Bluecoat Primary Academy

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Primary

believe in yourself, in others, in God

Written Calculation Statement of Practice

Information about approaches in mathematics at Bluecoat Primary Academy

Created September 2017

Reviewed September 2019

Next review September 2020

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Introduction

This calculation policy has been written in line with the programmes of study taken from the revised National Curriculum for Mathematics (2014). It provides guidance on appropriate calculation methods and progression. The content is set out in yearly blocks under the following headings: addition, subtraction, multiplication and division.

Age related expectations

The calculation policy is organised according to age related 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.

Aim of the Policy

- To ensure consistency and progression in our approach to calculation at Bluecoat.
- To ensure that children develop an efficient, reliable, formal written method of calculation for all operations.
- To ensure that children can use these methods accurately with confidence and understanding.
- To support parents and carers in understanding and supporting their child with the approaches in mathematics taught at Bluecoat.

Mathematical approaches

Children will be encouraged to use mental methods as their first port of call when appropriate, but for calculations that they cannot work out mentally or with informal jottings, they will be taught to use an efficient written method accurately and with confidence.

This policy concentrates on the introduction of standard symbols, jottings to aid mental calculation and the introduction of pencil and paper procedures. **It is important that children do not abandon jottings and mental methods once pencil and paper procedures are introduced. Therefore children will always be encouraged to look at a calculation/problem and then decide which is the best method to choose - mental calculation (with or without jottings) or formal written method. Our long-term aim is for children to be able to select an efficient method (whether this is mental, or written) that is appropriate for a given task**.

Addition – Year 1

Children should:

- Add with numbers up to 20.
- Recall number bonds to 10 and 20, and addition facts within 20.
- Read and write the addition (+) and equals (=) signs within number sentences *(NB: children need to understand the concept of equality before using the '=' sign. Calculations should be written either side of the equality sign so that the sign is not interpreted just as 'the answer.' (E.g. 3=1+1)*
- Solve simple 1 step problems involving addition, using objects, number lines and pictorial representations.

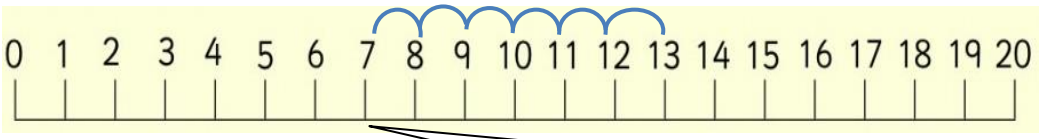
Children will practise counting on from any number *(e.g. 'point to five and count on four.')*

Initially use a number track to count on for addition, counting on from the largest number:

Put your finger on five. Count on four.

5 + 4 = 9

Progress to marked number line:



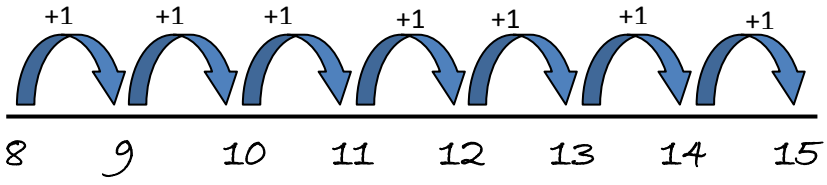
6 + 7 =13

Encourage children to start counting from the largest number first.

Children should be taught that addition is commutative (numbers can be added in any order).

When children are confident in using a marked number line, they may move onto using an **empty number line**.

8 + 7 = 15



"Start at the number 8 and make 7 jumps – what number do you get to?"

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

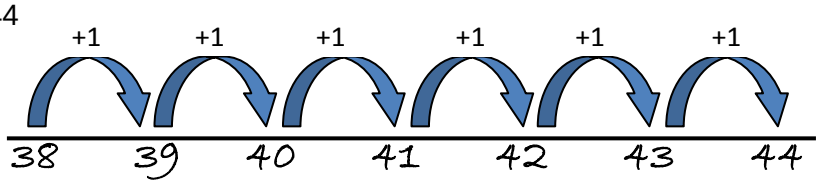
Addition – Year 2

Children should:

- 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 and start with larger number first (commutative law).
- Recall bonds to 20 and bonds of tens to 100 (30 + 70 etc.)
- Solve problems with addition, using concrete objects, pictorial representations, involving numbers, quantities and measures, and applying mental and written methods.

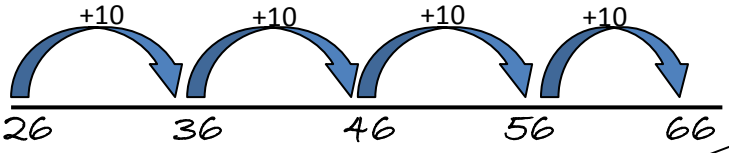
Counting on in ones using an empty number line:

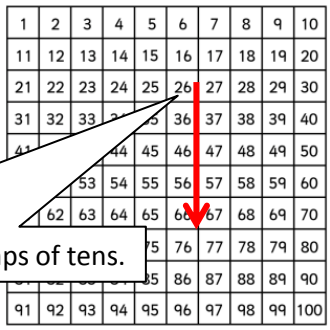
38 + 6 = 44



Counting on in tens using an empty number line:

26 + 40 = 64

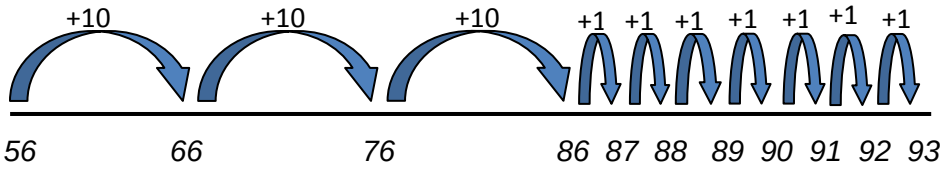




Use in conjunction with a 100 square to show jumps of tens.

Counting on in tens and ones.

37 + 56 = 93

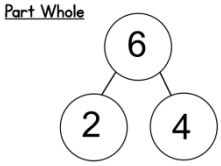


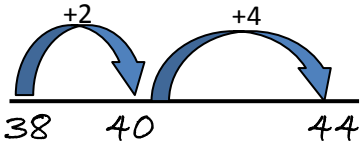
Children should recognise addition can be completed in any order and start counting from the largest number first.

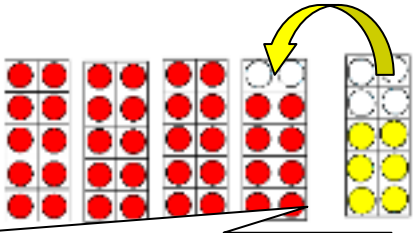
Bridging through 10

Making 10 is one of the most important mathematical concepts to be mastered in Key Stage 1. Children should now be encouraged to apply this skill to make more efficient jumps on the number line, using their knowledge of bonds to ten.

38 + 6 = 44



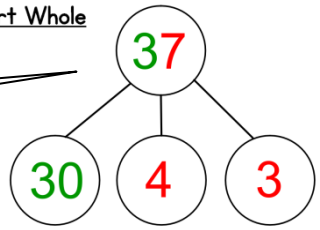




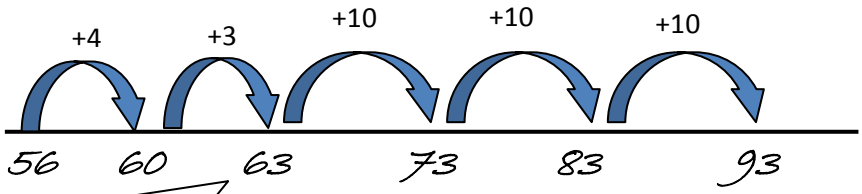
Use in conjunction with tens frames to show the ones being added to make the

Bridging through ten with larger numbers

56 + 37 = 93



Use in conjunction with a 'Part Part Whole' model to show how the number we are adding can be partitioned and added (by bridging through 10).



When adding the ones, take the first jump to the next ten and then add the remaining ones.

Partitioning Method

When children are secure with adding tens and ones using a number line, they should progress to using the partitioning method.

E.g. 43 + 25 =

43 + 25 = 68

40 + 3 + 20 + 5

'Partition the numbers into tens and ones.
Add the tens together and then add the ones together.
Recombine to give the answer.'

3 + 5 = 8
40 + 20 = 60
60 + 8 = 68

Then move on to calculations that bridge the tens:

48 + 27 = 75

40 + 8 + 20 + 7

At this stage, children should now be encouraged to start by adding the ones first.

8 + 7 = 15
40 + 20 = 60
60 + 15 = 75

If able, children can continue to develop addition with numbers that bridge 100.

Key vocabulary:
add, more, plus, and, make, altogether, total, equal to, equals, double, most, count on, number line, sum, tens, ones, partition, addition, column, tens boundary

Addition – Year 3

Children should:

- Recognise place value of each digit in 3-digit numbers (hundreds, tens, ones.)
- ***Add numbers with up to 3 digits using an expanded written method of addition.***
- 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)
- Solve problems, including missing number problems, using number facts, place value, and more complex addition.
- 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.

Revisit key concepts from Y2 such as bridging through 10 first, if necessary:

Partitioning Method

Further develop partitioning method with numbers which bridge 100

E.g. 85 + 37 =

85 + 37 = 122

80 + 5 + 30 + 7

Children should now be encouraged to start by adding the ones first.

5 + 7 = 12

80 + 30 = 110

110 + 12 = 122

The partitioning method can also be used with three-digit numbers…

E.g. 234 + 365 =

234 + 325 = 559

200 + 30 + 4 + 300 + 20 + 5

5 + 4 = 9

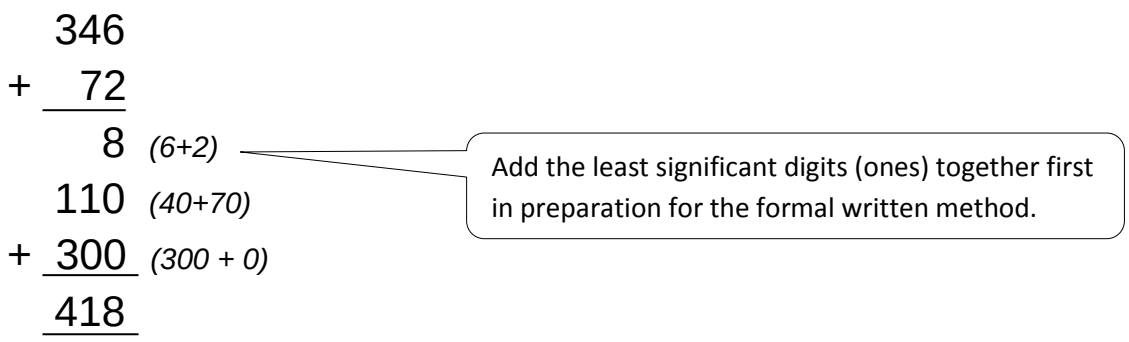
30 + 20 = 50

200 + 300 = 500

500 + 50 + 9 = 559

Expanded Addition Method

We now encourage children to begin organising their work into place value columns. They continue to add similar values and partition the number into hundreds, tens and ones.



If able, children can continue to develop addition with numbers that bridge 1000.

Key vocabulary:
add, more, plus, and, make, altogether, total, equal to, equals, double, most, count on, number line, sum, tens, ones, partition, plus, addition, column, tens boundary, hundreds boundary, increase, vertical, expanded, compact.

Addition – Year 4

Children should:

- Select most appropriate method: mental, jottings or written and explain why.
- 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.
- Recognise the place value of each digit in a four-digit number.
- Solve 2-step problems in context, deciding which operations and methods to use and why.
- Find 1000 more or less than a given number.
- ***Add numbers with up to 4 digits using the formal written method of column addition***

***NB**: Ensure that children are confident with the previous year's methods before moving on.*

Expanded Column Addition

Further develop the formal written method of addition, with three-digit numbers.
Revisit the expanded method first, if necessary:

176 + 147 = 323

$$\begin{array}{r} 176 \\ +\ 147 \\ \hline 13 \\ 110 \\ +\ 200 \\ \hline 323 \end{array}$$

Compact Column Addition

Move from expanded addition to the compact column method, adding ones first, and carrying numbers underneath the calculation.

$$\begin{array}{r} \mathbf{3517} \\ +\ \mathbf{2396} \\ \hline \mathbf{5913} \\ \hline \mathbf{1\ 1} \end{array}$$

'Carry' numbers underneath the bottom line.

Use the language of <u>place value</u> to ensure understanding:

"7 + 6 = 13. Write 3 in the ones column and 'carry' 1 across into the tens column (10).
10 + 90 and the 10 that we carried equals 110. Write 1 in the tens column (10) and 'carry' 1 across into the hundreds column (100).
500 + 300 and the 100 that has been carried equals 900. Write 9 in the hundreds column (900).
3000 + 2000 = 5000. Write 5 in the thousands column (5000)"

Continue to develop with addition of two four-digit numbers and with decimals (in the context of money or measures).

<u>Key vocabulary</u>:
add, more, plus, and, make, altogether, total, equal to, equals, double, most, count on, number line, sum, tens, ones, partition, plus, addition, column, tens boundary, hundreds boundary, increase, vertical, carry, expanded, compact, thousands, hundreds, digits, inverse

Addition – Year 5

Children should:

- Add numbers mentally with increasingly large numbers, using and practising a range of mental strategies ie. add the nearest multiple of 10, 100, 1000 and adjust; use near doubles, inverse, partitioning and re-combining; using number bonds.
- 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.
- ***Add numbers with more than 4 digits using formal written method of columnar addition.***

Compact column addition

Continue to develop the formal written method for addition with larger numbers (and decimal numbers) and with the addition of three or more numbers:

21848 + 1523 = 23371

```
  21848
+  1523
 23371
   1  1
```

Reinforce correct place value by reminding children the actual value is 8 hundreds add 5 hundreds, not 5 add 3, for example.

Use the formal written method for the addition of decimal numbers:

```
  £ 23 .59
+ £  7 .55
 £ 31 .14
    1 1  1
```

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

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

19.01 + 3.65 + 0.7 =

```
  19.01
   3.65
+  0.70
 23.36
   1 1
```

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

Key vocabulary:
sum, tens, ones, partition, plus, addition, column, tens boundary, hundreds boundary, increase, carry, expanded, compact, vertical, thousands, hundreds, digits, inverse, decimal places, decimal point, tenths, hundredths, thousandths

Addition – Year 6

Children should:

- 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.
- Understand how to add mentally with larger numbers and calculations of increasing complexity.

Compact column addition

By year 6, there is an expectation that children will continue to practise and use the formal written method for larger numbers and decimals and use these methods when solving problems. This includes:

Adding several numbers with more than 4 digits:

```
  81059
  20551
  15301
+  3668
 120579
 1111
```

Adding several numbers with different amounts of decimal places:

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

```
 59.770
 23.361
  9.080
+ 1.300
 93.511
 2 1 2
```

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

Key vocabulary:
sum, tens, ones, partition, plus, addition, column, tens boundary, hundreds boundary, increase, carry, expanded, compact, vertical, thousands, hundreds, digits, inverse, decimal places, decimal point, tenths, hundredths, thousandths.

Subtraction – Year 1

Children should:

- Given a number, say one more or one less.
- Count to and over 100, forward and back, from any number.
- Read and write numbers from 0 to 20 in numerals and words.
- 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.

Children will practise counting back from any number (e.g. 'Put nine in your head and count back three.')

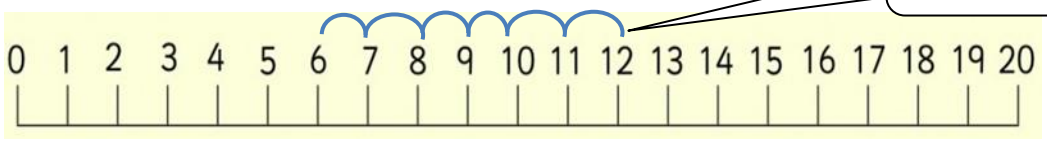
Initially use a number track to count back:

9 – 3 = 6

Put your finger on 9. Count back 3.

Progress to a marked number line:

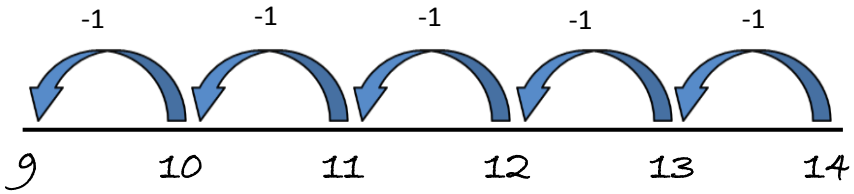
12 – 6 = 6



Put your finger on 12 and count back 6.

When children are confident in using a marked number line, they may move onto using an empty number line:

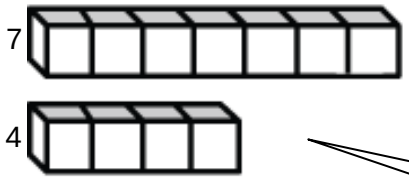
14 – 5 = 9



"Start at the number 14 and count back 5 – what number do you get to?"

Counting on to find a small difference

This will be introduced practically with the language 'find the distance between' and 'how many more?' in a range of familiar contexts.



"Seven is 3 more than four"

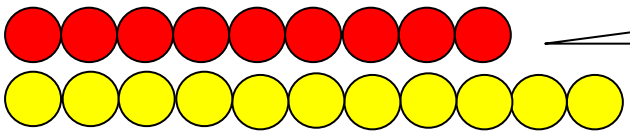
The difference between seven and four is 3.

"I am 2 years older than my sister."

Introduce complementary addition to find differences (only use for small differences).
The use of models is extremely important to understand the idea of "difference".

Count up from the smallest number to the largest to find the difference using resources such as cubes, beads, number tracks/lines:

11 – 9 = 2



The difference between nine and eleven is two.

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_?

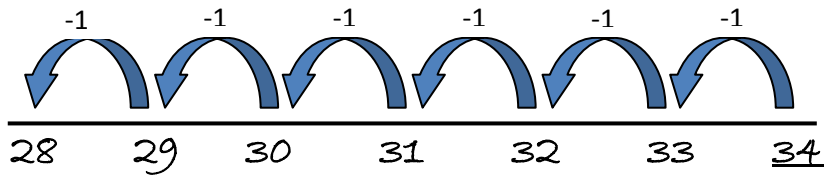
Subtraction – Year 2

Children should:

- 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.

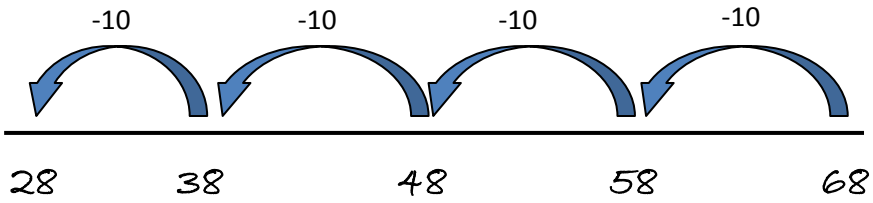
Counting back in ones using an empty number line:

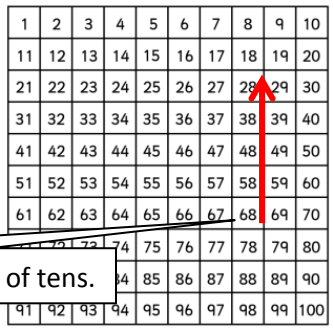
34 – 6 = 28



Counting back in tens using an empty number line:

68 - 30 = 28

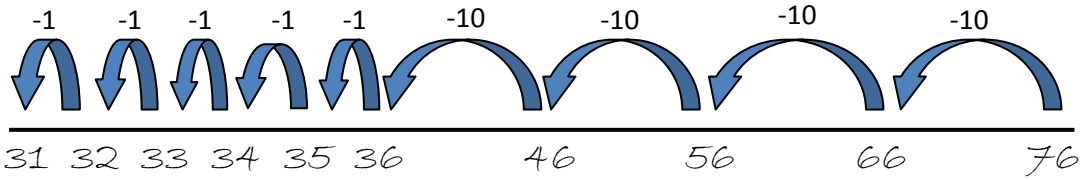




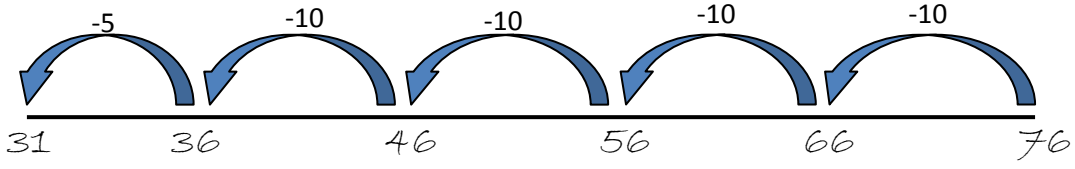
Use in conjunction with a 100 square to show jumps of tens.

Counting back in tens and ones (partitioning):

76 – 45 = 31

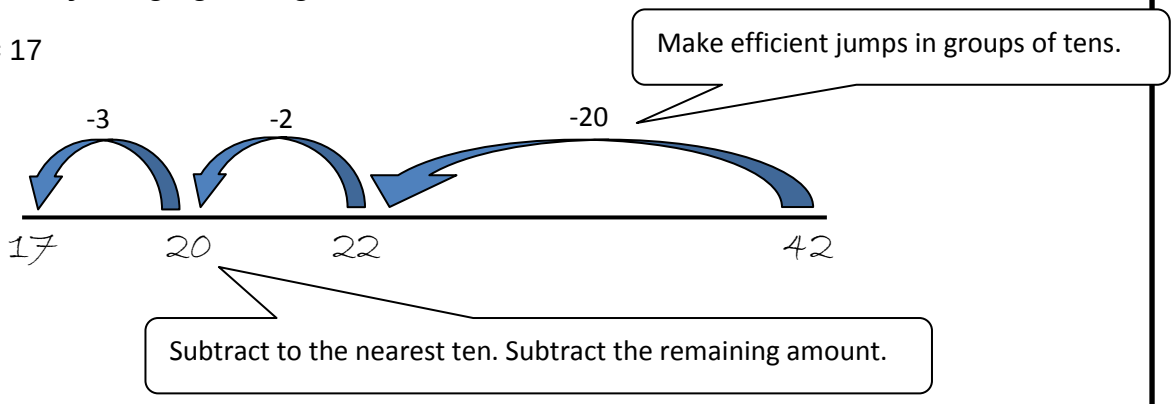


Move towards making more efficient jumps:



Subtraction by bridging through 10

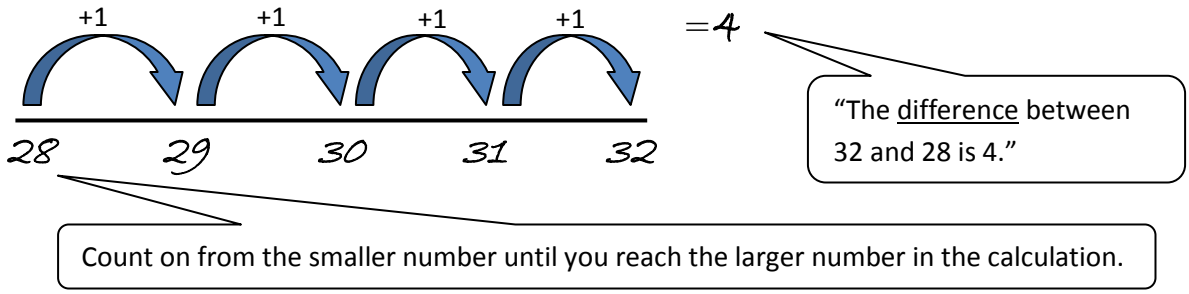
42 – 25 = 17



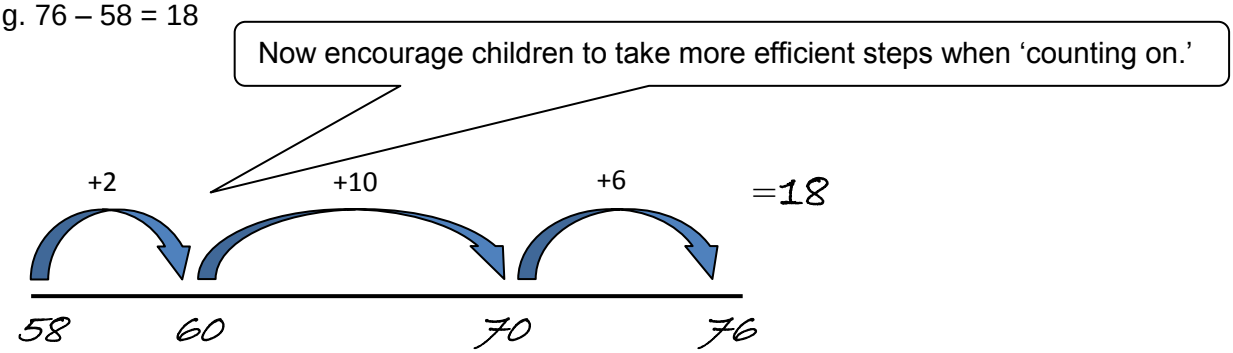
Counting on to find a small difference

Children should be taught to recognise that when numbers are close together, it is more efficient to 'count on' to find the difference.

E.g. 32 – 28 = 4



E.g. 76 – 58 = 18



If able, further develop subtraction with numbers that bridge 100.

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_?

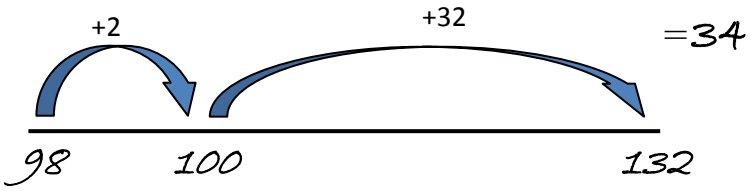
Subtraction – Year 3

- Subtract mentally a: 3-digit number and ones, 3-digit number and tens, 3-digit number and hundreds .
- Estimate answers and use inverse operations to check.
- Solve problems, including missing number problems.
- Recognise the place value of each digit in a 3-digit number .
- Use counting up to find the difference when numbers are close together or near multiples of 10
- Select most appropriate methods to subtract, explaining why.

Counting on (to find a small difference)

Continue to reinforce 'counting on' as a strategy for close-together numbers (e.g. 121—118), and also for numbers that are 'nearly' multiples of 10, 100, 1000 or £s, which make it easier to count on (e.g. 102-89, 131—79, or calculating change from £1 etc.).

E.g. 132 – 98 = 34



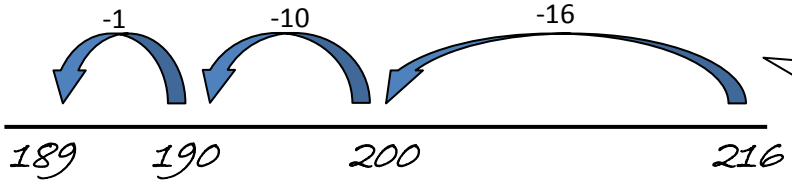
"The difference between 98 and 132 is 34."

This method should be practised and used as a mental strategy for subtraction.

Counting back on an empty number line

Further develop the use of the empty number line with larger numbers:

E.g. 216 – 27 = 189



Encourage children to make the most efficient 'jumps back' on the number line.

Partitioned column subtraction

Children are now taught to present their work in expanded place value columns.

Introduce this method using 2 digit numbers where no exchanging is needed.

89 – 35 =

80 + 9
- 30 + 5
50 + 4 = 54

'Partition numbers into tens and ones.
Subtract the ones, and then subtract the tens.
Recombine to give the answer.'

NB: the + sign could be replaced with the word 'and' to avoid confusion.

Next, introduce 'exchanging':

E.g. 72 – 47 = 25

60
~~70~~ + 12
- 40 + 7
20 + 5 = 25

Introduce 'exchanging' through practical subtraction using base ten materials.

Use the language of place value to ensure understanding.
'We can't subtract 7 from 2, so we need to exchange a ten for ten ones to give us '60 + 12.'

Once pupils are secure with the understanding of "exchanging", they can use the partitioned column method to subtract any 2 and 3-digit numbers.

238 – 146 = 92

100
~~200~~ + 130 + 8
100 + 40 + 6
0 + 90 + 2 = 92

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_? difference, count on, strategy, partition, tens, ones exchange, decrease, hundreds, value, digit.

Subtraction – Year 4

- 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.
- Solve number and practical problems that involve the above, with increasingly large positive numbers.

Partitioned column subtraction

Continue to develop the formal written method of subtraction by revisiting the expanded method first, if necessary. Continue to use base-ten materials to support understanding.
E.g. 2754 – 1562 = 1192

600

2000 + ~~700~~ + 50 + 4
- 1000 + 500 + 60 + 2
1000 + 100 + 90 + 2 = 1592

As introduced in year 3, continue with partitioned column subtraction with "exchanging" (decomposition) but with more complex numbers and values:

Compact column addition

Children are now taught how to use the formal written method for subtraction.

6

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.

When children are confident, develop with four digit numbers and decimal numbers (in the context of money and measures).

Mental strategies

A variety of mental strategies must be taught and practised, including counting on to find the difference where numbers are closer together, or where it is easier to count on (see previous years guidance).

Key vocabulary: take, take away, less, minus, subtract, leaves, how many more, how many fewer / less than, difference, count back, how many left, how much less is_? count on, strategy, partition, tens, ones exchange, decrease, hundreds, value, digit, inverse.

Subtraction – Year 5

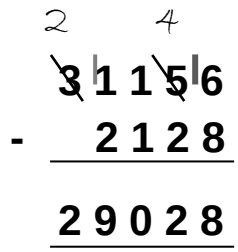
Children should:

- Subtract numbers mentally with increasingly large numbers .
- 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 zero.
- Round any number up to 1 million to the nearest 10, 100, 1000, 10,000 and 100,000.

Compact column addition

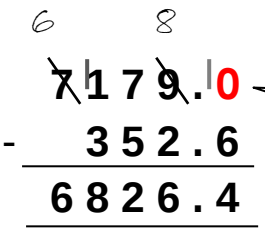
Children will continue to use the formal written method for subtraction which involves 'exchanging' with larger integers.

E.g. 31056 – 2128 = 28,928



Children should now progress to subtract with decimal values, including mixtures of integers and decimals, aligning the decimal point.

E.g. 7169 – 372.6 = 6796.4



Empty decimal places should be filled with a zero to show the place value in each column. This will also aid the understanding of what to subtract in that column.

Mental strategies

A variety of mental strategies must be taught and practised, including counting on to find the difference where numbers are closer together, or where it is easier to count on (see previous years guidance). Always encourage children to consider the best method for the numbers involved—mental, counting on, counting back or written method

Key vocabulary:

Subtract, minus, distance be-tween, how many more, how many fewer / less than, difference, count back, how many left, how much less is_? difference, count on, strategy, partition, tens, ones exchange, decrease, hundreds, value, digit, inverse, tenths, hundredths, thousandths.

Subtraction – Year 6

Children should:

- 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
- 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.

Compact column subtraction

Using the compact column method, children will subtract more complex integers and solve problems in context.

E.g. 150,699 – 89,949 =

```
  0 4 9
  1 5 0 6 9 9
-   8 9 9 4 9
  -------------
    6 0 7 5 0
```

Using the compact column method, children should subtract money and measures, including decimals with different numbers of decimal places.

E.g. 105.419 – 36.08

```
  0 9   3
  1 0 5 . 4 1 9
-   3 6 . 0 8 0
  -------------
    6 9 . 3 3 9
```

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

Mental strategies

Pupils should be able to apply their knowledge of a range of mental strategies, mental recall skills, and informal and formal written methods when selecting the most appropriate method to work out subtraction problems.

Key vocabulary:
Subtract, minus, distance be-tween, how many more, how many fewer / less than, difference, count back, how many left, how much less is_? count on, strategy, partition, tens, ones exchange, decrease, hundreds, value, digit, inverse, tenths, hundredths, thousandths.

Multiplication – Year 1

Children should:

- Count in multiples of 2, 5 and 10.
- Solve one-step problems involving multiplication, by calculating the answer using concrete objects,
- Use 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.

Children will learn to multiply with concrete objects, arrays and pictorial representations.

They will be taught to count repeated groups of the same size in practical contexts.

2, 4, 6, 8, 10, 12

'Six pairs of socks.
How many socks altogether?'

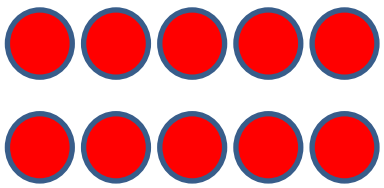
This is recorded as repeated addition:
2+2+2+2+2+2 = 12

10 + 10 + 10 + 10

'There are 4 bags with 10 sweets inside.
How many sweets are there altogether?'

Counting in multiples:
"10, 20, 30, 40"

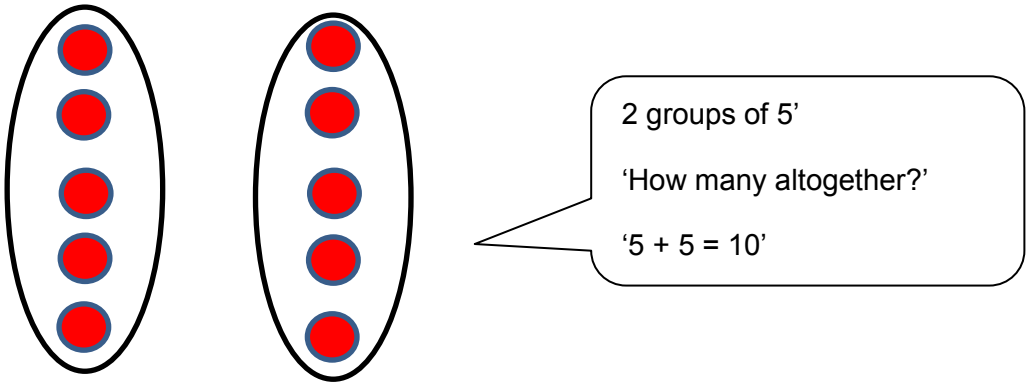
Use **arrays** to support early multiplication



Two groups of five faces. How many faces altogether?
5, 10'

Five groups of two counters. How many counters altogether?
2, 4, 6, 8, 10'

Doubling:



Continue to solve problems in practical contexts and develop the language of early multiplication, with appropriate resources, throughout Y1.

Key vocabulary:
Groups of, lots of, times, array, altogether, multiply, count

Multiplication – Year 2

Children should:

- 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 law).
- Solve a range of problems involving multiplication, using concrete objects, arrays, repeated addition, mental methods, and multiplication facts.

Combining Groups (repeated addition):

Children will continue to learn to multiply with concrete objects, arrays and pictorial representations

'4 groups of 5 pencils'

'How many pencils altogether?'

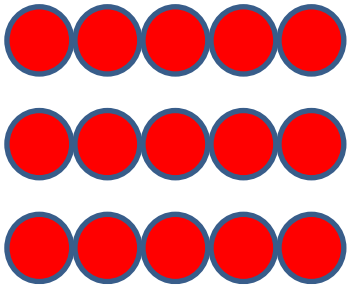
'5 + 5 + 5 + 5 = 20'

'4 groups of 5' = '4 times five'

'4 x 5 = 20' *or* '5 x 4 = 20'

Using Arrays:

Use arrays to help teach children to understand the commutative law of multiplication (can be done in any order).



5 groups of 3

5 x 3 = 15

5 + 5 + 5 = 15

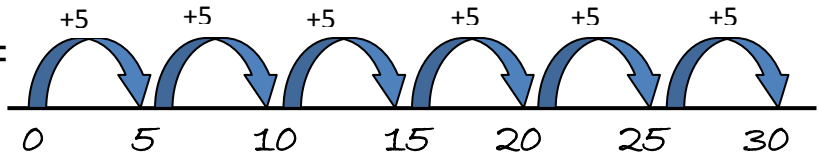
3 groups of 5

3 x 5 = 15

3 + 3 + 3 + 3 +3 = 15

Repeated addition on a number line:

6 x 5 =



6 x 5 = 30

Key vocabulary:

groups of, lots of, times, array, altogether, multiply, count, multiplied by, repeated addition, column, row, commutative, sets of, equal groups, …times as big as.

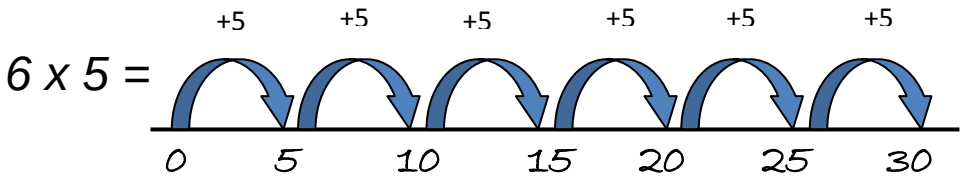
Multiplication – Year 3

Children should:

- 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)

Repeated addition on a number line:

Continue to use repeated addition and arrays to support multiplication, as appropriate (see year 2 guidance).



6 x 5 = 30

Partitioning method

Use for multiplication of a teen number by a one-digit number:

Partition 13 into 10 + 3

13 x 5 = 65

10 x 5 = 50

3 x 5 = 15

50 + 15 = 65

Grid Method

NB: To use this method, 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*

Children will now be introduced to grid method to solve one digit x 2 digit calculations.

24 x 8 =

x	20	4
8	160	32

160
+ 32
192

Add the partial products together

24 x 8 = 192

Partition 24 into 20 + 4, then multiply each number by 8

Multiplication – Year 4

Children should:

- Count in multiples of 6, 7, 9, 25 and 1000
- Recall multiplication facts for all multiplication tables up to 12 x 12.
- Recognise place value of digits in up to 4-digit numbers
- Use commutability and other strategies mentally (3 x 6 = 6 x 3 or 2 x 6 x 5 = 10 x 6).
- 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)

Grid Method

Children will further develop the grid method for three-digit numbers multiplied by a one- digit number.

235 x 6 = 1410

x	**200**	**30**	**5**
6	1200	180	30

1200
180
+ 30
1410
1

Continue to use this method when multiplying a 2 digit by 2 digit number:

57 x 17 = 969

x	**50**	**7**
10	500	70
7	350	49

= 570
= 399 +
969
1

Add the partial products together:

(500+70) + (350+49)

=969

Expanded short multiplication

NB: this method is only introduced when multiplying a two digit by one digit number.

36 x 4 = 144

Partition 36 into 30 + 6 so that children can recognise the value of the number they are multiplying.

30 + 6
X 4
24 (4 x 6 = 24)
+ 120 (4 x 30 = 120)
144

This method is continued to be used when multiplying a three digit by one digit number.

127 x 6 =508

100+ 20 + 7
X 4
28 (4 x 7 = 28)
80 (4 x 20 = 80)
400 (4 x 100 = 400)
508
1

Next, children are taught to refine the recording of the calculation in preparation for formal short multiplication.

36 x 4 = 144

36
X 4
24 (4 x 6)
+ 120 (4 x 30)
144

Continue with the same approach for multiplying three digits by one digit.
127 x 4 - 508

127
X 4
28 (4 x 7 = 28)
80 (4 x 20 = 80)
+ 400 (4 x 100 = 400)
508
1

Short Multiplication

This leads to short multiplication (formal method) of a two–digit number multiplied by a one-digit number.

36
x 4
1 4 4
2

4 x 6 = 14
Write 4 ones and carry the 2 tens underneath.
4 x 30 = 120
Add the 2 tens which has been carried to the tens answer.

Key vocabulary:
groups of, lots of, times, array, altogether, multiply, count, multiplied by, repeated addition, array, column, row, commutative, groups of, sets of, lots of, equal groups, times, multiply, times as big as, once, twice, three times... partition, grid method, total, multiple, product, sets of, inverse.

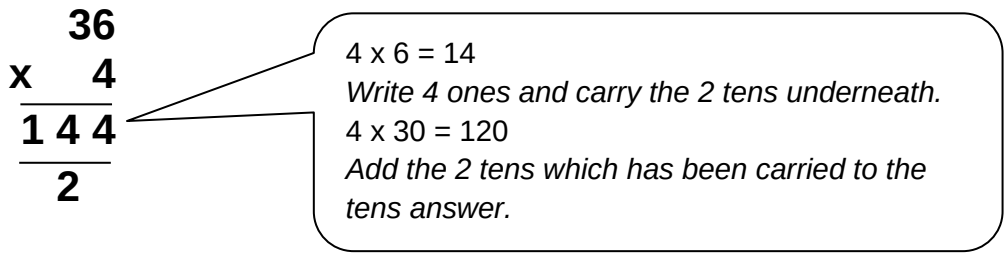
Multiplication – Year 5

Children should:

- *Identify multiples and factors, using knowledge of multiplication tables to 12x12.*
- *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.*
- Multiply numbers up to 4 digits by a one – or a two digit number using a formal written method, including long multiplication for two-digit numbers.

Short Multiplication

Build on the work covered in Y4 with the formal method of short multiplication (two-digit number multiplied by a one-digit number).



NB: Return to expanded short multiplication if mistakes are being made (see year 4 guidance).

Expanded Long Multiplication

When children are confident introduce multiplication by a two-digit number.
Introduce this method alongside grid method.

57 x 17 = 969

x	50	7
10	500	70
7	350	49

= 570
= 399 +
969
1

This leads to:

Ask children: What are the similarities and differences between grid method and expanded long multiplication? Unpick the process and show how it reduces steps.

57
X 17
49 (7 x 7)
350 (7 x 50)
70 (10 x 7)
500 (10 x 50)
969

Compact Long Multiplication

23 x 13 =

```
  23
x 13
 ---
  69   (3 x 23)
 230   (10 x 23)
 ---
 299
 ---
```

Continue with larger numbers:

```
  65
x 47
 ---
 455   (7 x 65)
  3
2600   (40 x 65)
 2
 ---
3055
 ---
```

First row: 7 x 65 on the *(7 x 5 = 35, carrying the 3 for thirty. 7 x 60 = 420, add the 3 tens to the total)*

Second row: 40 x 65 *(40 x 5= 200, carry below the hundreds column. 40 x 60 = 2400, add the 2 hundreds to the total).*

Add the total in columns below.

When children are confident with long multiplication, extend with three-digit numbers, multiplied by a two digit number. Return to expanded method first, if needed.

```
  124
x  26
 ---
 744   (6 x 124)
 1 2
2480   (20 x 124)
 4 8
 ---
3224
 ---
1 1
```

Use the language of place value to ensure understanding – particularly in the placing of the 0.

Extend with short and long multiplication of decimal numbers (initially in the context of money and measures), returning to an expanded method first, if necessary (see Y6 guidance).

Key vocabulary:
column, row, commutative, sets of, equal groups, _times as big as, once, twice, three times..., parti-tion, grid method, total, multiple, product, inverse, square, factor, integer, decimal, short/long multiplication, ‘carry‘

Multiplication – Year 6

Children should:

- *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.*
- *Estimate answers using round and approximation and determine levels of accuracy.*
- *Round any integer to a required degree of accuracy.*

Continue to practise and develop the formal short multiplication method and formal long multiplication method with larger numbers and decimals throughout Y6. Return to an expanded forms of calculation initially, if necessary (see Y5 guidance).

Compact short multiplication

3.19 x 8 =

```
   3 . 1 9
x  8 . 0 0
-----------
  2 5. 5 2
    1   7
```

Remind children that the single digit belongs in the ones column (place holders can be added in tenth and hundredths column.

Line up the decimal points in the question and the answer.

Compact long Multiplication

3.19 x 8 =

```
   6 1 . 5
x  4 3 . 0
-----------
  1 8 4 . 5     (3 x 61.5)
    1
2 4 6 0 . 0     (40 x 61.5)
  2
-----------
2 6 4 4 . 5
-----------
  1
```

The prompts (in brackets) can be omitted if the children no longer need them

.

Key vocabulary:
column, row, commutative, sets of, equal groups, times as big as, once, twice, three times... partition, grid method, total, multiple, product, inverse, square, factor, integer, decimal, short / long multiplication, „carry", tenths, hundredths, decimal

Division – Year 1

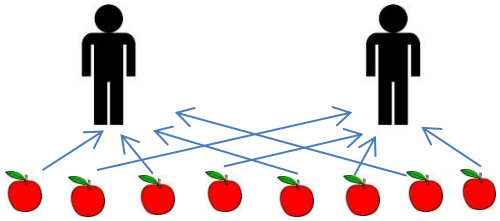
Children should:

- *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, begin to understand, division, and finding simple fractions of objects, numbers and quantities.*
- *Make connections between arrays, number patterns, and counting in twos, fives and tens.*

Share and group small quantities

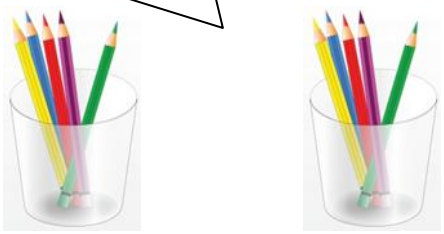
Use objects, diagrams and pictorial representations to solve problems involving both grouping and sharing.

E.g. 'Share these eight apples equally between two children. How many apples will each child have?'



Sharing

Share 20 pencils between 2 pots.



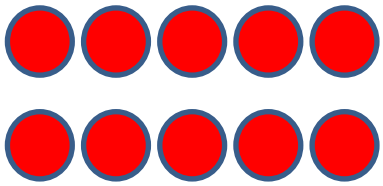
How many pencils are in each pot?

Grouping

Children will move from sharing to grouping in a practical way

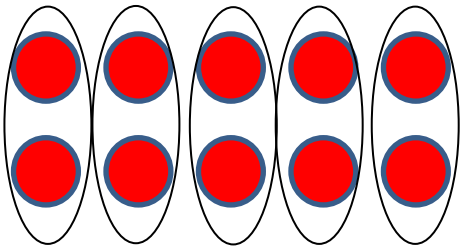
'Put 20 crayons into groups of 10. How many pots do we need?'

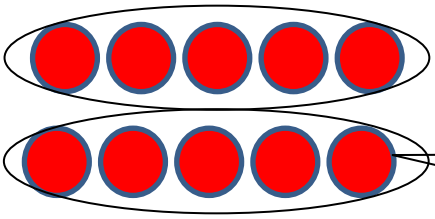
Use **arrays** to support division:



'How many counters altogether?
How many groups of two?

'Five groups of two'





'How many groups of five?'
'10 shared equally between 2 people'

'Half of ten is five'

Continue to solve problems in practical contexts throughout Y1, and develop the language of early division, with appropriate resources.

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

Division – Year 2

Children should:

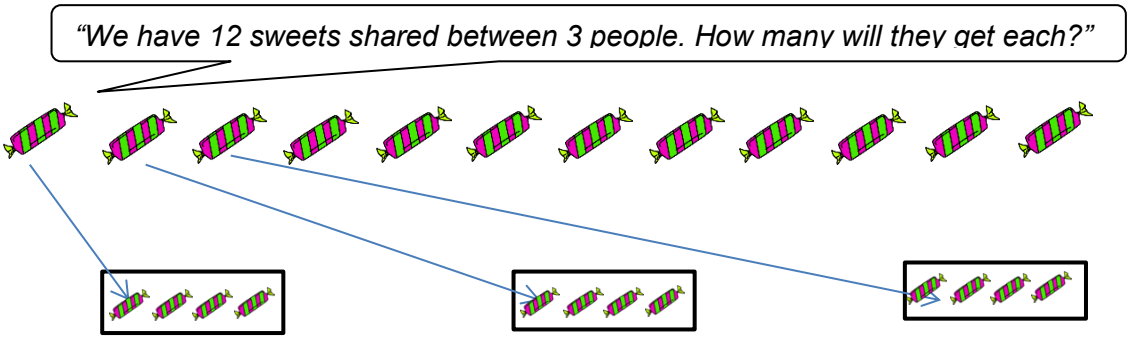
- *Recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers.*
- *Calculate mathematical statements for division within the multiplication tables they know and write them using the division (÷) and equals (=) signs*
- *Show 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.*

Sharing and Grouping

Children should know and understand how to share and group:

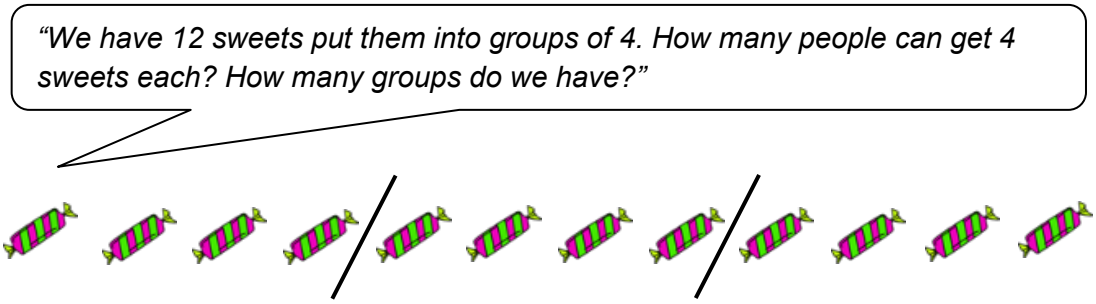
Sharing

12 ÷ 3 =

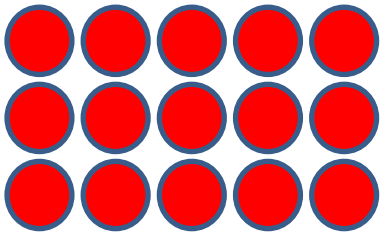


Grouping

12 ÷ 4 =



Use arrays to support division



How many groups of 3?
How many groups of 5?
15 shared between 3 people is…?
15 shared between 5 people is…?

15 ÷ 5 = 3
15 ÷ 3 = 5

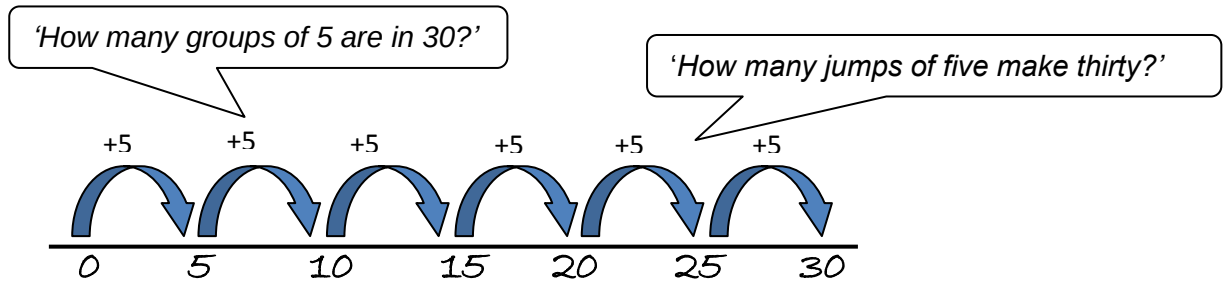
Children should be taught that the array can represent 15 ÷ 5 = 3 if grouped vertically as well as 15 ÷ 3 = 5 if grouped horizontally.

Grouping on a number line

When children are ready, use an empty number line to count forwards. This is an important method to develop the understanding of division as grouping.

$30 \div 5 = 6$

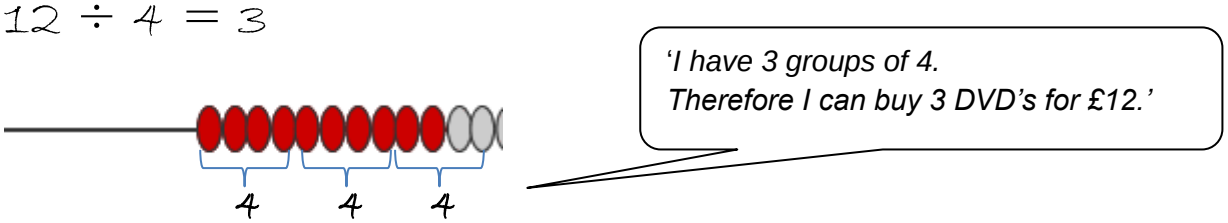
Group from zero in equal jumps of the divisor to find out *"how many groups of __ are in _ ?"*.



Children should be provided with opportunities to apply their understanding of grouping to problems in context. They could solve these problems using number lines as well as practical apparatus such as bead strings.

E.g. A DVD costs £4. How many DVD's can I buy with £12?"

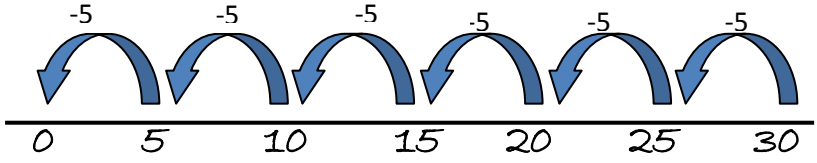
$12 \div 4 = 3$



Repeated subtraction

Children should be taught that they can aslo make jumps back on the number line to make a link with repeated subtraction:

$12 \div 4 = 3$



Key vocabulary:
share, share equally, one each, two each…, group, equal groups of, lots of, array, divide, divided by, divided into, division, grouping, number line, left, left over

Division – Year 3

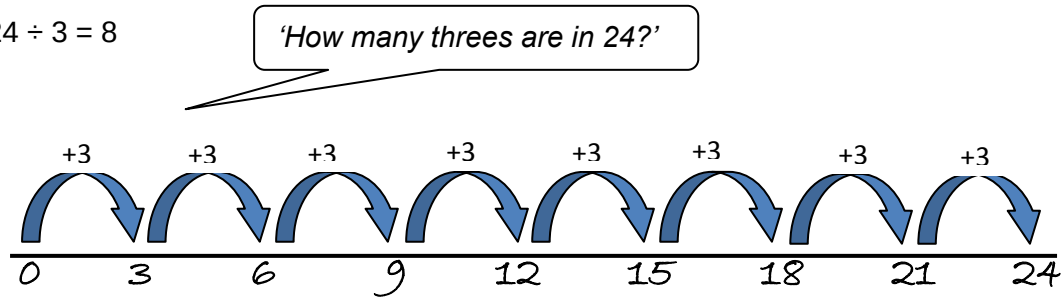
Children should:

- *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).*
- *Solve problems, in contexts, and including missing number problems, involving multiplication and division.*
- *Develop efficient mental methods, for example, using multiplication and division facts (e.g. using 3 × 2 = 6, 6 ÷ 3 = 2 and 2 = 6 ÷ 3) to derive related facts (30 × 2 = 60, so 60 ÷ 3 = 20 and 20 = 60 ÷ 3).*
- *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.*

Grouping on an empty number line

When children are ready, use an empty number line to count forwards. This is an important method to develop the understanding of division as grouping.

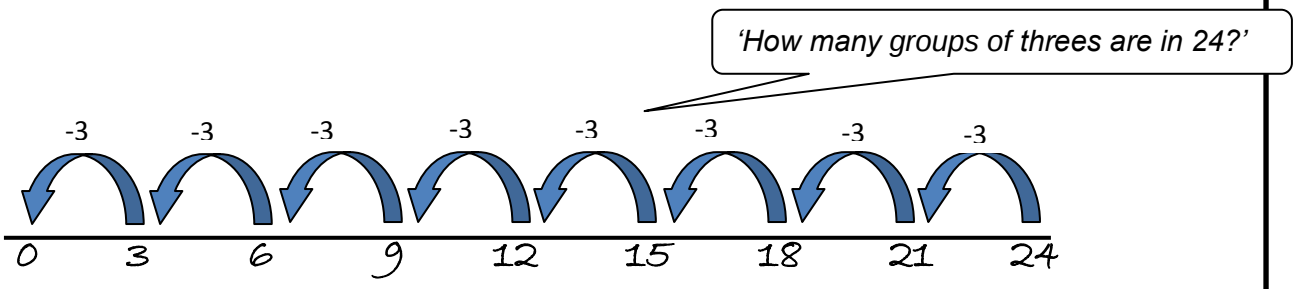
24 ÷ 3 = 8



Repeated Subtraction

24 ÷ 3 = 8

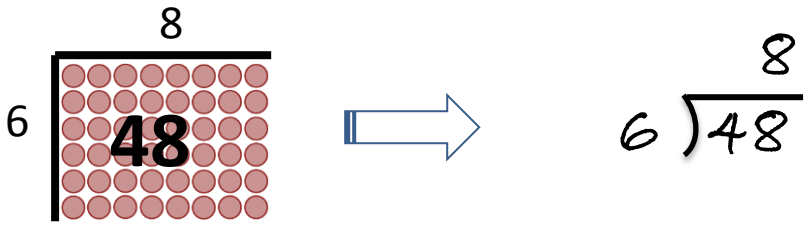
Children should be taught that they can also make jumps back on the number line to make a link with repeated subtraction:



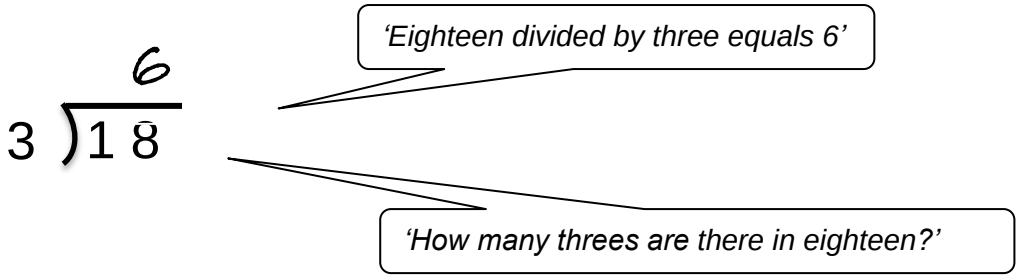
NB: Children should always be encouraged to check their working with the inverse.
24 ÷ 3 = 8 therefore 3 x 8 = …

Short Division

Start by introducing the layout of short division by comparing it to an array.



Introduce the formal layout using multiplication / division facts that the children know.



Key vocabulary:
share, share equally, one each, two each…, group, equal groups of, lots of, array, divide, divided by, divided into, division, grouping, number line, left, left over, inverse, short division, carry', remainder, multiple.

Division – Year 4

Children should:

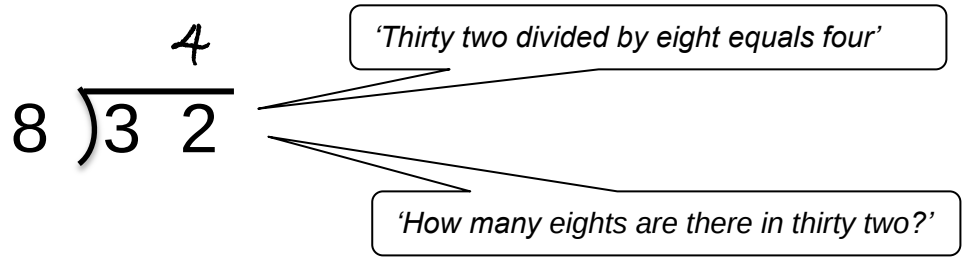
- ***Recall multiplication and division facts for all numbers up to 12 x 12.***
- *Use place value, known and derived facts to multiply and divide mentally, including: multiplying and dividing by 10 and 100 and 1.*
- *Practise to become fluent in the formal written method of short division with exact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

Continue to write and calculate mathematical statements for division using the multiplication tables that the children know e.g.

32 ÷ 8 = 4

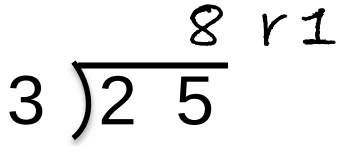
Short Division

Continue using the formal written layout for division using multiplication tables that they know:



Continue using the formal written layout, introducing remainders:

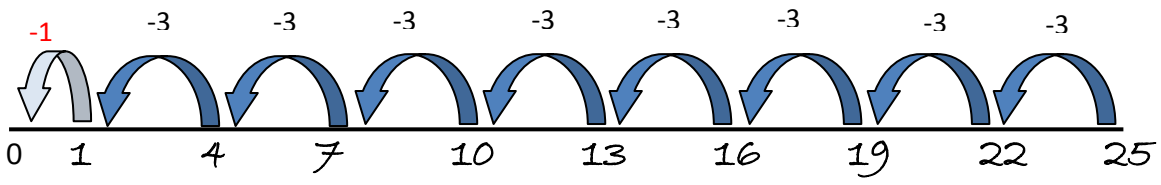
25 ÷ 3 = 8 r1



NB: Remainders are not specifically referred to until Y5 in the National Curriculum. However, this may be an appropriate point to introduce them using familiar multiplication facts.

If necessary his can be modelled using an empty number line.

25 ÷ 3 = 8 r1



Alternatively you could jump forwards in multiples of three from zero to twenty four ('and one more makes 25')

Division using partitioning (two digits divided by one digit)

65 ÷ 5 = 13

$65 = 50 + 15$

Partition 65 into 50 and

$50 \div 5 = 10$

$15 \div 5 = 3$

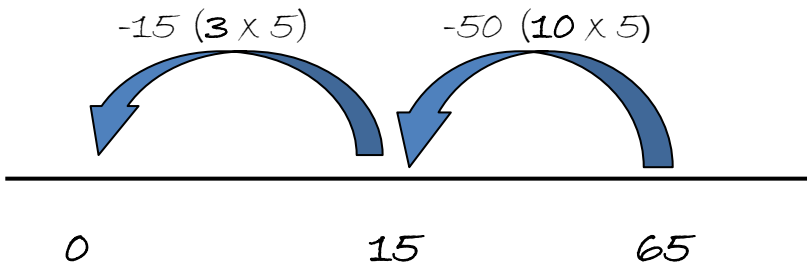
$10 + 3 = 13$

'By breaking up (partitioning) the larger number, I can see that it is made up of two multiples of 5.'

NB: Children will need to practise partitioning in a variety of ways.

Continue to use **empty number lines** to model the process of division by partitioning using multiples of the divisor:

65 ÷ 5 = 13



98 ÷ 7 = 14

$98 = 70 + 28$

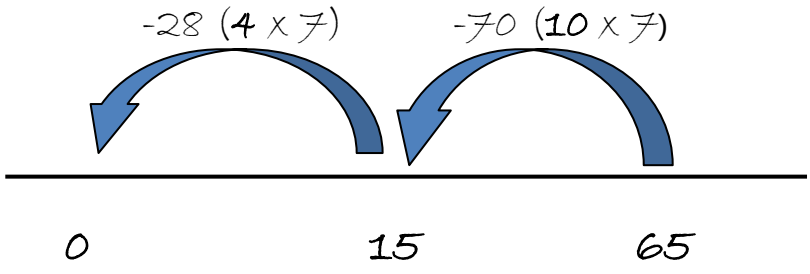
'Using my knowledge of multiples of 7, I can see that 98 is made up of a 70 and 28.'

$70 \div 7 = 10$

$28 \div 7 = 4$

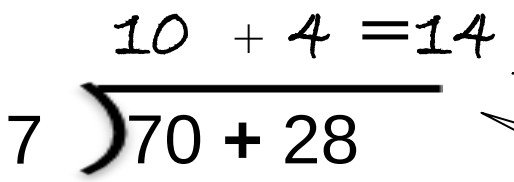
$10 + 4 = 14$

This process of division can be modelled in conjunction with a number line to further develop understanding.



This will move towards a more formal layout of division method (partitioned).

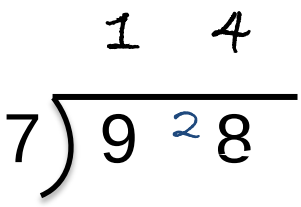
98 ÷ 7 = 14



'We have partitioned 98 into 70 and 28 (90 = 70 + 28).

'Seven 'goes into' 70 ten times and seven 'goes into' 28 four times. Ten add four equals 14'

This will lead into the **formal written method of <u>short division</u>**



Use the vocabulary of place value to ensure understanding and make the link to the previous partitioning method.

Continue to practise the formal method of short division throughout Y4.

If children are confident develop further, by dividing three-digit numbers by a one digit number using the formal method of short division with whole number answers (<u>no remainders</u>).

NB If, at any time, children are making significant errors, return to the previous stage in calculation.

<u>Key vocabulary</u>:
Share, share equally, group, equal groups of, lots of, array, divide, divided by, divided into, division, grouping, number line, left, left over, inverse, short division, „carry", remainder, multiple, divisible by, factor

Division – Year 5

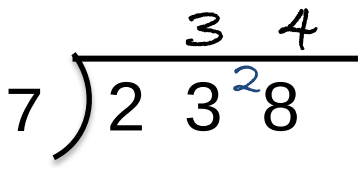
Children should:

- *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 & 1000.*
- *Use the vocabulary of prime numbers, prime factors and composite numbers.*
- *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.*

Short Division

Children should continue to practise the formal written method of short division with whole number answers.

238 ÷ 7 = 34

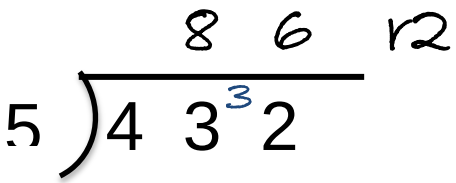


Use the vocabulary of place value to ensure understanding and make the link to the previous partitioning method.

Make the link to the partitioning method (see Y4 guidance).

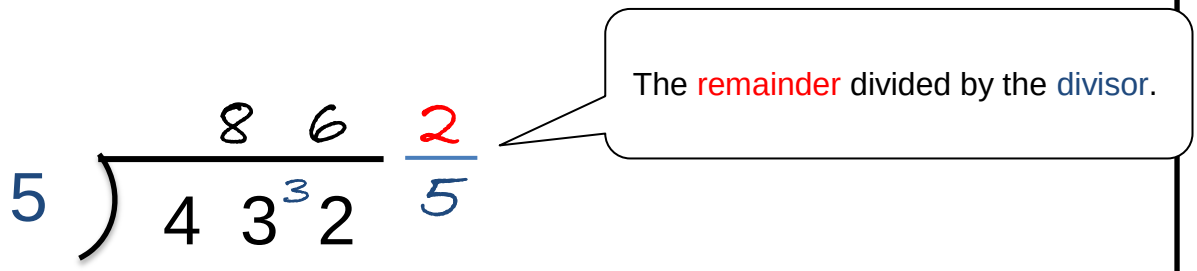
Short division with remainders.

238 ÷ 7 = 34



The remainder can also be expressed as a fraction.

$$432 \div 5 = 86\ \frac{2}{5}$$



Continue to practise, develop and extend the formal method of short division, with and without remainders. Interpret and express remainders according to the context.

Key vocabulary:
share, share equally, group, equal groups of, lots of, array, divide, divided by, divided into, division, grouping, number line, left, left over, inverse, short division, “carry", remainder, multiple, divisible by, factor, inverse, quotient, prime number, prime factors, composite number (non-prime)

Division – Year 6

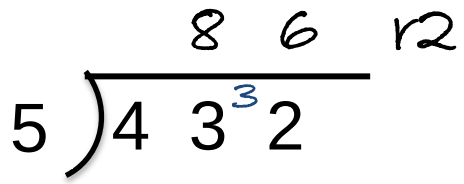
Children should:

- *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.*
- *Solve problems involving all 4 operations.*
- *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.*

Short division.

Continue to practise the formal method of short division, with and without remainders, using the language of place value to ensure understanding *(see Y4 & 5 guidance).*

238 ÷ 7 = 34

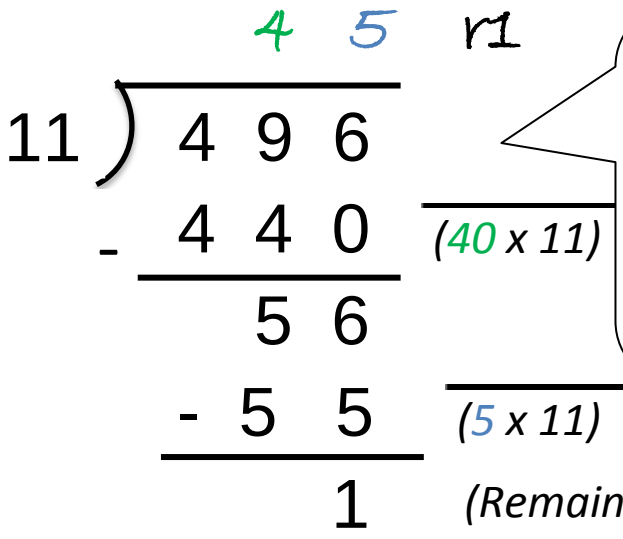


The remainder can also be expressed as a fraction.

The remainder divided by the divisor.

$$432 \div 5 = 86\frac{2}{5}$$

Formal method of long division.

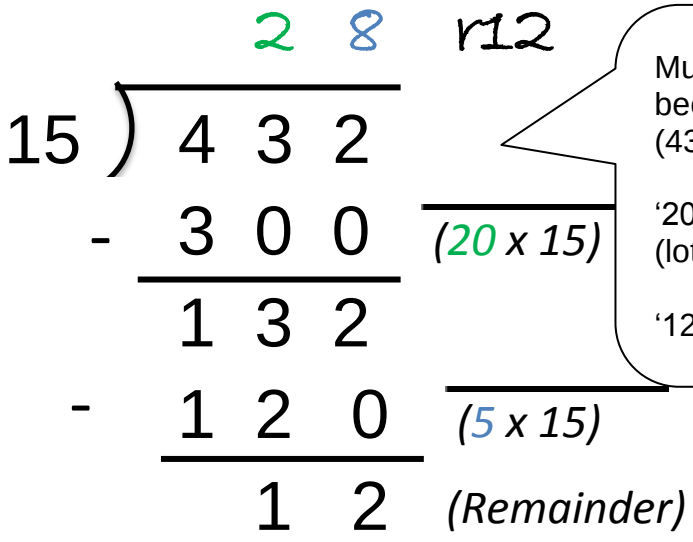


Multiples of the divisor (11) have been subtracted from the dividend (496)

'40 (lots of 11) + 5 (lots of 11) = 45 (lots of 11)'

'1 is the remainder'

Formal method of long division.



Multiples of the divisor (15) have been subtracted from the dividend (432)

'20 (lots of 15) + 8 (lots of 15) = 28 (lots of 15)'

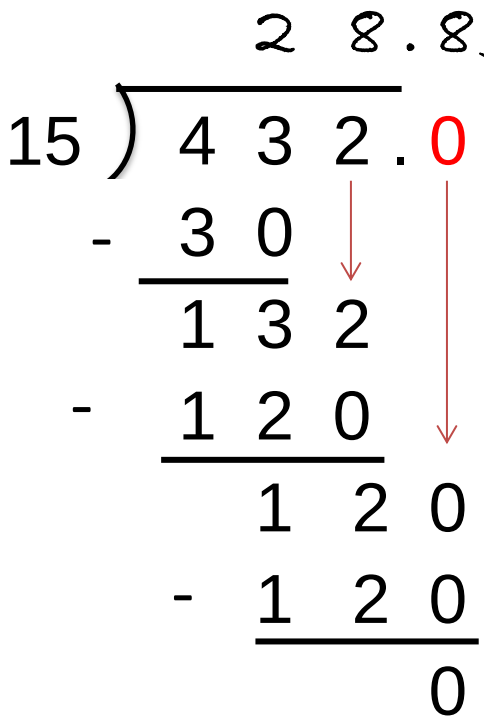
'12 is the remainder'

The remainder can also be expressed as a fraction, 12/13 (the remainder divided by the divisor) or as a decimal, 0.8 (see next example)

The answer is: 28 12/13 or 28·8

An alternative way of recording formal long division:

432 ÷ 15 = 28.8



The remainder is expressed as a decimal.

Children are only taught this method when children are completely secure with the previous method.

Key vocabulary:
share, share equally, group, equal groups of, lots of, array, divide, divided by, divided into, division, grouping, number line, left, left over, inverse, short division, "carry", remainder, multiple, divisible by, factor, inverse, quotient, prime number, prime factors, composite number (non-prime); common factor; common multiple.

Our aim is that by the end of Y6, children use mental methods (with jottings) when appropriate, but for calculations that they cannot do in their heads, they use an efficient formal written method accurately and with confidence.