

Great Wishford Primary School



Calculation policy for Mathematics.

July 2014.

Review date: July 2015.

About our Calculation Policy:

The following calculation policy has been devised to meet requirements of the National Curriculum 2014 for the teaching and learning of mathematics, and is also designed to give pupils a consistent and smooth progression of learning in calculations across the school.

Age stage expectations

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

Providing a context for calculation:

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

Ensuring conceptual understanding to then enable children to choose an appropriate calculation method:

It is vital that children have a conceptual understanding of numbers, the number system and the calculation methods they use. This will enable them to have a solid understanding in maths as well as giving them the tools to select appropriate calculation methods when solving mathematical problems.

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:

1
Can I do it in my head using a mental strategy?

2
Can I use some jottings to help me?

3
Which written method should I use to help me?

Addition

Big Maths Steps: 1-8



Foundation stage

National Curriculum 2014 reference(s):

Using quantities and objects, they add two single-digit numbers and count on to find the answer.

Finds the total number of items in two groups by counting all of them.

Says the number that is one more than a given number.

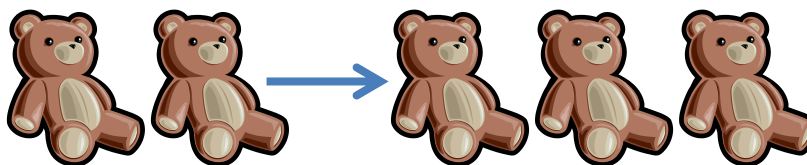
Finds one more from a group of up to five objects, then ten objects.

In practical activities and discussion, beginning to use the vocabulary involved in adding.

Calculation methods.

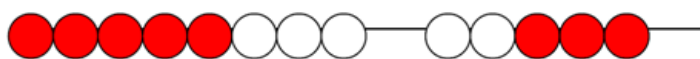
Combine two sets of objects in one group:

$$2 + 3$$



Bead strings or bead bars can be used to illustrate addition including bridging ten by counting on 2 then 3.

$$8 + 5$$



It is important to that children have a clear understanding of the concept of equality, before using the '=' sign. Calculations should be on either side of the '=' to that children don't misunderstand '=' as to mean 'the answer'.

Key vocab.

add, more, and, make, sum, total, altogether, score, double, one more, two more, ten more... how many more to make... ? how many more is... than...?

is the same as

Additional notes:

Numicon resources are weighted and can be used to check answers on a balance scale.

Big Math's

Aggregation=combining 2 sets

Augmentation = adding on from a given number.

Addition

Big Maths Steps: 9-13



Year 1

National Curriculum 2014 reference(s):

Read, write and interpret maths statements including +, -, =.

Represent and use number facts with 20.

Recall and use addition facts to 10.

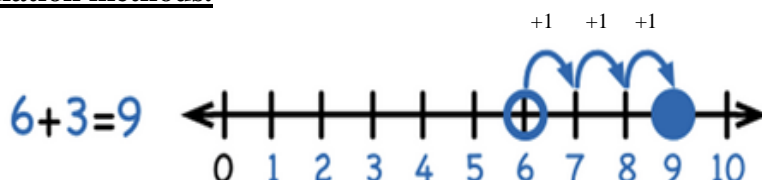
Solve one step problems that involve using concrete objects, pictorial representations and missing number problems.

Add 1 digit and 2 digit numbers to 20, including 0, e.g. (16+7=23).

Given a number, identify one more.

Calculation methods.

Use **prepared numbered lines** to add, by counting on in ones.
Encourage children to start with the larger number and count on:



Combine two sets of objects in one group:

Bead strings or bead bars can be used to illustrate addition including bridging ten by counting on 2 then 3.



It is important that children have a clear understanding of the concept of equality, before using the '=' sign. Calculations should be on either side of the '=' to that children don't misunderstand '=' as to mean 'the answer'.

To support this, when solving calculations, missing numbers should be placed in all possible places:

$$3 + 4 = \square$$

$$\square + 4 = 7$$

$$3 + \square = 7$$

$$7 = \square + 4$$

$$7 = \square + 3$$

$$\square = 3 + 4$$

Key vocab.

+, add, more, **plus**, make, sum, total, altogether, score, double, **near double**, one more, two more... ten more,
how many more to make...? how many more is... **than**...? **how much more is**...?

= equals, sign, is the same as

Additional notes:

Could use 'Where's Mully? From Big Maths or 'n' to represent an unknown number.

Addition

Big Maths Steps: 14-25



Year 2

National Curriculum 2014 reference(s):

Solve problems that involve using concrete objects, pictorial representations, including numbers, quantities and measures.

Recall and use + facts to 20, derive and use related facts to 100.

Add numbers using concrete objects, pictorial representations, and mentally, including:

2 digit numbers and ones, e.g. (23+6=29);

2 digit numbers and tens, e.g. (23+20=43);

two 2 digit numbers, e.g. (23+45=68);

three 1 digit numbers, e.g. (5+6+3=14).

Show that + of 2 numbers can be done in any order.

Use inverse operation (-) to check and solve missing number problems.

Find combinations of coins that equal the same amounts of money.

Combine amounts in £ and p to make a particular value.

Solve simple problems in a particular context involving addition and subtraction of money of the same unit, including giving change.

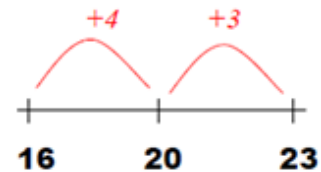
Calculation methods.

Use empty number lines to add 2 digit numbers and ones, by counting on in multiples of one, using known number facts to support bridging ten.

Encourage children to start with the larger number and count on:

T U U T U

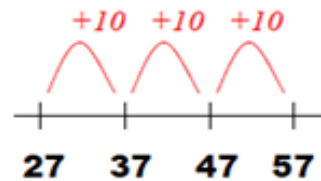
$$16 + 7 = 23$$



Use empty number lines to add 2 digit numbers and tens, by counting on in multiples of ten:

T U T U T U

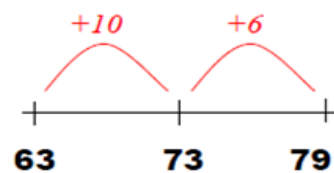
$$27 + 30 = 57$$



Use empty number lines to add two 2 digits numbers, by counting on in multiples of ten then multiples of one, using known number facts to support bridging ten.

T U T U T U

$$63 + 16 = 79$$



WARNING

Move on to partitioned column method.

Step 1: Only solve calculations that *do not* cross the tens boundary, until they are secure with the method.

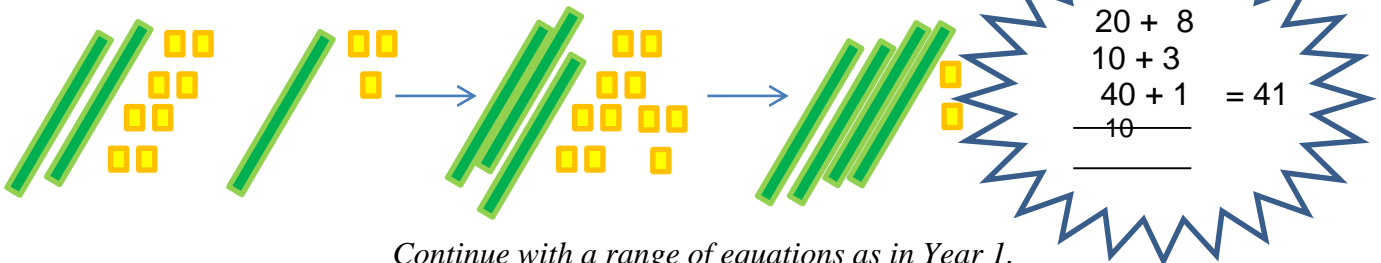
| | | | | |
|-------|---|---|---|-----------|
| 2 | 0 | + | 3 | |
| + | 3 | 0 | + | 4 |
| <hr/> | | | | |
| 5 | 0 | + | 7 | |
| | | | | = |
| | | | | <u>57</u> |

Step 2: Solve calculations that *do* cross the tens boundary. The children need to be proficient in mentally adding multiples of ten to a digit number to move on to this step. At this stage use base 10 (diennes) to support the understanding of 'carrying' and the value of 'digits'.

$$28 + 13$$

step 1

step 2



Continue with a range of equations as in Year 1.

Key vocab.

+, add, addition, more, plus, make, sum, total, altogether, score, double, near double, one more, two more... ten more... one hundred more, how many more to make...? how many more is... than...? how much more is...?
= equals, sign, is the same as
tens boundary

Addition

Big Maths Steps: 26-29



Year 3

National Curriculum 2014 reference(s):

Add numbers mentally, including:

3 digit numbers and ones, e.g. (243+6=249);

3 digit numbers and tens, e.g. (213+20=233);

3 digit number and hundreds, e.g. (215+200=415).

Add numbers with up to 3 digits, using formal written methods of columnar addition.

Solve problems, including missing number problems, using number facts, place value, and more complex +.

Estimate the answer to a calculation and use the inverse (-) to check answers.

Add fractions with the same denominator within one whole.

Add amounts of money, using both £ and p in practical contexts (mixed units: recording £ and p separately – decimal recording introduced in Y4).

Solve measure and money + problems involving numbers up to one decimal place.

Given a number, identify 10 or 100 more.

Calculation methods.

1. Use expanded column method:

Children should add the 'units' or 'ones' first, in preparation for the compact column method.

Children need to recognise the value of the hundreds, tens and units without recording the partitioning.

Children also need to be able to add in columns.

H T U

| | | | |
|---|---|---|---|
| | 2 | 3 | 6 |
| + | | 7 | 3 |
| | | | 9 |
| | 1 | 0 | 0 |
| | 2 | 0 | 0 |
| | 3 | 0 | 9 |

2. More able children, once competent in the expanded column method, can move on to compact column method:

Children should always add the 'units' or 'ones' first.

Numbers should be 'carried' underneath the bottom line.

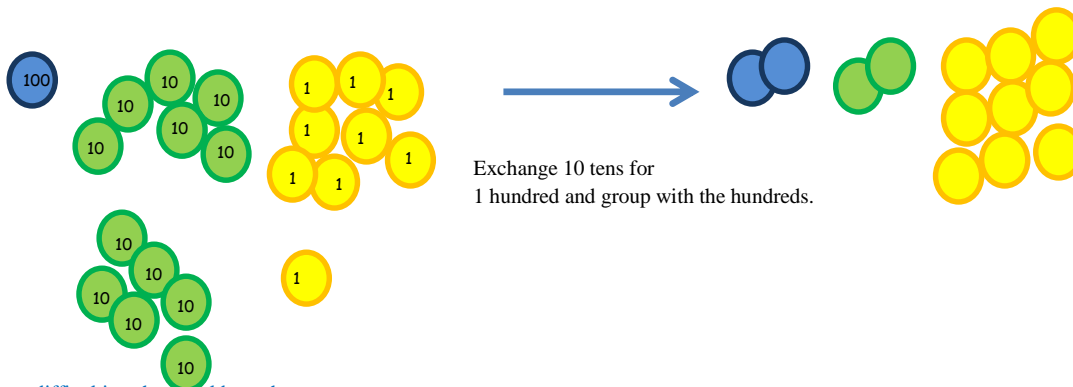
Emphasis should be placed on reminding the children to include in mental addition any 'carried' numbers.

H T U

$$\begin{array}{r} 236 \\ + 73 \\ \hline 309 \\ 1 \end{array}$$

Use base 10 (diennes) or place value counters to support understanding of carrying and to ensure conceptual understanding of place value:

$$\begin{array}{r} \text{H T U} \\ 168 \\ + 61 \\ 229 \\ \hline 1 \end{array}$$



If children are experiencing persistent difficulties, they could use the partitioned column method with carrying:

This method should support children's understanding of carrying, using a method which they are familiar and confident with.

When introducing this method, children should gain practical experience first using base 10 (diennes) equipment (see Year 2 for how to use these).

Key vocab.

+, add, addition, more, plus, make, sum, total, altogether, score, double, near double, one more, two more... ten more... one hundred more, how many more to make...? how many more is... than...? how much more is...?

= equals, sign, is the same as

tens boundary, **hundreds boundary**

$$\begin{array}{r} \text{H T U} \\ 200 + 40 + 6 \\ \hline 70 + 6 \\ \hline 300 + 20 + 2 \\ \hline 100 \quad 10 \end{array}$$

Addition

Big Maths Steps: 30-41



Year 4

National Curriculum 2014 reference(s):

Practise mental methods.

Add numbers with up to 4 digits, using formal written methods of columnar addition.

Estimate and use the inverse (-) to check answers.

Solve two step problems in context, deciding which operations and methods to use and why.

Add fractions with the same denominator.

Solve measure and money + problems involving numbers up to two decimal places (using decimal notation).

Given a number, identify 1000 more.

Calculation methods.

1. Use compact column method:

Children should add the 'units' or 'ones' first.

Numbers should be 'carried' underneath the line.

To ensure conceptual understanding, it is essential that place value is reinforced by frequently discussing the actual value of each digit, e.g. the 5 digit represents 5 hundreds.

Use **base 10 (diennes)** or **place value counters** to support understanding of carrying and to ensure conceptual understanding of place value (see year 2 and 3 for how to use these manipulatives).

| | Th | H | T | U |
|---|----|---|---|---|
| | 3 | 5 | 1 | 7 |
| + | | 3 | 9 | 6 |
| | 3 | 9 | 1 | 3 |

2. Extend the use of compact column method to decimals:

Children should add the column furthest to right first.

Numbers should be 'carried' underneath the line.

To ensure conceptual understanding, it is essential that place value is reinforced by frequently discussing the actual value of each digit, e.g. the 2 digit represents 2 tens.

Use actual **money** to support understanding.

| | | T | U | tenths | hundredths |
|---|---|---|---|--------|------------|
| | £ | 2 | 3 | . | 5 9 |
| + | £ | | 7 | . | 5 5 |
| | £ | 3 | 1 | . | 1 4 |

Key vocab.

add, addition, more, plus, **increase**, sum, total, altogether, score, double, near double, how many more to make...?
equals, sign, is the same as
tens boundary, hundreds boundary
inverse

Addition

No longer Big Maths.



Year 5

National Curriculum 2014 reference(s):

Practise mental methods using increasingly large numbers.

Add numbers whole numbers with more than 4 digits, using formal written methods of columnar addition.

Use rounding to check answers and determine levels of accuracy.

Solve multistep problems in context, deciding which operations and methods to use and why.

Add fractions and mixed numbers with the same denominator and denominators that are multiples of the same number.

Solve + problems involving numbers with up to three decimal places.

Solve comparison, sum and difference problems using information in tables, including timetables.

Calculation methods.

1. Extend the use of compact column method to numbers with more than 4 decimal places and decimals:

Children should add the column furthest to right first.

Numbers should be 'carried' underneath the line.

To ensure conceptual understanding, it is essential that place value is reinforced by frequently discussing the actual value of each digit, e.g. the 2 digit represents 2 tens.

Use base 10 (diennes) or place value counters to support understanding of carrying and to ensure conceptual understanding of place value (see year 2 and 3 for how to use these manipulatives).

| | HT | T | H | T | U |
|---|----|---|---|---|---|
| | 2 | 3 | 4 | 8 | 1 |
| + | | 1 | 3 | 6 | 2 |
| | 2 | 4 | 8 | 4 | 3 |

2. Pupils should be able to add more than 2 numbers using the compact column method.

Children should be made aware that it is essential to align the columns carefully.

3. Extend the use of compact column method to mixed decimals, not in the context of money.

Where there is an 'empty' space in a decimal column, pupils should insert a zero to show the value.

| | T | U | tenths | hundredths |
|---|---|---|--------|------------|
| | 1 | 9 | 0 | 1 |
| + | | 3 | 6 | 5 |
| | | 0 | 7 | |
| | 2 | 3 | 3 | 6 |

Holding the place

To ensure conceptual understanding, it is essential that place value is reinforced by frequently discussing the actual value of each digit, e.g. the 5 digit represents 5 hundredths.

Use place value counters to support understanding of carrying and to ensure conceptual understanding of place value (see year 2 and 3 for how to use these manipulatives), add counters with 0.1, and 0.01.

Key vocab.

add, addition, more, plus, increase, sum, total, altogether, score, double, near double, how many more to make...?
 equals, sign, is the same as
 tens boundary, hundreds boundary, units boundary, tenths boundary
 inverse

Addition



Year 6

National Curriculum 2014 reference(s):

Perform mental calculations, including with mixed operations and large numbers.

Add whole numbers with more than 4 digits, using formal written methods of columnar addition.

Use estimation to check answers and determine levels of accuracy.

Solve multistep problems in context, deciding which operations and methods to use and why.

Add fractions with different denominators and mixed numbers, using the concept of equivalent fractions.

Calculation methods.

1. Extend the use of [compact column method](#) to adding several numbers with mixed decimals.

Children should be reminded of the importance of aligning the columns accurately.

Where there is an 'empty' space in a decimal column, pupils could insert a zero to show the value.

| | T | U | | tenths | hundredths | thousandths |
|---|---|---|---|--------|------------|-------------|
| | 2 | 3 | . | 3 | 6 | 1 |
| + | | 9 | . | 0 | 8 | |
| | 5 | 9 | . | 7 | 7 | |
| | | 1 | . | 3 | | |
| | 9 | 3 | . | 5 | 1 | 1 |
| | 2 | 1 | | 2 | | |

Use [place value counters](#) to support understanding of carrying and to ensure conceptual understanding of place value (manipulatives), add counters with 0.1, 0.01, and 0.001.

Key vocab.

add, addition, more, plus, increase, sum, total, altogether, score, double, near double, how many more to make...?

equals, sign, is the same as

tens boundary, hundreds boundary, units boundary, tenths boundary

inverse

Subtraction

Big Maths Steps: 1-5



Foundation Stage

National Curriculum 2014 reference(s):

Using quantities and objects, they subtract two single-digit numbers and count back to find the answer.

Finds one less from a group of up to five objects, then ten objects.

In practical activities and discussion, beginning to use the vocabulary involved in subtracting.

Calculation methods:

Use practical methods to take away from a set of objects:

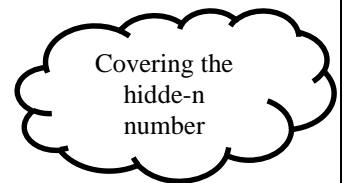


? ?

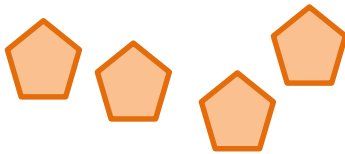
6 take away 2 is 4

Cross out drawn objects to represent what has been taken away:

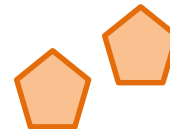
3 take away 2 is 1



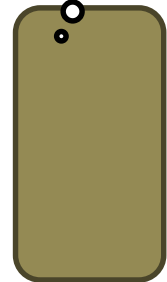
Group objects on a table then cover some to visualize the calculation:



2 less than 4 is 2



Where's Mully?



Key vocab:

take (away), leave, how many are left/left over? how many have gone? one less, two less... ten less... how many fewer is... than...? difference between

is the same as

Subtraction

Big Maths Steps: 6-12

Year 1

National Curriculum 2014 reference(s):

Read, write and interpret maths statements including +, -, =.

Represent and use number facts with 20.

Recall and use subtraction facts to 10.

Solve one step problems that involve using concrete objects, pictorial representations and missing number problems.

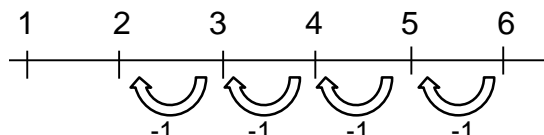
Subtract 1 digit and 2 digit numbers to 20, including 0, e.g. (27-5=22).

Given a number, identify one less.

Calculation methods:

Use prepared numbered lines to subtract, by counting back in ones:

$$6 - 4 = 2$$



Finding the difference (Use these methods when using the vocab 'Finding the difference' NOT 'subtraction':

1) Use practical equipment (such as numicon or cuisenaire) to identify the 'difference':

4

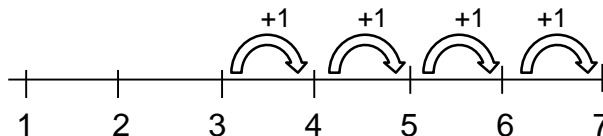


7

'The difference between 7 and 4 is 3' or
'Seven is 3 more than four'.

2) Use prepared numbers , by counting on in ones:

'The difference between 7 and 4 is 3',
Or 'Seven is 3 more than four'.



Key vocab:

- subtract, take (away), minus, leave, how many are left/left over? how many have gone? one less, two less, ten less... how many fewer is... than...? how much less is...? difference between, half, halve

= equals, sign, is the same as

Subtraction

Big Maths Steps: 13 – 18

Year 2

National Curriculum 2014 reference(s):

Solve problems that involve using concrete objects, pictorial representations, including numbers, quantities and measures.

Recall and use + facts to 20, derive and use related facts to 100.

Subtract numbers using concrete objects, pictorial representations, and mentally, including:

2 digit numbers and ones, e.g. (23-6=17);

2 digit numbers and tens, e.g. (23-10=13);

Two 2 digit numbers, e.g. (23-15=8).

Use inverse operation (+) to check and solve missing number problems.

Solve simple problems in a practical context involving addition and subtraction of money of the same unit, including giving change.

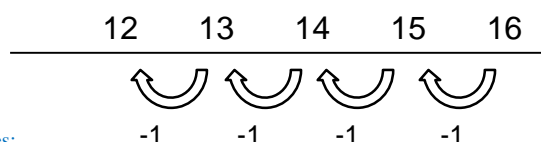
Calculation methods:

Counting back on a number line for subtraction.

- 1) Use unprepared numbered lines to subtract, by counting back in ones:

T U U T U

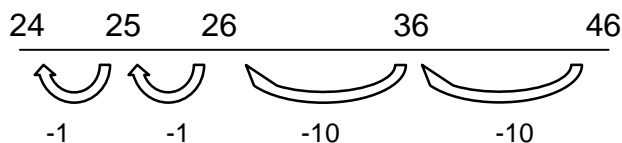
$$16 - 4 = 12$$



- 2) Use unprepared numbered lines to subtract, by counting back in tens and ones:

T U T U T U

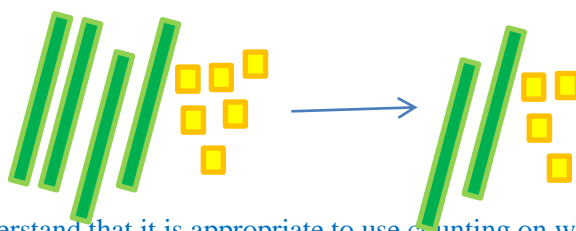
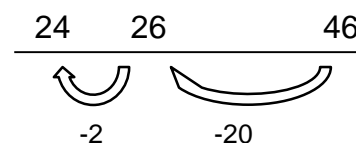
$$46 - 22 = 24$$



- 3) Use unprepared number lines to subtract by partitioning more efficiently:
(Pupils can use base 10 (diennes) to support understanding)

T U T U T U

$$46 - 22 = 24$$



Children should understand that it is appropriate to use counting on when there is a small difference between numbers, this should be used as a mental strategy.

When children are posed with a question that uses the vocab '*Finding the difference*', pupils should be encouraged to find the difference by counting on from the smallest number to the largest number using mental methods where possible. If not they should count on using a method that relates to the above (or those in addition).

Key vocab:

- subtract, subtraction, take (away), minus, leave, how many are left/left over? one less, two less... ten less... **one hundred less**, how many fewer is... than...? how much less is...? difference between, half, halve
= equals, sign, is the same as
tens boundary

Additional notes:

Encourage the use of inverse operation to reinforce addition skills.

Subtraction

No longer Big Maths. Moved to formal

Year 3

National Curriculum 2014 reference(s):

Subtract numbers mentally, including:
3 digit numbers and ones, e.g. (248-6=242);
3 digit numbers and tens, e.g. (213-20=193);
3 digit number and hundreds, e.g. (215-200=215).

Subtract numbers with up to 3 digits, using formal written methods of columnar subtraction.
Solve problems, including missing number problems, using number facts, place value, and more complex -.
Estimate the answer to a calculation and use the inverse (+) to check answers.

Subtract fractions with the same denominator within one whole.

Subtract amounts of money, using both £ and p in practical contexts (mixed units: recording £ and p separately. Decimal recording introduced in Y4).

Solve measure and money - problems involving numbers up to one decimal place.

Given a number, identify 10 or 100 less.

Calculation methods:

- 1) Introduce partitioned column method where *no exchanging* is required:

$$\begin{array}{r} \text{T U} \quad \text{T U} \quad \text{T U} \\ 46 - 22 = 24 \end{array}$$

$$\begin{array}{r} \text{T} \quad \text{U} \\ 40 + 6 \\ - 20 + 2 \\ \hline 20 + 4 \end{array}$$

- 2) EXCHANGING - Use base 10 (diennes) as a practical method to introduce exchanging

$$\begin{array}{r} \text{T U} \quad \text{T U} \quad \text{T U} \\ 31 - 18 = 1 \end{array}$$

$$31 - 18 = 1 \quad \text{Step 1}$$

31 = 3 tens + 1 unit

Step 2

31 = 2 tens + 11 units

Step 3

2 tens and 11 units take away
1 ten 8 units

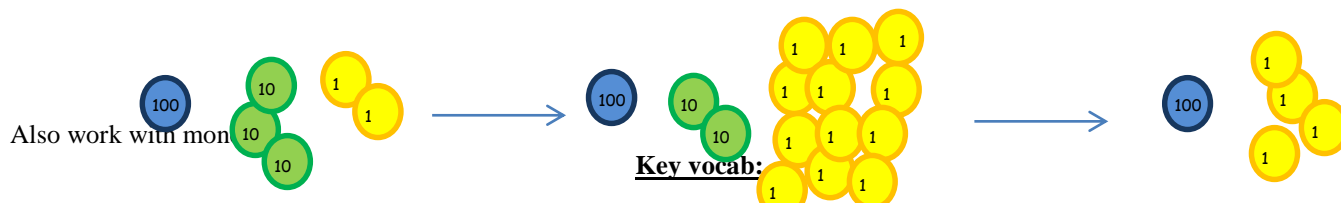
When pupil(s) are confident in doing this practically and verbalizing the calculation, begin to record using partitioned column method:

$$\begin{array}{r} \text{T} \quad \text{U} \\ 20 \quad 1 \\ 30 + 1 \\ - 10 + 8 \\ \hline 10 + 3 \end{array}$$

- 3) When secure with exchanging, use partitioned column method to solve calculations involving 3 digit numbers. Repeating the practical stage (as outlined in step 2) if necessary.

(Use place counters to support understanding of decomposition when pupils have a clear understanding of place value)

$$\begin{array}{r} \text{HTU} \quad \text{TU} \quad \text{HTU} \\ 132 - 28 = 104 \end{array}$$



- subtract, subtraction, take (away), minus, leave, how many are left/left over? one less, two less... ten less... one hundred less, how many fewer is... than...? how much less is...? difference between, half, halve
= equals, sign, is the same as
tens boundary, hundreds boundary

Subtraction

Year 4

National Curriculum 2014 reference(s):

- Practise mental methods.
- Subtract numbers with up to 4 digits, using formal written methods of columnar subtraction.
- Estimate and use the inverse (+) to check answers.
- Solve two step problems in context, deciding which operations and methods to use and why.
- Subtract fractions with the same denominator.
- Solve measure and money - problems involving numbers up to two decimal places (using decimal notation).
- Given a number, identify 1000 less.

Calculation methods

- 1) **Revision of partitioned column method** from Year 3. Moving on to numbers with 4 digits:
(Pupils can use place value counters to support understanding of decomposition and place value, see Year 3.)

| Th | H | T | U | | Th | H | T | U | | Th | H | T | U |
|----|----|---|---|---|----|---|---|---|---|----|---|---|---|
| 2 | 7 | 5 | 4 | - | 1 | 5 | 6 | 2 | = | 1 | 1 | 9 | 2 |
| | Th | | | | | H | | | | T | | | U |
| 2 | 0 | 0 | 0 | + | 7 | 0 | 0 | + | 5 | 0 | + | 4 | |
| 1 | 0 | 0 | 0 | + | 5 | 0 | 0 | + | 6 | 0 | + | 2 | |
| 1 | 0 | 0 | 0 | + | 1 | 0 | 0 | + | 9 | 0 | + | 2 | |

- 2) Once pupils are confident in exchanging and have a clear understanding of place value, move towards the **formal compact column method**:
(Pupils can use place value counters to support understanding of decomposition and place value, see Year 3.)

| | Th | H | T | U |
|---|----|---|---|---|
| - | 2 | 7 | 5 | 4 |
| | 1 | 5 | 6 | 2 |
| | 1 | 1 | 9 | 2 |

Key vocab:

subtract, subtraction, take (away), minus, decrease, leave, how many are left/left over? difference between, half, halve, how many more/fewer is... than...? how much more/less is...?

equals, sign, is the same as

tens boundary, hundreds boundary

inverse

Subtraction

Year 5

National Curriculum 2014 reference(s):

Practise mental methods using increasingly large numbers.

Subtract numbers whole numbers with more than 4 digits, using formal written methods of columnar subtraction.

Use rounding to check answers and determine levels of accuracy.

Solve multistep problems in context, deciding which operations and methods to use and why.

Subtract fractions and mixed numbers with the same denominator and denominators that are multiples of the same number.

Solve - problems involving numbers with up to three decimal places.

Solve comparison, sum and difference problems using information in tables, including timetables.

Calculation methods:

- 1) Revision of formal compact column method extending to calculations involving numbers with more than 4 digits:
(Pupils can use place value counters to support understanding of decomposition and place value, see Year 3.)

| | HTh | TH | H | T | U |
|---|-----|----|---|---|---|
| - | 3 | 1 | 0 | 5 | 6 |
| | | 2 | 1 | 2 | 8 |
| | 2 | 8 | 9 | 2 | 8 |

When pupils are confident in using formal compact column method with integers and decimals involving money (where there are always 2 decimal places), move on to looking at using the method to subtract with mixtures of integers and decimals. It is essential that pupils have a clear understanding of place value in these instances. Remind pupils to align the decimal point and use 'place holders', if needed:

| | | | | |
|---|---|----|---|--------|
| | H | T | U | tenths |
| | 5 | 12 | 1 | |
| | 2 | 6 | 3 | .0 |
| - | | 2 | 6 | .5 |
| | 2 | 3 | 6 | .5 |

(Pupils can use place value counters to support understanding of decomposition and place value, see Year 3. Add counters with 0.1)

Key vocab:

subtract, subtraction, take (away), minus, decrease, leave, how many are left/left over? difference between, half, halve, how many more/fewer is... than...? how much more/less is...?
equals, sign, is the same as
tens boundary, hundreds boundary, units boundary, tenths boundary
inverse operation

Subtraction

Year 6

National Curriculum 2014 reference(s):

Perform mental calculations, including with mixed operations and large numbers.

Subtract whole numbers with more than 4 digits, using formal written methods of columnar subtraction.

Use estimation to check answers and determine levels of accuracy.

Solve multistep problems in context, deciding which operations and methods to use and why.

Subtract fractions with different denominators and mixed numbers, using the concept of equivalent fractions.

Calculation methods:

- 1) Revision of formal compact column method extending to more complex integers and applying to problem solving using money and measures, including decimals with different numbers of decimal places (as in year 5):

Remind pupils to align the decimal point when setting out their calculations.

Use '*place holders*' to aid understanding of the value in that column.

| | H | T | U | | | | | |
|---|---|---|---|---|---|---|---|----|
| - | 1 | 1 | 5 | . | 4 | 1 | 9 | kg |
| | | 3 | 6 | . | 0 | 8 | 0 | kg |
| | | 6 | 9 | . | 3 | 3 | 9 | kg |

(Pupils can use *place value counters* to support understanding of decomposition and place value, see Year 3. Add counters with 0.1, 0.01 and 0.001)

Pupils should be able to apply their knowledge and understanding of a range of mental calculation strategies, formal and informal written methods when deciding which method is appropriate to solve a subtraction calculation.

Key vocab:

subtract, subtraction, take (away), minus, decrease, leave, how many are left/left over? difference between, half, halve, how many more/fewer is... than...? how much more/less is...?

equals, sign, is the same as

tens boundary, hundreds boundary, units boundary, tenths boundary

inverse operation

Multiplication

Big Maths Steps: 1-4

X

Foundation Stage

National Curriculum 2014 reference(s):

Children count reliably with numbers from one to 20.

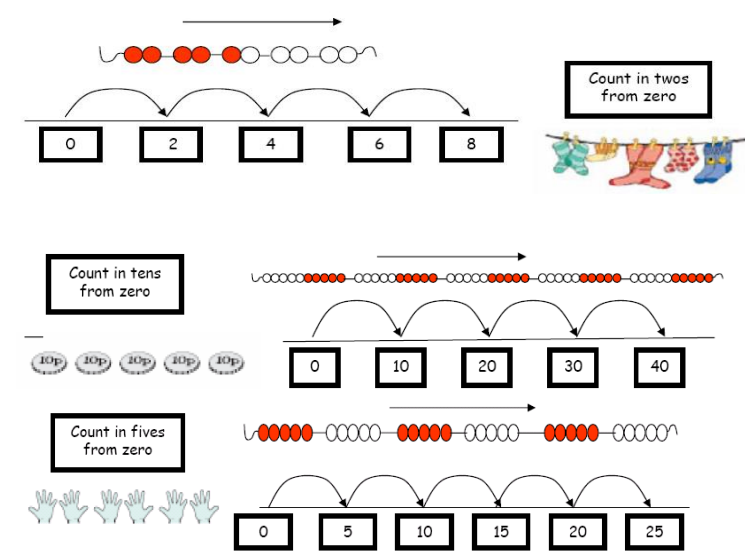
They solve problems, including doubling.

They solve practical problems that involve combining groups of 2, 5 or 10.

Calculation methods:

Use rhymes, songs and stories involving counting on and counting back in ones, twos, fives and tens.

When pupils are used to counting in 2s, 5s and 10s, use visual aids to support understanding of what is actually happening (combining groups of the same number);



Pupils can practically double a group of objects to find double of a number by combining then counting the two groups:



More able (exceeding) pupils can practically combine groups of numbers (2s, 5s and 10s):



Key vocab:

count on (from, to), count back (from, to), count in ones, twos... tens...

is the same as

Multiplication

Big Maths Steps: 5 - 8



Year 1

National Curriculum 2014 reference(s):

Count in different **multiples** including 2s, 5s, and 10s.

Begin to recall and use multiplication facts for the 2, 5, 10 tables.

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

Calculation methods:

- 1) Practically combine groups of objects (2s, 5s and 10s) and verbalise what has been found out:



There are 3 plates. Each plate has 2 star biscuits on. How many biscuits are there?

2 add 2 add 2 equals 6

- 2) Practically combine groups of numbers (2s, 5s and 10s) and record what has been found out:



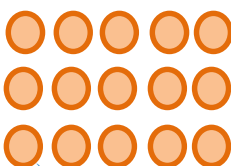
Mum washed 5 pairs of socks, how many socks did she get out of the washing machine?

$2 + 2 + 2 + 2 + 2 = 10$

- 3) Begin to use and become familiar with arrays with the support of a teacher:

$$5 + 5 + 5 = 15$$

$$3 + 3 + 3 + 3 + 3 = 15$$



$$3 \times 5$$

$$5 \times 3$$

Teach the children associated vocabulary (array, row, column)

Key vocab:

count, count (up) to, count on (from, to), count back (from, to), count in ones, twos, **threes**, **fours**, **fives**... count in tens
double, **near double**

= equals, sign, is the same as

Multiplication

Big Maths Steps: 9

X

Year 2

National Curriculum 2014 reference(s):

Count in different **steps** including 2, 3, and 5 from 0.

Count in tens from and number, forward and backwards.

Recall and use multiplication and division facts for the 2, 5, 10 tables.

Recognise odd and even numbers.

Calculate the **mathematical statements** for multiplication and division within the multiplication tables and write them using \times \div signs.

Show that multiplication of two numbers can be done in any order (**commutative**) and division of one number by another cannot.

Solve **problems** involving multiplication and division, using materials, arrays, repeated addition, mental methods, and multiplication and division facts, including problems in contexts.

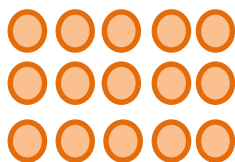
Calculation methods:

Use **arrays** for repeated addition and relate this to the \times calculation:

(Use **counters** or **objects** as well as visual representations to support understanding)

$$5 + 5 + 5 = 15$$

$$5 \times 3 = 15$$



$$3 + 3 + 3 + 3 + 3 = 15$$

$$3 \times 5 = 15$$

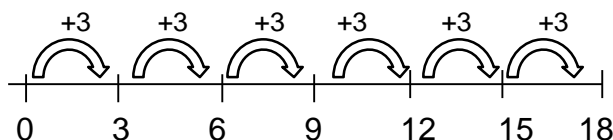
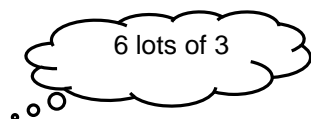
Ensure that children understand associated vocabulary (array, row, column).

Using arrays should help children to understand the commutative of multiplication (that the numbers can be swapped round).

When pupils become more confident, use their knowledge of counting in multiples to minimise the need for repeated addition. Recording the \times calculation, instead of the repeated addition.

Use a **number line** for repeated addition:

$$6 \times 3 = 18$$



Some children may still need to use **practical apparatus**.

See the use of practical apparatus in the Foundation Stage and Year 1 sections.

Key vocab:

count on (from, to), count back (from, to), count in ones, twos, threes, fours, fives... count in tens

lots of, groups of

\times , times, multiply, multiplied by, multiple of

once, twice, three times... ten times... times as (big, long, wide... and so on)

repeated addition

array, row, column

double, halve

= equals, sign, is the same as

Multiplication

It is very important that pupils can recall their times table facts before formalising written methods



Year 3

Smile Multiplication

Coin Multiplication

National Curriculum 2014 reference(s):

Count from 0 in **multiples** of 4, 8, 50 and 100.

Count up and down in tenths; recognise that tenths arise from dividing an object into 10 equal parts and in dividing one-digit numbers or quantities by 10.

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

Write and calculate mathematical statements for multiplication and division **using the multiplication tables** that they know, including 2 digit x 1 digit, using mental and progressing to formal written methods.

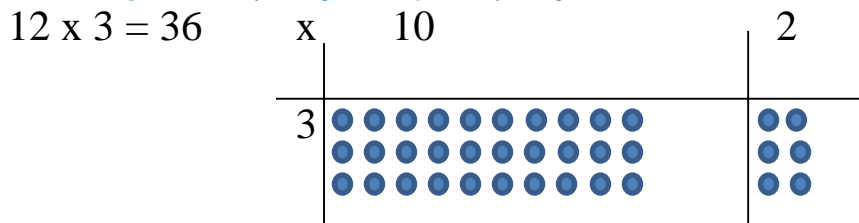
Pupils develop reliable written methods for multiplication and division, starting with calculations of two-digit numbers by one-digit numbers and progressing to the formal written methods of short multiplication and division.

Solve **problems** including missing number problems, involving multiplication and division, including integer scaling problems and correspondence problems in which n objects are connected to m objects.

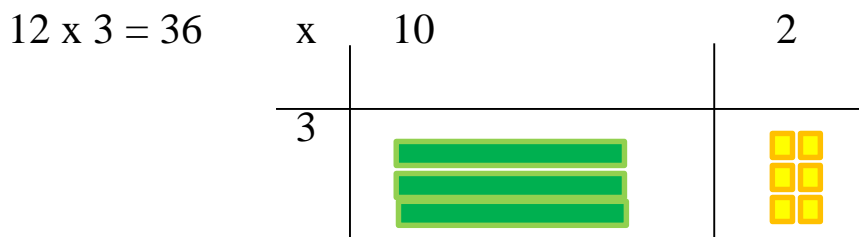
Recognise, find and write fractions of a discrete set of objects: unit fractions and non-unit fractions with small denominators.

Calculation methods:

Introduce the **grid method** by linking it to **arrays** initially (using counters), this could be done whole class when making the links to using base 10 (diennes):



Use base 10 (diennes) with **grid method** to support children's understanding of place value:



Use the **grid method**:



To use grid method pupils must be competent in the following:

Partitioning numbers into tens and ones (units);

Recall and work out x facts for the 2, 3, 5, 4, 8 and 10 times tables;

Mentally multiplying multiples of ten by a single digit number;

Recombining tens and ones (units) to make a 2 digit number.

Key vocab:

count, count (up) to, count on (from, to), count back (from, to), count in ones, twos, threes, fours, fives... count in tens, **hundreds**

lots of, groups of

x, times, multiply, **multiplication**, multiplied by, multiple of, **product**

once, twice, three times... ten times...times as (big, long, wide... and so on)

repeated addition

array, row, column

= equals, sign, is the same as

Year 4



Count from 0 in **multiples** of 6, 7, 9, 25 and 1000.

Recall and use multiplication and division facts for the tables up to 12×12 (6, 7, 9, 11 and 12 not learnt previously).

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

Recognise and use factor pairs and **commutativity** in mental calculations.

Multiply 2 digit and 3 digit numbers by a 1 digit number using formal written layout.

Pactice to become fluent in the formal written method of short multiplication for multiplying using multi-digit numbers.

Solve **problems** involving multiplying and adding, including the distributive law to multiply 2 digit numbers by 1 digit, integer scaling problems and harder multiplication problems such as n objects are connected to m objects.

Solve problems involving increasingly harder fractions to calculate quantities, and fractions to divide quantities, including non-unit fractions where the answer is a whole number.

Solve simple measure and money problems involving fractions and decimals to 2 decimal places.

Convert between units of measure.

Solve problems involving converting from hours to minutes; minutes to seconds; years to months; weeks to days.

Use the **grid method** as shown in Year 3, but extend to 3 digit numbers x a 1 digit number, use **base 10 (diennes)** or **place value counters** to support if needed:

HTU U THH T U

$$412 \times 3 = 1236$$

X

400

10

2

1200

3

1200

30

6

30 +

6

1236

X

400

10

2

3

A diagram consisting of 12 blue circles arranged in a 3x4 grid. Each circle contains the number 100. Below the grid, the text 'a group of 12 groups of 100' is partially visible.



452

X 3

1356

1

lots of, groups of

times, multiply, multiplication, multiplied by, multiple of, product
once, twice, three times... ten times... times as (big, long, wide... and so on)

repeated addition

array, row, column

double.

inverse

equals, sign, is the same as

Year 5



National Curriculum 2014 reference(s):

Identify all **multiples and factors**, including finding all factor pairs of a number, and common factors of two numbers. Solve problems involving multiplication and division where larger numbers are used by decomposing them into their factors.

Know and use the **vocabulary of prime numbers, prime factors and composite** (non-prime) numbers.

Establish where a number up to 100 is **prime** and recall prime numbers to 19.

Multiply numbers mentally drawing upon known facts.

Multiply numbers up to 4 digits by a 1 digit or 2 digit number using a formal written layout, including long multiplication for 2 digit numbers..

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

Recognise and use **square numbers and cube numbers**, and the notation for squared and cubed.

Solve problems involving all 4 operations, including combinations of these.

Solve problems involving \times and \div , including scaling by simple fractions and problems involving simple rates.

Convert between different units of metric measure.

Calculate and compare the area of squares and rectangles, including using standard units.

Solve problems involving converting between units of time.

Use all 4 operations to solve problems involving measure using decimal notation and scaling.

Calculation methods:

For **short** multiplication, use the **grid method** moving **on** to the standard method (See year 4).

Introduce long multiplication using the **grid method** initially, using **place value counters** to support if needed(See Year 4):

$$\begin{array}{r} \text{T U} \quad \text{T U} \quad \text{H T U} \\ 42 \times 23 = 966 \end{array}$$

| | | | |
|---|----|-----|----|
| | | T | U |
| 5 | x | 40 | 2 |
| | 20 | 800 | 40 |
| T | 3 | 120 | 6 |
| U | | | |

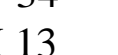
$$\begin{array}{r} 800 \\ 120 + \\ 40 \\ 6 \\ \hline 966 \end{array}$$

- + can be done in fewer steps

Move on to **formal long multiplication** with simple numbers (2 digit number x 2 digit number):

34
X 13
102
 1
340
442

34 x 3, 34 x 10



34 x 3, carrying 1 from 3 x 4

34 x 10

TH H T U

Move on to using **formal long multiplication** with more complex numbers:

| | Th | H | T | U |
|---|----|---|---|---|
| | 1 | 2 | 4 | 3 |
| X | | 8 | | |
| | 9 | 9 | 4 | 4 |
| | 1 | 3 | 2 | |

$$\begin{array}{r} 1234 \\ \times \quad 16 \\ \hline 7404 \\ 12340 \\ \hline 19744 \end{array}$$

Key vocab:

lots of, groups of

times, multiply, multiplication, multiplied by, multiple of, product

once, twice, three times... ten times... times as (big, long, wide... and so on)

repeated addition

array, row, column

double,

inverse

inverse
equals, sign, is the same as

Multiplication

X

Year 6

National Curriculum 2014 reference(s):

Identify **common factors, common multiples and prime numbers**.

Perform mental calculations, including mixed operations and large numbers.

Multiply multi-digit numbers up to 4 digits by a 2 digit whole number using the efficient written method of long multiplication.

Multiply numbers by 10, 100 and 1000 where answers are up to three decimal places.

Multiply one-digit numbers with up to two decimal places by whole numbers.

Use knowledge of the order of operations to carry out calculations involving **four operations**.

Solve problems involving the calculation and conversion of unit of measure, using decimal notation up to three decimal places where appropriate.

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

Calculate the area of parallelograms and triangles.

Calculate volume of cubes and cuboids using standard units.

Solve problems involving the relative sizes of two quantities where missing values can be found by using integer multiplication and division facts.

Solve problems involving the calculation of percentages.

Solve problems involving unequal sharing and grouping using knowledge of fractions and multiples.

Calculation methods:

Short multiplication and Long multiplication as in Year 5, but apply to numbers with decimals.



Pupils may need reminding that single digits belong in the ones (units) column.

Obviously, pupils need to have a sound understanding of place value and the formal method itself before progressing to decimal multiplication.

Use place value counters to support if needed but add counters with 0.1 and 0.01 on them.

Extend with ALGEBRA.

Key vocab:

lots of, groups of

times, multiply, multiplication, multiplied by, multiple of, product

once, twice, three times... ten times... times as (big, long, wide... and so on)

repeated addition

array, row, column

double,

inverse

equals, sign, is the same as

Division

Foundation Stage

Big Maths Steps: 1-3



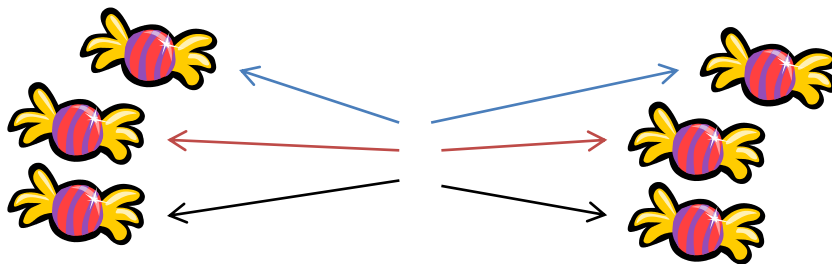
National Curriculum 2014 reference(s):

Children count reliably with numbers from one to 20.
They solve problems, including halving and sharing.
They solve practical problems that involve sharing into equal groups.

Calculation methods:

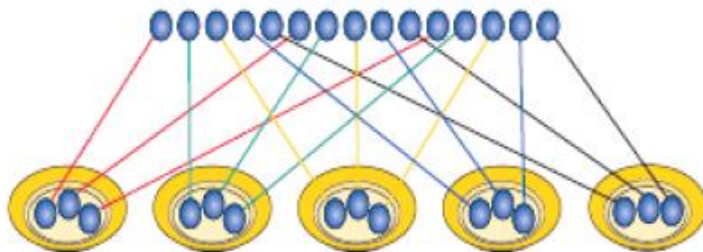
Find half of a quantity of objects by sharing them between 2. I can give out objects fairly.

Half of 6 is 3.



Practically 'share' objects fairly:

15 shared equally between 5 is 3.



How many does each person ha

Key vocab:

half, halve
count out, share out
left, left over
is the same as

Division

Big Maths Steps: 4-9



Year 1

National Curriculum 2014 reference(s):

Count in different **multiples** including 2s, 5s, and 10s.

Begin to recall and use multiplication facts for the 2, 5, 10 tables.

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

Recognise, find and name a half as one of two equal; parts of an object, shape or quantity.

Recognise, find and name a quarter as one of four equal; parts of an object, shape or quantity.

Calculation methods:

Have an understanding of 'sharing' and 'grouping'.

Pupils to **practically** 'share' and 'group' (see Foundation Stage for sharing):

There are 30 children, we need to get into groups of 5 to play a game.



How many groups of 4 stars can I make out of 12?



Key vocab:

half, halve

count out, share out

left, left over

= equals, sign, is the same as

÷ divide, divided by, divided into

Division

Big Maths Steps: 13-17



Year 2

National Curriculum 2014 reference(s):

Count in different **steps** including 2, 3, and 5 from 0.

Count in tens from and number, forward and backwards.

Recall and use multiplication and division facts for the 2, 5, 10 tables.

Recognise odd and even numbers.

Calculate the **mathematical statements** for multiplication and division within the multiplication tables and write them using \times \div = signs.

Show that multiplication of two numbers can be done in any order (**commutative**) and division of one number by another cannot.

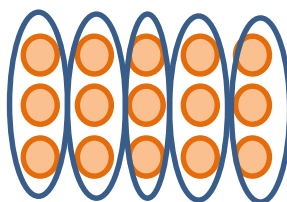
Solve **problems** involving multiplication and division, using materials, arrays, repeated addition, mental methods, and multiplication and division facts, including problems in contexts.

Recognise, find, name and write fractions $\frac{1}{3}$, $\frac{1}{4}$, $\frac{2}{4}$ and $\frac{3}{4}$ of a length, shape, set of objects or quantity.

Calculation methods:

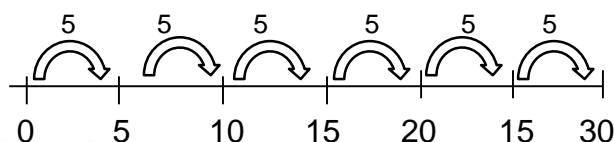
Initially, pupils to practically 'share' and 'group' using **practical equipment** and pictorial representation. Move on to using **arrays** to identify groups, use **physical counters** before pictorial representations:

How many groups of 3 are in 15?

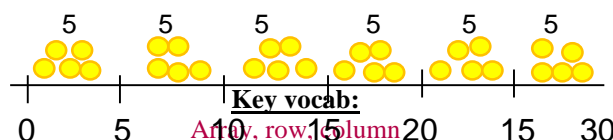


Grouping using a **number line**:

There are 30 children in the class, how many groups of 5 can we get into?



Use **counters** to support pupils understanding:



Key vocab:

Array, row, column

halve

share, share equally,

one each, two each, three each... group in pairs, threes... tens

equal groups of

\div divide, divided by, divided into

left, left over

= equals, sign, is the same as

Division Big Mats Steps: 15 - 19

Year 3



National Curriculum 2014 reference(s):

Count from 0 in **multiples** of 4, 8, 50 and 100.

Count up and down in tenths; recognise that tenths arise from dividing an object into 10 equal parts and in dividing one-digit numbers or quantities by 10.

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

Write and calculate mathematical statements for multiplication and division **using the multiplication tables** that they know, including 2 digit x 1 digit, using mental and progressing to formal written methods.

Pupils develop reliable written methods for multiplication and division, starting with calculations of two-digit numbers by one-digit numbers and progressing to the formal written methods of short multiplication and division.

Solve **problems** including missing number problems, involving multiplication and division, including integer scaling problems and correspondence problems in which n objects are connected to m objects.

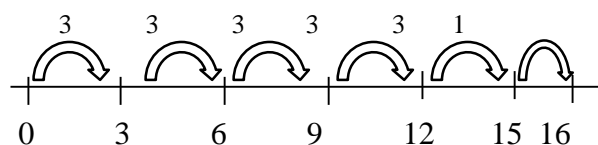
Recognise, find and write fractions of a discrete set of objects: unit fractions and non-unit fractions with small denominators.

Calculation methods:

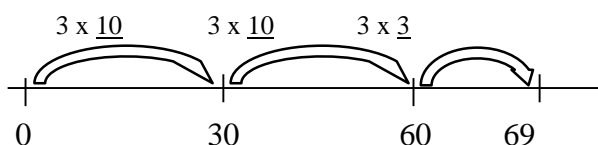
Grouping using a **number line** (see year 2), move on to calculations that leave remainders:

(Use **counters** to support pupils understanding, see year 2)

1) $16 \div 3 = 5 \text{ r } 1$

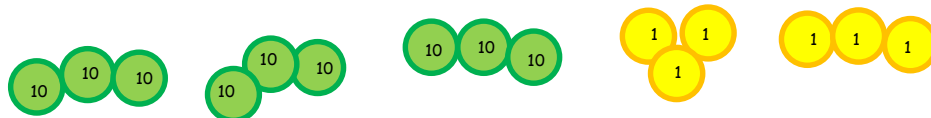


2) $69 \div 3 = 23$



Only when pupils have had experience with and demonstrated understanding of grouping for division. Begin to look at **Short division** with no remainders in the final answer

Use counters to support pupils understanding if needed:



Ensure that pupils understand what these digits represent, i.e. Not 3 lots of 3 in 9, but 30 lots of 3 in 90.

Key vocan:

Array, row, column

halve

share, share equally

one each, two each, three each... group in pairs, threes... tens,

equal groups of

÷, divide, **division**, divided by, divided into

left, left over, **remainder**

= equals, sign, is the same as

Division

Year 4



National Curriculum 2014 reference(s):

- Recall and use multiplication and division facts for the tables up to 12 x 12 (6, 7, 9, 11 and 12 not learnt previously).
 Use place value, known and derived facts to multiply and divide mentally, including **multiplying by 0 and 1; dividing by 1**; multiplying three number together.
 Recognise and use factor pairs and **commutativity** in mental calculations.
Practice to become fluent in the formal written method of short division with exact answers when dividing by a one-digit number.
 Solve problems involving increasingly harder fractions to calculate quantities, and fractions to divide quantities, including non-unit fractions where the answer is a whole number.
 Find the effect of dividing a one or two-digit number by 10 and 100, identifying the value of the digits in the answer as units, tenths and hundredths.
 Solve simple measure and money problems involving fractions and decimals to 2 decimal places.
 Convert between units of measure.
 Solve problems involving converting from hours to minutes; minutes to seconds; years to months; weeks to days.

Calculation methods:

Short division with no remainders in the final answer, use **place value counters** (see year 3):

- 1) 2 digit number ÷ by a 1 digit number:

$$\begin{array}{r} 18 \\ 4 \overline{) 72} \end{array}$$

- 2) 3 digit number ÷ by a 1 digit number:

$$\begin{array}{r} 218 \\ 4 \overline{) 872} \end{array}$$

- 3) 4 digit number ÷ by a 1 digit number:

$$\begin{array}{r} 037 \\ 5 \overline{) 185} \end{array}$$

Array, row, column
halve

share, share equally

one each, two each, three each...

group in pairs, threes... tens. equal groups of

divide, division, divided by, divided into

remainder

factor, quotient, divisible by

inverse

equals, sign, is the same as

Division

Year 5



National Curriculum 2014 reference(s):

Identify all **multiples and factors**, including finding all factor pairs of a number, and common factors of two numbers.
Solve problems involving multiplication and division where larger numbers are used by decomposing them into their factors.

Know and use the **vocabulary of prime numbers, prime factors and composite** (non-prime) numbers.

Establish where a number up to 100 is **prime** and recall prime numbers to 19.

Divide numbers mentally drawing upon known facts.

Divide numbers up to 4 digits by a 1 digit number using the formal written method of short division and interpret remainders appropriately for the context.

Divide whole numbers and those involving decimals **by 10, 100 and 1000**.

Recognise and use **square numbers and cube numbers**, and the notation for squared and cubed.

Solve problems involving all 4 operations, including combinations of these.

Solve problems involving \times and \div , including scaling by simple fractions and problems involving simple rates.

Convert between different units of metric measure.

Solve problems involving converting between units of time.

Use all 4 operations to solve problems involving measure using decimal notation and scaling.

Calculation methods:

Short division with remainders:

Pupils should consider whether remainders should be left as a reminder,
Rounded to the nearest whole or converted into a decimal or fraction.

Use **place value counters** to support changing remainders to decimals,
exchange remainders for counters of the next column.

432 \div 5 becomes

$$\begin{array}{r} 86 \\ 5 \overline{) 432} \end{array}$$

Answer: 86 remainder 2

If pupils are confident and accurate in using short division when dividing by a 1 digit number, introduce long division for calculations where they should divide by a 2 digit number (see chunking year 6).

Key vocab:

Array, row, column

halve

share, share equally one each, two each, three each...

group in pairs, threes... tens, equal groups of

divide, division, divided by, divided into

remainder

factor, quotient, divisible by

inverse

equals, sign, is the same as

Division

Year 6



National Curriculum 2014 reference(s):

Divide numbers up to 4 digits by a 1 digit number using the formal written method of short division and interpret remainders appropriately for the context.

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

Identify **common factors**, **common multiples** and **prime numbers**.

Perform mental calculations, including mixed operations and large numbers.

Divide proper fractions by whole numbers.

Divide numbers by 10, 100 and 1000 where answers are up to three decimal places.

Use knowledge of the order of operations to carry out calculations involving **four operations**.

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

Solve problems involving the relative sizes of two quantities where missing values can be found by using integer multiplication and division facts.

Solve problems involving the calculation of percentages.

Solve problems involving unequal sharing and grouping using knowledge of fractions and multiples.

Solve problems involving the calculation and conversion of unit of measure, using decimal notation up to three decimal places where appropriate.

Calculation methods:

Short division:

432 ÷ 5 becomes

$$\begin{array}{r} 86 \\ 5 \overline{) 432} \\ \underline{40} \\ 32 \\ \underline{30} \\ 2 \end{array}$$

Answer: 86 remainder 2

574 ÷ 15 becomes

$$\begin{array}{r} 38 \\ 15 \overline{) 574} \\ \underline{45} \\ 124 \\ \underline{120} \\ 4 \end{array}$$

Answer: $38 \frac{4}{15}$

511 ÷ 35 becomes

$$\begin{array}{r} 14.6 \\ 35 \overline{) 511.0} \\ \underline{35} \\ 161 \\ \underline{140} \\ 210 \\ \underline{210} \\ 0 \end{array}$$

Answer: 14.6

Long division:

432 ÷ 15 becomes

$$\begin{array}{r} 28 \\ 15 \overline{) 432} \\ \underline{30} \\ 132 \\ \underline{120} \\ 120 \\ \underline{120} \\ 0 \end{array}$$

$$\frac{4}{15} = \frac{4}{5}$$

Answer: $28 \frac{4}{5}$

I would suggest, when dividing by 2 digit numbers (or more), it may be advisable to just use the chunking method as it is easier to identify where mistakes have been made.

make a fraction $\frac{12}{15}$ break it down to its simplest form.

Where an answer leaves a remainder, children should be able to convert the remainder to a fraction or decimal (depending on the questions).

Key vocab:

Array, row, column

halve

share, share equally one each, two each, three each...

group in pairs, threes... tens, equal groups of

divide, division, divided by, divided into

remainder

factor, quotient, divisible by

inverse

equals, sign, is the same as