All Saints, Laxfield Primary School

September 2022 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.

This calculation policy should be used to support children to develop a deep understanding of number and calculation. This policy has been designed to teach children thro ugh the use of concrete, pictorial and abstract representations.

Concrete representation— a pupil is first introduced to an idea or skill by acting it out with real objects. This is a 'hands on' component using real objects and is a foundation for conceptual understanding.

Pictorial representation – a pupil has sufficiently understood the 'hands on' experiences performed and can now relate them to representations, such as a diagram or picture of the problem.

Abstract representation—a pupil is now capable of representing problems by using mathematical notation, for example 12 x 2 = 24.

It is important that conceptual understanding, supported by the use of representation, is secure for all procedures. Reinforcement is achieved by going back and forth between these representations.

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.

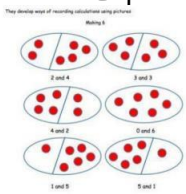
Providing a context for calculation:

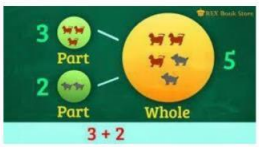
It is important that any type of calculation is given a real life context o r problem solving approach to help build children's understanding of the purpose of calculation, and to help them recognise when to use certain operations and methods when faced with problems. This must be a priority within calculation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

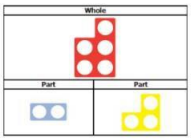
National Curriculum Addition

Reception

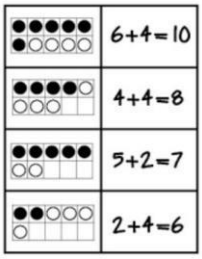
- Explore part part whole relationship— combining two parts to make a whole





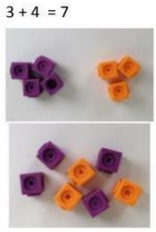


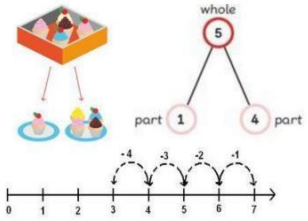
- Using the ten frame/egg boxes to support addition of single digits— counting all/ combining two groups



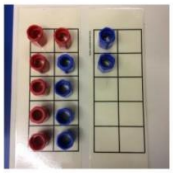
Year One

- Combining two parts to make a whole: part whole model. Joining two groups and then recounting all objects





- Using ten frames, Singapore bars and egg boxes.



Make 9 in one and 3 in the other. Take one from the 3 to make the 9 into a ten....10+2 = 12

- *The + and = signs and missing numbers*

  Children need to understand the concept of equality before using the '=' sign. Calculations should be written either side of the equality sign so that the sign is not just interpreted as 'the answer'.

  Example

  2 = 1+ 1

  2 + 3 = 4 + 1

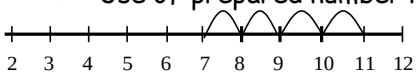
  3 = 3

  2 + 2 + 2 = 4 + 2

- Missing numbers need to be placed in all possible places.

  3 + 4 = = 3 + 4
  3 + = 7 7 = + 4
  + 4 = 7 7 = 3 +

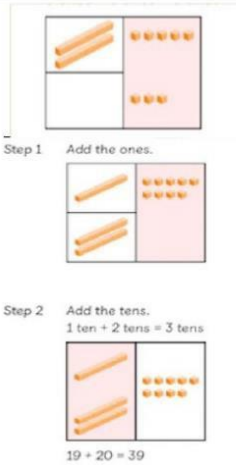
- Use of prepared number lines and concrete objects



- Children are encouraged to record by drawing jumps on prepared lines.

Year Two

- Using concrete and pictorial representations to add a 2 digit number to a 1 digit number and a 2 digit number to a tens number.



- The + and = signs and missing numbers

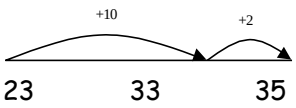
  Continue using a range of equations (See Year 1) but with appropriate, larger numbers as specified in Year 2 age level standards, i.e. extend to 14 + 5 = 10 + and 32 + + = 100 35 = 1 + + 5.

- Partition into tens and ones and recombine

  12 + 23 = 10 + 2 + 20 + 3
  = 30 + 5
  = 35

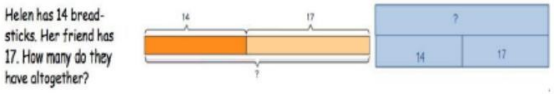
- Partitioning the second number only

  23 + 12 = 23 + 10 + 2
  = 33 + 2
  = 35



  Example: Add 9 or 11 by adding 10 and adjusting by 1 35 + 9 = 44

- Using the bar model to find missing digits: It is important for the children to use the bar model in this way to encourage the use of it to aid problem solving.

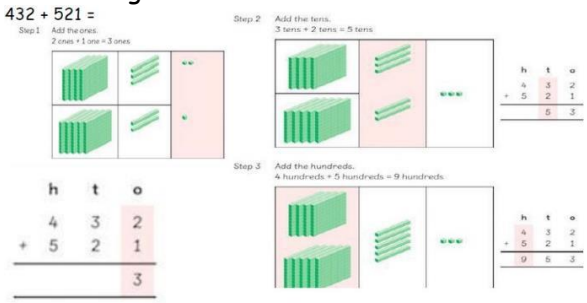


- Towards end of year 2, children to begin to learn the written formal method for addition. This will prepare them for year 3 and Key Stage 2.

Year Three

- The + and = signs and missing numbers
  Continue using a range of equations as in Year 1 and Year 2 but with appropriate larger numbers specified in the age level standards.

- Progression from deanes to formal written method.

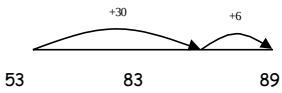


- Progression in mental calculations with larger numbers
  Calculate HTU + U
  Calculate HTU + TU
  Calculate HTU + HTU
- Progress from no crossing of boundaries to crossing of boundary.

- Partition into tens and ones and recombine Develop from Year 2- partitioning both numbers and recombining.

- Refine to partitioning the second number only:

  36 + 53 = 53 + 30 + 6
  = 83 + 6
  = 89



- Add a near multiple of 10 to a two-digit number Continue work from Year 2 but with appropriate numbers: 35 + 19 is the same as 35 + 20 – 1.

- Formal methods of columnar addition to add numbers with up to three digits

  285
  +73
  8
  150
  200
  358

- Extend to decimals in the context of money

  £ 2.50 + £ 1.75
  £ 2.50
  + £ 1.75
  £ 4.25
  1

- The expanded method should be used if children experience persisting difficulties.

- Children should then progress to the formal written method for addition. This should be taught early on in the year.

- Bar model to be used to help children with word problems.

Year Four

- The + and = signs and missing numbers
- Continue using a range of equations as in Key Stage 1 and Year 3 but with appropriate numbers.
- Partition into hundreds, tens and ones and recombine Either partition both numbers and recombine or partition the second number only e.g.

  358 + 73 = 358 + 70 + 3
  = 428 + 3
  = 431

- Add or subtract the nearest multiple of 10 or 100, then adjust
- Continue as in Year 2, 3 and 4 but with appropriate numbers e.g. 458 + 79 = is the same as 458 + 80 - 1

- Addition of numbers with at least four digits using formal method of columnar addition

```
  358
 +73
 431
  1 1
```

```
 3587
+675
4262
 1 1 1
```

The formal, efficient method of columnar addition will involve crossing of boundaries (at the tens, hundreds and/or thousands). Take a systematic approach to teaching this looking at crossing each boundary in turn before mixed practice.

- Revert to expanded method if children experience difficulties.

- Extend addition to decimals (same number of decimals places) and adding several numbers (with different numbers of digits).

- Bar modelling and part part whole to also be taught alongside this to develop word problems.

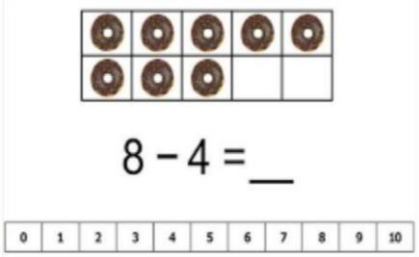
- Deanes and place value counters to also be used to help enforce understanding.

National Curriculum Subtraction

Reception

- Using concrete strategies for counting

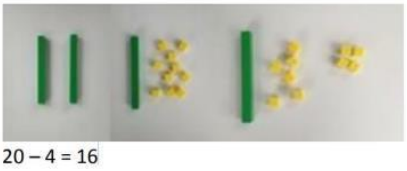
- Using the ten frames to support subtraction by taking away



Year One

- Subtracting using the part part whole model

- When subtracting using Dienes children should be taught to regroup (rename) a ten rod fo r 10 ones and then subtract from those



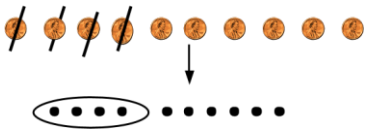
- *The - and = signs and missing numbers*

  7 - 3 = ? ? = 7 - 3

  7 - ? = 4 4 = ? - 3

- *Use of pictures, marks and concrete objects*

- Sam spent 4p. What was his change from 10p?

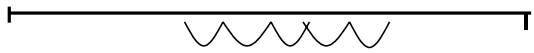


- Number Lines

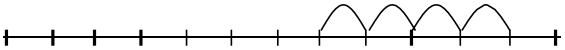
  Example- Counting Back/Down

  11 – 7

0 1 2 3 4 5 6 7 8 9 10 11 12



- *Example- Counting On/Up*
  The difference between 7 and 11

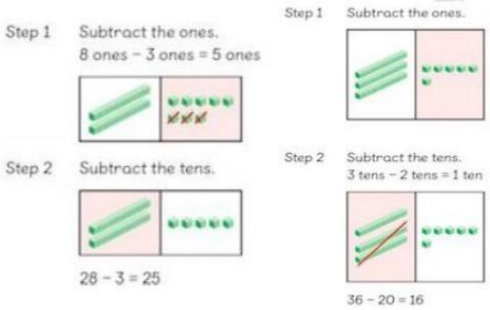


0 1 2 3 4 5 6 7 8 9 10 11 12

- Children are encouraged to record by drawing jumps on prepared lines and constructing their own lines.

Year Two

- Using pictorial and concrete representations using objects and deanes.

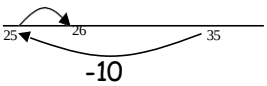


- The – and = signs and missing numbers
  Continue using a range of equations (See Year 1) but with appropriate numbers in relation to Year 2 age-level standards, i.e. extend to 14 + 5 = 20 - 1.

- Find a small difference by counting up
  42 – 39 = 3 + 1 + 2

  39 40 42

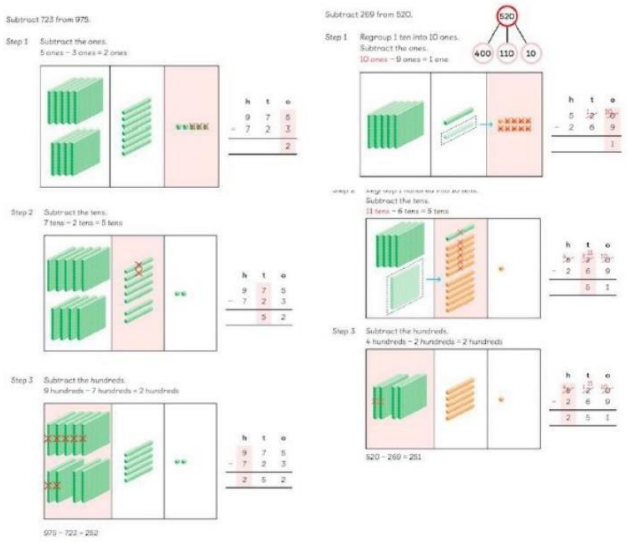
  Example: Subtract 9 or 11 & begin to add/subtract 19 or 21
  35 – 9 = 26 +1



  Use known number facts and place value to subtract
  (Partition second number only) 37 – 12 = 37 – 10 – 2 = 27 – 2 = 25

Year Three

- Use pictorial and concrete resources to develop formal written subtraction. Use of deanes and part part whole model.



- The - and = signs and missing numbers
  Continue using a range of equations as in Year 1 and Year 2 but with appropriate larger numbers specified in the age level standards.

- Find a small difference by counting up
  Continue from Year 2 but with appropriate numbers, e.g. 102 – 97 = 5

- Subtract mentally a 'near multiple of 10' to or from a two-digit number, extending to three digit numbers
  Continue as in Year 2 but with appropriate numbers e.g. 78 – 49 is the same as 78 – 50 + 1

- Progression in mental calculations with larger numbers
  Calculate HTU - U
  Calculate HTU - T
  Calculate HTU - H
  Progress from no crossing of boundaries to crossing of boundary.

- Bar model to be used for word problems.

- Formal methods of columnar subtraction to subtract numbers with up to three digits
- See Appendix 1 examples in Year 5 and Year 6 section of this document.

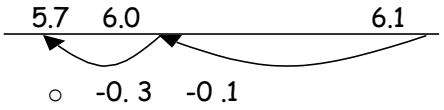
*From Year 3 onwards, teachers need to keep in mind the methods specified in age-level standards for end of Key Stage 2. Children should be developing their capacity to use formal written methods for all four number operations.

Year Four

- The – and = signs and missing numbers
  Continue using a range of equations as in Key Stage 1 and Year 3 but with appropriate numbers.

- Differences
  Find a difference by counting up, e.g. 8006 – 2993 = 5013. This can be modelled on an empty number line.

- Use known number facts and place value to subtract decimals
  6.1 – 0.4 = 5.7



- Subtraction with at least four digits using formal method of columnar subtraction
  For instance, 6467 – 2684 = 3783
  Using expanded column subtraction where children experience difficulty with decomposition.

- Extend subtraction to decimals (same number of decimals places) and adding several numbers (with different numbers of digits)

- Bar modelling and part part whole to also be taught alongside this to develop word problems.

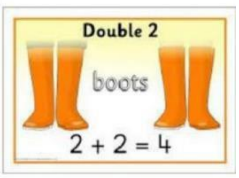
- Deanes and place value counters to also be used to help enforce understanding.

As specified in Year 3, teachers need to keep in mind the methods specified in age-level standards for end of Key Stage 2. Children should be developing their capacity to use formal written methods for all four number operations.

National Curriculum Multiplication

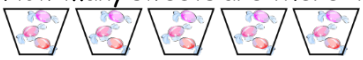
Reception

- Experiencing equal groups of objects

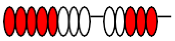


Year One

- Use of pictures and objects
  There are 3 sweets in one bag.
  How many sweets are there in 5 bags?



- Count in multiples of one, two, five and ten Counting steps using bead string and on prepared number lines.



  Counting in multiples using a range of objects, e.g. pairs of legs on animals; fingers in gloves etc.

- Use of arrays

- Counting in rows and columns

Two groups of three is six
Three groups of two is six

So 6 = 2 + 2 +2 or 6 = 3 + 3

Year Two

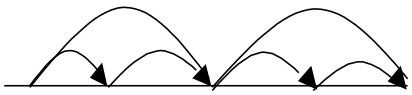
- The x and = signs and missing numbers
  7 x 2 = ? ? = 2 x 7
  7 x? = 14 14 = ?x 7 ? x 2 = 14 14 = 2 x ?

- Use materials, arrays, repeated addition
  (including solving problems in context)

□□ □□ □□ □□ 4 x 2 or 4 + 4 □□□□ □□□□

2 x 4

Or repeated



addition

0 2 4 6 8

2 + 2 + 2 + 2

Year Three

- The x and = signs and missing numbers
  Continue using a range of equations as in Year 2 but with appropriate numbers in relation to age-level standards.

- TU x U
  Use known facts x3, x4, x8 (Year 3 age-level standards) and x2, x5 and x10 (Year 2 age-level standards).

x	30	5
2	60	10

x	30	2
3	90	6

- At Year 3, children progress to using more formal written methods. In this case, the grid method drawing on knowledge of place value, multiplication facts and their ability to recombine partitioned numbers to derive an answer.

- Bar modelling to be used in word problems.

*From Year 3 onwards, teachers need to keep in mind the methods specified in age-level standards for end of Key Stage 2. Children should be developing their capacity to use formal written methods for all four number operations.

Year Four

- The x and = signs and missing numbers
  Continue using a range of equations but with appropriate numbers for Year 4.

- TU x U (See Year 3) and HTU x U (Introduced in Year 4 age-level standards).
  Partition
  23 x 4 = 92

  23 x 4 = (20 x 4) + (3 x 4)
  = (80) + (12)
  = 92

- Use the grid method of multiplication
  23 x 7 is approximately 20 x 10 = 200

x	20	3
7	140	21

As specified in Year 3, teachers need to keep in mind the methods specified in age-level standards for end of Key Stage 2. Children should be developing their capacity to use formal written methods for all four number operations.

NB: It is at the teacher's discretion on whether they progress the year 4s onto the formal written method of short multiplication. This will depend on the ability of the class and the children.

National Curriculum Division

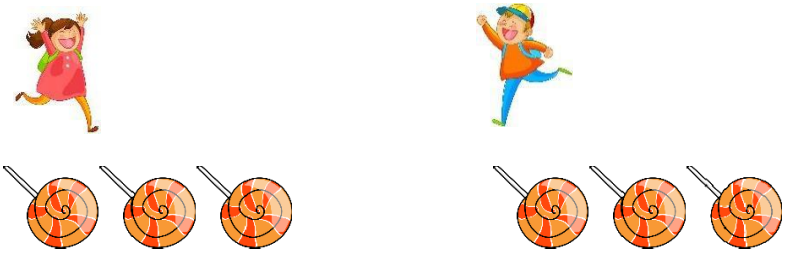
Reception

- Sharing practical objects

Year One

- Use of pictures and objects or marks
  Children get into teams of 4 to play a game. How many teams are there?

- Sharing
  6 sweets are shared between 2 people. How many do they have each?

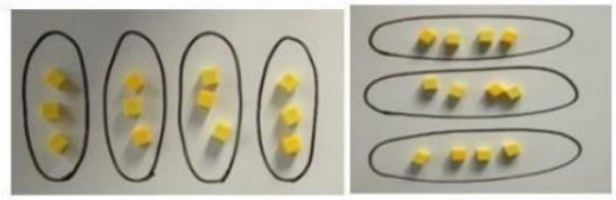


- Make use of practical activities involving sharing, e.g. distributing cards when playing a game, putting objects onto plates, into cups, hoops etc.

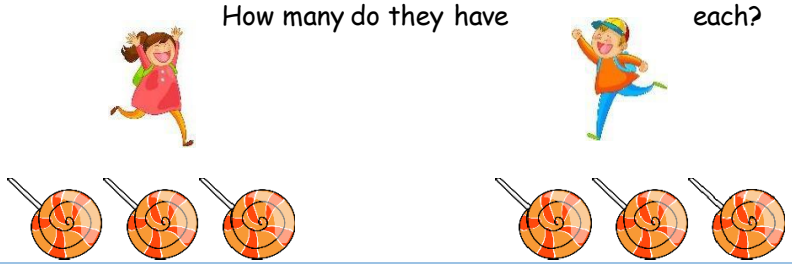
Year Two

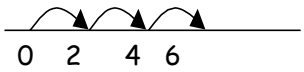
- The ÷ and = signs and missing numbers
  6 ÷ 2 = ? ? = 6 ÷ 2
  6 ÷ ? = 3 3 = 6 ÷ ?
  ? ÷ 2 = 3 3 = ? ÷ 2

- Use materials, arrays, repeated addition (including solving problems in context)
- *Use of sharing and grouping*



- *Sharing*
  6 sweets are shared between 2 people. How many do they have each?



- *Grouping*
  There are 6 sweets.
  How many people can have 2 each?
  
  (How many 2's make 6?)
  0 2 4 6

  Find and name fractions of length, shape and sets of objects and quantities
  Use of diagrams- count all equal parts to determine denominator. Link to division into equal groups/parts.

Year Three

- MD3.2 The ÷ and = signs and missing numbers Continue using a range of equations as in Year 2 but with appropriate numbers in relation to age-level standards.

- MD3.2 TU ÷ U Grouping 
- How many 3s make 18? 0 3 6 9 12 15 18

- MD3.2 & MD3.3 Remainders
- 16 ÷ 3 = 5 r1
- Sharing – There are 16 sweets shared between 3, how many left over?
  Grouping – How many 3s make 16, how many left over?

0 3 6 9 12 15 16

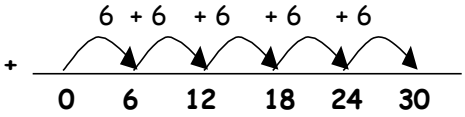
- Children with secure knowledge of multiplication facts and subtraction may progress to 'chunking' where TU are divided by U.

***From Year 3 onwards, teachers need to keep in mind the methods specified in age-level standards for end of Key Stage 2 (See Year 5 and Year 6 Calculation Policy Document). Children should be developing their capacity to use formal written methods for all four number operations.**

Year Four

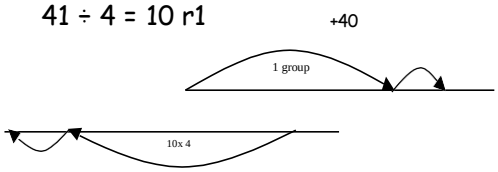
- The ÷ and = signs and missing numbers
  Continue using a range of equations but with appropriate numbers for Year 4.

- MD4.3 Sharing and grouping 30 ÷ 6 can be modelled as:
  Grouping – groups of 6 taken away and the number of groups counted e.g.



  Sharing – sharing among 6, the number given to each person.

- Remainders
  Note three approaches below:
  41 ÷ 4 = 10 r1



41 (10 x 4) + 1 **+1**

Towards the end of year 4 children will begin to develop short division to prepare them for the formal written methods in year 5 and year 6.

98 ÷ 7 becomes

$$\begin{array}{r} 1\ 4 \\ 7\overline{)\ 9\ 8} \\ \scriptstyle 2 \end{array}$$

Answer: 14

432 ÷ 5 becomes

$$\begin{array}{r} 8\ 6\ r2 \\ 5\overline{)\ 4\ 3\ 2} \\ \scriptstyle 3 \end{array}$$

Answer: 86 remainder 2

496 ÷ 11 becomes

$$\begin{array}{r} 4\ 5\ r1 \\ 1\ 1\overline{)\ 4\ 9\ 6} \\ \scriptstyle 5 \end{array}$$

Answer: $45\frac{1}{11}$

As specified in Year 3, teachers need to keep in mind the methods specified in age-level standards for end of Key Stage 2 (See Year 5 and Year 6 Calculation Policy Document). Children should be developing their capacity to use formal written methods for all four number operations.

New Mathematics Calculation Policy: Year 5 and Year 6

The exemplification of formal methods here should be taken into account by all Key Stage 2 teachers so children are adequately prepared by Year 5 and into Year 6 to use the means of calculating specified in age-level standards.

Addition & Subtraction

AS5.1 Columnar Addition & Subtraction

789 + 642 becomes

$$\begin{array}{r} 7\ 8\ 9 \\ +\ 6\ 4\ 2 \\ \hline 1\ 4\ 3\ 1 \\ \hline 1\ 1 \end{array}$$

Answer: 1431

874 – 523 becomes

$$\begin{array}{r} 8\ 7\ 4 \\ -\ 5\ 2\ 3 \\ \hline 3\ 5\ 1 \end{array}$$

Answer: 351

932 – 457 becomes

$$\begin{array}{r} {\scriptstyle 8\ \ 12\ \ 1} \\ 9\ \not{3}\ \not{2} \\ -\ 4\ 5\ 7 \\ \hline 4\ 7\ 5 \end{array}$$

Answer: 475

Multiplication & Division

MD5.5 Short Multiplication (DfE, 2013, Appendix 1)

24 × 6 becomes

$$\begin{array}{r} 2\ 4 \\ \times\ \ 6 \\ \hline 1\ 4\ 4 \\ \hline {\scriptstyle 2} \end{array}$$

Answer: 144

342 × 7 becomes

$$\begin{array}{r} 3\ 4\ 2 \\ \times\ \ 7 \\ \hline 2\ 3\ 9\ 4 \\ \hline {\scriptstyle 2\ \ 1} \end{array}$$

Answer: 2394

2741 × 6 becomes

$$\begin{array}{r} 2\ 7\ 4\ 1 \\ \times\ \ 6 \\ \hline 1\ 6\ 4\ 4\ 6 \\ \hline {\scriptstyle 4\ \ 2} \end{array}$$

Answer: 16 446

MD5.7 & ASMD6.2b Short Division (DfE, 2013, Appendix 1)

98 ÷ 7 becomes

$$\begin{array}{r} 1\ 4 \\ \hline 7\ \big)\ 9\ 8 \\ \quad\ {\scriptstyle 2} \end{array}$$

Answer: 14

432 ÷ 5 becomes

$$\begin{array}{r} 8\ 6\ \text{r}2 \\ \hline 5\ \big)\ 4\ 3\ 2 \\ \quad\ {\scriptstyle 3} \end{array}$$

Answer: 86 remainder 2

496 ÷ 11 becomes

$$\begin{array}{r} 4\ 5\ \text{r}1 \\ \hline 1\ 1\ \big)\ 4\ 9\ 6 \\ \quad\ {\scriptstyle 5} \end{array}$$

Answer: $45\frac{1}{11}$

MD5.5 & ASMD6.1 Long Multiplication (DfE, 2013, Appendix 1)

		6	3	2	1
x				1	5
	3	1_1	6_1	0	5
+	6	3	2	1	0
	9	4	8	1	5
			1		

		6	3	2	1
x				2	5
+	3	1_1	6_1	0	5
1	2	6	4	2	0
1	5	8	0	2	5
			1		

ASMD6.2a Long Division (DfE, 2013, Appendix 1)

432 ÷ 15 becomes

$$\begin{array}{r} 2\ 8\ \text{r}12 \\ 1\ 5\ \big|\ 4\ 3\ 2 \\ \quad 3\ 0\ 0 \\ \hline \quad 1\ 3\ 2 \\ \quad 1\ 2\ 0 \\ \hline \quad\ \ 1\ 2 \end{array}$$

Answer: 28 remainder 12

432 ÷ 15 becomes

$$\begin{array}{r} 2\ 8 \\ 1\ 5\ \big|\ 4\ 3\ 2 \\ \quad 3\ 0\ 0 \quad 15\times20 \\ \hline \quad 1\ 3\ 2 \\ \quad 1\ 2\ 0 \quad 15\times8 \\ \hline \quad\ \ 1\ 2 \end{array}$$

$\frac{12}{15} = \frac{4}{5}$

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

432 ÷ 15 becomes

$$\begin{array}{r} 2\ 8\cdot 8 \\ 1\ 5\ \big|\ 4\ 3\ 2\cdot 0 \\ \quad 3\ 0 \\ \hline \quad 1\ 3\ 2 \\ \quad 1\ 2\ 0 \\ \hline \quad\ \ 1\ 2\ 0 \\ \quad\ \ 1\ 2\ 0 \end{array}$$

Long division will be at the teacher's discretion. Children are able to do double digit division using the short method of division.