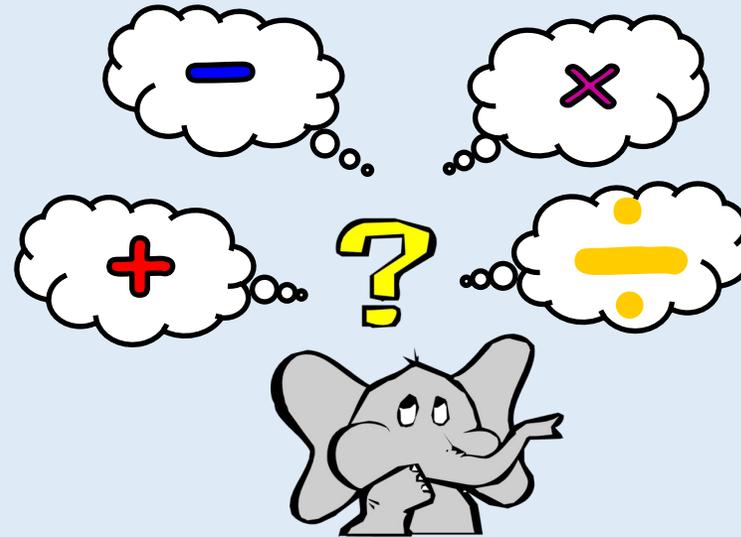
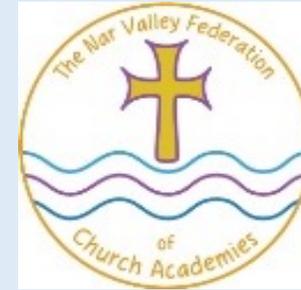


The Nar Valley Mathematics Calculation Policy: Part 1 Addition and Subtraction



Commissioned by The PiXL Club Ltd.
June 2016

ADAPTED FOR USE AT THE NAR VALLEY FEDERATION OF SCHOOLS BY E. WILLGRESS – JANUARY 2020

This resource is strictly for the use of member schools for as long as they remain members of The PiXL Club. It may not be copied, sold nor transferred to a third party or used by the school after membership ceases. Until such time it may be freely used within the member school. All opinions and contributions are those of the authors. The contents of this resource are not connected with nor endorsed by any other company, organisation or institution.

About Nar Valley's PiXL Calculation Policy



- The following calculation policy has been devised to meet requirements of the National Curriculum 2014 for the teaching and learning of mathematics, and is also designed to give pupils a consistent and smooth progression of learning in calculations across the school.

- Age stage expectations:

The calculation policy is organised according to age stage expectations as set out in the National Curriculum 2014 and the method(s) shown for each year group should be modelled to the vast majority of pupils. However, it is vital that pupils are taught according to the pathway that they are currently working at and are showing to have 'mastered' a pathway before moving on to the next one. Of course, pupils who are showing to be secure in a skill can be challenged to the next pathway as necessary.

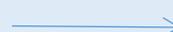
- Choosing a calculation method:

Before pupils opt for a written method they should first consider these steps:

Can I do it in my head using a mental strategy?



Could I use some jottings to help me?



Should I use a formal written method to work it out?

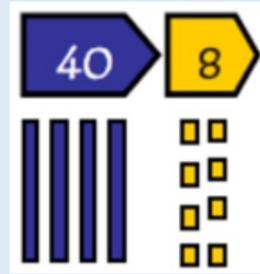
Calculation Guidance Principles

- *Develop children's fluency with basic number facts*
- *Develop children's fluency in mental calculation*
- *Develop children's understanding of the = symbol*
- *Teach inequality alongside teaching equality*
- *Use empty box problems*
- *Use intelligent practice*
- *Expose mathematical structure and work systematically*
- *Move between the concrete and the abstract*
- *Contextualise the mathematics*

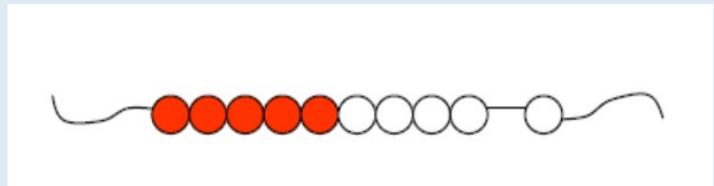
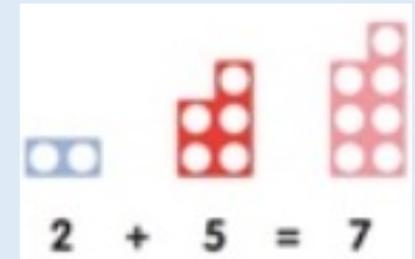
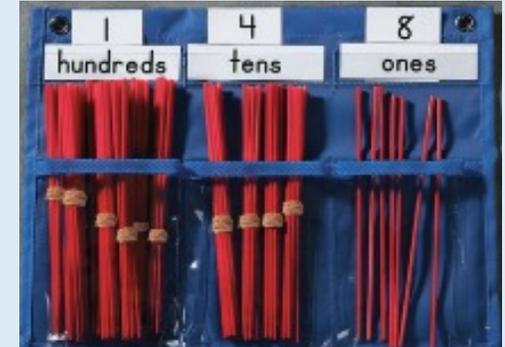
Addition

Concrete resources:

- 100 square
- Number lines
- Bead strings
- Straws
- Dienes
- Place value cards
- Place value dice
- Place value counters
- Numicon



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



sum addition total

make more

and plus

add increase

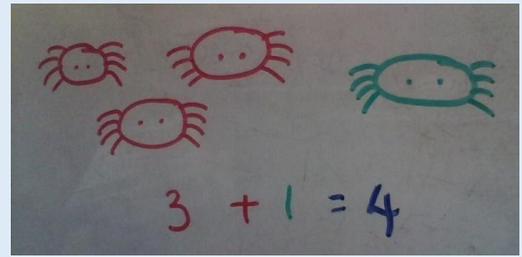
altogether

+

Addition: Reception

Early learning goals:

- ✓ Count reliably with numbers from 1 to 20, place them in order.
- ✓ Say which number is one more than a given number.
- ✓ Using quantities and objects, they add two single-digit numbers and count on to find the answer.



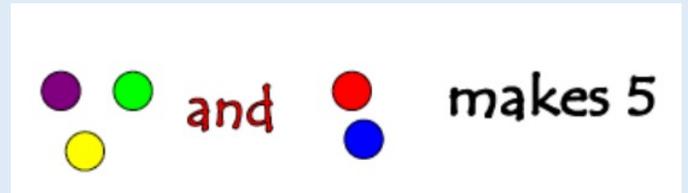
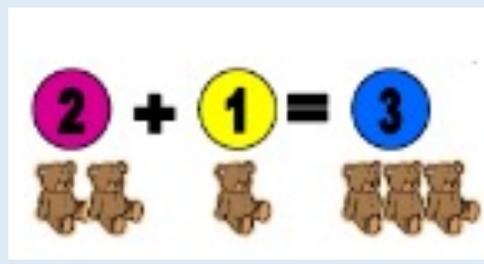
Recognise numbers up to 20 and understand the meaning of each number by recognising and knowing their clusters

1 one 	2 two 	3 three
4 four 	5 five 	6 six
7 seven 	8 eight 	9 nine

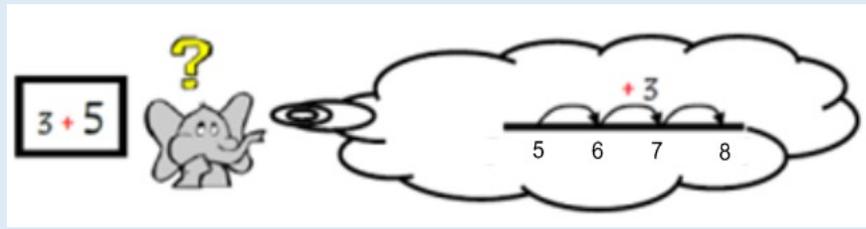
Count on in ones and say which number is one more than a given number using a number line or number track to 20.

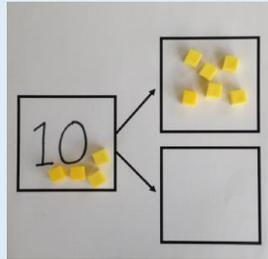


Begin to relate addition to combining two groups of objects using practical resources, role play, stories and songs.



Know that counting on is a strategy for addition. Use numbered number lines to 20.

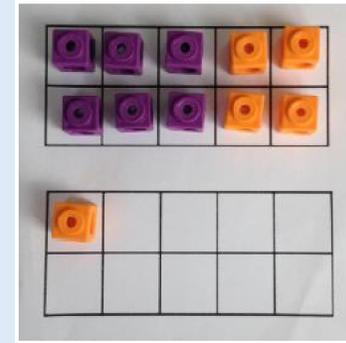




Addition: Year 1

Year 1 statutory requirements :

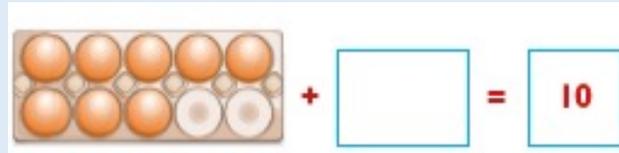
- ✓ Count to and across 100, forwards beginning with 0 or 1, or from any given number.
- ✓ Given a number, identify one more.
- ✓ Read, write and interpret mathematical statements involving addition (+), and equals (=) signs.
- ✓ Represent and use number bonds and related subtraction facts within 20
- ✓ Add one-digit and two-digit numbers to 20, including zero.
- ✓ Solve one-step problems that involve addition using concrete objects and pictorial representations, and missing number problems.



Identify and represent numbers using objects and pictorial representations (multiple representations)



Memorise and reason with number bonds to 10 and 20 in several forms.



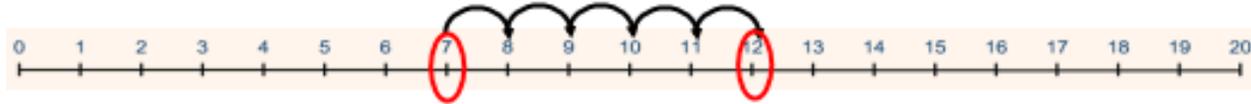
Count on in ones to and across 100 and find one more than a given number.

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

<p>6 + 4 = 10 4 + 6 = 10 10 - 4 = 6 10 - 6 = 4</p> <p>Tens Frame</p>	<p>6 + 4 = 10 4 + 6 = 10 10 - 4 = 6 10 - 6 = 4</p> <p>Part Whole Model</p>	<table border="1" style="margin: 0 auto;"> <tr><td colspan="2" style="text-align: center;">10</td></tr> <tr><td style="width: 50%;">6</td><td style="width: 50%;">4</td></tr> </table> <p>6 + 4 = 10 4 + 6 = 10 10 - 4 = 6 10 - 6 = 4</p> <p>Bar Model</p>	10		6	4
10						
6	4					

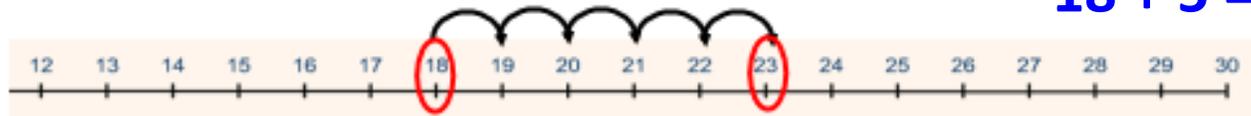
Addition: Year 1

Use concrete resources and a number line to support the addition of numbers. Know and use strategy of finding the larger number, and counting on in ones from this number.



1 digit + 1 digit

$$7 + 5 = 12$$



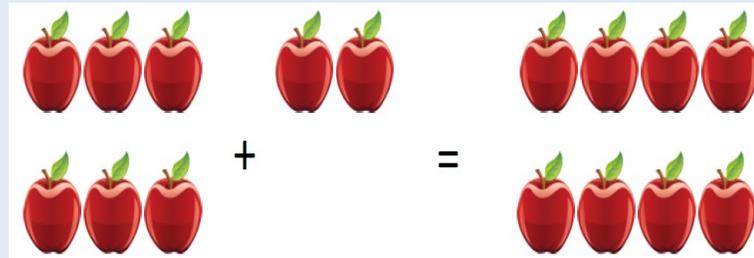
2 digit + 1 digit

$$18 + 5 = 23$$

Begin to use the + and = signs to write calculations in a number sentence.

Solve one-step problems using concrete objects and pictorial representations.

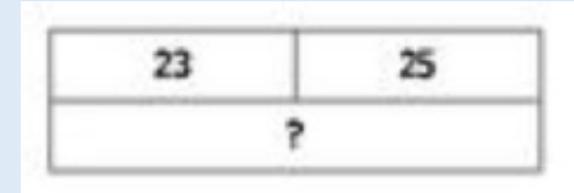
Tom picks 6 apples and Raj picks 2 apples.
How many apples do they have altogether?



Addition: Year 2

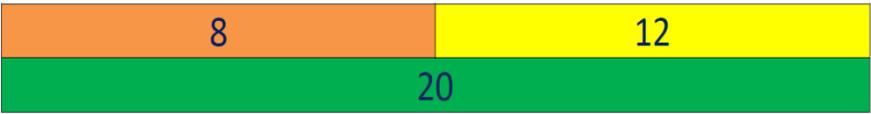
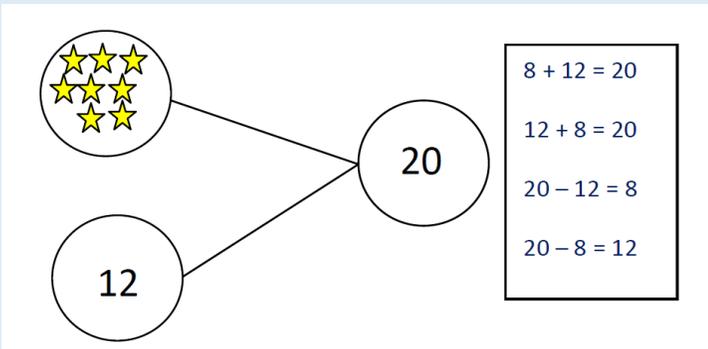
Year 2 statutory requirements :

- ✓ Recall and use addition and subtraction facts to 20 fluently, and derive and use related facts to 100.
- ✓ Recognise and use the inverse relationship between addition and subtraction and use this to check calculations and solve missing number problems.
- ✓ Add numbers using concrete objects, pictorial representations, and mentally, including:
 - a two-digit number and ones
 - a two-digit number and tens
 - two two-digit numbers
 - adding three one-digit numbers.
- ✓ Solve problems with addition including those involving numbers, quantities and measures.



Partition two 2-digit numbers using a variety of models and images.

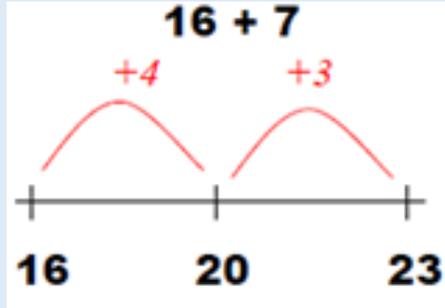
Memorise and reason with number facts to 20 in several forms.



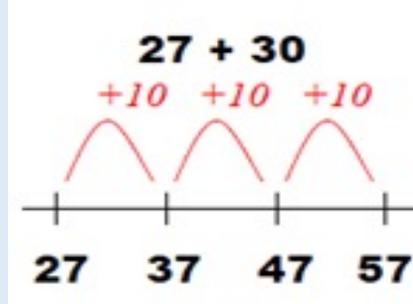
Addition: Year 2



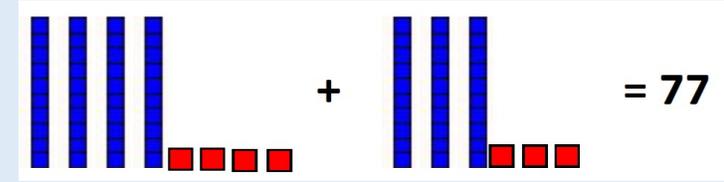
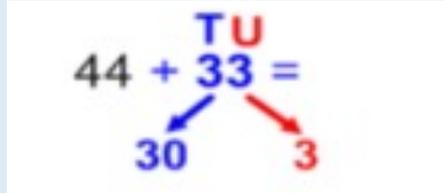
Add 2 digit number and ones



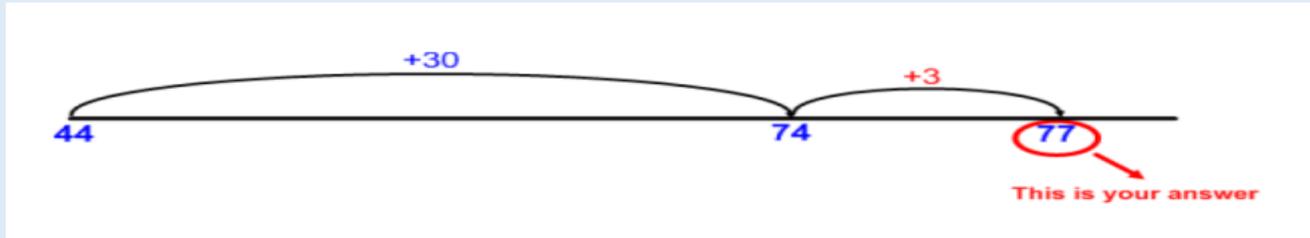
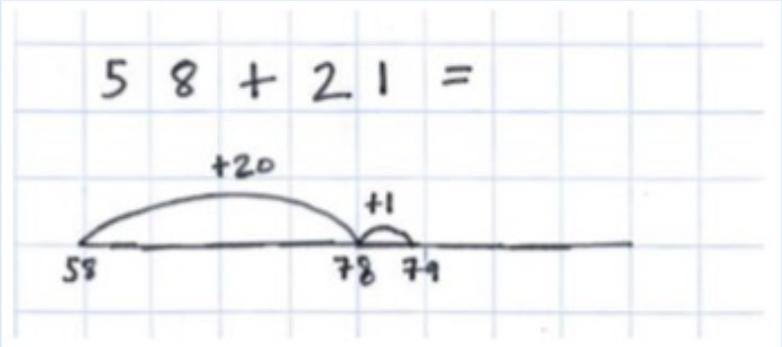
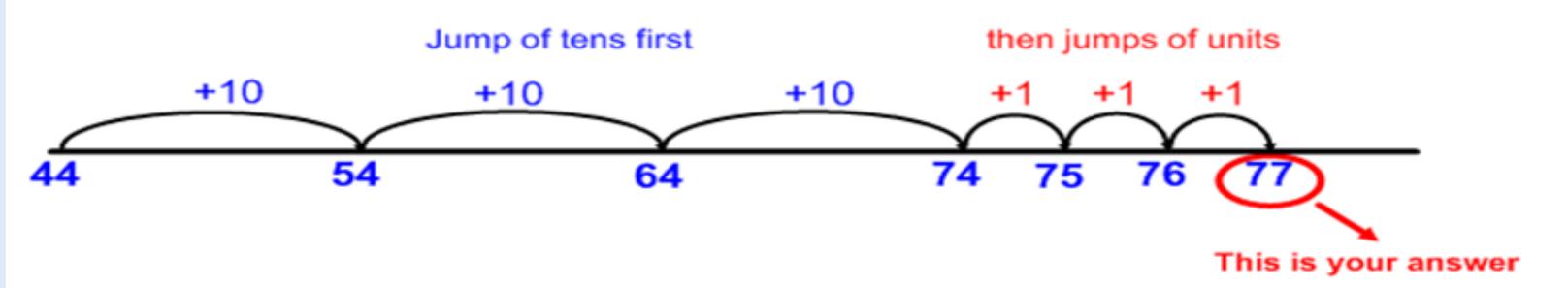
Add 2 digit number and tens



Use partitioning to add two 2-digit numbers using concrete resources and/or a numbered number line and then progressing to an empty number line.

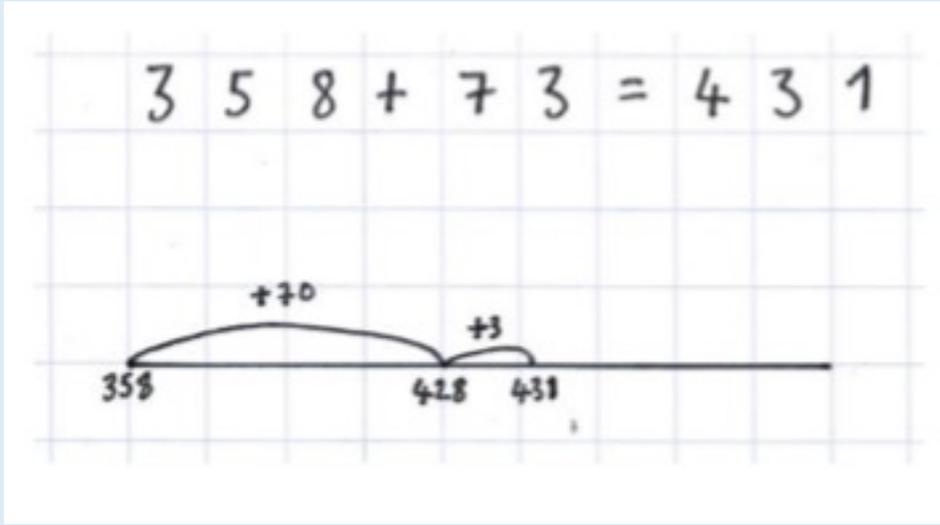


As children gain confidence with adding on tens and ones, they should be taught to combine the jumps on an empty number line. Add the tens first, then the ones. Taught with Dienes or place value counters alongside.



Addition: Year 3

Continue to add using number lines.



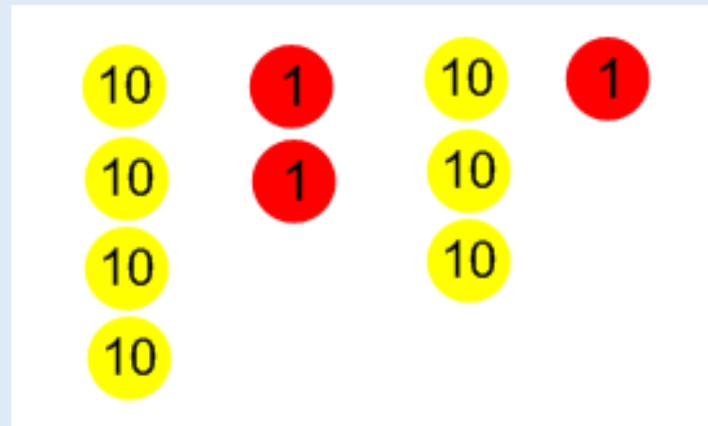
Use expanded column method with place value resources to support the conceptual understanding of adding numbers up to three digits **with no carrying**.

$$42 + 31 = 73$$

$$40 + 2$$

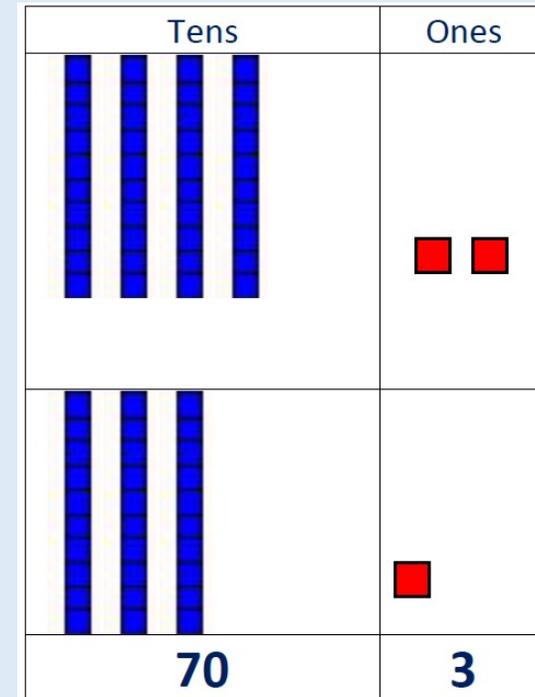
$$\underline{30 + 1}$$

$$\underline{70 + 3}$$



Year 3 statutory requirements :

- Find 10 or 100 more than a given number.
- Recognise the place value of each digit in a three-digit number (hundreds, tens, ones).
- Add numbers with up to three digits, using formal written methods of columnar addition.



OR



Addition: Year 3



Progress to using the expanded column method with place value resources to support the conceptual understanding of adding numbers up to three digits *with carrying*.

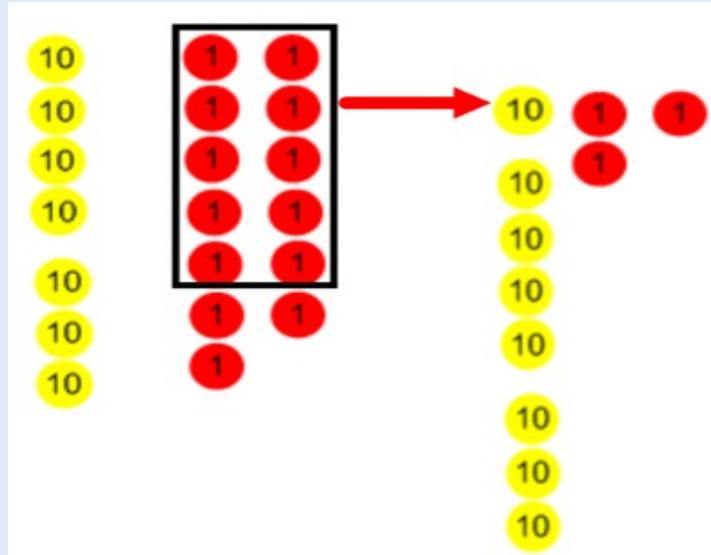
$$47 + 36 = 83$$

$$40 + 7$$

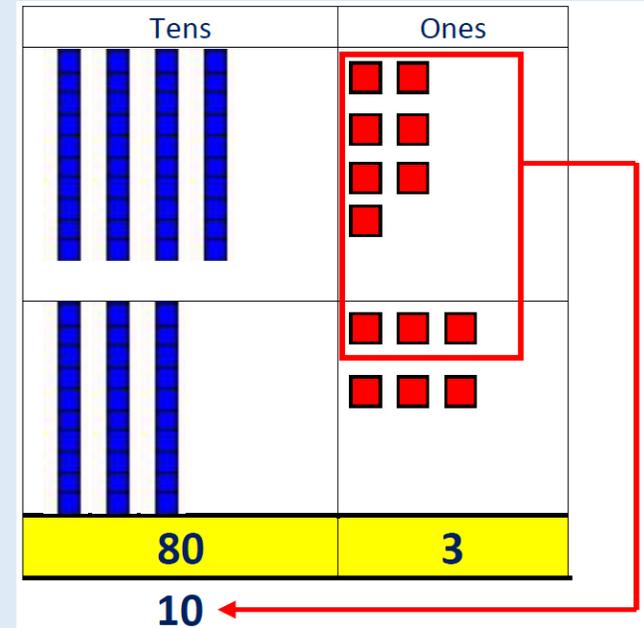
$$30 + 6$$

$$80 + 3$$

$$10$$



OR



Extend to using the expanded column method to add three digit numbers + three digit numbers *with carrying*.

$$367 + 185 = 552$$

$$300 + 60 + 7$$

$$100 + 80 + 5$$

$$500 + 50 + 2$$

$$100 \quad 10$$

Note: The carried ten or carried hundred is just as important as any other number, therefore, it should be written as clear and as large as any other number, and placed at the **bottom** of the column in which it is to be added.

Addition: Year 4



Year 4 statutory requirements :

- Find 1000 more than a given number.
- Add numbers with up to 4 digits using the formal written methods of columnar addition where appropriate.
- Solve addition two-step problems in contexts, deciding which operations and methods to use and why,

Build on learning from Year 3 and model how expanded method links to compact column addition method.

$$\begin{array}{r}
 40 + 7 \\
 \underline{30 + 6} \\
 \underline{80 + 3} \\
 10
 \end{array}
 \rightarrow
 \begin{array}{r}
 47 \\
 \underline{+36} \\
 83 \\
 1
 \end{array}$$

$$\begin{array}{r}
 300 + 60 + 7 \\
 \underline{100 + 80 + 5} \\
 \underline{500 + 50 + 2} \\
 100 \quad 10
 \end{array}
 \rightarrow
 \begin{array}{r}
 367 \\
 \underline{+185} \\
 \underline{552} \\
 11
 \end{array}$$

Note: The carried ten or carried hundred is just as important as any other number, therefore, it should be written as clear and as large as any other number, and placed at the **bottom** of the column in which it is to be added.

By the end of year 4, pupils should be adding numbers up to 4 digits using the compact column addition method.

$$\begin{array}{r}
 5271 \\
 + 2357 \\
 \hline
 7628 \\
 1
 \end{array}$$

Addition: Year 5 & 6



Year 5 statutory requirements :

- Add whole numbers with more than 4 digits using formal written methods of columnar addition.
- Add numbers mentally, with increasingly large numbers.
- Solve addition multi-step problems in contexts, deciding which operations and methods to use and why.
- Solve problems involving numbers up to three decimal places

Year 6 statutory requirements :

- Pupils are expected to solve more complex addition and subtraction problems

In year 5 and 6 pupils should be adding numbers using compact column addition method. **Note:** The carried ten, hundred, thousand is just as important as any other number, therefore, it should be written as clear and as large as any other number, and placed at the **bottom** of the column in which it is to be added.

$$\begin{array}{r}
 46892 \\
 + 32758 \\
 \hline
 79650 \\
 \hline
 111
 \end{array}$$

When adding decimals, it is essential that the decimal point does not move and is kept in line.

Where necessary, a zero should be added as a **place holder**.

$$12.5 + 23.7$$

$$\begin{array}{r}
 12.5 \\
 + 23.7 \\
 \hline
 36.2 \\
 \hline
 1
 \end{array}$$

$$34.5 + 27.43$$

$$\begin{array}{r}
 34.50 \\
 + 27.43 \\
 \hline
 61.93 \\
 \hline
 1
 \end{array}$$

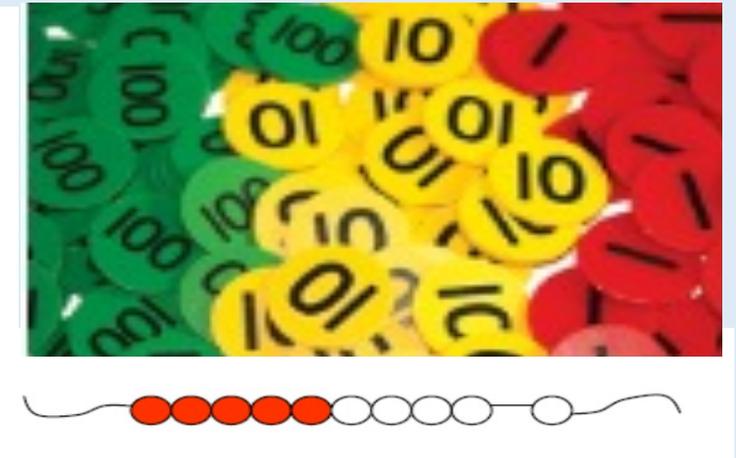
Subtraction

Concrete resources:

- 100 square
- Number lines
- Bead strings
- Straws
- Dienes
- Counting stick
- Place value dice
- Place value cards
- Place value counters



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



subtract
count on count back
fewer — less
take away minus
 difference



Subtraction: Reception

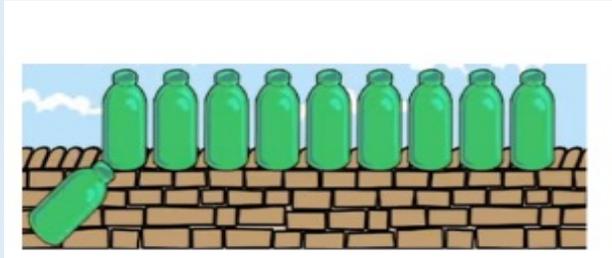
Early learning goals:

- ✓ Say which number is one less than a given number.
- ✓ Using quantities and objects, they subtract two single-digit numbers and count back to find the answer.

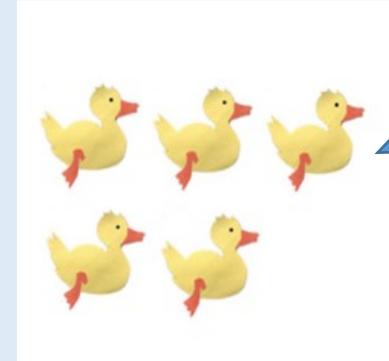
Say which number is one less than a given number using a number line or number track to 20.



Begin to count backwards in familiar contexts such as number rhymes or stories.



10 Green Bottles sitting on the wall ...



5 little ducks went swimming one day...

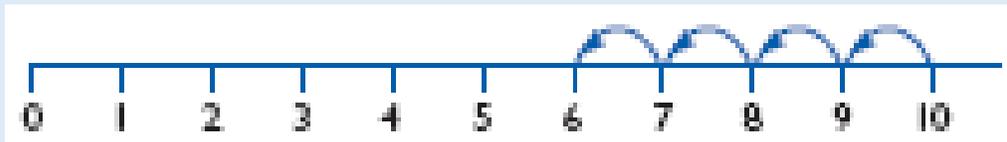
Begin to relate subtraction to 'taking away' using concrete objects and role play.



Three teddies **take away** two teddies leaves one teddy



If I **take away** four shells there are six left

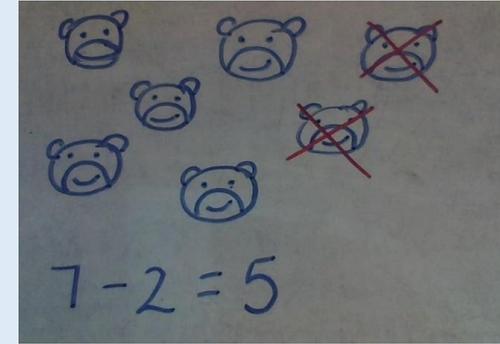


Count backwards along a number line to 'take away'

Subtraction: Year 1

Year 1 statutory requirements:

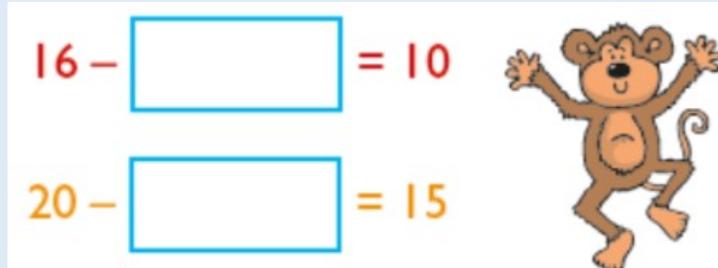
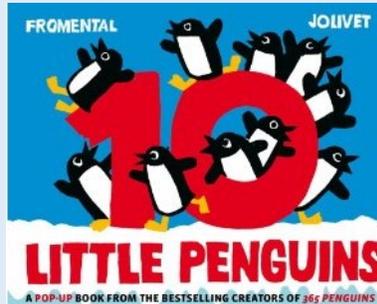
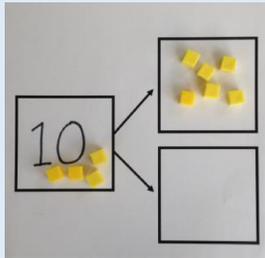
- ✓ Say which number is one less than a given number.
- ✓ Represent and use number bonds and related subtraction facts within 20.
- ✓ Read, write and interpret mathematical statements involving subtraction (-) and equals (=) signs.
- ✓ Subtract one-digit and two-digit numbers to 20, including zero.
- ✓ Solve one-step problems that involve subtraction using concrete objects and pictorial representations, and missing number problems.



Understand subtraction as taking away. Use practical resources, pictorial representations, role play, stories and rhymes.

Use number bonds and related subtraction facts within 20.

Count back in ones and find one less than a given number.



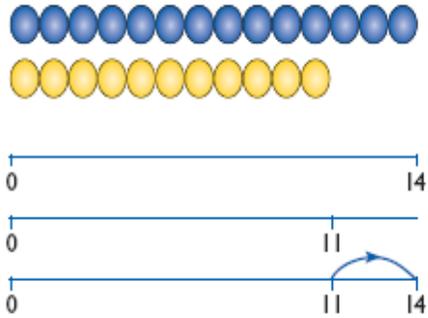
1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100



<p>6 + 4 = 10 4 + 6 = 10 10 - 4 = 6 10 - 6 = 4</p> <p>Tens Frame</p>	<p>6 + 4 = 10 4 + 6 = 10 10 - 4 = 6 10 - 6 = 4</p> <p>Part Whole Model</p>	<table border="1"> <tr><td colspan="2">10</td></tr> <tr><td>6</td><td>4</td></tr> </table> <p>6 + 4 = 10 4 + 6 = 10 10 - 4 = 6 10 - 6 = 4</p> <p>Bar Model</p>	10		6	4
10						
6	4					

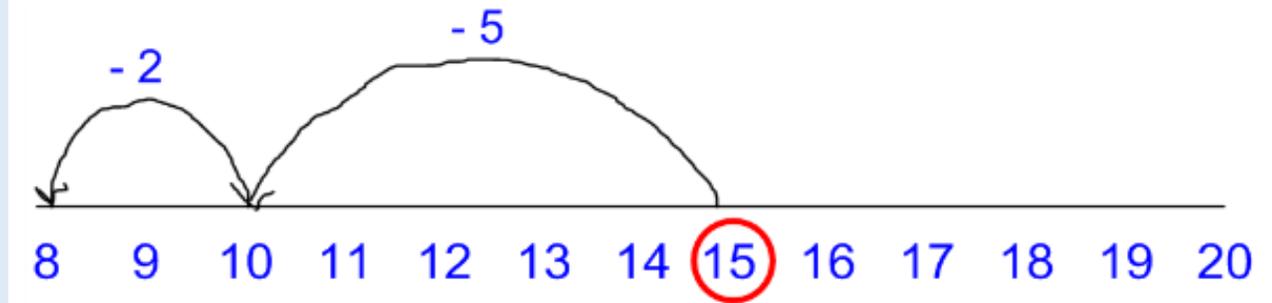
Subtraction: Year 1

Counting on should only be used when the language used is 'find the difference', 'difference between' and 'distance between'.



The difference between 11 and 14 is 3.
 $14 - 11 = 3$
 $11 + \square = 14$

Use number line to support the subtraction of numbers. Know and use strategy of **counting back** to subtract one-digit and two-digit numbers to 20.



$$15 - 7 = 8$$

Solve one-step problems using concrete objects and pictorial representations.

Dan has 12 football stickers.
 He gives 4 to Ben.
 How many stickers does he have left?



$$12 - 4 = 8$$

Begin to use the - and = signs to write calculations in a number sentence.

Subtraction: Year 2

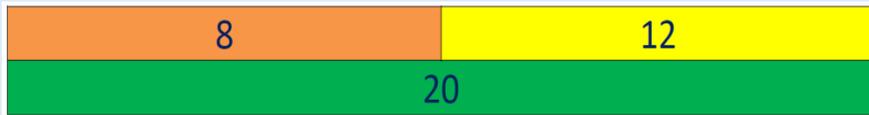
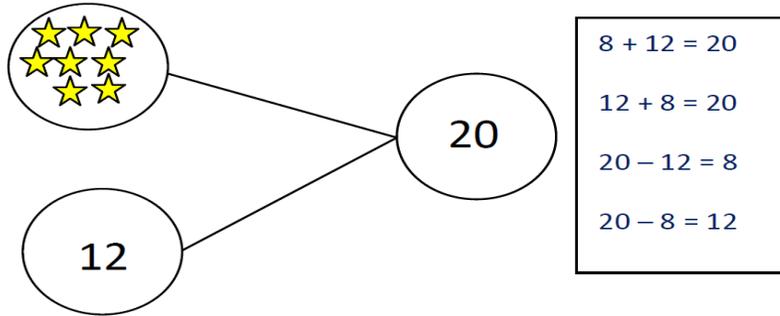


Year 2 statutory requirements:

- Recall and use subtraction facts to 20 fluently, and derive and use related facts to 100.
- Recognise and use the inverse relationship between addition and subtraction and use this to check calculations and solve missing number problems.
- Subtract numbers using concrete objects, pictorial representations, and mentally, including: a two-digit number and ones; a two-digit number and tens; two two-digit numbers; adding three one-digit numbers.

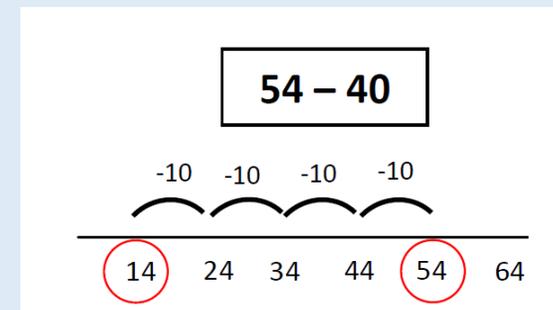
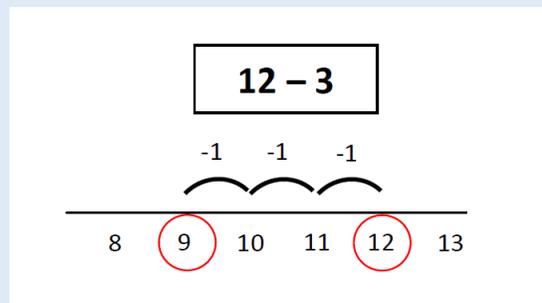
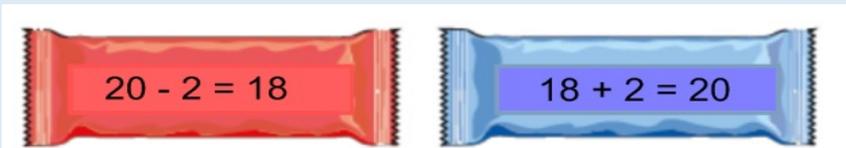
Memorise and reason with number facts to 20 in several forms.

Partition two 2-digit numbers using a variety of models and images.



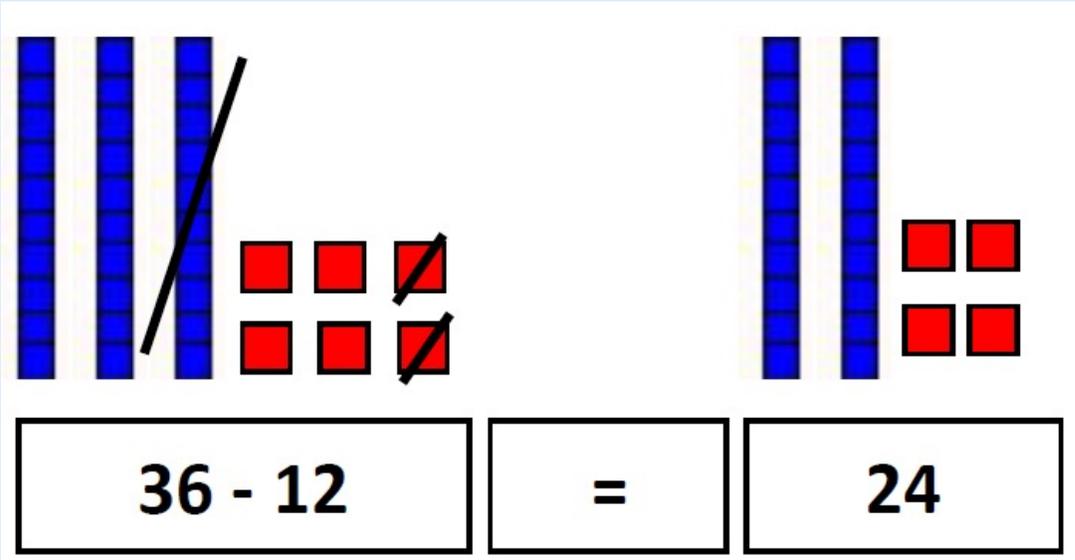
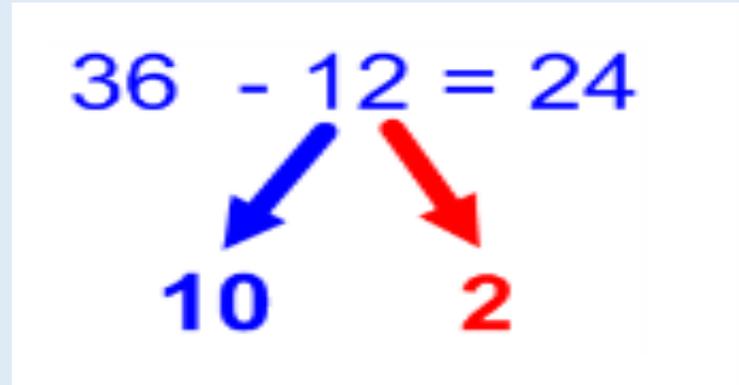
Subtract 2 digit and ones

Subtract 2 digit and tens



Subtraction: Year 2

Use partitioning to subtract two 2-digit numbers using concrete resources and/or a numbered number line and then progressing to an empty number line.



OR

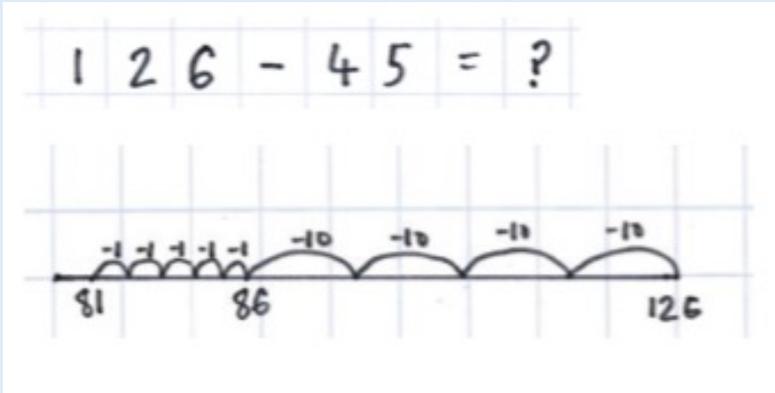


Subtraction: Year 3

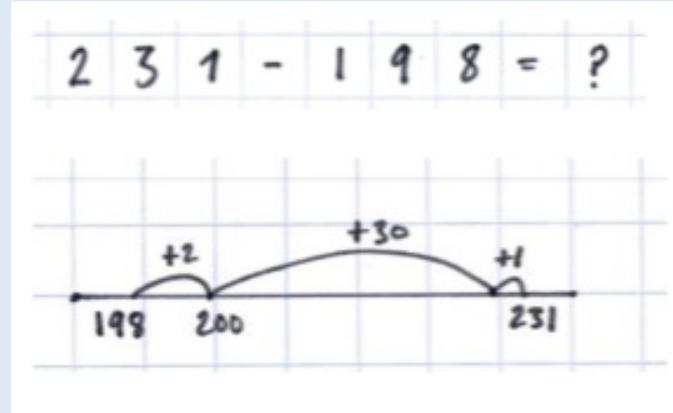


Year 3 statutory requirement:

- Find 10 or 100 less than a given number.
- Recognise the place value of each digit in a three-digit number (hundreds, tens, ones).
- Subtract numbers with up to three digits, using formal written methods of column subtraction.
- Subtract numbers mentally, including: a 3-digit number & ones; a 3-digit number & tens; a 3-digit number & hundreds.



Counting back on a number line.
Counting back tens, then ones.

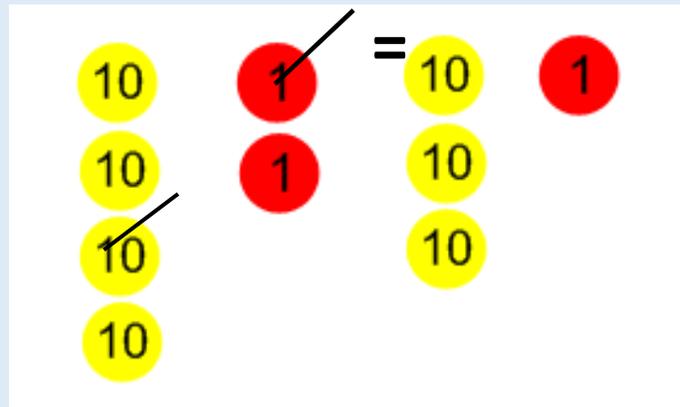


Finding a difference between two numbers by counting on.

Use expanded column method with place value resources to support the conceptual understanding of subtracting numbers with up to three digits **with no exchanging**.

$42 - 11 = 31$

$$\begin{array}{r} 40 + 2 \\ - 10 + 1 \\ \hline 30 + 1 \end{array}$$



OR

Tens	Ones
- 10	- 1
30	1



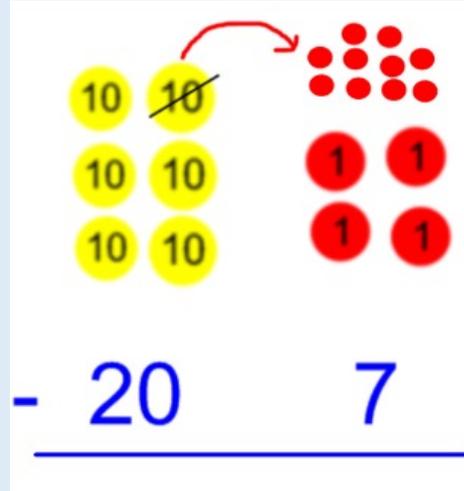
Subtraction: Year 3



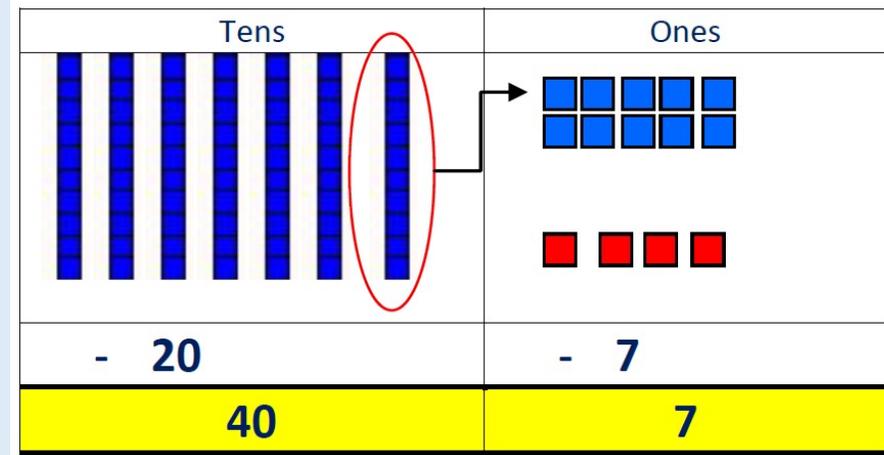
Progress to using the expanded column method with place value resources to support the conceptual understanding of subtracting numbers with up to three digits **with exchanging tens and/or hundreds.**

$$74 - 27 = 47$$

$$\begin{array}{r} 60 + 14 \\ ~~70~~ + ~~4~~ \\ - 20 + 7 \\ \hline 40 + 7 \end{array}$$



OR



In this example to subtract 7 ones from 4 ones we need to **exchange** a ten for ten ones. We now can subtract 7 ones from 14 ones.

Extend to using the expanded column method to subtract three digit numbers from three digit numbers.

$$537 - 254 = 283$$

$$\begin{array}{r} 400 + 130 \\ ~~500~~ + ~~30~~ + 7 \\ - 200 + 50 + 4 \\ \hline 200 + 80 + 3 \end{array}$$

Note: The exchanged ten or hundred is just as important as any other number, therefore, it should be written as clear and as large as any other number, and placed at the **top** of the column which has been adjusted.

Subtraction: Year 4

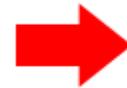


Build on learning from Year 3 and model how expanded method links to compact column subtraction method.

Year 4 statutory requirements:

- Find 1000 less than a given number.
- Subtract numbers with up to four digits, using formal written methods of columnar subtraction where appropriate.
- Solve subtraction two-step problems in contexts, deciding which operations and methods to use and why.

$$\begin{array}{r}
 60 + 14 \\
 \cancel{70} + \cancel{4} \\
 - \quad \quad \\
 \hline
 20 + 7 \\
 \hline
 40 + 7
 \end{array}$$



$$\begin{array}{r}
 6 \\
 \cancel{7}^1 4 \\
 - \quad \quad \\
 \hline
 27 \\
 \hline
 47
 \end{array}$$

$$\begin{array}{r}
 400 + 130 \\
 \cancel{500} + \cancel{30} + 7 \\
 - \quad \quad \quad \\
 \hline
 200 + 50 + 4 \\
 \hline
 200 + 80 + 3
 \end{array}$$



$$\begin{array}{r}
 4 \\
 \cancel{5}^1 \cancel{3} 7 \\
 - \quad \quad \quad \\
 \hline
 254 \\
 \hline
 283
 \end{array}$$

By the end of year 4, pupils should be subtracting numbers up to 4 digits using compact column subtraction method.

$$\begin{array}{r}
 3 \\
 78\cancel{4}^1 2 \\
 - \quad \quad \quad \\
 \hline
 1829 \\
 \hline
 6013
 \end{array}$$

Note: The exchanged ten or hundred is just as important as any other number, therefore, it should be written as clear and as large as any other number, and placed at the **top** of the column which has been adjusted.

Subtraction: Year 5 & 6

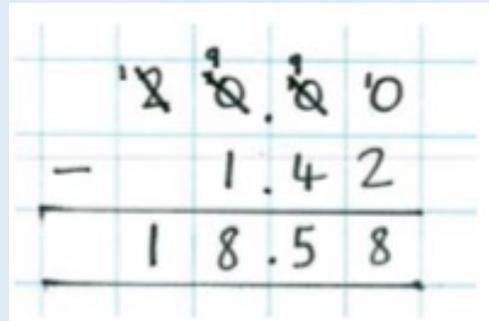
Year 5 statutory requirements :

- Subtract whole numbers with more than 4 digits using formal written methods of columnar subtraction.
- Subtract numbers mentally, with increasingly large numbers.
- Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why.
- Solve problems involving numbers up to three decimal places.

Year 6 statutory requirements: pupils are expected to solve more complex addition and subtraction problems

In year 5 and 6 pupils should be subtracting numbers using compact column subtraction method.

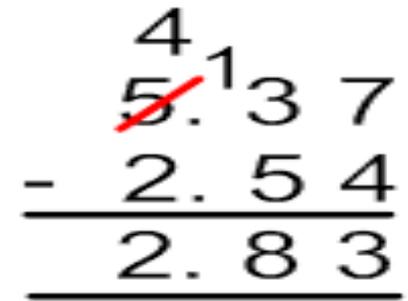
$$\begin{array}{r}
 8 7 \\
 \cancel{9}^1 6 7 \cancel{8}^1 3 \\
 - \\
 5 8 7 3 5 \\
 \hline
 3 8 0 4 8
 \end{array}$$



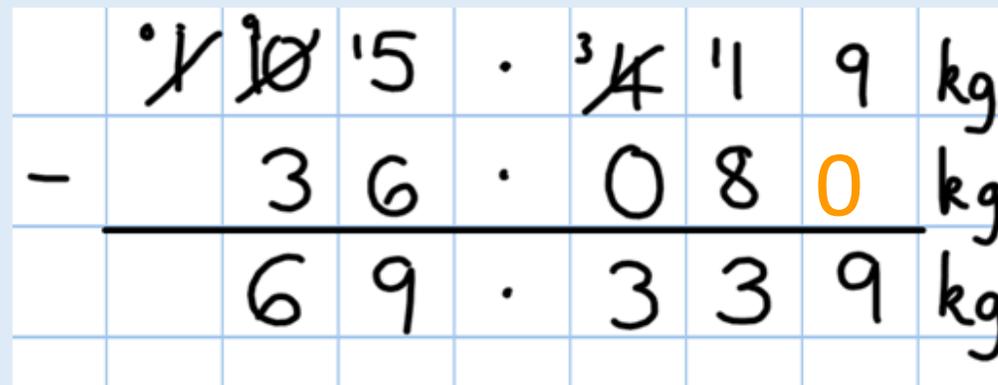
$$\begin{array}{r}
 \cancel{1}^1 \cancel{8}^1 \cancel{5}^1 8 \\
 - 1.42 \\
 \hline
 1 8.58 \\
 \hline
 1 7.16
 \end{array}$$

When subtracting decimals, it is essential that the decimal point does not move and kept in line.

Where necessary, a zero should be added as a *place holder*.



$$\begin{array}{r}
 4 \cancel{5}^1 3 7 \\
 - 2.54 \\
 \hline
 4 2.83
 \end{array}$$



$$\begin{array}{r}
 \cancel{1}^1 \cancel{5}^1 5 \cdot \cancel{4}^1 1 9 \text{ kg} \\
 - 3 6 \cdot 0 8 0 \text{ kg} \\
 \hline
 1 1 \cdot 8 1 9 \text{ kg}
 \end{array}$$