Calculation policy: Addition

Key language: sum, total, parts and wholes, plus, add, altogether, more, ‘is equal to’ ‘is the same as’.

<table>
<thead>
<tr>
<th>Concrete</th>
<th>Pictorial</th>
<th>Abstract</th>
</tr>
</thead>
</table>
| **Combining two parts to make a whole** (use other resources too e.g. eggs, shells, teddy bears, cars). | Children to represent the cubes using dots or crosses. They could put each part on a part whole model too. | 4 + 3 = 7
Four is a part, 3 is a part and the whole is seven. |

| Counting on using number lines using cubes or Numicon. | A bar model which encourages the children to count on, rather than count all. | The abstract number line:
What is 2 more than 4?
What is the sum of 2 and 4?
What is the total of 4 and 2?
4 + 2 |
| Regrouping to make 10; using ten frames and counters/cubes or using Numicon.  
| 6 + 5 | Children to draw the ten frame and counters/cubes.  
| ![Ten frame](image1) ![Counters](image2) | Children to develop an understanding of equality e.g.  
| ![Equation](image3) |  
| 6 + □ = 11  
6 + 5 = 5 + □  
6 + 5 = □ + 4 |  
| TO + O using base 10. Continue to develop understanding of partitioning and place value.  
41 + 8 | Children to represent the base 10 e.g. lines for tens and dot/crosses for ones.  
| ![Base 10 representation](image4) |  
| 41 + 8  
1 + 8 = 9  
40 + 9 = 49 |  
| TO + TO using base 10. Continue to develop understanding of partitioning and place value.  
36 + 25 | Children to represent the base 10 in a place value chart.  
| ![Place value chart](image5) | Looking for ways to make 10.  
| ![Ways to make 10](image6) |  
| 36 + 25=  
30 + 20 = 50  
5 + 5 = 10  
50 + 10 + 1 = 61 | Formal method:  
| ![Formal method](image7) |
Use of place value counters to add HTO + TO, HTO + HTO etc. When there are 10 ones in the 1s column - we exchange for 1 ten, when there are 10 tens in the 10s column - we exchange for 1 hundred.

<table>
<thead>
<tr>
<th>100s</th>
<th>10s</th>
<th>1s</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Children to represent the counters in a place value chart, circling when they make an exchange.

Conceptual variation; different ways to ask children to solve 21 + 34

Word problems:
In year 3, there are 21 children and in year 4, there are 34 children. How many children in total?

21 + 34 = 55. Prove it

Calculate the sum of twenty-one and thirty-four.

Missing digit problems:

<table>
<thead>
<tr>
<th>10s</th>
<th>1s</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>?</td>
</tr>
<tr>
<td>?</td>
<td>5</td>
</tr>
</tbody>
</table>
## Calculation policy: Subtraction

### Key language:
- take away
- less than
- the difference
- subtract
- minus
- fewer
- decrease

<table>
<thead>
<tr>
<th>Concrete</th>
<th>Pictorial</th>
<th>Abstract</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physically taking away and removing objects from a whole (ten frames,</td>
<td>Children to draw the concrete resources they are using and cross out the</td>
<td>4 - 3 = 1</td>
</tr>
<tr>
<td>Numicon, cubes and other items such as beanbags could be used).</td>
<td>correct amount. The bar model can also be used.</td>
<td></td>
</tr>
<tr>
<td>4 - 3 = 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>![Concrete example]</td>
<td>![Pictorial example]</td>
<td>![Abstract example]</td>
</tr>
<tr>
<td>Counting back (using number lines or number tracks) children start with</td>
<td>Children to represent what they see pictorially e.g.</td>
<td></td>
</tr>
<tr>
<td>6 and count back 2.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 - 2 = 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>![Counting back example]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Children to represent the calculation on a number line or number track and show their jumps. Encourage children to use an empty number line.**
<table>
<thead>
<tr>
<th>Finding the difference (using cubes, Numicon or Cuisenaire rods, other objects can also be used).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calculate the difference between 8 and 5.</td>
</tr>
<tr>
<td>Children to draw the cubes/other concrete objects which they have used or use the bar model to illustrate what they need to calculate.</td>
</tr>
<tr>
<td>Find the difference between 8 and 5. 8 – 5, the difference is 3. Children to explore why 9 - 6 = 8 - 5 = 7 - 4 have the same difference.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Making 10 using ten frames.</th>
</tr>
</thead>
<tbody>
<tr>
<td>14 – 5</td>
</tr>
<tr>
<td>Children to present the ten frame pictorially and discuss what they did to make 10.</td>
</tr>
<tr>
<td>Children to show how they can make 10 by partitioning the subtrahend.</td>
</tr>
<tr>
<td>14 - 5 = 9 14 - 4 = 10 10 - 1 = 9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Column method using base 10.</th>
</tr>
</thead>
<tbody>
<tr>
<td>48 - 7</td>
</tr>
<tr>
<td>Children to represent the base 10 pictorially.</td>
</tr>
<tr>
<td>Column method or children could count back 7.</td>
</tr>
<tr>
<td>48 - 7 = 41</td>
</tr>
</tbody>
</table>
### Column method using base 10 and having to exchange.

**41 - 26**

<table>
<thead>
<tr>
<th>10s</th>
<th>1s</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Image 10s 1s" /></td>
<td><img src="image" alt="Image 10s 1s" /></td>
</tr>
</tbody>
</table>

Represent the base 10 pictorially, remembering to show the exchange.

![Image 10s 1s](image)

Formal column method. Children must understand that when they have exchanged the 10 they still have 41 because 41 = 30 + 11.

```
\[
\begin{array}{c}
341 \\
- 26 \\
\hline
15
\end{array}
\]
```

### Column method using place value counters.

**234 - 88**

<table>
<thead>
<tr>
<th>100s</th>
<th>10s</th>
<th>1s</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Image 100s 10s 1s" /></td>
<td><img src="image" alt="Image 100s 10s 1s" /></td>
<td><img src="image" alt="Image 100s 10s 1s" /></td>
</tr>
</tbody>
</table>

Represent the place value counters pictorially; remembering to show what has been exchanged.

Formal column method. Children must understand what has happened when they have crossed out digits.

```
\[
\begin{array}{c}
234 \\
- 88 \\
\hline
6
\end{array}
\]
```

### Conceptual variation; different ways to ask children to solve 391 - 186

Raj spent £391, Timmy spent £186. How much more did Raj spend?

Calculate the difference between 391 and 186.

\[
\begin{array}{c}
391 \\
- 186 \\
\hline
\end{array}
\]

What is 186 less than 391?

```
\[
\begin{array}{c}
391 \\
- 186 \\
\hline
15
\end{array}
\]
```

Missing digit calculations:

```
\[
\begin{array}{c}
391 \\
- 186 \\
\hline
\end{array}
\]
```

```
\[
\begin{array}{c}
05
\end{array}
\]"
## Calculation policy: Multiplication

Key language: double, times, multiplied by, the product of, groups of, lots of, equal groups.

<table>
<thead>
<tr>
<th>Concrete</th>
<th>Pictorial</th>
<th>Abstract</th>
</tr>
</thead>
</table>
| **Repeated grouping/repeated addition**  
3 × 4  
4 + 4 + 4  
There are 3 equal groups, with 4 in each group. | Children to represent the practical resources in a picture and use a bar model. | 3 × 4 = 12  
4 + 4 + 4 = 12 |

### Concrete
- Images of jars and Cuisenaire rods are used to demonstrate the concrete representation of the problem.

### Pictorial
- Children are encouraged to represent the practical resources in a picture and use a bar model.
- Example: A bar model showing three groups of four items.

### Abstract
- The abstract representation includes simple calculations like 3 × 4 = 12.

### Key language
- Double, times, multiplied by, the product of, groups of, lots of, equal groups.

### Calculation policy: M
- Multiplication

### Number lines to show repeated groups
- 3 × 4
- Number lines are used to show repeated groups of four.
- Example: A number line with jumps of four, leading to 3 × 4 = 12.

### Cuisenaire rods can be used too.
- Cuisenaire rods are another concrete representation to help visualize the problem.
<table>
<thead>
<tr>
<th>Use arrays to illustrate commutativity</th>
<th>Children to represent the arrays pictorially.</th>
<th>Children to be able to use an array to write a range of calculations e.g.</th>
</tr>
</thead>
</table>
| counters and other objects can also be used. | 2 × 5 = 5 × 2 | $10 = 2 \times 5$
$5 \times 2 = 10$
$2 + 2 + 2 + 2 + 2 = 10$
$10 = 5 + 5$ |
| 2 lots of 5 | 5 lots of 2 |

<table>
<thead>
<tr>
<th>Partition to multiply</th>
<th>Children to represent the concrete manipulatives pictorially.</th>
<th>Children to be encouraged to show the steps they have taken.</th>
</tr>
</thead>
</table>
| using Numicon, base 10 or Cuisenaire rods. | $4 \times 15$ | $10 \times 4 = 40$
$5 \times 4 = 20$
$40 + 20 = 60$

<table>
<thead>
<tr>
<th>Formal column method</th>
<th>Children to represent the counters pictorially.</th>
<th>Children to record what it is they are doing to show understanding.</th>
</tr>
</thead>
</table>
| with place value counters (base 10 can also be used.) | $3 \times 23$ | $3 \times 20 = 60$
$3 \times 3 = 9$
$20 \times 3 = 60 + 9 = 69$

| | | |
| | | |
Formal column method with place value counters.

6 x 23

Children to represent the counters/base 10, pictorially e.g. the image below.

Formal written method

6 x 23 =

\[
\begin{array}{c}
23 \\
\times 6 \\
\hline
138 \\
\end{array}
\]

When children start to multiply 3d x 3d and 4d x 2d etc., they should be confident with the abstract:

To get 744 children have solved 6 x 124.
To get 2480 they have solved 20 x 124.

Conceptual variation; different ways to ask children to solve 6 x 23

Mai had to swim 23 lengths, 6 times a week.
How many lengths did she swim in one week?

With the counters, prove that 6 x 23 = 138

Find the product of 6 and 23

What is the calculation?
What is the product?
### Calculation policy: Division

Key language: share, group, divide, divided by, half.

<table>
<thead>
<tr>
<th>Concrete</th>
<th>Pictorial</th>
<th>Abstract</th>
</tr>
</thead>
</table>
| **Sharing** using a range of objects.  
6 ÷ 2 | Represent the sharing pictorially. | 6 ÷ 2 = 3  
3 | 3
| | | Children should also be encouraged to use their 2 times tables facts. |
| **Repeated subtraction** using Cuisenaire rods above a ruler.  
6 ÷ 2 | Children to represent repeated subtraction pictorially. | Abstract number line to represent the equal groups that have been subtracted. |
| | | |

- **Concrete**
  - Sharing using a range of objects.
  - 6 ÷ 2
  - Repeated subtraction using Cuisenaire rods above a ruler.
  - 6 ÷ 2
  - 3 groups of 2

- **Pictorial**
  - Represent the sharing pictorially.
  - Children to represent repeated subtraction pictorially.

- **Abstract**
  - 6 ÷ 2 = 3
  - Abstract number line to represent the equal groups that have been subtracted.
### 2d ÷ 1d with remainders

using lollipop sticks. Cuisenaire rods, above a ruler can also be used.

13 ÷ 4

Use of lollipop sticks to form wholes - squares are made because we are dividing by 4.

There are 3 whole squares, with 1 left over.

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</table>

Children to represent the lollipop sticks pictorially.

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</table>

13 ÷ 4 – 3 remainder 1

Children should be encouraged to use their times table facts; they could also represent repeated addition on a number line.

‘3 groups of 4, with 1 left over’

### Sharing using place value counters.

42 ÷ 3 = 14

Children to represent the place value counters pictorially.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>10s</td>
<td>1s</td>
<td></td>
</tr>
</tbody>
</table>

= 14

Children to be able to make sense of the place value counters and write calculations to show the process.

42 ÷ 3
42 = 30 + 12
30 ÷ 3 = 10
12 ÷ 3 = 4
10 + 4 = 14
### Short Division

Using place value counters to group.

\[ 615 \div 5 \]

1. Make 615 with place value counters.
2. How many groups of 5 hundreds can you make with 6 hundred counters?
3. Exchange 1 hundred for 10 tens.
4. How many groups of 5 tens can you make with 11 ten counters?
5. Exchange 1 ten for 10 ones.
6. How many groups of 5 ones can you make with 15 ones?

![Place value counters](image)

Represent the place value counters pictorially.

![Pictorial representation](image)

Children to the calculation using the short division scaffold.

\[ \begin{array}{c|cc|c}
5 & 1 & 2 & 3 \\
\hline
6 & 1 & 4 \\
\end{array} \]

### Long Division

Using place value counters

\[ 2544 \div 12 \]

1. We can't group 2 thousands into groups of 12, so will exchange them.

2. We can group 24 hundreds into groups of 12 which leaves with 1 hundred.

\[ \begin{array}{c|cc|c}
12 & 2 & 5 & 4 \\
\hline
24 & 1 \\
\end{array} \]
### Conceptual variation; different ways to ask children to solve $615 \div 5$

<table>
<thead>
<tr>
<th>Using the part whole model below, how can you divide 615 by 5 without using short division?</th>
<th>I have £615 and share it equally between 5 bank accounts. How much will be in each account?</th>
<th>What is the calculation? What is the answer?</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Part whole model" /></td>
<td>615 pupils need to be put into 5 groups. How many will be in each group?</td>
<td><img src="image" alt="Calculation" /></td>
</tr>
</tbody>
</table>

- **After exchanging the hundred, we have 14 tens. We can group 12 tens into a group of 12, which leaves 2 tens.**

- **After exchanging the 2 tens, we have 24 ones. We can group 24 ones into 2 group of 12, which leaves no remainder.**

### Calculation

$$5 \big| 615$$

$$615 \div 5 = 123$$

**615 ÷ 5 = 123**