

Written Calculation Methods at Ashmount Primary School



Calculation Workshop
November 2015

This booklet has been produced to give you an overview of the calculation methods taught at Ashmount Primary School.

The decision about when to introduce a new method to children is always informed by the child's confidence and fluency.

Although a child may be able to complete a more complex method with support, the emphasis should be on gaining deep understanding of the processes of addition, subtraction, multiplication and division. By Year 6 the emphasis is on consolidation of all mental and written calculation skills.

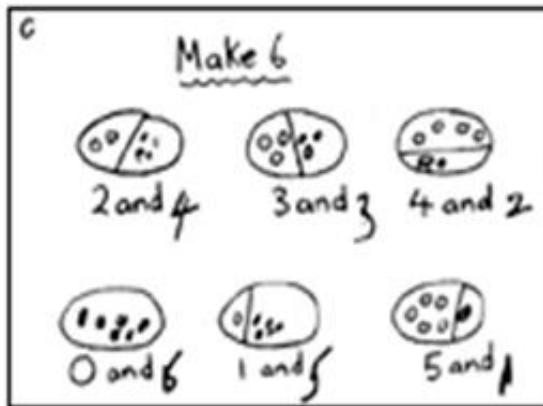
Please speak to your child's class teacher or the Maths Lead if you have any questions regarding this booklet or your child's progress.

We are always happy to help.

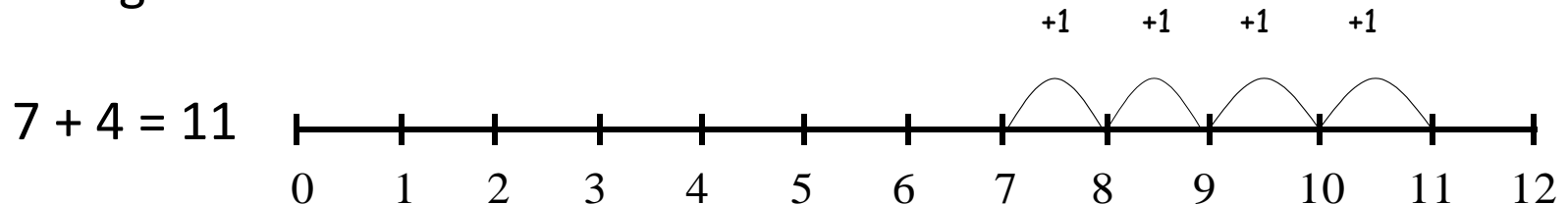
Stages in Addition

Usually introduced in Year 1 and Year 2

1. Children represent numbers using objects and pictures. They combine amounts to add and make amounts in different ways.



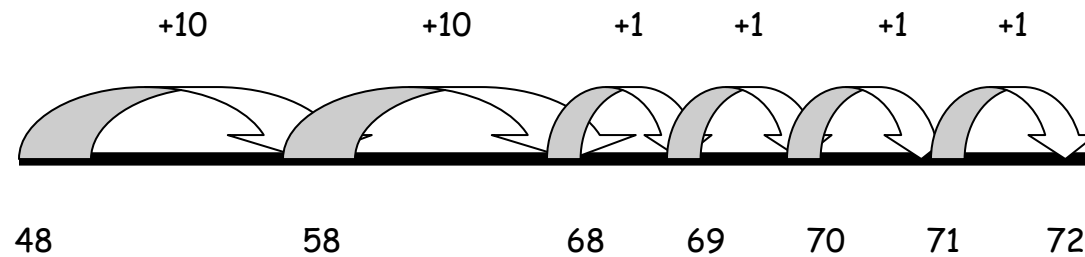
2. Counting on in ones. Children will then progress to counting on from the largest number, either using objects, a number line, a hundred square or mental strategies.



3. Partitioning – Children will then begin to add by partitioning numbers into tens and units, and adding these separately, using tens sticks and units as well as on paper.

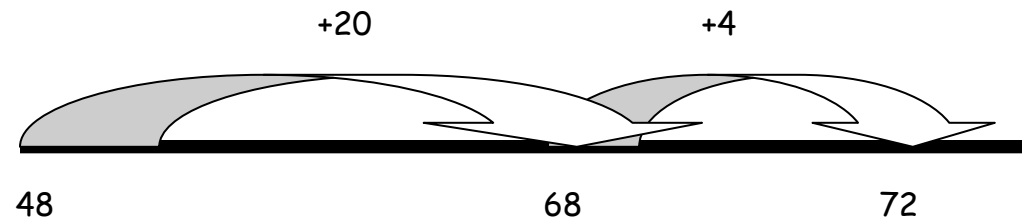
4. Counting on in tens and ones. On a number line children can first count on the tens and then the units.

$$48 + 24 = 72$$



5. Counting on multiples of ten, then chunks of ones with bridging through ten.

$$48 + 24 = 72$$



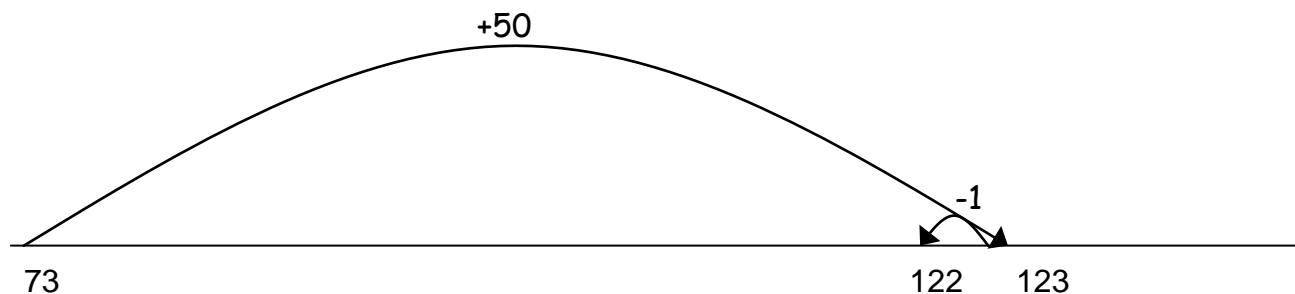
6. The development of partitioning - children begin to add by partitioning the number and adding the units first and then the tens. This is done mentally and in written work.

$$\begin{array}{r} 47 \\ + 76 \\ \hline \end{array} \quad \begin{array}{l} \longrightarrow \\ \longrightarrow \end{array} \quad \begin{array}{r} 40 + 7 \\ 70 + 6 \\ \hline 110 + 13 = 123 \end{array} \quad (\textit{Remember to add the units first})$$

Usually introduced from year 3

1. Children continue to use empty number lines with increasingly large numbers and compensating where appropriate.

$$49 + 73 = 122 =$$



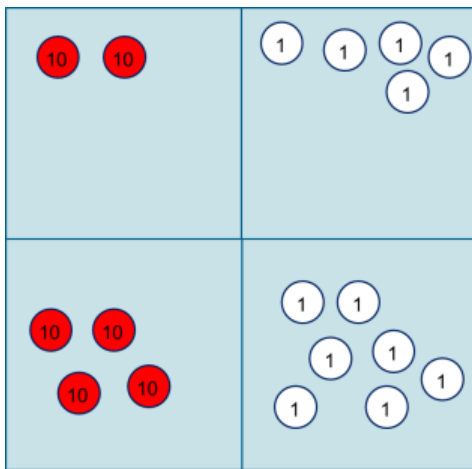
2. Vertical layout – Children are then introduced to column addition including having to regroup (carry over) to the next place value column. In year 3 children are learning to add numbers up to 1000.

$$\begin{array}{r} 43 \\ + 35 \\ \hline 78 \end{array} \quad \begin{array}{c} \text{moving onto} \\ \longrightarrow \end{array} \quad \begin{array}{r} 47 \\ + 76 \\ \hline \underline{123} \\ 1 \end{array}$$

Children must remember to add the units first. In the example above the ten that is created by the addition of the ones is recorded underneath however we more often teach children to record it above the other tens so that they remember to add it in with them, like this:

$$\begin{array}{r} 1 \\ 47 \\ + 76 \\ \hline \underline{123} \end{array}$$

3. To support the transition to the column method using place value counters or other objects to represent the tens and one may be helpful.



$$\begin{array}{r}
 25 \\
 +47 \\
 \hline
 \hline
 \end{array}$$

4. Children consolidate methods learnt and extend to adding three two-digit numbers, two three digits numbers and begin to explore adding decimals.

Remember to line the decimal points up under each other when adding mixed numbers, including amounts of money.

Children will also apply their skills in solving problems.

Usually introduced Year 4

1. Children should extend and consolidate the regrouping (previous called 'carrying') method to numbers with at least four digits and decimals:

$$\begin{array}{r} 3587 \\ + 675 \\ \hline 4262 \\ \hline 111 \end{array}$$

Year 5 onwards

1. Children should extend the regrouping method to numbers with more than four digits and decimal numbers:

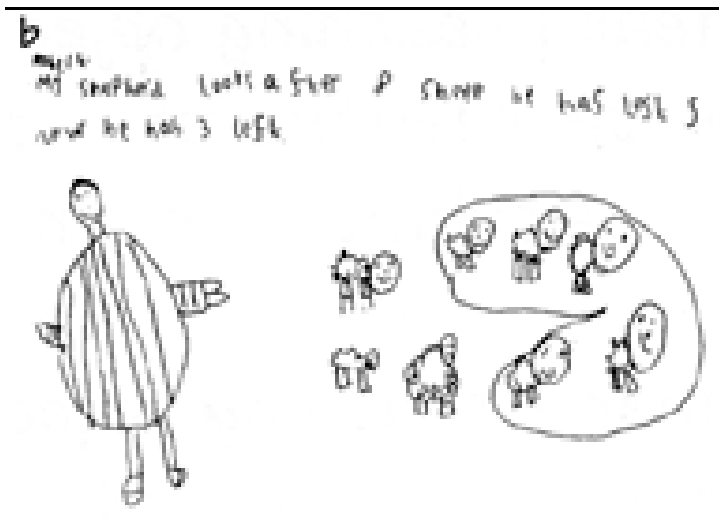
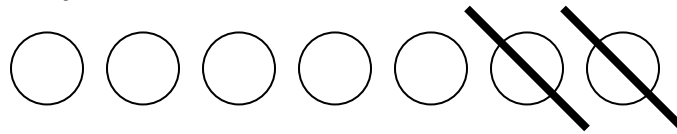
$$\begin{array}{r} 43587 \\ + 5675 \\ \hline 49262 \\ \hline 111 \end{array}$$

Stages in Subtraction

Usually introduced in early years and Year 1

1. Children will begin to understand subtraction as taking away using objects, their fingers and in pictures.

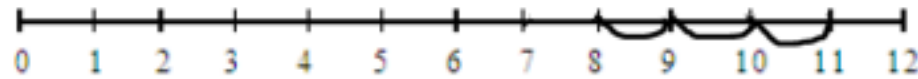
$$7 - 2 = 5$$



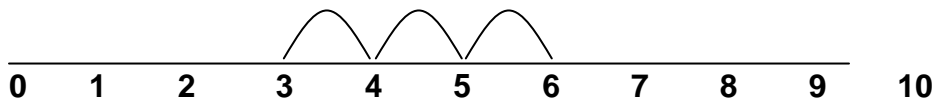
Usually introduced in Years 1 and 2

1. Using the number line. Children will progress to counting back in ones using a number line or a number square.

$$11 - 3 =$$



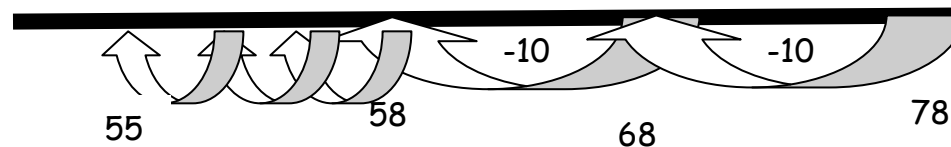
The number line should also be used to show that $7 - 3$ means the 'difference between 7 and 3' or 'the difference between 3 and 7' and how many jumps they are apart.



Usually introduced in year 2

1. Counting back in tens and ones

$$78 - 23 = 55$$



2. Counting back in multiples of ten.

$$78 - 23 = 55$$



Usually introduced in year 3

1. The development of partitioning.

Children begin to subtract by partitioning the second number, subtracting the tens and then the units.

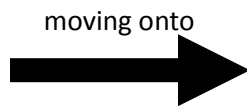
$$\begin{array}{r} 57-23 \\ 57-20 = 37 \\ 37-3 = 34 \end{array}$$

OR

$$\begin{array}{r} 57 = 50 + 7 \\ - 23 = 20 + 3 \\ \hline 30 + 4 = 34 \end{array}$$

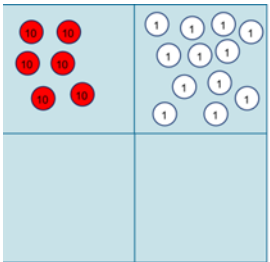
2. Vertical layout, using the most efficient method, using regrouping (also previous called exchanging or borrowing):

$$\begin{array}{r} 76 \\ -23 \\ \hline 53 \end{array}$$

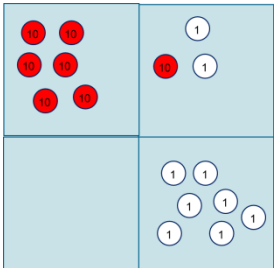


$$\begin{array}{r} \overset{6}{\cancel{7}}6 \\ -48 \\ \hline 28 \end{array}$$

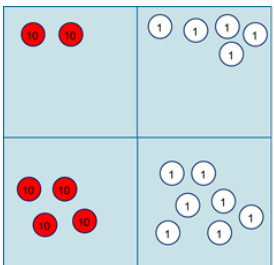
Using equipment to represent the ones and ten can help in moving from expanded to compact methods.



$$\begin{array}{r} \overset{6}{\cancel{7}}2 \\ - 47 \\ \hline \\ \hline \end{array}$$



$$\begin{array}{r} \overset{6}{\cancel{7}}2 \\ - 47 \\ \hline 5 \\ \hline \end{array}$$



$$\begin{array}{r} \overset{6}{\cancel{7}}2 \\ - 47 \\ \hline 25 \\ \hline \end{array}$$

Year 4 onwards

Consolidating methods learnt and extend to subtracting three two-digit numbers, two three and four digits numbers and decimals.

Remember to line the decimal points up under each other when subtracting mixed numbers. Children also apply their skills in multistep subtraction problems.

Stages in Multiplication

All times tables should be learnt by the end of Year 4.

- Year 1: Count on or back in 1s, 2s, 5s and 10s
- Year 2: Recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables. Count on or back in 3s.
- Year 3: Recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables.
- Year 4: Recall and use multiplication facts for all multiplication tables up to 12 x 12.
- Year 5 & 6: Regularly revisit multiplication facts for all tables up to 12 x 12.

Usually introduced in year 1

Children will experience equal groups of objects and will count in 2s, 5s and 10s. They will work on practical problem solving activities involving equal sets or groups.

1. Pictorial multiplication

How many feet have these three teddy bears got altogether?



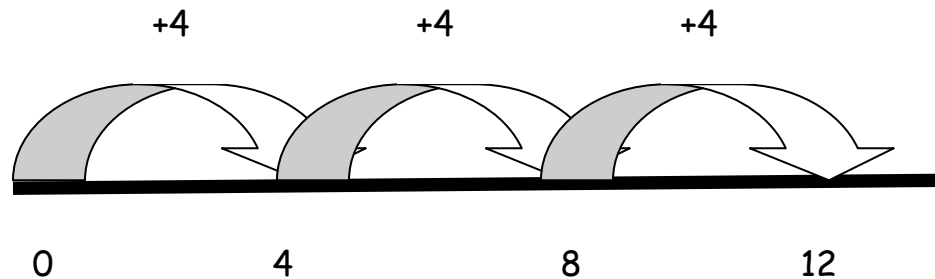
How many wheels do we need for these three lego cars?



Usually introduced in Year 2 continuing to early Year 3

1. Repeated addition

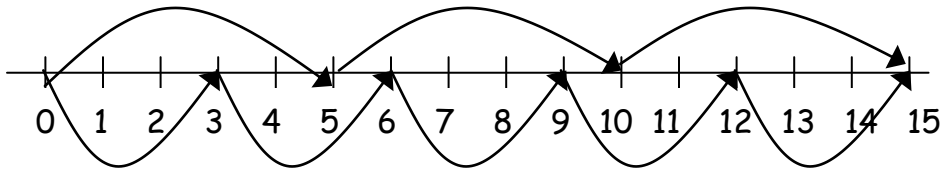
$$3 \times 4 = 12$$



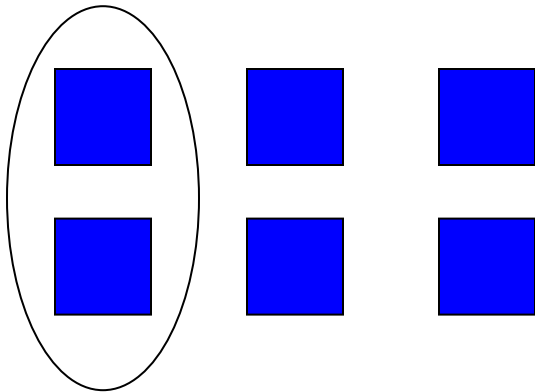
2. Commutativity

Children should know that 3×5 has the same answer as 5×3 . This can also be shown on the number line.

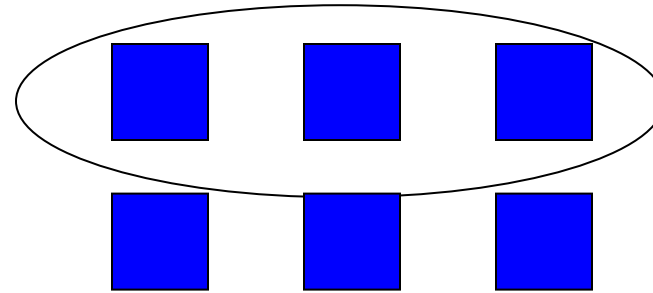
5 5 5



3. Introducing arrays



3 lots of 2 = 6 **or** 2 + 2 + 2 = 6



2 lots of 3 = 6 **or** 3 + 3 = 6

Usually introduced in year 3

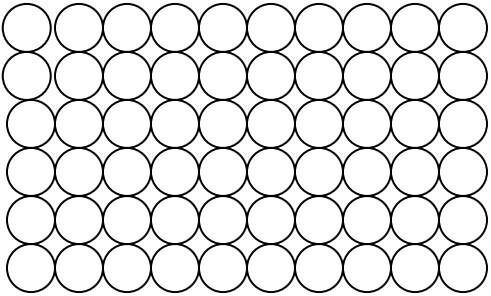
1. Grid Layout

In order to progress to formal written method for short multiplication children need to learn the grid method as a preparation, so that they have a mental image to work from.

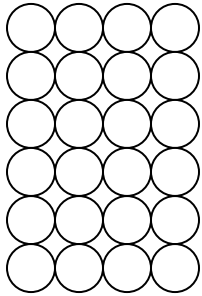
Children will continue to use arrays where appropriate, leading into the grid method of multiplication.

x	10	4	

6



60



24

$(6 \times 10) + (6 \times 4)$

60	+	24	
			84

With grid method we start with multiplication of a 2-digit number by a 1-digit number where there is only one 'ten' (e.g. 17×6)

38×7

X	30	8
7	210	56

$$\begin{array}{r}
 210 \\
 + 56 \\
 \hline
 266
 \end{array}$$

Then extending to larger numbers:

$$56 \times 27 = (50 + 6) \times (20 + 7)$$

X	50	6
20	1000	120
7	350	42

$$\begin{array}{r} 1000 \\ +350 \\ +120 \\ + \underline{42} \\ =\underline{\underline{1512}} \end{array}$$

Usually introduced in year 4

1. Vertical format, expanded working

$$\begin{array}{r} 38 \\ \times 7 \\ \hline 56 \quad (7 \times 8) \\ 210 \quad (7 \times 30) \\ \hline 266 \end{array}$$

Remember to multiply by the 7

2. Vertical multiplication compact method

$$\begin{array}{r} 38 \\ \times 7 \\ \hline 266 \\ \hline 5 \end{array}$$

When multiplying tens by tens or larger numbers, for example 32×15 the grid method would be more appropriate.

3. Extend to three or four-digit numbers, and decimals.

24×16 becomes

$$\begin{array}{r} 2 \\ 24 \\ \times 16 \\ \hline 240 \\ 144 \\ \hline 384 \end{array}$$

Answer: 384

124×26 becomes

$$\begin{array}{r} 1 \quad 2 \\ 124 \\ \times 26 \\ \hline 2480 \\ 744 \\ \hline 3224 \\ \hline 1 \quad 1 \end{array}$$

Answer: 3224

124×26 becomes

$$\begin{array}{r} 1 \quad 2 \\ 124 \\ \times 26 \\ \hline 744 \\ 2480 \\ \hline 3224 \\ \hline 1 \quad 1 \end{array}$$

Answer: 3224

Stages in Division

Usually introduced in year 1

1. Pictorial division – sharing and grouping

Children will understand equal groups and share items out in play and problem solving.



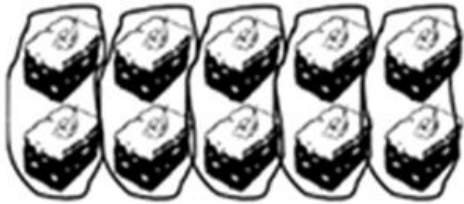
a) Can you share six cakes between 2 plates?



b) Can we share out these cakes fairly? How shall we do it? If we put two cakes on each plate, how many plates do we need?



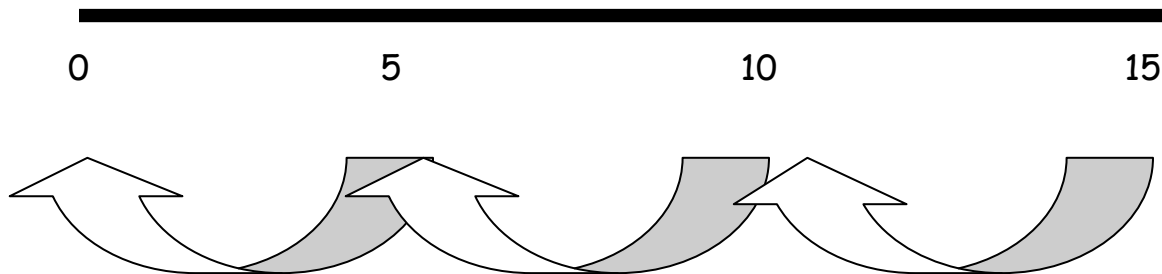
c) There are ten cakes. Two cakes are put into each box. How many boxes do we need?



Usually introduced in year 2

1. Repeated subtraction.

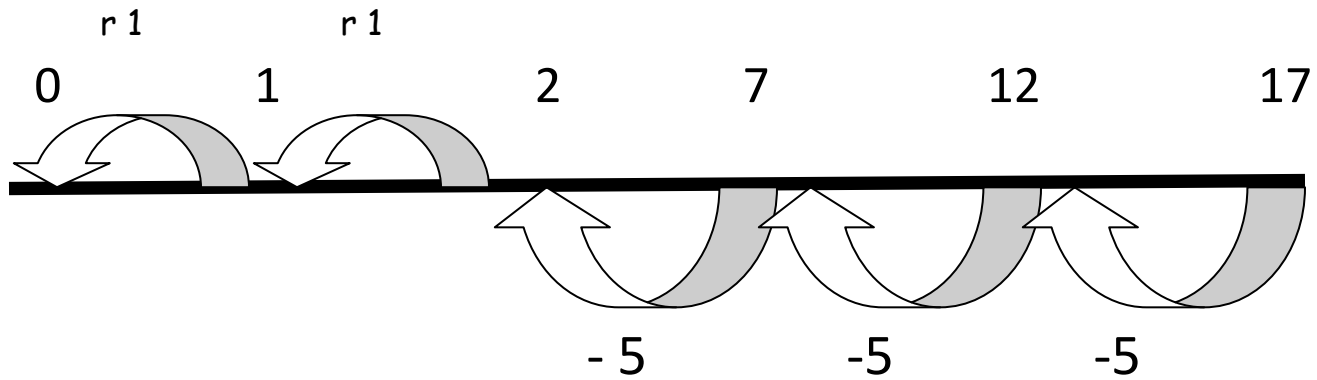
a) $15 \div 5 = 3$ (How many times can I subtract 5 from 15?)



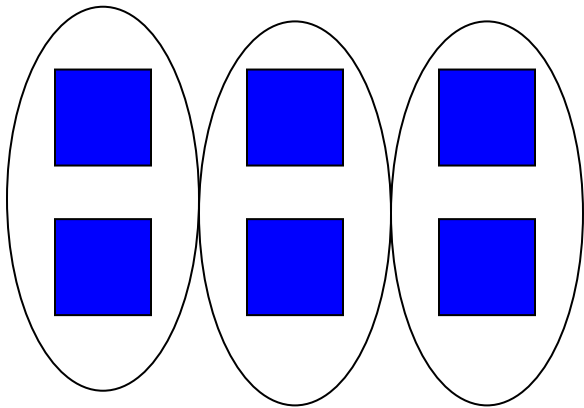
Count back in jumps of 5 for the answer.

b) Repeated subtraction with remainders

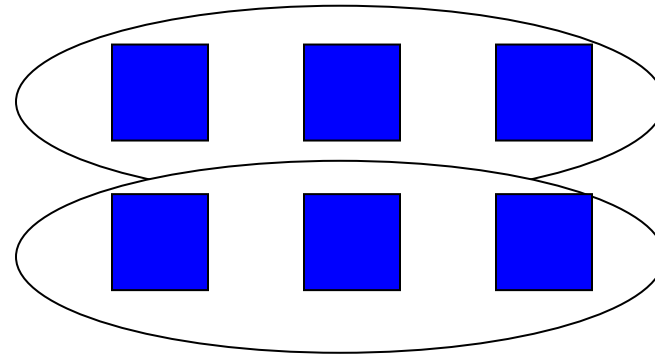
$$17 \div 5 = 3r2$$



2. Arrays for division



$$6 \div 3 = 2$$



$$6 \div 2 = 3$$

This is explicitly linked to arrays in multiplication.

Usually introduced in late Year 3/ Year 4

1. Long division (also called chunking).

$$72 \div 5 =$$

$$\begin{array}{r} 5 \overline{) 72} \\ \underline{50} \quad (\underline{10} \times 5) \\ 22 \\ \underline{20} \quad (\underline{4} \times 5) \\ 2 \end{array}$$

Answer = 14r2

Usually introduced in Year 5

1. Short division (also called the 'Bus Stop' method).

$$81 \div 3 = 27$$

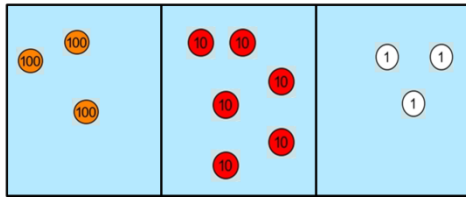
$$\begin{array}{r} 27 \\ 3 \overline{) 81} \end{array}$$

The small 2 here represents what remains when I divide 3 into 8.

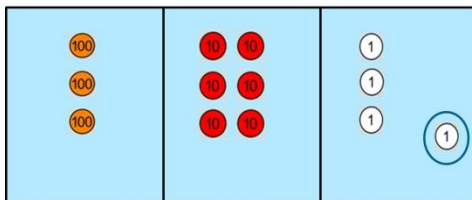
The use of place value counters can be very helpful in understanding how the method works.

$$363 \div 3 =$$

$$\begin{array}{r} 121 \\ 3 \overline{) 363} \end{array}$$



$$\begin{array}{r} 121 \text{ rem } 1 \\ 3 \overline{) 364} \end{array}$$



Long division is used for two digit numbers:

$$432 \div 15 \text{ becomes}$$

$$\begin{array}{r} 28 \text{ r } 12 \\ 15 \overline{) 432} \\ \underline{300} \\ 132 \\ \underline{120} \\ 12 \end{array}$$

Answer: 28 remainder 12

$$432 \div 15 \text{ becomes}$$

$$\begin{array}{r} 28 \\ 15 \overline{) 432} \\ \underline{300} \quad 15 \times 20 \\ \underline{132} \quad 15 \times 8 \\ 12 \end{array}$$

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

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

$$432 \div 15 \text{ becomes}$$

$$\begin{array}{r} 28.8 \\ 15 \overline{) 432.0} \\ \underline{300} \\ 132 \\ \underline{120} \\ 120 \\ \underline{120} \\ 0 \end{array}$$

Answer: 28.8