

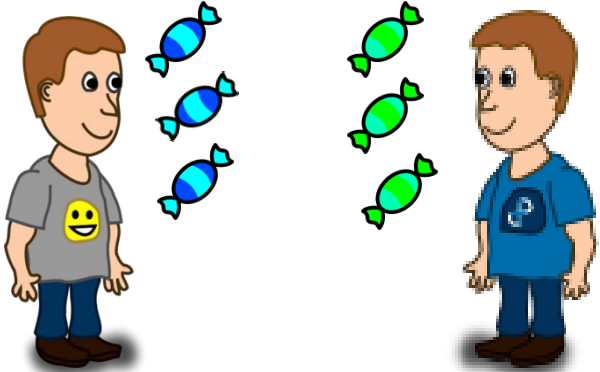
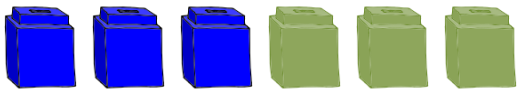


Progression in Calculation – Division

Methods should be introduced with the support of resources that enable pictorial representation and so develop conceptual understanding.

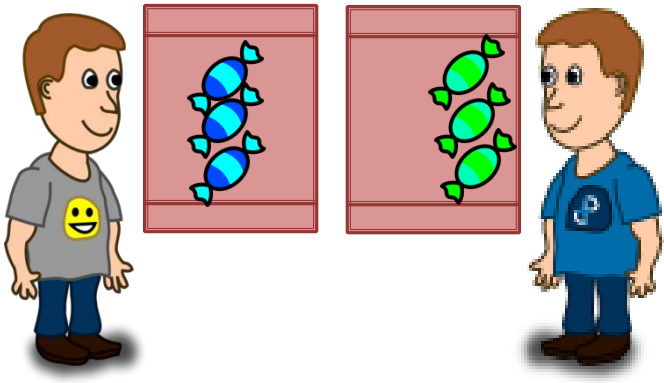



Before recording, it is essential that pupils have experience of division (sharing & grouping) using practical apparatus. This practical apparatus is also essential when developing mental calculation methods. The inverse relationship between multiplication and division is clear and pupils should have developed understanding of the relevant steps for multiplication before developing written division methods.

This can then be represented pictorially.

eg 1. ***There are 6 sweets for Tom and James to share. How many do they have each?***

| | |
|---|--|
| Sharing  |  |
| |  |
| |  |

eg 2. ***Tom has 6 sweets. 3 sweets fill a bag. How many bags can he fill?***

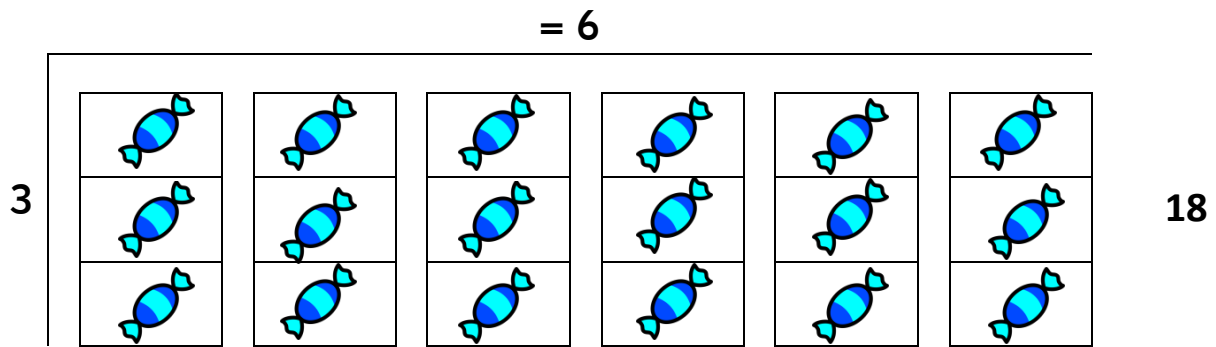
| | |
|---|--|
| Grouping  |  |
| |  |
| |  |

Once this conceptual understanding is in place, pupils can start developing meaningful mental methods. These should then be supported by written methods. Concrete resources should be used until the pupil no longer feels the need for them. Every new step must be supported by concrete resources, then pictorial representations before becoming abstract calculations.

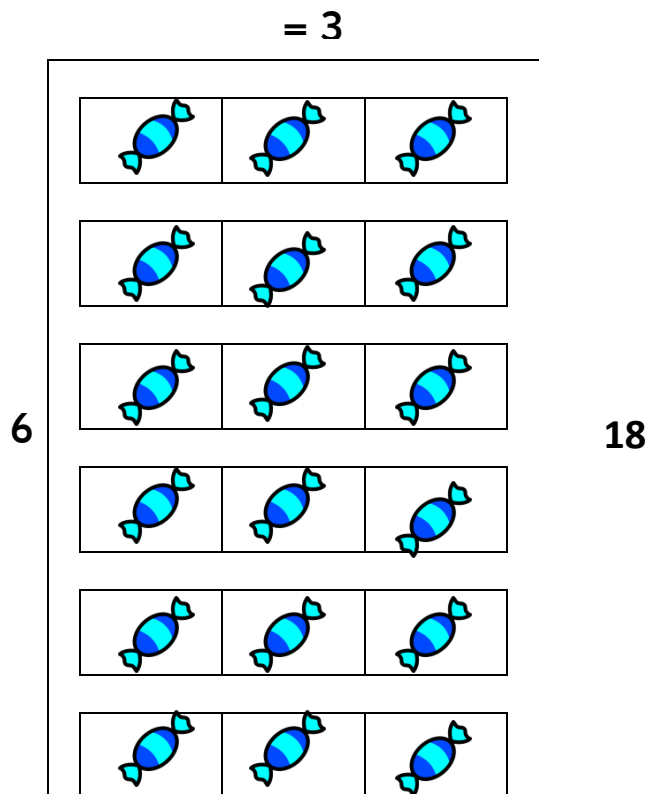
1. Introduction of arrays

Arrays are important elements to conceptual understanding of multiplication and the commutative nature of this operation. They are a useful ways for pupils to start organising their apparatus when counting large quantities etc. It is useful for pupils to be introduced to the idea of remainders with each of these stages.

There are 18 sweets. 3 sweets fit in a packet. How many packets does Tom have?



There are 18 sweets. Tom has 6 packets. How many sweets are in each packet?



2. Introduction of a numberline

Numberlines and hundred squares are useful tools in helping count on or back but are not always conceptually easy to use for division. Further experience sharing and grouping practical apparatus can often be more valuable, with the numberlines used as a recording device rather than as the method itself. They can be useful for identifying the size of remainders.

There are 20 balloons. 4 balloons make a bunch.

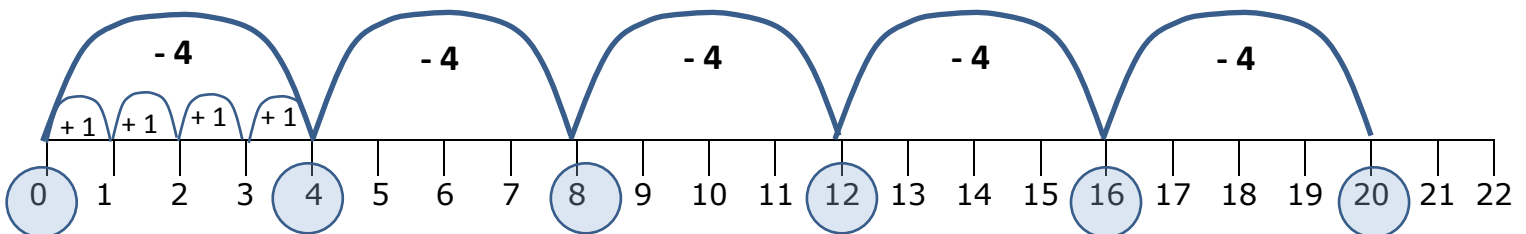
How many bunches can be made?

Step 1 – Represent the problem

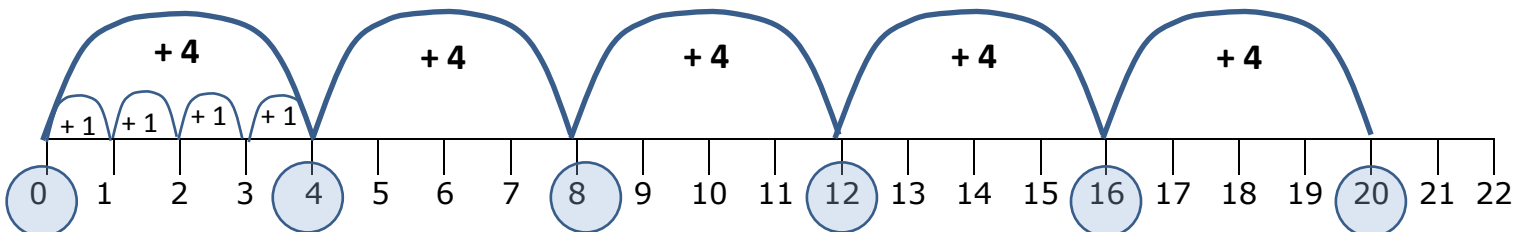


Step 2 – Use a numberline (Backwards or forwards)

Count the jumps/groups

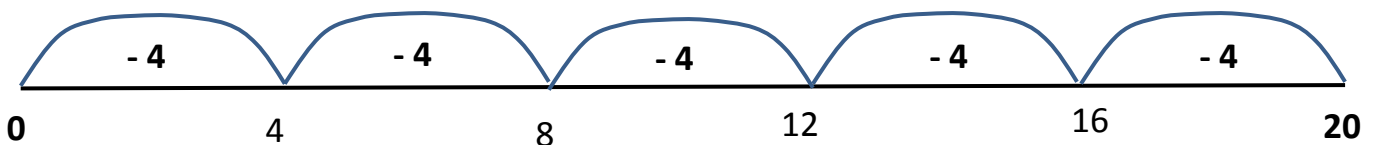


Count the jumps/groups

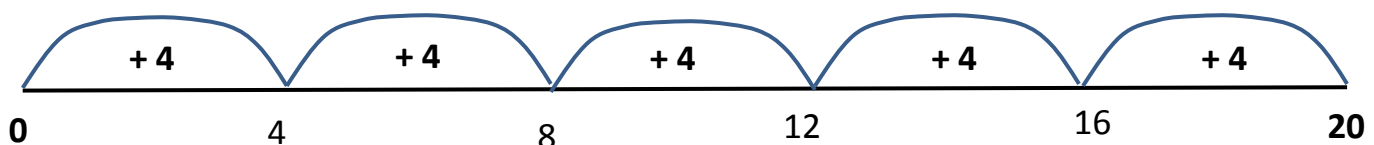


Step 3 – Use a blank numberline (Backwards or forwards)

Count the jumps/groups



Count the jumps/groups.

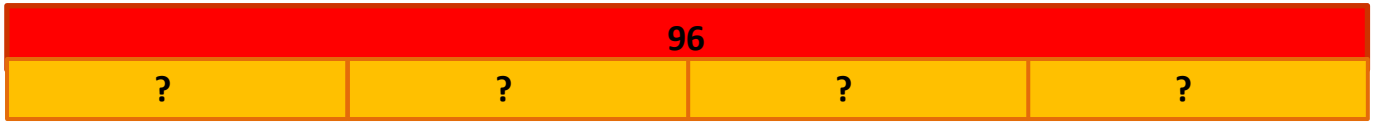


3. Chunking

Before developing this method, pupils must have developed their understanding of multiplying and dividing by ten and multiples of ten.

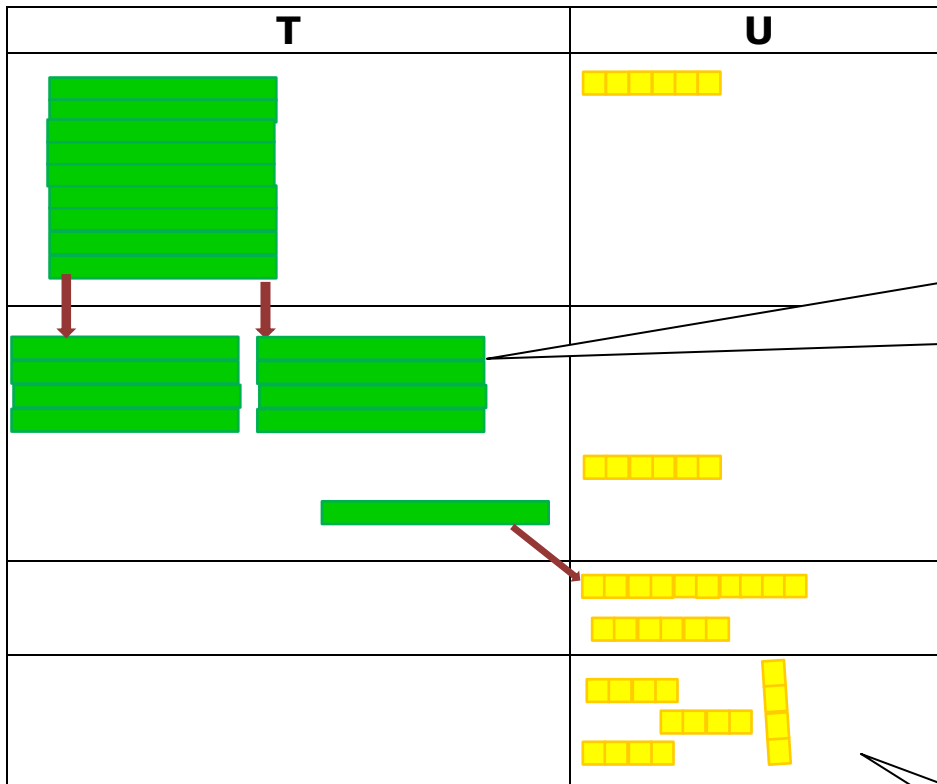
Tom has 96 sweets to share with his 3 friends. How many sweets will they each have?

Step 1 – Represent the problem



Step 2 – Partition

$$96 = 90 + 6$$



How many groups of 4 tens are there in the tens?

There are 2 groups of 4 tens and 1 single ten remaining. (20 groups of 4)

re-group

How many groups of 4 are there in the units?

There are four groups of 4 units.

Step 2 - Recording

| | T | U |
|---|----|---|
| | 20 | 4 |
| 4 | 90 | 6 |
| | 80 | 0 |
| | 10 | 6 |
| | 10 | 6 |
| | 0 | 0 |

How many groups of 4?

There are 2 groups of 4 tens (20 groups of 4)

(4 X 20)

Subtract the 2 x 40 from the original number.

(4 X 4)

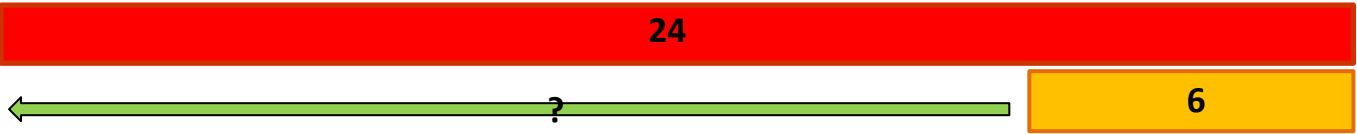
There are 4 groups of 4 in 16

No remainder

4. Introduction of short division

Tom has 24 marbles in a box. 6 fit in a box. How many boxes does he need?

Step 1 – Represent the problem



Step 2 – Use place value counters to partition the number.

| T | U |
|----|---------|
| 10 | 1 1 1 1 |
| 10 | |

How many *groups* of 6 with the tens?

| T | U | |
|---|---|---|
| 0 | 4 | |
| 6 | 2 | 4 |

| | | | |
|---|---|---|---|
| 1 | 1 | 1 | 1 |
| 1 | 1 | 1 | 1 |
| 1 | 1 | 1 | 1 |
| 1 | 1 | 1 | 1 |
| 1 | 1 | 1 | 1 |
| 1 | 1 | 1 | 1 |

No groups of 6 with tens

Regroup and arrange as an **array**

How many *groups* of 6 in the units?

| | | | |
|---|---|---|---|
| 1 | 2 | 3 | 4 |
|---|---|---|---|

There are **4** groups of 6 in the array.

5. Introducing long division

Pupils should have a good understanding of short division and be able to complete short division algorithms, without apparatus, before beginning to use long division.

Tom has 432 marbles. 24 fit in a box. How many boxes does he need?

| | H | T | U |
|-------------------|----------|----------|----------|
| | 0 | 1 | 8 |
| 24 | 4 | 3 | 2 |
| | 2 | 4 | 0 |
| (1 X <u>240</u>) | | | |
| 1 | 9 | 2 | |
| 1 | 9 | 2 | |
| (8 X <u>24</u>) | | | |
| 0 | 0 | 0 | |

How many groups of 24 in 4?

0

How many groups of 240 in 430?

1

Subtract the 240 from the original number.

How many groups of 24 in 192?

8

(which they can work out through multiplication with trial & improvement)

6. Recording short and long division

(From DfE - National Curriculum calculation guidance)

a) Short division

98 ÷ 7 becomes

$$\begin{array}{r} 14 \\ 7 \overline{) 98} \\ \underline{7} \\ 28 \\ \underline{28} \\ 0 \end{array}$$

Answer: 14

432 ÷ 5 becomes

$$\begin{array}{r} 86 \text{ r } 2 \\ 5 \overline{) 432} \\ \underline{40} \\ 32 \\ \underline{30} \\ 2 \end{array}$$

Answer: 86 remainder 2

496 ÷ 11 becomes

$$\begin{array}{r} 45 \text{ r } 1 \\ 11 \overline{) 496} \\ \underline{44} \\ 56 \\ \underline{55} \\ 1 \end{array}$$

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

b) Long division

432 ÷ 15 becomes

$$\begin{array}{r} 28 \text{ r } 12 \\ 15 \overline{) 432} \\ \underline{30} \\ 132 \\ \underline{150} \\ 120 \\ \underline{150} \\ 0 \end{array}$$

Answer: 28 remainder 12

432 ÷ 15 becomes

$$\begin{array}{r} 28 \\ 15 \overline{) 432} \\ \underline{30} \\ 132 \\ \underline{150} \\ 120 \\ \underline{150} \\ 0 \end{array} \begin{array}{l} 15 \times 20 \\ 15 \times 8 \end{array}$$

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

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

432 ÷ 15 becomes

$$\begin{array}{r} 28.8 \\ 15 \overline{) 432.0} \\ \underline{30} \\ 132 \\ \underline{150} \\ 120 \\ \underline{150} \\ 0 \end{array}$$

Answer: 28.8