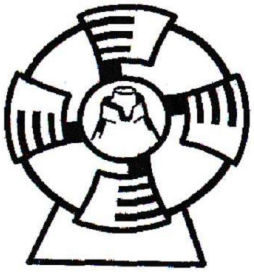
An Daras
Multi Academy Trust

Windmill Hill Academy

KS1 Calculation Policy for Addition, Subtraction, Multiplication and Division

Updated for September 2014

Calculations Policy for Mathematics

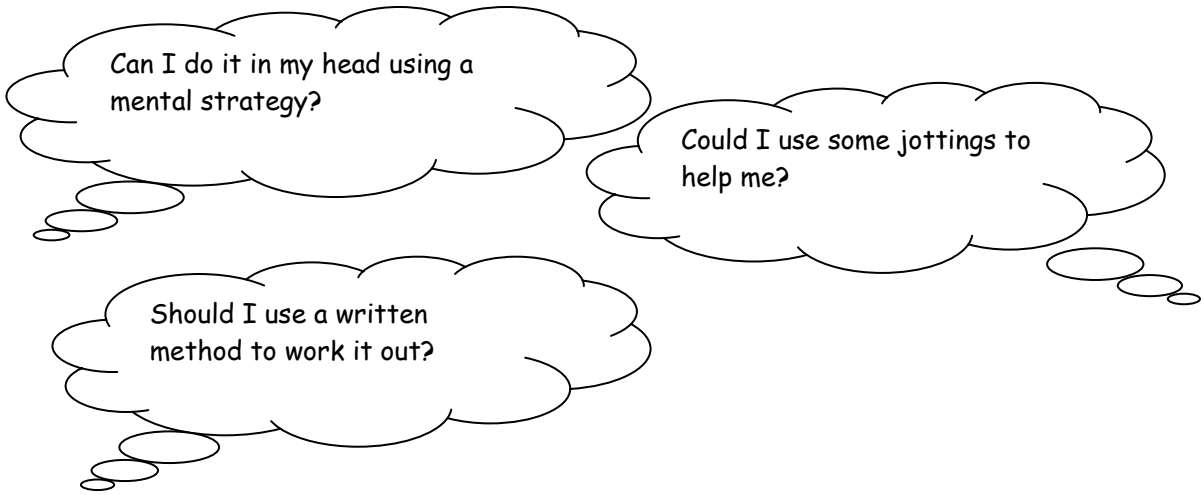


The following calculations policy has been devised to meet the requirements of the National Curriculum 2014 for the teaching and learning of mathematics, and also to give pupils a consistent and smooth progression of learning in calculation across the school. Please note that early learning in number and calculation in YF follows the 'Development Matters EYFS document and this calculation policy is designed to build on progression from the content and methods established in the Early Years Foundation Stage.

Age stage expectations
The calculation policy is organised according to age stage expectations as set out in the National Curriculum 2014, however it is vital that pupils are taught according to the stage that they are currently working at, working at a lower stage until they are secure enough to move on. Children must consolidate their learning with mathematical challenges in various contexts before moving on to the next stage.

Providing a context for calculation
It is important that any calculation is given a real life context or problem solving approach to help build children's understanding of the purpose of calculation, and to help them recognise when to use certain operations and methods when faced with problems. This must be a priority within calculation lessons.

Choosing a method:
Children need to be taught and encouraged to use the following processes in deciding what approach they will take at solving a calculation, to ensure they select the most appropriate method for the numbers involved.



To work out a tricky calculation	Approximate	Calculate	Check it!

Overview of Key Stage 1

Children in Years 1 and 2 will be given a really solid foundation in the basic building blocks of mental and written arithmetic. Through being taught place value, they will develop an understanding of how numbers work, so that they are confident in 2-digit numbers and beginning to read and say numbers above 100. A focus on number bonds, first via practical hands-on experiences and subsequently using memorisation techniques, enables a good grounding in these crucial facts, and ensures that all children leave Y2 knowing the pairs of numbers which make all the numbers up to 10 at least. They will also have experienced and been taught pairs to 20. Their knowledge of number facts enables them to add several single-digit numbers, and to add/subtract a single digit number to/from a 2-digit number. Another important conceptual tool is their ability to add/subtract 1 or 10, and to understand which digit changes and why. This understanding is extended to enable children to add and subtract multiples of ten to and from any 2-digit number. The most important application of this knowledge is their ability to add or subtract any pair of 2-digit numbers by counting on or back in tens and ones. Children may extend this to adding by partitioning numbers into tens and ones. Children will be taught to count in 2s, 3s, 5s and 10s, and will have related this skill to repeated addition. They will have met and begun to learn the associated 2x, 3x, 5x and 10x tables. Engaging in a practical way with the concept of repeated addition and the use of arrays enables children to develop a preliminary understanding of multiplication, and asking them to consider how many groups of a given number make a total will introduce them to the idea of division. They will also be taught to double and halve numbers, and will thus experience scaling up or down as a further aspect of multiplication and division. Fractions will be introduced as numbers and as operators, specifically in relation to halves, quarters and thirds.

Addition

Children should not be made to go onto the next stage if:

***they are not ready.**

***they are not confident.**

- ✓ **Children should be taught through real life experiences and word problems.**
- ✓ **Children should be encouraged to consider if a mental calculation would be appropriate before using written methods.**
- ✓ **Children should be encouraged to approximate their answers before calculating.**
- ✓ **Children should be encouraged to check their answers after calculation using an appropriate strategy.**

Year 1

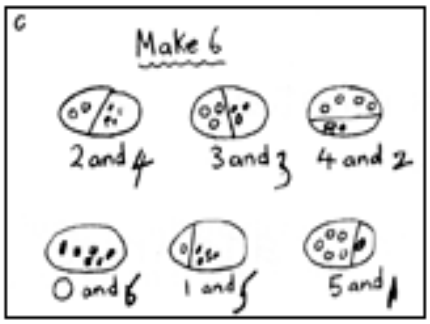
Key vocabulary: *add, more, plus, and, make, altogether, total, equal to, equals, double, most, count on, number line*

Key skills for addition at Y1:

Read and write numbers to 100 in numerals, incl. 1—20 in words

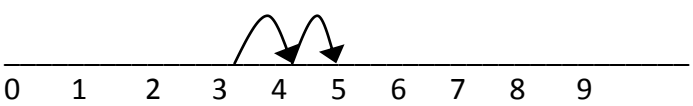
- Recall bonds to 5,6,7,8,9, 10 and 20, and addition facts within 20
- Count to and across 100
- Count in multiples of 1 2, 5 and 10
- Count on in ones from a given 2-digit number
- Add two single-digit numbers
- Add three single-digit numbers spotting doubles or pairs to 10
- Count on in tens from any given 2-digit number
- Add 10 to any given 2-digit number
- Use number facts to add single-digit numbers to two-digit numbers e.g. use 4 + 3 to work out 24 + 3, 34 + 3…
- Add by putting the larger number first
- Solve simple 1-step problems involving addition, using objects, number lines and pictorial representations.

Children are encouraged to develop a mental picture of the number system in their heads to use for calculation. They develop ways of recording calculations using pictures, etc.



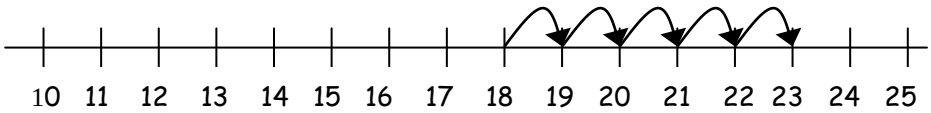
They use numberlines and practical resources to support calculation and teachers *demonstrate* the use of the numberline.

3 + 2 = 5 +1 +1

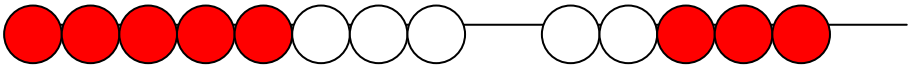


Children then begin to use numbered lines to support their own calculations using a numbered line to count on in ones from a 2-digit number.

18 + 5 = 13 +1 +1 +1 +1 +1



Bead strings or bead bars can be used to illustrate addition including bridging through ten by counting on 2 then counting on 3.



- ✓ Children should have access to a wide range of counting equipment, everyday object, number tracks and number lines, numicon, and be shown numbers in different context.
- ✓ Read and write the addition(+) and equals (=) signs within number sentences
- ✓ Interpret addition number sentences and solve them: 8+3= ❑ 15+4= ❒ 4+3+1 = ❑

  ❒ + ❑ = 6

This builds on from prior learning of adding by combining two sets of object into one group (5 cubes and 3 cubes) in Early years.

Year 2

Children will begin to use 'empty number lines' themselves starting with the larger number and counting on.

Key vocabulary: add, more, plus, and, make, altogether, total, equal to, equals, double, most, count on, number line, sum, tens, units, partition, addition, column, tens boundary

Calculation skills for addition at Y2:

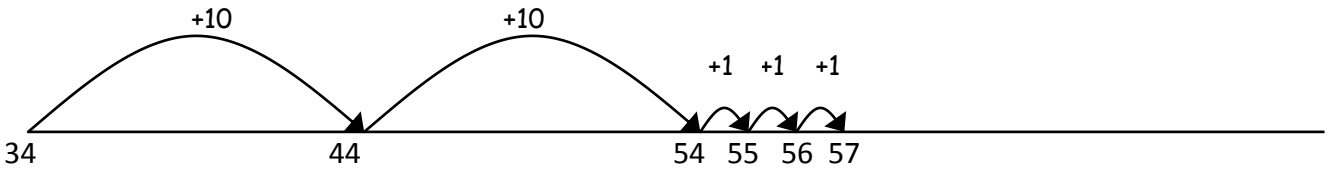
- Add a 2-digit number and ones, using number facts and bridging 10 (e.g. 27 + 6)
- Add a 2-digit number and tens (e.g. 23 + 40)
- Add pairs of 2-digit numbers (e.g. 35 + 47)
- Add three single-digit numbers (e.g. 5 + 9 + 7)
- Recall bonds to 12, 20 and bonds of tens to 100 (30 + 70 etc.)
- Count in steps of 2, 3 and 5 and count in tens from any number.
- Understand the place value of 2-digit numbers (tens and ones)
- Compare and order numbers to 100 using < > and = signs.
- Read and write numbers to at least 100 in numerals and words.

Show that adding can be done in any order (the commutative law).

- Solve problems with addition, using concrete objects, pictorial representations, involving numbers, quantities and measures, and applying mental and written methods.

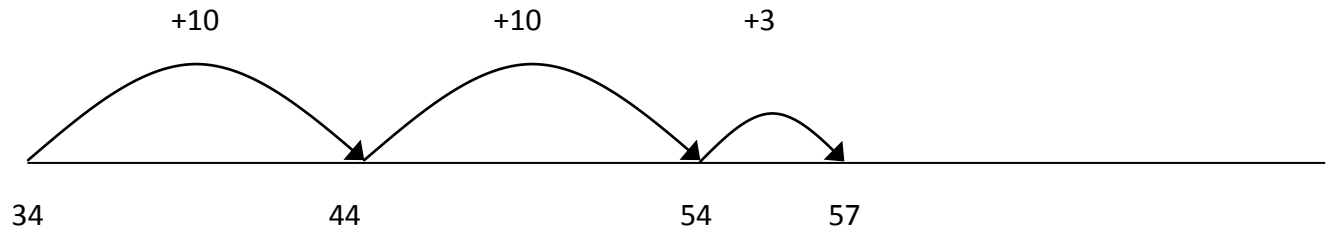
- First counting on in tens and ones.

34 + 23 = 57



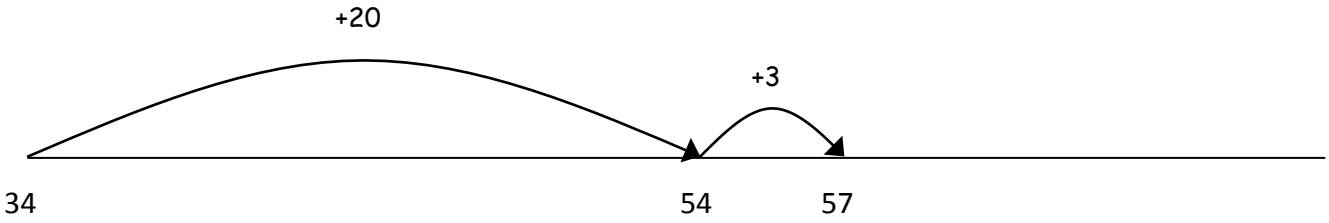
✓ Then helping children to become more efficient by adding the units in one jump (by using the known fact 4 + 3 = 7).

34 + 23 = 57



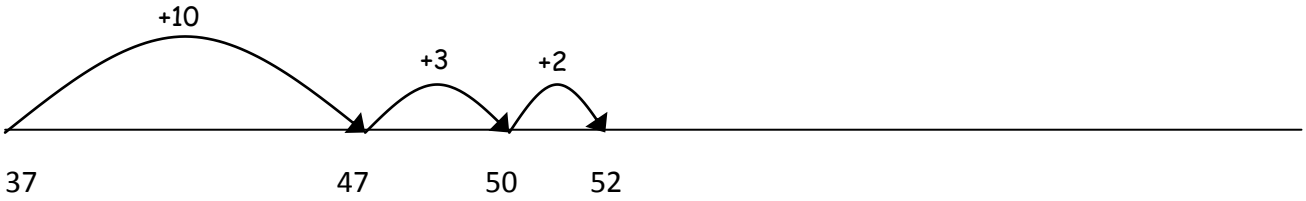
✓ Followed by adding the tens in one jump and the units in one jump.

34 + 23 = 57



✓ Bridging through ten can help children become more efficient.

37 + 15 = 52



Add pairs of 2-digit numbers, moving to the partitioned column method when secure adding tens and ones

23+34 20 + 3
<u>30 + 4</u>
50 + 7 = 57

- ✓ Only provide examples that do not cross the boundaries until they are secure with the method.
- ✓ Once children can add a multiple of ten to a 2-digit number mentally (e.g. 80+11) they are ready for adding 2-digit numbers that DO cross the tens boundary (e.g. 58+43).

58+43 50+8
<u>40+3</u>
<u>90+11</u>

To support understanding, pupils may physically make and carry out calculation with Dienes base 10, numicon, or place value counters, then compare their practical version to the written form, to build on understanding of it.

Subtraction

Children should not be made to go onto the next stage if:

***they are not ready.**
***they are not confident.**

- ✓ **Children should be taught through real life experiences and word problems.**
- ✓ **Children should be encouraged to consider if a mental calculation would be appropriate before using written methods.**
- ✓ **Children should be encouraged to approximate their answers before calculating.**
- ✓ **Children should be encouraged to check their answers after calculation using an appropriate strategy.**

Year 1

Key vocabulary: equal to, take, take away, less, minus, subtract, leaves, distance between, how many more, how many fewer / less than, most, least, count back , how many left, how much less is_?

Key skills for subtraction at Y1:

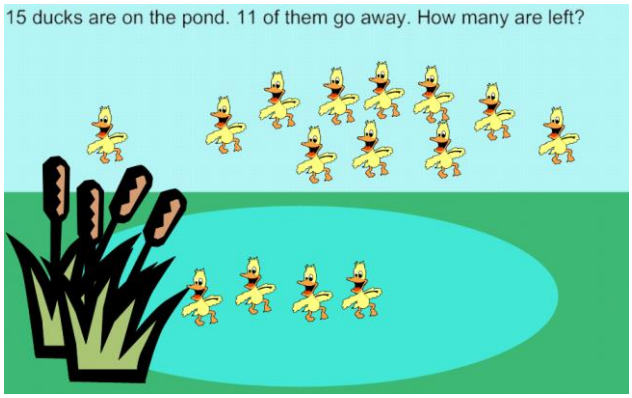
- Recall bonds to 5,6,7,8,9,10 and 20, (number bond 'story')
- Given a number, say **one more or one less.**
- Count to and over 100, **forward and back**, from any number.
- Represent and use **subtraction facts to 20 and within 20**.
- Subtract with **one-digit and two-digit** numbers to 20, including zero.
- Solve one-step problems that involve addition and subtraction, using concrete objects (ie bead string, objects, cubes) and pictures, and missing number problems.
- Read and write numbers from 0 to 20 in numerals and words.
- Use number facts to subtract single-digit numbers from 2-digit numbers, e.g. use 7-2 to work out 27-2, 37-2

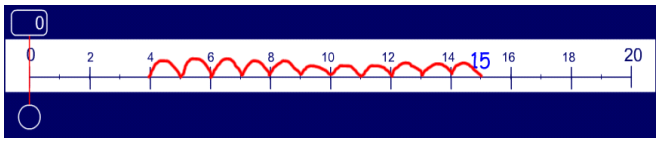
- Understand subtraction as 'take away' and find a 'difference' by counting up; use practical and informal written methods to support the subtraction of a one-digit number from a one digit or two-digit number and a multiple of 10 from a two-digit number

Taking away

Children interpret subtraction as 'taking away'. They represent 'taking away' using objects and with number sentences, recognising that the number of objects remaining is the answer in a calculation such as 15 – 11 = 5. They begin to rely less on manipulating practical resources and use strategies such as counting back on a number line or software that provides images and diagrams.

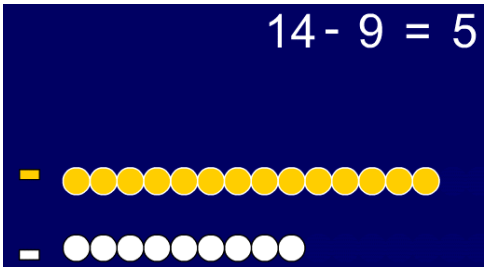
15 ducks are on the pond. 11 of them go away. How many are left?

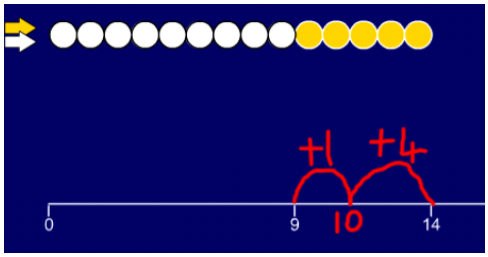




<u>Finding the difference</u>

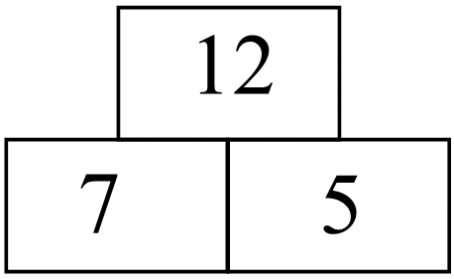
Children build on their understanding of subtraction to interpret 14 – 9 as finding the difference between 14 and 9 or: 'How many more must I add to 9 to get 14?' They use a counting on strategy and record the process as staps on a number line





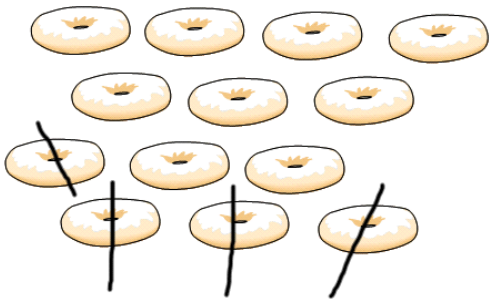
<u>Inverse relationship</u>

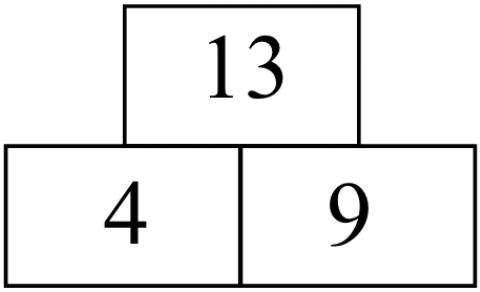
They construct sequences of calculations involving subtraction such as: 5 – 1 = 4, 6 – 2 = 4, 7 – 3 = 4, … They continue sequences such as: 12 – 0 = 12, 12 – 1 = 11, 12 – 2 = 10, … to build up patterns of calculations that highlight the underlying process of subtraction. They begin to recognise that subtraction and addition 'undo each other'.



e.g. 7 + 5 = 12 and 12 – 7 = 5

Children apply their knowledge to problems; for example, they work out how many biscuits are left on a plate of 13 biscuits if 4 are eaten. They solve problems such as finding the biggest and smallest possible differences between a pair of numbers from the set 8, 5, 12 and 6.





Using +/- and = signs

Children record addition and subtraction number sentences using the operation signs + and –. They generate equivalent statements using the equals sign, for example:

7 = 6 + 1; 7 = 5 + 2 …etc

7 = 8 – 1; 7 = 9 – 2 …etc

They recall the number that is 1 or 10 more or less than a given number and use this to support their calculations, for example to give answers to 12 + 1, 13 – 1 and 30 + 10 and 60 – 10.

Year 2

Key vocabulary: equal to, take, take away, less, minus, subtract, leaves, distance between, how many more, how many fewer / less than, most, least, count back , how many left, how much less is_?
difference, count on, strategy, partition, tens, units
Key skills for subtraction at Y2:

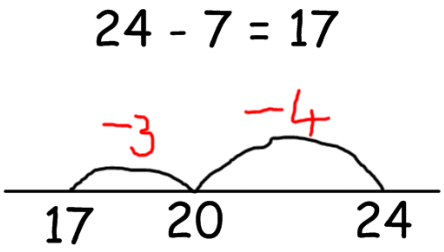
- Recognise the place value of each digit in a two-digit number.
- Recall and use subtraction facts to 12, 20 fluently, and derive and use related facts up to 100 (number bonds story).
- Subtract using concrete objects, pictorial representations, 100 squares and mentally, including: a two-digit number and ones, a two-digit number and tens, and two two-digit numbers.
- Show that subtraction of one number from another cannot be done in any order.
- Recognise and use inverse relationship between addition and subtraction, using this to check calculations and missing number problems.
- Solve simple addition and subtraction problems including measures, using concrete objects, pictorial representation, and also applying their increasing knowledge of mental and written methods.
- Read and write numbers to at least 100 in numerals and in words.

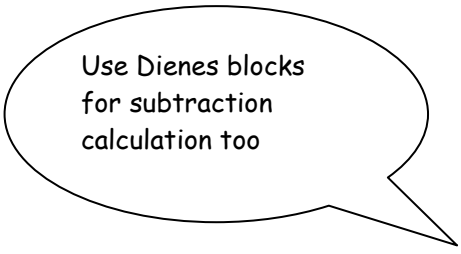
Children subtract with 2 -digit numbers.

*Counting back – they subtract on a number line by **counting back**, aiming to develop mental calculation skills.*

This strategy will be used for:

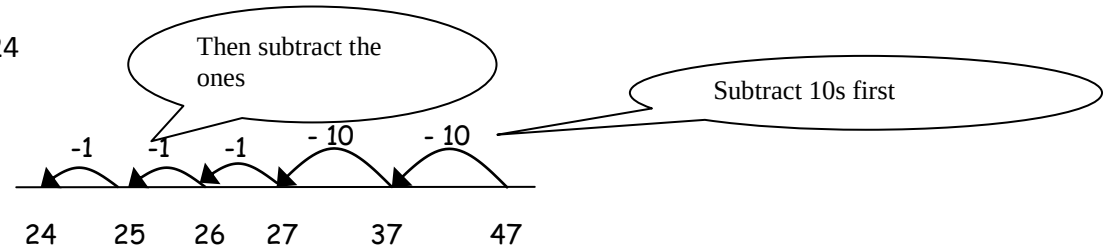
- 2-digit numbers subtract ones (by taking away / counting back)e.g.24-7





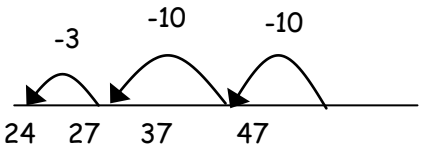
- 2-digit numbers subtract tens (by taking away / counting back) e.g. 48-3
- Subtracting pairs of 2-digit numbers -counting back in tens and ones.

47 – 23 = 24



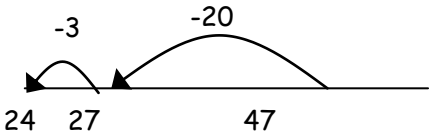
Then helping children to become more efficient by subtracting the units in one jump (by using the known fact 7 – 3 = 4).

47 – 23 = 24

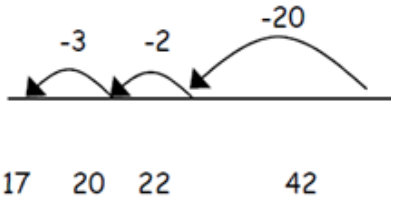


Combine methods with use of a hundred square to reinforce understanding of number value and order.

Subtracting the tens in one jump and the units in one jump.



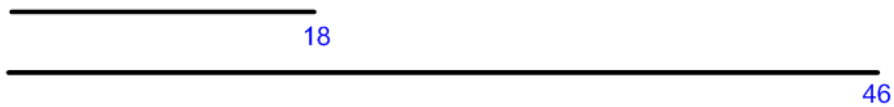
Teaching children to bridge through ten can help them become more efficient, for example 42-25.



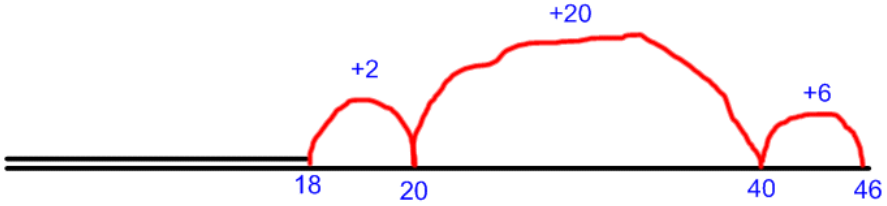
Finding the difference / counting on.

e.g. *Work out the difference between 46 and 18.*

Children should be encouraged to solve these types of calculation by representing both numbers initially on separate number lines and reinforcing the language of how many more or less, e.g.



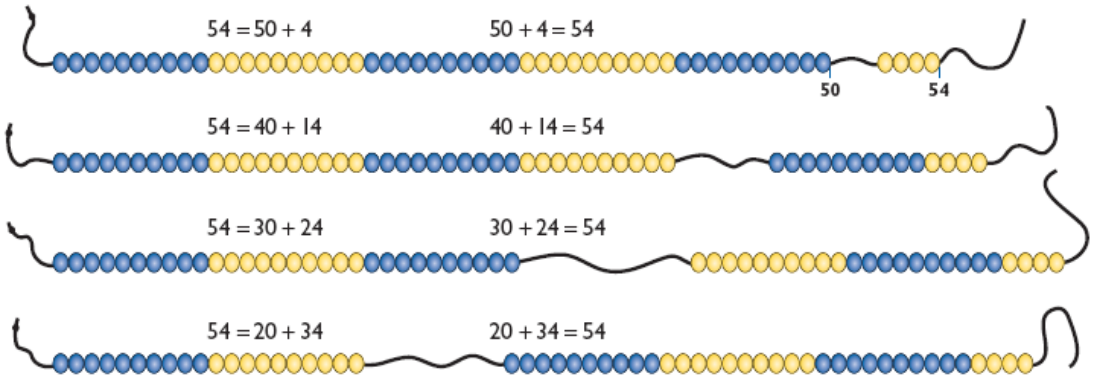
Through modelling and discussion, explore how this can be represented as 46-18 and that complementary addition (counting on) can be a useful checking strategy.



Many mental strategies are taught. Children are taught to recognise that when numbers are close together, it is more efficient to **count on** the difference. Children should be encouraged to decide which strategy to use depending on the numbers involved.
They need to be clear about the relationship between addition and subtraction.

Towards a standard written method (preparation for key stage 2)

In preparation for understanding decomposition and division strategies taught in key stage 2, it is important that children gain experience of partitioning beyond simple tens and ones, e.g.



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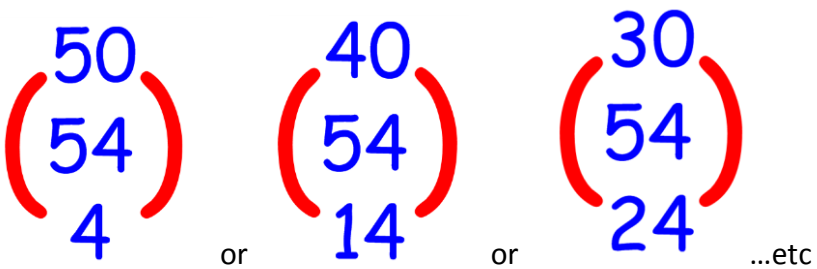


Inverse relationship

Children know that addition and subtraction are inverse operations and can state the subtraction calculation corresponding to a given addition calculation and vice versa. They check their answers; for example, to confirm 24 – 7 = 17, they add 17 and 7.

14+ ☐ =35. What is the missing number? How do you know? What subtraction could you do to find the answer?

Approximate,
Calculate,
Check it mate!

Multiplication

Children should not be made to go onto the next stage if:

***they are not ready.**

***they are not confident.**

- ✓ **Children should be taught through real life experiences and word problems.**
- ✓ **Children should be encouraged to consider if a mental calculation would be appropriate before using written methods.**
- ✓ **Children should be encouraged to approximate their answers before calculating.**
- ✓ **Children should be encouraged to check their answers after calculation using an appropriate strategy.**

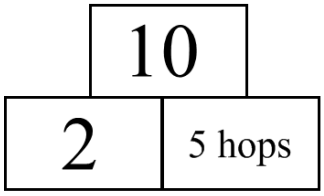
Year 1

Key vocabulary: groups of, lots of, times, array, altogether, multiply, count

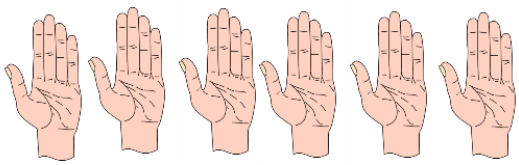
Key skills for multiplication at Y1:

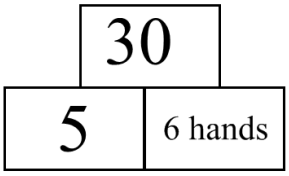
- Count in multiples of 2, 5 and 10.
- Begin to say what three 5s are by counting in 5s or what four 2s are by counting in 2s, etc.
- Solve one-step problems involving multiplication, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.
- Make connections between arrays, number patterns, and counting in twos, fives and tens.
- Double numbers to 10 using concrete objects and pictorial representations.

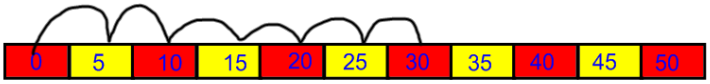
- Children will experience equal groups of objects and will count in 2s, 5s and 10s and begin to count in 5s. They will work on practical problem solving activities involving equal sets or groups, e.g. Count five hops of 2 along this number track. What number will you reach? (Children will begin to move from using number tracks to number lines as appropriate through year 1 and 2)



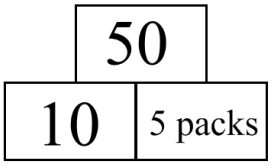
How many fingers are there altogether on six hands?

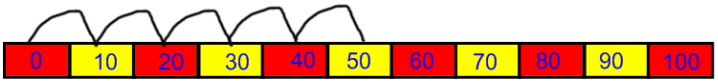






There are 10 crayons in each box.
How many crayons are there altogether?





3+3+3+3+3 =15

There are 3 sweets in one bag. How many sweets are in 5 bags altogether?

Year 2

Key vocabulary: groups of, lots of, times, array, altogether, multiply, count, multiplied by, repeated addition, column, row, commutative, sets of, equal groups, times as big as, once, twice, three times...

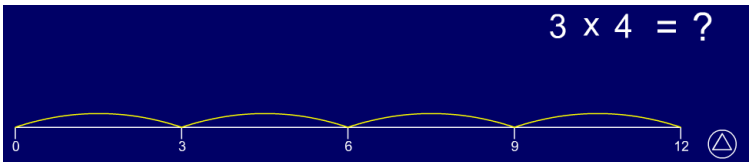
Key skills for multiplication at Y2:

- Count in steps of 2, 3 and 5 from zero, and in 10s from any number.
- Recall and use multiplication facts from the **2, 3, 5 and 10** multiplication tables, seeing these as 'lots of', e.g. 5 lots of 2
- Recognising odds and evens.
- Double numbers up to 20
- Begin to double multiples of 5 to 100
- Begin to understand that multiplication is repeated addition and to use arrays (E.g) 3x4 is three rows of four dots.
- Write and calculate number statements **using the x and = signs**.
- Show that multiplication can be done in any order (commutative).
- Solve a range of problems involving multiplication, using concrete objects, arrays, repeated addition, mental methods, and multiplication facts.
- Pupils use a variety of language to discuss and describe multiplication.

Children will develop their understanding of multiplication and use jottings to support calculation:

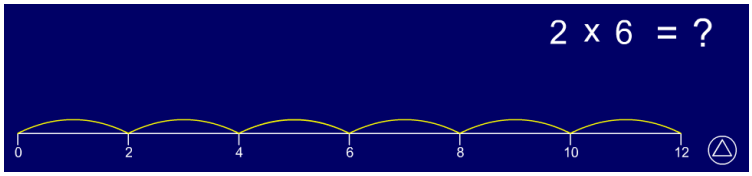
- Repeated addition
- Starting from zero, make equal jumps up on a number line to work out multiplication facts and write multiplication statements using x and = signs.

Show me on a number line how you could do:



3 ×4, how would 4 x 3 be different?

2 ×6, how would 6 x 2 be different?

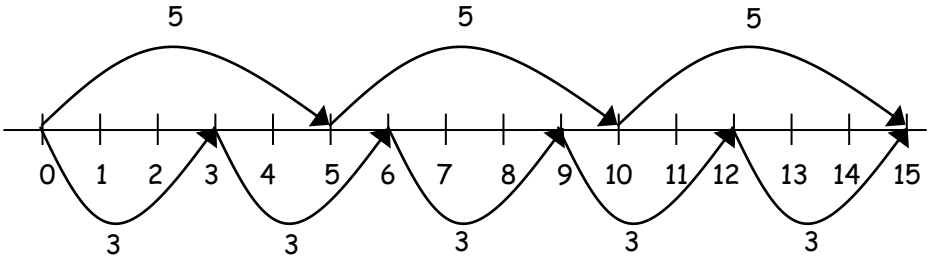


4 +4 +4 +4 +4 =20
Write this addition fact as a multiplication fact.

☐ x ☐ = ☐

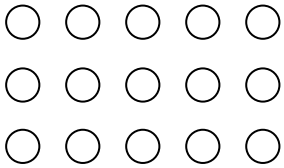
- **Commutativity**

Children should know that 3 x 5 has the same answer as 5 x 3 but describes a different situation. This can also be shown on the number line.

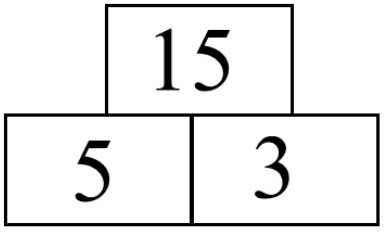


- **Arrays**

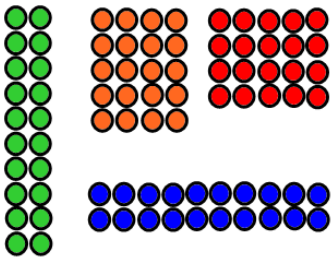
Children should be able to model a multiplication calculation using an array. This knowledge will support with the development of the grid method and makes links to division.



5 x 3 = 15
3 x 5 = 15



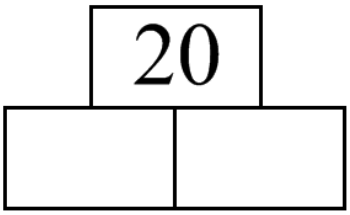
5 x 3 = 15
3 x 5 = 15



Here are 20 counters. How could you arrange them in equal rows? How could you use a number sentence to show your arrangement?

Link the above activity to missing box questions like the ones below.

What could the missing numbers be?



÷ Division ÷

Children should not be made to go onto the next stage if:

***they are not ready.**

***they are not confident.**

- ✓ **Children should be taught through real life experiences and word problems.**
- ✓ **Children should be encouraged to consider if a mental calculation would be appropriate before using written methods.**
- ✓ **Children should be encouraged to approximate their answers before calculating.**
- ✓ **Children should be encouraged to check their answers after calculation using an appropriate strategy.**

Year 1 ÷

Key Vocabulary: share, share equally, one each, two each…, group, groups of, lots of, array
Key number skills needed for division at Y1:

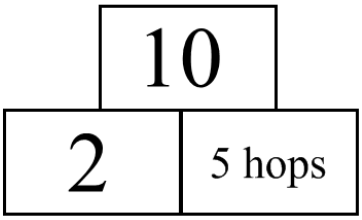
- Begin to count in 2s, 5s and 10s
- Find half of an even numbers to 12 and know it is hard to halve an odd number
  Find half of even numbers by sharing
- Solve one-step problems involving multiplication and division, by calculating the answer using concrete objects, pictorial representations arrays with the support of the teacher
- Through grouping and sharing small quantities, pupils begin to understand, division, and finding simple fractions of objects, numbers and quantities.
- They make connections between arrays, number patterns, and counting in twos, fives and tens.

Pupils should :

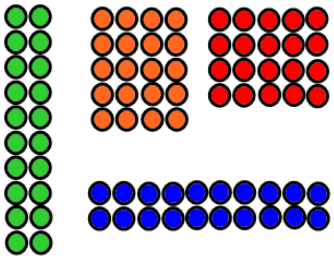
- use lots of practical apparatus, arrays and picture representations
- Be taught to understand the difference between „grouping" objects (How many groups of 2 can you make?) and „sharing" (Share these sweets between 2 people)
- Be able to count in multiples of 2s, 5s and 10s.
- Find **half** of a group of objects by sharing into 2 equal groups.

Group and share small quantities:

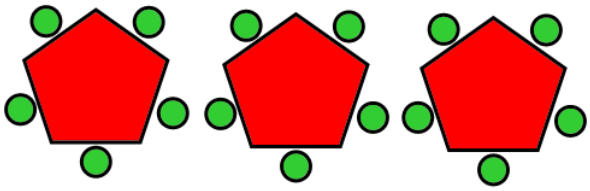
Children will experience equal groups of objects and will count in 2s, 5s and 10s. They will work on practical problem solving activities involving equal sets or groups,



e.g. If the frog hops in 2s, how many hops will there be before he lands on 10?

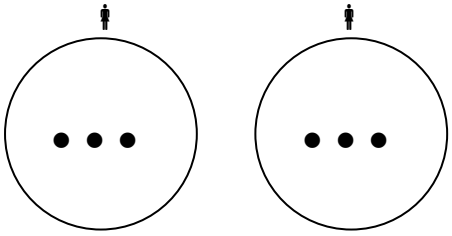


Here are 20 counters. Arrange them in equal rows. Is there a different way to arrange them in equal rows?



15 children sit at 3 tables. There is the same number of children at each table. How many children sit at each table?

Millie had 6 toffees; she gave half to her friend. How many toffees do they each get?



Example division problem in a familiar context:
There are 6 pupils on this table and there are 18 pieces of fruit to share between us. If we share them equally, how many will we each get? Can they work it out and give a division statement… ?
"18 shared between 6 people gives you 3 each."

Year 2

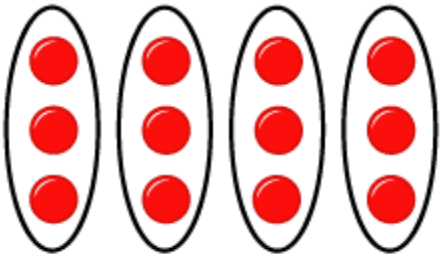
Key Vocabulary: share, share equally, one each, two each…, group, equal groups of, lots of, array, divide, divided by, divided into, division, grouping, number line, left, left over
Key number skills needed for division at Y2:

- Count in steps of 2, 3, and 5 from 0
- Using fingers, say where a number is in the 2s,5s or 10s. (E.g> 8 is the fourth number when I count)
- Relate division to grouping,
- Recall and use multiplication and division facts for the **2, 5 and 10** multiplication tables, including recognising odd and even numbers.
- Calculate mathematical statements for multiplication and division within the multiplication tables and write them using the x, ÷ and = signs.
- Show that multiplication of two numbers can be done in any order (commutative) and division of one number by another cannot.
- Solve problems involving multiplication and division, using materials, arrays, repeated addition, mental methods, and multiplication and division facts, include problems in contexts.

Group and share, using the ÷and = sign.

Use objects, arrays, diagrams and pictorial representations, and grouping on a number line.

Arrays:

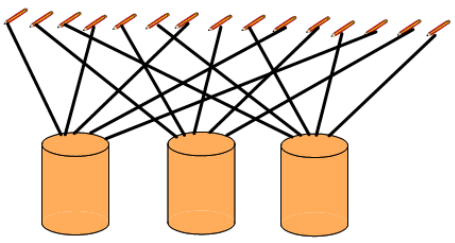


12 ÷ 3 = 4

This represents **12 ÷ 3, posed as** how many groups of 3 are in 12?

Pupils should also show that the same array can represent **12 ÷ 4 = 3** if grouped horizontally.

Sharing equally



Use **sharing** to answer division questions; Suppose 15 pencils were to be shared out between three children. How many pencils would each child get? Explain to me how you could work it out.

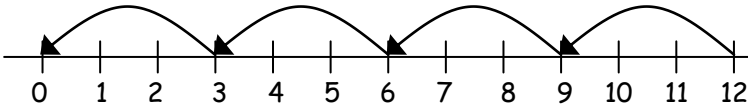
Experience divisions that give rise to remainders, such as:

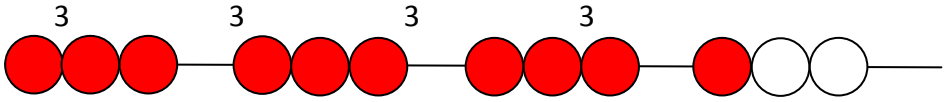
Three friends share 16 marbles equally. How many marbles does each friend get? How many marbles are left over?

- **Grouping or repeated subtraction using a number line or bead bar.:**

Group from zero in equal jumps of the divisor to find out "how many groups of _ in _ ?". Pupils could and using a bead string or practical apparatus to work out problems like „A CD costs £3. How many CDs can I buy with £12?" **This is an important method to develop understanding of division as grouping.**

Show me on a number line how you could do: 12 ÷ 3 = 4





The bead bar will help children with interpreting division calculations such as 12 ÷ 3 as 'how many 3s make 12?'

- **Using symbols to stand for unknown numbers to complete equations using inverse operations**

□ ÷ 2 = 4	20 ÷ △ = 4	□ ÷ △ = 4
A number of marbles divided between 2 groups gives each group 4 each	20p is divided between some children. Each child gets 4p. How many children are there?	On a number line, I do four equal jumps. What numbers could I land on?