WELLINGTON PRIMARY SCHOOL
CALCULATIONS POLICY

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PROGRESSION THROUGH CALCULATIONS FOR THE FOUR OPERATIONS

The aim is that children use mental methods when appropriate, but for calculations that they cannot do in their heads, they use an efficient written method accurately and with confidence. This will allow them to become more fluent in mathematics, which will result in an improved ability to reason and to problem solve.

Pupils who grasp methods rapidly should be challenged through being offered rich and sophisticated problems before any acceleration through new content.

By the end of Year 6, all children will have a secure written method for each of the four operations, underpinned by a concrete understanding of place value.

The use of **practical equipment and pictures** should be ingrained into the teaching of mathematics:

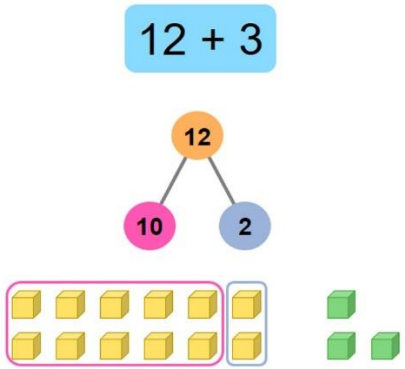
- as equipment/skills for children to use;
- as visual aids for children in the classroom - displays/working wall;
- as part of teacher modelling/demonstration when introducing new concepts/topics;
- Finally, more able children should use equipment to ensure they can explain why/how (fluency and reasoning).

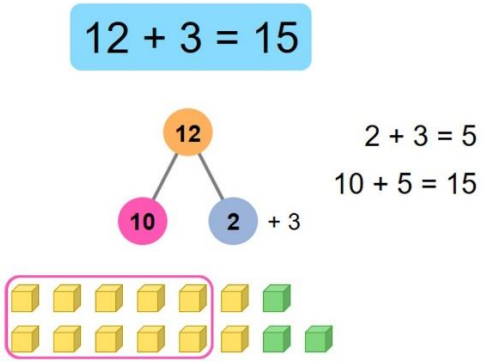
Note: If a child becomes out of sync with the phase(s) appropriate to their age, please consult the SENCo.

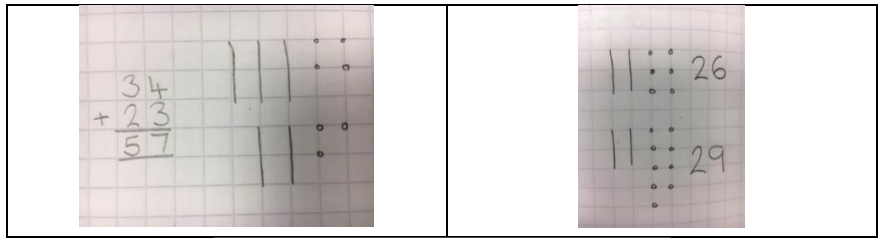
Children should always be encouraged to:

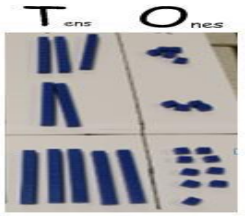
- approximate their answers before calculating, in order to be able to reflect on their answer;
- check their answers after calculation using an appropriate strategy;
- consider if a mental calculation would be appropriate before using a written method. For example, would you use decomposition for 1001-998?

<table>
<tr><th colspan="2">Addition</th></tr>
<tr><th>Year 1</th><th>Year 1/2</th></tr>
<tr><td>Using number bonds to 10 (Dienes and multi-link cubes)

 
</td><td>(initially without crossing tens barrier) Using the pictoral and concrete (Dienes) alongside the abstract, with lines of 2 squares in length to represent tens and single dots to represent ones (ones dots should be, when writing 8 for example, 2 squares wide and 4 squares down). This method should be used alongside Dienes equipment to support understanding. Always begin by adding the ones.

Once children:
• can add a multiple of ten to a 2-digit number mentally (e.g. 80+11),
• understand place value (tens and ones)
they are ready for adding pairs of 2-digit numbers that do cross the tens boundary (e.g. 58 + 43)</td></tr>
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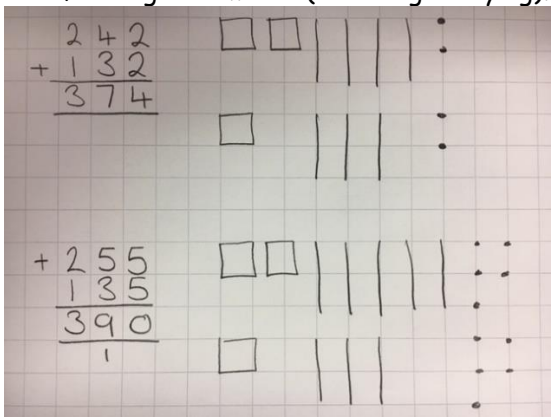
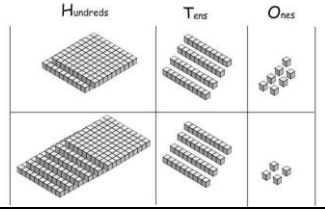
Addition

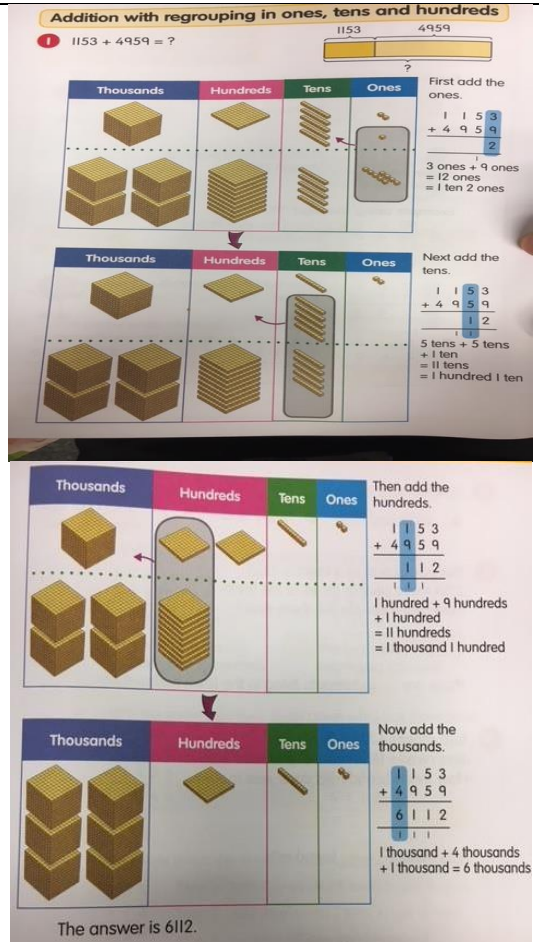
Year 2/3/4

Build upon children's understanding from addition in Year 2, by using the same method for larger numbers (including carrying).



Progress to column addition (formal method – use pictures to support still if necessary). E.g. 247 + 645 =

6 4 5 + 2 4 7 8 9 2 1	Use Dienes equipment to support the concept of place value and carrying. 

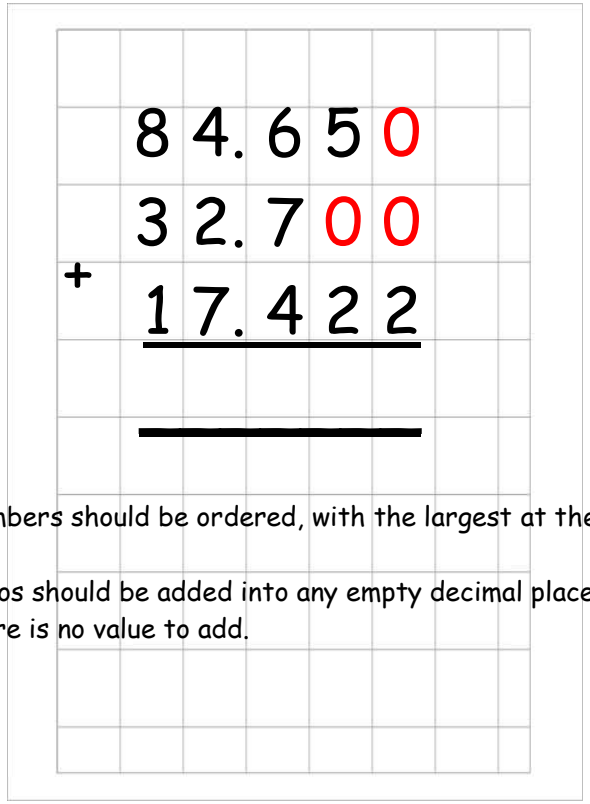


Addition

Year 5/6

Add several numbers with different numbers of decimal places (including money and measures).
Tenths, hundredths and thousandths should be correctly aligned, with the decimal point lined up vertically including in the answer row.

17.422 + 84.65 + 32.7=



Numbers should be ordered, with the largest at the top.

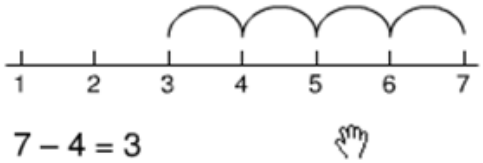
Zeros should be added into any empty decimal places, to show there is no value to add.

Subtraction

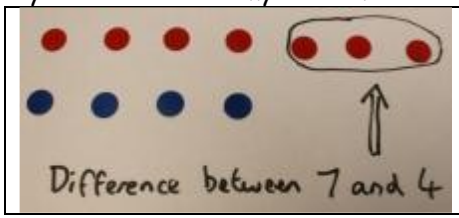
Year 1

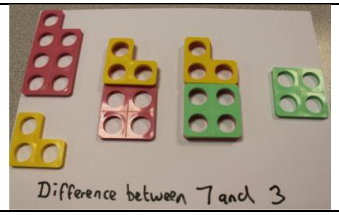
Understanding concepts
Visual representation and understanding of one less, take away.
Physically removing an object from a set of objects.
Use pictures/marks E.g. Sam spent 4p.
What was his change from 10p?
Record as 10 – 4 = 6

Count backwards using a number line (with numbers on), progressing to blank number lines.



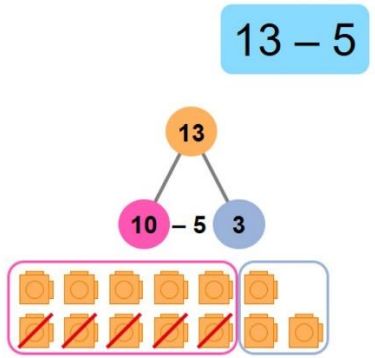
Use practical equipment to understand 'difference between'. Eg 'I am 3 years older than my sister'.

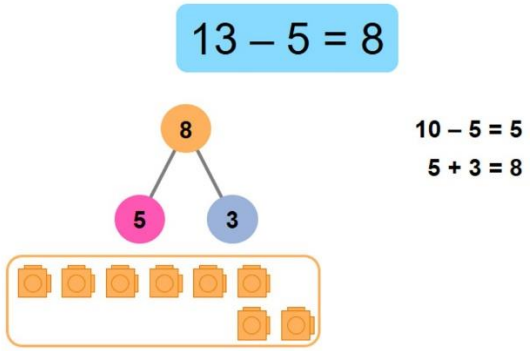




Understand subtraction as the inverse of addition - = signs and missing numbers. **Eg 7 – 3 = *, 7 - * = 4, * - 3 = 4**

Using number bonds to 10 (Dienes and multi-link cubes)





Subtraction

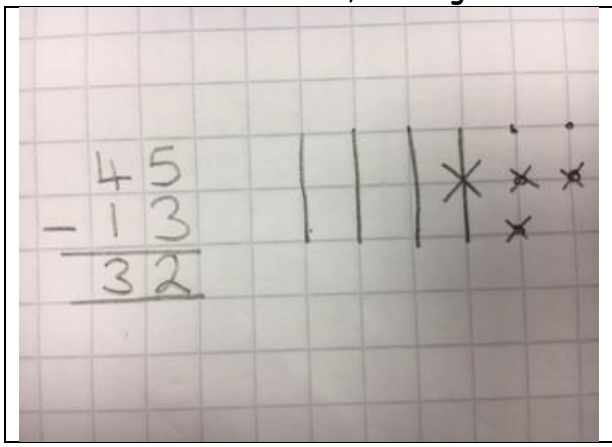
Year 2/3

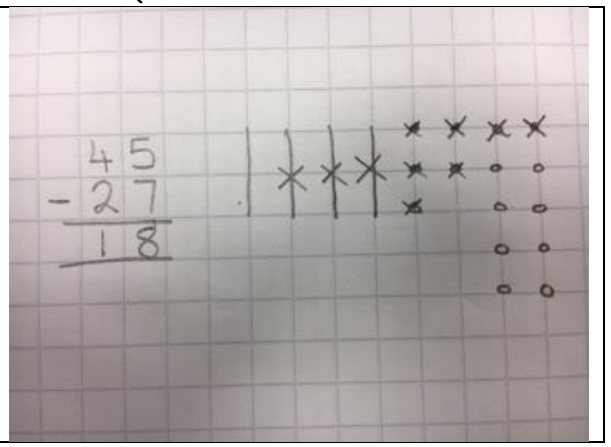
Use Dienes equipment to support understanding of place value and carrying.

Use Dienes equipment to show the need for exchanging.

Move on to decomposition supported by pictoral and Dienes.

Because you can't subtract 7 ones from 5, **exchange** one ten for ten ones (*draw the additional ones on and cross out a ten*).



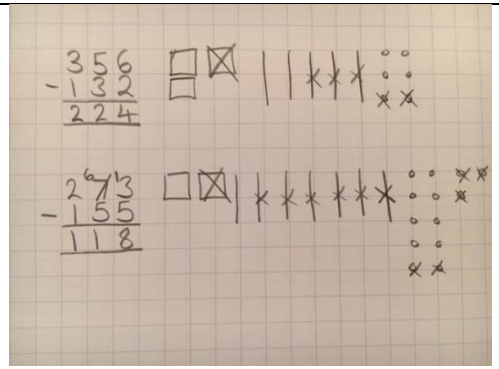


Subtraction

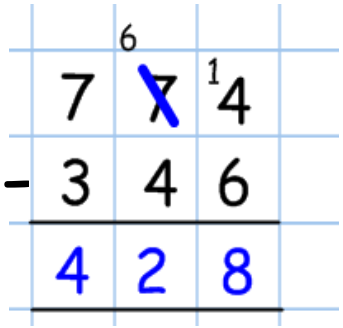
Year 3/4

Use Dienes equipment; pictures; hundreds, tens, ones counters to support understanding.

When secure with exchanging, progress to standard method of column subtraction – decomposition. Begin subtracting from least significant digit (right hand side).

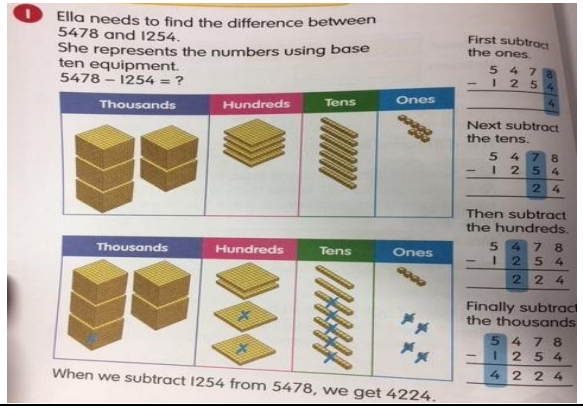


Moving to:



Ensure children recognise subtraction is **not commutative**. In column subtraction, 6 can't be subtracted from 4, so exchanging is required.

Reinforce understanding of place value by explaining value of digits being exchanged. Eg 14 – 6 = *and* then 60 – 40 =

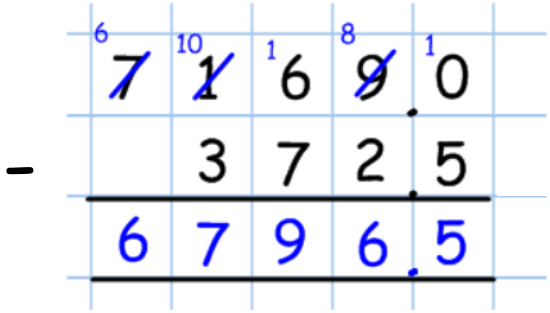


Subtraction

Year 5/6

Subtracting with increasingly large and more complex numbers and decimal values.

7169 – 372.5 =

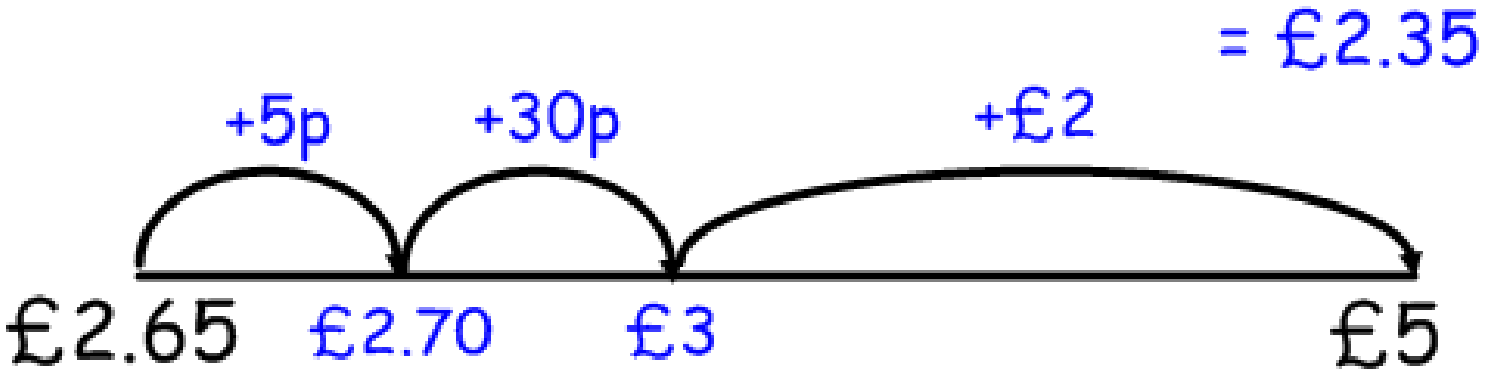


Mental method may be more appropriate for:
Using a number line to 'count on' where suitable.
E.g. 7005 – 1983 =
Or £20 - £13.65 =

Mental Subtraction

Year 3/4/5/6

Mental methods may be more appropriate when working with money. Eg: Use number lines to 'count on' and find change/find the difference.



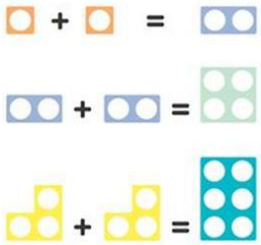
Division

Year 1/2

Introduce division as sharing. E.g. sharing out items. Understanding the term 'equal', everyone gets the same.

Begin to understand division as grouping. 12 children get into teams of 4 to play a game. How many teams are there?

Relate halving to doubling using practical equipment.
Ensure children begin to have instant recall of facts and understand doubling (multiplication) and halving (division) are inverse operations.



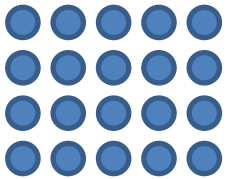
Understand division as the inverse of multiplication.
Children should use lots of practical apparatus, arrays and picture representations.
E.g. 20 ÷ 5 = 4
A CD costs £5. How many CDs can I buy with £20?

Use Numicon to visualise division.

How many groups of five are in twenty?

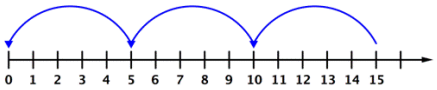
<u>Mental methods (supported by jotting)</u>

This represents **20 ÷ 5, posed as** how many groups of 5 are in 20?
There are 20 children in the choir.
They sit in rows of 5. How many rows are there?



1) Draw five dots in a row.
2) Continue drawing dots in each column until 20 have been drawn.
3) Count the number of rows. Pupils should also show that the same array can represent 20 ÷ 4 = 5 if grouped vertically.

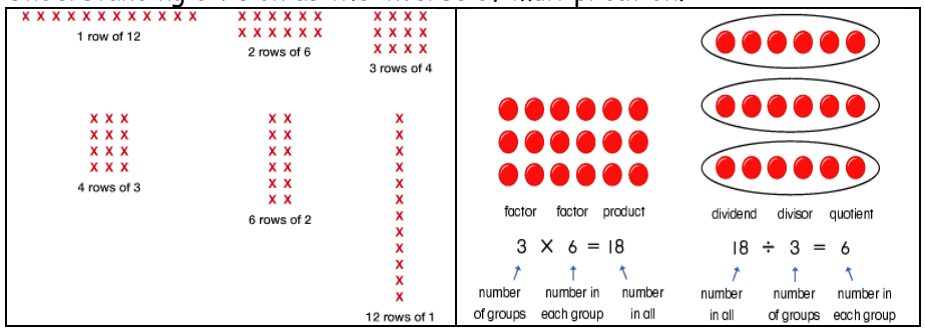
Rather than a formal written method, the number line should be used to develop understanding of division as grouping. Count from zero in equal jumps of the divisor to find out the how many groups there are. (4 groups of 5)



Division

Year 3/4/5

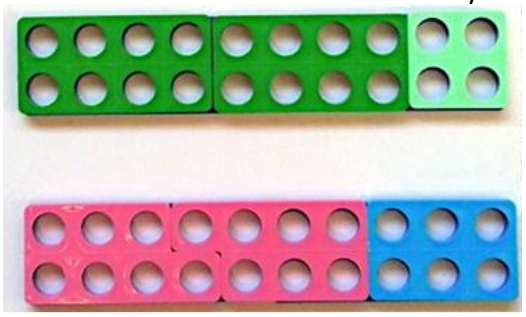
Understanding division as the inverse of multiplication.

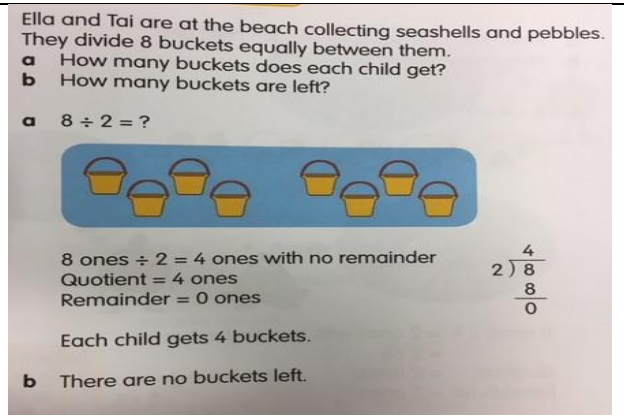


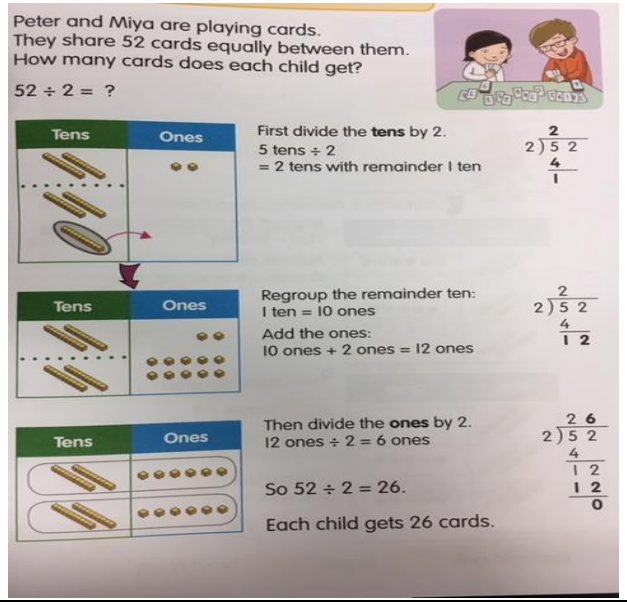
Use counters to investigate division and finding factors. How many different ways
can 12 counters be arranged in rows?

<u>Understanding concepts</u>

Continue to develop instant recall of division fact including remainders.
E.g. 20 ÷ 8 = 2r4 and 20 ÷ 7 = 2r6
Use Numicon, arrays and number lines (shown in Y3) to represent division with remainders in different ways. Use Numicon, arrays and number lines to represent division with remainders in different ways.



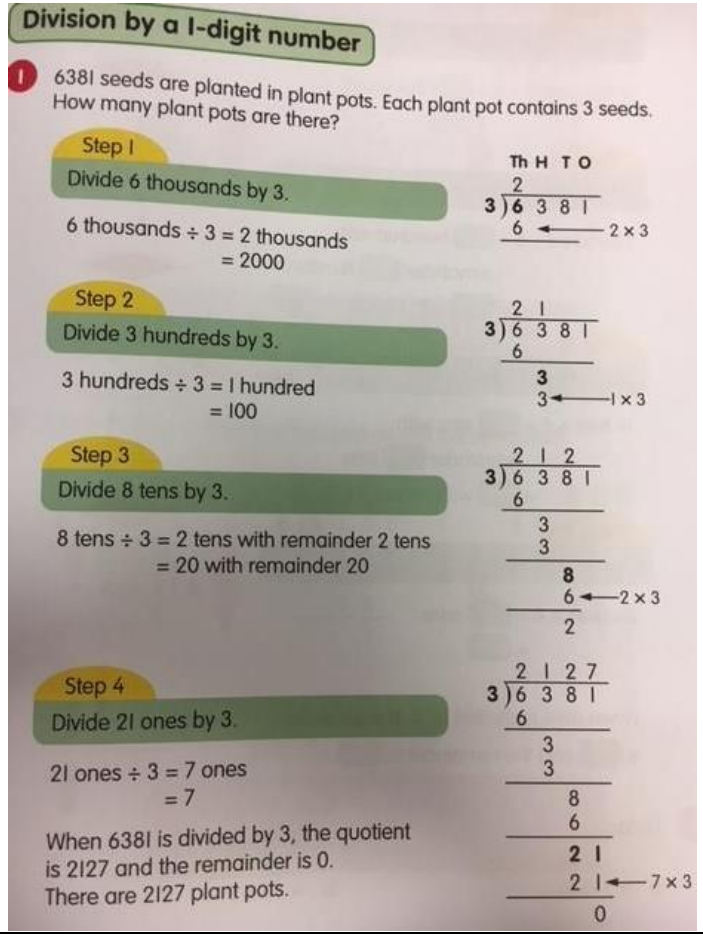




Division

Year 4/5/6

Dividing by a one-digit number



Division by a 1-digit number

1 6381 seeds are planted in plant pots. Each plant pot contains 3 seeds. How many plant pots are there?

Step 1

Divide 6 thousands by 3.

6 thousands ÷ 3 = 2 thousands
= 2000

Step 2

Divide 3 hundreds by 3.

3 hundreds ÷ 3 = 1 hundred
= 100

Step 3

Divide 8 tens by 3.

8 tens ÷ 3 = 2 tens with remainder 2 tens
= 20 with remainder 20

Step 4

Divide 21 ones by 3.

21 ones ÷ 3 = 7 ones
= 7

When 6381 is divided by 3, the quotient is 2127 and the remainder is 0.
There are 2127 plant pots.

Th H T O

```
  2 1 2 7
3)6 3 8 1
  6
  3
  3
  8
  6
  2 1
  2 1
  0
```

2 × 3 = 6
1 × 3 = 3
2 × 3 = 6
7 × 3 = 21

Dividing by a two-digit number

Have a look at the calculation: **8,640 ÷ 15**

```
15 | 8 6 4 0
```

15 into 8 doesn't go, so look at the next digit.

```
     5
15 | 8 6 4 0
   - 7 5
     1 1
```

15 goes into 86 five times, so put a 5 above the 6.
15 x 5 = 75

Take that 75 away from the 86 to get your remainder.
86 – 75 = 11

```
     5 7
15 | 8 6 4 0
     7 5
     1 1 4
   - 1 0 5
       9
```

Next, carry the 4 down to make 114.

15 goes into 114 seven times, so put a 7 above the 4.
15 x 7 = 105

Take 105 from the 114 to get your remainder
114 – 105 = 9

```
     5 7 6
15 | 8 6 4 0
     7 5
     1 1 4
   - 1 0 5
       9 0
```

Carry the 0 down to make 90

15 goes into 90 exactly 6 times, so put a 6 above the 0

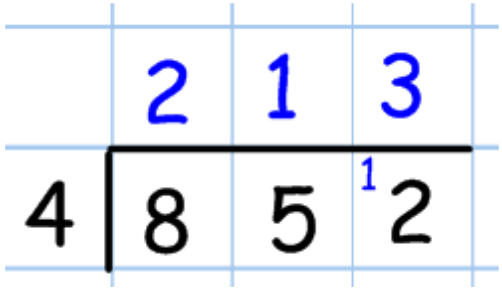
15 x 6 = 90

8,640 ÷ 15 = 576

Division

Year 5/6

Once conceptual understanding is strong.



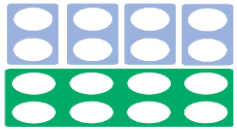
Working through, from left to right. How many groups of 4 hundreds in 800?

Reinforce understanding of place value:
How many groups of 4 tens are in 50?
(one, with one remainder)… this one ten is carried to the ones making it 12 rather than 2. (This is because one ten = ten ones)

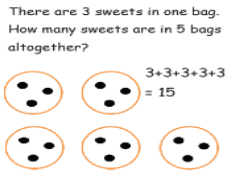
Multiplication

Year 1/2

Understand multiplication as repeated addition, using objects, equipment and visual representations.

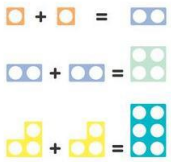


Strategies for multiplication: concrete objects such as small toys, progressing to cubes, counters and Numicon pieces.

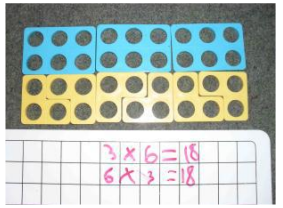


Progressing to pictorial representations (e.g. 3 x 5 = 15)

Learn 'doubles' as facts using practical equipment and visual representations.



Continue to understand multiplication as repeated addition, lots of,
Understand **commutativity**.
Know that 3 x 6 = 18 ∴ 6 x 3 = 18.
Use practical equipment (cubes, Numicon, arrays) to demonstrate and explain this concept.



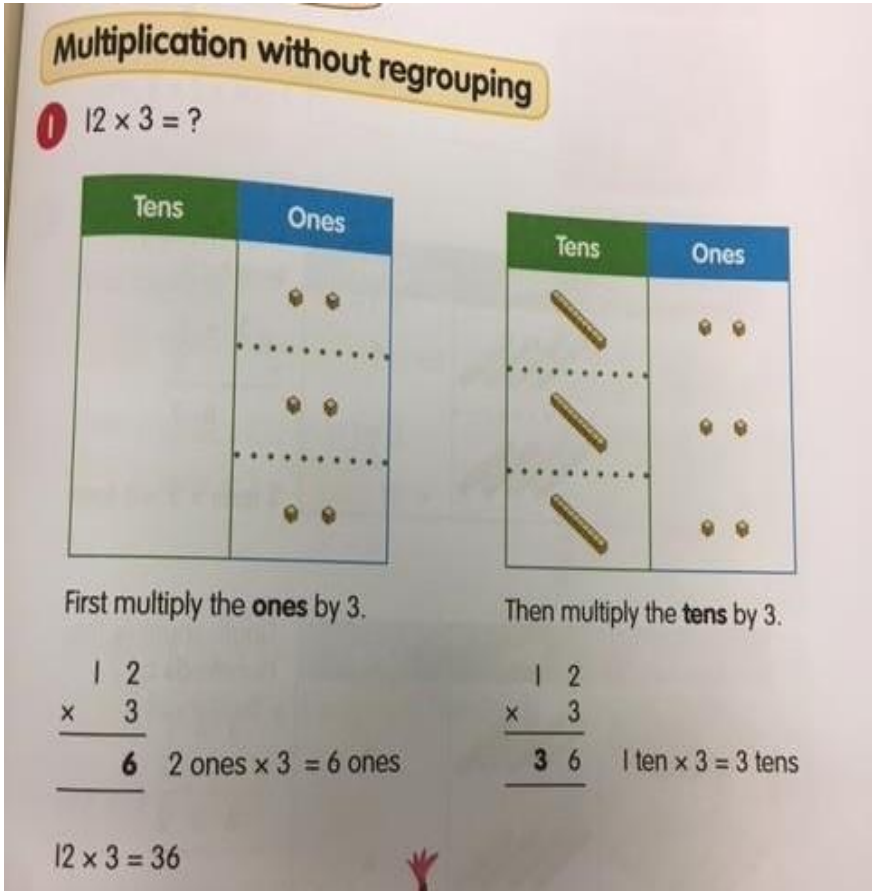
Use arrays to record and recognise multiplication.
Record as:
5 x 3 = 3 + 3 + 3 + 3 = 15
3 x 5 = 5 + 5 + 5 = 15

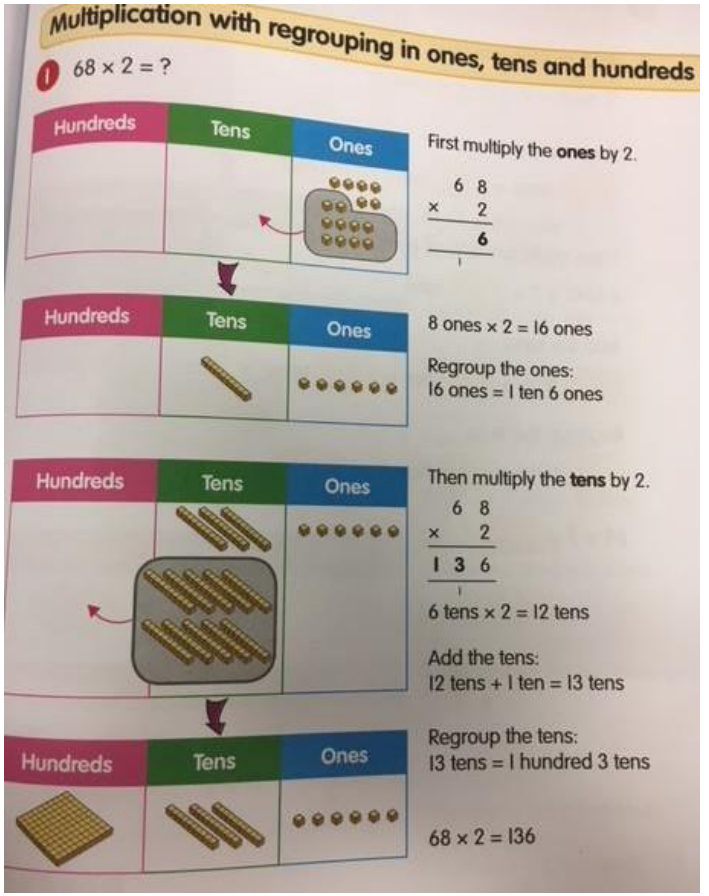
5 x 3 = 15

3 x 5 = 15

Multiplication

Year 3/4





Multiplication

Year 4/5/6

Multiplying by a one-digit number

1 Jenny sells 2476 oranges. Mark sells 3 times as many oranges as Jenny. How many oranges does Mark sell?

2476 × 3 = ?

Step 1

Multiply 6 ones by 3.
6 ones × 3 = 18 ones
= 1 ten 8 ones

Th	H	T	O
	2	4	7 6
×			3
			8
			1

Step 2

Multiply 7 tens by 3.
7 tens × 3 = 21 tens
= 2 hundreds 1 ten
Add 1 ten.
2 hundreds 1 ten + 1 ten = 2 hundreds 2 tens

	2	4	7 6
×			3
		2	8
	2	1	

Step 3

Multiply 4 hundreds by 3.
4 hundreds × 3 = 12 hundreds
= 1 thousand 2 hundreds
Add 2 hundreds.
1 thousand 2 hundreds + 2 hundreds
= 1 thousand 4 hundreds

	2	4	7 6
×			3
	4	2	8
1	2	1	

Step 4

Multiply 2 thousands by 3.
2 thousands × 3 = 6 thousands
Add 1 thousand.
6 thousands + 1 thousand = 7 thousands

	2	4	7	6
×				3
	7	4	2	8
	1	2	1	

Mark sells 7428 oranges.

Multiplying by a two-digit number

2 A ship carries petrol in 27 barrels. Each barrel contains 32 litres of petrol. What is the total volume of petrol carried on the ship?

27 × 32 = ?

Step 1

Multiply 2 tens 7 ones by 2.
7 ones × 2 = 14 ones
= 1 ten 4 ones
2 tens × 2 = 4 tens
Add.
4 tens + 1 ten 4 ones = 5 tens 4 ones
27 × 2 = 54

	1	**2 7**
×		3 2
	5	4

Step 2

Multiply 2 tens 7 ones by 30.
7 ones × 30 = 210 ones
= 21 tens
= 2 hundreds 1 ten
2 tens × 30 = 60 tens
= 6 hundreds
Add.
6 hundreds + 2 hundreds 1 ten
= 8 hundreds 1 ten
27 × 30 = 810

	2 1	**2 7**
×		3 2
		5 4
	8	1 0

Step 3

Add.
54 + 810 = 864
27 × 32 = 864

	2 1	2 7
×		3 2
		5 4
	8	**1 0**
	8	**6 4**

The ship carries 864 litres of petrol.

Multiplying decimals

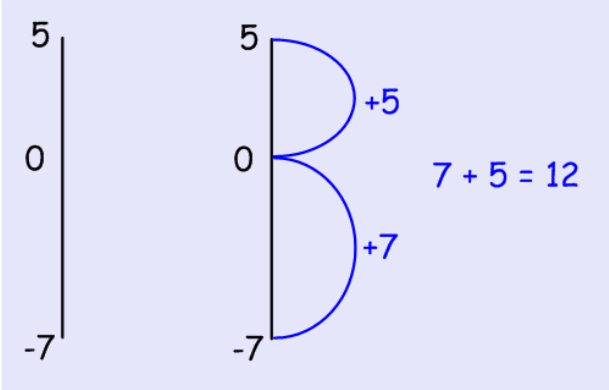
$$\begin{array}{r} 2.43 \\ \times \quad 7 \\ \hline 17.01 \\ \hline 3\ 2 \end{array}$$

When multiplying by decimals, numbers should be aligned to the right hand side and the decimal point placed within the answer lines.

Negative Numbers

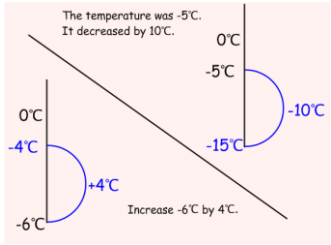
Year 3/4/5/6

Find the difference between negative and positive integers.
e.g. the difference between 5 and -7.
Use a vertical number line to 'count on' to find the difference.

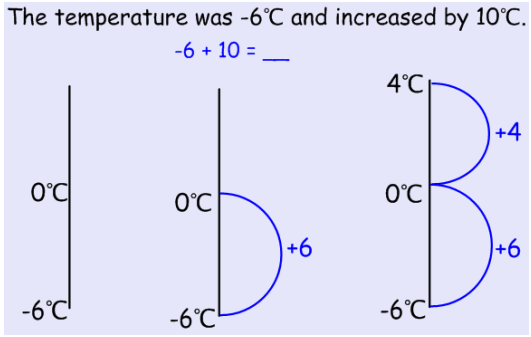


Use efficient jumps: from the negative number to zero, and then zero to the positive number.

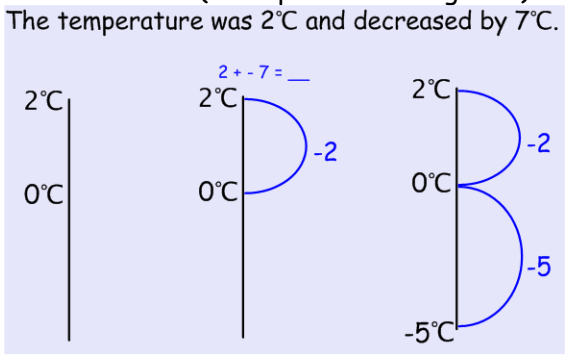
For increases and decreases within negative numbers, use a number line with the 'zero' placed on to support understanding.



Show addition/increases (from negative to positive) using a vertical number line.
Encourage children to use efficient jumps, rather than counting every integer.



Show subtraction/decreases (from positive to negative) in a similar way.



Time
Year 2/3/4/5/6

Using a numberline to count on between two times, or to calculate elapsed time.