Calculation Policy

Aims

The Calculation Policy has been created in order to reflect concepts and pedagogy surrounding the teaching of mathematics. It is also designed to give pupils a consistent and smooth progression of learning in calculations throughout the school.

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. Teachers are not limited to the age group that they are teaching and will frequently need to refer to lower or more advanced stages in order to support the needs of their students.

Providing a context for calculation

It is important that any type of calculation is given real life context or problems 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 should be a priority within calculation lessons.

Teaching of Mathematics

Children are introduced to the processes of calculation through **practical, oral** and **mental** activities. As teachers model alternative strategies, children will begin to understand the underlying ideas and develop ways of recording to

support their thinking and calculation methods. They will use particular methods that apply to special cases, and learn to interpret and use the signs and symbols involved. Over time children learn how to **use models and images,** such as empty number lines, to **support their mental and informal written methods of calculation**. As children's mental methods are strengthened and refined, so too are their informal written methods. These methods become more efficient and succinct and lead to efficient written methods that can be used more generally.

Children will be continually reminded of the wide variety of mathematical terms that relate to each topic. **Maths vocabulary** should be clearly displayed in every classroom during a lesson and referred to frequently.

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: They will do this by asking themselves:

Can I do this in my head?

Can I do this in my head using drawings or jottings?

Do I need to use a pencil and paper procedure?*

*Where a pencil and paper procedure is used, the teacher will choose which method is to be used according to the need of the child.

Progression in Methods of Calculation

Useful Resources:

Models and images charts: 'Partitioning and recombining'; 'Addition and subtraction facts' and 'Understanding addition and subtraction'.

integer *– whole number*

ADDITION

Prerequisite skills: (Continue to address through the Oral/Mental Starter Rolling Program)

- Read and write numbers to 100 in numerals, inc. 1-20 in words
- Recall bonds to 10 and 20, and addition facts within 20
- Count to and across 100
- Count in multiples of 1,2, 5 and 10
- Solve missing number problems
- 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

Stage 1: Mental method, using partitioning, adding the most significant digit first:

The mental method to which written methods most closely relate involves partitioning, adding the tens and ones separately. Initially carried out with jottings then mentally.

e.g. 47 + 76 = (40 + 70) + (7 + 6) *leading to*

= 110 + 13

= 123

47 + 76 = 40 + 70 + 7 + 6 = 110 + 13 = 123

T U T U

47 + 76 = 110 + 13

= 123

or 47 + 76 = (47 + 70) + 6

= 117 + 6

= 123

47 + 76 = 47 + 70 + 6 = 117 + 6 = 123

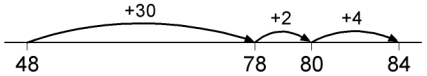
(quite a difficult method when crossing tens or hundreds mentally. Needs to be supported by a numberline or 100square)

- Children need to be able to partition numbers in ways other than into tens and ones to help them make multiples of ten by adding in steps.

The **empty number line** helps to record the steps on the way to calculating the total.

The steps often bridge through a multiple of 10: 8 + 7 = 15

48 + 36 = 84



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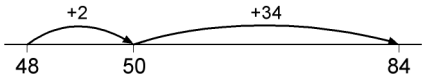


Key Skills for addition at stage 1:

- Add a 2 digit number and ones (28 + 5)
- Add a 2 digit number and tens (28 + 30)
- Add pairs of 2 digit numbers (26 + 38)
- Add three single digit numbers (4 + 8 + 6)
- Show that adding can be done in any order (commutative law)
- Recall bonds to 20 and bonds of tens to 100 (40 + 60)
- 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 (inc. missing numbers problems) 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, sum, tens, ones, partition, addition, column, tens boundary

Stage 2: Vertical layout, expanded working, adding the least significant digit first:

The next step is to show children the vertical format (units under ones, tens under tens, etc.) and link it to the mental method. They first practise this method with calculations they can do mentally, and then extend to three-digit numbers, which provides justification for developing a written method.
An important point is that children should be able to describe what they are doing by referring to the **actual values of the digits in the columns i.e. '20 + 50' or '2 tens + 5 tens', never '2 +5'.*

e.g. 47 + 76

```
  47
+ 76
  13   (7+6)
 110   (40 +70)
 123
```

The expanded method leads children to the more compact method so that they understand its structure and efficiency. **The amount of time that should be spent teaching and practising the expanded method will depend on how secure the children are in their recall of number facts and in their understanding of place value.**

Key skills for addition at stage 2:

- Add 2 digit numbers mentally, inc. those exceeding 100
- Add a 3 digit number and ones mentally (128 +5)
- Add a 3 digit number and tens mentally (128 + 30)
- Add a 3 digit number and hundreds mentally (128 + 300)
- Read and write numbers to 1000 in numerals and words
- Estimate answers to calculations, using inverse to check answers
- Solve problems, inc. 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, i.e. number bonds, using near doubles, partitioning and recombining, adding the nearest multiple of 10, 100 and adjusting.

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

<u>Stage 3:</u> Vertical layout, contracting the working to a compact, efficient form:

A conventional compact, efficient method, with carrying below the line, is introduced by linking it directly to the expanded method, starting with the ones. Children should be able to explain the link and appreciate that the compact method saves time recording their working.

If, with a little practice, they cannot use the compact method without making errors, they should return to the expanded format.

**Again, when describing each step, <u>children should refer to the actual values</u> of the digits.*

```
  47          to      47
+ 76                +76
  13                 123
 110                  11
 123
```

<u>Key Skills for addition at stage 3:</u>

- 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 two step word 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 i.e. add to 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 compact method of column addition

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, hundreds boundary, increase, vertical, carry, expanded, compact

<u>Stage 4:</u> Extend to bigger numbers and decimals:

When returning to written calculations at a later stage, e.g. to revise or to extend to decimals or numbers with more digits, it is a good idea to start again with informal, expanded methods. This helps children to retain their understanding of the link between different methods, and makes it easier for them to resort to an expanded method if they need to do so.

```
  258          366
+  87         +458
 ----         ----
  345          824
  11           11
```

```
  25.8
+  8.7
 ----
  34.5
  11
```

<u>Key skills for addition at stage 4:</u>

- Add numbers mentally with increasingly large numbers, using and practising a range of mental strategies i.e. add the nearest multiple of 10, 100 and 1000 and adjust, use near doubles, inverse, partitioning and recombining
- 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 and 100 000
- Add numbers with more than 4 digits using a formal written method of column addition

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, hundreds boundary, increase, vertical, carry, expanded, compact, thousands, hundreds, digits, inverse

SUBTRACTION: Complementary Addition (counting up)

This method can also be easily applied, at different levels, to finding differences in values of money, measures and time.

Useful Resources:

Models and images charts: 'Partitioning and recombining'; 'Counting on and back'; 'Addition and subtraction facts' and 'Understanding addition and subtraction'.

Prerequisite skills: (Continue to address through the Oral/Mental Starter Rolling Program)

- 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 (i.e. bead strings, objects, cubes) and pictures, and missing number problems
- Read and write numbers from 0 to 20 in numerals and words

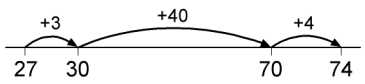
Stage 1: counting up

- The steps can also be recorded by **counting up** from the smaller to the larger number to **find the difference**, for example by counting up from 27 to 74 in steps totalling 47.

- It is useful to ask children whether counting up or back is the more efficient for calculations such as 57 – 12, 86 – 77 or 43 – 28.

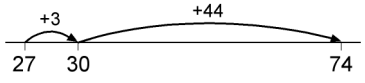
Show the children the vertical layout for a calculation they can do mentally. Link the steps to those on an empty number line.

e.g. 74 – 27



$$\begin{array}{rl} 74 & \\ -\ 27 & \\ 3 & \rightarrow 30 \\ 40 & \rightarrow 70 \\ 4 & \rightarrow 74 \\ \hline 47 & \end{array}$$

or:



$$\begin{array}{rl} 74 & \\ -\ 27 & \\ 3 & \rightarrow 30 \\ 44 & \rightarrow 74 \\ \hline 47 & \end{array}$$

Key skills in subtraction at stage 1:

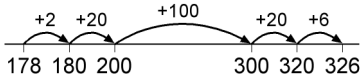
- Recognise the place value of each digit in a two digit number
- Recall and use subtraction facts to 20 fluently, and derive and use related facts up to 100
- Subtract using concrete objects, pictorial representations, 100 squares and mentally
- Show that subtraction of one number from another cannot be done in any order
- Recognise and use inverse relationship between addition and subtraction, using this to check calculations and missing number problems
- Continue to solve missing number calculations with 1 and 2 digit numbers e.g. 20 – D = 15 or 15 + 5 = 20 – D
- Solve simple addition and subtraction problems including measures, using concrete objects, pictorial representation and also applying their increasing knowledge of mental and written methods

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

Stage 2

Show how this form of recording can help organise the steps involved in subtracting a three-digit number from another three-digit number

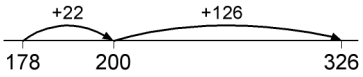
e.g. 326 - 178



326
−178
2 → 180
20 → 200
100 → 300
26 → 326
148

You can reduce the number of stages further, by using knowledge of pairs of numbers that total 100.

or:



326
−178
22 → 200
126 → 326
148

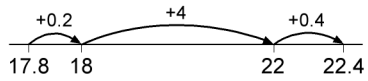
Key skills for subtraction at stage 2:

- Subtract mentally: 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
- Find 10 or 100 more/less than a given number
- Recognise the place value of each digit in a 3 digit number
- Know when to count up differences as a mental strategy when numbers are close together or near multiples of 10
- Read and write numbers up to 1000 in numerals and words
- Practise mental subtraction strategies, such as subtracting near multiples of 10 and adjusting (e.g. subtracting 19 to 21) and select most appropriate methods to subtract, explaining why.

Key Vocabulary: equal to, take, take away, less, minus, subtract, leaves, distance between, difference 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, taking (not borrowing)

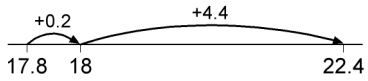
Stage 3

Extend to bigger numbers and decimals.
e.g. 22.4 – 17.8



22.4
−17.8
0.2 → 18
4.0 → 22
0.4 → 22.4
4.6

or:



22.4
−17.8
0.2 → 18
4.4 → 22.4
4.6

Key skills for subtraction at stage 3: (As for stage 2 but also-)

- Solve simple measure and money problems involving fractions and decimals to two decimal places

SUBTRACTION: Decomposition

*Only to be taught if appropriate, (depending on ability of children), and after children are completely secure with the counting up method (complementary addition). *If, with a little practice, they cannot use the compact method without making errors, they should return to the expanded format.*
**Again, when describing each step, children should refer to the actual values of the digits.*

Prerequisite skills: (Continue to address through the Oral/Mental Starter Rolling Program)

Children need to have a good understanding of how to partition and repartition numbers.

e.g. 63 = 60 + 3
= 50 + 13 (by making the tens 10 less and the ones 10 more)

Useful Resources:

Models and images charts: 'Partitioning and recombining'.

Stage 1: Expanded vertical method

The expanded vertical method of decomposition involves partitioning and repartitioning. The subtraction calculation is carried out in columns, starting with the least significant digits (the ones).

e.g. 263 – 141

200 + 60 + 3
- 100 + 40 + 1
100 + 20 + 2 = 122

Leading to 'repartitioning' tens to subtract larger numbers of ones from smaller ones

eg. 342 – 126

30 12
300 + 40 + 2
- 100 + 20 + 6
200 + 10 + 6 = 216

Progressing through the stages of repartitioning, until repartitioning tens and hundreds

Key skills for subtraction at stage 1:

- Subtract by counting on where numbers are close together or they are near to multiples of 10, 100
- 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
- Find 100 more/less than a given number
- Count backwards through zero, inc. negative numbers
- Recognise place value of each digit in a 4 digit number
- Round any number to the nearest 10, 100, 1000

Key Vocabulary: equal to, take, take away, less, minus, subtract, leaves, distance between, difference 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, taking (not borrowing), **decrease, hundreds, value, digit, inverse**

Stage 2: Standard compact method of decomposition (providing previous stage understood)

A conventional compact, efficient method, with carrying below the line, is introduced by linking it directly to the expanded method, starting with the ones. Children should be able to explain the link and appreciate that the compact method saves time recording their working. If, with a little practice, they cannot use the compact method without making errors, they should return to the expanded format or to counting up on a number line.
**Again, when describing each step, children should refer to the actual values of the digits.*

e.g. 725 – 367

$$\begin{array}{r} {}^{6}\cancel{7}{}^{11}\cancel{2}{}^{1}5 \\ -\ 3\ \ 6\ \ 7 \\ \hline 3\ \ 5\ \ 8 \end{array}$$

Key skills for subtraction at stage 2:

- 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 10 million to the nearest 10, 100, 1000, 10 000 and 100 000.

Key Vocabulary: equal to, take, take away, less, minus, subtract, leaves, distance between, difference 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, taking (not borrowing), **decrease, hundreds, value, digit, inverse**

Stage 3: Extend to bigger numbers and decimals

When returning to written calculations at a later stage, e.g. to revise or to extend to decimals or numbers with more digits, it is a good idea to start again with informal, expanded methods. This helps children to retain their understanding of the link between different methods, and makes it easier for them to resort to an expanded method if they need to do so.

Key skills for subtraction at stage 3: (As for stage 2 but also-)

- Solve simple measure and money problems involving fractions and decimals
- Solve number and practical problems that involve the above, with increasingly large positive numbers.

Key Vocabulary: equal to, take, take away, less, minus, subtract, leaves, distance between, difference 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, taking (not borrowing), **decrease, hundreds, value, digit, inverse, tenths, hundredths, decimal point, decimal**

MULTIPLICATION

Useful Resources:

Models and images charts: 'Partitioning and recombining' and 'Understanding multiplication and division'.

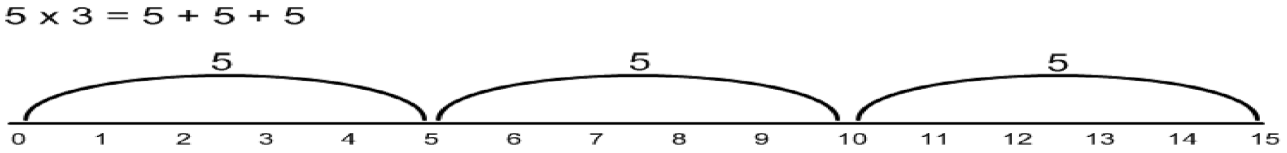
Prerequisite skills: (Continue to address through the Oral/Mental Starter Rolling Program)

- Count in multiples of 2, 5 and 10
- Solve one step problems involving multiplication, by calculating the answer using concrete objects, pictorial representations and arrays with 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

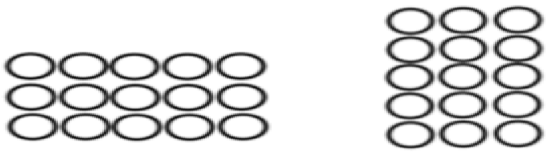
Key Vocabulary: groups of, lots of, times, array, altogether, multiply, count

Stage 1: Arrays and repeated addition:

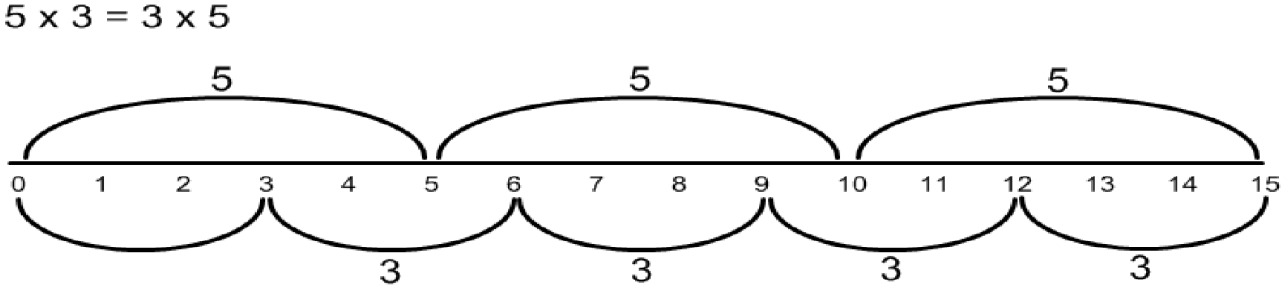
Use repeated addition on a number line



Use arrays



Commutativity



Key skills for multiplication at stage 1:

- 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 and other tables facts if confident (once division has been introduced children should also be able to derive division facts for learnt multiplication facts)
- 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

Key Vocabulary: groups of, lots of, times, array, altogether, multiply, count, multiplied by, repeated addition, column, row, sets of, equal groups, times as big as, once, twice, three times…

Stage 2: Grid method, expanded working:

The mental method from which written methods are developed involves partitioning, and then multiplying the tens and ones separately. It is common to start with the tens when working mentally. A useful way of recording intermediate steps is the 'grid' method. This relates to finding the area of a rectangle.

×	30	8
7	(30 x 7) = 210	(8 x 7) = 56

Key skills for multiplication at stage 2:

- Recall and use multiplication facts for the 2, 3, 4, 5, 8 and 10 times tables and multiply multiples of 10. Goon to 6, 9, 11 and 12 times tables if confident
- Continue to derive division facts from new multiplication tables
- Solve multiplication problems, inc. missing number problems ___ x 5 = 20 3 x ___ = 18 ___ x ___ = 32
- Develop mental strategies using commutativity (e.g. 4x12x5 = 4x5x12 = 20x12 = 120)
- Solve simple problems in contexts, deciding which operations and methods to use.

Key Vocabulary: groups of, lots of, times, array, altogether, multiply, count, multiplied by, repeated addition, column, row, sets of, equal groups, times as big as, once, twice, three times…, partition, grid method, multiple, product, tens, ones, value

Stage 3: Extended to bigger numbers

e.g. 56 × 27
Estimate: 1800 because 60 × 30 = 1800
56 × 27 = (50 + 6) × (20 + 7)

×	50	6
20	= 1000	= 120
7	= 350	= 42

1000 + 350 + 120 + 42 = 1512

1350 + 162 = 1512

Key skills for multiplication at stage 3:

- Count in multiples of 6, 7, 9, 25, 50, 100 and 1000

- Recall multiplication facts for all multiplication tables up to 12 x 12
- Use place value, known facts and derived facts to multiply mentally, e.g. multiply by 1, 10, 100. They should be able to do this with 1- 3 digit numbers
- Use commutativity and other strategies mentally 3x6 = 6x3, 2x6x5 = 10x6, 39x7 = 30x7+9x7

Key Vocabulary: groups of, lots of, times, array, altogether, multiply, count, multiplied by, repeated addition, column, row, sets of, equal groups, times as big as, once, twice, three times…, partition, grid method, multiple, product, tens, ones, value

Stage 4: Extended to decimals

e.g. 23.5 × 12
Estimate: 25 × 10 = 250
23.5 × 12 = (20 + 3 + 0.5) × (10 + 2)

x	20	3	0.5
10	(20 x 10) = 200	(3 x 10) = 30	(0.5 x 10) = 5
2	(20 x 2) = 40	(3 x 2) = 6	(0.5 x 2) = 1

200 + 40 + 30 + 6 + 5 + 1
= 282

Stage 5: Vertical format, expanded working

Eventually, children may be introduced to a vertical format. They should first practise this with calculations they can do mentally. They can also investigate starting with the ones first rather than the tens. Children should describe what they do by referring to the actual values of the digits in the columns. The method is then extended to multiplying by two-digit numbers.

```
  38
× 7
  56    (8 × 7 =  56)
 210    (30 × 7 =210)
 ---
 266
```

link to the grid method:

x	30	8
7	30 x 7 = 210	8 x 7 = 56

```
  56
× 27
1000  (50 × 20 =1000)
 120  (6 × 20 =  120)
 350  (50 × 7 =  350)
  42  (6 × 7 =    42)
1512
 1
```

link to the grid method:

x	50	6
20	50 x 20 = 1000	6 x 20 = 120
7	50 x 7 = 350	6 x 7 = 42

Key skills for multiplication at stage 5:

- 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.

Key Vocabulary: groups of, lots of, times, array, altogether, multiply, count, multiplied by, repeated addition, column, row, sets of, equal groups, times as big as, once, twice, three times…, partition, grid method, multiple, product, tens, ones, value, approximate, factor, integer, decimal, short/long multiplication, carry

Stage 6: Vertical format, compact working

The method is made more compact by combining steps. If after practice, children cannot use the compact method without making errors, they should return to the expanded format.

```
  38          56          link to the grid method:
× 7         x 27
266        1120   (56 x 20)
 5          392   (56 x 7)
          1512
           1
```

Key skills for multiplication at stage 6:

- Recall multiplication facts for all times table facts
- 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 rounding and approximation
- Round any integer to a required degree of accuracy

Key Vocabulary: groups of, lots of, times, array, altogether, multiply, count, multiplied by, repeated addition, column, row, sets of, equal groups, times as big as, once, twice, three times…, partition, grid method, multiple, product, tens, ones, value, approximate, factor, integer, decimal, short/long multiplication, carry, tenths, hundreths

DIVISION

Prerequisite skills: (Continue to address through the Oral/Mental Starter Rolling Program)

- Solve one step problems involving multiplication and division, by calculating the answer using concrete objects, pictorial representation and 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

Useful Resources:

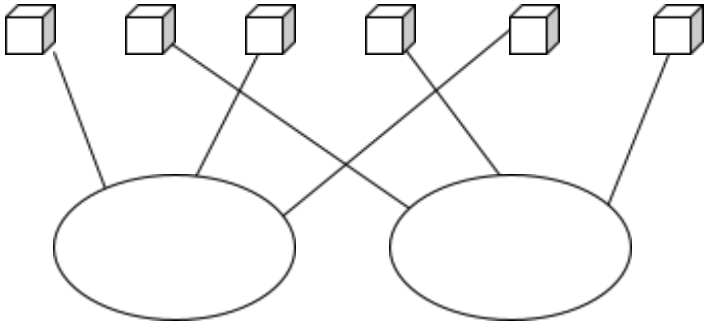
Models and images charts: 'Counting on and back'; 'Understanding Multiplication and division'.

Stage 1:

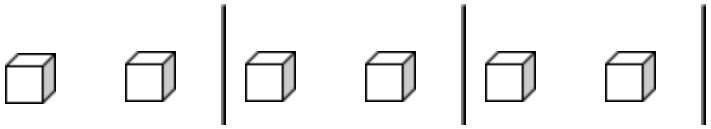
Understanding division as:

- **Sharing equally** *occurs when a quantity is shared out equally into a given number of portions, and we can work out how many are in each portion.*

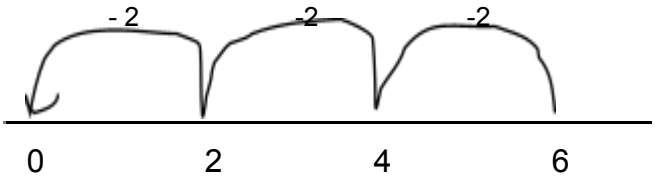
e.g. 6 ÷ 2 (share 6 sweets between 2 children)



- **Grouping (or repeated subtraction)** *occurs when we are asked to find how many groups of a given size are equivalent to the original quantity. For example how many groups of 2 marbles are in a set of 6 marbles, the calculation*
  6 ÷ 2 (how many 2s in 6?)



Shown/calculated on a number line:



IT IS VITAL THAT WE TEACH ALL THE ABOVE METHODS OF DIVISION, INCLUDING REPEATED SUBTRACTION, TO ENABLE CHILDREN TO UNDERSTAND METHODS TAUGHT LATER ON.

Key skills for division at stage 1:

- 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 recognizing odd and even numbers
- Calculate mathematical statements for multiplication and division within the multiplication tables and write them using the x, ÷ and = signs
- Know that multiplication 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 or subtraction, mental methods, and multiplication and division facts, inc. problems in context.

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

Stage 2: Informal written methods – *subtracting multiples of the divisor ('chunking')*

Division by subtracting multiples of the divisor…

Using key facts, a simple way of subtracting multiples of the divisor, using known times-table facts.

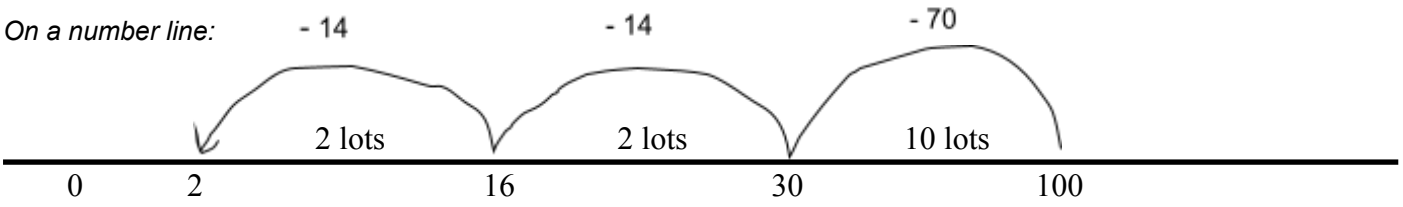
Key facts: 10 ×
5 ×
2 ×
1 ×

e.g. 100 ÷ 7 = 14 r 2

Key facts: 10 × 7 = 70
5 × 7 = 35
2 × 7 = 14

1 × 7 = 7

On a number line:



Key skills for division at stage 2:

- 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, inc. for two digit numbers times one digit numbers, using mental and progressing to formal written methods
- Solve problems in context and including missing number problems involving times and divide
- Use efficient mental methods to solve problems e.g. using multiplication and division facts (3x2=6, 6÷3=2 and 2 = 6÷3) to derive related facts (30x2=60, 60÷3 = 20 and 20=60÷3)

Key Vocabulary: share, share equally, one each, two each, group, groups of, lots of, array, divide, divided by, divided into, division, grouping, number line, left, left over, inverse, chunking carry, remainder, multiple

Stage 3: Progressing to an expanded vertical method:

e.g. 234 ÷ 13

234
- 130 (10) × 13
104
- 65 (5) × 13
39
- 26 (2) × 13
13
- 13 (1) × 13
0

→ 234 ÷ 13 = 18

Help Box
10 13 = 130
5 13 = 65
2 13 = 26
1 13 =13

- Chunking is useful for reminding children of the link between division and repeated subtraction.

The key to the efficiency of chunking lies in the *estimate* that is made before the chunking starts:

- *Estimating* has two purposes when doing a division:
  - to help to choose a starting point for the division;
  - to check the answer after the calculation.

Key skills for division at stage 3:

-Recall multiplication and division facts for all numbers up to 12x12

-Use place value, known and derived facts to multiply and divide mentally, inc.: multiplying and dividing by 10 and 100 and 1000

-Use mental methods and extend this to three digit numbers to derive facts e.g. 200x3=600 so 600÷3=200

-Pupils solve two step problems in contexts, choosing the appropriate operation, working with increasingly harder numbers

Key Vocabulary: share, share equally, one each, two each, group, groups of, lots of, array, divide, divided by, divided into, division, grouping, number line, left, left over, inverse, chunking carry, remainder, multiple, divisible by, factor

Stage 4: Standard written methods:

196 ÷ 6

```
  __32____
6 )196
- 180   (30)
   16
-  12    (2)
    4
```

→ 196 ÷ 6 = 32 r 4 or 32 4/6 or 32 2/3

972 ÷ 36

```
  __27_____
36 )972
  - 720     (20)
    252
  - 252     (7)
```

→ 972 ÷ 36 = 27

- '**Short' division** of a two-digit or three-digit number can be introduced to children who are confident with multiplication and division facts and with subtracting multiples of 10 mentally, and whose understanding of partitioning and place value is sound.

The accompanying talk is 'How many threes divide into 80 so that the answer is a multiple of 10?' This gives 20 threes or 60, with 20 remaining. We now ask: 'What is 21divided by three?' which gives the answer 7.

$$3\overline{)8^{2}1}\quad 27$$

The carry digit '2' represents the 2 tens that have been exchanged for 20 ones, to show that 21 is to be divided by 3. In second it is written as a superscript.

The 27 written above the line represents the answer: 20 + 7, or 2 tens and 7 ones.

$$3\overline{)2\,9^{2}1}\quad 97$$

The next step is to tackle HTU ÷ TU.

- In this **'long division'** method, recording the build-up to the quotient on the right of the calculation keeps the links with 'chunking' and reduces the errors that tend to occur with the positioning of the first digit of the **quotient**.

How many packs of 24 can we make from 560 biscuits?

Start by multiplying 24 by multiples of 10 to get an **estimate**. As 24 × 20 = 480 and 24 × 30 = 720, we know the answer lies between 20 and 30 packs. We start by subtracting 480 from 560.

$$
\begin{array}{rrl}
24\overline{)\,560} & & \\
20 & \underline{480} & 24 \times 20 \\
 & 80 & \\
3 & \underline{72} & 24 \times 3 \\
 & 8 &
\end{array}
$$

Answer: 23 R 8

Conventionally the 20, or 2 tens, and the 3 ones forming the answer are recorded above the line, as in the second recording.

Key skills for division at stage 4:

-Recall multiplication and division facts for all numbers up to 12x12

- Multiply and divide numbers mentally, drawing on known facts

-Identify multiples and factors, inc. finding all factor pairs of a number, and common factors of two numbers

-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

- Use multiplication and division as the inverse

-Interpret non-integer answers to division by expressing results in different ways according to the context, inc. with remainders, as fractions, as decimals or by rounding e.g. 98÷4 = 24 r2 = 24 and 2 quarters or 24.5 rounded =25.0

-Be fluent in a formal written method to solve division

Key Vocabulary: share, share equally, one each, two each, group, groups of, lots of, array, divide, divided by, divided into, division, grouping, number line, left, left over, inverse, chunking carry, remainder, multiple, divisible by, factor, prime number, prime factors