 14 = 6 20 – 6 = 14  ***Number lines for 2-digit minus 1 digit and for subtracting multiples of 10***   ***Column subtraction for two 2-digit number, with regrouping*** NB: Emphasis to be made on the place value of each digit and when introduced to the method children should be shown it using Numicon or Base 10 to model the exchanging of tens and ones. 

Y2 **x**	Recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers. Calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication (×), division (÷) and equals (=) signs. Show that the multiplication of two numbers can be done in any order (commutative) and division of one number by another cannot. Solve problems involving multiplication and division, using materials, arrays, repeated addition, mental methods and multiplication and division facts, including problems in context.	Children to use a range of vocabulary to describe multiplication and use a variety of practical resources to explain multiplication. Use songs to aid children's initial ability to recite counting in 10s, 2s, 5s and 3s (in that order). Rote learn times tables to increase children's rapid recall.	***Count in 2s, 5s, 10s and 3s using variety of concrete and pictorial representations***    ***Arrays for multiplication*** 3 x 4 = 12  Show multiplication as repeated addition. 3 +3+3+3=12 4 x 3 = 12  Rotate arrays to show that multiplication of two numbers can be done in any order **(commutative law)** ***Use other pictorial representations to help children visualise the concept of multiplication.***  

Y2 **÷**	Recall and use division facts for the 2, 5 and 10 multiplication tables. Solve problems involving division, using materials, arrays, repeated subtraction, mental methods, and multiplication and division facts, including problems in contexts. Calculate mathematical statements for division within the multiplication tables and write them using the division (÷) and equals (=) signs. Show that division of one number by another is not commutative [i.e. can be done in any order].	Children to use a range of vocabulary to describe division and use a variety of practical resources to explain multiplication. Use their multiplication knowledge to derive known division facts. Eg. 5 x 10 = 50 so 50 ÷ 10 = 5	***Make links to multiplication by continuing to use arrays to support division.***  NB: Continue to reinforce sharing and grouping in a practical context. How many groups of 3? How many groups of 5? 15 shared between 3 people is....? 15 shared between 5 people is....? 15 divided by 3 = 5 15 divided by 5 = 3 15 ÷ 3 = 5 15 ÷ 5 = 3 ***Use pictorial representations to share into equal groups*** 12 ÷ 3 = 4 NB: This method also to be used when finding fractions of amounts. $\frac{1}{2}$ of 8 is 4

Heptonstall Primary School

Calculation Policy
Year 3 and 4

This booklet contains the calculation methods used in year 3 and 4 for each of the four operations – addition, subtraction, multiplication and division.

Please use this document as a tool to support your child at home. The methods we use in school may or may not be familiar to you. Children can become confused when they seek support from an adult at home because often, the adult will teach the method they themselves were taught.

Knowing how the methods in this booklet work will help you to help your child. All staff in school use this document so that we can ensure consistency in our approach.

Year 3

Year 3

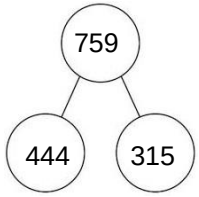
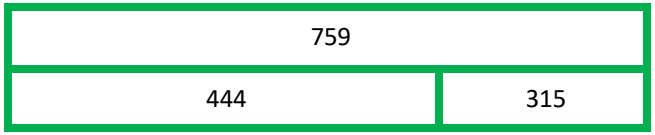
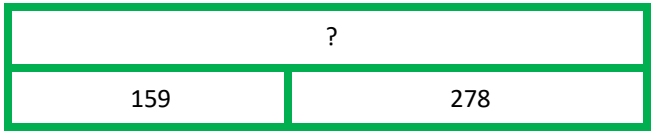
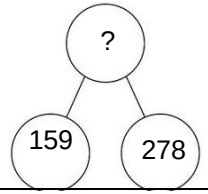
LOWER KEY STAGE 2

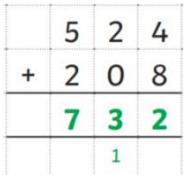
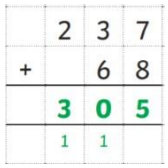
The principal focus of mathematics teaching in lower key stage 2 is to ensure that pupils become increasingly fluent with whole numbers and the four operations, including number facts and the concept of place value. This should ensure that pupils develop efficient written and mental methods and perform calculations accurately with increasingly large whole numbers.

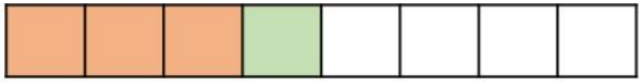
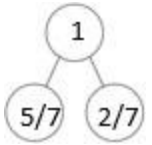
Addition and subtraction: Children are taught to use place value and number facts to add and subtract numbers mentally and they will develop a range of strategies to enable them to become less reliant on the 'counting in 1s' or fingers-based methods of Key Stage 1. In particular, children will learn to add and subtract multiples and near multiples of 10, 100 and 1000 (year 4) and will become fluent in complementary addition as an accurate means of achieving fast and accurate answers to 3-digit subtractions. Standard written methods for adding larger numbers are taught, learned and consolidated, and written column subtraction is also introduced.

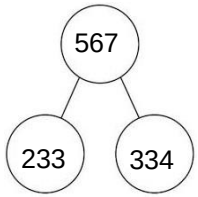
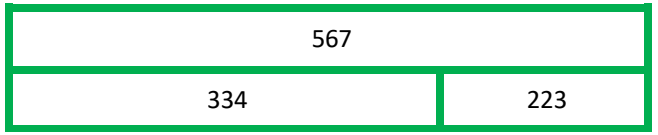
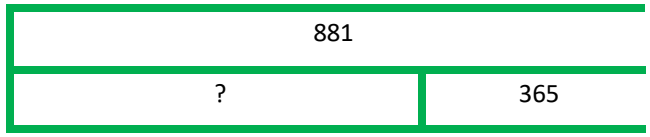
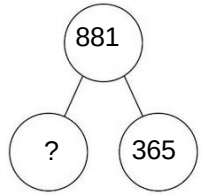
Multiplication and division: This key stage is also the period during which all the multiplication and division facts are thoroughly memorised, including all facts up to 12 × 12. Efficient written methods for multiplying or dividing a 2-digit or 3-digit number by a 1-digit number are taught, as are mental strategies for multiplication or division with large but 'friendly' numbers, e.g. when dividing by 5 or multiplying by 20.

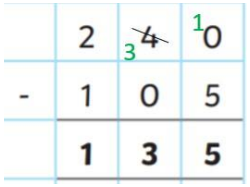
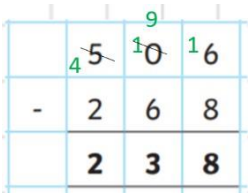
Fractions and decimals: Children will develop their understanding of fractions, learning to simplify fractions and find equivalents as well as finding fractions of amounts and quantities. The concept of a decimal number is introduced and children consolidate a firm understanding of 1-place decimals, dividing whole numbers by 10 and 100 and seeing the effect on the digits.

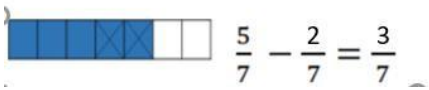
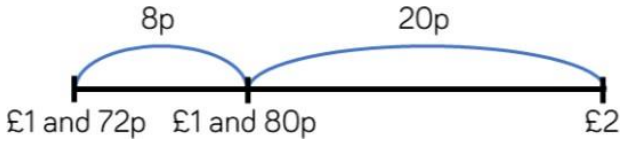
	National Curriculum Objectives	Mental calculation	Written calculation
Y3 +	Add and Subtract numbers mentally, <u>including:</u> • a three-digit number and 1s • a three-digit number and 10s • a three-digit number and 100s Add and subtract numbers with up to 3 digits, using formal written methods of columnar addition and subtraction Estimate the answer to a calculation and use	Use place value knowledge to add a 3-digit number and ones, tens and hundreds up to 1000. Place value grids and counters are used to help children visualise and understand what they are doing mentally. Children are encouraged to use the basic number facts they know to help them. For example: <u>Adding ones:</u> 5 + 3 = 8 so, 34<u>5</u> + <u>3</u> = 348 6 + 4 = 10 so, 45<u>6</u> + <u>4</u> = 460 **<u>Adding tens:</u>**	**<u>Continue to use part whole models and bar models</u>** **<u>Use to represent related addition and subtraction facts.</u>**  444 + 315 = 759 315 + 444 = 759 So… 759 – 444 = 315 759 – 315 = 444  **<u>Use to help solve missing number problems/ inverse. Use to check answers to a calculation.</u>** We know that 159 + 278= ? We can help visualise this problem by putting it into a bar model (or part whole model), now we know we need to add them together. We can do 159 + 278 to find our missing number (=437). We can now do 437 – 289 to check. If we get 159 we are correct.  

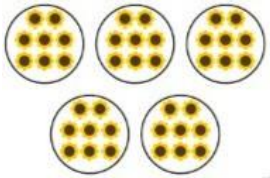
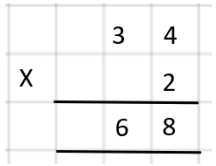
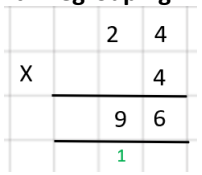
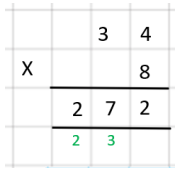
	inverse operations to check answers	70 + 20 = 90 so, 876 + 20 = 896 Where numbers bridge over 100, children are encouraged to look at the hundreds and tens as a 2-digit number: 891 + 10 = 901 **Adding hundreds:** **400 + 300= 700** so, 472 + 300= 772 Relate number bonds to 10 to number bonds to 100 and 1000 (e.g. 3 + 7 = 10 so 30 + 70 = 100 therefore 300 + 700 = 1000 and be able to recall them.	**Column addition for up to two 3-digit number, with 1 or more regrouping** Use of (compact) column addition with up to two 3-digit numbers (may also do 3 digit number + 2 digit number, or three 3 digit numbers added together etc). May have no regrouping, one regroup or multiple regroups. **Regroup once**  Starting with the ones, add each column in turn. When adding 4 ones + 8 ones = 12 = 1 ten and 2 ones. Place 1 ten under the equal sign on the ten column and the 2 ones in the answer ('hang it on the washing line') **Regroup multiple times**  Starting with the ones, add each column in turn. Regroup tens and hundreds as required ('hang it on the washing line') NB: Children to understand commutative law. Numbers can be added in any order and it will not effect the answer. NB: Emphasis to be made on the place value of each digit so children do not think it is 8 - 7. Ask questions such as 'What is the value of 8 in this calculation?', 'Can you show me this number partitioned?' **Estimate the answer to a calculation** Children to look for the nearest multiple of 10 or 100 and add the 2 numbers together to get an estimate. **51 + 29 =** ☐ **50 + 30 = 80** **204 + 198 =** ☐ **200 + 200 = 400**

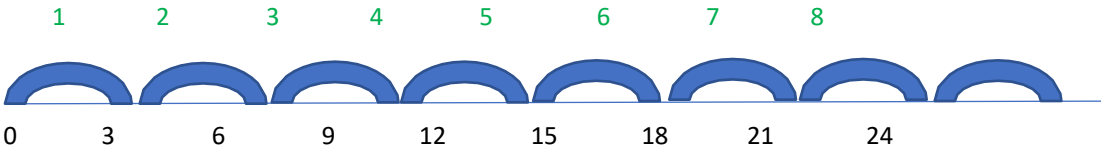
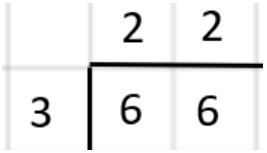
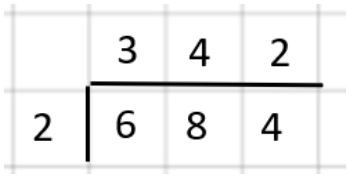
	Add and subtract fractions with the same denominator within one whole		**Add and subtract fractions with the same denominator** • Children use practical equipment and pictorial representations to add two or more fractions with the same denominator where the total is less than 1. • Children understand that we only add the numerators and the denominators stay the same.  We can use this model to calculate $\frac{3}{8}+\frac{1}{8}=\frac{4}{8}$ NB: Children need to recognise that fractions add to 1 whole 1/3 + 2/3 = 1 3/8 + 5/8 = 1  **Adding amounts of money** Children add two amounts of money using pictorial representations to support them. They are encouraged to add the pounds first and then add the pence. Children then exchange the pence for pounds to complete their calculations.
	Add and subtract amounts of money to give change, using both £ and p in practical contexts		£2 and 35p + £1 and 75 p. There is £3 and 110p. Altogether there is £1 and10p.   £5 and 30p + £3 and 75p. There is £8 and 105p. Altogether there is £9 and 5p.

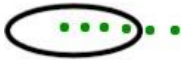
			Adding measurement Use of column addition with up to two 4-digit numbers (may also use up to two 5-digit number). May have no regrouping, one regroup or multiple regroups. • Differentiate using the partitioning method. e.g. litre and millilitre 5l and 161ml + 1l and 437ml 5 1 6 1 + 1 4 3 7 6 5 9 8
Y3 –	Add and subtract numbers mentally, including: Add and subtract numbers with up to 3 digits, using formal written methods of columnar addition and subtraction	Use place value knowledge to a subtract a 3-digit number and ones, tens and hundreds up to 1000. Place value grids and counters are used to help children visualise and understand what they are doing mentally. Children are encouraged to use the basic number facts they know to help them. For example: Subtracting ones: 5 - 3 = 2 so, 345 - 3 = 342 Subtracting tens: 70 - 20 = 50 so, 876 - 20 = 856 Where numbers bridge over 100, children are encouraged to look at the hundreds and tens as a 2-digit number: 801 - 10 = 791	**Continue to use part whole models and bar models** **Use to represent related addition and subtraction facts.**  233 + 334 = 567 334 + 233 = 567 **So…** 567 – 334 = 233 567 – 233 = 334  **Use to help solve missing number problems and represent inverse**. We know that 781 - ? = 365 We can help visualise this problem by putting it into a bar model (or part whole model) like on the right. Now we can see the other subtraction we need to do. We now know we can do 881 – 365 to find our missing number which is 516   **Column subtraction for up to two 3-digit number, with 1 or more exchange**

	Estimate the answer to a calculation and use <u>inverse operations to</u> check answers	<u>Subtracting hundreds:</u> 400 – 300 = 100 so, <u>4</u>72 - <u>3</u>00= <u>1</u>72	Use of (compact) column subtraction with up to two 3-digit numbers (may also do 3-digit number – 2 digit number etc). May have no exchanging, one exchange or multiple exchanging. **One exchange**  Starting with the ones, subtract each column in turn. When subtracting 0 ones from 5 ones, exchange 1 ten from the tens column to make 1 ten and 4 ones (14). Change the 4 tens into 3 tens. NB: Emphasis to be made on the place value of each digit so children do not think it is 2 - 1. Ask questions such as 'What is the value of 2 in this calculation?', 'Can you show me this number partitioned?' **Multiple exchanging**  Starting with the ones, subtract each column in turn. Exchange in the tens / hundreds as required **Estimation:** Children to look for the nearest multiple of 10 or 100 and subtract the 2 numbers to get an estimate. **59 – 31 = ☐ 60 – 30 = 30** **598 - 203 = ☐ 600 - 200 = 400** **<u>Add and subtract fractions with the same denominator</u>** Children use practical equipment and pictorial representations to subtract fractions with the same denominator within one whole.

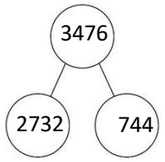
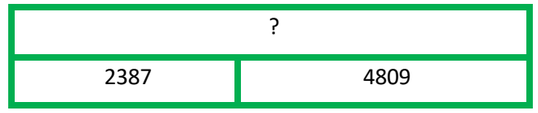
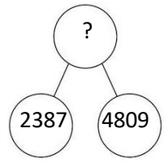
	Add and subtract fractions with the same denominator within one whole Add and subtract amounts of money to give change, using both £ and p in practical contexts		Children understand that we only subtract the numerators and the denominators stay the same. Use the models to help you subtract the fractions.  $\frac{5}{7} - \frac{2}{7} = \frac{3}{7}$ **Subtracting amounts of money** Children use different methods to subtract money. They will see examples where they can physically remove the coins, and examples where they will need to use their knowledge of converting money to exchange £1 for 100 pence. Children also use number lines to count on or back to calculate the difference between two amounts.  Alex has £3 and 50p. She gives £2 and 10p to her sister. How much money does she have left? £3 − £2 = £1. 50p − 10p = 40p. Alex has £1 and 40p remaining.  Tommy has £1 and 72p. Rosie has £2 How much more money does Rosie have than Tommy? Rosie has 28p more than Tommy **<u>Subtracting measurement</u>** Use of column subtraction with up to two 4-digit numbers (may also use up to two 5-digit number). May have no regrouping, one regroup or multiple regroups. • Differentiate using the partitioning method. e.g. litre and millilitre 7l and 263ml – 2l and 621ml $\begin{array}{rcccc} & {}^{6}\not{7} & {}^{1}2 & 6 & 3 \\ - & 2 & 6 & 2 & 1 \\ \hline & 4 & 6 & 4 & 2 \end{array}$

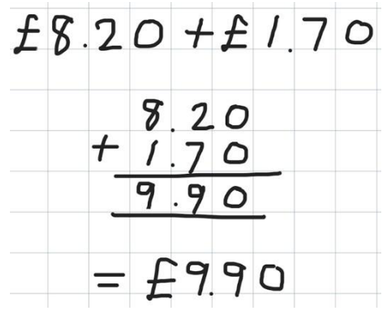
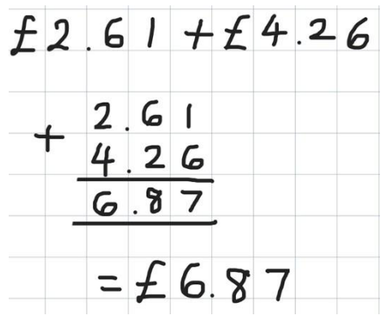
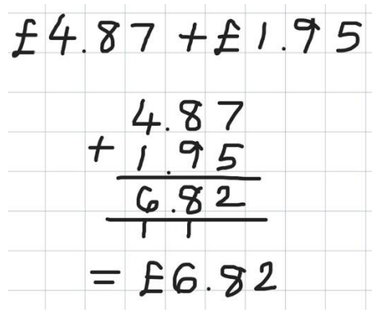
Y3 **×**	Recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables Write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including for <u>two-digit numbers times</u> one-digitnumbers, using mental and progressing to formal written methods	Know by heart all the multiplication facts in the ×3, ×4 and ×8 tables Recognise that multiplication is commutative 3 x 5 = 15 5 x 3 = 15 NB: Reinforce division facts as inverse of multiplication throughout teaching. Multiplying by 1 Know that any number x by 1 = itself **For example: 8 x 1 = 8** Multiplying by 0 Know that any number x by 0= 0	 Understanding multiplication as equal groups of and that multiplication is commutative. There are 3 equal groups of 4. 3 x 4 = 12 or 4 x 3 = 12  There are 5 equal groups of 8. 5 x 8 = 40 or 8 x 5 = 40 Using known multiplication facts and partitioning to answer 2 digit by 1digit calculations :  3 2 x 3 = 30 2 30 x 3 = 90 (3 x 3) 2 x 3 = 6 30 + 6 = 36 **<u>Formal written method: 2 digit numbers by 1 digit number (2, 3, 4, 5 and 8 times tables)</u>** **<u>No regrouping</u>**  NB: Emphasis to be made on the place value of each digit so children do not think it is 2 x 3 . Ask questions such as 'What is the value of 3 in this calculation?', 'Can you show me this number partitioned?' **With Regrouping**  

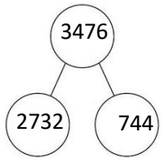
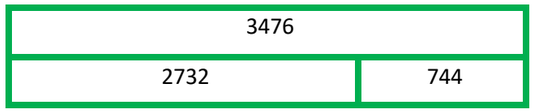
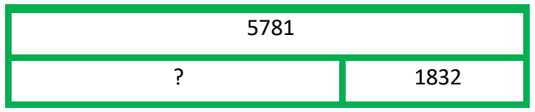
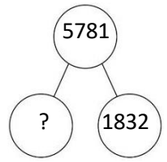
Y3 **÷**	Recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables	Know by heart all the division facts derived from the ×2, ×3, ×4, ×5, ×8 and ×10 tables. Recognise that division is not commutative Use place value and number facts in mental division Check that Children can halve even numbers to 100, halve odd numbers to 20 NB: Reinforce multiplication facts as inverse of division throughout teaching columns.	**<u>Write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental and progressing to formal written methods</u>** To understand division as equal groupings:  21 shared into equal groups of 3. **21 ÷ 3 = 7** or **21 ÷ 7 = 3** **<u>Chunking on a number line: (numbers that will divide equally by 2, 3, 4, and 8)</u>** Using a number line to count from zero in the multiple until you get to the required amount. Count the number of jumps made to get the answer. **24 ÷ 3 = 8**  **<u>Bus stop method: (2 and 3 digit, multiples of 2, 3, 4, 5 and 8- no remainders)</u>** **No regrouping**   NB: Emphasis to be made on the place value of each digit so children do not think it is 3 ÷ 6. Ask questions such as 'What is the value of 6 in this calculation?', 'Can you show me this number partitioned?' **With regrouping**

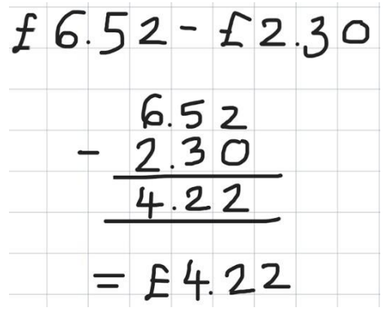
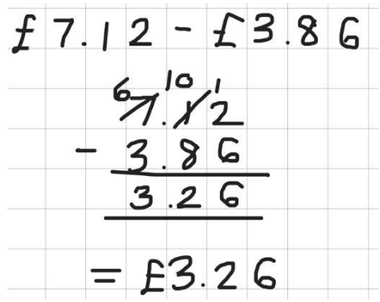
			1 2 8 | 9 1 6 **Diagrams to help:** 1 equal group of 8 and 1 remaining  1 5 2 4 | 6 2 0 8 1 equal group of 4 and 2 remaining 

Year 4

	National Curriculum Objectives	Mental Calculation	Written Calculation
Y4 +	Add numbers with up to 4 digits using the formal written methods of columnar addition where appropriate Estimate and use inverse operations to check answers to a calculation Solve addition and subtraction two-step problems in contexts, deciding which operations and methods to use and why	Simple mental addition to ensure no errors with column addition. Use of place value to find 10, 100 or 1000 more. Use of place value to find morethan a given number and including in negative numbers. **For example: Find 3 more than -8.** Use number line initially, then jottings and then mentally Relate number bonds to 10 to number bonds to 100 and 1000 (e.g. 3 + 7 = 10 so 30 + 70 = 100 therefore 300 + 700 = 1000 and be able to recall them. NB: Emphasis to be made on the place value of each digit and when introduced in Y4 (already done version of this in Y2 and Y3) to the method children should be shown it with counters and place value grid on the IWB to model regrouping. If need practical apparatus - use Numicon or Base 10 to model the regrouping.	**<u>Continue to use part whole models and bar models</u>** **<u>Use to represent related addition and subtraction facts.</u>**  2732 + 744 = 3476 744 + 2732 = 3476 **So…** 3476 – 2732 = 744 3476 – 744 = 2732  **<u>Use to help solve missing number problems/ inverse. Use to check answers to a calculation.</u>** We know that 2387 + 4809 = ? We can help visualise this problem by putting it into a bar model (or part whole model) like on the right, now we know we need to add them together. We can do 2387 + 4809 to find our missing number (=7196). We can now do 7196 – 2387 to check. If we get 4809 we are correct.   **<u>Column addition for up to two 4-digit number, with 1 or more regrouping</u>** Use of (compact) column addition with up to two 4-digit numbers (may also do 4 digit number + 3 digit number, or three 4 digit numbers added together etc). May have no regrouping, one regroup or multiple regroups. **Regroup once** 5162 +3497 8659 1 Starting with the ones, add each column in turn. When adding 6 tens + 9 tens = 15 tens = 1 hundred = 5 tens. Place 1 hundred <u>under</u> the equal sign on the hundred column and the 5 tens in the answer (‘hang it on the washing line’) **Regroup multiple times** 5864 +3497 9361 1 1 1 Starting with the ones, add each column in turn. Regroup tens, hundreds and/or thousands as required (‘hang it on the washing line’)

	(See above)	(See above)	**Column addition for decimals** Use of (compact) column addition for numbers with the same amount of decimal places **For example**: when solving addition problem with a money context that goes into the decimal system with tenths and hundredths For two amounts with same number of decimal places (only tenths):  For two amounts with same number of decimal places (tenths and hundredths):  For two amounts with same number of decimal places (tenths & hundredths) and require regrouping: 

Y4 **–**	Subtract numbers with up to 4 digits using the formal written methods of columnar subtraction where appropriate Estimate and use inverse operations to check answers to a calculation Solve addition and subtraction two-step problems in contexts, deciding which operations and methods to use and why	Simple mental subtraction to ensure no errors with column subtraction. Use of place value to find 10, 100 or 1000 less. Use of place value to find less than a given number and going into negative numbers. For example: Find 7 less than 2. Use number line initially, then jottings and then mentally	**<u>Continue to use part whole models and bar models</u>** **<u>Use to represent related addition and subtraction facts.</u>**  2732 + 744 = 3476 744 + 2732 = 3476 **So…** 3476 – 2732 = 744 3476 – 744 = 2732  **<u>Use to help solve missing number problems and represent inverse</u>**. We know that 5781 - ? = 1832 We can help visualise this problem by putting it into a bar model (or part whole model) like on the right. Now we can see the other subtraction we need to do. We now know we can do 5781 – 1832 to find our missing number.   **<u>Column subtraction for up to two 4-digit number, with 1 or more exchange</u>** Use of (compact) column subtraction with up to two 4-digit numbers (may also do 4 digit number – 3 digit number etc). May have no exchanging, one exchange or multiple exchanging. One exchange 6 1 5749 - 3471 2278 Starting with the ones, subtract each column in turn. When subtracting 4 tens -7 tens, exchange 1 hundred to make: 14 tens – 7 tens = 7 tens Multiple exchanges 6 13 1 5742 - 3476 2266 Starting with the ones, subtract each column in turn. Exchange tens, hundreds and/ or thousands as required. NB: Emphasis to be made on the place value of each digit and when introduced in Y4 (already done version of this in Y2 and Y3) to the method children should be shown it with counters and place value grid on the IWB to model exchanging. If need practical apparatus - use Numicon or Base 10 to model the exchanging.

	(See above)	(See above)	**Column Subtraction** **Column subtraction for decimals** Use of (compact) column subtraction for numbers with the same amount of decimal places **For example**: when solving subtraction problem with a money context that goes into the decimal system with tenths and hundredths. For two amounts with same number of decimal places:  For two amounts with same number of decimal places and require exchanging: 

Y4

x

Recall multiplication facts for multiplication tables up to 12 × 12

Use place value, known and derived facts to multiply mentally, including: multiplying by 0 and 1; multiplying together 3 numbers

Recognise and use factor pairs and commutativity in mental calculations

Multiply two-digit and three-digit numbers by a one-digit number using formal written layout

Solve problems involving multiplying and adding, including using the distributive law to multiply two-digit numbers by 1 digit, integer scaling problems and harder correspondence problems such as n objects are connected to m objects

(not necessarily in this order)

Learn shortcuts for mental multiplication

For example:

- to x4 you x2 and x2 again
- to x5 you x10 and divide by 2
- to x20 you x2 and x10

Use known multiplication facts to mentally solve other multiplications

For example: if you know 8x3=24 you know…

- 8x30=240
- 80x3=240
- 80x30=2400

Multiplication is commutative

Factor pairs of numbers

Fact families – using known fact to find the others

For example: if you know 9x4=36 then you know 4x9=36 and 36÷9=4 and 36÷4=9

Multiplying by 1

Know that any number x by 1 = itself

For example: 81 x 1 = 81

Multiplying by 0

Know that any number x by 0= 0

For example: 72 x 0 = 0

Multiplying 3 numbers together and shortcuts to take

For example: 8 x 7 x 2

First solve 8 x 7 = 56 (as it's the trickier one)

Then 56 x 2 = 112 (as doubling is easier)

Multiplying a number by 10 and 100

Use of place value grids

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

NB: Start with counters then write digits in.

Th Thousands	H Hundreds	T Tens	U Units	
			1	
		1	0	x 10
	1	0	0	x 100

Once children understand the place value reasons behind this they can use shortcuts of putting zeros onto the end (making it more of a mental calculation)

For example: 78 x 10. Multiplying by 10 → 10 has 1 zero so I need to put 1 zero on the end of my number → 780
For example: 6 x 100. Multiplying by 100 → 100 has 2 zeroes so I need to put 2 zeroes on the end of my numbers → 600
For example: 52 x 100. Multiplying by 100 → 100 has 2 zeroes so I need to put 2 zeroes on the end of my numbers → 5200

Children to learn both of the following methods and choose what they prefer to use (guided towards choosing column method.)

NB: If children struggled, can use either of these methods with counters & PV grid.

Using grid method for multiplication

123 × 5

×	100	20	3
5	500	100	15

500
+ 100
+ 15
615

Multiplying 2 and 3 digit numbers x 1 digit numbers using grid method.

- First – partition the number into its (hundreds,) tens and ones.
- Draw grid and set out partitioned numbers into the grid.
- Multiply each partitioned number along the top by the 1 digit number, fill in the answer
- Line up all the parts of the answer and complete a column addition
- Now you have the final answer

Using column method for multiplication

	H	T	O	
		3	4	
×			5	
	1	7	0	

1 2

Multiplying 2 and 3 digit numbers x 1 digit numbers using column multiplication method

- First set out the numbers in a column method ensuring HTO are accurately lined up
- Start by multiplying the ones by the x number
- Record the answer under the line in the correct column
- Work through the tens and then hundreds.
- If the digits are larger than 9 they need to be regrouping into the next place value column as the children are familiar in doing with column addition.

Y4 **÷**	(Multiplication & Division) Recall division facts for multiplication tables up to 12 × 12 Use place value, known and derived facts to divide mentally, including dividing by 1 Recognise and use factor pairs and commutativity in mental calculations (Fractions & Decimals) Find the effect of dividing a one- or two-digit number by 10 and 100, identifying the value of the digits in the answer as ones, tenths and hundredths	Use their multiplication knowledge to divide mentally. Eg. 8 x 9 = 72 so 72 ÷ 8 = 9 Use inverse of factors and factor pairs. Eg. Know that factors of 36 are 1 and 36, 2 and 18, 3 and 12, 4 and 9, and 6. Therefore we know that 36 ÷ 3 = 12. Know that division is not commutative. Fact families – using known fact to find the others Eg. if you know 9x4=36 then you know 4x9=36 and 36÷9=4 and 36÷4=9 Know that any number ÷ by 1 = itself Eg. 81 ÷ 1 = 81	***Dividing a number by 10 and 100*** Use of place value grids Moving 1 place to the right for ÷10 or 2 places to the right for ÷100 NB: Start with counters then write digits in. Th Thousands / H Hundreds / T Tens / U Units 1 0 0 1 0 → ÷ 10 1 → ÷ 100 ***Bus stop Division*** Bus stop division for 2 or 3 digit numbers divided by 1 digit number (no remainders) Start with numbers that fully divide (no regrouping required) - with 2 digit 2 1 / 4 8 4 — or 3 digit 3 1 2 / 3 9 3 6 Then move onto some regrouping across - with 2 digit 1 5 / 3 4 ¹5 — or 3 digit & one regroup 2 1 4 / 4 8 5 ¹6 or 3 digit & one regroup 0 4 5 / 8 3 ³6 ⁴0

Heptonstall Primary School

Calculation Policy
Year 5 and 6

This booklet contains the calculation methods used in year 5 and 6 for each of the four operations – addition, subtraction, multiplication and division.

Please use this document as a tool to support your child at home. The methods we use in school may or may not be familiar to you. Children can become confused when they seek support from an adult at home because often, the adult will teach the method they themselves were taught.

Knowing how the methods in this booklet work will help you to help your child. All staff in school use this document so that we can ensure consistency in our approach.

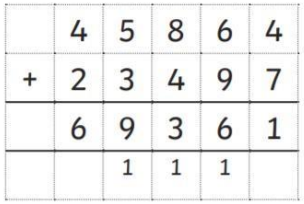
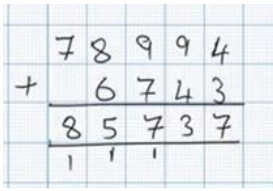
Year 5

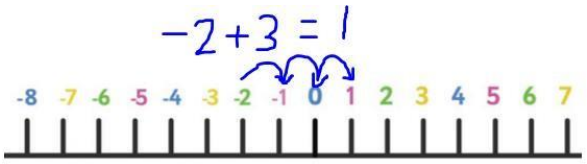
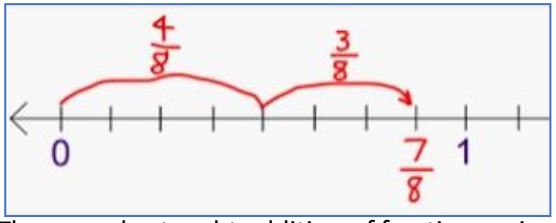
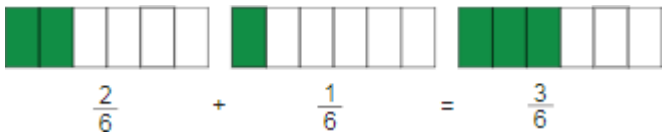
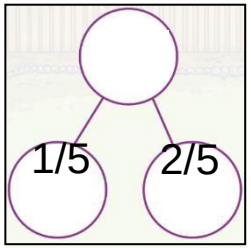
Year 5

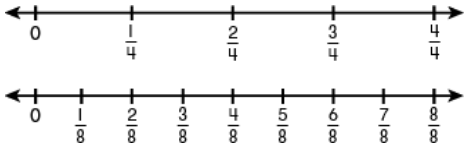
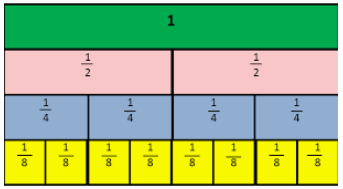
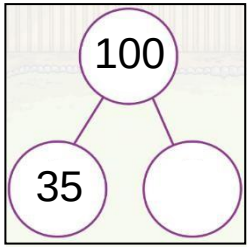
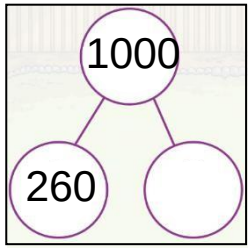
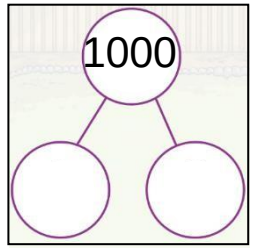
UPPER KEY STAGE 2

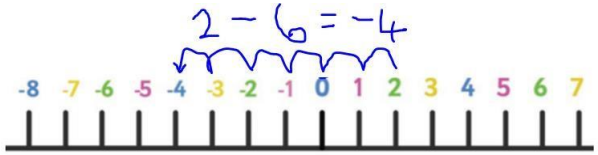
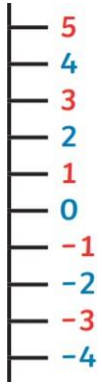
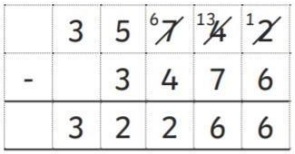
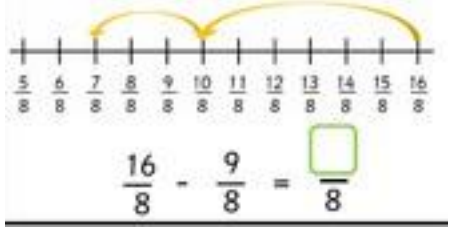
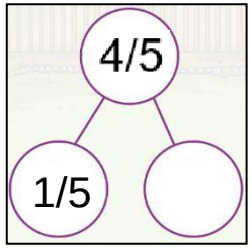
Children move on from dealing mainly with whole numbers to performing arithmetic operations with both decimals and fractions. By the end of year 6, pupils should be fluent in written methods for all four operations, including long multiplication and division, and in working with fractions, decimals and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

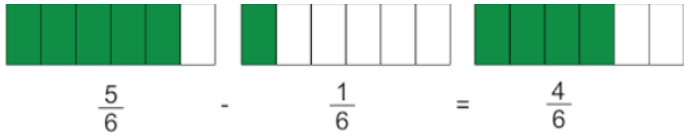
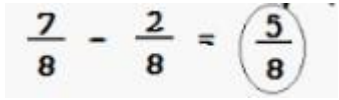
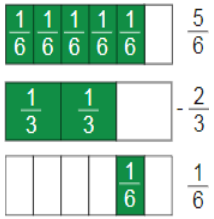
Addition and subtraction: Children will consolidate their use of written procedures in adding and subtracting whole numbers with up to 6 digits and also decimal numbers with up to 3 decimal places. Mental strategies for adding and subtracting increasingly large numbers will also be taught. These will 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
Y5 +	Add whole numbers with more than 4 digits, including using formal written methods Add numbers mentally with increasingly large numbers	Simple mental addition to ensure no errors with column addition. Use of place value to find 10, 100,	**<u>Column method for addition including regrouping.</u>** Children will be working with place value of numbers up to 1,000,000 in year 5 and will continue to build upon the column addition skills they have worked on in Y4 by calculating with numbers with more than 4 digits.  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 **<u>Children will also use this method to add numbers that have up to 3 decimal places</u>** 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.

		1,000, 10,000, 100,000 or 1,000,000 more. **Negative numbers** Find 12 more than -8. Children to use a number line to start with and then use counting through 0 to support with this type of calculation e.g. -8 to 0 = 8. 0 + 4 = 4. **Number bonds** Have a focus on quick and accurate recall of number bonds to 100 (in tens and ones) 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.	 **Adding fractions with the same denominator** Children are taught using a range of different models. They are taught to count in fractions and use number lines to add fractions of the same denominator.  They are also taught addition of fractions using the bar model.   These pictorial representations demonstrate that when adding fractions of the same denominator, only the numerators are added and the denominator stays the same. The children can then use a more abstract method as shown. $\frac{2}{9} + \frac{5}{9} = \frac{7}{9}$
	Add fractions with the same denominator and denominators that are multiples of the same number		

			<u>Adding Fractions with denominators that are multiples of the same number</u>. Children are taught to use their knowledge of equivalent fractions to convert the fractions to the same denominator before adding them. For example, 4/8 + ¼ First they would convert 4/8 to 2/4 at first using pictorial representations (bar model, number line, fraction wall etc) and then the more abstract way of multiplying the numerator and denominator by the same number.    Then they would add the numerators together 2/4 + ¼ = ¾
Y5 –	Subtract numbers mentally with increasingly large numbers	**<u>Number bonds</u>** Have a focus on quick and accurate recall of number bonds to 100 (in tens and ones) and to 1000 (in hundreds and tens) and be able to apply these to larger numbers e.g. 100 – 49 = 51 so 1,000 – 490 = 510 and therefore 10,000 – 4900 = 5,100 etc. **<u>Compensating and bridging</u>** Children are taught to use rounding to support with the mental calculation of subtracting larger numbers e.g. 4,000 – 1998. Children are to round to the	   Part whole models can be used to help children see the relationship between number bonds

	Subtract whole numbers with more than 4 digits, including using formal written methods	nearest ten, hundred, thousand, ten thousand, hundred thousand dependent on the calculation. 4,000 – 1998 would be 4,000 – 2,000 and then the two would need to be added back on. **Negative numbers** Find 12 less than 8. Children to use a number line to start with and then use counting through 0 to support with this type of calculation e.g. 8 – 8 = 0 and 0 – 4 leftover = -4	  **Column method for subtraction including exchanging.** Children will be working with numbers up to 1,000,000 in year 5 and will continue to build upon the column subtraction skills they have worked on in Y4 by calculating with numbers with more than 4 digits.  Starting with the ones, subtract each column in turn. Exchange tens, hundreds, thousands and/or ten thousands as required. **Children will also use this method to subtract numbers that have up to 3 decimal places** **Subtracting fractions with the same denominator.** Children are taught using a range of different models. They are taught to count in fractions and use number lines to add fractions of the same denominator.  
	Subtract fractions with the same denominator and denominators that are multiples of the same number		

			They are also taught subtraction of fractions using the bar model and also represent it using part-whole models.  These pictorial representations demonstrate that when subtracting fractions of the same denominator, only the numerators are subtracted and the denominator stays the same. The children can then use a more abstract method as shown.  **<u>Subtracting Fractions with denominators that are multiples of the same number</u>** Children are taught to use their knowledge of equivalent fractions to convert the fractions to the same denominator before subtracting them.  For this they would first recognise that 2/3 is equivalent to 4/6 and then subtract 4/6 from 5/6. Children will use pictorial representations to support them with calculations. E.g. number lines, bar models and fraction walls.
Y5 x	Multiply numbers mentally drawing upon known facts	Children will be taught to build upon their rapid recall of 1-12 x multiplication facts, and multiplication facts for multiples of 10 and 100 to calculate an increasing range of multiplication questions mentally. E.g. if they know 3x4 they can work out 30x4, 0.3x4 etc. Multiply a 2 or 3 digit number by a single digit by partitioning– e.g. 26 x 3 = 20 x 3 + 6 x 3 $6 \times 204 = 6 \times 200 + 6 \times 4$ $= 1,200 + 24$ $= 1,224$	

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

Multiply whole numbers and those involving decimals by 10, 100 and 1000

Multiply proper fractions and mixed numbers by whole numbers, supported by materials and

Long Multiplication method

Children have been introduced to the formal written method of short multiplication for 2 or 3 digit numbers multiplied by one digit in year 4. This will be recapped prior to extending to long multiplication (see Yr 4 policy).

1	3	2	
	1	5	4
×		2	6
	9	2	4
3	0	8	0
4	0	0	4
1	1		

Start with the ones.

154 × 6 = 924

154 × 20 = 3080

3080 + 924 = 4004

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.

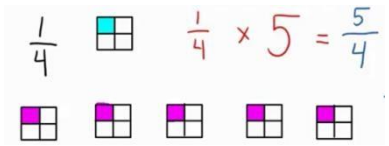
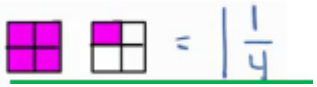
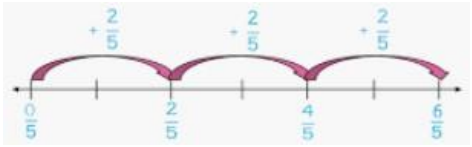
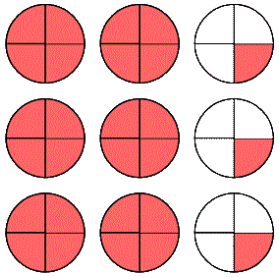
Multiplication by 10, 100 and 1000

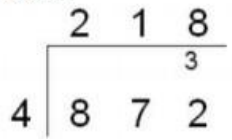
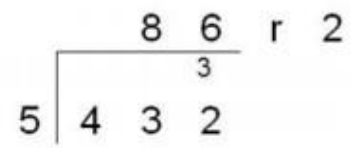
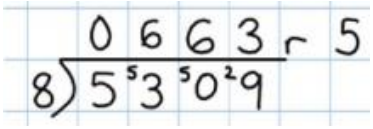
Children are provided with a laminated version of this grid to practise moving the digits when multiplying by 10, 100 and 1000. The majority of children will move on to drawing their own grid on their whiteboard in their book to support their calculations and then to complete the calculations mentally.

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 for multiplying 5.6 by 10.

Move 1 place to the left for x 10
Move 2 places to the left for x 100
Move 3 places to the left for x 100

Multiply proper fractions and mixed numbers by whole numbers, supported by materials and

	diagrams		**diagrams**    Children are provided with visual representation to show how to multiply fractions. They are also taught how to convert an answer from an improper fraction to a mixed number as shown above. Number lines are used to show the repeated addition method for multiplying fractions. **Multiply mixed numbers by whole numbers**  Children are provided with visual representation to show how to multiply mixed numbers by whole numbers. They calculate using images to begin with. They are taught the following more abstract steps. 1. Convert the mixed number into an improper fraction. 2. Multiply the numerator by the whole number. 3. Convert the answer back into a mixed number by dividing the numerator by the denominator. The remainder is represented as a fraction. 2 ¼ x 3 = 4/4 + 4/4 + ¼ x 3 = 9/4 x 3 9/4 x 3 = 27/4 27 divided by 4 = 6 r3 6 3/4
Y5 **÷**	Divide numbers mentally drawing upon known facts	Children will be taught to build upon their rapid recall of 1-12 x division facts, and dividing and multiplying by 10 and 100 to calculate an increasing range of division questions mentally. E.g. if they know 12 divided by 3 =4 they can work out 12 divided by 0.3= 40	**Divide numbers up to 4 digits by a one-digit number using the formal written method of short**

	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 Divide whole numbers and those involving decimals by 10, 100 and 1000		**division** 'Bus Stop Division' has been introduced in year 4 with 3 digit dividends and a single digit divisor with no remainders. This will be the first step in year 5. They will then move on to 3 digit dividends with single digit divisor with remainders. Finally, they will work with 4 digit dividends. Begin with divisions that divide equally with no remainder.  Move onto divisions with a remainder.   **Interpreting remainders** Children will be taught how to interpret remainders from division questions and whether they should round to the next whole number or not. They will be taught to read questions carefully, underlining key words/phrases e.g. full boxes, how many do they need, how many … can be bought? **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. 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. Move 1 place to the right for ÷10 Move 2 places to the right for ÷100 Move 3 places to the right for ÷1000

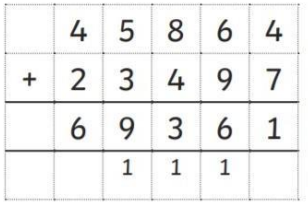
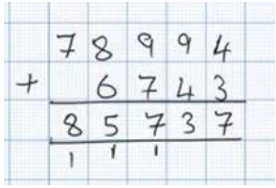
Year 6

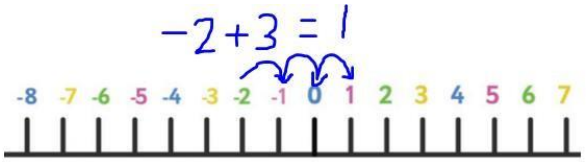
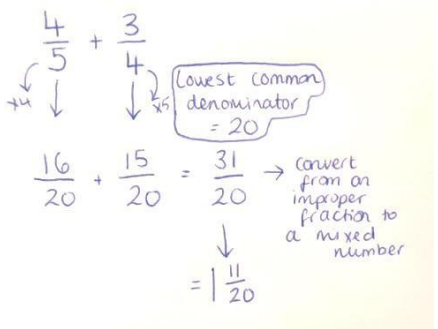
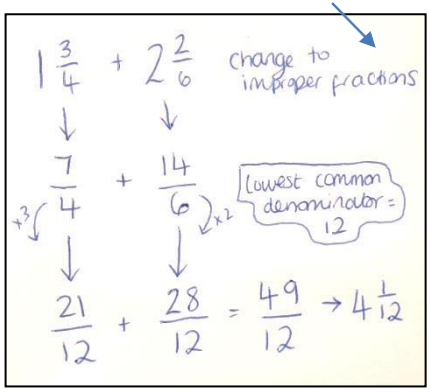
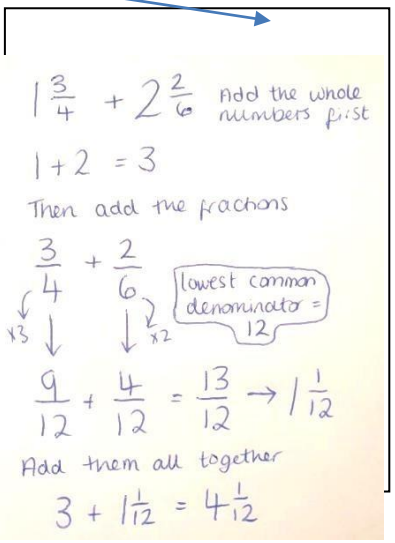
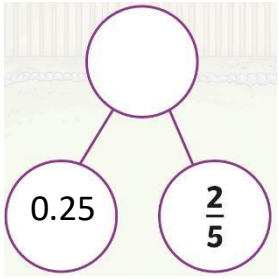
Year 6

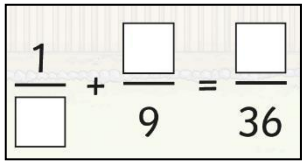
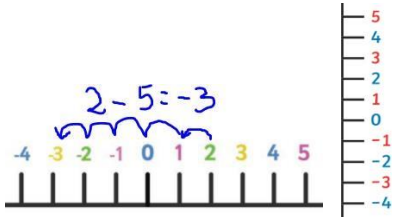
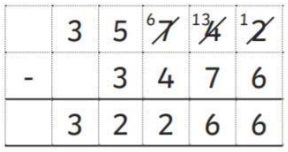
UPPER KEY STAGE 2

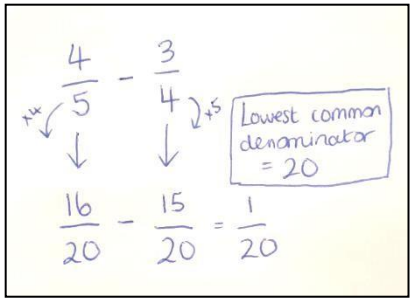
Children move on from dealing mainly with whole numbers to performing arithmetic operations with both decimals and fractions. By the end of year 6, pupils should be fluent in written methods for all four operations, including long multiplication and division, and in working with fractions, decimals and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

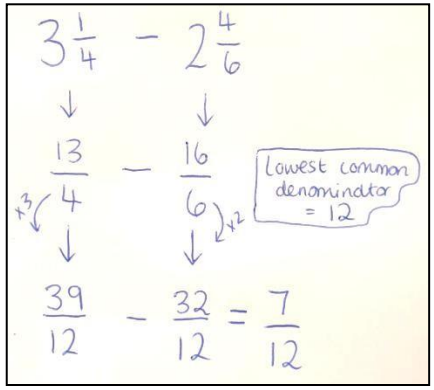
Addition and subtraction: Children will consolidate their use of written procedures in adding and subtracting whole numbers with up to 6 digits and also decimal numbers with up to 3 decimal places. Mental strategies for adding and subtracting increasingly large numbers will also be taught. These will 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.

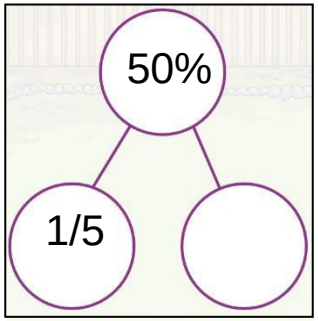
	National Curriculum Objectives	Mental Calculation	Written Calculation- including concrete, pictorial and abstract methods
Y6 ***+***	Undertake mental calculations with increasingly large numbers and more complex calculations	Have a focus on quick and accurate recall of number bonds to 100 (in ones and 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	**<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  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. 

	Use negative numbers in context and calculate intervals across zero.	Children will be taught to count on from a negative number up through zero in ones and to do this with problems in context.	**Calculating negative numbers pictorially-** 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	Use negative numbers in context and calculate intervals across zero.	Children will be taught to <u>count back</u> through zero in ones and to do this with problems in context.	**<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.
-	Subtract fractions with	Use common factors to simplify fractions	**<u>Subtracting Fractions</u>**

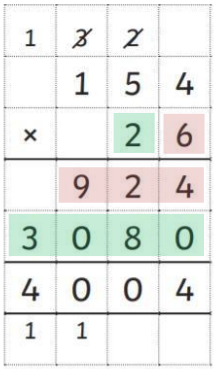
<table>
<tr>
<td></td>
<td>different denominators and mixed numbers, using the concept of equivalent fractions</td>
<td>mentally</td>
<td>Children are taught to change the fractions to an alternate equivalent fraction so that they both have the same denominator, subtract the numerators and then simplify 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.
 

<u>Use of the part-whole model for subtracting fractions, decimals and percentages</u>
 

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.</td>
</tr>
<tr>
<td>Y6
×</td>
<td>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</td>
<td>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</td>
<td><u>Long Multiplication method</u>
 

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.

124 × 26 becomes
1 2
1 2 4
× 2 6
7 4 4
2 4 8 0
3 2 2 4
1 1
Answer: 3224</td>
</tr>
</table>

multiplication

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

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

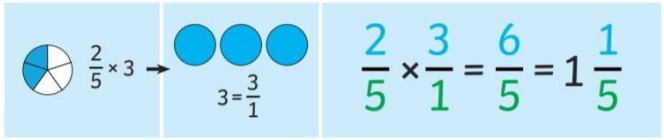
N.B. Children are taught that **of** and **x** are interchangeable in these types of calculations e.g. 2/5 **x** 3 is the same as 2/5 **of** 3

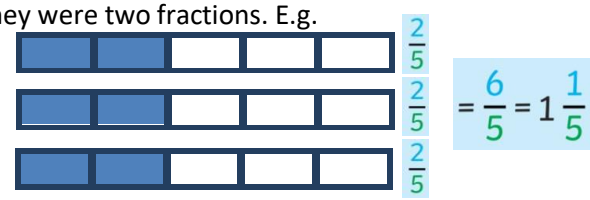
Multiplying Fractions

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

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

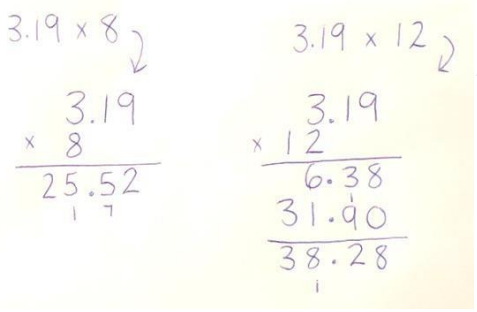
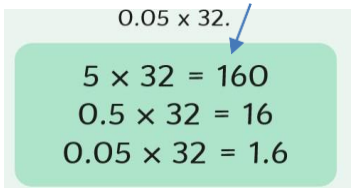
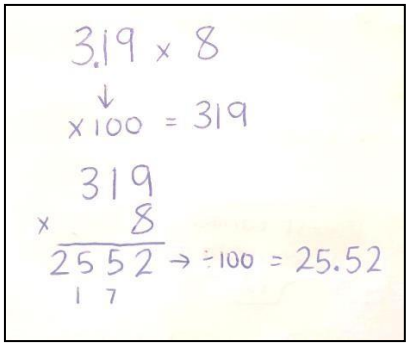
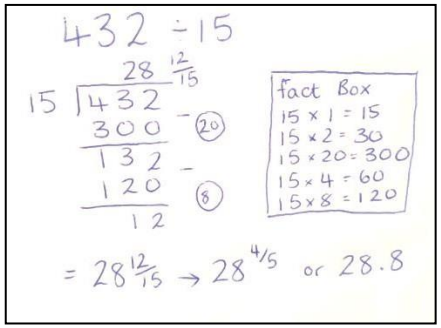
Children are provided with a laminated version of this grid to practise moving the digits when multiplying by 10, 100 and 1000. The majority of children will move on to drawing their own grid on their whiteboard in their book to support their calculations and then to complete the calculations mentally.

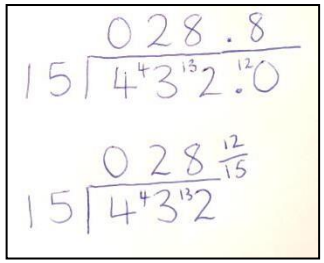
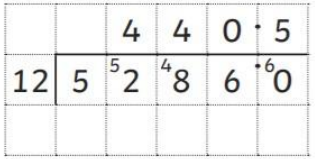
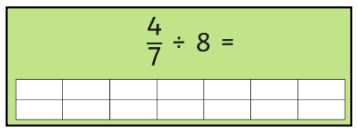
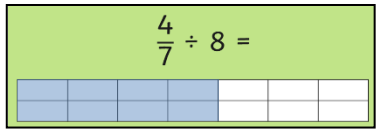
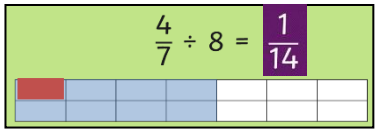
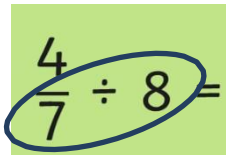
Move 1 place to the left for x10

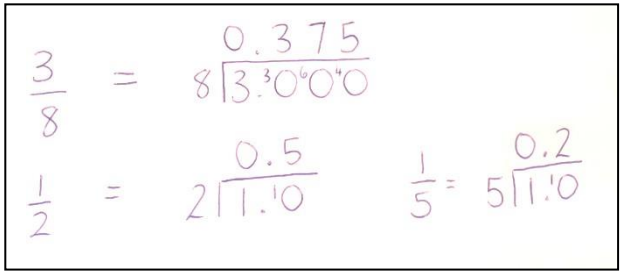
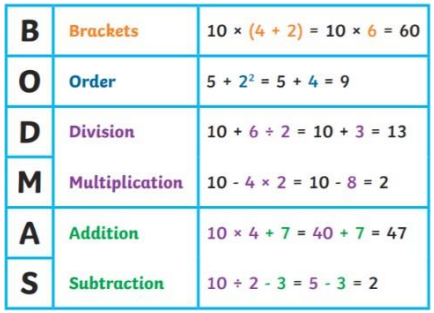
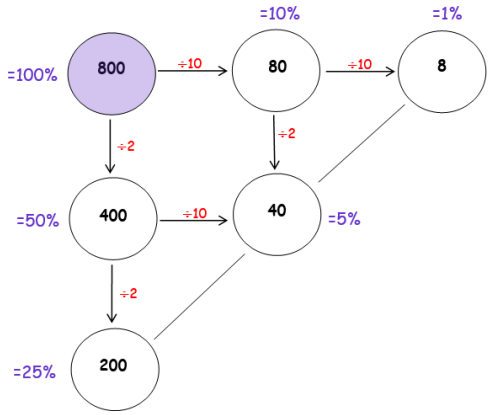
Move 2 places to the left for x100

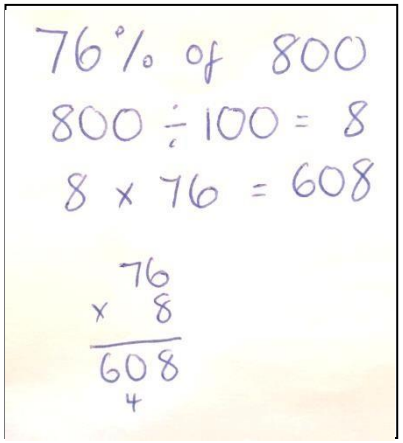
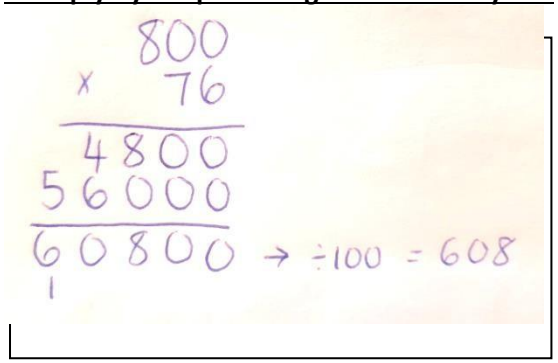
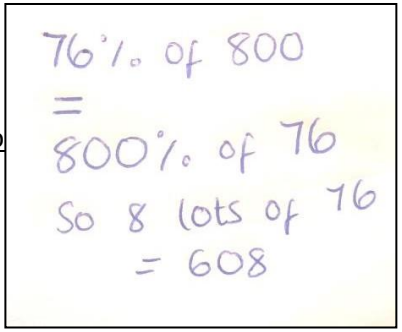
Move 3 places to the left for x1000

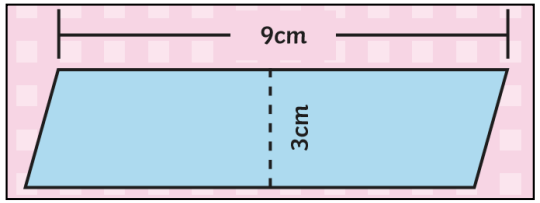
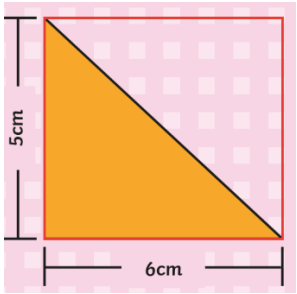
N.B. We continue to reiterate here that children **cannot** simply add a zero. When we work with numbers with decimal places, this becomes really apparent as the place value doesn't change, e.g. 5.6 is the same value as 5.60. The example in the table demonstrates the correct working

	giving answers 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.	Children will often use 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.	**<u>Short and long multiplication of one-digit numbers with up to two decimal places and whole numbers</u>**  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	**<u>Perform mental calculations, including with mixed operations and large numbers</u>** 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	**<u>Long Division- Chunking</u>** In year 6, children are taught to show remainders of division calculations as **<u>fractions</u>** or **<u>decimals</u>**.  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.

	the context 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	540÷6=90 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 decimal, they will need to use a place holder after the decimal point and continue to divide. They can also interpret their 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  (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		**<u>Area of parallelograms and triangles</u>** 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