



Calculation Policy

As the school uses the White Rose Scheme of work as its main structure, the images have been taken from the White Rose calculation policies.

The National Curriculum outlines how maths should be taught:

Key stage 1 – Years 1 and 2

The principal focus of mathematics teaching in key stage 1 is to ensure that pupils develop confidence and mental fluency with whole numbers, counting and place value. This should involve working with numerals, words and the four operations, including with practical resources [for example, concrete objects and measuring tools]. At this stage, pupils should develop their ability to recognise, describe, draw, compare and sort different shapes and use the related vocabulary. Teaching should also involve using a range of measures to describe and compare different quantities such as length, mass, capacity/volume, time and money. By the end of year 2, pupils should know the number bonds to 20 and be precise in using and understanding place value. An emphasis on practice at this early stage will aid fluency. Pupils should read and spell mathematical vocabulary, at a level consistent with their increasing word reading and spelling knowledge at key stage 1.

Lower key stage 2 – years 3 and 4

The principal focus of mathematics teaching in lower key stage 2 is to ensure that pupils become increasingly fluent with whole numbers and the four operations, including number facts and the concept of place value. This should ensure that pupils develop efficient written and mental methods and perform calculations accurately with increasingly large whole numbers. At this stage, pupils should develop their ability to solve a range of problems, including with simple fractions and decimal place value. Teaching should also ensure that pupils draw with increasing accuracy and develop mathematical reasoning so they can analyse shapes and their properties, and confidently describe the relationships between them. It should ensure that they can use measuring instruments with accuracy and make connections between measure and number. By the end of year 4, pupils should have memorised their multiplication tables up to and including the 12 multiplication table and show precision and fluency in their work. Pupils should read and spell mathematical vocabulary correctly and confidently, using their growing word reading knowledge and their knowledge of spelling.

Upper key stage 2 – years 5 and 6

The principal focus of mathematics teaching in upper key stage 2 is to ensure that pupils extend their understanding of the number system and place value to include larger integers. This should develop the connections that pupils make between multiplication and division with fractions, decimals, percentages and ratio. At this stage, pupils should develop their ability to solve a wider range of problems, including increasingly complex properties of numbers and arithmetic, and problems demanding efficient written and mental methods of calculation. With this foundation in arithmetic, pupils are introduced to the language of algebra as a means for solving a variety of problems. Teaching in geometry and measures should consolidate and extend knowledge developed in number. Teaching should also ensure that pupils classify shapes with increasingly complex geometric properties and that they learn the vocabulary they need to describe them. By the end of year 6, pupils should be fluent in written methods for all four operations, including long multiplication and division, and in working with fractions, decimals and percentages. Pupils should read, spell and pronounce mathematical vocabulary correctly.

Key processes

CPA

At Vigo, children will be taught a range of strategies through a Concrete, Pictorial and Abstract (CPA) approach to learning.

Concrete is the “doing” stage of learning. Children will be provided with physical resources, which they can manipulate to see and understand mathematical concepts.

Pictorial is the “seeing” stage. Here, visual **representations** of concrete objects are used to model problems. Children are able to create links between the physical objects they have handled to pictures, diagrams or models that represent the objects.

Abstract is the “symbolic” stage, where children use abstract symbols to model problems using written numbers and mathematical symbols, for example, $+$, $-$, \times , \div , to indicate addition, subtraction, multiplication or division.

The "Commutative Law" says you can add or multiply a pair of numbers, regardless of their order. Addition and multiplication have the commutative property, subtraction and division do not. Commutativity is linked to associativity.

$$6 + 3 = 3 + 6$$

$$2 \times 4 = 4 \times 2$$

Laws of arithmetic

An operation on three or more numbers is "associative" if the order in which the calculation is carried out does not change the outcome. Addition and multiplication are associative. Subtraction and division are not.

$$(6 + 3) + 4 = 6 + (3 + 4)$$

$$(2 \times 4) \times 3 = 2 \times (4 \times 3)$$

The "Distributive Law" lets you multiply a sum by multiplying each addend separately and then adding the two products. This is linked to the order of operation and to partitioning.

$$49 \times 6 = (40 \times 6) + (9 \times 6) = 240 + 54 = 294$$

$$3 \times (2+4) = 3 \times 2 + 3 \times 4$$

3 lots of **(2+4)** is the same as **3 lots of 2** plus **3 lots of 4**

$$\begin{aligned} 16 \times 6 + 16 \times 4 &= 16 \times (6+4) \\ &= 16 \times 10 \\ &= 160 \end{aligned}$$

$$\begin{aligned} 26 \times 3 - 24 \times 3 &= (26 - 24) \times 3 \\ &= 2 \times 3 \\ &= 6 \end{aligned}$$

Addition and Subtraction are inverses of each other.

Adding moves us one way, subtracting moves us the opposite way.

Example: $20 + 9 = 29$ can be reversed by $29 - 9 = 20$ (back to where we started)

And the other way around:

Example: $15 - 3 = 12$ can be reversed by $12 + 3 = 15$ (back to where we started)

Multiplication and Division are inverses of each other

Multiplying can be "undone" by dividing.

Example: $5 \times 9 = 45$ can be reversed by $45 / 9 = 5$

It works the other way around too, dividing can be undone by multiplying.

Example: $10 / 2 = 5$ can be reversed by $5 \times 2 = 10$

Inverse and estimation

Estimation is finding a number that is close enough to the right answer. Pupils are taught that estimation is not about trying to get the exact right answer through a calculation but finding something that is good enough.

Pupils learn to estimate how many things they can see, or consider how long or how big something would be, and whether an answer to a calculation is reasonable.

Number bonds

Children need to know and recall at speed, number bonds to 10, and the related subtraction facts.

+	0	1	2	3	4	5	6	7	8	9	10
0	0+0	0+1	0+2	0+3	0+4	0+5	0+6	0+7	0+8	0+9	0+10
1	1+0	1+1	1+2	1+3	1+4	1+5	1+6	1+7	1+8	1+9	1+10
2	2+0	2+1	2+2	2+3	2+4	2+5	2+6	2+7	2+8	2+9	2+10
3	3+0	3+1	3+2	3+3	3+4	3+5	3+6	3+7	3+8	3+9	3+10
4	4+0	4+1	4+2	4+3	4+4	4+5	4+6	4+7	4+8	4+9	4+10
5	5+0	5+1	5+2	5+3	5+4	5+5	5+6	5+7	5+8	5+9	5+10
6	6+0	6+1	6+2	6+3	6+4	6+5	6+6	6+7	6+8	6+9	6+10
7	7+0	7+1	7+2	7+3	7+4	7+5	7+6	7+7	7+8	7+9	7+10
8	8+0	8+1	8+2	8+3	8+4	8+5	8+6	8+7	8+8	8+9	8+10
9	9+0	9+1	9+2	9+3	9+4	9+5	9+6	9+7	9+8	9+9	9+10
10	10+0	10+1	10+2	10+3	10+4	10+5	10+6	10+7	10+8	10+9	10+10

Multiplication facts

1 × 1	1 × 2	1 × 3	1 × 4	1 × 5	1 × 6	1 × 7	1 × 8	1 × 9	1 × 10	1 × 11	1 × 12
2 × 1	2 × 2	2 × 3	2 × 4	2 × 5	2 × 6	2 × 7	2 × 8	2 × 9	2 × 10	2 × 11	2 × 12
3 × 1	3 × 2	3 × 3	3 × 4	3 × 5	3 × 6	3 × 7	3 × 8	3 × 9	3 × 10	3 × 11	3 × 12
4 × 1	4 × 2	4 × 3	4 × 4	4 × 5	4 × 6	4 × 7	4 × 8	4 × 9	4 × 10	4 × 11	4 × 12
5 × 1	5 × 2	5 × 3	5 × 4	5 × 5	5 × 6	5 × 7	5 × 8	5 × 9	5 × 10	5 × 11	5 × 12
6 × 1	6 × 2	6 × 3	6 × 4	6 × 5	6 × 6	6 × 7	6 × 8	6 × 9	6 × 10	6 × 11	6 × 12
7 × 1	7 × 2	7 × 3	7 × 4	7 × 5	7 × 6	7 × 7	7 × 8	7 × 9	7 × 10	7 × 11	7 × 12
8 × 1	8 × 2	8 × 3	8 × 4	8 × 5	8 × 6	8 × 7	8 × 8	8 × 9	8 × 10	8 × 11	8 × 12
9 × 1	9 × 2	9 × 3	9 × 4	9 × 5	9 × 6	9 × 7	9 × 8	9 × 9	9 × 10	9 × 11	9 × 12
10 × 1	10 × 2	10 × 3	10 × 4	10 × 5	10 × 6	10 × 7	10 × 8	10 × 9	10 × 10	10 × 11	10 × 12
11 × 1	11 × 2	11 × 3	11 × 4	11 × 5	11 × 6	11 × 7	11 × 8	11 × 9	11 × 10	11 × 11	11 × 12
12 × 1	12 × 2	12 × 3	12 × 4	12 × 5	12 × 6	12 × 7	12 × 8	12 × 9	12 × 10	12 × 11	12 × 12

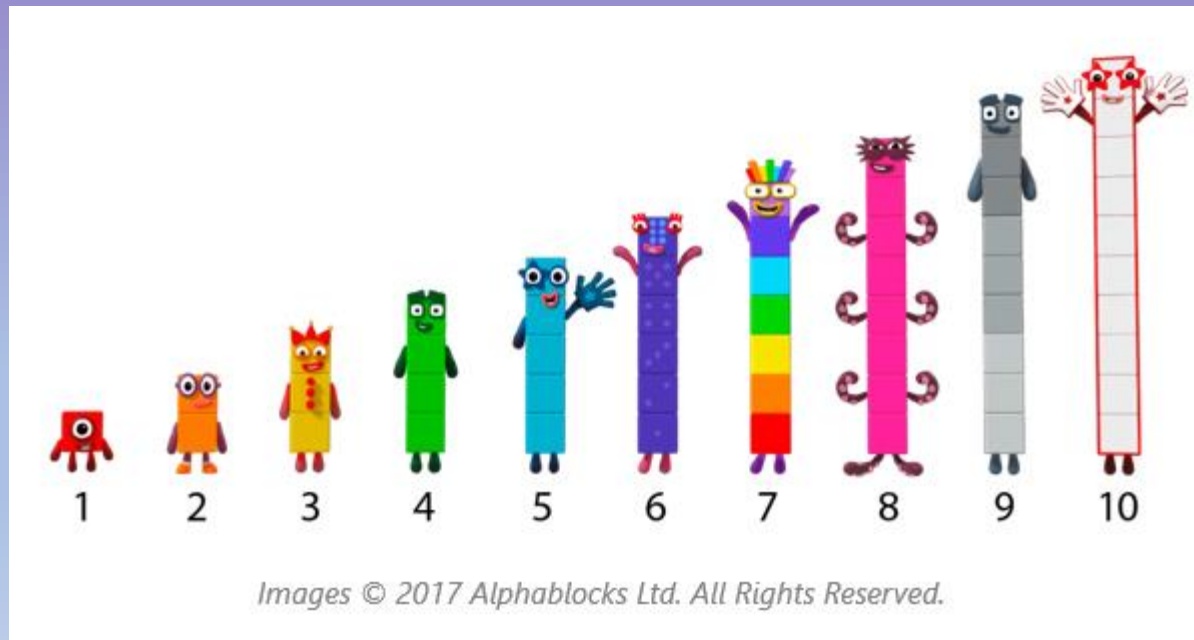
Children need to know and recall at speed, multiplication facts, and the related division facts.

Pupils should learn the multiplication tables in the ‘families’ described in the progression table – making connections between the multiplication tables in each family will enable pupils to develop automatic recall more easily, and provide a deeper understanding of multiplication and division.

	Year 1	Year 2	Year 3	Year 4	Year 5
Additive factual fluency	Addition and subtraction within 10.	Addition and subtraction across 10.	Secure and maintain fluency in addition and subtraction within and across 10, through continued practice.		
Multiplicative factual fluency			Recall the 10 and 5 multiplication tables, and corresponding division facts.	Recall the 3, 6 and 9 multiplication tables, and corresponding division facts.	Secure and maintain fluency in all multiplication tables, and corresponding division facts, through continued practice.
			Recall the 2, 4 and 8 multiplication tables, and corresponding division facts.	Recall the 7 multiplication table, and corresponding division facts.	
				Recall the 11 and 12 multiplication tables, and corresponding division facts.	

Composition of number particularly to 5.
(new ELG) – see number facts HIAS document
Groupings and sharing
Hungarian dice model

EYFS



The Number blocks are our friends in Reception.

Early Learning Goals

Number


- Have an understanding of numbers to 10, linking names of numbers, numerals, their value, and their position in the counting order.
- Subitise (recognise quantities without counting) up to 5.
- Automatically recall number bonds for numbers 0- 5 and for 10, including corresponding partitioning facts.

Numerical Patterns

- Automatically recall double facts up to $5+5$.
- Compare sets of objects up to 10 in different contexts, considering size and difference.
- Explore patterns of numbers within numbers up to 10, including evens and odds.

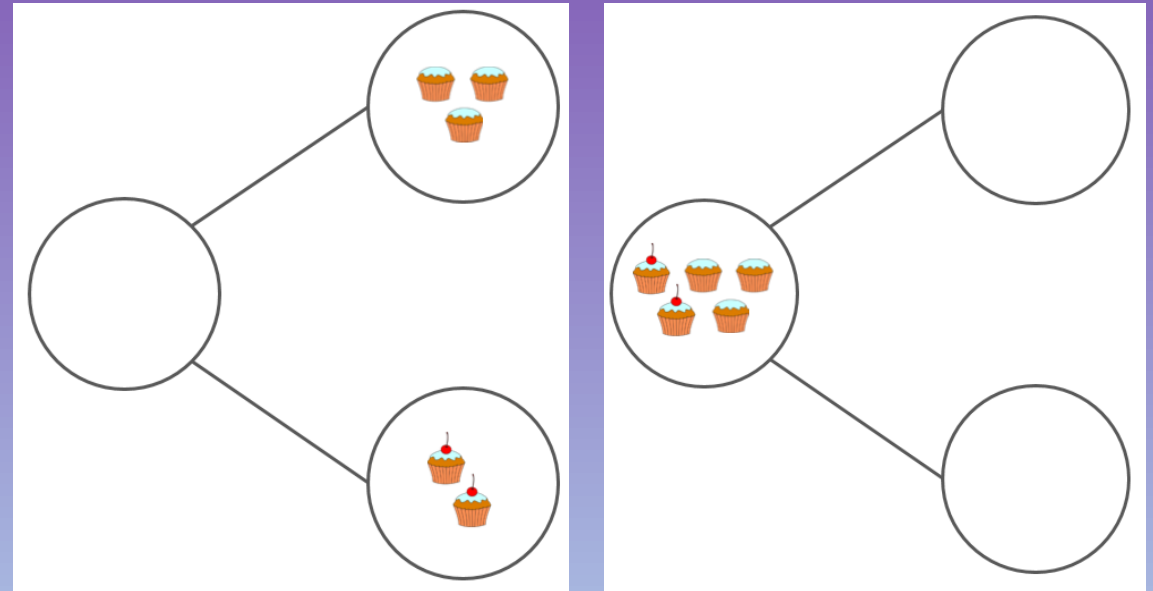

Models and images used in year R

We introduce children to language of “part-part-whole”.



3 red owls 2 blue owls

We turn images into abstract representations.
For example the owls are represented by blocks.



We explore relationships between the part.

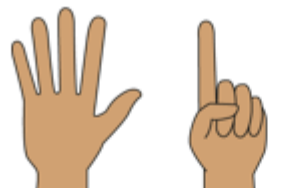

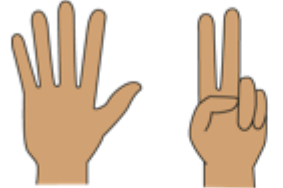
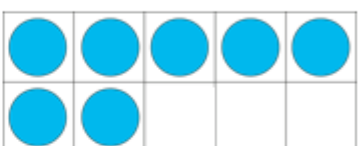
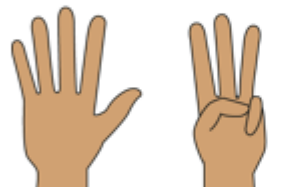

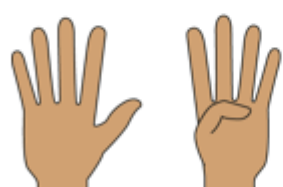
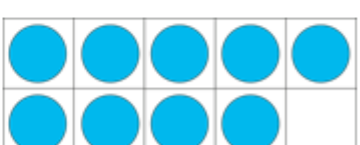

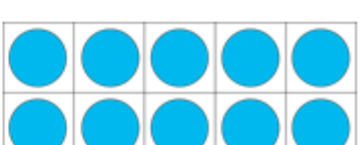
For example:

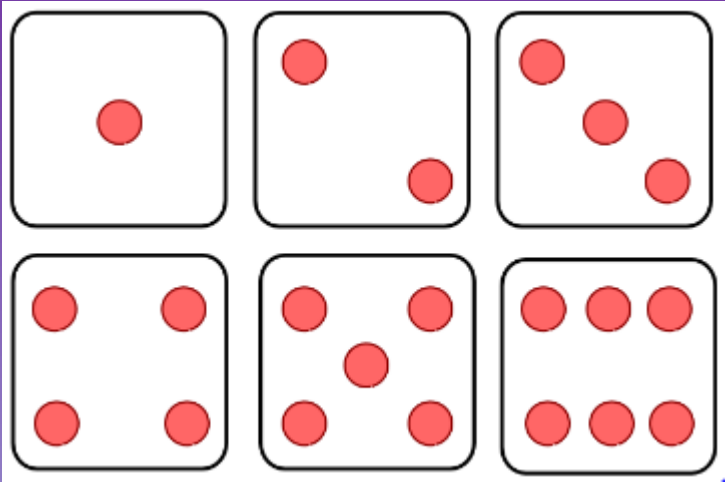
There are 3 iced cakes and 2 cherry cakes.

There are 5 cakes altogether.

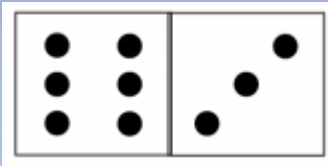
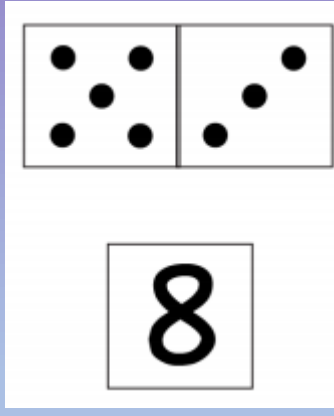
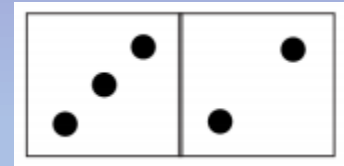
5 cakes take away the 2 cakes leaves

3 cakes. There are 3 cakes left.

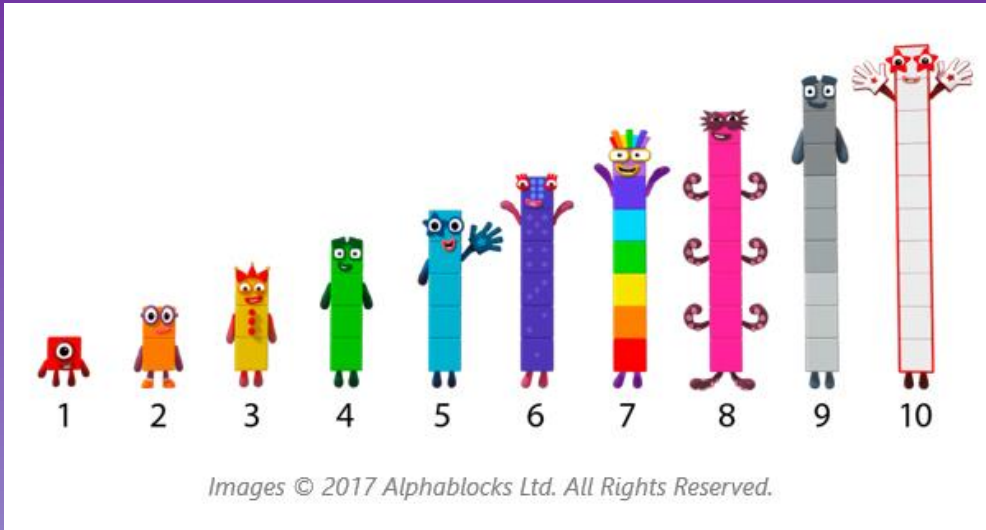
6		
7		
8		
9		
10		



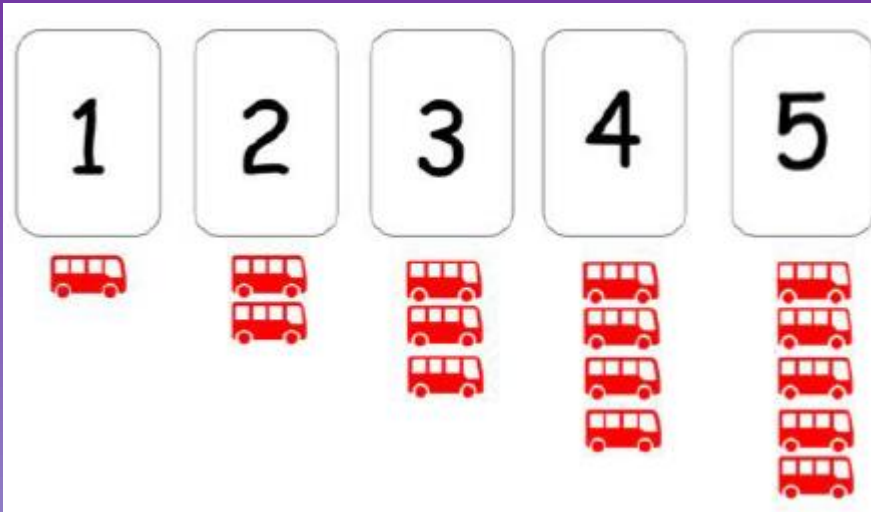
We learn to recognise numbers on dice.

		
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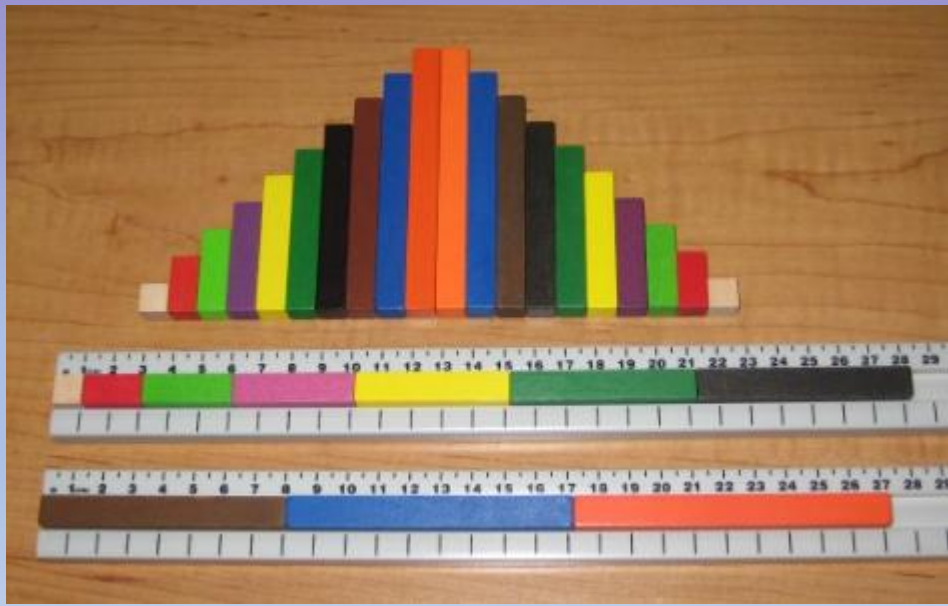
We represent numbers using our fingers and tens frames. We always look for groups of 5 and see how many more are needed. For example, 8 is 5 and 3 more.



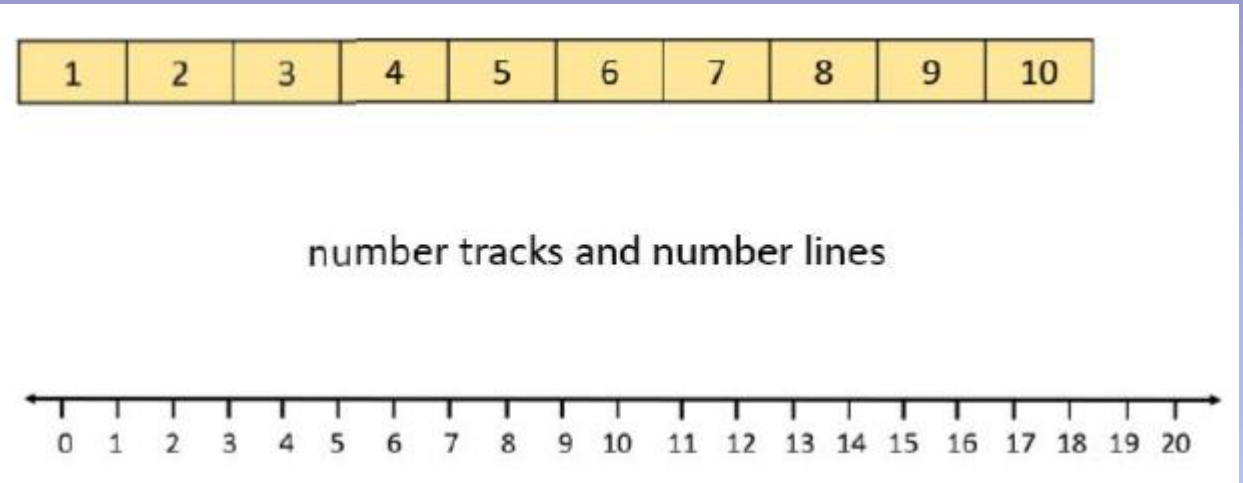
We learn to compare numbers of different sizes using multi-link and Cuisenaire rods.



We learn how to link objects and pictures to the written number.



<http://marcialmiller.com/wordpress/2011/01/playing-with-cuisenaire-rods/>



We use number tracks and number lines to compare numbers and combine quantities.

Addition

Mental and informal methods

Counting
on or
backwards

Adding
on 1, 10,
100
more

Rounding and
adjusting,
e.g. $82 + 99 =$
 $(82 + 100) - 1$

Partitioning
numbers, e.g.
 $64 + 52 =$
 $(60+50) +$
 $(4+2) = 110 +$
 $6 = 116$

Near
doubles,
e.g. $7 + 8$

Year 1 – Adding single digits. Examples given to illustrate the calculation $3+4 = 7$

Concrete



Representing the calculation in multiple ways using Numicon and non-standard manipulatives

Pictorial

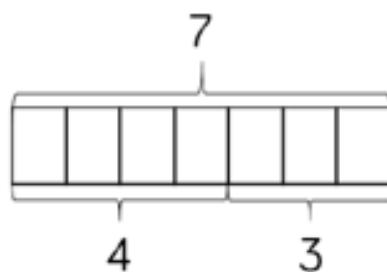
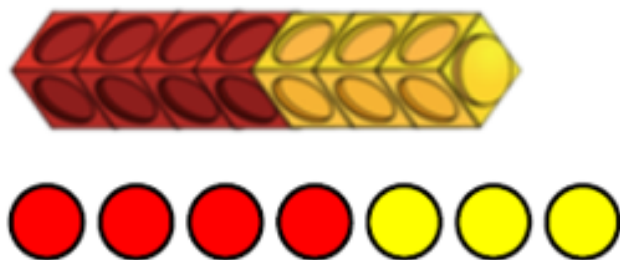
Drawing of marks or pictures to represent the calculation.



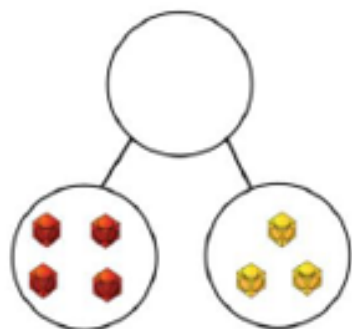
Abstract

$$4 + 3 = 7$$

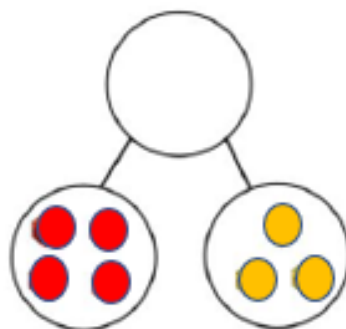
Bar model using multilink and counters



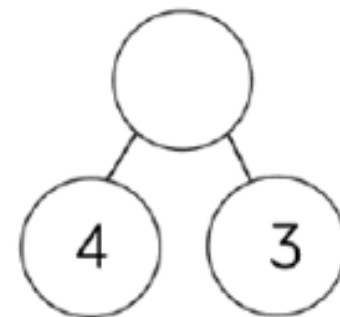
Part-part whole using objects



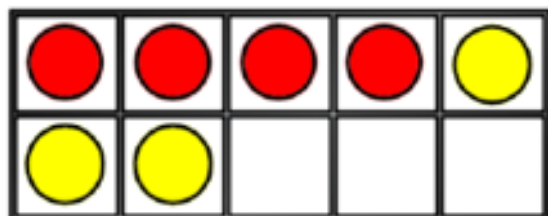
Part-part whole using pictures or marks



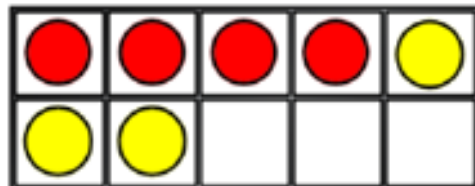
Part-part whole with numbers



Tens frames using counters



Tens frames using coloured dots



Bead strings



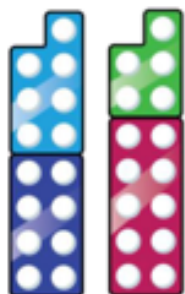
Number lines – counting on



Year 1/2 – “Making 10”

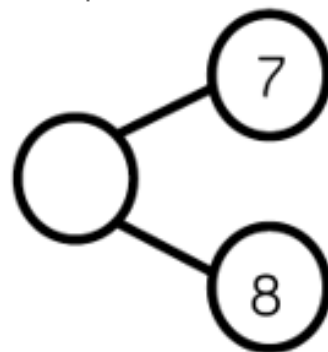
Concrete

Numicon plates can be placed on top of each other to show how to make a group of 10.



Pictorial

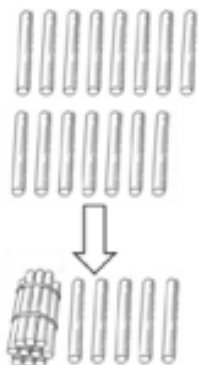
Part-part whole model



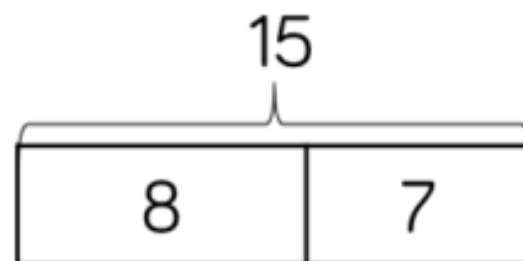
Abstract

$$8 + 7 = 15$$

Straws can be put into bundles of 10 to create tens and ones.

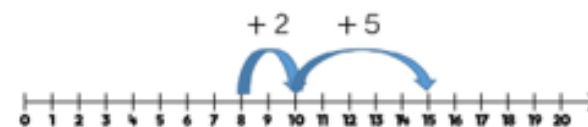
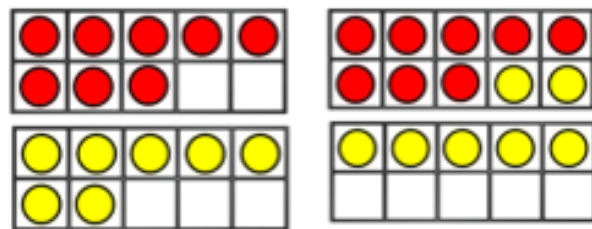


Bar model

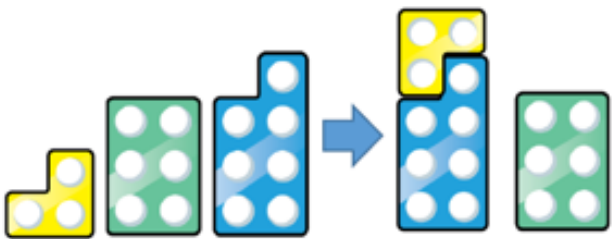
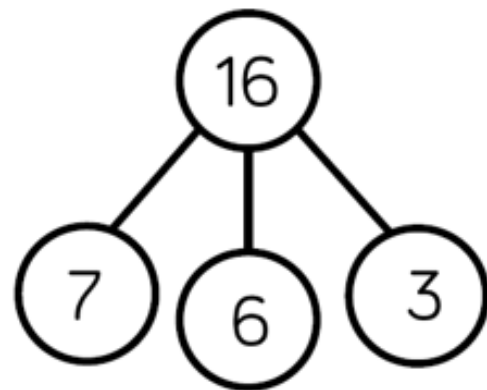
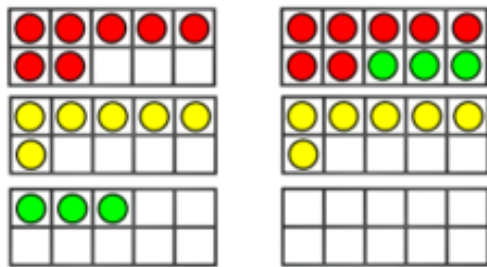
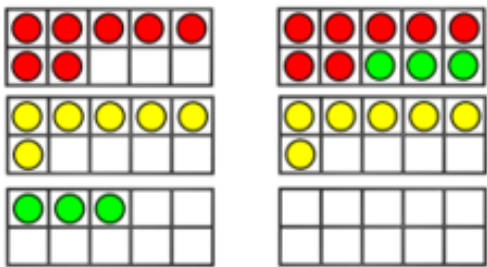
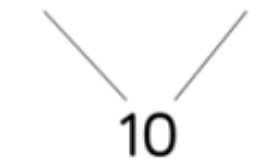


$$8 + 7 = 15$$

Tens frames – moving counters to make groups of 10.



Year 2 – Adding three single digits

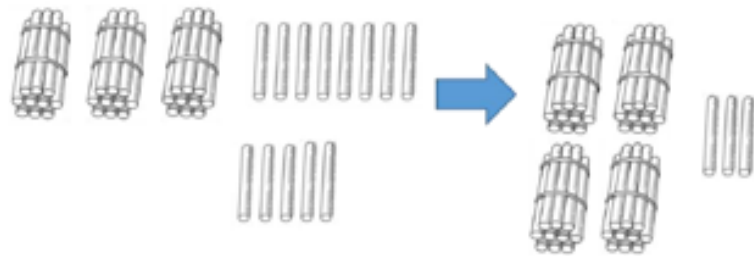
Concrete	Pictorial	Abstract
<p>Numicon</p> 	<p style="text-align: center;">Pictorial</p>	<p style="text-align: center;">Abstract</p> <p style="text-align: center;">Part-Part-Whole</p> 
<p>Using counters on tens frames</p> 	<p style="text-align: center;">Drawing tens frames</p> 	<p style="text-align: center;">$7 + 6 + 3 = 16$</p> 

Children need to recall and use their number bonds.

Year 2 – Adding two-digits and ones

Concrete

Using straws. Make the next set of 10.



Pictorial

Counting on using a hundred square.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

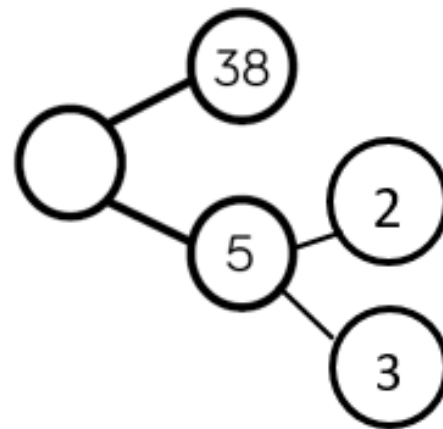
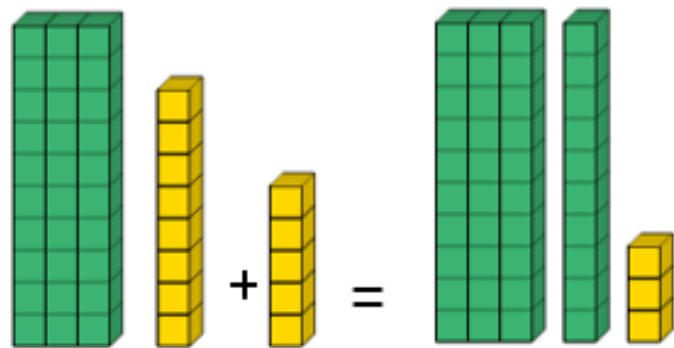
Abstract

$$38 + 5 =$$

$$38 + 2 + 3 =$$

$$40 + 3 = 43$$

Dienes



Cuisenaire rods

Make the number 38 then add 5.



Regroup the 8 and 5 to make 10 and 3



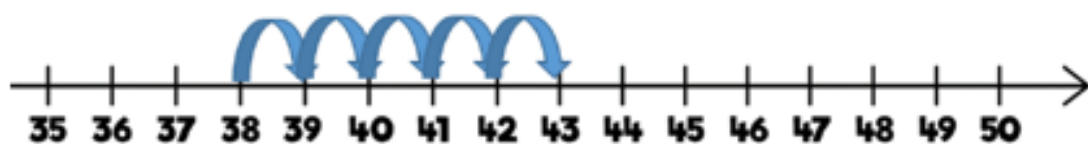
Bar model



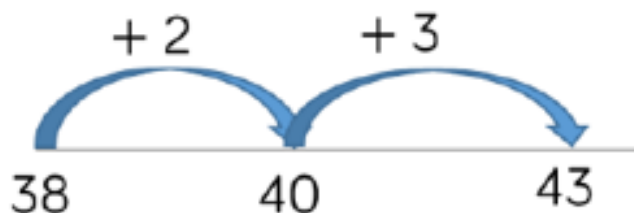
$$38 + 5 = 43$$

Using a number line

Jump in ones

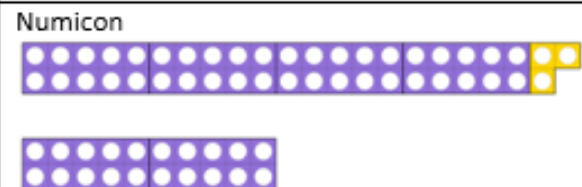


Bridge through the next ten using larger jumps and knowledge of number bonds.



Year 2 – Adding tens to a two-digit number

Concrete



Pictorial

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Abstract

$$43 + 20$$

Dienes



Tens



Ones



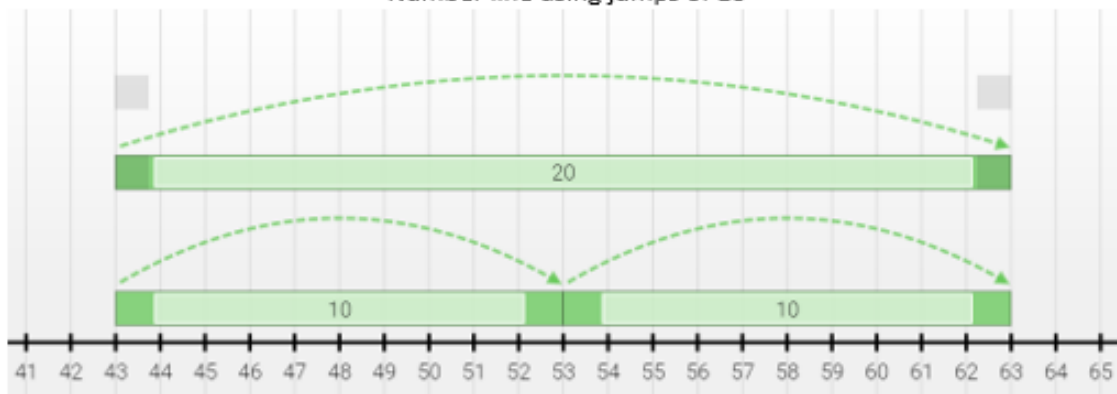
$$43 + 20$$

40

3

20

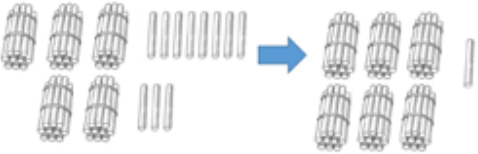
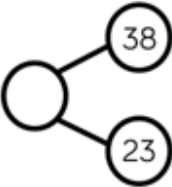
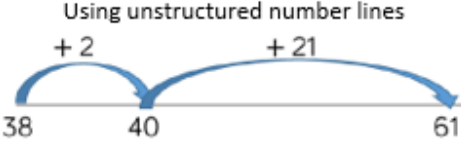
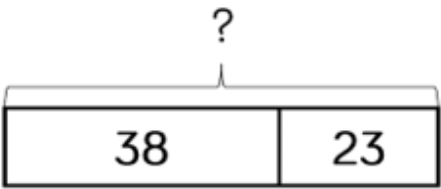
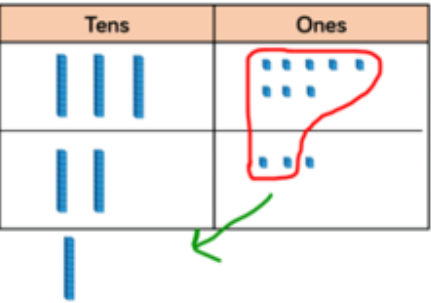
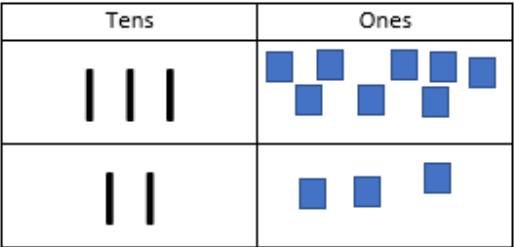
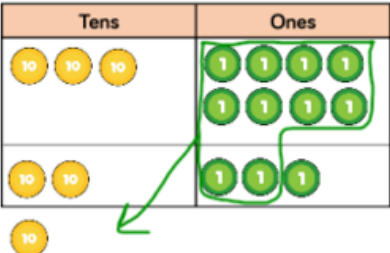
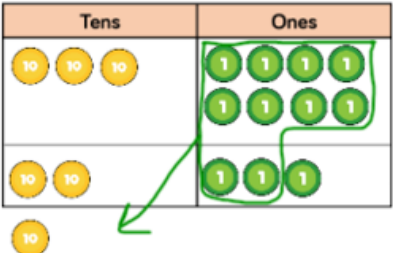
Number line using jumps of 10



<https://apps.mathlearningcenter.org/number-line/>

<https://mathsbot.com/>





Year 2/3 – Adding two numbers up to 100 together.

Concrete	Pictorial	Abstract
<p>Using bundles of straws</p> 	<p>Pictorial</p>  <p>Part-part whole model</p>	<p>Using unstructured number lines</p> 
	<p>Bar model</p> 	<p>$38 + 23 = 61$</p>
<p>Using Dienes</p> 	<p>Drawings of the dienes</p> 	<p>Expanded written method</p> $ \begin{array}{r} 30 \quad 8 \\ + \quad 20 \quad 3 \\ \hline 50 \quad + 11 = 61 \end{array} $
<p>Using place value counters</p> 	<p>Drawings of the counters</p> 	<p>Formal written method</p> $ \begin{array}{r} 38 \\ + 23 \\ \hline 61 \\ \hline 1 \end{array} $

Year 3 – Adding a three-digit number and ones

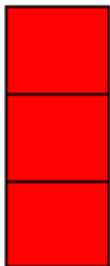



Concrete

Dienes

Hundreds	Tens	Ones
		
		

Pictorial

Drawing dienes

Hundreds	Tens	Ones
		
		

Abstract

$$321 + 6$$

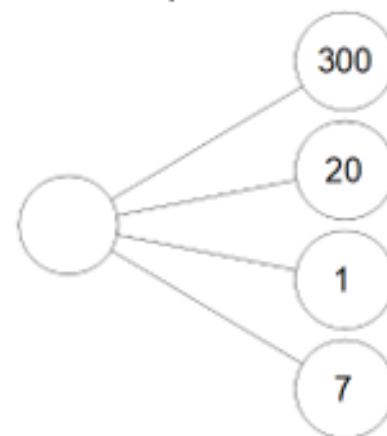
Place value counters

Hundreds	Tens	Units
		
		

Draw place value counters

Hundreds	Tens	Units
		
		

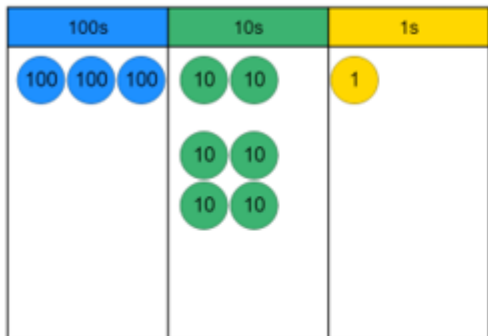
Part-part-whole



Year 3– Adding a three-digit number and tens

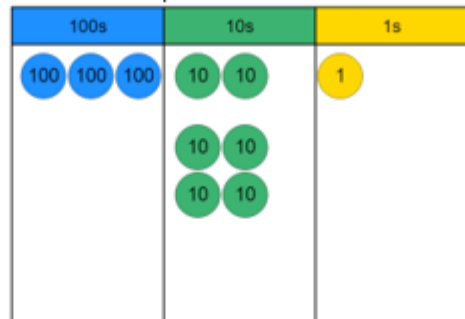
Concrete

Place value counters



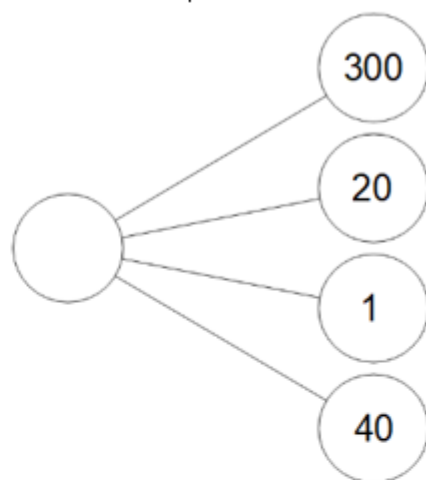
Pictorial

Draw place value counters

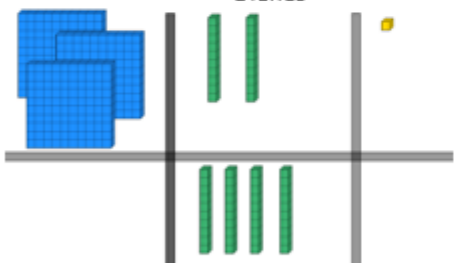


Abstract

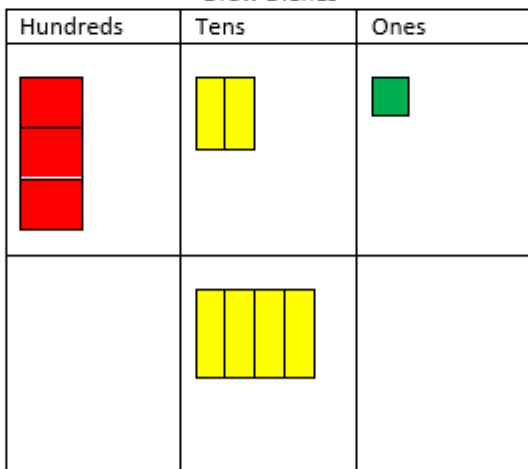
Part-part-whole



Dienes

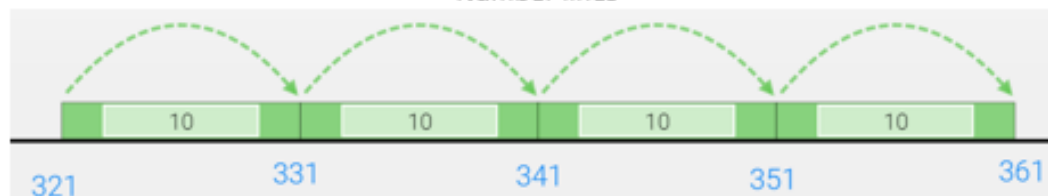


Draw Dienes



$$321 + 40$$

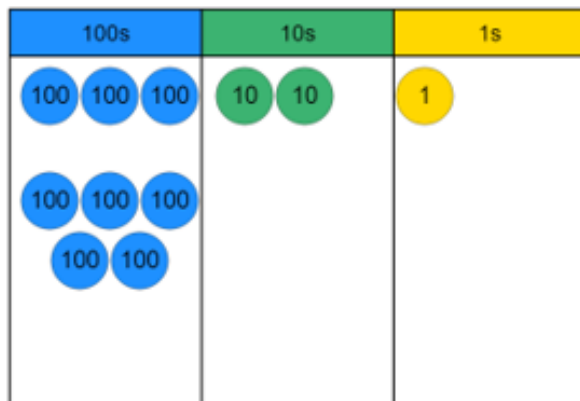
Number lines



Year 3 – Adding a three-digit number and hundreds

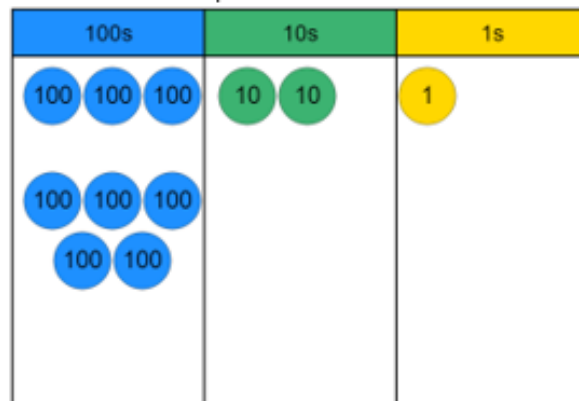
Concrete

Place Value counters



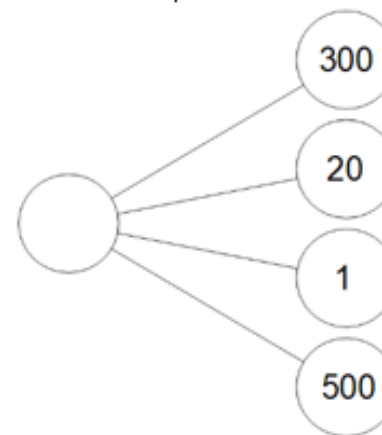
Pictorial

Draw place value counters

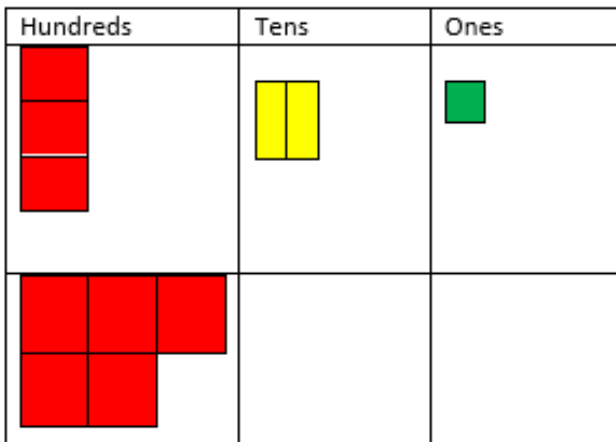


Abstract

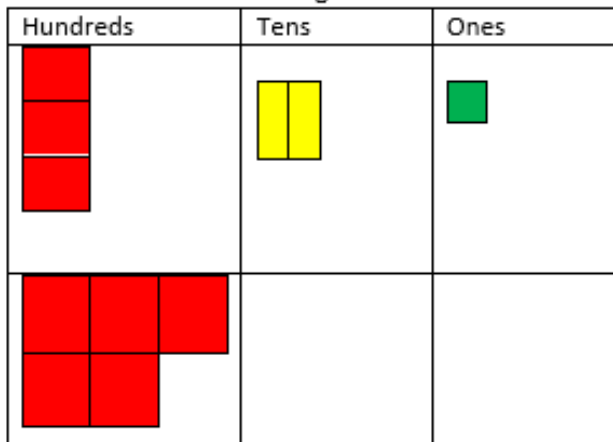
Part-part-whole



Dienes

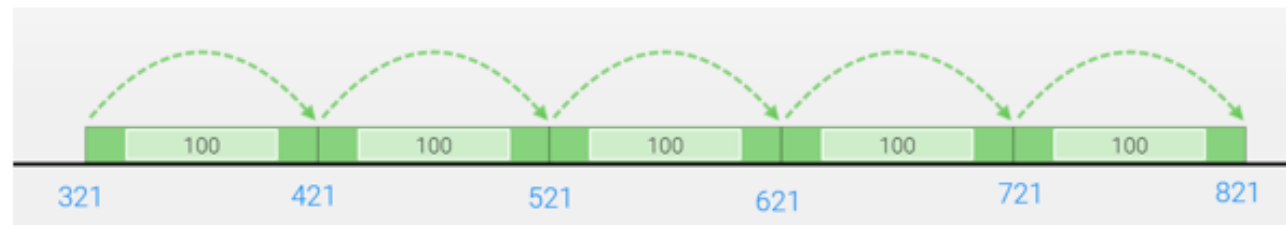


Drawing Dienes



$$321 + 500$$

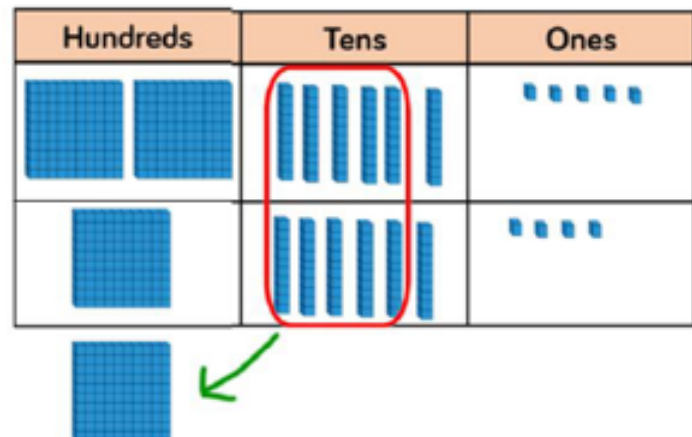
Number lines



Year 3 – Adding numbers with up to three-digits

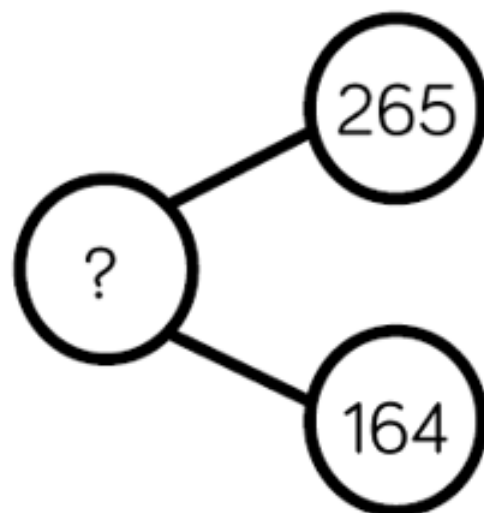
Concrete

Dienes



Pictorial

Part-part-whole

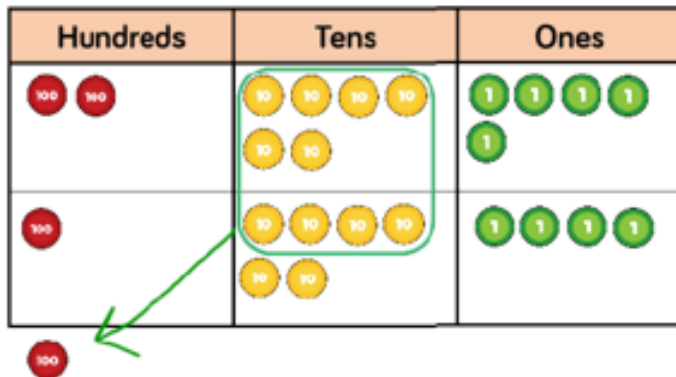


Abstract

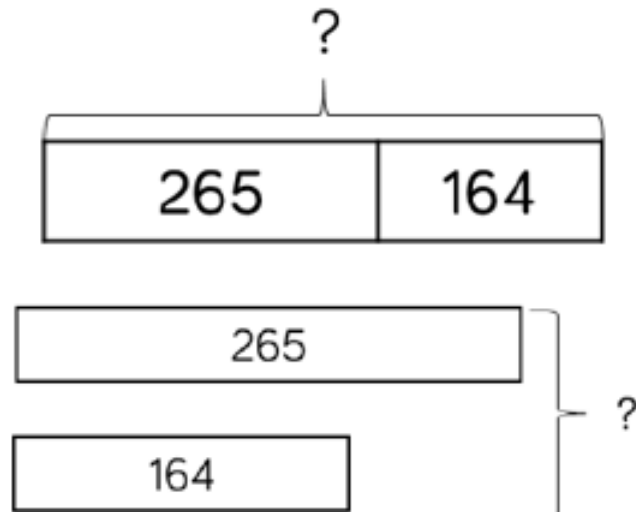
Formal written method

$$\begin{array}{r}
 265 \\
 + 164 \\
 \hline
 429 \\
 \hline
 1
 \end{array}$$

Place Value Counters



Bar Model

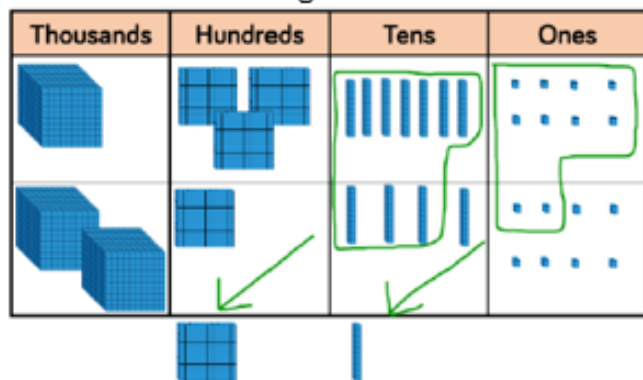


$$265 + 164 = 429$$

Year 3/4 – Adding numbers up to four-digits

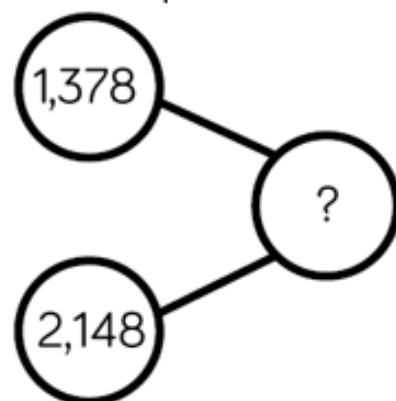
Concrete

Using Dienes



Pictorial

Part-part whole

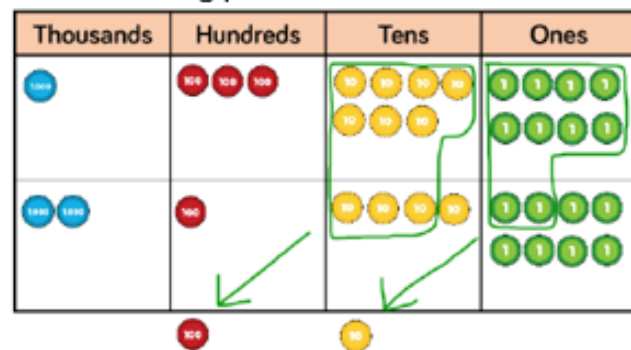


Abstract

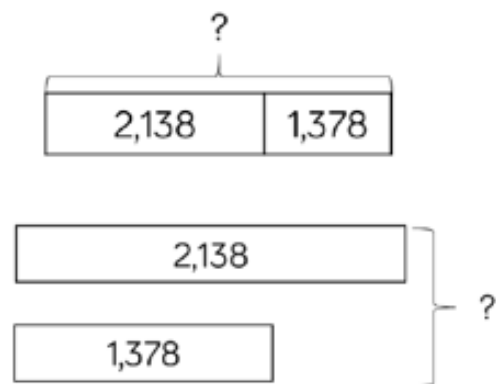
Formal written method

	1	3	7	8
+	2	1	4	8
3	5	2	6	
	1	1		

Using place value counters



Bar models

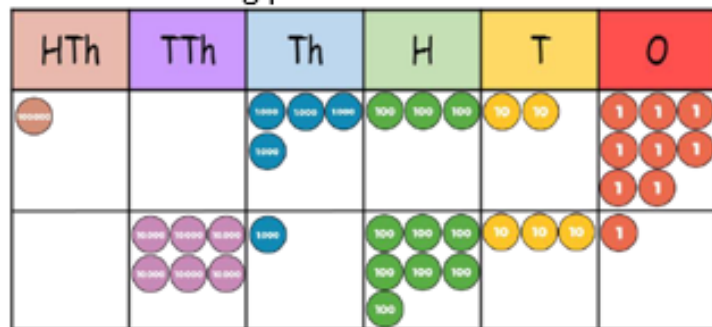


$1,378 + 2,148 = 3,526$

Year 5/6 – Adding larger numbers

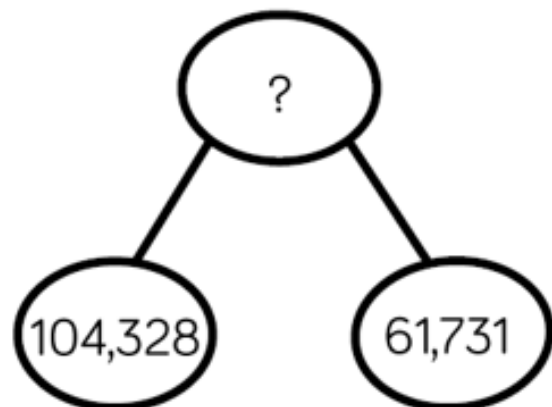
Concrete

Using place value counters



Pictorial

Part-part whole

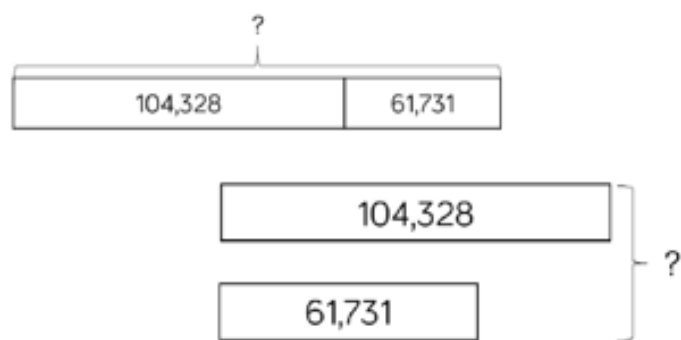


Abstract

Formal written method

1	0	4	3	2	8
+	6	1	7	3	1
1	6	6	0	5	9
1					

Bar models



$104,328 + 61,731 = 166,059$

Subtraction

Mental and informal methods

Finding one more, one less, ten more, ten less using place value knowledge

Counting backwards to find the answer or find the difference


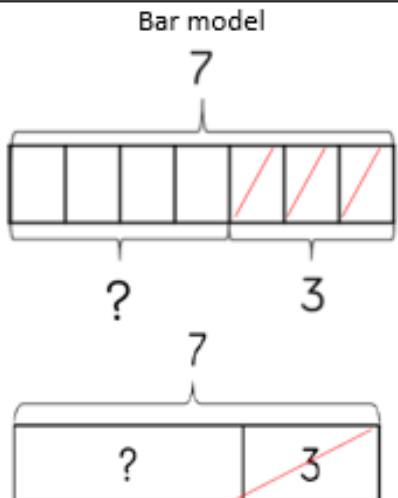
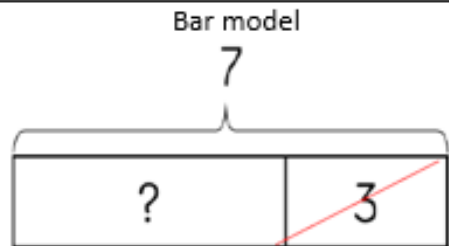
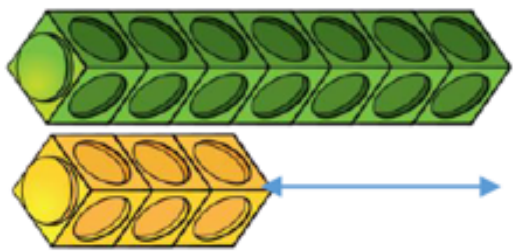

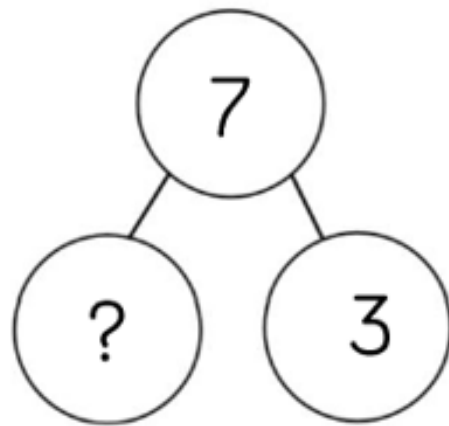
Rounding and adjusting.
For example to solve $45 - 9$ do $45 - 10$, then add 1 back on.

Counting on
For example, when I spend £3.50, how much change would I have from a £10 note.

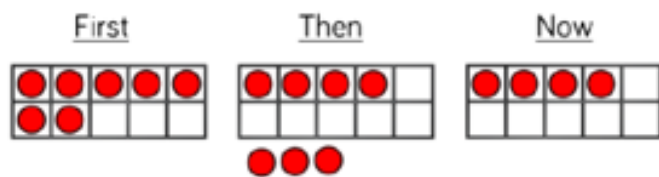
Partitioning numbers
For example
 $356 - 24$
 $= 356 - 20 - 4$

Constant difference
For example $14 - 8$ has the same difference between $10 - 4$ when 4 is subtracted from both numbers.

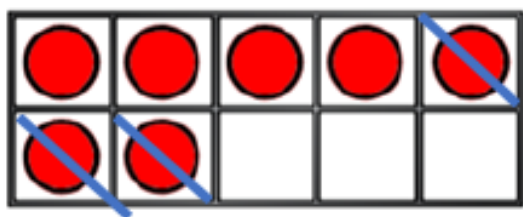
Year 1 – Subtracting a single digit within 10, using the example $7 - 3 = 4$

Concrete	Pictorial	Abstract
<p>Numicon – Lay one number on top of another and see what the difference is, or what is left uncovered.</p> <p>E.g. Put down the 7 plate and then lay the 3 plate on top. 4 are not covered so $7 - 3 = 4$</p> 	<p style="text-align: center;">Bar model</p> 	<p style="text-align: center;">Bar model</p> 
<p style="text-align: center;">Multilink cubes</p> <p>Make a row of cubes and then subtract a number from it, e.g. build a tower of 7 and then remove 3 cubes. What is left.</p> <p>Alternatively, make two rows and look to see what is the difference between them.</p>  <p style="text-align: center;">This could also be done as towers by building vertical rows.</p>	<p style="text-align: center;">Draw the row of cubes.</p> 	<p style="text-align: center;">Part-part whole</p> 

Tens frames



Tens frame drawing



$$7 - 3 = 4$$

Bead strings



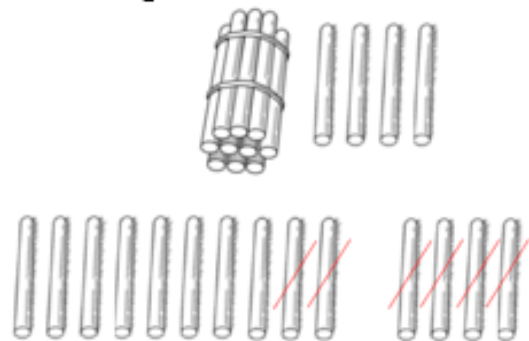
Counting back on a number line.



Year 1/2 – Subtracting a single digit up to 20

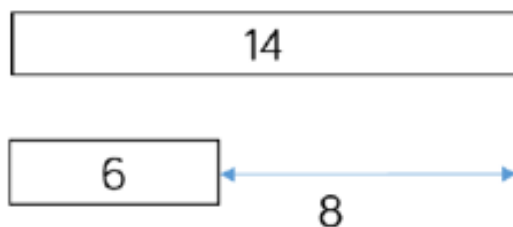
Concrete

Using straws to show tens and ones



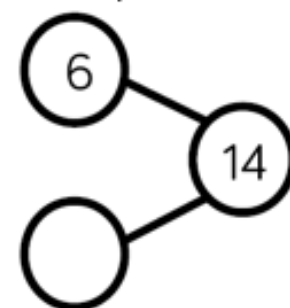
Pictorial

Bar model

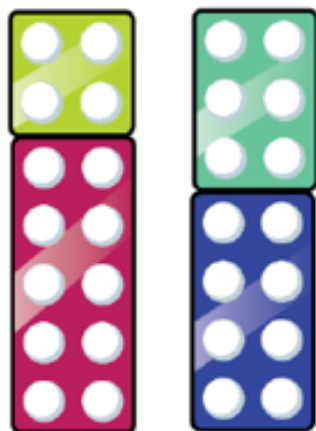


Abstract

Part-part whole



Numicon. Layer plates over each other, e.g. to solve $14 - 6$, make 14, then lay a 6 over the top. What's left? What size plate would that be? Alternatively make 14 and then use the numicon to make a shape exactly the same size, including the 6 plate.

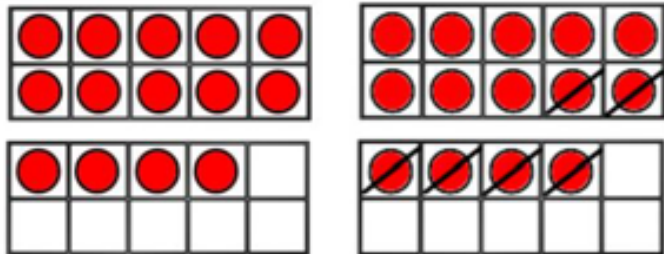


$$14 - 6 = 8$$

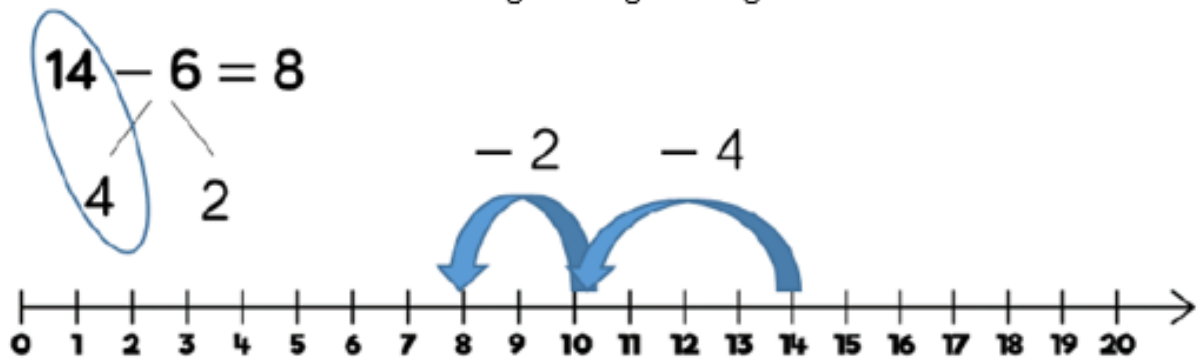
Number tracks and number lines – counting backwards



Tens frames



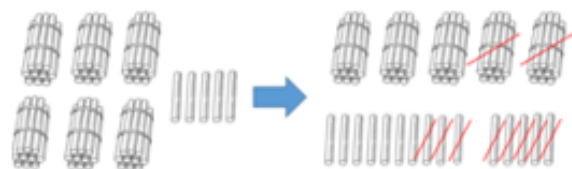
Partitioning to bridge through 10.



Year 2/3 – Subtracting two-digit numbers

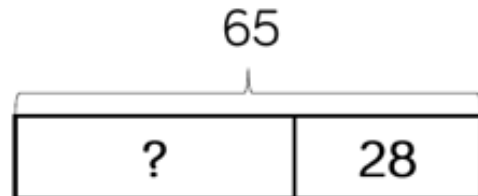
Concrete

Bundles of straws



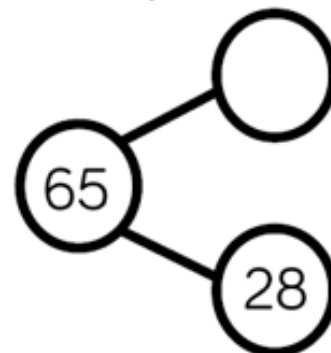
Pictorial

Bar model

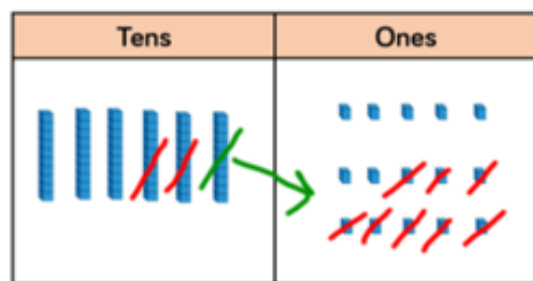


Abstract

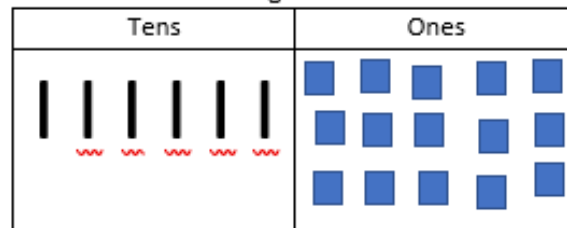
Part-part whole



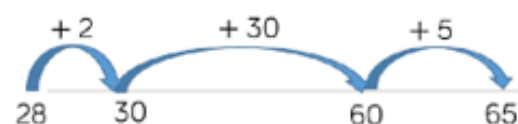
Dienes



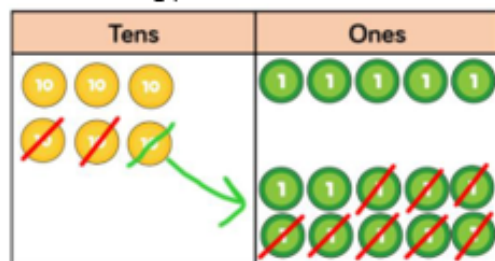
Drawings of Dienes



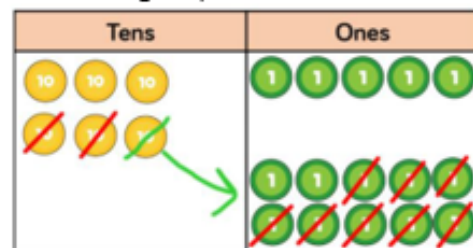
Number lines to count on



Using place value counters



Drawings of place value counters



$$65 - 28 = 37$$

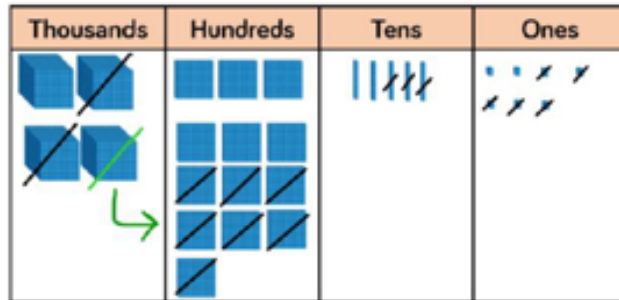
50	10	
60	5	
20	8	
30	+ 7	= 37

$$\begin{array}{r}
 \overset{5}{\cancel{6}}\overset{1}{5} \\
 - 28 \\
 \hline
 37
 \end{array}$$

Year 3/4– Subtracting numbers with up to four-digits

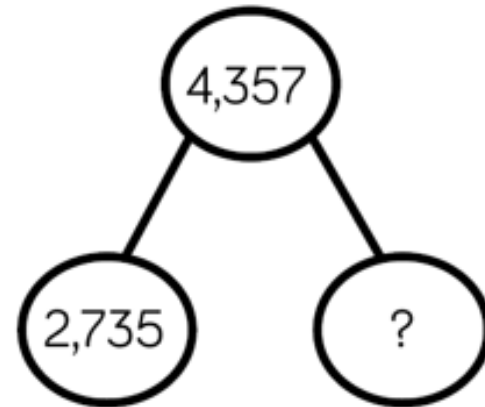
Concrete

Dienes



Pictorial

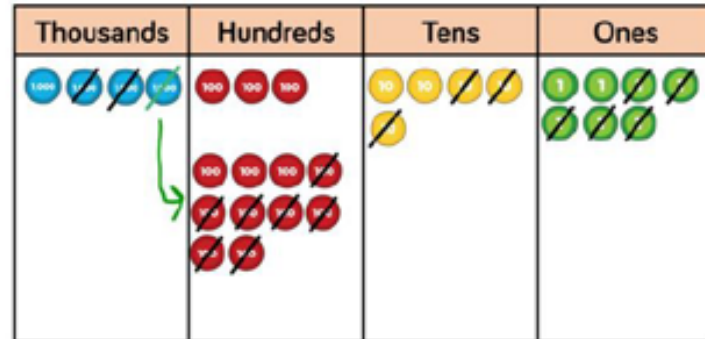
Part-part whole



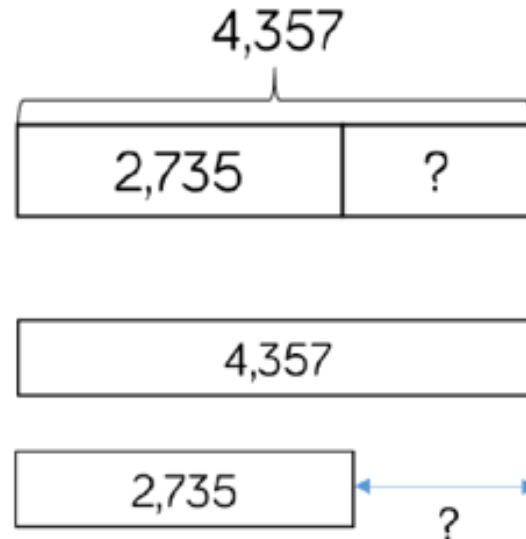
Abstract

$$\begin{array}{r}
 3 \quad 1 \\
 \cancel{4}357 \\
 - 2735 \\
 \hline
 1622
 \end{array}$$

Place value counters



Bar models

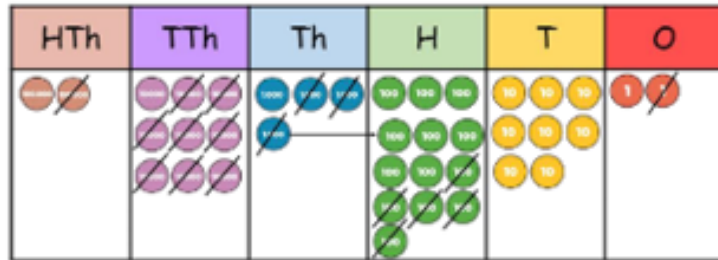


$$4,357 - 2,735 = 1,622$$

Year 5/6 – Subtraction using large numbers

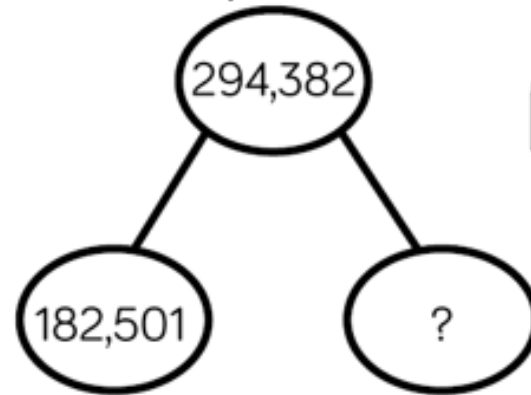
Concrete

Use of place value counters



Pictorial

Part-part whole

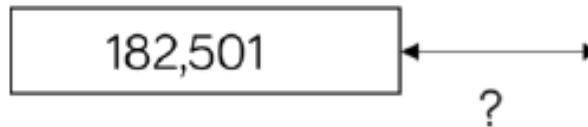
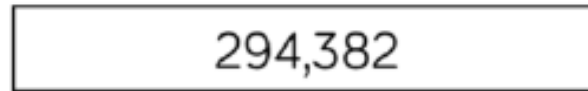


Abstract

	2	9	3	¹ 3	8	2
-	1	8	2	5	0	1
	1	1	1	8	8	1

Bar models

294,382



$$294,382 - 182,501 = 111,881$$

Multiplication

Mental and informal methods

Partitioning numbers

$$\begin{aligned} \text{e.g. } & 23 \times 8 \\ & = 160 + 24 \end{aligned}$$

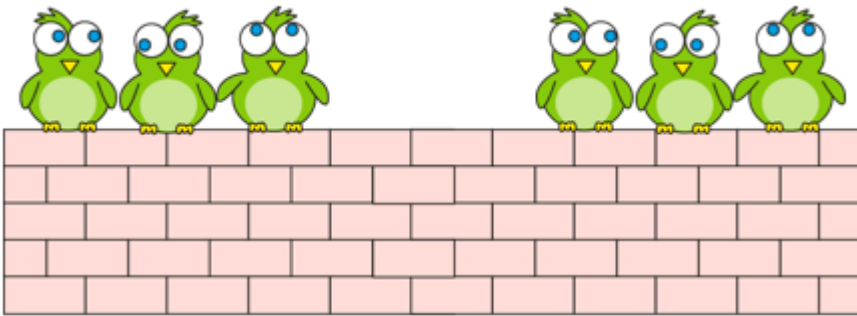
Adjust multiplications

e.g. 23×9 could be solved by finding 10 lots of 23 and then subtracting one lot of 23:

$$\begin{aligned} & (23 \times 10) - (21 \times 1) \\ & = 230 - 23 \end{aligned}$$

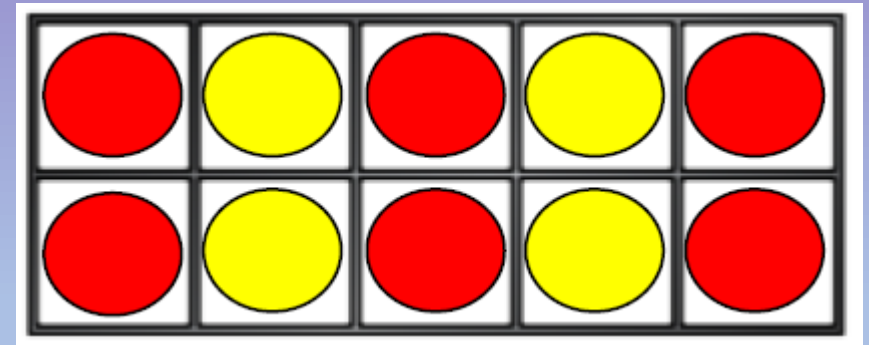
- Include halves and quarters (halve and halve again)

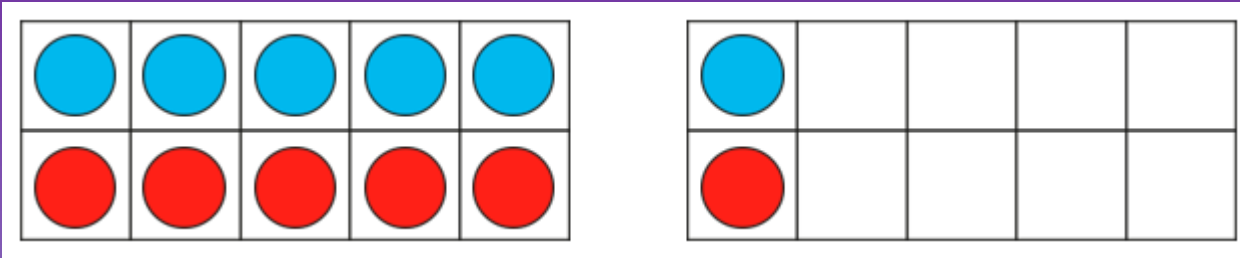
Doubling and halving within 20



Double 3 is the same as
2 groups of 3.

Children create pictures and use objects to physically double and halve numbers.





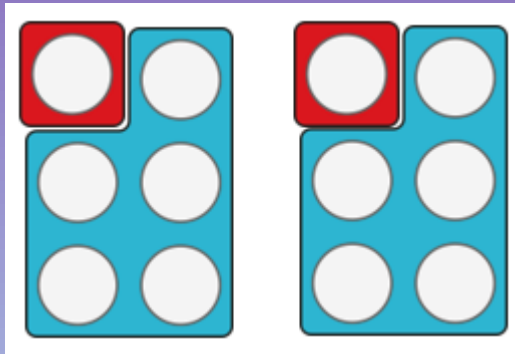
Tens frames, Numicon and other maths resources are used to double and halve numbers.

$$\boxed{12} = 6 + 6$$

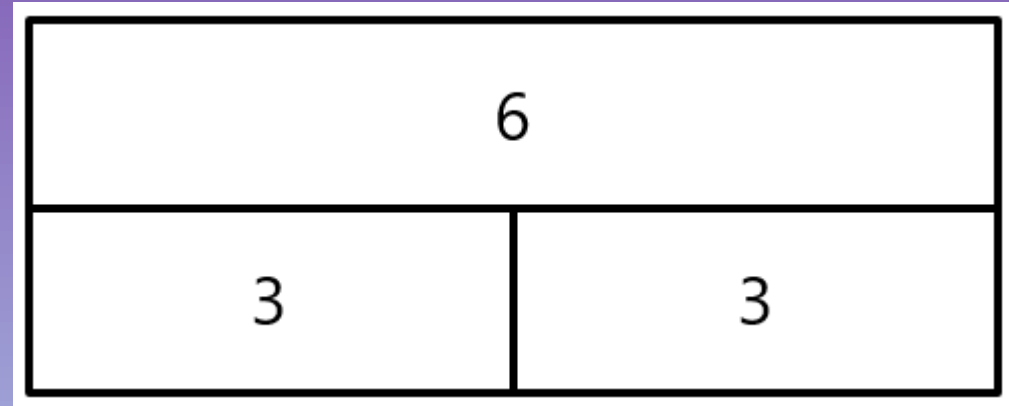
$$5 + 5 = 10$$

$$1 + 1 = 2$$

$$10 + 2 = 12$$



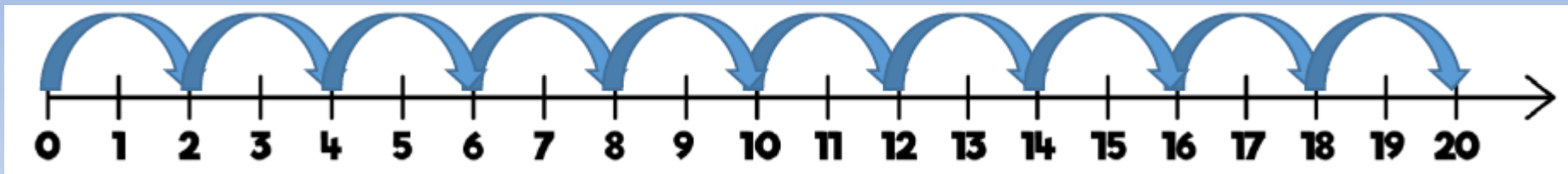
The calculations are shown as number sentences or recorded in a bar model.

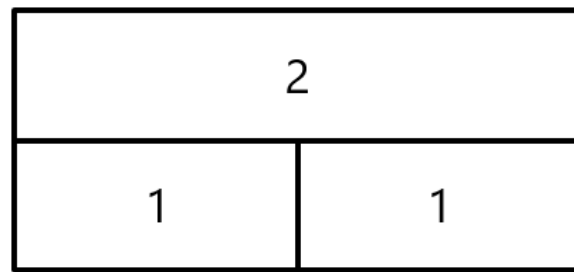
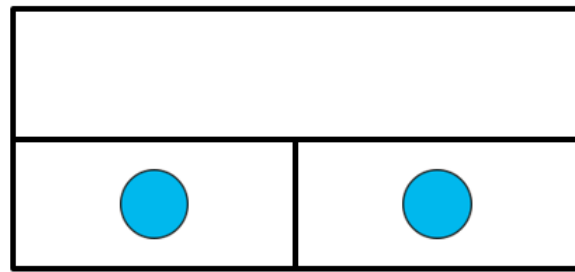


$$2 \times 3 = 6$$

$$2 \text{ times } 3 = 6$$

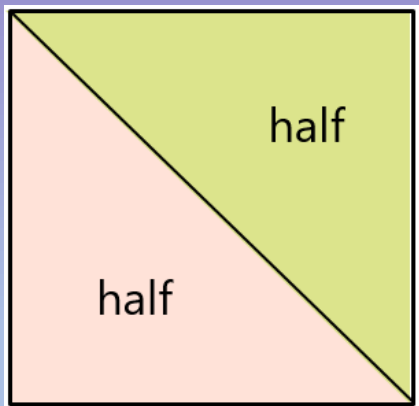
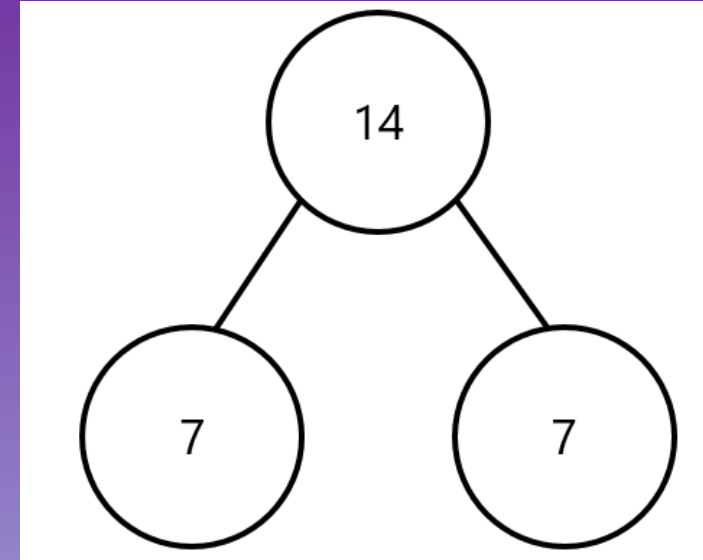
Children count in twos to help with doubling.



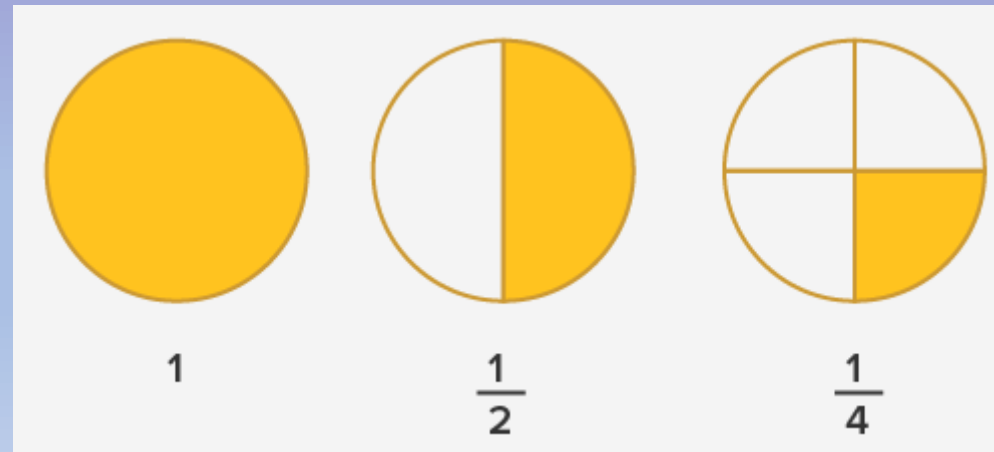


Half of 2 is equal to 1.

Double 1 is equal to 2.



Children learn that doubling and halving are inverses through looking at shapes, bar models and part-part-whole models.



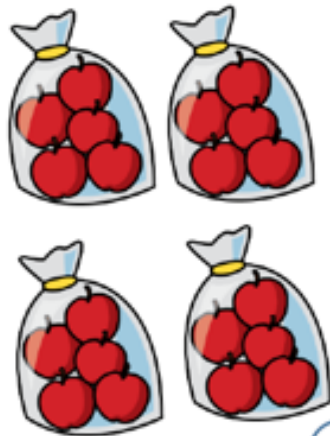
Children learn that a quarter is half a half.

Year 1/2 – Representing multiplication problems

One bag holds 5 apples.
How many apples do 4 bags hold?

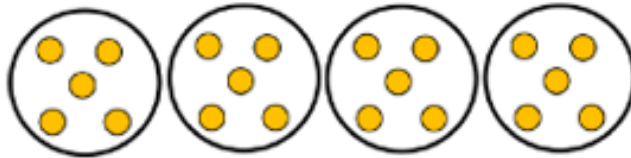
Concrete

Physical representation of the problem using sorting hoops or where possible the actual items, e.g. using apples and bags.



Pictorial

Draw sets



Abstract

Repeated addition

$$5 + 5 + 5 + 5 = 20$$

Using Numicon to show groups of 5



$$4 \times 5 = 20$$

$$5 \times 4 = 20$$

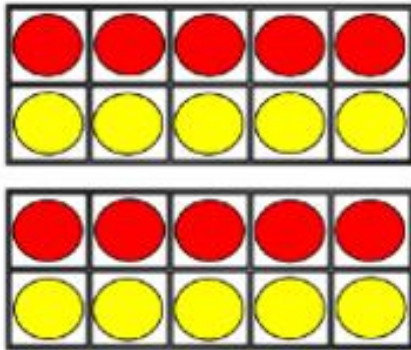
Using bead strings to show groups of 5



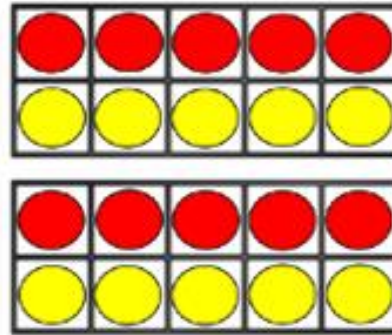
Use of a number track or number line to show jumps of 5



Use of tens frame and double-sided counters to show groups of 5

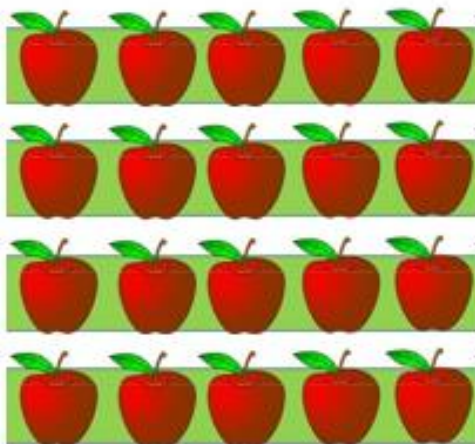


Fill in tens frames using coloured marks to show groups of 5.

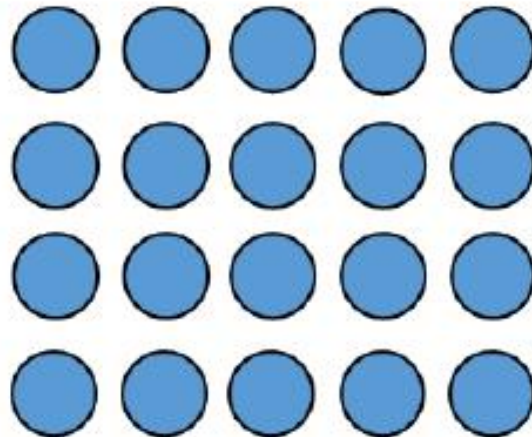


Jumps of 2 and jumps of 10 on a number line

Make arrays out of objects in the question (e.g. apples) or with counters representing them.



Draw an array

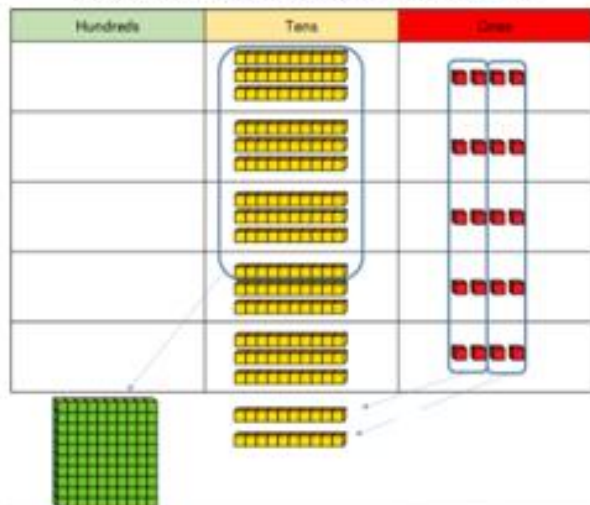


Year 3/4 – Multiplying a 2-digit number by a 1-digit number

$$34 \times 5 = 170$$

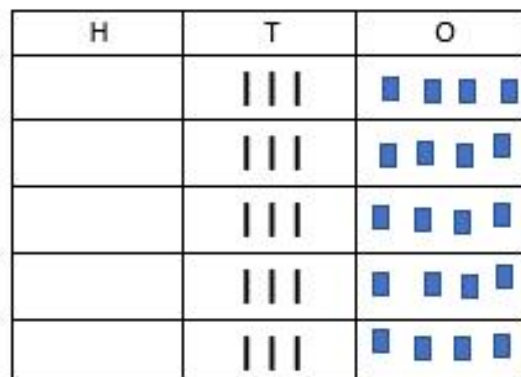
Concrete

Use dienes and a place value table



Pictorial

Draw the images of the Dienes.



Abstract

Expanded written method

	H	T	O	
		3	4	
x			5	
		2	0	(5 × 4)
+	1	5	0	(5 × 30)
	1	7	0	

Use place value counters



Draw the images of the place value counters



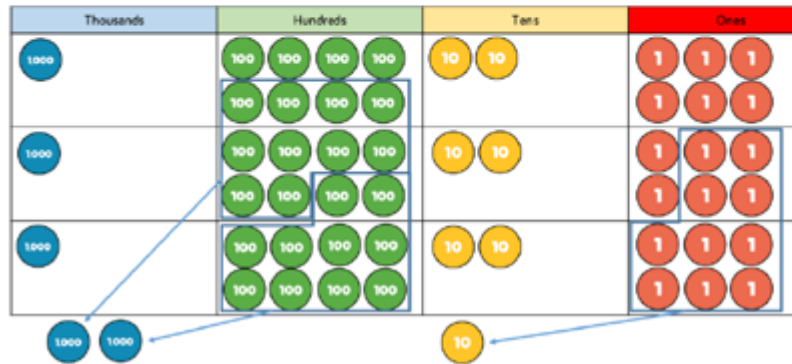
Formal written method

	H	T	O
		3	4
x			5
	1	7	0
	1	2	

Year 4/5 – Multiplying larger numbers by a 1-digit number

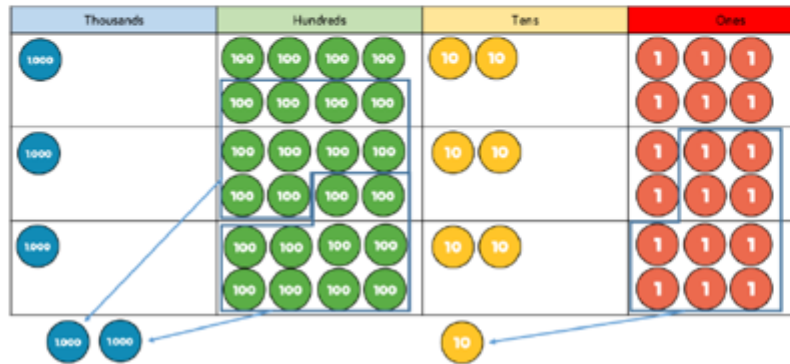
Concrete

Place value counters



Pictorial

Draw place value counters



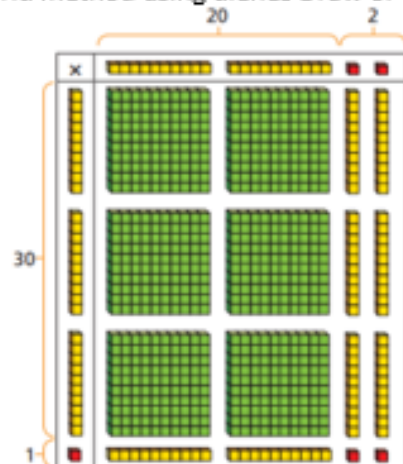
Abstract

	Th	H	T	O
	1	8	2	6
x				3
	5	4	7	8
	2		1	

Year 5/6 – Multiplying larger numbers by a 2-digit number

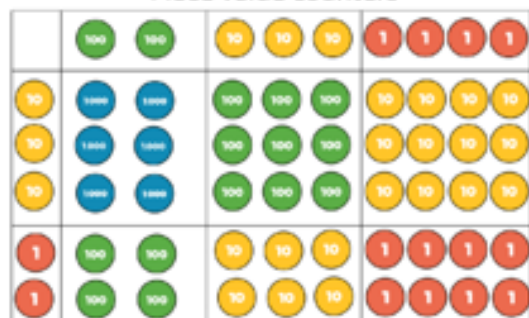
Concrete

Grid method using dienes Draw or use



Place value counters

Place value counters



Abstract

Grid method

×	20	2
30	600	60
1	20	2

Expanded column method

	H	T	O
		2	2
×		3	1
<hr/>			
		2	2
	6	6	0
	6	8	2

Grid method

×	200	30	4
30	6,000	900	120
2	400	60	8

Formal written method

	Th	H	T	O
		2	3	4
×			3	2
<hr/>				
		4	6	8
¹ 7	¹ 0	2	0	
<hr/>				
7	4	8	8	

Division

Mental and informal methods

Partitioning and distributing
the numbers in different ways

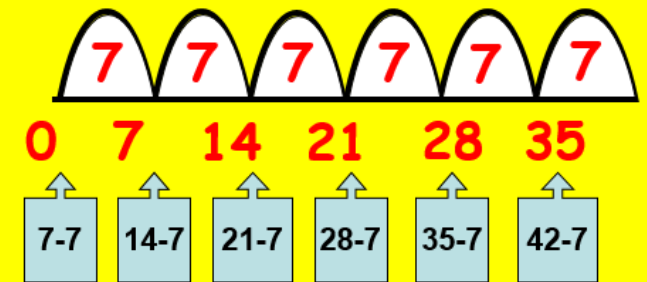
$$\begin{aligned} &\text{e.g. } 91 \div 7 \\ &= (70 \div 7) + (21 \div 7) \text{ because} \\ &91 = 70 + 21 \end{aligned}$$

Using known
multiplication facts, e.g.
 $91 = (10 \times 7) + (3 \times 7)$ so
 $13 \times 7 = 91$

Using number lines for
repeated subtraction.

Repeated subtraction
e.g. $91 \div 7 = 91 - 70 - 21$
(subtract 10×7 and then
 3×7)

$$42 \div 7 = 6$$

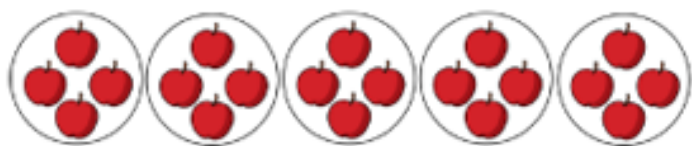


Year 1/2 – Division by sharing

There are 20 apples altogether.
They are shared equally between 5 bags.
How many apples are in each bag?

Concrete

Using sorting hoops and items to represent the object (apples)



Pictorial

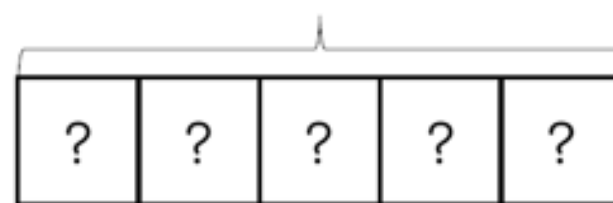
Drawings of sorting hoops



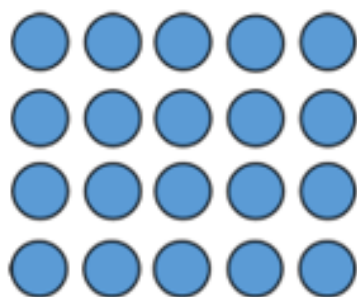
Abstract

Bar model

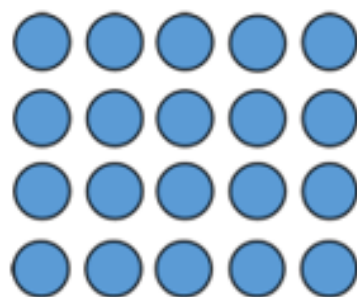
20



Making arrays



Drawing arrays



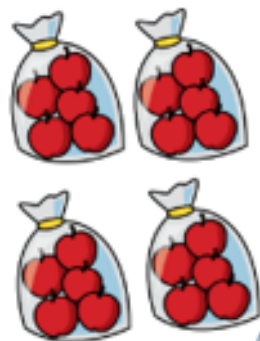
$$20 \div 5 = 4$$

Year 1/2 – Division by grouping

There are 20 apples altogether.
They are put in bags of 5.
How many bags are there?

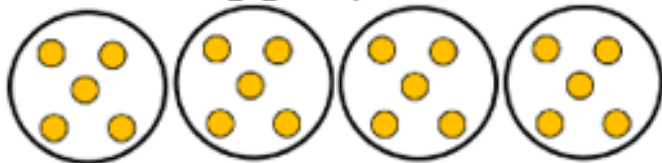
Concrete

Use named objects to put into groups.



Pictorial

Drawing groups in circles.



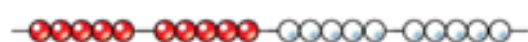
Abstract

$$20 \div 5 = 4$$

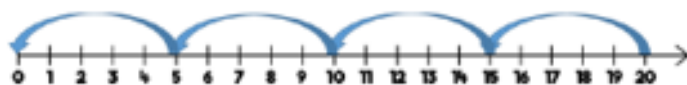
Numicon. Lay the original number out (e.g. 20) and lay the number to group by over the top (5).



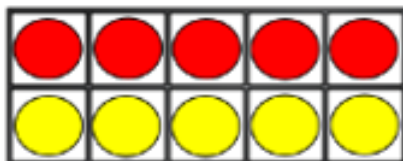
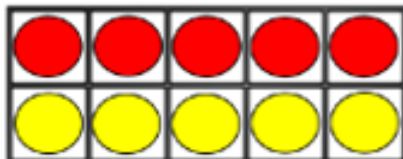
Bead string showing groupings.



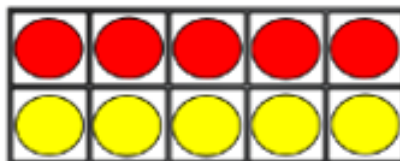
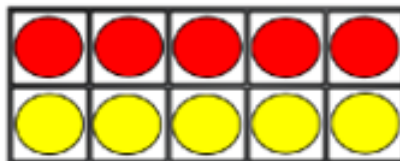
Use a number track and count back in steps of the divisor (e.g. 5)



Layout groupings using double-sided counters on a tens frame.



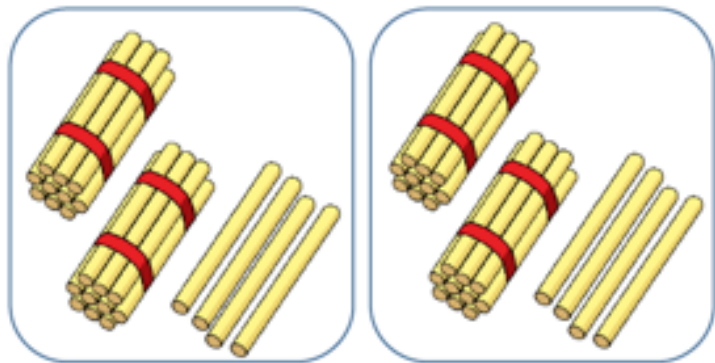
Draw the counters on the tens frame.



Year 1/2 – Dividing a two-digit number by a one-digit number (no exchange)

Concrete

Bundles of straws



Pictorial

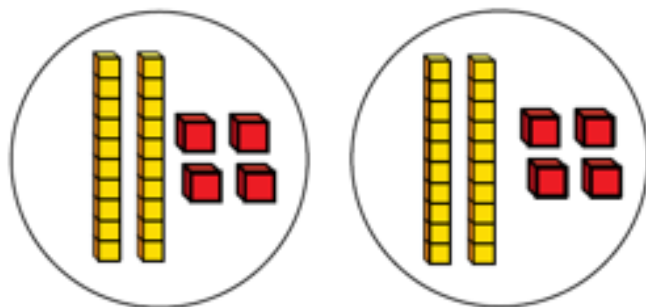
Use or draw place value counters on a place value chart. There should be the same number of rows as the divisor.

Tens		Ones			
10	10	1	1	1	1
10	10	1	1	1	1

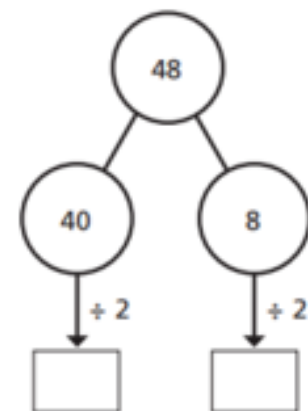
Abstract

$$48 \div 2 = 24$$

Dienes



Part-part whole



Year 3/4 – Division with exchange

Concrete

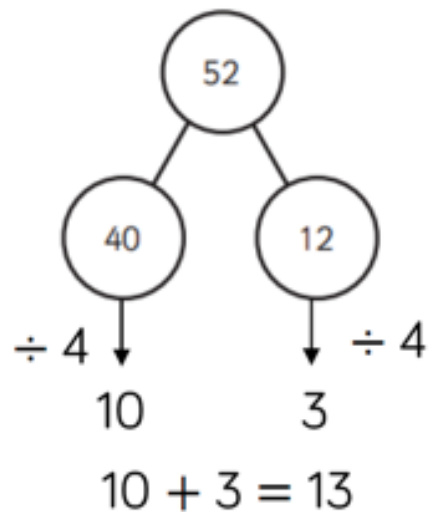
Dienes



Tens	Ones
[Rod]	[4 Squares]
[Rod]	[4 Squares]
[Rod]	[4 Squares]
[Rod]	[4 Squares]

Pictorial

Part-part whole



Abstract

$52 \div 4 = 13$

Check 4×13

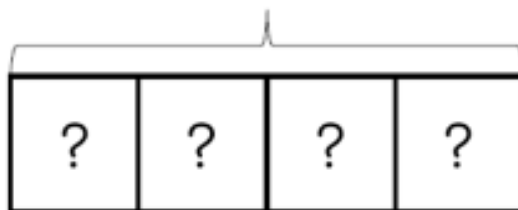
Place value counters



Tens	Ones
[Counter]	[10 Counters]
[Counter]	[10 Counters]
[Counter]	[10 Counters]
[Counter]	[10 Counters]

Bar model

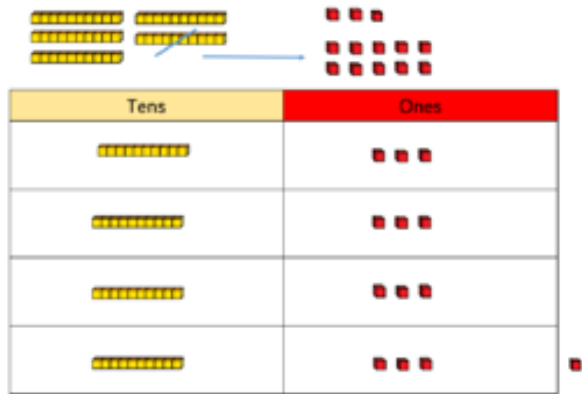
52



Year 3/4 – Dividing a two-digit number by a one-digit number with remainders

Concrete

Dienes



Pictorial

Bar model

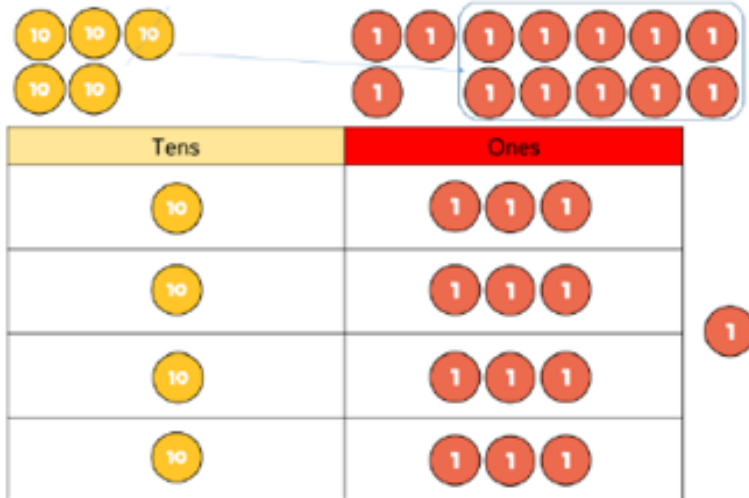
53



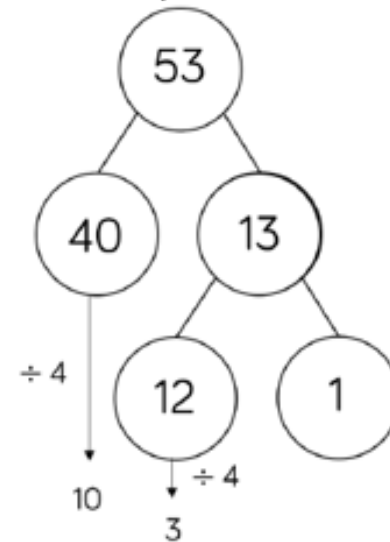
Abstract

$$53 \div 4 = 13 \text{ r}1$$

Place value counters



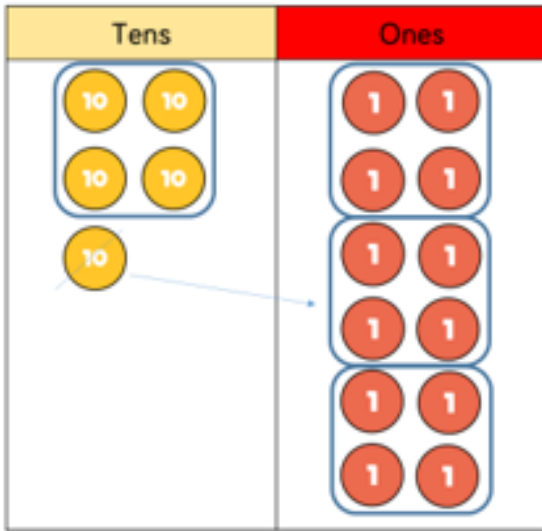
Part-part whole



Year 4/5 – Division using grouping

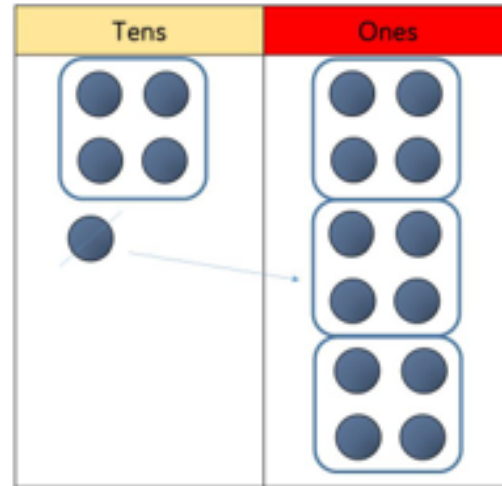
Concrete

Place value counters



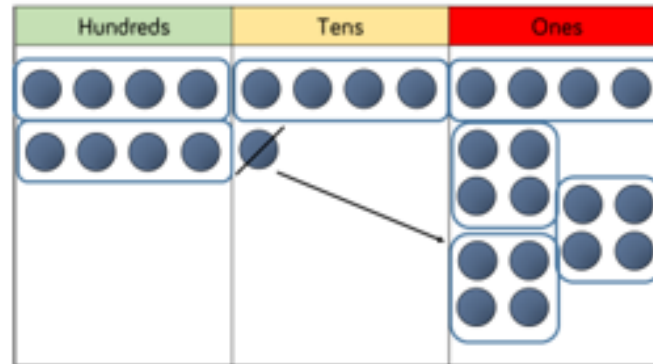
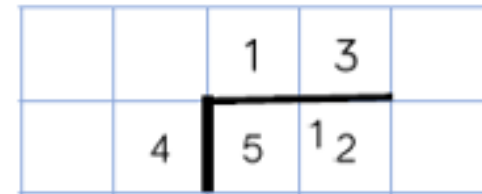
Pictorial

Drawing counters



Abstract

Short division written method



Remainders can be interpreted in different ways: $53 \div 4 = 13 \text{ r } 1 = 13 \frac{1}{4} = 13.25$

Year 6 – Division formal written methods

Abstract

$$432 \div 12 = 36$$

		0	3	6
12	4	4	3	7 2

$$7,335 \div 15 = 489$$

	0	4	8	9
15	7	7	3	13 3
				13 5

15	30	45	60	75	90	105	120	135	150
----	----	----	----	----	----	-----	-----	-----	-----

$$7,335 \div 15 = 489$$

	0	4	8	9
15	7	3	3	5
-	6	0	0	0
	1	3	3	5
-	1	2	0	0
		1	3	5
-		1	3	5
				0

- $1 \times 15 = 15$
- $2 \times 15 = 30$
- $3 \times 15 = 45$
- $4 \times 15 = 60$
- $5 \times 15 = 75$
- $10 \times 15 = 150$

(x400)
(x80)
(x9)

By the end of KS2 these are the methods the children may use:

Addition and subtraction

789 + 642 becomes

$$\begin{array}{r} 789 \\ + 642 \\ \hline 1431 \\ \hline 11 \end{array}$$

Answer: 1431

874 - 523 becomes

$$\begin{array}{r} 874 \\ - 523 \\ \hline 351 \end{array}$$

Answer: 351

932 - 457 becomes

$$\begin{array}{r} 8 \quad 12 \quad 1 \\ 932 \\ - 457 \\ \hline 475 \end{array}$$

Answer: 475

Short multiplication

24 × 6 becomes

$$\begin{array}{r} 24 \\ \times 6 \\ \hline 144 \\ \hline 2 \end{array}$$

Answer: 144

342 × 7 becomes

$$\begin{array}{r} 342 \\ \times 7 \\ \hline 2394 \\ \hline 21 \end{array}$$

Answer: 2394

2741 × 6 becomes

$$\begin{array}{r} 2741 \\ \times 6 \\ \hline 16446 \\ \hline 42 \end{array}$$

Answer: 16 446

Long multiplication

24 × 16 becomes

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

Answer: 384

124 × 26 becomes

$$\begin{array}{r} 12 \\ 124 \\ \times 26 \\ \hline 744 \\ 2480 \\ \hline 3224 \\ \hline 11 \end{array}$$

Answer: 3224

Short division

$98 \div 7$ becomes

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

Answer: 14

$432 \div 5$ becomes

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

Answer: 86 remainder 2

$496 \div 11$ becomes

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

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

Long division

$432 \div 15$ becomes

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

Answer: 28 remainder 12

$432 \div 15$ becomes

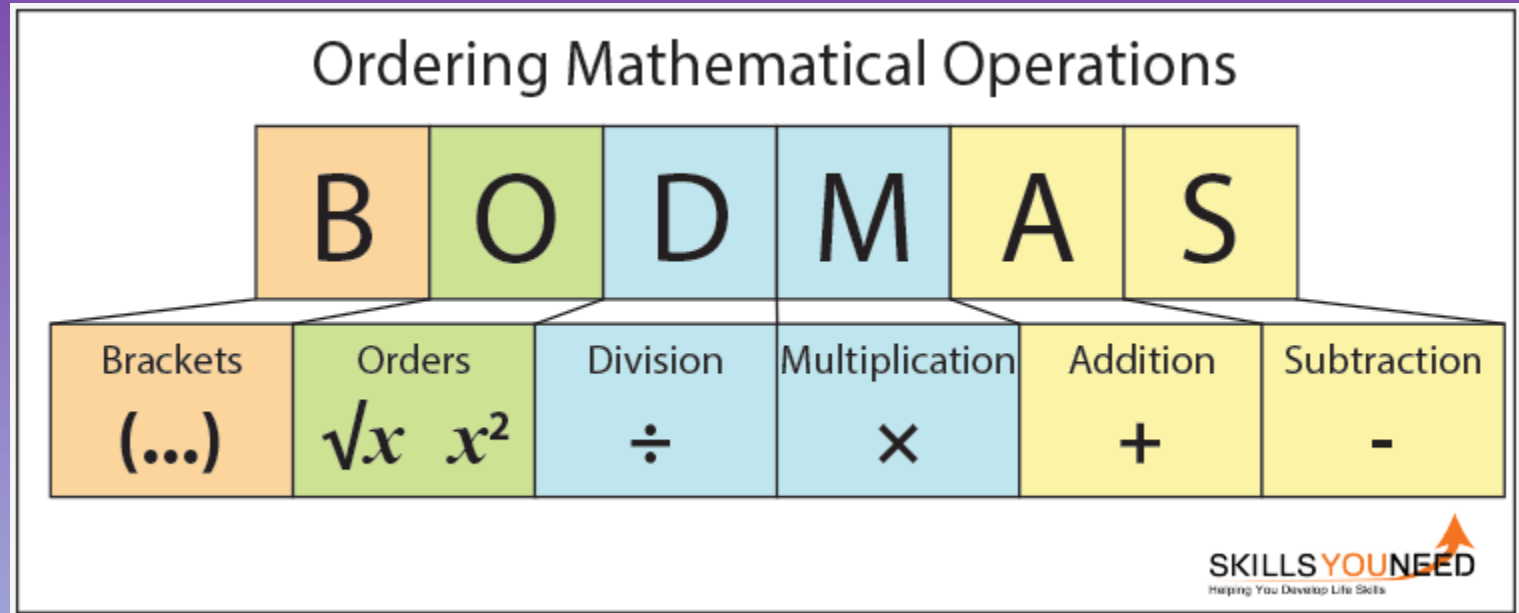
$$\begin{array}{r} 28 \\ 15 \overline{) 432} \\ \underline{30} \quad 15 \times 20 \\ 132 \\ \underline{120} \quad 15 \times 8 \\ 12 \end{array}$$

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

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

[https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/335158/PRIMARY_national_curriculum - Mathematics 220714.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/335158/PRIMARY_national_curriculum_-_Mathematics_220714.pdf)

Year 6 children are taught to solve calculations with different operations in them, e.g. $25 + 3 \times 4 + (10 \div 5)$. They learn about BODMAS.



BODMAS is a useful acronym that tells you the order in which you solve mathematical problems. It's important that you follow the rules of BODMAS, because without it your answers can be wrong.

The **BODMAS** acronym is for:

- **B**rackets (parts of a calculation inside brackets always come first).
- **O**rders (numbers involving powers or square roots).
- **D**ivision.
- **M**ultiplication.
- **A**ddition.
- **S**ubtraction.