

# Trumpington Federation calculation policy

## Vision

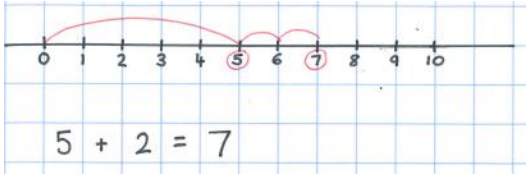
For our children to feel confident, wanting to give it a go, when solving a mathematical problem that they haven't seen before.

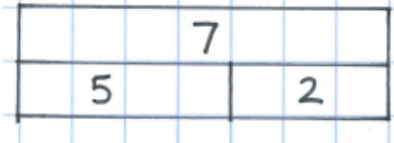
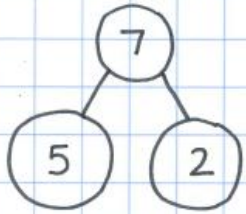
## Introduction

The purpose of this calculation policy is to ensure consistency and progression in the teaching of the different calculation methods across the school from Years 1 to 6. It aims to give an overview of the key calculation strategies for addition, subtraction, multiplication and division. Our intention is that our children will be flexible with the methods that they use to perform different calculations.

Early Years: for information on the approach to the teaching of Maths in the Early Years please see the document 'Early Years Approach to Teaching Maths'.

## Addition

CALCULATION STRATEGIES	KEY MANIPULATIVES
<i>Year 1</i>	
<p><b>Number lines</b> Start adding using a number line. Initially, children are taught to start at the biggest number. As they grow in confidence they start to explore starting with the smallest number which develops an understanding of commutativity.</p>  <p>Children are shown how the number sentence can be represented in a part-whole model and on a bar model.</p>	<p>Rekenrek Bead strings Numicon Multi-link Dienes Number line</p>

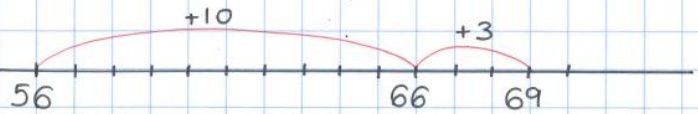


**Year 2**

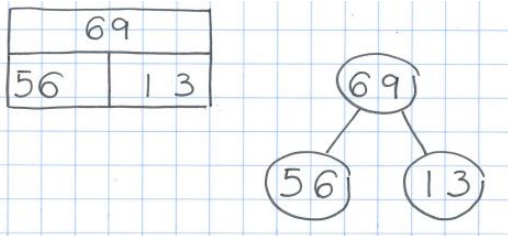
**Number lines**

Switch to a partially empty number line (e.g. with multiples of 5, 10).

$$56 + 13 = 69$$



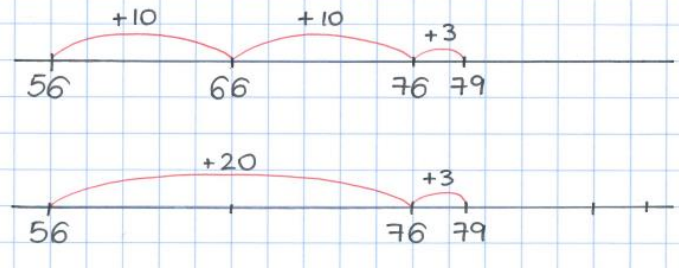
Children are shown how the number sentence can be represented in a part-whole model and on a bar model.



As children become more confident with their number bonds their number line strategies will progress.

- Rekenrek
- Bead strings
- Numicon
- Multi-link
- Dienes
- Place value counters
- Number line

$$\bullet 56 + 23 = 79$$



### Partitioning

Children are shown how to partition numbers into tens and ones and then add them.

$$56 + 13 = 69$$

$$50 + 10 = 60$$

$$6 + 3 = 9$$

$$60 + 9 = 69$$

### Expanded column method

Building on from partitioning, children are shown how to set up the 10s and 1s in columns. They are taught to add the 1s first.

$$\bullet 56 + 13 = 69$$

$$50 + 6$$

$$+ 10 + 3$$

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$$60 + 9$$

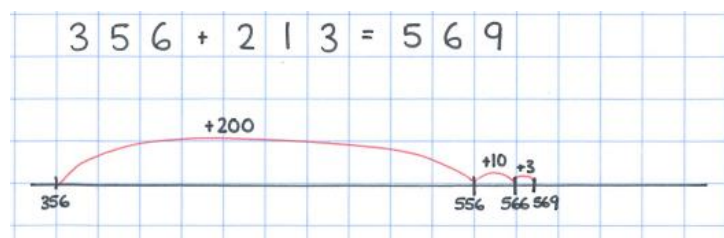
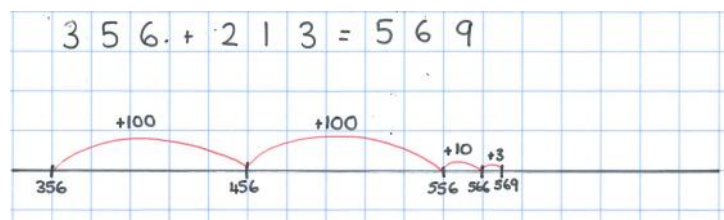
Here is an example where the 1s exceed 9.

$$\begin{array}{r} 56 + 15 = 71 \\ \begin{array}{r} 50 \\ + 10 \\ \hline 60 \end{array} + 6 \\ \begin{array}{r} 10 \\ + 5 \\ \hline 15 \end{array} \\ \begin{array}{r} 70 \\ + 1 \\ \hline 71 \end{array} \end{array}$$

### Year 3

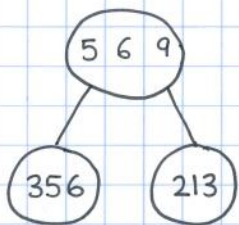
#### Number lines

Switch to an empty number line to increase flexibility and speed and allow demonstration of understanding.



Children are shown how the number sentence can be represented in a part-whole model and on a bar model.

- Bead strings
- Dienes
- Place value counters
- Number line



5	6	9	
3	5	6	2 1 3

### Partitioning

Children are shown how to partition numbers into hundreds, tens and ones and then add them.

### Expanded column method

Building on from partitioning, children are shown how to set up the 100s, 10s and 1s in columns, showing the full value of each digit. They are taught to add the 1s first.

$$356 + 213 = 569$$

$$300 + 50 + 6$$

$$200 + 10 + 3$$

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$$500 + 60 + 9$$

$$366 + 263 = 629$$

$$100 + 300 + 60 + 6$$

$$200 + 60 + 3$$

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$$600 + 20 + 9$$

### Compact column method

Building on from the expanded column method, children are shown how to set up an addition by putting their 100s, 10s and 1s in the correct place value column. They are taught to add the 1s first.

$$356 + 213 = 569$$

$$\begin{array}{r} 356 \\ + 213 \\ \hline 569 \end{array}$$

**With exchanging**

$$357 + 213 = 570$$

$$\begin{array}{r} 357 \\ + 213 \\ \hline 570 \end{array}$$

#### Year 4

Children consolidate their learning from previous years.  
They continue to be shown how to use a blank number line, partitioning, the expanded and the compact column method.  
Children continue to be shown how the number sentence can be represented in a part-whole model and on a bar model.

**[Children should be shown how to use the number line and the compact column method when adding decimals]**

Bead strings  
Dienes  
Place value counters  
Number line

#### Year 5

Children consolidate their learning from previous years.  
They continue to be shown how to use a blank number line, the expanded and the compact column method.  
Children continue to be shown how the number sentence can be represented in a part-whole model and on a bar model.

**[Children should be shown how to use the number line and the compact column method when adding decimals]**

Dienes  
Number line



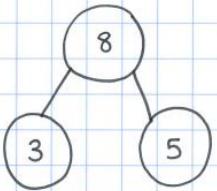
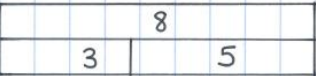
## Year 6

Children consolidate their learning from previous years.  
They continue to be shown how to use a blank number line, the expanded and the compact column method.  
Children continue to be shown how the number sentence can be represented in a part-whole model and on a bar model.

**[Children should be shown how to use the number line and the compact column method when adding decimals]**

Dienes  
Number line

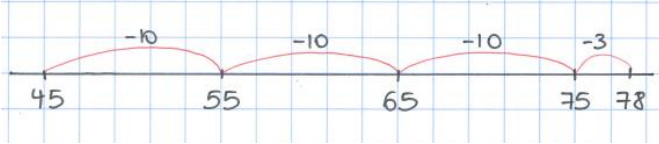
Subtraction

CALCULATION STRATEGIES	KEY MANIPULATIVES
<b>Year 1</b>	
<p><b>Number lines</b> Start subtracting using a number line. With subtraction, children are taught to count back to take away or count up to find the difference.</p> <p><b>Take away</b></p>  $8 - 3 = 5$ <p><b>Find the difference</b></p>  $8 - 3 = 5$ <p>Children are shown how the number sentence can be represented in a part-whole model and on a bar model.</p>  	<p>Rekenrek Bead strings Numicon Multi-link Dienes Number line</p>
<b>Year 2</b>	
<p><b>Number lines</b> Switch to a partially empty number line (e.g. with multiples of 5, 10).</p>	<p>Rekenrek Bead strings Numicon</p>



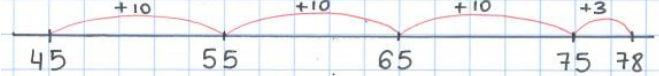
### Take away

$$78 - 45 = 33$$



### Find the difference

$$78 - 45 = 33$$



$$10 + 10 + 10 + 3 = 33$$

Children are shown how the number sentence can be represented in a part-whole model and on a bar model.

As children become more confident with their number bonds their number line strategies will progress.

### Partitioning

Children are shown how to partition numbers into tens and ones and then subtract them.

$$78 - 45 = 33$$

$$70 - 40 = 30$$

$$8 - 5 = 3$$

### Expanded column method

Building on from partitioning, children are shown how to set up the 10s and 1s in columns with the larger number on the top. They are taught to subtract the 1s first.

Multi-link

Dienes

Place value counters

Number line

$$\cdot 78 - 45 = 33$$

$$\begin{array}{r} 70 \quad 8 \\ - 40 \quad 5 \\ \hline 30 \quad 3 \end{array}$$

Here is an example with exchanging.

$$\cdot 75 - 48 = 27$$

$$\begin{array}{r} 60 \quad 15 \\ \cancel{70} \quad \cancel{8} \\ - 40 \quad 8 \\ \hline 20 \quad 7 \end{array}$$

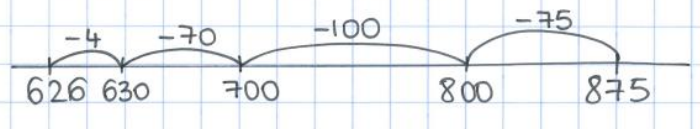
### Year 3

#### Number lines

Switch to an empty number line to increase flexibility and speed and allow demonstration of understanding.

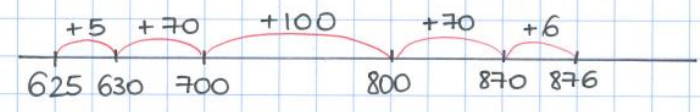
#### Take away

$$875 - 626 = 249$$



#### Find the difference

$$876 - 625 = 151$$



Bead strings

Dienes

Place value counters

Number line

Children are shown how the number sentence can be represented in a part-whole model and on a bar model.

### Partitioning

Children are shown how to partition numbers into hundreds, tens and ones and then subtract them.

$$876 - 625 = 251$$

$$800 - 600 = 200$$

$$70 - 20 = 50$$

$$6 - 5 = 1$$

### Expanded column method

Building on from partitioning, children are shown how to set up the 100s, 10s and 1s in columns, showing the full value of each digit with the larger number on top. They are taught to subtract the 1s first.

$$876 - 625 = 251$$

$$\begin{array}{r} 800 & 70 & 6 \\ - & & \end{array}$$

$$\begin{array}{r} 600 & 20 & 5 \\ \hline \end{array}$$

$$\begin{array}{r} 200 & 50 & 1 \end{array}$$

### Compact column method

Building on from the expanded column method, children are shown how to set up a subtraction putting their 100s, 10s and 1s in the correct place value column. They are taught to subtract the 1s first.

$$876 - 625 = 251$$

**With exchanging**

$$876 - 627$$

#### Year 4

Children consolidate their learning from previous years. They continue to be shown how to use a blank number line, partitioning, the expanded and the compact column method. Children continue to be shown how the number sentence can be represented in a part-whole model and on a bar model.

**[Children should be shown how to use the number line and the compact column method when subtracting decimals]**

Bead strings  
Dienes  
Place value counters

#### Year 5

Children consolidate their learning from previous years. They continue to be shown how to use a blank number line, the expanded and the compact column method.

Dienes  
Number line

Children continue to be shown how the number sentence can be represented in a part-whole model and on a bar model.

**[Children should be shown how to use the number line and the compact column method when subtracting decimals]**

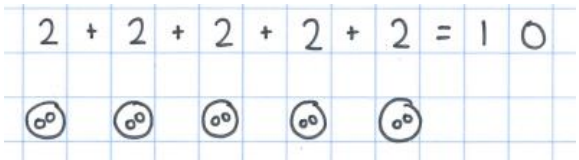
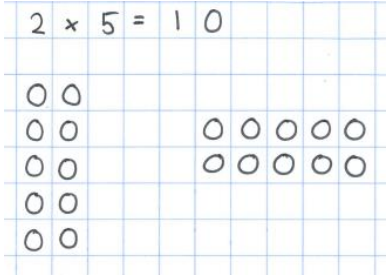
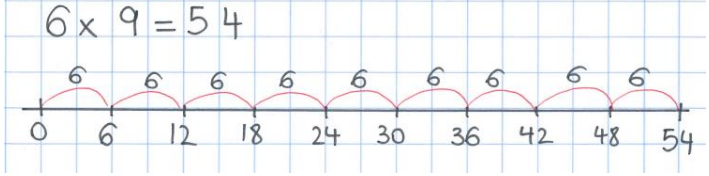
*Year 6*

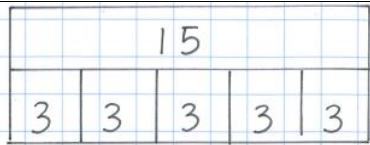
Children consolidate their learning from previous years.  
They continue to be shown how to use a blank number line, the expanded and the compact column method.  
Children continue to be shown how the number sentence can be represented in a part-whole model and on a bar model.

**[Children should be shown how to use the number line and the compact column method when subtracting decimals]**

Dienes  
Number line

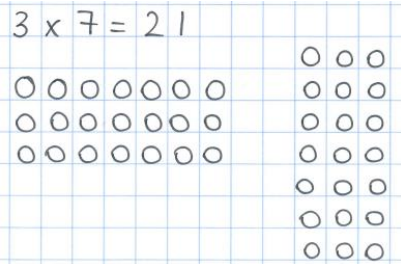
Multiplication

CALCULATION STRATEGIES	KEY MANIPULATIVES
<b>Year 1</b>	
<p>Start with objects and pictorial representations showing repeated addition.</p>  <p>Children are shown how the number sentence can be represented on a bar model.</p> <p><b>Arrays</b> Children are shown how multiplication can be represented as an array.</p> 	<p>Number line Counters Multi-link cubes</p>
<b>Year 2</b>	
<p><b>Number lines</b> Multiply using a number line, continue framing as repeated addition.</p>  <p>Children are shown how the number sentence can be represented on a bar model.</p>	<p>Number line Counters Multi-link</p>



**Arrays**

Children are shown how multiplication can be represented as an array.

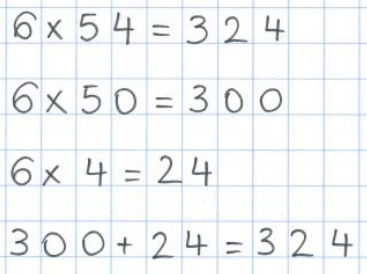


**Year 3**

Children consolidate their learning from previous years.

**Partitioning**

Children are shown how to partition numbers into tens and ones and then multiply them.



**Grid method**

Building on from partitioning, children are shown how to set up the 10s and 1s in a grid and add the products.

$$6 \times 54 = 324$$

x	50	4
6	300	24

#### Year 4

Children consolidate their learning from previous years. They continue to use the grid method and partitioning.

#### Partitioning

Children are shown how to partition numbers into hundreds, tens and ones and then multiply them.

$$4 \times 271 = 1084$$

$$4 \times 200 = 800$$

$$4 \times 70 = 280$$

$$4 \times 1 = 4$$

#### Grid method

Building on from partitioning, children are shown how to set up the 100s, 10s and 1s in a grid and add the products.

$$4 \times 271 = 1084$$

x	200	70	1
4	800	280	4

$$800 + 280 + 4$$



### Expanded column method

Building on the grid method, children are shown how to set up a multiplication with the larger number on the top. Starting with the 1s, they calculate the product of the 1s and the multiplier and follow on from there.

$$\begin{array}{r} \times 253 \\ 6 \\ \hline 18 \quad (6 \times 3) \\ 300 \quad (6 \times 50) \\ 1200 \quad (6 \times 200) \\ \hline 1518 \end{array}$$

### Compact column method

Building on the expanded column method, children are shown how to shorten the method.

$$\begin{array}{r} \times 253 \\ 6 \\ \hline 1518 \\ \hline 3 \quad 1 \end{array}$$

## Year 5

Children consolidate their learning from previous years. They continue to use the grid method, expanded and compact column method for multiplying by a 1 digit number.

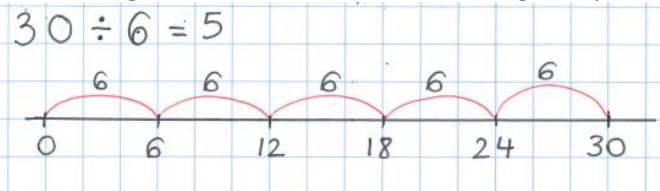
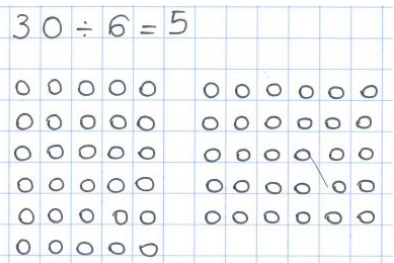
Children are shown how the grid method and expanded column method can be used when multiplying by a 2 digit number.

Children learn how to use the compact column method multiplying by a 2 digit number.

$$\begin{array}{r} 18 \\ \times 13 \\ \hline 54 \\ 180 \\ \hline 234 \end{array} \quad \begin{array}{r} 1234 \\ \times 16 \\ \hline 74204 \\ 12340 \\ \hline 19744 \end{array}$$

<i>Year 6</i>	
Children consolidate their learning from previous years. They continue to use the grid method, expanded and compact column method.	

Division

CALCULATION STRATEGIES	KEY MANIPULATIVES
<b>Year 1</b>	
<p>Start with objects and pictorial representations showing equal sharing of small quantities and repeated subtraction.</p>	<p>Number line Counters Multi-link Bead strings</p>
<b>Year 2</b>	
<p><b>Number lines</b> Divide using a number line, continue framing as repeated subtraction.</p>  <p><b>Arrays</b> Children are shown how to share the dividend by the divisor.</p>  <p><b>Number line with grouping</b> Use grouping to develop flexibility and increase efficiency, subtracting the groups.</p>	<p>Number line Counters Multi-link Bead strings</p>

$$54 \div 3 = 18$$

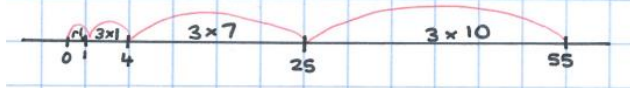


### Year 3

#### Number line with grouping

Continue to use grouping and subtraction.  
Children learn to see how much is left over.

$$55 \div 3 = 18 \text{ r } 1$$



#### Chunking

Continue to use grouping and subtract from the dividend.  
Children learn to see how much is left over.

$$95 \div 4 = 23 \text{ r } 3$$

$$4 \times 20 = \begin{array}{r} 95 \\ -80 \\ \hline \end{array}$$

$$4 \times 3 = \begin{array}{r} 15 \\ -12 \\ \hline \text{r } 3 \end{array}$$

Bead strings

### Year 4

Children consolidate their learning from previous years. They continue to use the number line with grouping and chunking.

**Bus-stop method**

Children learn to apply this formal method.

$$245 \div 7 = 35$$
$$\begin{array}{r} 035 \\ 7 \overline{) 245} \\ \underline{14} \phantom{0} \\ 105 \\ \underline{105} \\ 0 \end{array}$$

**Year 5**

Children consolidate their learning from previous years. They continue to use the number line with grouping, chunking and the bus stop method.

**Year 6**

Children consolidate their learning from previous years. They continue to use the number line with grouping, chunking and the bus stop method.

All these methods can be used to divide by a 2-digit number.

**Long division**

Children learn to apply this formal method.

$$684 \div 19 = 36$$
$$\begin{array}{r} 036 \\ 19 \overline{) 684} \\ \underline{57} \phantom{0} \\ 114 \\ \underline{114} \\ 0 \end{array}$$

**Other useful documents:**

- Federation approach to teaching times tables
- Mathematical vocabulary progression

### **May 2024 - changes made**

#### Addition

- Year 4, 5 and 6: use of bar models and part-whole models made explicit
- Year 5 and 6: partitioning removed

#### Subtraction

- Year 4, 5 and 6: use of bar models and part-whole models made explicit
- Year 5 and 6: partitioning removed

#### Multiplication

- Year 1: removed multiplication on a number line
- Year 5 and 6: partitioning removed

#### Division

- Year 1: removed arrays, removed division on a number line
- Year 2: removed chunking