

Progression in calculation

Addition

Children need to understand the concept of addition, that it is:

- **Combining two or more groups to give a total or sum**
- **Increasing an amount**

They also need to understand and work with certain principles:

- **Inverse of subtraction**
- **Is commutative**
i.e. $5 + 3 = 3 + 5$
- **Is associative**
i.e. $5 + 3 + 7 = 5 + (3 + 7)$

Key vocabulary

- add, more, plus, increase
- sum
- total, altogether
- score
- how many more is... than...?
- how much more is...?
- equals, is the same as

Progression in calculation - addition

	Mental strategies	Written strategies
Reception	Count to 20 One more than a given number Number songs, rhymes and stories Practical addition $U + U$	
Year 1	Number bonds facts for 10 and 20 Practically add 1 and 2 digit numbers from numbers up to 20 Adding 0	Read, write and interpret mathematical statements using + and = Single jumps on a number track
Year 2	Fluently recall addition facts for numbers to 20 and use to derive facts to 100 $TU + U$ Multiples of 10 $U + U + U$	Empty number line $TU + TU$
Year 3	$HTU + U$ $HTU + \text{multiples of } 10$ $HTU + \text{multiples of } 100$	Introduce expanded method $HTU + HTU$
Year 4	Add multiples of 1000	Expanded method $THHTU + THHTU$ Carrying
Year 5	Mentally add increasingly larger numbers	Column addition $THHTU + THHTU$
Year 6	Mixed operations	BODMAS Column addition More than four digits including decimals

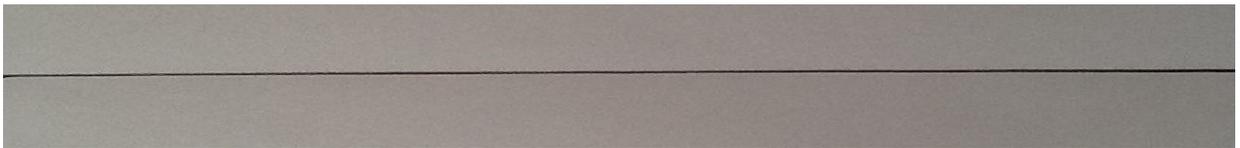
Written calculation methods for addition

Using a number line

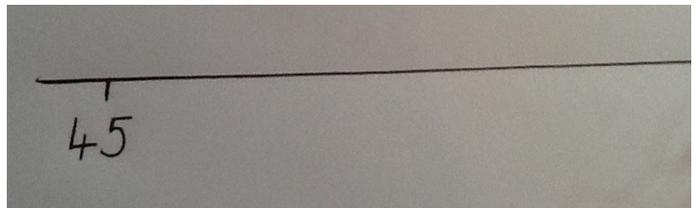
1. Extend the number sentence by partitioning the second number in the number sentence into tens and units.

$$45 + 27$$
$$45 + 20 + 7$$

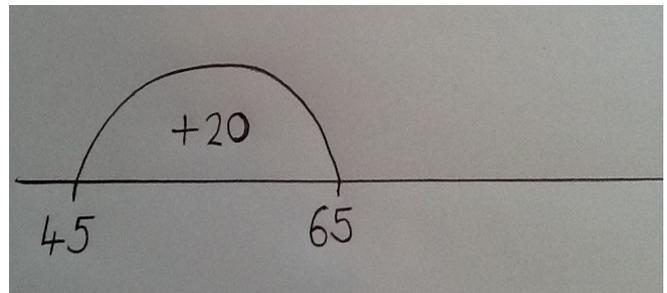
2. Draw a horizontal line using a ruler.



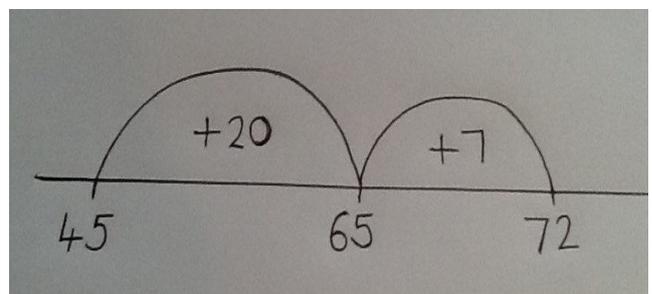
3. Write the first number of the number sentence on the left hand end of the number line.



4. Add the tens number (in one jump or as smaller jumps of 10). Record the value of the jump inside the jump and the number you land on underneath the line.



5. Add the units number (in one jump or as smaller jumps of 1). Record the value of the jump inside the jump and the number it adds up to underneath the line.



6. Complete the number sentence.

$$45 + 27 = 72$$

Prior learning/skills and concepts they need to understand:

- place value
- partitioning
- mental addition

Written calculation methods for addition

Expanded method

1. Partition each number in the calculation and use place value to line them up underneath each other.

Handwritten calculation showing the partitioning of 254 and 165 into their place value components: 200, 50, and 4 for 254; and 100, 60, and 5 for 165. The numbers are aligned vertically under their respective place values.

2. Draw a big add sign to the left hand side and a set of equals bars.

Handwritten calculation showing the addition of 200, 50, and 4 to 100, 60, and 5. A large plus sign is on the left. Two horizontal lines (equals bars) are drawn below the numbers, one under the top row and one under the bottom row.

3. Add the units numbers and record the answer inside the equals bars.

Handwritten calculation showing the addition of the units column. The number 9 is written below the 4 and 5, between the two equals bars.

4. If the answer produces a number larger than the place value column you are working with, carry the additional number over (writing it under the equals bar).

Handwritten calculation showing the carrying over of 10 from the tens column. The number 10 is written below the 60 and 5, between the two equals bars.

5. Continue across adding each place value column.

Handwritten calculation showing the addition of the tens and hundreds columns. The number 10 is written below the 50 and 60, and the number 400 is written below the 200 and 100, between the two equals bars.

6. Recombine the numbers between the equals bars and complete your number sentence.

Handwritten final number sentence: $254 + 165 = 419$

Prior learning/skills and concepts that they need to understand:

- place value
- partitioning
- mental calculation of units and multiples of 10

Written calculation methods for addition
Formal written method (column addition)

1. Set out calculation using place value columns.

$$\begin{array}{r} 1375 + 2153 \\ 1375 \\ + 2153 \\ \hline \hline \end{array}$$

2. Add the numbers in each column together starting with the units.

$$\begin{array}{r} 1375 \\ + 2153 \\ \hline 8 \\ \hline \hline \end{array}$$

3. If the answer produces a number larger than the place value column you are working with, carry the additional number over (writing it under the equals bar).

$$\begin{array}{r} 1375 \\ + 2153 \\ \hline 28 \\ \hline 1 \\ \hline \hline \end{array}$$

4. Continue across and complete the calculation.

$$\begin{array}{r} 1375 \\ + 2153 \\ \hline 3528 \\ \hline 1 \\ \hline \hline \end{array}$$

5. Complete your number sentence.

$$1375 + 2153 = 3528$$

Prior learning/skills and concepts that they need to understand:

- place value
- expanded method
- columns
- borrowing
- mental addition

What is BODMAS? It stands for 'brackets', 'other', division', 'multiplication', 'addition' and 'subtraction'. The order in which we carry out a calculation is important.

Order of operation

What is $2 + 3 \times 4$?

If we calculate the '2 + 3' part first, we get:

$$\begin{aligned}(2 + 3) \times 4 &= 5 \times 4 \\ &= 20\end{aligned}$$

If we calculate the '3 x 4' part first, we get:

$$\begin{aligned}2 + (3 \times 4) &= 2 + 12 \\ &= 14\end{aligned}$$

These are obviously two different answers — but which one is correct?

BODMAS tells us that 'multiplication' comes before 'addition', so the **second** answer is correct:

$$2 + 3 \times 4 = 2 + 12 = 14$$