Y3

MENTAL CALCULATION
Multiplication & Division

National Curriculum Programme of Study:

- Count from 0 in multiples of 4, 8, 50 and 100.
- Recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables.
- Write and calculate mathematical statements for multiplication and division using the multiplication tables that they know. including for two-digit numbers times one-digit numbers, using mental and progressing to formal written methods.

FLUENCY

By the end of Year 3, children should fluently derive and recall:

- multiplication facts for the 2, 3, 4, 5, 8 and 10 times-tables, and corresponding division facts
- doubles of multiples of 10 to 100, e.g. double 90, and corresponding halves

COUNT FROM 0 IN MULTIPLES OF 4, 8, 50 AND 100

Teaching should focus on:

- Counting on and back to zero in steps of 4,8,50 and 100.
- Count on and back in steps of 100 from any given number.

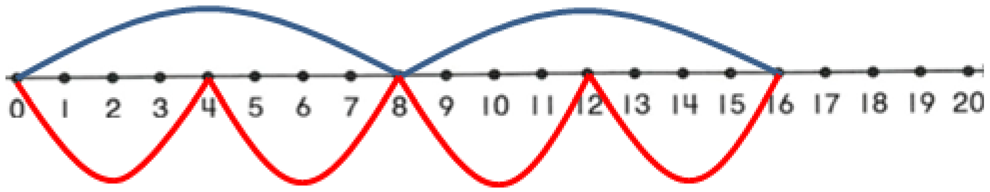
- The counting stick can be considered as part of a continuous or ‘empty number line’ with clearly marked intervals along the stick to represents specific points. Progressing from activities in Year 2, pupils can focus on counting on and back in steps of 4,8,50 and 100.

Tell the children, they are counting in steps of 4 and practice counting forwards and backwards from a starting point of zero, counting in steps of 4 as each interval line is touched. Attach number cards to the interval lines to remind children of the steps. Make links to multiplication and division. What are 5 steps of 4? How many steps of 4 make 44? How do you know? How could we write that? Next count in 8s from zero and place markers on the stick. What do they notice about the relationship between the numbers when counting in 4s and the numbers when counting in 8s? If the count continued past the end of the stick, which other numbers would appear in both the 4 and 8 counts? How could this help with learning the 4 and 8 times tables?

8 x 1 = 4 x 2
8 x 2 = 4 x 4
8 x 3 = 4 x 6

As 2 jumps of 4 are the same as 1 jump of 8, you can work out the 8 times table by working out double the steps of the 4 times table.

For example
8 x 2 will be the same as 4 x 4.



What if the start of the stick was 40, counting in 4s where would 64 be? If the end of the stick was 68 where would 52 be?

When counting on in 100s, make the beginning of the stick any number, for example 132. Count along the stick in 100s from 132. Ask a child to write down the numbers - what patterns do the children notice? Which digits stay the same? Which change? Ask, if the starting point is 132 and we are counting on in 100s, what number will this be (point to an interval further along the stick.)?

Point to the centre of the stick and say, if this is 350 and we are counting in 50s, what are the numbers either side? What are the numbers at the beginning and end of the stick? Pupils could have an empty number line or track marked in ten intervals to represent the counting stick as an aid to counting.

RECALL AND USE MULTIPLICATION AND DIVISION FACTS FOR THE 3, 4 AND 8 MULTIPLICATION TABLES

Teaching should focus on:

- Deriving and recalling multiplication facts for the 2, 3, 4, 5, 6 and 10 times-tables and corresponding division facts
- Deriving and recalling doubles of multiples of 10 to 100 and corresponding halves
- Recognising multiples of 2, 3, 4, 5, 6 and 10 up to the twelfth multiple

See also ***Written Calculation Guidance,***
Year 3 Multiplication *'Using arrays and known facts for multiplication of two single digit numbers'*

- Demonstrate the relationship between the 2 times table and the 4 times table and the relationship between 4 times table and the 8 times table using the counting stick and number lines as shown above. Pupils could also colour the 2 times table and 4 times table on a multiplication square. What patterns do they see? What is the same and what is different about the numbers they have coloured? Can they create a general rule to help somebody learn their 4 times table using their 2 times table?

- Each pair of pupils will need a 12 sided spotted die and a 3 x 3 grid each. Alternatively a 6 sided die can be used and pupils can choose to double the spots after their throw.
To practise the 4 times table, each spot is worth 4 points. Pupil A throws the die, multiplies the spots by 4 and writes the total in one of the squares in the grid. Pupil B throws the die and repeats the same steps. This continues until both players have the 9 squares in their grid filled. The pupils then exchange grids. Pupil A throws the die and multiplies the spots by 4. If the total is on their new grid, they can cross that number out. Pupil B takes their turn and the game continues until a player crosses out all the numbers in their grid. Can pupils work out which numbers they need to throw using division facts?

- This chart contains numbers from the 3, 4, 5 and 6 times tables. Some of the numbers appear in just one of the tables, other numbers may appear in more than 1 table.

3	4	5	6
8	9	10	12
15	16	18	20
30	60	80	90
100			

Point to one of the number and ask pupils to provide multiplication and division facts relating to this number. Which other numbers could they add to the chart?

WRITE AND CALCULATE MATHEMATICAL STATEMENTS FOR MULTIPLICATION AND DIVISION USING THE MULTIPLICATION TABLES THAT THEY KNOW, INCLUDING FOR TWO-DIGIT NUMBERS TIMES ONE-DIGIT NUMBERS, USING MENTAL AND PROGRESSING TO FORMAL WRITTEN METHODS

Teaching should focus on:

- Doubling multiples of 10 to 100, e.g. double 90, and corresponding halves
- Doubling multiples of 5 to 100 and find the corresponding halves, e.g. double 85, halve 170
- Multiplying a two-digit number by 10
- Multiplying a two-digit by a single-digit number
- Dividing a two digit number by a single-digit number
- Developing mental methods using commutativity and associativity

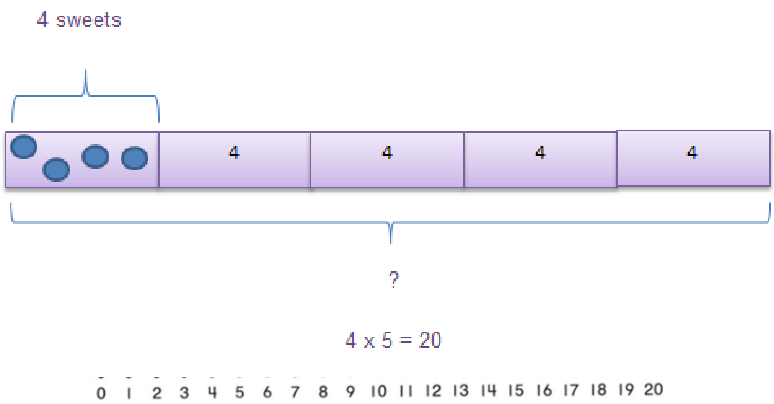
See also ***Written Calculation Guidance,***
Year 3 Multiplication ‘ Using arrays and known facts for multiplying a two-digit by a single-digit number’
Year 3 Division *‘ Using place value counters to model division with arrays’*

- Pupils should solve simple problems in contexts, deciding which of the four operations to use and why. They need to consider which parts of the calculation they might be able to solve in their heads, which parts require the aid of jottings and which will need a written method. Compare pupils’ jottings and consider which elements are the same and which are different. Discuss why certain jottings are more helpful than others.

  These problems will include measuring and scaling contexts, (for example, four times as high, eight times as long etc.). Mental methods should progress to multiplying and dividing 2 digit numbers by 1 digit.

- The bar model provides an effective visual representation which can support pupils in solving multiplication and division problems.

  For example, *Sam wants to give 4 sweets to each of his 5 friends. How many sweets will he need?*



Tim's pencil is 3 times longer than Dylan's. Dylan's pencil is 8 cm long. How long is Tim's pencil?

Pupils will need plenty of opportunities to represent these situations with physical objects and drawings before being expected to determine an abstract calculation such as 8 x 3.

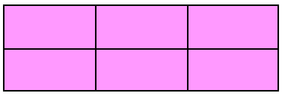
Dylan

Tim

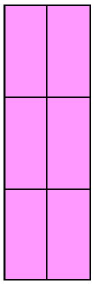
- Pupils should start to develop efficient mental methods using commutativity and associativity.

Commutative Law:

Example: 2 x 3 = 3 x 2



Is the same as



Distributive Law:

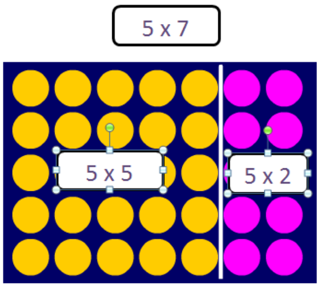
Example

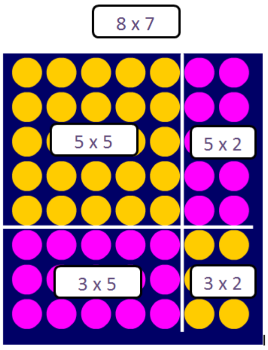
4 x 9

= 4 (2 + 7)

= (4 x 2) + (4 x 7)

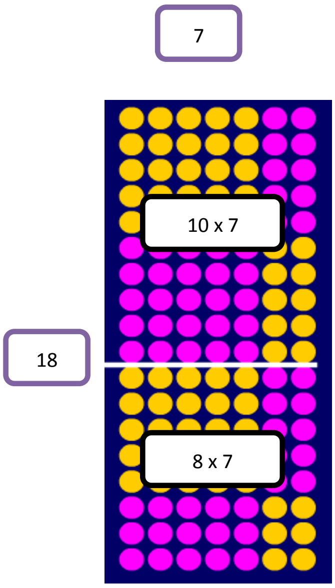
Pupils will need practical activities and models to understand how the distributive law works. The Interactive Teaching Programme (ITP) ' Multiplication Array' can help pupils see how one multiplication fact can be created from knowing simpler facts. For example





Using the ITP, ask pupils to represent other table facts using simpler known facts

Demonstrate how the distributive law can help to solve more complex multiplication calculations.
Use the ITP 'Multiplication array' to demonstrate multiplication of a 2 digit number by a 1 digit number.
For example, 18 x 7.



Pupils should have extensive practice at breaking up larger arrays into smaller components using practical equipment and images such as the ITP.

They can then begin to write down the corresponding multiplication sentences as they are doing their practical work. For example

18 x 7
10 x 7 = 70
8 x 7 = 56
70 + 56 = 126
18 x 7 = 126

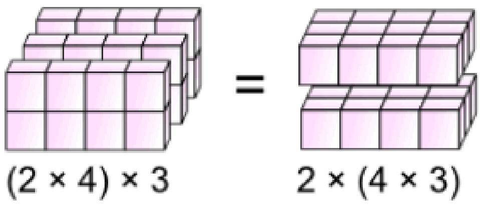
The associative law: Example

4 × 12 × 5

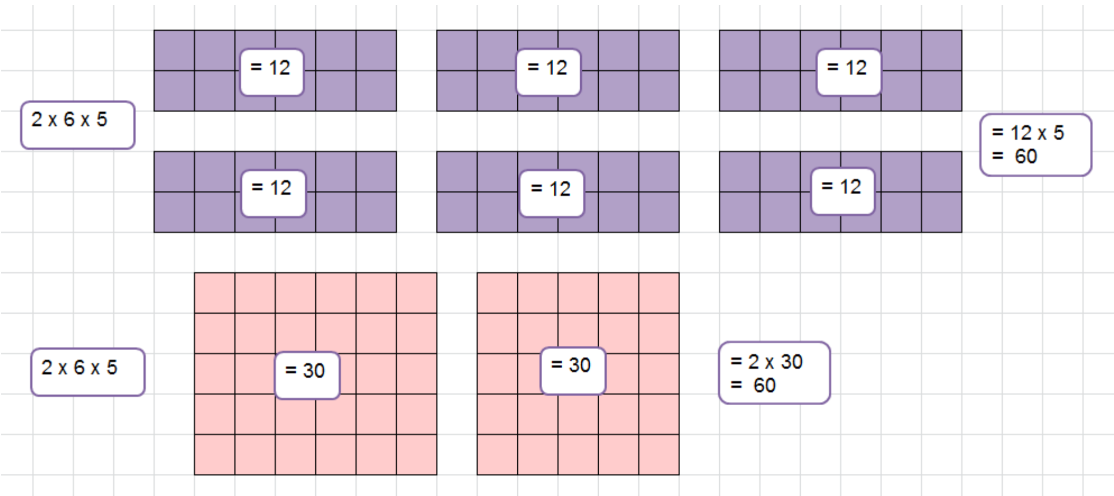
= 4 × 5 × 12

= 20 × 12 = 240

Using smaller numbers and multilink cubes, demonstrate how three blocks of 2 x 4 cubes contain the same amount of multilink cubes as two blocks of 4 x 3 cubes.



Ask pupils to represent multiplication sentences in two or three different ways by creating smaller arrays and compare totals. For example



Ask pupils ‘What would 2 x 5 x 6 look like? Would we still get a total of 60? Why/why not?’’

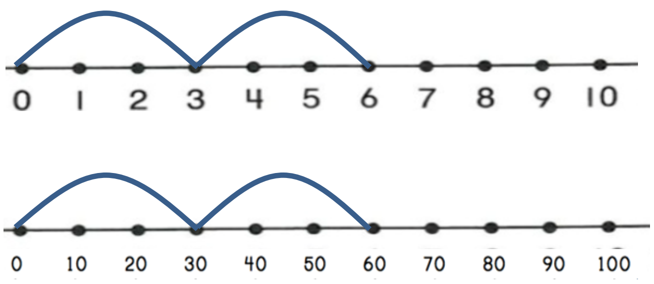
Explain that sometimes, as when adding, multiplication can be made easier by multiplying the numbers in a different order. For example

4 x 2 x 6

One way of calculating this could be (4 x 2) x 6 = 8 x 6. However it may be easier to do

(4 x 6) x 2 = 24 x 2 as pupils may be able to double more easily than recall their 6 or 8 times table facts.

- Pupils should also use multiplication and division facts (for example, using 3 × 2 = 6, 6 ÷ 3 = 2 and 2 = 6 ÷ 3) to derive related facts (for example, 30 × 2 = 60, 60 ÷ 3 = 20 and 20 = 60 ÷ 3).

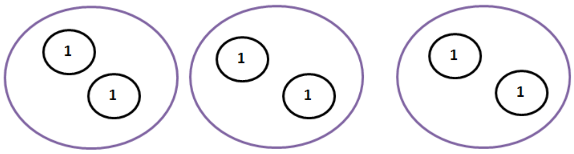


3 x 2 = 6

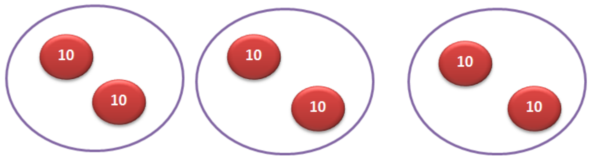
30 x 2 = 60

6 ÷ 3 = 2

One image could be:



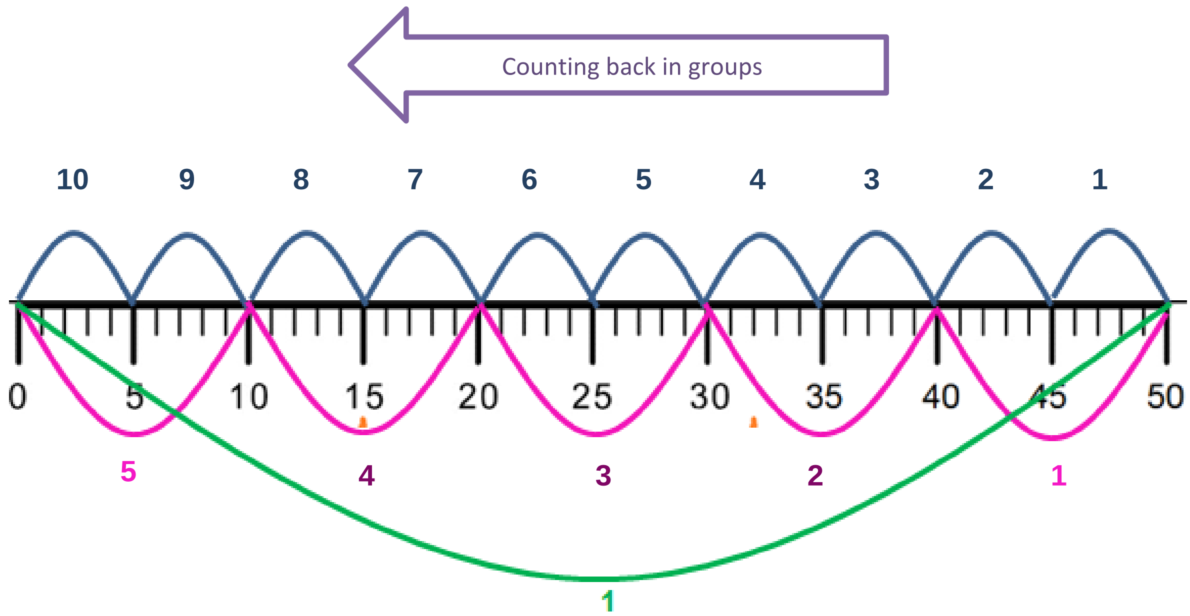
60 ÷ 3 = 20



- Use practical resources and objects to demonstrate division through grouping. How many groups of 8 cubes can be made from 24 cubes? 26 cubes? As numbers become larger, counting out the initial group in ones becomes inefficient, for example 'How many groups of 8 cubes can we make from 96 cubes?'.

- Demonstrate how to use more efficient grouping and repeated subtraction to solve division calculations.

  50÷ 5 could b calculated by working out how many groups of 5 are in 50. Links to repeated subtraction can be made, showing that 5 can be taken away from 50 **ten** times. More efficiently, 2 groups of 5 can be taken away in a chunk of 10 leaving 40. Another 2 chunks can be taken away to leave 30 and so on. Altogether **ten** groups of 5 will be taken away in five more efficient chunks. Ultimately, ten groups of 5 can be taken away in one large chunk of 50.



Pupils should be encouraged to subtract the largest multiples of the divisor from the dividend. For example,

72 ÷ 4

72 – 40 = 32 (10 groups)
32 – 32 = 0 (8 groups)

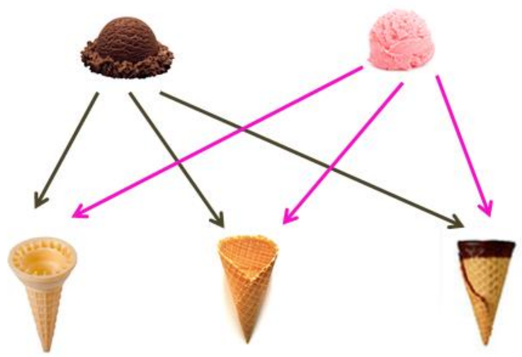
72 ÷ 4 = 18

- Pupils should solve correspondence problems in which m objects are connected to n objects (for example, 3 hats and 4 coats, how many different outfits?; 12 sweets shared equally between 4 children; 4 cakes shared equally between 8 children).

  Early experiences of correspondence will have taken place as pupils learn to count by one to one correspondence. As pupils develop, they should learn that relationships in mathematics also occur 'one to many' and 'many to one'.

  "At the ice cream shop, you can choose between a cone, a waffle cone and a chocolate cone. You can have 1 scoop of either chocolate or strawberry ice cream. How many different ice creams could you choose from?"

  One way to look at this would be as a mapping diagram



Tell pupils that the ice cream shop has bought a tub of vanilla ice cream as well as the chocolate and strawberry. How many options could they choose between now? What if the shop introduced a sprinkle dipped cone?