Enriching Learning, Enriching Life'

John 10:10 '...I have come that they may have life, and have it to the full.'

# KS1 and KS2 Maths Calculation Policy

| Year 1 | Year 2 | Year 3 |
|---|---|---|
| Pupils memorise and reason with number bonds to 10 and 20 in several forms. | Practice addition to 20 and become increasing fluent in deriving facts. | I can add numbers with up to three digits using formal written methods. |

**Addition**

**Year 1**

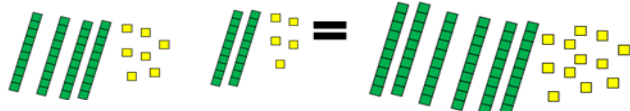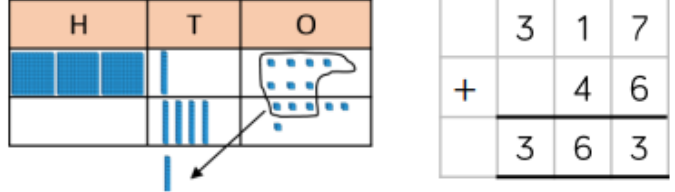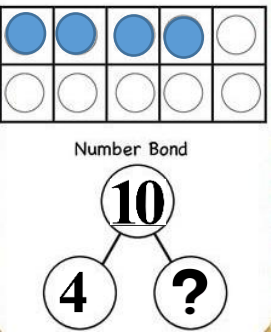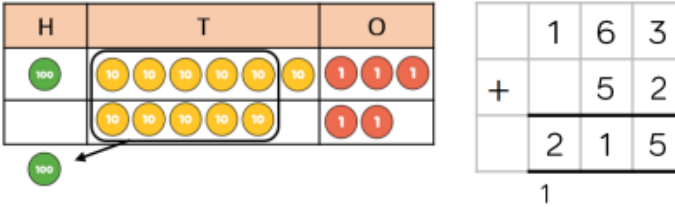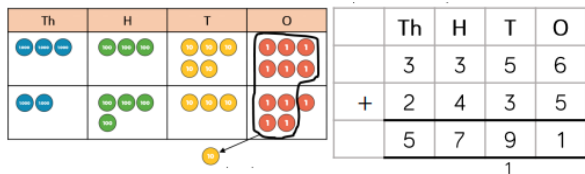Complete the part whole models by drawing the counters then writing the numerals. Linking to bar modelling in Year 1.



Understanding of counting on with a numbertrack and using numicon.



Understanding of counting on with a number line (supported by models and images).
7+4



Ten frames to be used for addition, specifically number bonds.



Number Bond
10
4   ?

4 + ? = 10

**Year 2**

Methods taught in Year 1 should continue to be used to consolidate learning and understanding in Year 2.

**Continue to use number lines** to develop understanding of:



25 + 36

Partitioning and bridging through 10.
The steps in addition often bridge through a multiple of 10
e.g. Children should be able to partition the 7 to relate adding the 2 and then the 5.
8 + 7 = 15

Use of diene to add 2 two digit numbers
47+25=

47   +   25   = 72



Children work towards using column method:
E.g. 28+7=



Tens   Ones
2 8
+   7
3 5
1

**Year 3**

Pupil needing to use number lines from Year 2 into 3 should continue to do so depending on their ability.
Using base **10 apparatus** for addition:
E,g 245+7=



Using **number lines**:
E.g 346+7=



**Towards a Written Method**
Introduce column addition modelled with place value counters or Dienes.

| Year 4 | Year 5 | Year 6 |
|---|---|---|
| Pupils continue to practise mental methods with increasingly large numbers using models and images to help them. | Pupils continue to practise mental methods with increasingly large numbers using models and images to help them. Children to practise mental and methods with increasingly large numbers to add (e.g. 12,462 + 2300 = the 762) using models and images to help them. | Pupils continue to practise mental methods with increasingly large numbers using models and images to help them. Children to practise mental and methods with increasingly large numbers to add (e.g. 12,462 + 2300 = 14,762) using models and images to help them. |

**Addition**

### Year 4

Children can draw a pictoral representation of the columns and place value counters to further support their learning and understanding.



789 + 642 becomes

2634
+4517
7151

Answer: 1431
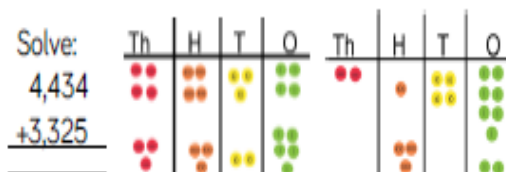
Find the missing numbers. What methods did you use?



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

### Year 5

**Written methods (progressing to more than 4-digits)**

As Year 4, progressing when understanding of the expanded method is secure, children will move on to the formal column method for whole numbers and decimal numbers as an efficient written algorithm.
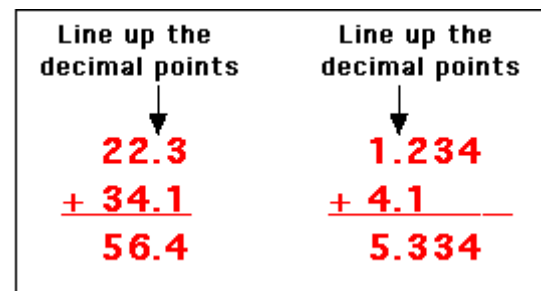


### Year 6

**Written methods**
As year 5, progressing to larger numbers, aiming for both conceptual understanding and procedural fluency with columnar method to be secured.
Continue calculating with decimals, including those with different numbers of decimal places



Pupils will also learn to add three decimal numbers.

3.452
9.74
29.338 +

| | Year 1 | Year 2 | Year 3 |
|---|---|---|---|
| **Subtraction** | Pupils memorise and reason with number bonds in several forms (16 - 7 = 9  7 = 16 – 9) | Practise subtraction to 20 becoming increasingly fluent in deriving facts (such as; 10 - 7 = 3  7 = 10 – 3 to calculate 100 – 70 = 30 70 = 100 - 30 ) | Practise solving varied subtraction questions – calculations with two digit numbers, the answers exceed 100. |

| Year 1 | Year 2 | Year 3 |
|---|---|---|
| Missing number problems e.g. 7 = □ - 9; 20 - □ = 9; 15 – 9 = □; □ - □ = 11; 16 – 0 = □ | Missing number problems e.g. 52 – 8 = □; □ – 20 = 25; 22 = □ – 21; 6 + □ + 3 = 11 | Pupil needing to use number lines from Year 2 into 3 should continue to do so depending on their ability. |

**Year 1**

Missing number problems e.g. 7 = □ - 9; 20 - □ = 9; 15 – 9 = □; □ - □ = 11; 16 – 0 = □



Use physical objects, counters, cubes etc to show how objects can be taken away.
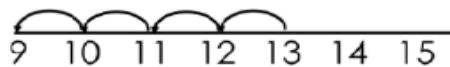
6 – 2 = 4

4 – 2 = 2
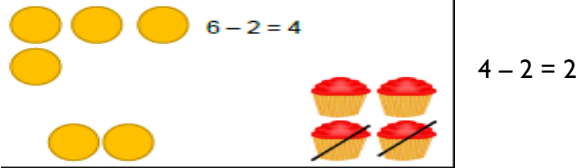
Understand subtraction as take-away:



-5

0     14     19
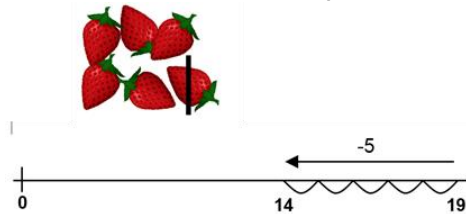
Understand subtraction as finding the difference:
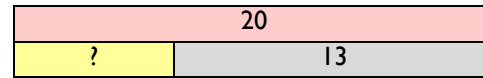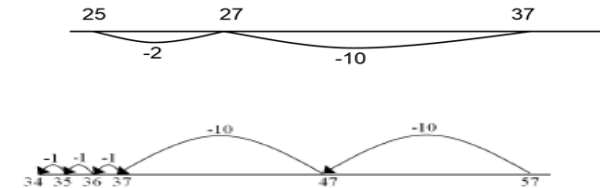
Count back on a number line or number track



9  10  11  12  13  14  15

Start at the bigger number and count back the smaller number showing the jumps on the number line.

**Year 2**

Missing number problems e.g. 52 – 8 = □; □ – 20 = 25; 22 = □ – 21; 6 + □ + 3 = 11

20 - ? = 13

| 20 | |
|---|---|
| ? | 13 |

Use number lines to model take-away and difference. E.g.



25          27                    37
   -2            -10



-1 -1 -1          -10          -10
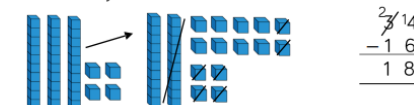34 35 36 37              47              57

This can progress all the way to counting back using two 2 digit numbers.

**Written methods (progressing to 2-digits)**
Introduce column subtraction modelled with place value counters or Dienes.



Tens  Ones
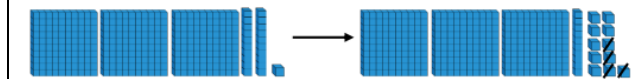¹2̸ ¹4
  –    8
  1  6

Take 16 away from 34

²3̸ ¹4
– 1  6
  1  8

**Year 3**

Pupil needing to use number lines from Year 2 into 3 should continue to do so depending on their ability.
Using base **10 apparatus** for subtraction:
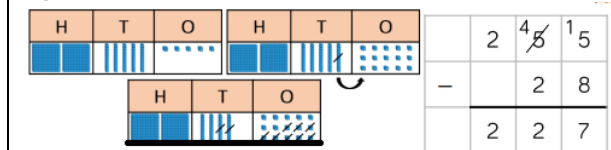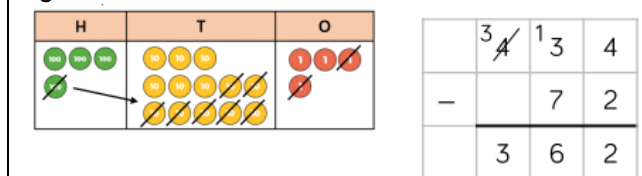E.g. 321-4=



Using **number lines**:

E.g.132-4=



125 126 127 128 129 130 131 132 133 134 135
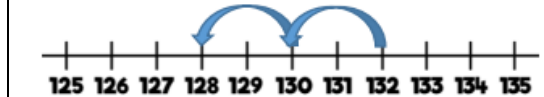
**Written methods (progressing to 3-digits)**
Introduce column subtraction modelled with place value counters or Dienes.
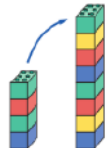e.g. 255-28=



| | | | 2 | ⁴5̸ | ¹5 |
|---|---|---|---|---|---|
| | | – | | 2 | 8 |
| | | | 2 | 2 | 7 |

e.g. 434-72=



| | | | ³4̸ | ¹3 | 4 |
|---|---|---|---|---|---|
| | | – | | 7 | 2 |
| | | | 3 | 6 | 2 |

| Year 4 | Year 5 | Year 6 |
|---|---|---|
| Pupils continue to practise mental methods with increasing large numbers using models and images to help them. | Pupils continue to practise mental methods with increasingly large numbers using models and images to help them. Children to practise mental and written methods with increasingly large numbers to aid fluency (12,462 – 2300 = 4,762) using models and images to help them. | Pupils continue to practise mental methods with increasingly large numbers using models and images to help them. Children to practise mental and written methods with increasingly large numbers to aid fluency (12,462 – 2300 = 4,762) using models and images to help them. |

**Subtraction**

**Year 4**

Children can draw a pictoral representation of the columns and place value counters to further support their learning and understanding.



| Th | H | T | O |
|---|---|---|---|
| 3 | 4 | 5 | 4 |
| − 1 | 2 | 2 | 4 |
| 2 | 2 | 3 | 0 |

874 – 523 becomes

```
  8 7 4
− 5 2 3
-------
  3 5 1
```

Answer: 351

932 – 457 becomes



Answer: 475

932 – 457 becomes



Answer: 475

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



line up the decimals

44.5
− 3.3
41.2

**Year 5**

**Written methods (progressing to more than 4-digits)**

As Year 4, progressing when understanding of the expanded method is secure, children will move on to the formal column method for whole numbers and decimal numbers as an efficient written algorithm.



Line up the decimal points

4.321
− 4.1
0.221

**Year 6**

**Written methods**
As year 5, progressing to larger numbers, aiming for both conceptual understanding and procedural fluency with columnar method to be secured.
Continue calculating with decimals, including those with different numbers of decimal places

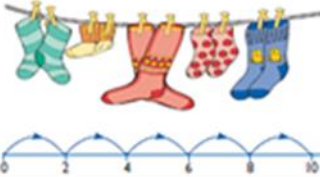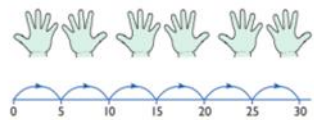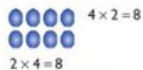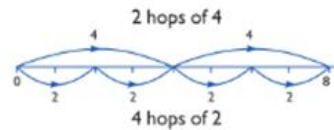| | Year 1 | Year 2 | Year 3 |
|---|---|---|---|
| **Multiplication** | Through grouping and sharing small quantities, pupils begin to understand doubling numbers and quantities. The children can count in twos, fives and tens. | Children practise and become fluent in the 2, 5 and 10 multiplication tables. They connect the 10 multiplication table to place value. | Practise their recall of multiplication tables and through doubling they connect the 2, 4 and 8 multiplication tables. |
| | Understand multiplication is related to doubling and combing groups of the same size (repeated addition)<br><br>double 4 is 8<br>$4 \times 2 = 8$<br><br>Washing line, and other practical resources for counting. Concrete objects. Numicon; bundles of straws, bead strings<br><br>$2 + 2 + 2 + 2 + 2 = 10$<br>$2 \times 5 = 10$<br>2 multiplied by 5<br>5 pairs<br>5 hops of 2<br><br>$5 + 5 + 5 + 5 + 5 + 5 = 30$<br>$5 \times 6 = 30$<br>5 multiplied by 6<br>6 groups of 5<br>6 hops of 5<br><br>Problem solving with concrete objects (including money and measures. Use cuissenaire rods and numicon to develop the vocabulary relating to 'times' –<br>Pick up five, 4 times. Use arrays to understand multiplication can be done in any order (commutative)<br><br>$4 \times 2 = 8$<br>$2 \times 4 = 8$<br>$2 \times 4 = 8$<br>$4 \times 2 = 8$<br>2 hops of 4<br>4 hops of 2 | Expressing multiplication as a number sentence using x<br>Using understanding of the inverse and practical resources to solve missing number problems.<br>$7 \times 2 = \square$      $\square = 2 \times 7$<br>$7 \times \square = 14$     $14 = \square \times 7$<br>$\square \times 2 = 14$     $14 = 2 \times \square$<br>$\square \textcircled{x} = 14$      $14 = \square \textcircled{x}$<br>Develop understanding of multiplication using array and number lines (see Year 1). Include multiplications not in the 2, 5 or 10 times tables. Begin to develop understanding of multiplication as scaling (3 times bigger/taller).<br><br>$5 + 5 + 5 = 15$<br>$3 + 3 + 3 + 3 + 3 = 15$<br><br>$5 \times 3 = 15$<br>$3 \times 5 = 15$<br><br>Towards written methods<br>Use jottings to develop an understanding of doubling two digit numbers.<br><br>16<br>10    6<br>x2    x2<br>20    12 | Doubling 2 digit numbers using partitioning – using jottings from Year 2.<br>**Written methods (progressing to 2d x 1d)**<br>Developing written methods using understanding of visual images.<br>Show the link with arrays to first introduce the grid method.<br><br>| x | 10 | 3 |<br>| 4 | | |<br>4 rows of 10<br>4 rows of 3<br><br>Move on to using Base 10 to move towards a more compact method.<br><br>| x | Tens | ones |<br>4 rows of 13<br><br>Move on to place value counters to show how we are finding groups of a number. We are multiplying by 4 so we need 4 rows.<br><br>Calculations<br>4 x 126<br><br>Fill each row with 126.<br><br>Calculations<br>4 x 126<br><br>Add up each column, starting with the ones making any exchanges needed.<br><br>Then you have your answer. |

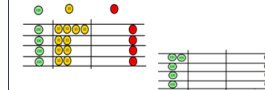| Year 4 | Year 5 | Year 6 |
|---|---|---|
| Recall all multiplication facts up to 12 x 12. Counting in multiples of 6, 7, 9, 25 and 1000, and steps of 1/100. Solving practical problems where children need to scale up. Relate to known number facts. (E.g. how tall would a 25cm sunflower be if it grew 6 times taller. | Identify multiples and factors and factor pairs of numbers. Know and use prime numbers and prime factors. Recognise squared and cubed numbers (using the correct notation). | Undertake mental multiplications with increasingly hard numbers and decimals. Continue to use all multiplication facts to aid fluency. |
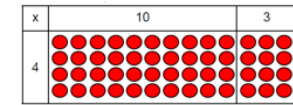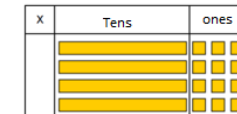
**Multiplication**

**Year 4**

**Begin by using counting objects and resources.**

| Hundreds | Tens | Units |
|---|---|---|
| 100 | ●● | ⦿⦿⦿⦿⦿⦿ |
| 100 | ●● | ⦿⦿⦿⦿⦿ |
| 100 | ●● | ⦿⦿⦿⦿⦿ |

126x3=

**Then use this to lead into grid multiplication**

| x | 100 | 20 | 6 |
|---|---|---|---|
| 3 | 300 | 60 | 18 |

300 + 60 + 18

**Leading to expanded vertical method**

```
  126
x   3
   18  (3 x 6)
   60  (3 x 20)
  300  (3 x 100)
  378
```

**Compact vertical method**

```
  1 2 6
x     3
  3 7 8
    1
```

It is important at this stage that they always multiply the ones first and note down their answer followed by the tens which they note below.

**Year 5**

**Begin with grid method**
47x36=

| x | 40 | 7 |
|---|---|---|
| 30 | 1200 | 210 |
| 6 | 240 | 42 |

```
  1200
+  240
   210
    42
  1692
```

**Leading to expanded vertical**

```
   47
 x 36
   42  (6x7)
  240  (6x40)
  210  (30x7)
 1200  (30x40)
 1692
```

Notice that we start by multiplying the digit in the one's place first.

Compact method:

```
   4 7
 x 3 6
   2 8 2
     ⁴
 1 4 1 0
     ²
 1 6 9 2
```
Answer: 47 x 36 = 1692

**Year 6**

Multiply multi-digit numbers up to 4 digits by a two-digit whole number using the efficient written method of long multiplication.
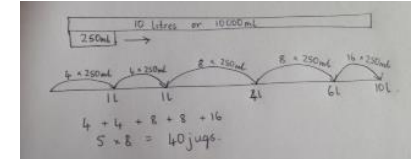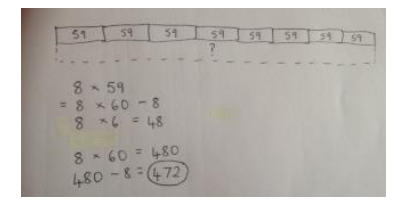Start with long multiplication, reminding the children about lining up their numbers clearly in columns.
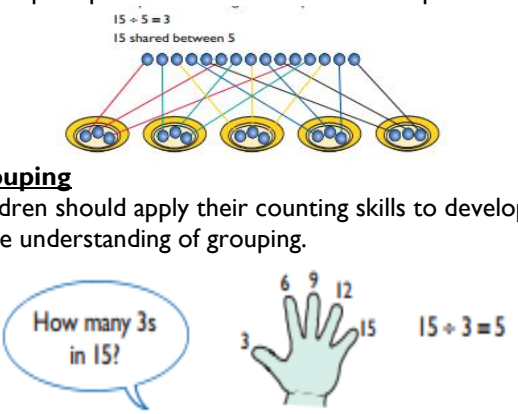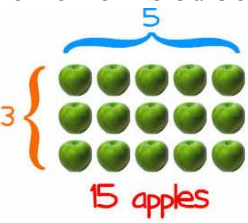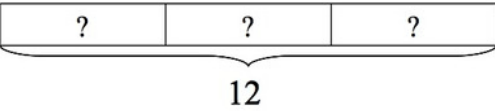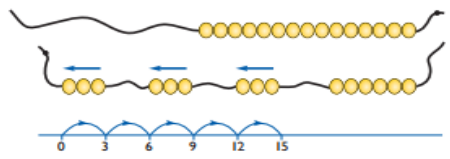
**Compact Vertical Method**

```
      1 2 4
  ×     2 6
    ₁  7 4 4
       ₁ ₂
    2 ⁻4 8 0
    3 2 2 4
      1 1
```
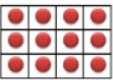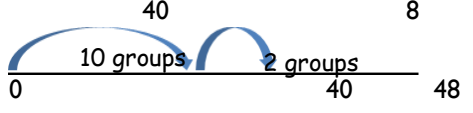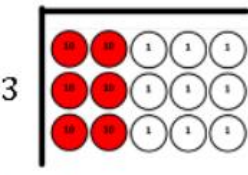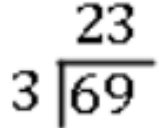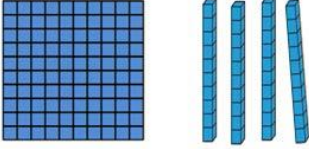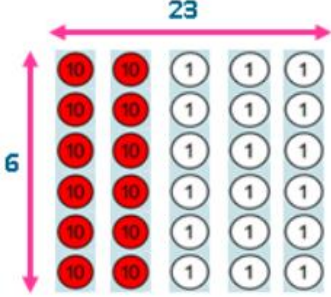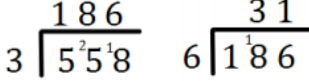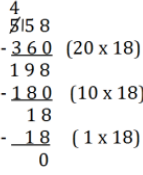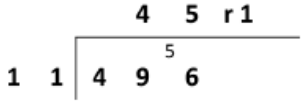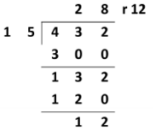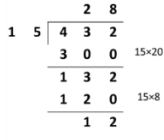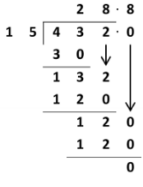
Answer: 3224

Bar modelling and number lines can support learners when solving problems with multiplication alongside the formal written methods.

| | | Year 1 | Year 2 | Year 3 |
|---|---|---|---|---|
| **Division** | | Through sharing small quantities, children begin to understand division, and finding simple fractions of amounts and quantities. | Children practise and become fluent in their recall of the 2, 5 and 10 division facts. | Children practise and become fluent in the recall of the 2, 3, 4 and 8 division facts. |

Children must have secure counting skills- being able to confidently count in 2s, 5s and 10s. Children should be given opportunities to reason about what they notice in number patterns.

**Group** AND **share small quantities- understanding the difference between the two concepts.**

**Sharing**

Develops importance of one-to-one correspondence.

$15 \div 5 = 3$
15 shared between 5

**Grouping**

Children should apply their counting skills to develop some understanding of grouping.

How many 3s in 15?

6   9   12

3        15        $15 \div 3 = 5$

**Arrays**

Use of arrays as a pictorial representation for division. $15 \div 3 = 5$ There are 5 groups of 3.

5

3 { 15 apples

---

**Sharing using a bar model**

$12 \div 3 = ?$

| ? | ? | ? |

12

**Grouping on a number line**

Group from zero in jumps of the divisor to find our 'how many groups of 3 are there in 15?'

15 divided by 3

0   3   6   9   12   15

**Arrays**

Continue work on arrays. Support children to understand how multiplication and division are inverse. Look at an array – what do you see?

$3 \times 4 = 12$
$12 \div 4 = 3$

Missing number problems.

$20 = \square \times 5$     $3 = \square \div 6$

---

**Becoming more efficient using a numberline**

Children need to be able to partition the dividend in different ways.

$48 \div 4 = 12$

40                              8

10 groups        2 groups

0                        40        48

Extending divisions to resemble written method of short division.

23

3

$69 \div 3 = 23$

Progressing to the formal written method of short division:

23

3 ⟌ 69

| | **Year 4** | **Year 5** | **Year 6** |
|---|---|---|---|
| **Division** | <span style="color:red">Children should know all the division facts up to 12 x 12</span> | <span style="color:red">Undertake mental divisions with increasingly hard numbers and decimals.</span> | <span style="color:red">Undertake mental divisions with increasingly hard numbers and decimals.</span> |

Use base 10 blocks to divide by 10

**140÷ 10 = 14**

Grouping/sharing counters are used to make the link with short division

Leads directly onto:

$$138 \div 6 = 23$$

**Showing remainder as a whole number:**

Answer: 858 remainder 2

**Showing remainder as a fraction:**

Answer: $858 \frac{2}{3}$

**HTU ÷ TU (Using factor pairs as divisors)**
558 ÷ 18 =
Step 1: Identify a pair of factors for the divisor e.g. 18 = 3 x 6
Step 2: Divide by one of the factors.
Step 3: Divide the answer by the other factor.

Answer: 558 ÷ 18 = 31

**HTU ÷ TU
(beginning to look at chunking as a precursor to long division)**

8|5 8
- 3 6 0 (20 x 18)
1 9 8
- 1 8 0 (10 x 18)
1 8
- 1 8 ( 1 x 18)
0
Answer: 558 ÷ 18 = 31

<u>÷ = signs and missing numbers</u>
Continue using a range of equations but with appropriate numbers
<u>Sharing and Grouping and using a number line</u>
Children will continue to explore division as sharing and grouping, and to represent calculations on a number line as appropriate.
Remainders should be expressed as decimals and fractions.

496 ÷ 11 becomes

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

**Long Division**

432 ÷ 15 becomes

Answer: 28 remainder 12

432 ÷ 15 becomes

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

432 ÷ 15 becomes

Answer: 28·8