



Written Calculation

A whole school approach



Sacred Heart Catholic Primary School

Byermoor



Written Calculation Policy

The purpose of this calculation policy is to ensure consistency in teaching throughout Sacred Heart Catholic Primary School.

This policy will give an overview of the different strategies used in our school to teach maths throughout the Primary Maths Curriculum.

As children progress at different rates, some may need to use the strategies from previous or future year groups.



The introduction of calculation strategies

At Sacred Heart Catholic Primary School, children are introduced to the processes of calculation through practical, oral and mental activities. As children begin to understand the underlying ideas they develop ways of recording to support their thinking and calculation methods, use particular methods that apply to special cases, and learn to interpret and use the signs and symbols involved. Over time children learn how to use models and images, such as empty number lines, to support their mental and informal written methods of calculation.

There is a considerable emphasis on teaching mental calculation strategies. Informal written recording takes place regularly and is an important part of learning and understanding. More formal written methods follow only when the child is able to use a wide range of mental calculation strategies. As children's mental methods are strengthened and refined, so too are their informal written methods. Some recording takes the form of jottings, which are used to support children's thinking. This may be done on scrap paper and whiteboards and is not always retained as it is for the children's own personal use.



This policy contains the key pencil and paper procedures that will be taught within our school. It has been written to ensure consistency and progression throughout the school and reflects a whole school agreement.

This policy concentrates on the introduction of standard symbols, the use of the empty number line as a jotting to aid mental calculation and on the introduction of pencil and paper procedures. It is important that children do not abandon jottings and mental methods once pencil and paper procedures are introduced. Therefore children will always be encouraged to look at a calculation/problem and then decide which is the best method to choose – pictures, mental calculation with or without jottings, structured recording or a calculator.

Our long-term aim is for children to be able to select an efficient method of their choice (whether this be mental, written or in upper Key Stage 2 using a calculator) that is appropriate for a given task. They will do this by always asking themselves:

‘Can I do this in my head?’

‘Can I do this in my head using drawings or jottings?’

‘Do I need to use a pencil and paper procedure?’

‘Do I need a calculator?’



Although the focus of the policy is on pencil and paper procedures it is important to recognise that the ability to calculate mentally lies at the heart of the Primary National Strategy for mathematics. The mental methods in the *Primary Framework for teaching mathematics* will be taught systematically from Reception onwards and pupils will be given regular opportunities to develop the necessary skills. However mental calculation is not at the exclusion of written recording and should be seen as complementary to and not as separate from it.

In every written method there is an element of mental processing. Sharing written methods with the teacher encourages children to think about the mental strategies that underpin them and to develop new ideas. Therefore written recording both helps children to clarify their thinking and supports and extends the development of more fluent and sophisticated mental strategies.



Our Aims

The overall aim is that when children leave primary school they:

- Have a secure knowledge of number facts and a good understanding of the four operations;
- Are able to use this knowledge and understanding to carry out calculations mentally and to apply general strategies when using one-digit and two-digit numbers and particular strategies to special cases involving bigger numbers;
- Make use of diagrams and informal notes to help record steps and part answers when using mental methods that generate more information than can be kept in their heads;
- Have an efficient, reliable, compact written method of calculation for each operation that children can apply with confidence when undertaking calculations that they cannot carry out mentally;
- Use a calculator effectively, using their mental skills to monitor the process, check the steps involved and decide if the numbers displayed make sense.



Objectives

The objectives in the revised Framework show the progression in children's use of written methods of calculation in the strands 'Using and applying mathematics' and 'Calculating'.

Using and Applying Mathematics	Calculating
<p>Foundation Stage</p> <ul style="list-style-type: none">● Use developing mathematical ideas and methods to solve practical problems● Match sets of objects to numerals that represent the number of objects● Sort objects, making choices and justifying decisions● Talk about, recognise and recreate simple patterns● Describe solutions to practical problems, drawing on experience, talking about their own ideas, methods and choices	<p>Foundation Stage</p> <ul style="list-style-type: none">● Begin to relate addition to combining two groups of objects and subtraction to 'taking away'● In practical activities and discussion begin to use the vocabulary involved in adding and subtracting● Count repeated groups of the same size● Share objects into equal groups and count how many in each group

Using and Applying Mathematics

Year 1

- * Solve problems involving counting, adding, subtracting, doubling or halving in the context of numbers, measures or money, for example to 'pay' and 'give change'
- * Describe a puzzle or problem using numbers, practical materials and diagrams; use these to solve the problem and set the solution in the original context

Calculating

Year 1

- * Relate addition to counting on; recognise that addition can be done in any order; use practical and informal written methods to support the addition of a one-digit number or a multiple of 10 to a one-digit or two-digit number
- * 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
- * Use the vocabulary related to addition and subtraction and symbols to describe and record addition and subtraction number sentences

Using and Applying Mathematics

Year 2

- * Solve problems involving addition, subtraction, multiplication or division in contexts of numbers, measures or pounds and pence.
- * Identify and record the information or calculation needed to solve a puzzle or problem; carry out the steps or calculations and check the solution in the context of the problem

Calculating

Year 2

- * Represent repeated addition and arrays as multiplication, and sharing and repeated subtraction (grouping) as division; use practical and informal written methods and related vocabulary to support multiplication and division, including calculations with remainders
- * Use the symbols $+$, $-$, \times , \div and $=$ to record and interpret number sentences involving all four operations; calculate the value of an unknown in a number sentence (e.g. $\square \div 2 = 6$, $30 - \square = 24$)



Using and Applying Mathematics

Year 3

- * Solve one-step and two-step problems involving numbers, money or measures, including time, choosing and carrying out appropriate calculations
- * Represent the information in a puzzle or problem using numbers, images or diagrams; use these to find a solution and present it in context, where appropriate using £.p notation or units of measure

Calculating

Year 3

- * Develop and use written methods to record, support or explain addition and subtraction of two-digit and three-digit numbers
- * Use practical and informal written methods to multiply and divide two-digit numbers (e.g. 13×3 , $50 \div 4$); round remainders up or down, depending on the context
- * Understand that division is the inverse of multiplication and vice versa; use this to derive and record related multiplication and division number sentences



Using and Applying Mathematics

Year 4

- * Solve one-step and two-step problems involving numbers, money or measures, including time; choose and carry out appropriate calculations, using calculator methods where appropriate
- * Represent a puzzle or problem using number sentences, statements or diagrams; use these to solve the problem; present and interpret the solution in the context of the problem

Calculating

Year 4

- * Refine and use efficient written methods to add and subtract two-digit and three-digit whole numbers and £.p
- * Develop and use written methods to record, support and explain multiplication and division of two-digit numbers by a one-digit number, including division with remainders (e.g. 15×9 , $98 \div 6$)



Using and Applying Mathematics

Year 5

- * Solve one-step and two-step problems involving whole numbers and decimals and all four operations, choosing and using appropriate calculation strategies, including calculator use
- * Represent a puzzle or problem by identifying and recording the information or calculations needed to solve it; find possible solutions and confirm them in the context of the problem

Calculating

Year 5

- * Use efficient written methods to add and subtract whole numbers and decimals with up to two places
- * Use understanding of place value to multiply and divide whole numbers and decimals by 10, 100 or 1000
- * Refine and use efficient written methods to multiply and divide $\text{HTU} \times \text{U}$, $\text{TU} \times \text{TU}$, $\text{U.t} \times \text{U}$ and $\text{HTU} \div \text{U}$



Using and Applying Mathematics

Year 6

* Solve multi-step problems, and problems involving fractions, decimals and percentages; choose and use appropriate calculation strategies at each stage, including calculator use

* Represent and interpret sequences, patterns and relationships involving numbers and shapes; suggest and test hypotheses; construct and use simple expressions and formulae in words then symbols (e.g. the cost of c pens at 15 pence each is $15c$ pence)

Calculating

Year 6

* Use efficient written methods to add and subtract integers and decimals, to multiply and divide integers and decimals by a one-digit integer, and to multiply two-digit and three-digit integers by a two-digit integer

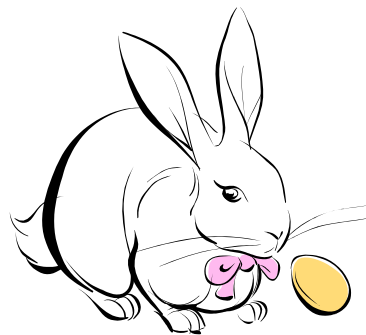
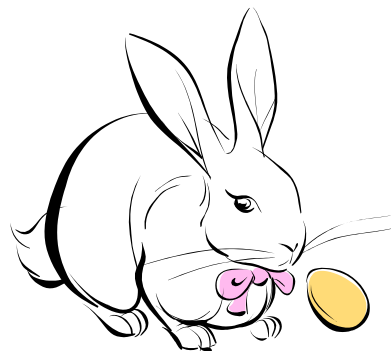
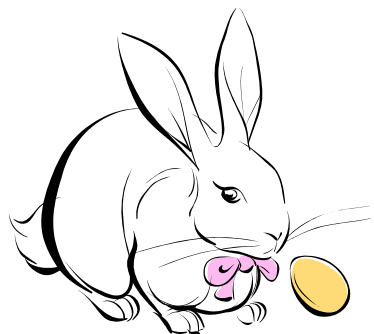




Addition



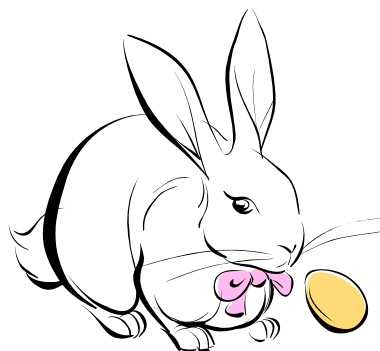
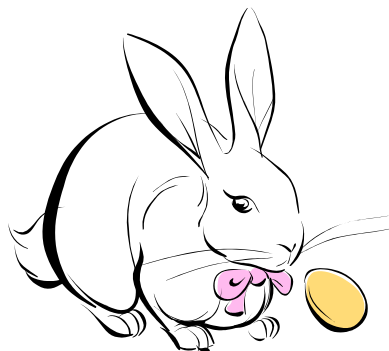
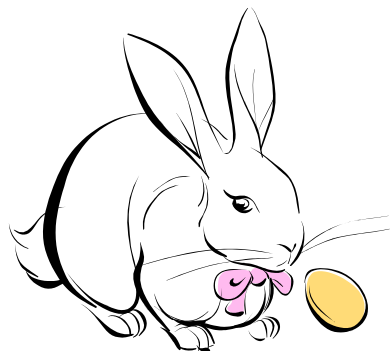
Reception



How many?

Add 1 more

How many now?



Lots of practical first.

Could be then used as a recording activity.

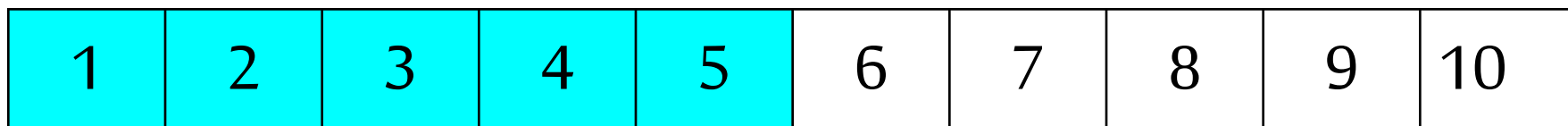


Recording Simple Calculations in Reception

4	...
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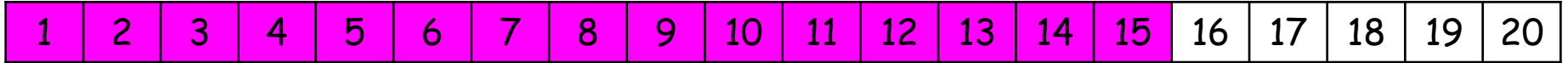
$$4 + \square = \square$$

$$\boxed{5 \text{ p}} + \begin{array}{c} \text{1p} \\ \circ \end{array} \begin{array}{c} \text{1p} \\ \circ \end{array} \begin{array}{c} \text{1p} \\ \circ \end{array} = \square \text{ p}$$



$$5 + 1 = \square$$

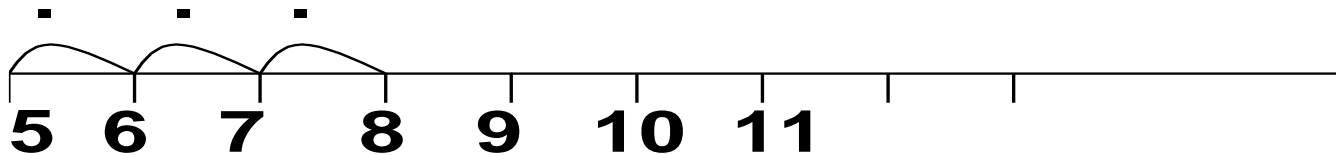
Year One



$15 + 3 = \square$

Number Line

$5 + 3$



Begin with all numbers identified.

Move onto having just markers.

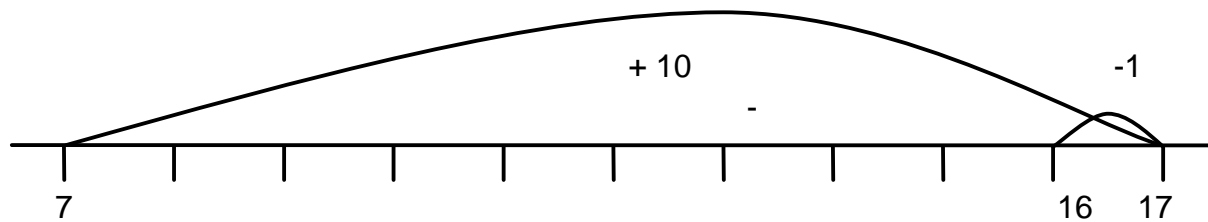


Adding 9

$$7 + 9 =$$

$$7 + 10 = 17 - 1 = 16$$

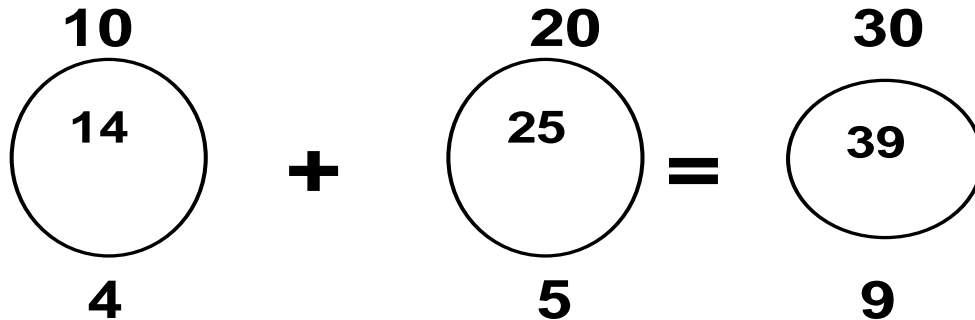
Use a number line to record



Year Two

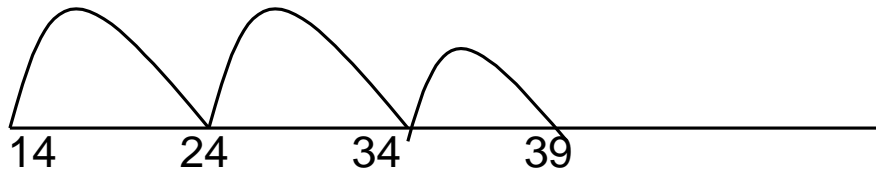
$14 + 25 =$

Partition numbers into tens and units:



Empty Number Line

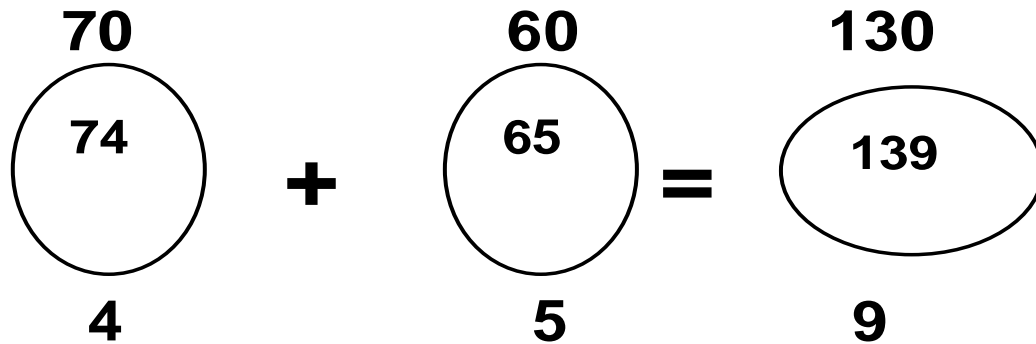
+10 +10 +5



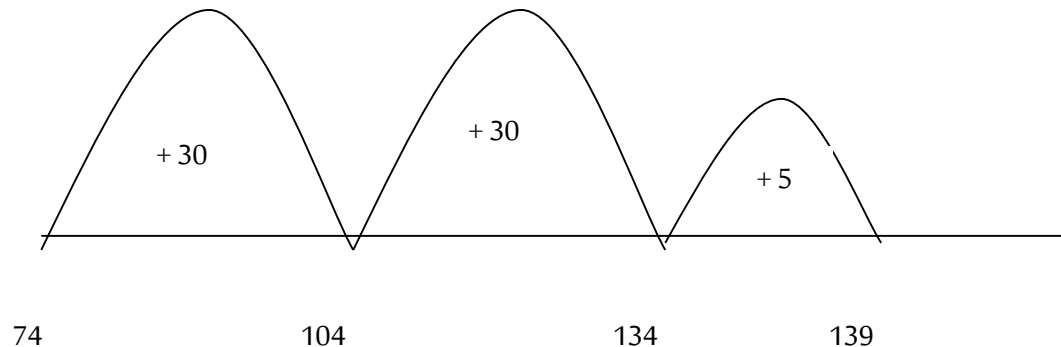
Year Three

$74 + 65 =$

Partition numbers into tens and units:



Use an empty number line



Vertical Strategy (Spring / Summer Term)

$$\begin{array}{r} 274 \\ + 349 \\ \hline 13 \\ 110 \\ \hline 500 \\ \hline 623 \end{array}$$



Year Four, Year Five and Year Six

Addition using vertical strategies

$$\begin{array}{r} 446 \\ + 75 \\ \hline 11 \\ 110 \\ 400 \\ \hline 521 \end{array}$$

Leading to 'carrying'
below the line



$$\begin{array}{r} 543 \\ + 37 \\ \hline 580 \\ 1 \end{array}$$

$$\begin{array}{r} 688 \\ + 31 \\ \hline 719 \\ 1 \end{array}$$

$$\begin{array}{r} 375 \\ + 87 \\ \hline 462 \\ 11 \end{array}$$

$$\begin{array}{r} 2547 \\ + 676 \\ \hline 3223 \\ 111 \end{array}$$

$$\begin{array}{r} £5.68 \\ + £4.87 \\ \hline £10.55 \\ 111 \end{array}$$



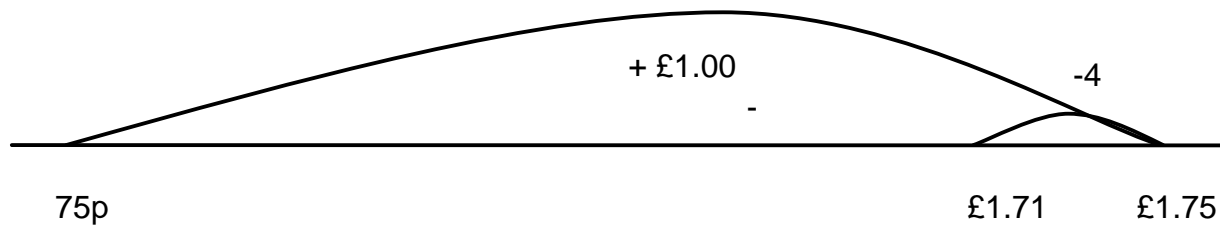
Extend to decimals:-

$$128.17 + 36.08$$

$$\begin{array}{r} 128.17 \\ + 36.08 \\ \hline 164.25 \\ 1 \end{array}$$



Compensation Addition



$$75p + 96p$$

$$75p + £1.00 = £1.75$$

$$£1.75 - 4p = £1.71$$

Use a number line to record

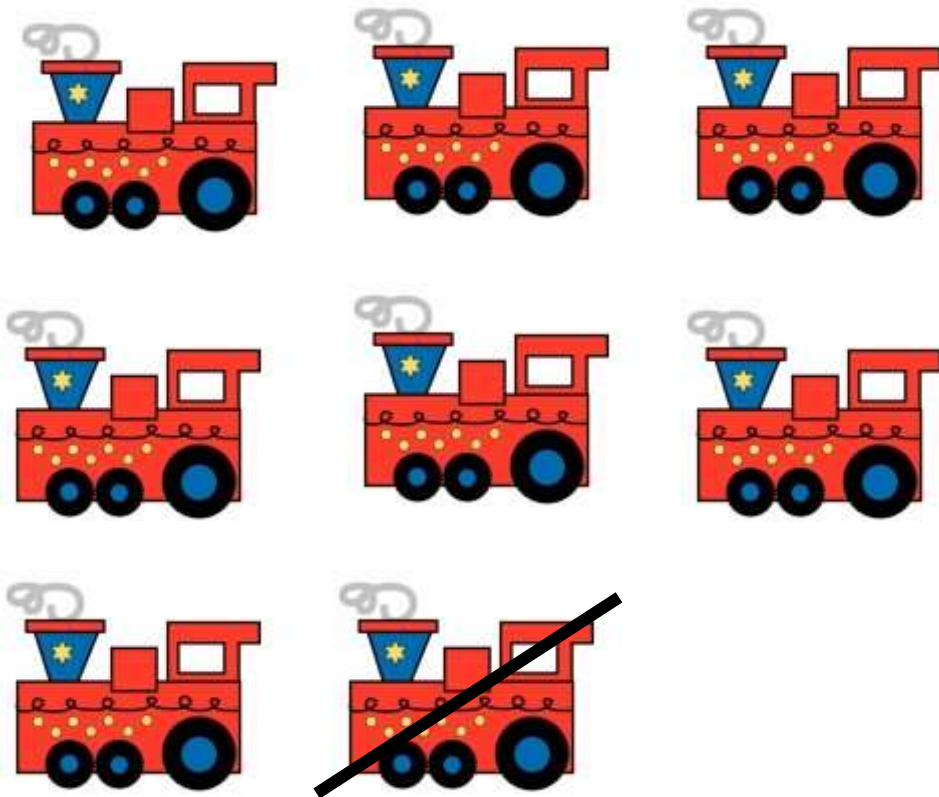
Informal strategies such as this one can still be used in Y4, Y5 and Y6 to help the children arrive at the correct answer,



Subtraction



Reception



How many?

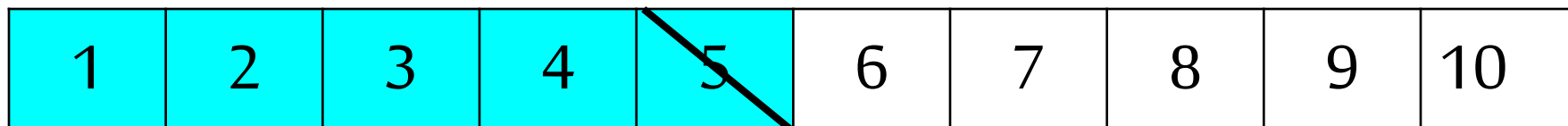
Take 1 away

How many now?

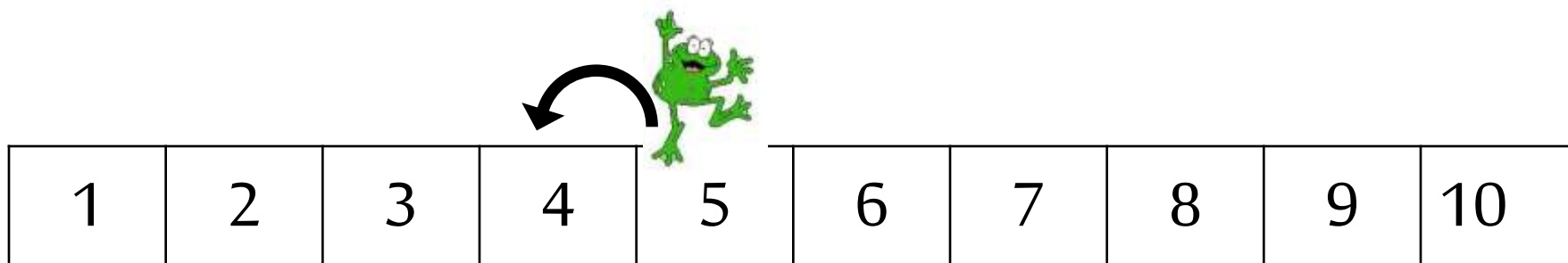
Lots of practical first.

Could be then used as a recording activity.

Recording Simple Calculations in Reception

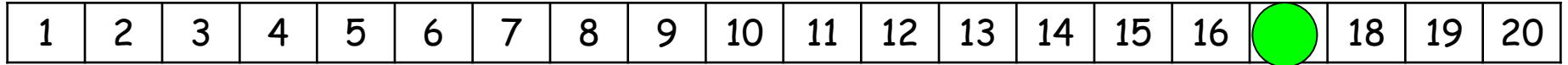


$5 - 1 =$



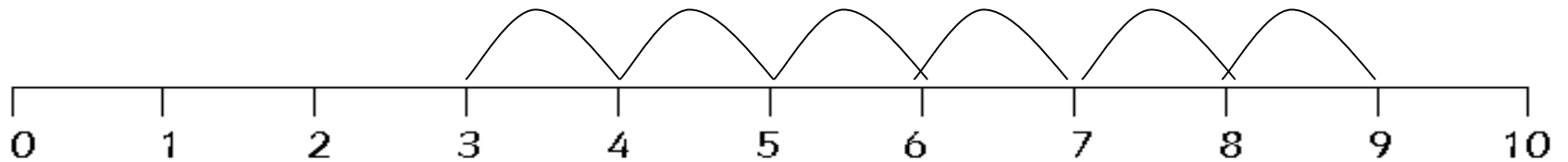
$5 - 1 =$

Year One



$17 - 6 = \square$

Use a counter, then count back.

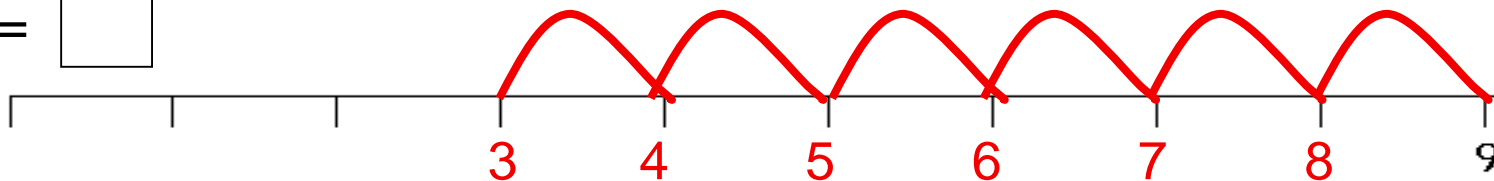


$9 - 6 = \square$

Begin with all numbers identified.



$9 - 6 = \square$



Move onto just having the start number and then just markers for other numbers.

$19 - 3 =$

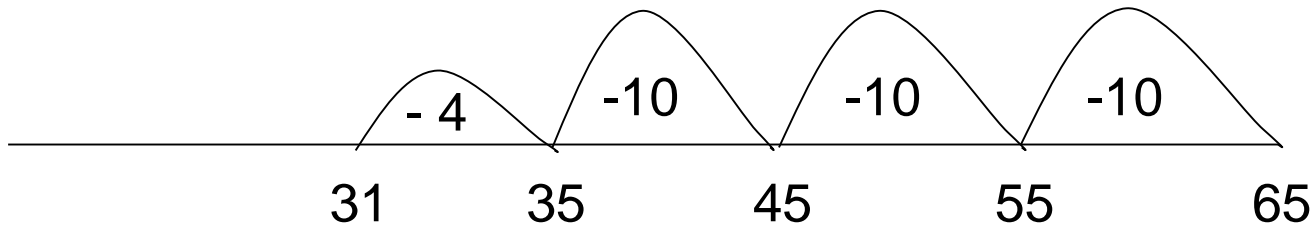


Depending on how children cope, you could move onto no markers.

Year Two

Counting back on an empty number line

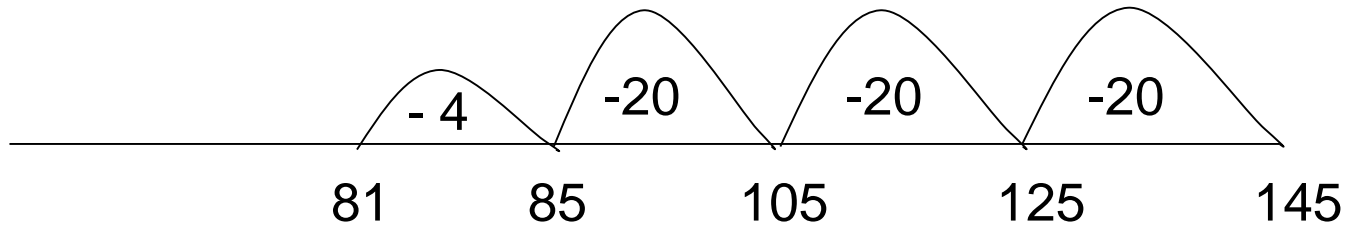
$$65 - 34 =$$



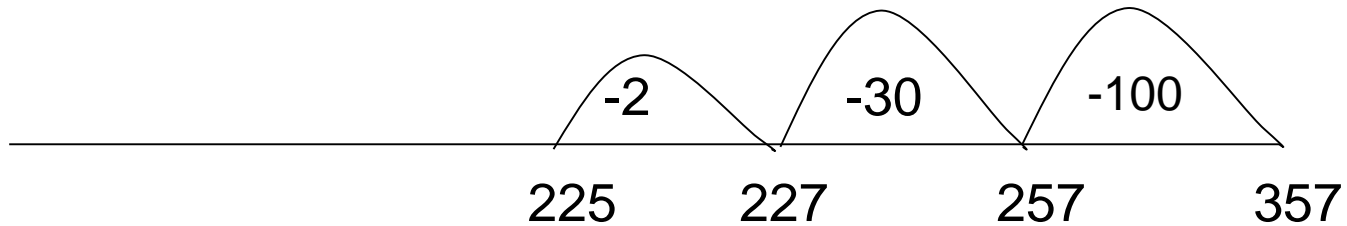
Year Three

Counting back on an empty number line

$$145 - 64 =$$



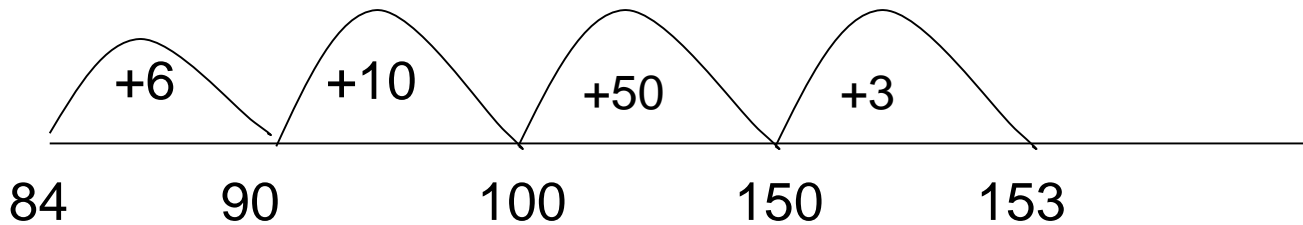
$$357 - 132 =$$



Year Three

Counting up

$$153 - 84 =$$



Vertical Counting up (Summer term)

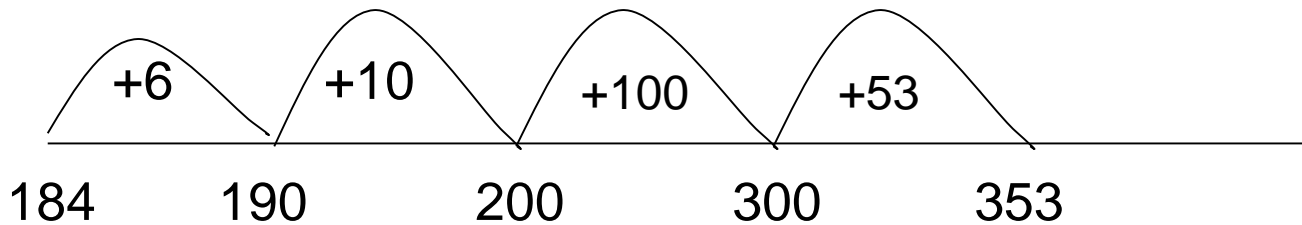
$$\begin{array}{r} 153 \\ - 84 \\ \hline 6 \text{ (to 90)} \\ 10 \text{ (to 100)} \\ 50 \text{ (to 150)} \\ \hline 3 \text{ (to 153)} \\ \hline 69 \end{array}$$



Year Four

Counting up

$$353 - 184 =$$



Counting up

$$\begin{array}{r} 353 \\ - 184 \\ \hline 6 \quad (\text{to } 190) \\ 10 \quad (\text{to } 200) \\ 100 \quad (\text{to } 300) \\ \hline 53 \quad (\text{to } 353) \\ \hline 169 \end{array}$$



Year Five and Year Six

Decomposition strategy

(Could be introduced at end of Year 4 with MA pupils)

$$\begin{array}{r} 3 \overset{4}{\cancel{5}} \overset{1}{2} \\ - \underline{237} \\ 115 \end{array}$$

$$\begin{array}{r} \overset{6}{\cancel{7}} \overset{12}{\cancel{3}} \overset{1}{8} \\ - \underline{579} \\ 159 \end{array}$$

$$\begin{array}{r} \overset{5}{\cancel{6}} \overset{13}{\cancel{4}} \overset{16}{\cancel{7}} \overset{1}{5} \\ - \underline{2586} \\ 3889 \end{array}$$





Multiplication



Multiplication Facts

Using multiplication facts

Tables should be taught everyday from Y2 onwards, either as part of the mental oral starter or other times as appropriate within the day.

Year 2 2 times table
 5 times table
 10 times table

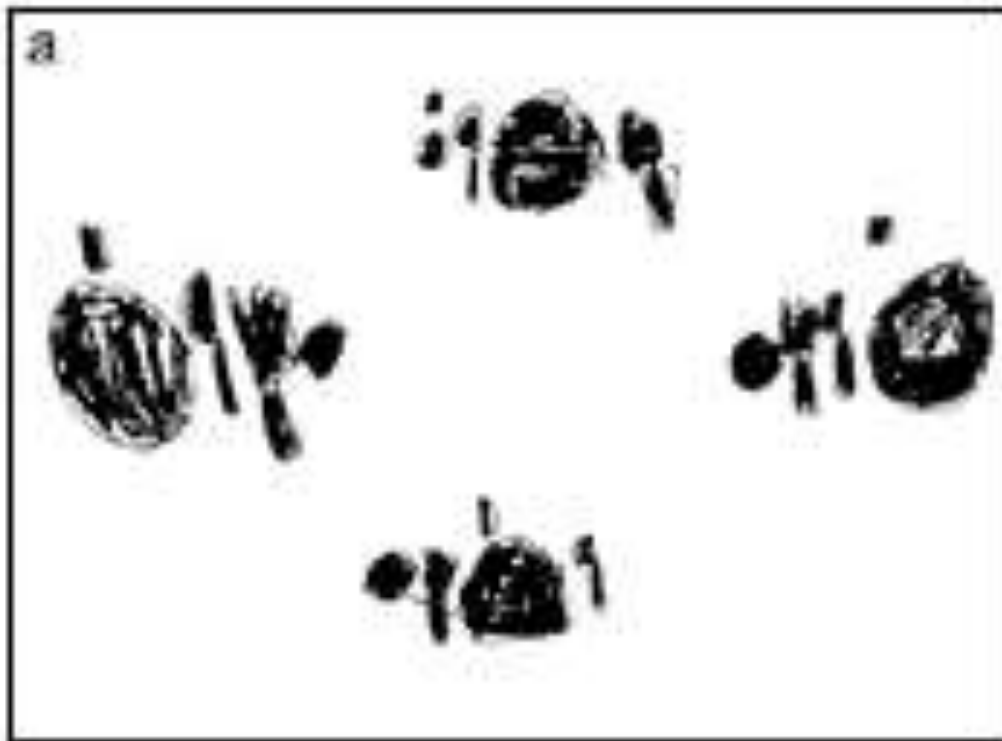
Year 3 2 times table
 3 times table
 4 times table
 5 times table
 6 times table
 10 times table

Year 4, 5 & 6 Derive and recall all multiplication facts up to 10×10



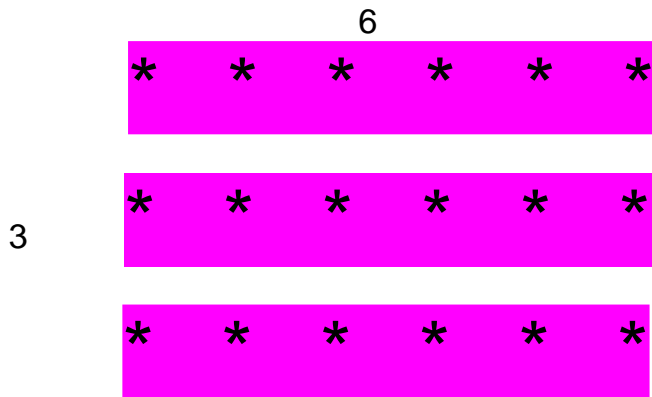
Year One

Children will experience equal groups of objects and will count in 2s and 10s and begin to count in 5s.

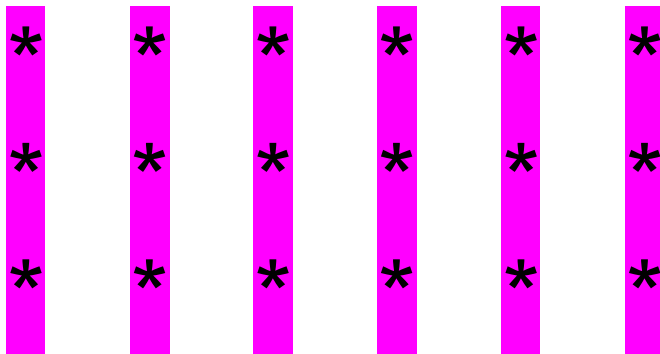


Year Two and Three

Dot Pattern Grids



$$3 \times 6 = 18$$



$$6 \times 3 = 18$$

Multiplication as array patterns.

The calculation can be done in any order and you still have the same answer.

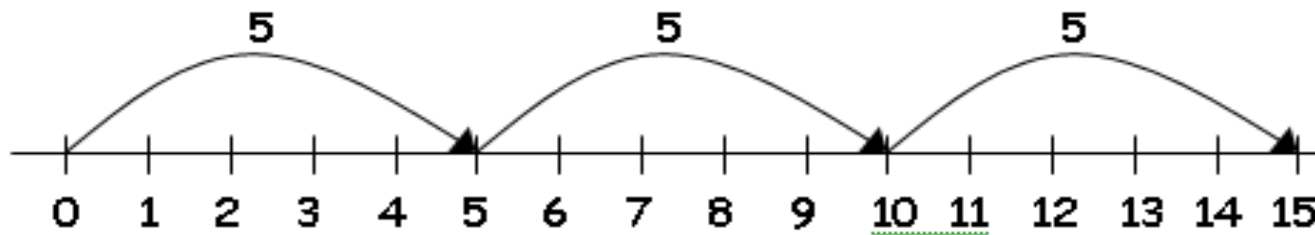
Year Two and Three

✓ Repeated addition

3 times 5 is $5 + 5 + 5 = 15$ or 3 lots of 5 or 5×3

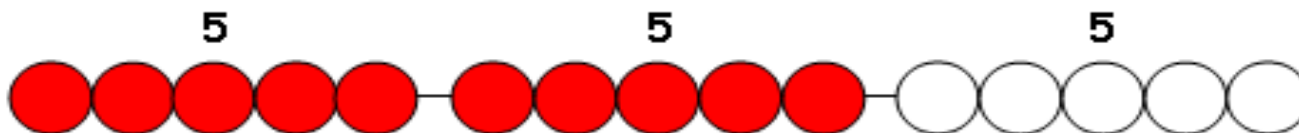
Repeated addition can be shown easily on a number line:

$$5 \times 3 = 5 + 5 + 5$$



and on a bead bar:

$$5 \times 3 = 5 + 5 + 5$$



Year Four, Year Five and Year Six

The Grid Method of Multiplication

This is introduced in Year 4 and developed and progressed throughout Year 5 and Year 6.

33 x 6 is approximately 30 x 6 = 180

$$\begin{array}{r} \times \quad 30 \quad 3 \\ 6 \quad \boxed{\begin{array}{|c|c|} \hline 180 & 18 \\ \hline \end{array}} = 198 \end{array}$$

26 x 7 is approximately 25 x 7 = 175

$$\begin{array}{r} \times \quad 20 \quad 6 \\ 7 \quad \boxed{\begin{array}{|c|c|} \hline 140 & 42 \\ \hline \end{array}} = 182 \end{array}$$

This can even be extended to decimals in Year 6

6.93 x 6 is approximately 7 x 6 = 42

$$\begin{array}{r} \times \quad 6 \quad 0.9 \quad 0.03 \\ 6 \quad \boxed{\begin{array}{|c|c|c|} \hline 36 & 5.4 & 0.18 \\ \hline \end{array}} = 41.58 \end{array}$$

Year Four, Year Five and Year Six

Short multiplication Year 4

$$\begin{array}{r} 26 \\ \times 7 \\ \hline 140 \\ \quad 42 \\ \hline 182 \end{array}$$

leading to \longrightarrow

$$\begin{array}{r} 26 \\ \times 7 \\ \hline 182 \\ \quad 4 \end{array}$$

Year 5 and Year 6

63 x 46 is approximately 60 x 50 = 3000

$$\begin{array}{r} 63 \\ \times 46 \\ \hline 2520 \text{ (63 x 40)} \\ \quad 378 \text{ (63 x 6)} \\ \hline 2898 \end{array}$$

extend to simple decimals \longrightarrow

5.7 x 7 is approximately 6 x 7 = 42

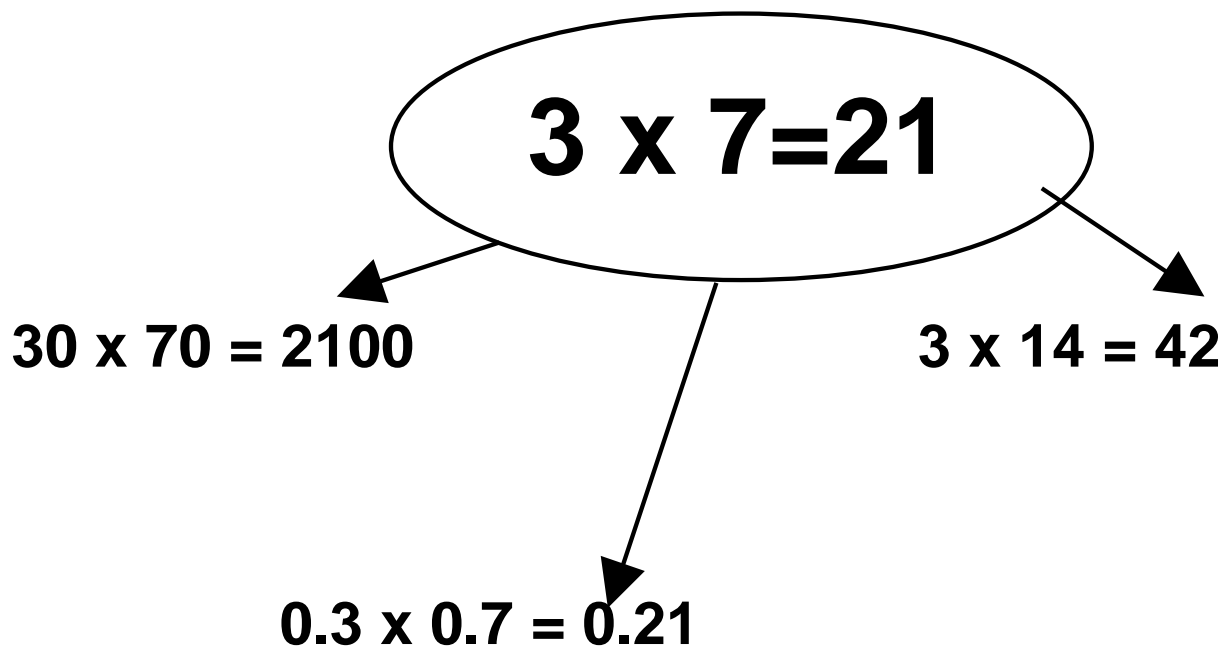
$$\begin{array}{r} 5.0 \times 7 = 35.0 \\ 0.7 \times 7 = \underline{4.9} \\ \hline 39.9 \end{array}$$

Year Five and Year Six

Fact Webs

$$30 \times 7 = 210$$

$$3 \times 0.7 = 2.1$$



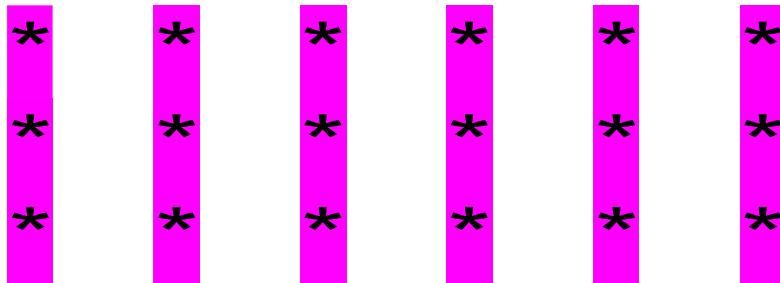
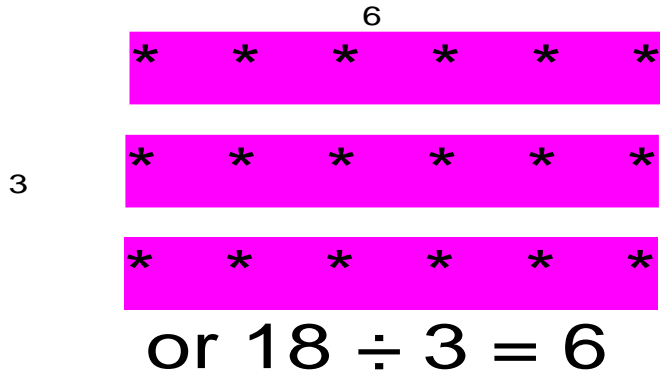


Division



Year Two and Three

Dot Pattern Grids



Division as array patterns.

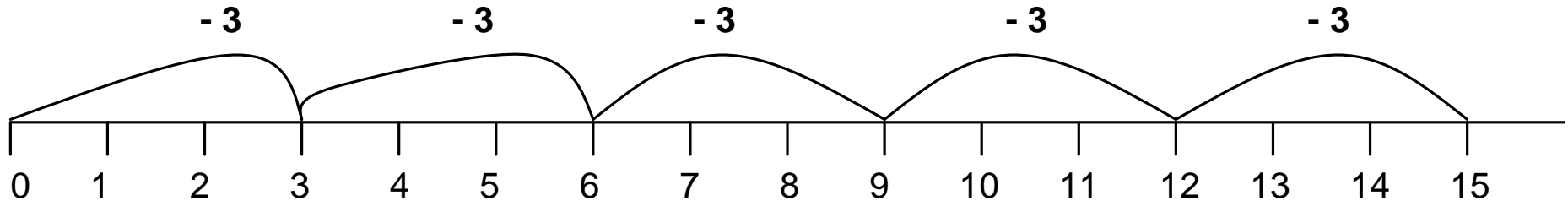
The calculation can be done in any order and you still have the same answer.

Year Two and Three

Division as repeated subtraction.

This is usually a question on Key Stage 1 SATs.

Repeated Subtraction

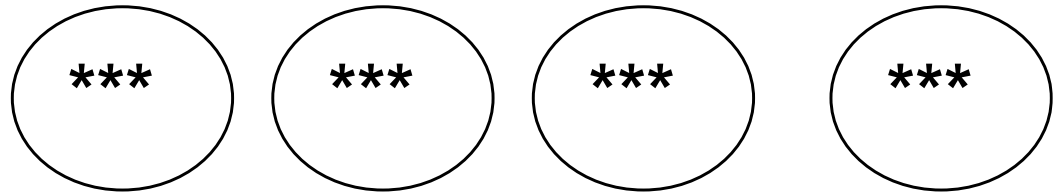


Year Two and Three

Sharing

If I share 12 sweets between 4 children, how many will they have each?

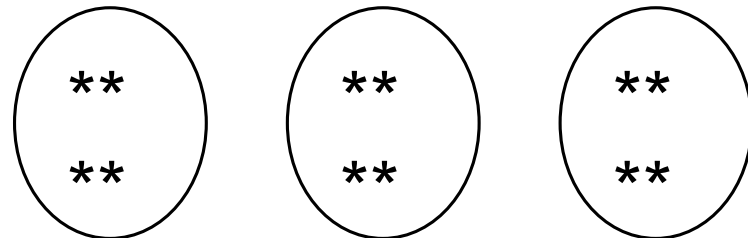
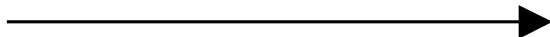
$$12 \div 4 = 3$$



Grouping

How many 4s in 12?

$$12 \div 4 = 3$$



Year Four, Year Five and Year Six

Short division (Chunking)

$$87 \div 6$$

$$\begin{array}{r} \overline{6) 87} \\ \underline{-60} \quad (10 \times 6) \\ 27 \\ \underline{-24} \quad (4 \times 6) \\ 3 \end{array}$$

Answer: 14 remainder 3

Year Six

Long division HTU \div TU

896 \div 24 is approximately 900 \div 25 = 36

$$\begin{array}{r} 24 \overline{) 896} \\ \underline{- 720} \quad (30 \times 24) \\ 176 \\ \underline{- 168} \quad (7 \times 24) \\ 8 \end{array} \xrightarrow{\text{extend to decimals}}$$

Answer: **37** $\frac{8}{24}$ \longrightarrow **37** $\frac{1}{3}$

$$\begin{array}{r} 24 \overline{) 896} \\ \underline{- 720} \quad (30 \times 24) \\ 176 \\ \underline{- 168} \quad (7 \times 24) \\ 8.0 \\ \underline{- 7.2} \quad (0.3 \times 24) \\ 0.80 \\ \underline{- 0.72} \quad (0.03 \times 24) \end{array}$$

Answer: **37.33**