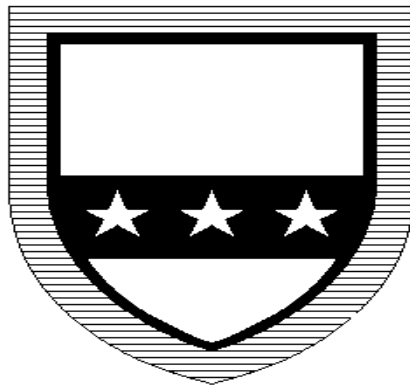# Poulton Lancelyn Primary School

How we teach calculations:

Calculation Policy for Mathematics

April 2018

About our Calculation Policy

The following calculation policy has been devised to meet requirements of the National Curriculum 2014 for the teaching and learning of mathematics, and is also designed to give pupils a consistent and smooth progression of learning in calculations across the school so that they become fluent mathematicians. Please note that early learning in number and calculation in Reception follows the "Development Matters" EYFS document, and this calculation policy is designed to build on progressively from the content and methods established in the Early Years Foundation Stage.

Age stage expectations

The calculation policy is organised according to age stage expectations as set out in the National Curriculum 2014, **however it is vital that pupils are taught according to the stage that they are currently working at,** being moved onto the next level as soon as they are ready, or working at a lower stage until they are secure enough to move on.

Providing a context for calculation:

It is important that any type of calculation is given a real life context or problem solving approach to help build children's understanding of the purpose of calculation, and to help them recognise when to use certain operations and methods when faced with problems. This must be a priority within calculation lessons.

Choosing a calculation method:

Children need to be taught and encouraged to use the following processes in deciding what approach they will take to a calculation, to ensure they select the most appropriate method for the numbers involved:

Can I do it in my head using mental strategy?

Could I use some jottings to help me?

Should I use a written method to work it out?
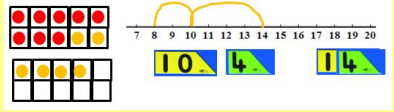
To work out a tricky
Approximate,
Calculate,
Check it !

Year 1 Addition

Steps to success

EYFS to Year 1	2 + 5 =	2 + 5 =	2 + 5 Leading to 5 + 5 + 2 (without counters)	2 + 5 5 + 8 4 + 13 11 + 7	6 + 8 becomes 8 + 2 + 4
	Count out each set then find the total	Count on from first number (Cover first number or display as numeral)	Recognise the biggest number in the calculation and count on from it (using objects for smaller number if necessary)	Recognise the biggest number in the calculation and count on from it mentally or using number line	Partitioning the smaller number and use the tens number to bridge calculation 5 + 17 becomes 17 + 3 + 2

Children should
- Have access to a wide range of counting equipment, everyday objects, number tracks and number lines, and be shown numbers in different contexts.
- Read and write the addition (+) and equals (=) signs within number sentences.
- Interpret addition number sentences and solve missing box problems, using concrete objects and number line addition to solve them

  8 + 3 =   15 + 4 = ☐   5 + 3 + 1 = ☐

Key Skills
- Read and write numbers to 100 in numerals, incl. 1—20 in words
- Recall bonds of numbers to 10 and of all numbers to 20, and addition facts within 20
- Count to and across 100
- Count in multiples of 1, 2, 5 and 10
- Solve simple 1-step problems involving addition, using objects, number lines and pictorial representations.
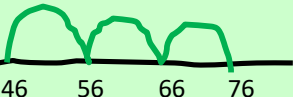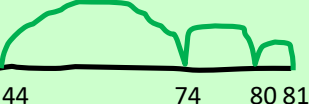
Key vocabulary:
add, more, plus, and, make, altogether, total, equal to, equals, double, most, count on, number line

Year 2 Addition — Steps to success

Developing mental fluency with addition and place value involving 2-digit numbers, then establish more formal methods.

Year 2	6 + 18	6 + 58	TU + TU within 100	Addition of three single digits – look for bonds you know and doubles	Special cases + 9
Add and subtract 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** **-adding three one-digit numbers**	By counting on from the largest number 17 18 19 20 21 22 23 24 25 26 27 28 29 30 **30 + 46** By counting on in tens 46 56 66 76	By partitioning the smaller number through the multiple of 10 58 + 2 + 4 58 60 64 **22 + 50** By counting in groups of ten and one from largest number 50 70 72	**37 + 44** 44 74 80 81 or 40 + 30 = 70 7 + 4 = 11 70 + 11 = 81 Or 44 + 40 – 3 = 81 **Recall of facts to 20 and by recall of adding multiples of 10 will support this thinking**	**6 + 9 + 3** 6 + 3 = 9 Double 9 = 18	**9 + 33** 33 42 43 **Using Doubles** **29 + 30** is the same as 30 + 30 – 1

Key Skills
- Add a 2-digit number and ones (e.g. 27 + 6)
- Add a 2-digit number and tens (e.g. 23 + 40)
- Add pairs of 2-digit numbers (e.g. 35 + 47)
- Add three single-digit numbers (e.g. 5 + 9 + 7)
- Show that adding can be done in any order (the commutative law).

- Recall bonds of any number to 20 and bonds of tens to 100 (30 + 70 etc.)
- Count in steps of 2, 3 and 5 and count in tens from any number.
- Understand the place value of 2-digit numbers (tens and ones)
- Compare and order numbers to 100 using < > and = signs.
- Read and write numbers to at least 100 in numerals and words.
- Solve problems with addition, using concrete objects, pictorial representations, involving numbers, quantities and measures, and applying mental and written methods.

Key vocabulary:
add, more, plus, and, make, altogether, total, equal to, equals, double, most, count on, number line

Year 3 Addition

Steps to success

Year 3	Introduce the **expanded column addition** method	**Special cases**	**Partitioning**	**Addition of three digit + 2 digit numbers and 3-digit + 3 digit**	Addition of numbers with decimal places
Add and subtract numbers mentally, including: -a three-digit number and ones -a three-digit number and tens -a three-digit number and hundreds Two 2-digit numbers across 100 (non-statutory guidance) Add and subtract numbers with up to three digits, using formal written methods of column addition and subtraction	**Partitioning** the numbers for TU + TU across 100. Adding the units in preparation for the compact method **55 + 78** 8 + 5 = 13 70 + 50 = 120 133	**66 + 79** 80 +66 – 1 = 145 **Using doubles** **76 + 78** Double 70 + double 6 + 2 Double 70 + double 8 – 2 Recall of facts to 20 and by adding multiples of 10 will support this thinking	Adding ones and tens to a 3digit number **356 + 8** 356 + 4 + 4 = 364 **356 + 70** 350 + 70 + 6 = 420 **356 + 600** 600 + 300 + 56 = 956	$\begin{array}{r} 268 \\ 79 \\ \hline 17 \\ 130 \\ 200 \\ \hline 347 \end{array}$ $\begin{array}{r} 268 \\ 179 \\ \hline 17 \\ 130 \\ 300 \\ \hline 447 \end{array}$ Children need to understand the value of the digits without recording the partition. Pupils need to be able to add in columns. Children may begin to use compact column addition with carrying.	 **1.5 + 1.5** Double 1 and double 0.5 **1.6 + 1.7** 1.7 + 0.3 + 1.3 = 3.3

Key Skills
- Read and write numbers to 1000 in numerals and words.
- Add 2-digit numbers mentally, incl. those exceeding 100.
- **Add a three-digit number and ones mentally (175 + 8)**
- **Add a three-digit number and tens mentally (249 + 50)**
- **Add a three-digit number and hundreds mentally (381 + 400)**
- Estimate answers to calculations, using inverse to check answers.

- Solve problems, including missing number problems, using
- number facts, place value, and more complex addition.
- Recognise place value of each digit in 3-digit numbers (hundreds, tens, ones.)
- Continue to practise a wide range of mental addition strategies, ie. number bonds, adding the nearest
- multiple of 10, 100, 1000 and adjusting, using near doubles, partitioning and recombining.

Key vocabulary:
hundreds boundary, increase, vertical, carry, expanded, compact

Year 4 Addition

Steps to success

Year 4	Using mental strategy where appropriate	Addition of three digit + 3-digit and four digit + four digit	Addition of numbers to 2 decimal places

Add and subtract numbers with up to 4 digits using the formal written methods of columnar addition and subtraction where appropriate	**1460 + 499**
	
	1460 + 500 – 1 = 1959
	
	2560 + 3570
	6000 + 130 = 7130
	
	2524 + 3176
	5600 + 100 (number bond) = 5700
		Move from expanded addition to the compact column method, **adding units first**, and 'carrying' numbers **underneath** the calculation. Also include money and measures contexts.
		
		 5 7 6
		 3 6 9
		 9 4 5
		  1 1
		
		 7 2 6 8
		 5 1 7 9
		 1 2 4 4 7
		 1 1 1
			4. 4 5
			 3. 5 5
			 8. 0 0
			  1 1
			
			 5 7. 8 9
			 4 6. 6 7
			1 0 4. 5 6
			1 1 1 1

Key Skills
- Select most appropriate method: mental, jottings or written and explain why.
- Recognise the place value of each digit in a four-digit number.
- Round any number to the nearest 10, 100 or 1000.
- Estimate and use inverse operations to check answers.
- Solve 2-step problems in context, deciding which operations and methods to use and why.

- Find 1000 more or less than a given number.
- Continue to practise a wide range of mental addition strategies, ie. number bonds, add the nearest multiple of 10, 100, 1000 and adjust, use near doubles, partitioning and recombining.
- Add numbers with up to 4 digits using the formal written method of column addition
- Solve 2-step problems in contexts, deciding which operations and methods to use and why.
- Estimate and use inverse operations to check answers to a calculation.

Key vocabulary:
thousands,
hundreds,
digits,
inverse

Year 5 Addition

Steps to success

$$£23.59 + £7.55 = £31.14$$

The decimal point should be aligned in the same way as the other place value columns, and must be in the same column in the answer.

$$23.481 + 1362 = 24843$$

Numbers should exceed 4 digits.

$$19.01 + 3.65 + 0.7 = 23.36$$

Pupils should be able to add more than two values, carefully aligning place value columns.

Empty decimal places can be filled with zero to show the place value in each column.

Say "6 tenths add 7 tenths" to reinforce place value.

Key Skills

- Add numbers mentally with increasingly large numbers, using and practising a range of mental strategies ie. add the nearest multiple of 10, 100, 100 and adjust; use near doubles, inverse, partitioning and re-combining; using number bonds.
- Use rounding to check answers and accuracy.
- Solve multi-step problems in contexts, deciding which operations and methods to use and why.
- Read, write, order and compare numbers to at least 1 million and determine the value of each digit.
- Round any number up to 1 000 000 to the nearest 10, 100, 1000, 10 000 and 100 000.
- Add numbers with more than 4 digits using formal written method of columnar addition

Key vocabulary:

decimal places, decimal point, tenths, hundredths, thousandths

Year 6 Addition

```
   2 3 · 3 6 1
      9 · 0 8
   5 9 · 7 7
 +    1 · 3
 _____
   9 3 · 5 1 1
   2 1     2
```

Adding several numbers with different numbers of decimal places (including money and measures):

Tenths, hundredths and thousandths should be correctly aligned, with the decimal point

lined up vertically including in the answer row.

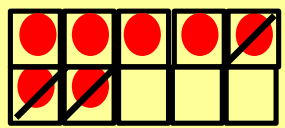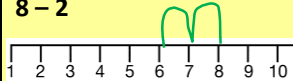Zeros could be added into any empty decimal places, to show there is no value to add.
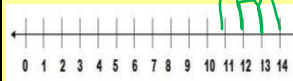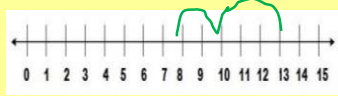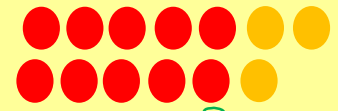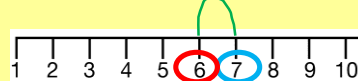
```
     8 1,0 5 9
      3,6 6 8
     1 5,3 0 1
 +   2 0,5 5 1
 _____
 1 2 0,5 7 9
   1 1 1 1
```

Adding several numbers with more than 4 digits

Key Skills

- Perform mental calculations, including with mixed operations and large numbers, using and practising a range of mental strategies.
- Solve multi-step problems in context, deciding which operations and methods to use and why.
- Use estimation to check answers to calculations and determine, in the context of a problem, levels of accuracy.
- Read, write, order and compare numbers up to 10 million and determine the value of each digit.
- Round any whole number to a required degree of accuracy.
- Pupils understand how to add mentally with larger numbers and calculations of increasing complexity.

Year 1 Subtraction — Steps to success

EYFS to Year 1	5 – 2	7 – 2	8 – 2	15 – 5	Difference or distance between
Add and subtract one-digit and two-digit numbers to 20, including zero Read, write and interpret number sentences with – and = signs.	Count out 5 and remove 2 to find the answer **7 – 3** Using a 10 frame to subtract - The children may subitise how many are remaining without having to count them all.	Count back on the number line by saying start on 7, count back 1,2, what number are you on? 1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10 **14 – 3** 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 Count backwards mentally or using a number line.	Use tens and ones when the calculation doesn't bridge 10 **13 – 5** 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 becomes **13 – 3 – 2** Partitioning the number being subtracted through the multiple of 10 mentally or using a number line	7 – 6 or find the difference between 7 and 6 1 2 3 4 5 6 7 8 9 10 This will be introduced practically with the language '**find the distance between'** and "**how many more?**" in a range of familiar contexts.
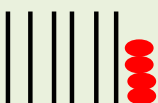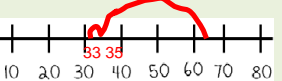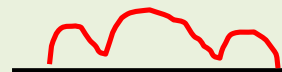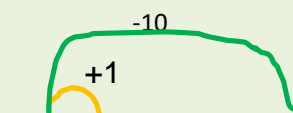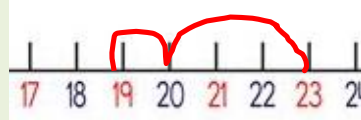
Key Skills
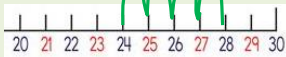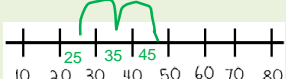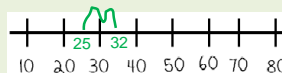- Given a number, say **one more or one less.**
- Count to and over 100, **forward and back**, from any number.
- Represent and use **subtraction facts to 20 and within 20**.
- Subtract with **one-digit and two-digit** numbers to 20, including zero.
- Solve one-step problems that involve addition and subtraction, using concrete objects (ie bead string, objects, cubes) and pictures, and missing number problems.
- Read and write numbers from 0 to 20 in numerals and words.

Key vocabulary:
equal to, take, take away, less, minus, subtract, leaves, distance between, how many more, how many fewer/less than, most, least, count back, how many left, how much less is?

Year 2 Subtraction — Steps to success

Year 2	Subtracting by counting backwards in tens or ones	Subtracting in groups of ten(rather than counting in tens) or groups of ones (by partitioning number being subtracted through multiple of 10)	65 – 32	Special cases	Difference
Add and subtract 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**	**28 – 4** **45 – 20** Use tens and ones when the calculation doesn't bridge 10 **Partitioning** 28 – 8 = 20 76 – 70 = 6	**32 – 7** **32 – 2 – 5** **64 – 40** Use a number line or manipulatives	**52 – 16** This calculation bridges through 10 so we need to partition the 16 into 2/4/10 or 12/4 and subtract 36 40 50 52 36 40 52	**When subtracting 9 or 19** **28 – 9** -10 +1 18 19 28	**23 – 19** When numbers are close together, count on from the smallest number through the multiple of ten or count back from the largest to the smallest through the multiple of ten.
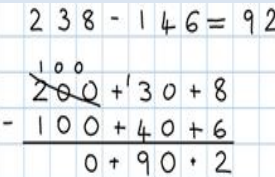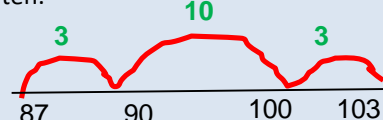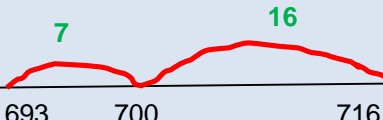
Key Skills
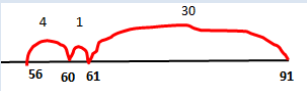- Recognise the place value of each digit in a two-digit number.
- Recall and use subtraction facts to 20 fluently, and derive and use related facts up to 100.
- Subtract using concrete objects, pictorial representations, 100 squares and mentally, including: a two- digit number and ones, a two-digit number and tens, and two two-digit numbers.
- Show that subtraction of one number from another cannot be done in any order

- Recognise and use inverse relationship between addition and subtraction, using this to check calculations and missing number problems.
- Solve simple addition and subtraction problems including measures, using concrete objects, pictorial representation, and also applying their increasing knowledge of mental and written methods.
- Read and write numbers to at least 100 in numerals and in words.

Key vocabulary:
difference,
count on,
strategy,
partition,
tens, units

Year 3 Subtraction — Steps to success

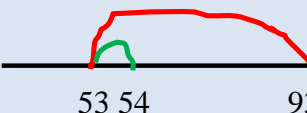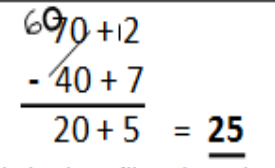| Year 3	Partitioning	TU – TU	Expanded column subtraction	Exchanging method	Difference
Add and subtract numbers mentally, including: □a three-digit number and ones □a three-digit number and tens □a three-digit number and hundreds Two 2-digit numbers across 100 (non-statutory guidance) Add and subtract numbers with up to three digits, using formal written methods of columnar addition and subtraction	Subtracting ones and tens from a 3digit number 567 – 60 = 507 745 – 700 = 45 832 – 2 = 830 **364 – 8** 364 – 4 – 4 = 356 **356 – 70** 356 – 50 – 20 = 286 **956 – 600** 956 – 600 = 356	**By counting back in tens and ones** **91 – 35** **91 – 30 – 1 – 4** 4 1 30 56 60 61 91 **Special cases** 93 – 39 as 93 – 40 + 1 53 54 93	**89 – 35 = 54** $$80 + 9$$ $$-\ 30 + 5$$ $$50 + 4$$ Introduce this method with examples where **no exchanging** is required. When learning to 'exchange', explore 'partitioning in different ways' so that pupils understand that when you exchange, the **VALUE** is the same ie **72** = 70+2 = 60+12 = 50+22 etc. Emphasise that the **value hasn't changed**, we have just partitioned it in a different way. **£5.67 – £2.20** £5.67 – £2.00 = £3.67 £3.67 – 20p = £3.47	introduce 'exchanging' through practical subtraction. Make the larger number with Base 10, then subtract 47 from it. $$\begin{array}{r} 6^{7}0 + 12 \\ -\ 40 + 7 \\ \hline 20 + 5\ = 25 \end{array}$$ 238 – 146 = 92 200 + '30 + 8 – 100 + 40 + 6 0 + 90 + 2	(see also subtraction up to three digits) **103 – 87 = 16** When numbers are close together, count on from the smallest number through the multiple of ten or count back from the largest to the smallest through the multiple of ten. 3 10 3 87 90 100 103 **716 – 693 = 23** 7 16 693 700 716

Year 4 Subtraction

Steps to success

Year 4	Subtraction up to four digits		
Add and subtract numbers with up to 4 digits using the formal written methods of columnar addition and subtraction where appropriate	£50 – £28.25 = £21.75 75p £1 £20 £28.25 £29 £30 £50	$$2754 - 1562 = 1192$$ $$2000 + 700 + 50 + 4$$ (600 crossed out above 700) $$- 1000 + 500 + 60 + 2$$ $$1000 + 100 + 90 + 2$$ As introduced in Y3, but moving towards more complex numbers and values. Use **place value counters** to reinforce 'exchanging'	2 7 5 4 − 1 5 6 2 1 1 9 2 To introduce the compact method, ask children to perform a subtraction calculation with the familiar partitioned column subtraction then display the compact version for the calculation they have done. Ask pupils to consider how it relates to the method they know, what is similar and what is different, to develop an understanding of it

Key Skills

- Subtract by counting on where numbers are close together or they are near to multiples of 10, 100 etc.
- Children select the most appropriate and efficient methods for given subtraction calculations.
- Estimate and use inverse operations to check answers.
- Solve addition and subtraction 2-step problems, choosing which operations and methods to use and why.
- Solve simple measure and money problems involving fractions and decimals to two decimal places.
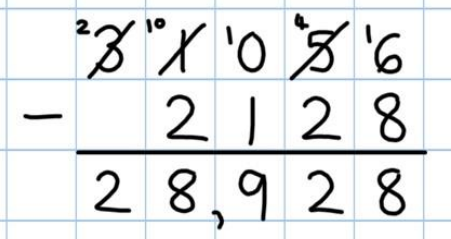- Find 1000 more or less than a given number.
- Count backwards through zero, including negative numbers.
- Recognise place value of each digit in a 4-digit number Round any number to the nearest 10, 100 or 1000
- Solve number and practical problems that involve the above, with increasingly large positive numbers.

Year 5 Subtraction Steps to success

Year 5

Add and subtract numbers mentally with increasingly large numbers eg 5-digit – 4-digit multiple of 10

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

$$
\begin{array}{r}
3\ {}^{2}\cancel{3}\ {}^{1}\cancel{1}\ 0\ {}^{4}\cancel{5}\ {}^{1}\cancel{6} \\
-\ \ \ 2\ 1\ 2\ 8 \\
\hline
2\ 8,9\ 2\ 8
\end{array}
$$

Children who are still not secure with number facts and place value will need to remain on the partitioned column method until ready for the compact method.

$$
\begin{array}{r}
{}^{6}\cancel{7}\ {}^{1}\cancel{1}\ \cancel{6}\ {}^{8}\cancel{9}\ .\ 0 \\
-\ \ \ 3\ 7\ 2\ .\ 5 \\
\hline
6\ 7\ 9\ 6\ .\ 5
\end{array}
$$

Subtract with decimal values, including mixtures of integers and decimals, aligning the decimal point

Add a 'zero' in any empty decimal places to aid understanding of what to subtract in that column.

Key Skills

- Subtract numbers mentally with increasingly large numbers .
- Use rounding and estimation to check answers to calculations and determine, in a range of contexts, levels of accuracy .
- Solve addition and subtraction multi-step problems in context, deciding which operations and methods to use and why.
- Read, write, order and compare numbers to at least 1 million and determine the value of each digit.
- Count forwards or backwards in steps of powers of 10 for any given number up to 1 million.
- Interpret negative numbers in context, counting forwards and backwards with positive and negative integers through 0.
- Round any number up to 1 million to the nearest 10, 100, 1000, 10 000 and 100 000.

Key vocabulary:

tenths,
hundredths,
decimal point,
decimal

Year 6 Subtraction

Steps to success

Year 6		
Perform mental calculations, including with mixed operations and large numbers	Using the compact column method to subtract more complex integers	Using the compact column method to subtract money and measures, including decimals with different numbers of decimal places. Empty decimal places can be filled with **zero** to show the place value in each column.
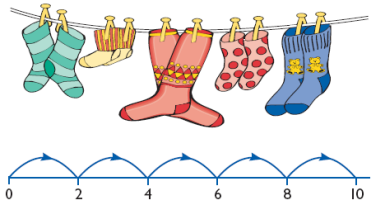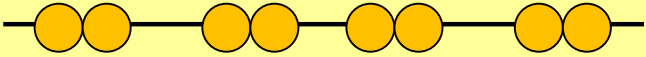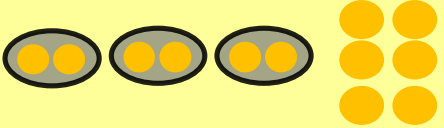
Key Skills

- Solve addition and subtraction multi-step problems in context, deciding which operations and methods to use and why.
- Read, write, order and compare numbers up to 10 million and determine the value of each digit
- Round any whole number to a required degree of accuracy
- Use negative numbers in context, and calculate intervals across zero.
- Children need to utilise and consider a range of mental subtraction strategies, jottings and written methods before choosing how to calculate.

Year 1 Multiplication

Steps to success

Year 1 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 multiples of twos, fives and tens from any number Present practical problem solving activities involving counting equal sets or groups, as above.		**There are two apples on one plate. How many apples on 3 plates?**

Key Skills

Count in multiples of 2, 5 and 10 starting from any number.

Solve one-step problems involving multiplication, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.

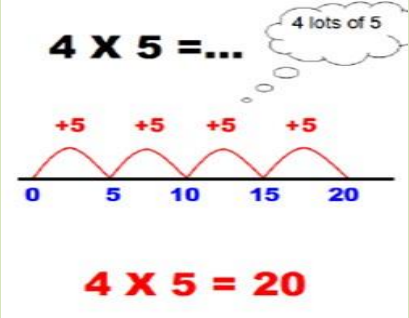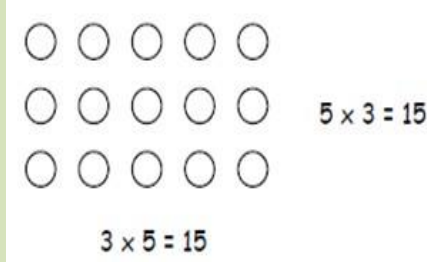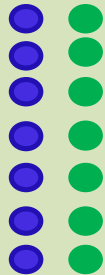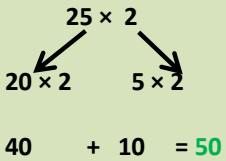Make connections between arrays, number patterns, and counting in twos, fives and tens.

Begin to understand doubling using concrete objects and pictorial representations.

Key vocabulary:

groups of, lots of, times, array, altogether, multiply, count

Year 2 Multiplication — Steps to success

Year 2	Recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers **Multiply using arrays and repeated addition (using at least 2s, 5s and 10s)**	**Use repeated addition on a number line:**	**Use arrays**		**Recall and derive doubles**
Calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication (×), division (÷) and equals (=) signs		Starting from zero, make equal jumps up on a number line to work out multiplication facts and write multiplication statements using x and = signs. 4 X 5 =... 4 lots of 5 +5 +5 +5 +5 0 5 10 15 20 4 X 5 = 20	5 x 3 = 15 3 x 5 = 15 Use arrays to help teach children to understand the commutative law of multiplication,	**Recall and Derive doubles** 7 + 7 = 14 7 × 2 = 14	25×2 20×2 5×2 $40 + 10 = 50$
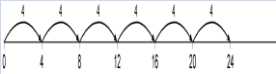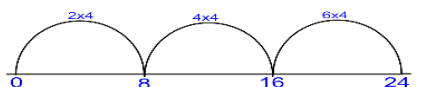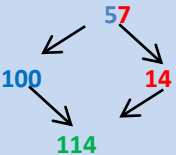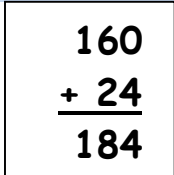
Key Skills
- Count in steps of 2, 3 and 5 from zero, and in 10s from any number.
- Recall and use multiplication facts from the **2, 5 and 10** multiplication tables, including recognising odds and evens.
- Write and calculate number statements **using the x and = signs**.
- Show that multiplication can be done in any order (commutative).
- Solve a range of problems involving multiplication, using concrete objects, arrays, repeated addition, mental methods, and multiplication facts.
- Pupils use a variety of language to discuss and describe multiplication.

Key vocabulary:
multiplied by, repeated addition, column, row, commutative, sets of, equal groups, times as big as, once, twice, three times...

Year 3 Multiplication

Steps to success

Year 3	Recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables		Using partitioning to multiply	48 × 3 = 144 (Partitioning using the grid method)

Year 3

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

Recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables

Multiply single digits by 20,30,40,50 and 80

4 × 6 = 24
Use arrays and number lines to count in multiples

Using partitioning to multiply

57 × 2 = 114
50 × 2   7 × 2
100 + 14 = 114

57
100   14
114

48 × 3 = 144
(Partitioning using the grid method)

Eg. 23 × 8 = 184

X	20	3
8	160	24

160
+ 24
184

To do this, children must be able to:
- Partition numbers into tens and ones
- Multiply multiples of ten by a single digit (e.g. 20 x 4) using their knowledge of multiplication facts and place value
- Recall and work out multiplication facts in the **2, 3, 4, 5, 8 and 10** times tables.
- Work out multiplication facts not known by repeated addition or other taught mental strategies (e.g. by commutative law, working out near multiples and adjusting, using doubling etc.)

Key Skills
- Recall and use multiplication facts for the **2, 3, 4, 5, 8 and 10** multiplication tables, and multiply multiples of 10.
- Write and calculate number statements using the multiplication tables they know, including **2-digit x single-digit**, drawing upon mental methods, and progressing to reliable written methods.
- Solve multiplication problems, including missing number problems.
- Develop mental strategies using commutativity (e.g. 4 x 12 x 5 = 4 x 5 x 12 = 20 x 12 = 240)
- Solve simple problems in contexts, deciding which operations and methods to use.
- Develop efficient mental methods to solve a range of problems e.g using commutativity (**4 × 12 × 5** = 4 × 5 × 12 = **20 × 12 = 240**) and for missing number problems   ? x 5 = 20,   3 x ? = 18,   ? x 1 = 32

Key vocabulary:
partition, grid method, multiple, product, tens, units, value
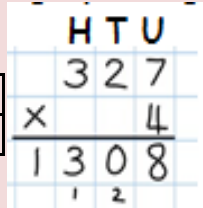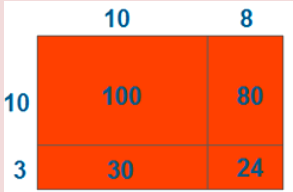
Year 4 Multiplication

Steps to success

Year 4

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

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

---

Recall multiplication and division facts for multiplication tables up to 12 × 12 (facts for 6,7,9,11,12 are new)

Multiply single digits by 60,70, and 90

Mental
Multiplying by 10 and 100

Th	H	T	U
		2	4
2	4	0	0

Eg. **24** × 100

Partitioning
267 × 2
200 × 2 = 400
 60 × 2 = 120
  7 × 2 = 14
400 + 120 + 14 =534

---

67 × 9

×	60	7
9	540	63

437 × 6

×	400	30	7
6	2400	180	42

2400 + 180 + 42 = 2622

Partitioning grid multiplication leading to formal compact methods

67 × 9 =

```
  6 7
  ⁶ 9
 ____
  6 0 3
```

540 + 63 = 603

Children should be able to:

Approximate before they calculate, and make this a regular part of their calculating, going back to the approximation to check the reasonableness of their answer. e.g:

346 x 9 is approximately 350 x 10 = **3500‖**

Record an approximation to check the final answer against.

Key Skills

- Count in multiples of 6, 7, 9, 25 and 1000
- Recall multiplication facts for **all multiplication tables up to 12 × 12.**
- Recognise place value of digits in up to 4-digit numbers
- Use place value, known facts and derived facts to multiply mentally, e.g. multiply by 1, 10, 100, by 0, or to multiply 3 numbers.
- Use commutativity and other strategies mentally 3 x 6 = 6 x 3, 2 x 6 x 5 = 10 x 6 , 39x7 = 30 x 7 + 9 x 7.
- Solve problems with increasingly complex multiplication in a range of contexts.
- Count in multiples of 6, 7, 9, 25 and 1000
- Recognise the place value of each digit in a four-digit number (thousands, hundreds, tens, and ones)

Year 5 Multiplication

Year 5	Multiply and divide numbers mentally drawing upon known facts	Mental calculation
Multiply numbers up to 4 digits by a one- or two-digit number using a formal written method, including long multiplication for two-digit numbers	multiply and divide whole numbers and those involving decimals by 10, 100 and 1000	**Partitioning** **407 × 4** **400 × 4 = 1600** **0 × 4 = 0** **7 × 4 = 28** **1600 + 28 = 1628** **Rounding and adjusting** **£3.99 × 6** **£4 × 6 = £24** **£24.00 – £0.06 = £23.94** **28 × 19** **28 × 10 × 2 = 560** **560 – 28 = 532**

Short multiplication for multiplying by a single digit

x	300	20	7
4	1200	80	28

HTU
327
× 4
1308

Introduce by comparing a grid method calculation to a short multiplication method, to see how the steps are related, but notice how there are less steps involved in the column method.

Children need to be taught to approximate first, e.g. for **72 x 38, they will use rounding: 72 x 38** is approximately 70 x 40 = **2800**, and use the approximation to check the reasonableness of their answer against.

Introduce long multiplication for multiplying by 2 digits

	10	8
10	100	80
3	30	24

Use the grid to introduce long multiplication as the relationship can be seen in the answer in each row

```
      1  8
  ×   1  3
      5  4
   1  8  0
   2  3  4
```

18 x 3 on the 1st row

(8 x 3 = 24, carrying the 2 for twenty, then '1' x 3).

18 x <u>10</u> on the 2nd row. Put a zero in units first, then say 8 x 1, and 1 x 1

Key Skills

Identify multiples and factors, using knowledge of **multiplication tables to 12x12.**

Solve problems where larger numbers are decomposed into their factors

Multiply and divide integers and decimals by 10, 100 and 1000

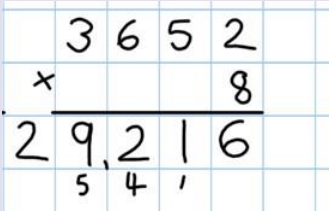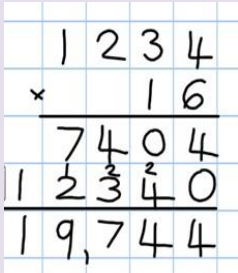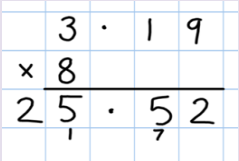Recognise and use square and cube numbers and their notation

Solve problems involving combinations of operations, choosing and using calculations and methods appropriately.

Video clips: <u>Moving from grid method to a compact method (youtube)</u>

Key vocabulary:

square, factor, integer, decimal, short/long multiplication, 'carry'

Year 6 Multiplication Steps to success

Year 6 Multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication	Perform mental calculations, including with mixed operations and large numbers	Mental calculation **Partitioning** 5.7 × 6 5 × 6 = 30 0.7 × 7 = 4.2 30 + 4.2 = 34.2 5.3 × 19 5.3 × 10 × 2 = 106 106 − 5.3 = 100.7			**Multiply decimals with up to 2d.p by a single digit.**
			$$\begin{array}{r} 3\ 6\ 5\ 2 \\ \times\ \ \ \ \ \ 8 \\ \hline 2\ 9{,}2\ 1\ 6 \\ {\scriptstyle 5\ 4\ 1} \end{array}$$	$$\begin{array}{r} 1\ 2\ 3\ 4 \\ \times\ \ \ \ 1\ 6 \\ \hline 7\ 4\ 0\ 4 \\ 1\ 2\ 3\ 4\ 0 \\ \hline 1\ 9{,}7\ 4\ 4 \end{array}$$ (1234 x 6) (1234 x 10)	$$\begin{array}{r} 3\cdot 1\ 9 \\ \times\ \ \ 8 \\ \hline 2\ 5\cdot 5\ 2 \\ {\scriptstyle 1\ \ \ 7} \end{array}$$ Line up the decimal points in the question and the answer. Remind the children that the single digit belongs in the units column.

Key Skills
- Recall multiplication facts for all times tables up to **12 x 12 (as Y4 and Y5).**
- Multiply multi-digit numbers, up to 4-digit x 2-digit using long multiplication.
- Perform mental calculations with mixed operations and large numbers.
- Solve multi-step problems in a range of contexts, choosing appropriate combinations of operations and methods.
- Estimate answers using round and approximation and determine levels of accuracy.
- Round any integer to a required degree of accuracy.

Video clips:
Moving from grid method to a compact method (youtube)
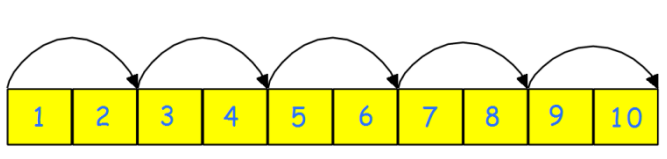**Reinforcing rapid times table recall:** (youtube)
Demonstration of long multiplication (SLEP)
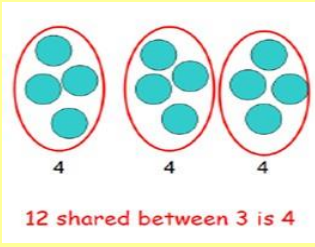
Key vocabulary:
tenths,
hundredths,
decimal

Year 1 Division

Steps to success

Year 1
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.

Group and share small quantities

Using objects, diagrams and pictorial representations to solve problems involving **both** grouping and sharing.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

Pupils should

Be able to count in multiples of 2s, 5s and 10s

Find **half** of a group of objects by sharing into 2 equal groups

Understand the difference between „grouping" objects (How many groups of 2 can you make?) and „sharing" (Share these sweets between 2 people)

Grouping

Sharing

12 shared between 3 is 4

Example division problem in a familiar context:

There are 6 pupils on this table and there are 18 pieces of fruit to share between us. If we share them equally, how many will we each get?

Can they work it out and give a division statement… ?

"18 shared between 6 people gives you 3 each."
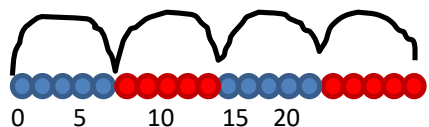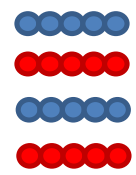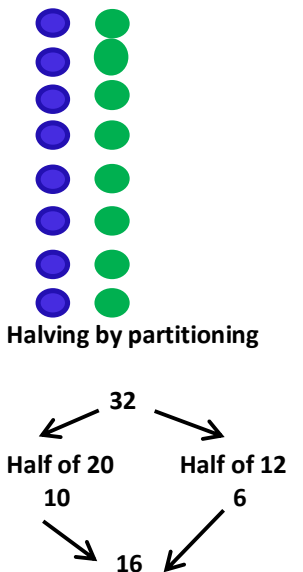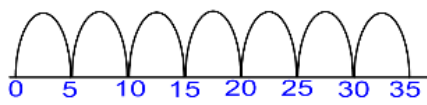
Key Skills
- Solve one-step problems involving multiplication and division, by calculating the answer using concrete objects, pictorial representations arrays with the support of the teacher
- Through grouping and sharing small quantities, pupils begin to understand, division, and finding simple fractions of objects, numbers and quantities.
- They make connections between arrays, number patterns, and counting in twos, fives and tens.

Key vocabulary:

share, share equally, one each, two each…, group, groups of, lots of, array

Year 2 Division

Steps to success

Year 2		Counting		Division by sharing	Division by grouping
Year 2 Calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication (×), division (÷) and equals (=) signs	Recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers	**Counting** 0 5 10 15 20 Relate division to counting and multiplication facts. Count in 5s to see that there are 4 5s in 20. How many groups of five are there in 20?	**Halving by partitioning** 32 Half of 20 Half of 12 10 6 16	**Division by sharing** 10 ÷ 5 = **Recall and Derive Halves** Look at doubles of even numbers and seeing half of odd numbers as one left over or ½	**Division by grouping** 35 ÷ 5 = 1 2 3 4 5 6 7 0 5 10 15 20 25 30 35
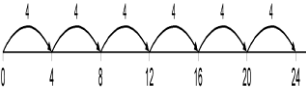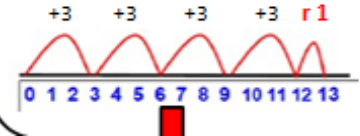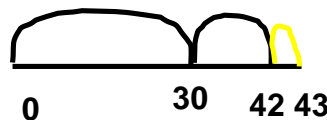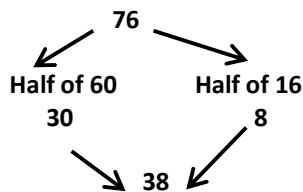
Key Skills
- Count in steps of 2, 3, and 5 from 0
- Recall and use multiplication and division facts for the **2, 5 and 10** multiplication tables, including recognising odd and even numbers.
- Calculate mathematical statements for multiplication and division within the multiplication tables and write them using the x, ÷ and = signs.
- Show that 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 contexts.

Key vocabulary:
divide, divided by, divided into, division, grouping, number line, left, left over

Year 3 Division — Steps to success

Year 3	Recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables	Counting	Division as grouping	Halving by partitioning
Write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including for two-digit numbers divided one-digit numbers, using mental and progressing to formal written methods	Use facts for numbers up to 10 times the divisor Eg 28 ÷ 3 This is between 27 ÷ 3 = 9 and 30 ÷ 3 = 10 So 9 remainder 1	Relate division to counting and multiplication facts. Count in 4s to see that there are 6 4s in 24 Arrays show 6 groups of 4 so 24 ÷ 4 = 6	**Grouping on a number line:** $13 \div 3 = 4\ r\ 1$ $+3\ +3\ +3\ +3\ r\ 1$ 0 1 2 3 4 5 6 7 8 9 10 11 12 13 $43 \div 3$ 3×10 3×4 0 30 42 43 **Children continue to work out unknown division facts by grouping on a number line from zero.** They are also now taught the concept of **remainders,** as in the example. This should be introduced practically and with arrays, as well as being translated to a number line. Children should work towards calculating some basic division facts with remainders mentally for the 2s, 3s, 4s, 5s, 8s and 10s, ready for 'carrying' remainders across within the short division method.	**76** Half of 60 → Half of 16 **30** **8** → **38** ←
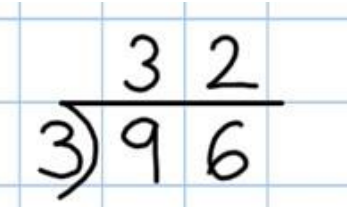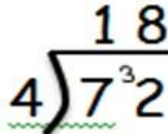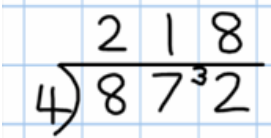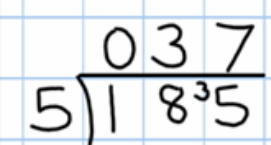
Key Skills
- Recall and use multiplication and division facts for the 2, 3, 4, 5, 8 and 10 multiplication tables (through doubling, connect the 2, 4 and 8s).
- Write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental and progressing formal written methods.
- Solve problems, in contexts, and including missing number problems, involving multiplication and division.
- Pupils develop efficient mental methods, for example, using multiplication and division facts
(e.g. using $3 \times 2 = 6$, $6 \div 3 = 2$ and $2 = 6 \div 3$) to derive related facts ($30 \times 2 = 60$, so $60 \div 3 = 20$ and $20 = 60 \div 3$).
- Pupils develop reliable written methods for division, starting with calculations of 2-digit numbers by 1-digit numbers and progressing to the formal written method of short division.

Key vocabulary:

inverse, short division, 'carry', remainder, multiple

Year 4 Division Steps to success

Year 4					
Use place value, known and derived facts to multiply and divide mentally, including: multiplying by 0 and 1; dividing by 1; multiplying together three numbers	Division facts for multiplication tables up to 12 × 12	Short division: Limit numbers to **NO** remainders in the answer **OR** carried (each digit must be a multiple of the divisor	Short division: Limit numbers to **NO** remainders in the final answer, but with remainders occurring within the calculation.		Pupils move onto dividing numbers with up to **3-digits** by a single digit, however

Short division: Limit numbers to **NO** remainders in the answer **OR** carried (each digit must be a multiple of the divisor

Remind children of correct place value, that 96 is equal to 90 and 6, but in short division, pose:
- How many 3's in 9? = 3, and record it above the **9 tens**.
- How many 3's in 6? = 2, and record it above the **6 units**.

Once children are secure with division as grouping and demonstrate this using number lines, arrays etc., **short division** for larger 2-digit numbers should be introduced, initially with carefully selected examples requiring no calculating of remainders at all. Start by introducing the layout of short division by comparing it to an array.

Short division: Limit numbers to **NO** remainders in the final answer, but with remainders occurring within the calculation.

Once children demonstrate a full understanding of remainders, and also the short division method taught, they can be taught how to use the method when remainders occur within the calculation (e.g. 96÷4), and be taught to 'carry' the remainder onto the next digit. **If needed, children should use the number line to work out individual division facts that occur which they are not yet able to recall mentally.**

Pupils move onto dividing numbers with up to **3-digits** by a single digit, however problems and calculations provided should **not result in a final answer with remainder** at this stage**.**

When the answer for the **first column** is zero (1 ÷ 5, as in example), children could initially write a zero above to acknowledge its place, and must always 'carry' the number (1) over to the next digit as a remainder

Key Skills

- Recall multiplication and division facts for all numbers up to 12 x 12.
- Use place value, known and derived facts to multiply and divide mentally, including: multiplying and dividing by 10 and 100 and 1.
- Pupils practise to become fluent in the formal written method of short division with exact answers when dividing by a one-digit number
- Pupils practise mental methods and extend this to three-digit numbers to derive facts, for example
  200 × 3 = 600 so 600 ÷ 3 = 200
- Pupils solve two-step problems in contexts, choosing the appropriate operation, working with increasingly harder numbers. This should include correspondence questions such as three cakes shared equally between 10 children.

Key vocabulary:

divisible by, factor

Year 5 Division — Steps to success

Year 5	multiply and divide	Division as grouping drawing on known facts	Divide up to 4 digits by a single digit, including those with remainders.
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	numbers mentally drawing upon known facts Divide numbers by 10 and 100	Use partitioning and known facts	

multiply and divide numbers mentally drawing upon known facts

Divide numbers by 10 and 100

H	T	U	1/10	1/100
	2	7		
			2	7

Division as grouping drawing on known facts

Use partitioning and known facts

$196 \div 6 = 32r4$ $325 \div 3 = 108r1$

180   16   300   25
(6 x 30) (6 × 2 + 4) (3 × 100) (3 × 8 + 1)

Divide up to 4 digits by a single digit, including those with remainders.

$$0\,6\,6\,3\,r\,5$$
$$8)5\,^5\!3\,^5\!0\,^2\!9$$

Short division with remainders: Now that pupils are introduced to examples that give rise to remainder answers, division needs to have a real life problem solving context, where **pupils consider the meaning of the remainder and how to express it,** ie. as a fraction, a decimal, or as a rounded number or value , depending upon the context of the problem

The answer to $5309 \div 8$ could be expressed as 663 and five eighths, 663 r 5, as a decimal, or rounded as appropriate to the problem involved.

Key Skills

- Recall multiplication and division facts for all numbers up to 12 x 12 (as in Y4).
- Multiply and divide numbers mentally, drawing upon known facts.
- Identify multiples and factors, including finding all factor pairs of a number, and common factors of two number.
- Solve problems involving multiplication and division where larger numbers are decomposed into their factors.
- Multiply and divide whole numbers and those involving decimals by 10, 100 and 1000.
- Use the vocabulary of prime numbers, prime factors and composite (non-prime) numbers.
- Work out whether a number up to 100 is prime, and recall prime numbers to 19.

- 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
- Use multiplication and division as inverses.
- Interpret non-integer answers to division by expressing results in different ways according to the context, including with remainders, as fractions, as decimals or by rounding (e.g. $98 \div 4 = 24 \ r \ 2 = 24^{1}/2 = 24.5 \approx 25$).
- Solve problems involving combinations of all four operations, including understanding of the equals sign, and including division for scaling by different fractions and problems involving simple rates.

Key vocabulary:

quotient, prime number, prime factors, composite number (non-prime)

Year 6 Division

Steps to success

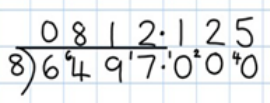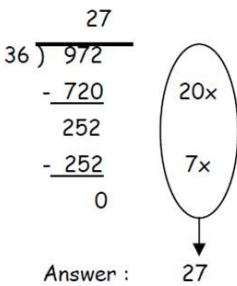| Year 6	Use known facts	Use tests of divisibility	Short division, for dividing by a single digit	Introduce long division by chunking for dividing by 2 digits
Divide numbers up to 4 digits by a two-digit whole number using the formal written method of long division, and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate for the context	Know 378 is a multiple of 3 because 300/60 and 18 are all multiples of 3	Multiple of 3, digits in the number add to 3, 6 or 9		

Short division with remainders: Pupils should continue to use this method, but with numbers to at least 4 digits, and understand how to express remainders as fractions, deci- mals, whole number remainders, or rounded numbers. Real where life problem solving contexts need to be the starting point, pupils have to consider the most appropriate way to express the remainder.

Calculating a decimal remainder: In this example, rather than expressing the remainder as **r 1**, a decimal point is added after the units because there is still a remainder, and the one remainder is carried onto zeros after the decimal point (to show there was no decimal value in the original number). Keep dividing to an appropriate degree of accuracy for the problem being solved.

Find out 'How many 36s are in 972?' by subtracting 'chunks' of 36, until zero is reached (or until there is a remainder).
Teach pupils to write a '**bank**' first at the side that will help them decide what chunks to use, e.g.:

Bank   1x = 36
          10x = 360
          100x = 3600

Additional column details:

- **Know 378 is a multiple of 3 because 300/60 and 18 are all multiples of 3**
- **Know 385 is a multiple of 7 because 350 and 35 are multiples of 7**

Tests of divisibility:
- Multiple of 3, digits in the number add to 3, 6 or 9
- Multiple of 4, tens and ones in the number are a multiple of 4
- Multiple of 6, the number is even and digits in the number add to 3, 6 or 9
- Multiple of 9, digits in the number add to 9

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

Introduce the method in a simple way by limiting the choice of chunks to 'Can we use 10 lots? Can use 100 lots?' As children become confident with the process, encourage more efficient chunks to get to the answer more quickly (e.g. 20x, 5x), and expand on their 'bank'.

Key Skills

- Recall and use multiplication and division facts for all numbers to 12 x 12 for more complex calculations
- Divide numbers up to 4 digits by a two-digit whole number using the formal written method of long division, and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate for the context. Use short division where appropriate.
- Perform mental calculations, including with mixed operations and large numbers.
- Identify common factors, common multiples and prime numbers.
- Use estimation to check answers to calculations and determine accuracy, in the context of a problem.
- Use written division methods in cases where the answer has up to two decimal places.
- Solve problems which require answers to be rounded to specified degrees of accuracy.

Key vocabulary:

common factor