

William Tyndale Calculation Policy

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At William Tyndale our mathematics teaching focusses strongly on developing confident mental mathematicians, as this will lead to children being confident with written algorithms when required. Therefore, we strongly advise children only to move onto more conventional written methods when they have demonstrated a clear understanding of the place value of digits and can explain the method they have chosen and why they have chosen it.

This Calculation Policy only covers the teaching of place value, addition, subtraction, multiplication and division with whole and some decimal numbers. It does not cover the curriculum for fractions, decimals and percentages, geometry, measures or statistics. For more information on the curriculum for these aspects of mathematics, please visit the government website for the programme of study for maths.

www.gov.uk/government/publications/national-curriculum-in-england-mathematics-programmes-of-study

Mathematical Language

These are examples of vocabulary that we encourage within the school:

Equals (=) means 'is the same as', so we use these phrases synonymously to ensure children understand that this is the meaning of **equals**. This will lead to an understanding that **equivalent** fractions are fractions that are **the same**.

Sum only relates to addition (what is the sum of 3 and 2? 5), and is never used as a synonym for calculation. Do not say "What is the answer to the sum: 3 - 1?", but "What is the answer to the **calculation**: 3-1?".

Operation - the four **operations** are + - x and ÷.

Know the difference between **digit** and **number**. For 345, the number is three hundred and forty five, while the digit underlined is 4. The value of the digit underlined is 40.

When discussing **halving**, ensure the children know that halving is the same as:

- Dividing by 2
 - $\frac{1}{2}$ of
- Year 4 - 50%
- 0.5 x....

Year 2 - **Multiples** - any number that is in a times table - so 15 is a multiple of 3 and 5.

Year 4 - **Factors** - 2 numbers that can be multiplied together to make another number - so 3 and 5 are factors of 15.

Below follows a progression in skills from Foundation Stage to KS2. Included are National Curriculum questions from the 2016 sample tests for both KS1 and KS2.

There is a strong focus on physical resources throughout the school to ensure a concrete understanding of maths before moving onto abstract thinking. These resources may include; Numicon, deennes materials, counters, toys (particularly in the Foundation Stage) counters, unifix, coins.

Early Skills

- The first skill children need to develop is counting, by moving physical resources - developing 1 to 1 correspondence and a familiarity with the number system.
- Counting aloud in 1s, 2s, 5s and 10s.
- Physical number lines with number cards.



- Counting forward and backwards from 1-20.
- Accurate formation of numbers.

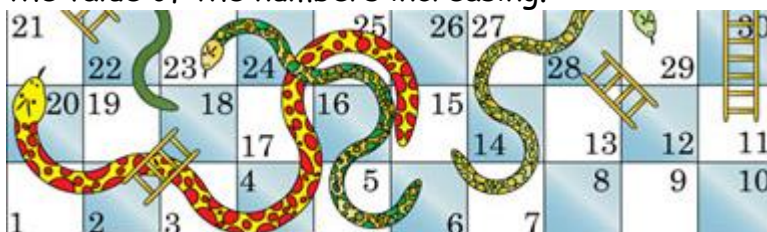


Place Value

Place value means to understand the value of a digit due to its place in the number. It is common for young children to muddle up the order, which means many children write 15 as 51 without seeing the difference in value.

We do **not** call the ones column 'units' as it can confuse children, so please call it the ones column.

- To **write** numbers accurately.
- To order numbers up to 100 - to be able to know if a number is bigger or smaller than another number.
- Snakes and Ladders is a good game to play with children to see the value of numbers as they need to know which way to go around the board with the value of the numbers increasing.



Year 1 Children are expected to:

- count forwards and backwards to 100, order numbers.
- find one more and one less than any number up to 100.
- read and write numbers from 1 to 100 in numerals and words.
- use the language of: equal to, more than, less than (fewer), most, least.

Write the numbers in order of size.

15	16	5	71	50
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What is one more than...?

What is one less than...?

Complete:

19		21	22		
----	--	----	----	--	--

We develop further and deeper understanding by using digit cards to make numbers.



Use two of the digit cards to make a number greater than 50.

Use two of the digit cards to make a number less than 30.

Use two of the digit cards to make an odd/even number.

Use two of the digit cards to make a number between 47 and 59.

What is the smallest 2-digit number you can make?

What is the largest 2-digit number you can make?

Explain your reasoning.

Year 2 Children are expected to:

- know the value of digits - if they are in the tens column or in the ones column.
 - compare and order numbers from 0 up to 100 using $>$ $<$ and $=$ signs.
 - count in tens from any number including crossing boundaries into hundreds.
 - identify, represent and estimate numbers using different representations, including the number line



10	1
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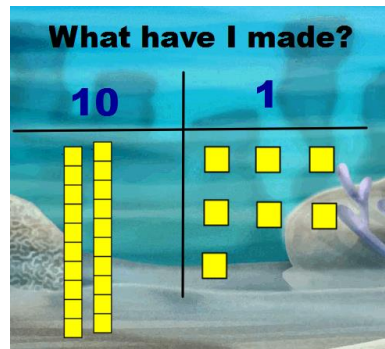
10	1

These are the deennes materials.

We use deennes, place value cards, digit cards, dice and place value grids to support children's understanding of place value.

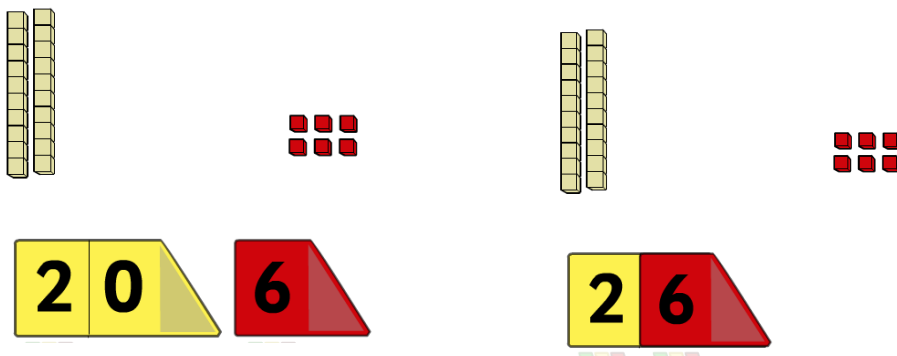
- A particular challenge for grasping the concept of place value is language. There is one ten and one one in eleven. Often when asking children 'How many tens are there?' the response will be 'there are 10', but there is only one ten, so you would write 1 in the tens column and 1 in the ones column.
- We use deennes for children to recognise the value of each digit.

10	1
	
1	1



- We use place value arrow cards to show how the tens and ones merge to make a number.
- The calculation would be written as:

$$20 + 6 = 26$$



Place value examples from 2016 sample test questions for KS1

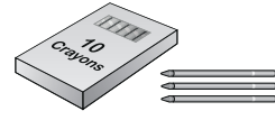
Mental question:

How many tens are there in ninety-six?



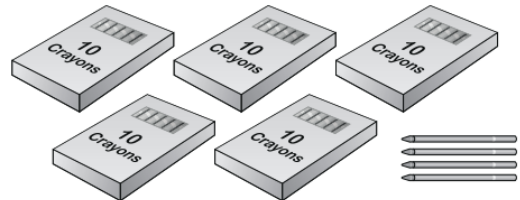
Reasoning question:

Ben has 13 crayons.



Here are Abdul's crayons.

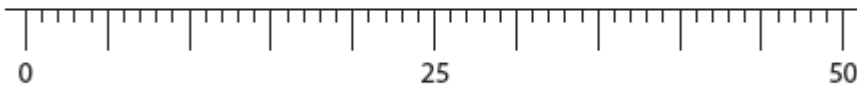
How many crayons does Abdul have?



Children need to use place value to be able to order and place numbers on a number line as well as be able to compare numbers, measures or amounts of money.

Place these numbers on the number line:

10, 48, 30



By the KS1 SATs children are expected to use the **greater than** ($>$), **less than** ($<$) and **equals** ($=$) symbols to compare values.

- Please see the mathematical language section for **equals** ($=$).
- To teach the $<$ $>$ symbols we use a story of a hungry crocodile, who always wants to eat the larger number.



KS1 Reasoning question.



Compare the mass of the animals.

Write **<** or **>** or **=** in each box.

Cheetah's mass Tiger's mass

Tiger's mass Lion's mass

A strong grasp of place value will support partitioning (see below) and estimating whether an answer sounds plausible when they move onto more traditional methods for calculating.

Writing is also a part of the KS1 maths curriculum as the children are expected to be able to spell the numbers to one hundred and to form their digits correctly.

KS1 reasoning question.

Complete the table.

words	digits
thirty-eight	38
	40
ninety-four	

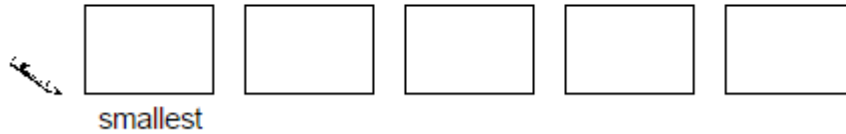


Year 3 Children are expected to:

- understand the value of each digit in a 3 digit number.
- read and write numbers up to 1000 in numerals and words
- compare and order numbers up to 1000
- count in tens and hundreds and can add or subtract 10 or 100 from any given number up to 1000

Write these numbers in order of size, starting with the smallest.

901 1091 910 109 190



Tricky areas - these digits are all very similar so the children must look carefully to see what the value is of each digit.

Holly made a number using these digit cards.



The **hundreds** digit is greater than 4

Holly's number is **odd**.

What number did Holly make?



Tricky areas - there are two pieces of information that have to be correct, so there is only one right answer. Children will often only use one of the pieces of information.

Year 4 Children are expected to:

- understand the value of each digit in a 4 digit number.
- compare and order numbers beyond 1000.
- round any whole number to the nearest 10, 100 or 1000.
- count backwards through zero to include negative numbers.

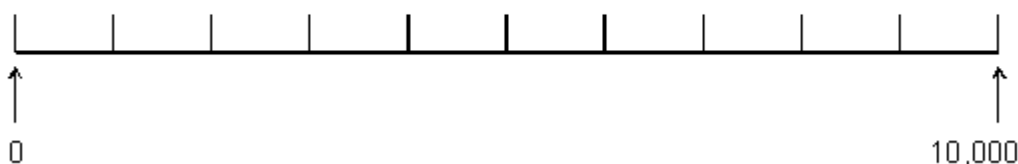
$$8391 - 1000 =$$



Tip - there is no need to use the counting on method or column subtraction to solve this problem, knowing your place value will mean that if you know that the digit 8 is in the thousands column, you

just need to take 1 000 from the 8 000 and all the other digits remain the same.

Draw an arrow (\uparrow) to show the position for 7,500.



Tricky areas - to find what the calibrations are worth. You can count how many calibrations there are and divide the difference between the two numbers by the number of calibrations. Reading a number line is tricky in itself; give children practice at reading a ruler to see the calibrations and working out what they are worth.




Tip - find the middle calibration and if you know your halves, you know that half of 10 000 is 5 000. If you know your fractions, decimals and percentages you know that 75% is the same as $\frac{3}{4}$ so 7 500 is $\frac{3}{4}$ of 10 000, so you can draw your arrow $\frac{3}{4}$ of the way along the line.

Year 5 Children are expected to:

- read, write, order and compare numbers to at least 1 000 000 and determine the value of each digit
- count forwards or backwards in steps of powers of 10 for any given number up to 1 000 000
- interpret negative numbers in context, count forwards and backwards with positive and negative whole numbers, including through zero
- round any number up to 1 000 000 to the nearest 10, 100, 1000, 10 000 and 100 000
- solve number problems and practical problems that involve all of the above

Write the number that is nearest to **5000** which uses all the digits **4, 5, 6** and **7**.



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Tip - use digit cards to move the digits around. Is it going to be higher or lower than 5 000? If it is lower what digit would it start with?

Would the hundreds column have a high or low digit? Why?

Write the missing number in the sequence

<input type="text"/>	273 001	283 001	293 001	<input type="text"/>
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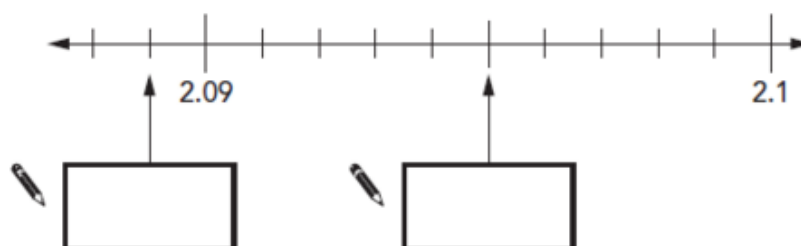
Tricky area - crossing the 10s, 100s or in this case the 100 000 boundary is always tricky for children. Give them experience of counting up past these boundaries.

Year 6 Children are expected to:

- read, write, order and compare numbers up to 10 000 000 and determine the value of each digit
- round any whole number to a required degree of accuracy
- use negative numbers in context, and calculate intervals across zero

This is part of a number line.

Write in the missing numbers.



Tricky area - children will struggle to realise that they need to go into the one thousandths column to write 2.091, 2.092 etc. on the calibrations. Counting backwards in one thousandths is also tricky.



Tip - Play with money and discuss the value of pennies as decimals to give children experience of decimals. This one goes into the thousandths, but a secure understanding of decimals with money will help.

Here is part of a number line.

It is divided into equal sections.



Write the letter of the section where each of these numbers belongs.

The number 99 has been done for you.

number	section
99	J
29	
-83	
-15	
44	



Tip - make sure the child writes the value of each calibration down as then the hard part has been done.

Tricky area - working out the calibrations and counting below zero. Give children plenty of opportunity for counting below zero and figuring out calibrations, as number lines come up a lot in real life too - measuring jugs, scales, etc.

Multiplying and dividing by 10, 100, 1 000 etc.

We need to multiply and divide by multiples of ten:

- to see patterns in numbers, i.e. $2 + 8 = 10$, so $20 + 80 = 100$
- conversion from measures - $100\text{m} = 0.1\text{ Km}$ and $10\text{p} = \text{£}0.10$

When we teach this we never say that we are adding a zero, because when we move onto decimals it is not true.

We say that the digits are moved across a place value board - **the decimal point never moves.**

Addition and Subtraction

We teach addition and subtraction together as much as possible to ensure that children understand that they are inverse operations. Eventually we want children to be able to use this knowledge of inverse to switch around the calculation to make it as easy as possible to solve.

Addition Vocabulary - altogether, add, plus, total, make, greater than

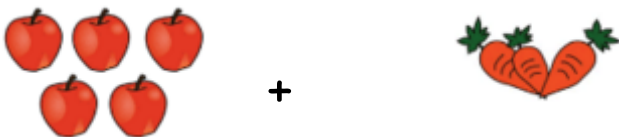
Subtraction Vocabulary - minus, take away, less than, find the difference between, left, how many more giraffes than kangaroos?

Year 1 Children are expected to:

- Add and subtract in ones using practical resources.
- Add and subtract using a numberline.
- Know addition and subtraction facts to 10 (numberbonds)
- Know some of the addition and subtraction facts to 20.

To develop an understanding of addition we group together objects and ask the children to count how many there are altogether. For subtraction we have physical objects and take them away to see how many are left.

We use a concrete - pictorial - abstract method, which means that children can use physical resources like toys, pencils or counters which can be moved around before moving towards pictorial images.

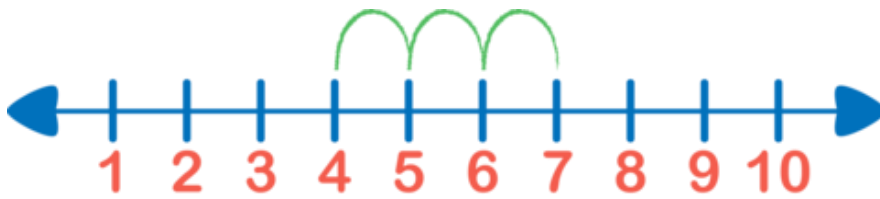


Counting on using a numberline

It is important to learn that addition is counting on. A good way to practise counting the jumps is by playing board games with counters, like snakes and ladders, as you do not count the number you start on.

$$4 + 3 =$$

The child needs to now to start from the 4 and count on 3 jumps to find the answer.



This method is best for adding on a one digit number. When adding two 2 digit numbers (TO), partitioning is a better method.

Counting back using a number line

$10 - 3$

The child needs to start from the first (and larger) number and count back the number of jumps for the second (and smaller) number.



Number bonds to 10,

We teach the number bonds to 10 by using both addition and subtraction facts, as it is important to know both together. When we start teaching we use physical resources - beads, Numicon, fingers, etc. and move on to pictorial representations.

$5 + \square = 10$ $6 + \square = 10$ $10 - \square = 4$

- Addition and subtraction facts to 5

$3 + \square = 5$ $5 - \square = 2$ $\square + 4 = 5$ $\square - 4 = 1$

Year 1 It is a national curriculum expectation that children will know the number bonds to **all** the numbers up to 10 by the end of year 1.

- $6 + 0 = 6$
- $5 + 1 = 6$
- $4 + 2 = 6$
- $3 + 3 = 6$
- $2 + 4 = 6$
- $1 + 5 = 6$
- $0 + 6 = 6$



$6 + 0$



$5 + 1$



$4 + 2$



$3 + 3$

These are Numicon

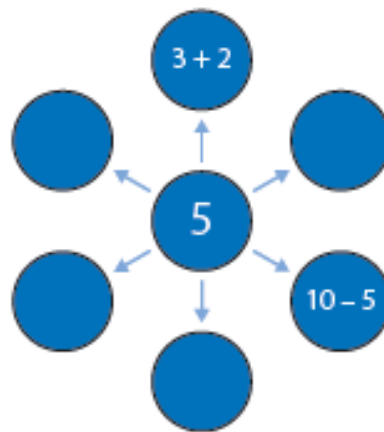
Example from 2016 sample test questions for KS1

$$\boxed{} + 5 = 9$$

We often begin lessons with the question:

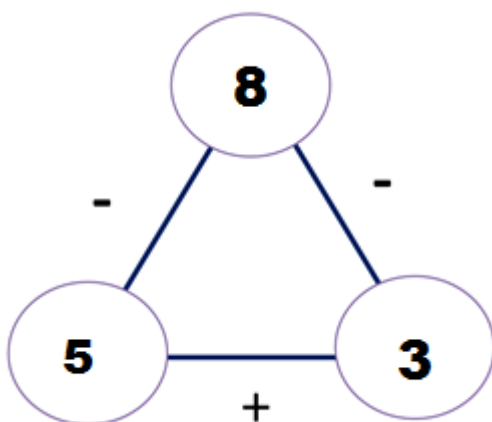
Tell me all you can about: **5**

If you know one fact, what other facts do you know?
Complete:



This is an open ended way to develop greater depth of understanding about numbers and number bonds, especially if you give the middle number without any particular number of answers expected.

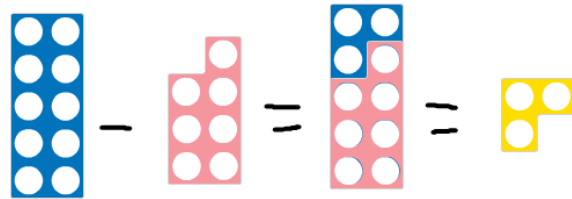
Addition is commutative, so the numbers can be swapped around and still get the same answer.



$$\begin{aligned} 5 + 3 &= 8 \\ 3 + 5 &= 8 \\ 8 - 3 &= 5 \\ 8 - 5 &= 3 \end{aligned}$$

It is important that children understand that subtraction is the inverse (opposite) of addition and can understand that if they know their number bonds to 10, they can also use these for subtraction.

So if $7 + 3 = 10$
 $10 - 7 = 3$



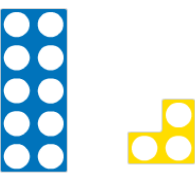
This will help them solve the missing number questions, which are important to practise with children to give them experience of using the inverse mentally.

Write numbers in the boxes to make these correct.

$$3 + \square = 8$$

$$\square + 5 = 9$$

It is important to be able to add and subtract a 1 digit number to or from 10. We use physical resources to show it to begin with, like blocks, deennes, Numicon, money, before we move on to the abstract, as then the children can count the holes to cement their understanding of the concept.

- $10 + 3 = \square$ 

- $20 - 3 = \square$ 

- The next stage is to use the place value cards (see place value) and digit flips to add ones onto any multiple of 10.
- So knowing that $40 + 9 = 49$

Year 2 Children are expected to:

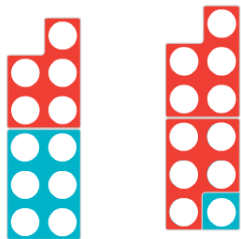
- Know addition and subtraction are opposites.
- Add 10s and 1s on a numberline and then draw their own numberline to add in 10s and 1s.
- Partition numbers to bridge 10.
- Recall and use number bonds to 20 to find addition and subtraction facts to 100.
- Use the counting on method for subtraction for numbers up to 50.
- Add 10 or 100 to any number.

Year 2 - by the end of the year the national expectations are that children should know all of their number bonds to all the numbers up to 20.

So $8 + 7 = 15$, $9 + 5 = 14$, $9 + 8 = 17$

This is a challenging expectation but it needs to be worked on throughout Year 1 and 2.

Bridging 10 - using number bonds to break up

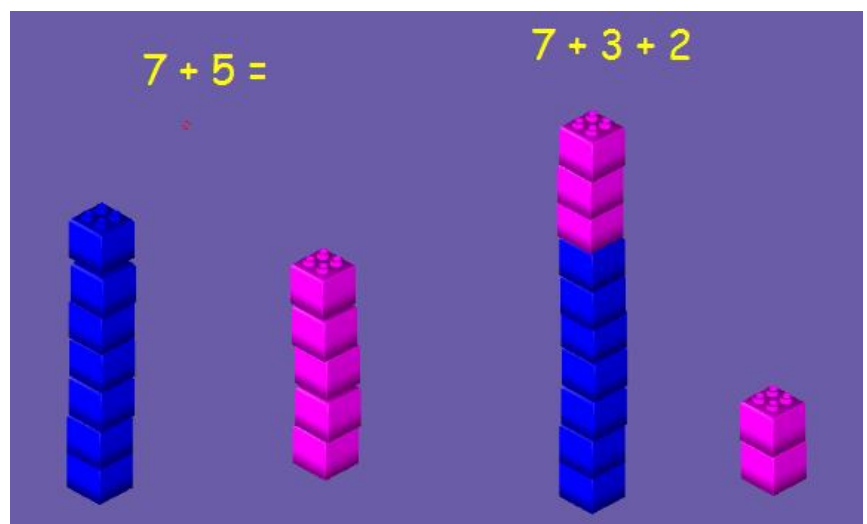


$$5 + 6 = (5 + 5) + 1 = 11$$

Example from 2016 sample test questions for KS1

$$5 + 7 = \boxed{}$$

5 + 7 = 10 + 2



By knowing your number bonds to 10 and being able to bridge 10, you will then be able to know your number bonds to 100 and bridge 100 more easily.

When multiplying by 10, we teach that you move the numbers across the place value board, **NOT** that you add a zero as this does not work when dealing with decimals, nor change the value of a digit.

Using number bonds to subtract below 10.

12 - 5 = 7

10 - 3 = 7

12 - 5 is the same as 12 - 2 - 3 and children can use Numicon to show this breaking up of the numbers into constituent parts.

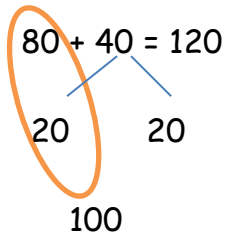
For 12 - 5, we want to break the 5 up into 2 and 3, because then we have taken 2 from the 12 to get to 10 and then just have 3 left from the 5. Using number bonds to 10, we can subtract the 3 to end up with 7.

Year 2 Number bonds to 100

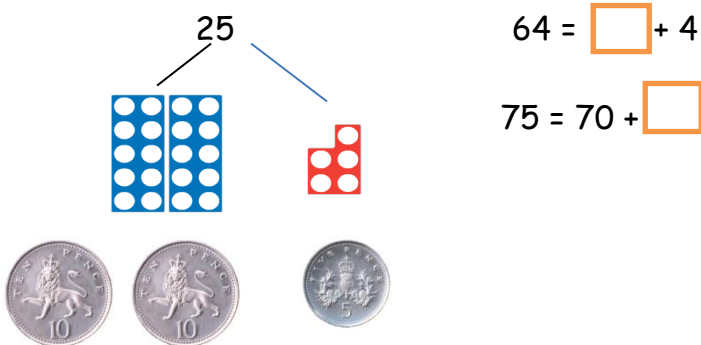
- $50 + \square = 100$ $100 - 30 = \square$

Bridging 100

The same method for bridging 10 is used for bridging 100.



Partitioning - breaking numbers up into their actual value, so $25 = 20 + 5$.



Rounding and Estimating

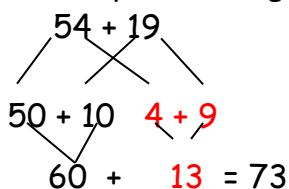
- 19 is nearly 20
- 21 is close to 20
- 39 is nearly 40

How we would help children solve some questions:

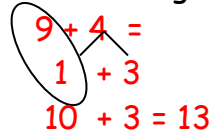
1. Write the answer.

$$54 + 19 =$$

Either partitioning



Use bridging 10 to add 9 + 4



Or compensation $54 + 20 = 74$,
so $54 + 19 = (54 + 20) - 1 = 74 - 1 = 73$

KS1 Arithmetic test

$$36 + 24 = \boxed{}$$

30 + 20 = 50
6 + 4 = 10
50 + 10 = 60

Year 3 - use partitioning to add. Only use counting on a number line if you think they are not yet ready for partitioning.

Year 1 and 2

Counting back

Children draw their own numberline to count backwards.

$$29 - 5$$

24 25 26 27 28 29

- **Year 2** Using partitioning and number bonds

$$29 - 5$$

20 9 - 5 9 - 5 = 4

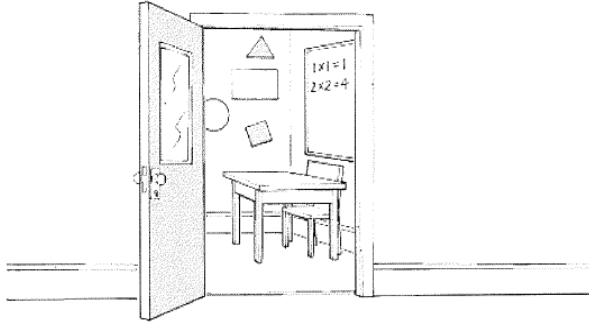
During **Year 2 and 3** we move on from counting back to counting on from the smaller number.

Counting on Method

Start from the smaller number.

Year 2 question

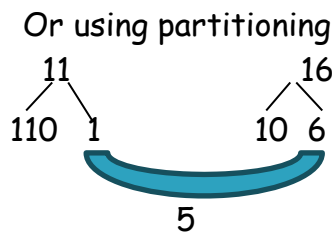
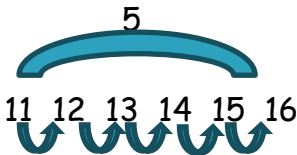
3.



There are **more** girls than boys.

How many more?

There are 11 boys and 16 girls in Blue Class.

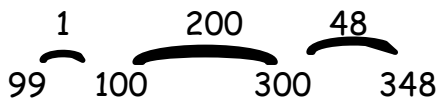


Year 3 question

Write the answer.

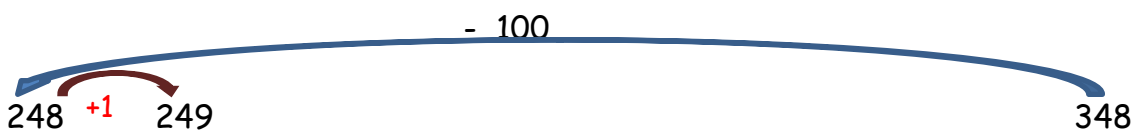
$$348 - 99 =$$

- Use the counting on method and start with the smaller number.



Add up the jumps (starting with the biggest) $200 + 48 + 1 = 249$

Estimating and compensation - make it easier by rounding 99 up to 100

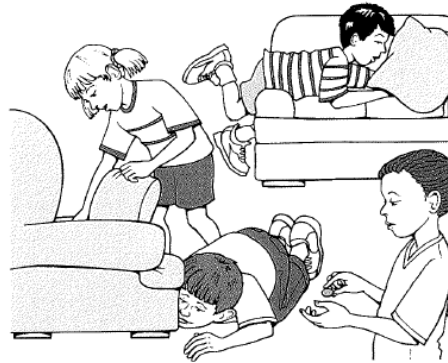


Adding several numbers

Year 2 question

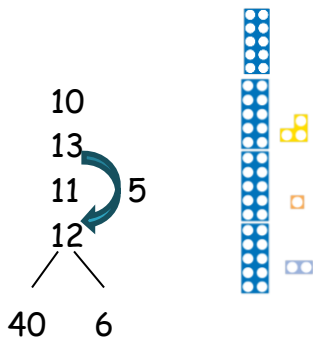
2. Anna's mum hides some chocolate eggs.

Sara finds	10	eggs
Carl finds	13	eggs
Lee finds	11	eggs
Anna finds	12	eggs



How many eggs do they find altogether?

- Estimate roughly what the answer could be. Could it be over 100?



Add the 10s and then the 1s, so must know partitioning and value of the digits.

Find easy pairs to add up: $2 + 3 = 5$

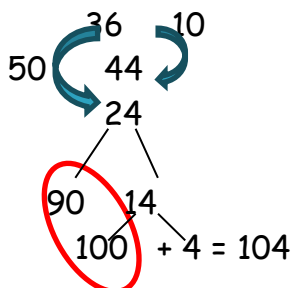
Year 3 Children are expected to:

- Use partitioning to add TO and HTO.
- Use counting on method for subtracting TO and HTO
- Add and subtract HTO and O, T and H (e.g. $346 - 4$, $346 - 20$, $346 - 100$)
- Estimate answer to a calculation and use inverse to check

Year 3 question

Write the total.

$$36 + 44 + 24 =$$



Skills required:
Recognising number bonds
Partitioning

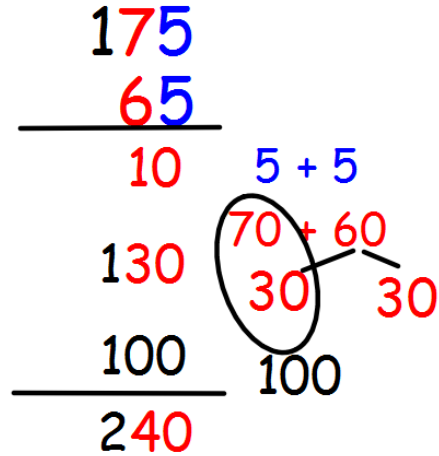
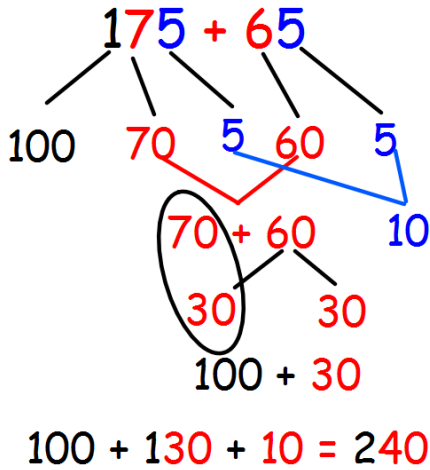
Partitioning to add HTO

Year 3

Write the total.

$$175 + 65 =$$

Or the expanded method



Number bonds to 100

Year 3

1. Here are four digit cards.



Use all four digit cards to make this sum correct.

$\square\square + \square\square = 100$



- Skills required - partitioning and number bonds

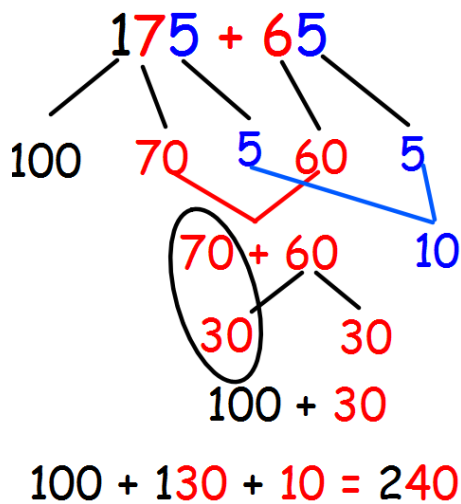
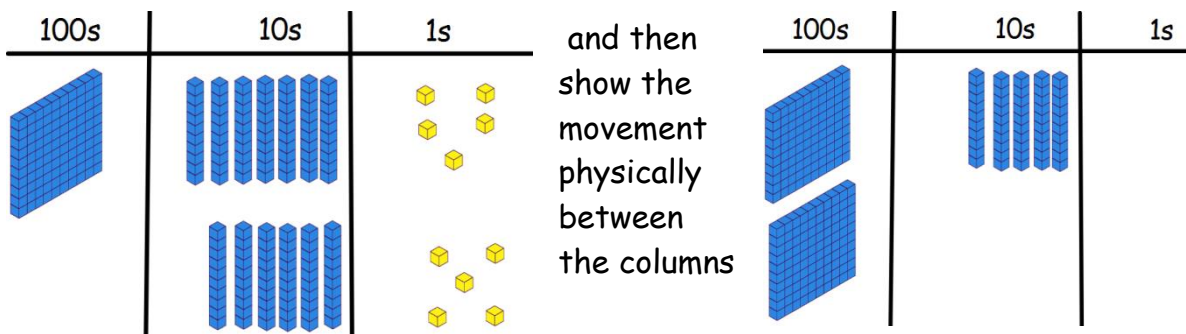
Tip You know that to make 100 that you need to have a 0 in the 1s column, therefore you require to numbers in the 1s column that add up to 10 (4 + 6). Which allows you to use the remaining numbers in the 10s column in which ever order you wish - 24 + 76 or 74 + 26.

Year 3 - Getting ready for the expanded method of addition.

Continue partitioning to include 3 digit numbers and also go through the concrete - pictorial - abstract process, so use deennes, digit cards, digit flips, etc. to embed the place value of each digit to get children ready for the expanded method of addition.

Write the total.

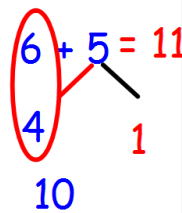
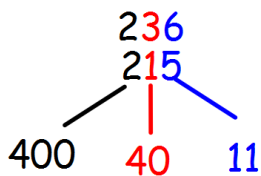
$$175 + 65 =$$



Year 4- Children are expected to:

- Begin to use expanded method to add HTO and TO.
- Begin to use column addition to add HTO and TO without crossing boundaries.
- Use the counting on method to find change.
- Add decimals up to 2 decimal places.

Continue to use partitioning and gradually move into the expanded method. Ensure that you continue to call the digit by their value - i.e. the 7 is really 70. Make sure children still have the opportunity to use physical resources like money to help them add so they fully understand the concept.



Tip - Use your number bonds to mentally work out 6 + 5.

$$40 + 11 = 51$$

$$400 + 51 = 451$$

Expanded method

$$200 \quad 30 \quad 6 \quad +$$

$$200 \quad 10 \quad 5$$

$$\hline 400 \quad 40 \quad 11$$

$$40 + 11 = 51$$

$$400 + 51 = 451$$

Write the total.

$$175 + 65 =$$

The expanded method gradually moves from partitioning towards a more column style of addition.

Expanded method

$$100 + 0 = 100$$

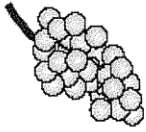
$$70 + 60 = 130$$

$$5 + 5 = 10$$

More formal style of column addition

$$\begin{array}{r} 175 \\ + 65 \\ \hline 10 \quad 5+5 \\ 130 \quad 70+60 \\ 100 \quad 30 \quad 30 \\ \hline 240 \end{array}$$

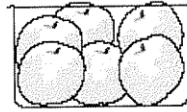
Amir and Lara buy some fruit.



grapes
£2.50
for 1 kilogram



pineapples
£1.40
each



peaches
£1.99
for a box

In **Year 4** children are also expected to add decimals. Begin with partitioning and move onto the expanded method when ready.



Tip - Use doubling and compensating, so that it can be done mentally.

Amir buys 2 pineapples and a box of peaches.

How much does he pay?

Pineapples
£1.40
x2 →
£2.80

Peaches
£1.99 is nearly £2.00.
1p

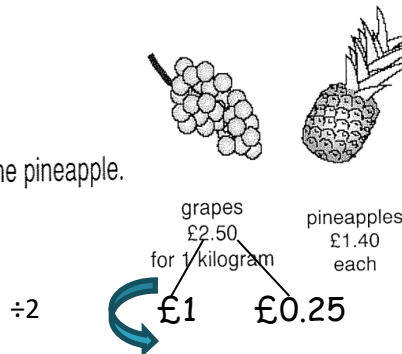
Add together £2.80 + £2.00 = £4.80.

Remember to compensate for the **1p** you added on to make the £1.99 easier to handle - £4.80 - £0.01 = £4.79.

2 step word problems require children to do at least two calculations. The quickest way to solve these problems is through mental calculations and only writing things down to aid your memory.

Lara buys half a kilogram of grapes and one pineapple.

How much change does she get from £5?



How much has she spent altogether?

$$£1.40 + £1.25 = £2.65$$

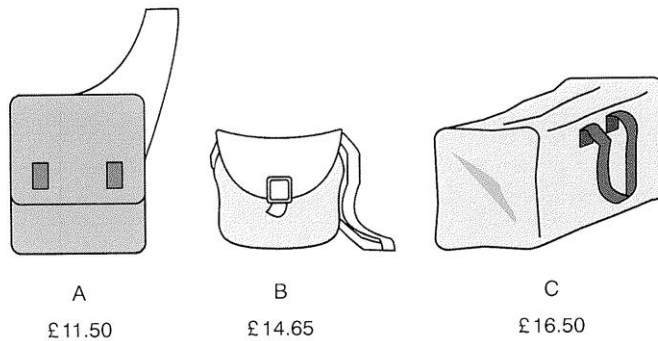
Then to find the change, use the counting on method. (This is always the best method when the larger number is a multiple of 10).

£0.05 £0.30 £2
 £2.65 £2.70 £3 £5

Finally add up the jumps, using the largest numbers first. **£2.35 change.**

Year 4

1. Here are three bags in a shop



How much does bag B cost to the nearest pound?



Tip - Rounding numbers up or down, requires us to see what we are being asked to round it to. In this case it is to the **nearest pound**, so we need to know what the pounds on either side of £14.65 are.

£14

£15

Tricky Area - children often find it difficult to identify the smaller pound - the £14, so physical coins can help.

Then look to the column one smaller than the pound, in this case the 10p column, to see whether it is nearer to £14 or £15. We know that halfway is £14.50, so £14.65 is above £14.50, so nearer to £15.

£14

↑
£14.65

£15

The 2nd part of the question is a 2 step word problem.

Jamie buys bag A and bag C.

How much change does he get from £40?

Bag A = £11.50 Bag C = £16.50.

We would encourage children to use their mental knowledge rather than the column method.

£11 + £16 = £27 £0.50 + £0.50 = £1 £27+£1 = £28



Tip - The part children often forget is the **how much change does he get from £40?**

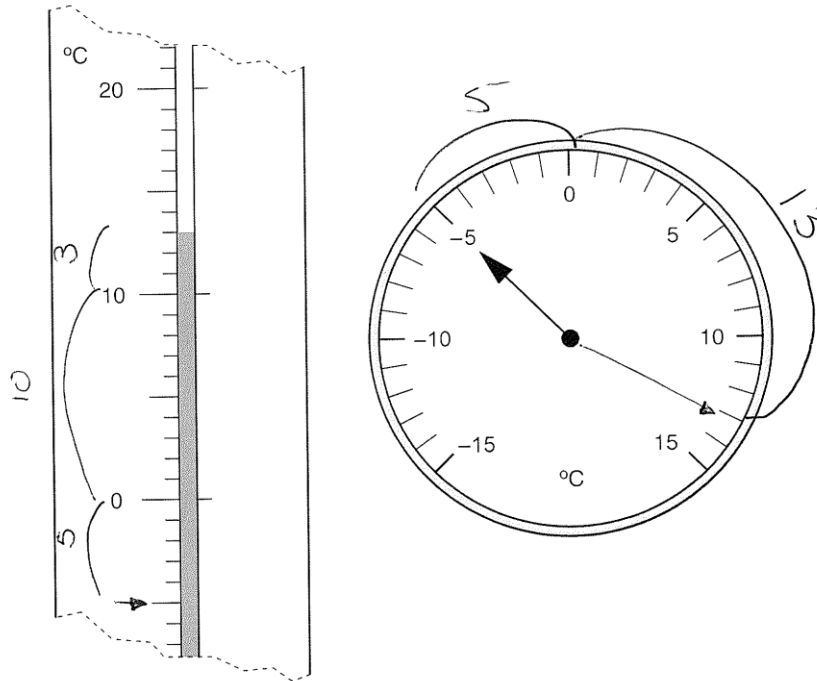
Again the counting on method is much easier than the column method for subtraction, because it does not require borrowing, but just uses the number bonds to 10 that children should be comfortable with.

$\begin{array}{r} \text{£2} \\ \text{£28} \end{array}$
 $\begin{array}{r} \text{£10} \\ \text{£30} \end{array}$
 $\begin{array}{r} \text{£40} \end{array}$
 so add up the jumps and he gets £12 change.

Year 4 - finding the difference


2. Here are two thermometers.

They show two different temperatures.



What is the **difference** between the two temperatures?

- Put both temperatures on the same thermometer.
- Count up the jumps.
 $5 + 13 = 18$

 18 degrees

1 mark

Another example of when the counting on method is most effective is when finding the difference between negative and positive numbers. It is much easier to count on from the negative number than to count back from the positive to the negative.

Year 4 - Adding decimals

When adding decimals we encourage children to think about money, so we discuss the place value of the decimals in terms of money, as it is a topic that they understand.

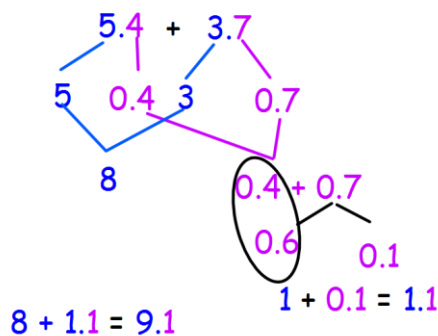
£1	.	10p	1p
1	.	1/10 th	1/100 th
4	.	5	2

There are one hundred 1ps in £1 in the same way that there are one hundred 1/100ths in a whole.

There are ten 10p in a £1 in the same way that there are ten 1/10ths in a whole.

The value of the 4 is 4 wholes or £4. The value of the 5 is 5/10ths or 5 10ps. The value of the 2 is 2/100ths or 2p.

When adding together 5.4 and 3.7 children should use partitioning.



This is just a continuation of the methods that the children have been learning since year 1 and so they are confident to use their mental methods.

By the end of Year 4, children also begin to use the column method to add decimals.

$$6.1 + 0.3 =$$

1	.	1/10
6	.	1
0	.	3
6	.	4



Tip - make sure that children are confident with the value of the columns.

Year 5 Children are expected to:

- Use formal column addition to add large numbers and decimals.
- Begin to use formal column subtraction (decomposition) to subtract large numbers and decimals.

Year 6 Children are expected to:

- Use formal column subtraction (decomposition) to subtract large numbers and decimals.

Calculate $52.85 + 143.6$

Mental method

$52.85 + 143.6$ $52.85 + 143.60$ <hr/> $52 + 143 \quad 0.85 + 0.60$ $195 + \quad 0.45 \quad 0.40$ $0.45 + 1 = 1.45$ $195 + 1.45 = 196.45$	<p>Think about them as amounts of money, so to be less likely to confuse the tenths and hundredths.</p> <p>Break up into wholes and decimals.</p>
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Column method -

Tricky Area - without a clear understanding of place value and if not written clearly in columns this can lead to confusion, especially as to the place of the decimal point and without estimation beforehand can create some outlandish answers.

100s	10s	1s	.	1/10	1/100
		1			
1	4	3	.	6	+
	5	2	.	8	5
1	9	6	.	4	5

Begin with the larger number and make sure each digit is in the correct column.

The answer will be close to 200, but a little less, because $52 + 43$ does not equal 100.

Carry the 1s at the top of the correct column.

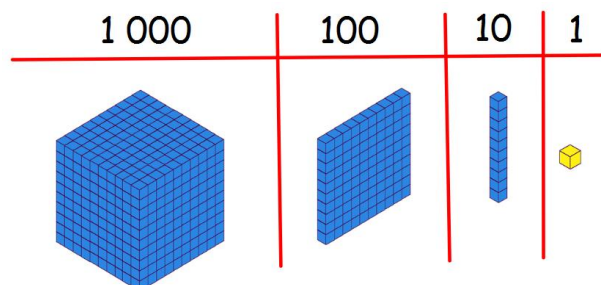


Tip - encourage the child to discuss what they are doing to ensure that they fully understand this method. If they have not grasped the mental method, please make sure that they can do that first.

Column Subtraction (decomposition)

At William Tyndale, we focus strongly on mental calculation and developing a sound understanding of place value as these are fundamental to gaining a secure foundation in mathematics. The new curriculum requires children to use the column method for subtraction, which we begin teaching in Year 5.

Begin by reinforcing children's understanding about place value, so that they are confident with the value of each digit. We use physical resources to cement children's understanding of place value, like deennes (right), arrow cards, coins and digit flips, as well as pictorial representations, before we move on to the abstract.



Remind children of the properties of subtraction.

- It is not commutative so the larger number must go first in the calculation.
- Subtraction makes things smaller, so the answer will be smaller than the larger number in the question.
- It is the inverse of addition, so use the inverse to check the answer.

We begin with numbers where all the digits in the larger number are larger than the digits in the smaller number, so no borrowing is required.

487-253



Begin with the expansion method, so that children are fully confident with the value of the digit.

$$\begin{array}{r} 400 \quad 80 \quad 7 \\ 200 \quad 50 \quad 3 \\ \hline 200 \quad 30 \quad 4 \end{array}$$

Then you can move onto the column method, but with no borrowing.

100	10	1
4	8	7
2	5	3
2	3	4

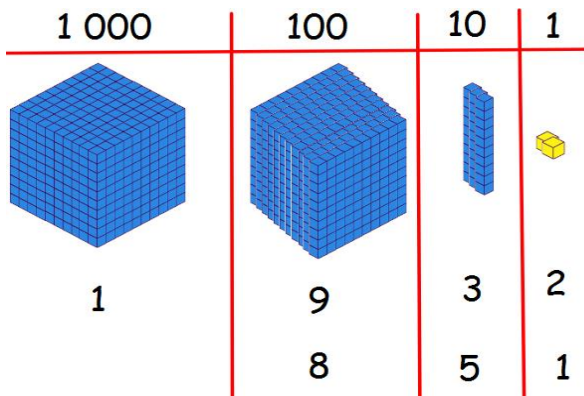


Tip - Start with the ones column and take the bottom number away from the top number. Move from right to left through the columns.

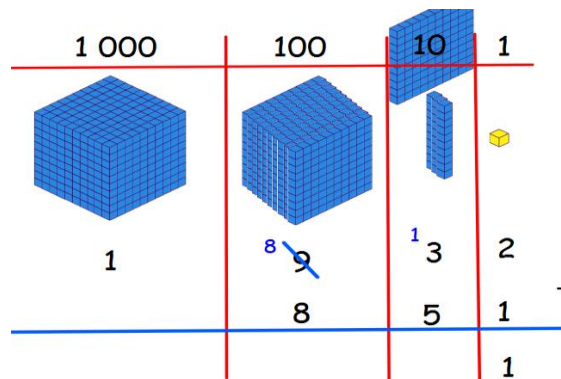
Go back to the expanded method for decomposition and use physical resources to demonstrate when you move onto borrowing, as it helps children to visualise what is happening.

$$1932 - 851 =$$

$$\begin{array}{r} 1\ 000\ 900\ 30\ 2 \\ \underline{800\ 50\ 1} - \end{array}$$



It is easy to take away 1 from the ones column, but then the larger number, 1932, does not have enough 10s so we must borrow 100 from the hundreds column.



So now there is 130 in the tens column and only 800 in the hundreds column.



$$\begin{array}{r} 800\ +100 \\ 1\ 000\ \cancel{900}\ 30\ 2 \\ \underline{800\ 50\ 1} - \\ 1\ 000\ 0\ 80\ 1 \end{array}$$

Tip - Use your number bonds to 100 to work out that $130 - 50 = 80$.

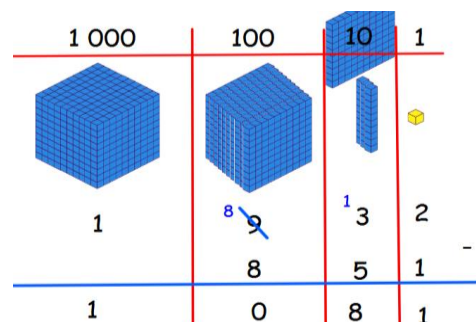
$50\ 30$
50 100 130 and add up the jumps $50 + 30 = 80$.

Then just take the bottom number from the top number, so as there is now only 800 in the hundreds column

$$800 - 800 = 0$$

$$1\ 000 - 0 = 1\ 000$$

Put the partitioned numbers back together to get 1 081.



When children are confident with the expanded method and using physical resources, move onto column subtraction.

$$\begin{array}{r} 36\ 342 \\ - 27\ 838 \\ \hline \end{array}$$

10 000	1 000	100	10	1
3	6	3	4	2
2	7	8	3	8



Tip - write out the calculation in clear columns, so you know what each digit is worth, particularly when the numbers become this large or decimals are involved.

10 000	1 000	100	10	1
3	6	3	³ 4	¹ 2
2	7	8	3	8
			0	4

10 000	1 000	100	10	1
3	⁵ 6	¹ 3	³ 4	¹ 2
2	7	8	3	8
			0	4

Now there is another problem, because 5 000 is smaller than 7 000, so look in the ten thousands column. $15\ 000 - 7\ 000 = 8\ 000$.
 $20\ 000 - 20\ 000 = 0$, so there is nothing in the ten thousands column.

Tricky Area - you cannot subtract a larger number from a smaller number as it goes into negatives, i.e. $2 - 8$, so you need to borrow from the adjacent column, 10s in this case, so now the 2 is worth 12 and therefore larger than the 8.

10 000	1 000	100	10	1
3	6	3	³ 4	¹ 2
2	7	8	3	8

Start in the ones column,
 $12 - 4 = 8$

In the tens column,
 $30 - 30 = 0$

But now there is another need to borrow, because 300 is smaller than 800, so look in the thousands column.

Borrow 1 000 from 6 000 to move into the hundreds column, so 300 becomes 1 300.

$$1\ 300 - 800 = 500$$

$$\begin{array}{r} \underline{200} \quad \underline{300} \\ 800\ 1\ 000\ 1\ 300 \end{array}$$

10 000	1 000	100	10	1
2	¹ 6	1	³ 4	¹ 2
3	7	8	3	8
		5	0	4

The final calculation should look like this.

10 000	1 000	100	10	1	
2	¹ 5	1	³	1	
3	6	3	4	2	
2	7	8	3	8	-
0	8	5	0	4	

Multiplication and division

Important vocabulary for children to know so that they can solve word problems:

Multiplication

Times - What is 3 times 4?

Multiply - Find 3 multiplied by 4.

Lots - How many sweets are 4 lots of 3?

Product - What is the product of 3 and 4?

Division

Groups of - how many groups of 4 are there in 12?

Go into - how many 4s go into 12?

Share - I share 12 sweets with 4 children. How many do they each have?

Times tables

Year 1 - count on fingers to find 2x, 5x and 10x.

Year 2 - 2x, 3x 5x and 10x

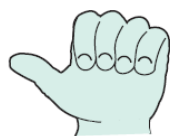
Year 3 - 2x, 3x, 4x, 5x, 8x and 10x

Year 4 - 2x, 3x, 4x, 5x, 6x, 8x, 9x and 10x.

Year 5 - 2x, 3x, 4x, 5x, 6x, 7x, 8x, 9x and 10x, 11x, 12x.

To learn their tables children should use known facts to support and should be tested out of sequence - so What is 3x2? Then what is 6x2? Then what is 4 x 2?

Doubling and halving - using physical resources, fingers or drawings.



$$\text{double } 6 = 12 \quad 6 + 6 = 12$$

$$\text{half of } 12 = 6 \quad 12 - 6 = 6$$

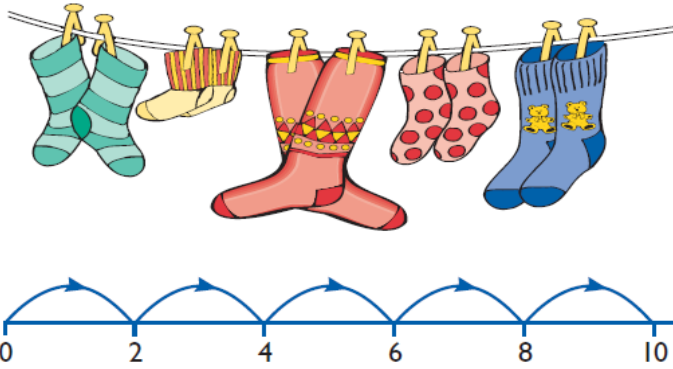
$$1 + 1 = 2$$

$$2 - 1 = 1$$

double 1 is 2

half of 2 is 1

Doubling and halving is an essential part of knowing how to multiply and divide, which we begin teaching in the Foundation Stage using physical objects. We relate multiplication to repeated addition. We continue to use physical resources for as long as the children require them, to ensure that they have a confident understanding of the processes.



$2 + 2 + 2 + 2 + 2 = 10$
 $2 \times 5 = 10$
 2 multiplied by 5
 5 pairs
 5 hops of 2



Remember to practise counting backwards as well as forwards, because children learn the patterns of the words.

Year 1 expectations for multiplication and division are that children should:

- Count forward and back in 1s, 2s, 5s and 10s.
- Use knowledge of 2s, 5s and 10s to share (divide).
- Know all the doubles of numbers to 10.
- Link doubling with halving.

Show pupils pictures or groups of objects like the examples below. Ask questions such as 'How many biscuits are there altogether?'

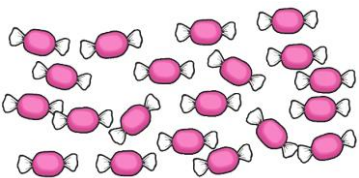
'How many cherries are there altogether?'

Observe how pupils count the objects. Do they count in twos, fives etc. or do they count in ones?



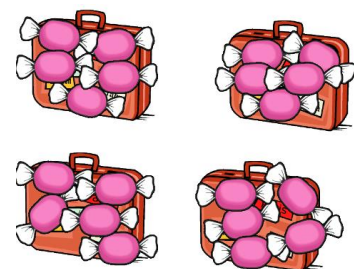
Year 1 Expectations

Sarah is filling party bags with sweets. She has 20 sweets altogether and decides to put 5 in every bag. How many bags can she fill?



To teach this we would start with physical resources, perhaps 20 sweets or counters and 5 bags or groups. The opportunity to physically move objects is essential for children to begin to understand what is happening with division.

Once children are confident with moving physical resources, we would encourage children to draw pictures to solve problems.



Year 2 Children are expected to:

- recall 2x, 5x, 10x multiplication and division facts
- Count in 3s from zero
- Solve multiplication and division problems using pictures and concrete resources.
- Know multiplication is commutative while division is not.

Examples of expectations

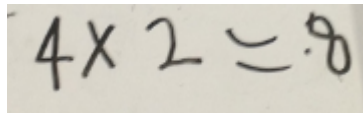
What is 5×4 ? (5 times table)

What is 10×6 ? (10 times table)

Being able to answer such questions is, of course, important, but check pupils understand the meaning of them. For example, ask them to make 5×4 and 10×6 using concrete apparatus.

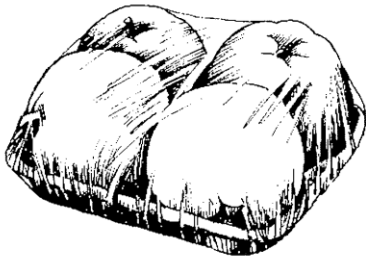
We use physical resources to demonstrate the idea of multiplication as groups of, or lots of an amount.

There are 4 lots of 2. How many are there altogether?


$$4 \times 2 = 8$$



1. There are 4 apples in each pack.

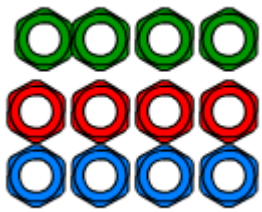


Mrs Pullen buys 3 packs of apples.

How many apples does she buy?

Children are encouraged to draw out the question, using the array system. By drawing out the question children find it easier to see which operation to use, a common difficulty with word problems.

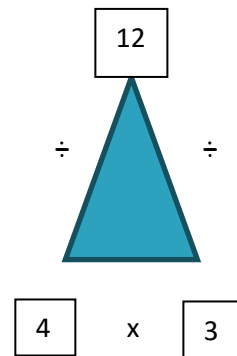
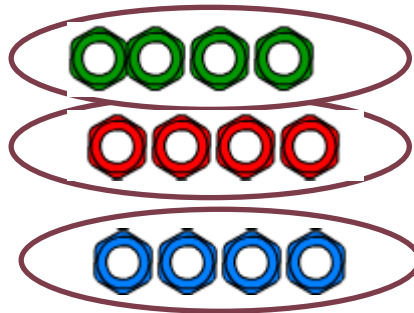
We encourage children begin to use arrays to count out groups to multiply and also to divide.



$$3 \times 4 = 12$$

$$12 \div 3 = 4$$

$$12 \div 4 = 3$$



The use of the arrays and the triangle help to reinforce the idea that multiplication and division are opposites (inverse operations), which can support to answer questions like those below.

Amy makes **20** cakes.

She shares the cakes between **5** plates.

Tick the calculation that shows how many cakes are on each plate.



Tick **one**.

$20 + 5 = 25$

$20 - 5 = 15$

$20 \div 5 = 4$

$20 \times 5 = 100$

This array represents $5 \times 3 = 15$.



Write three other multiplication or addition facts that this array shows.

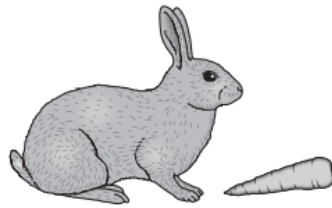
Write one division fact that this array shows.

22

Amy plants **4** rows of carrots.

There are **3** carrots in each row.

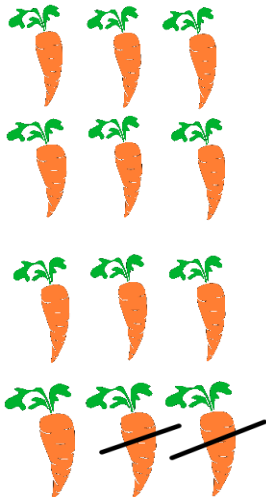
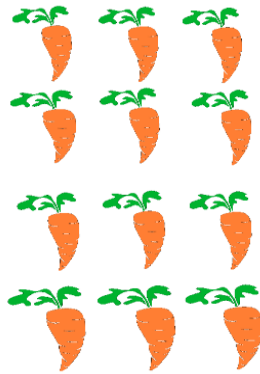
A rabbit eats **2** of the carrots.



How many carrots are left?

When questions become complicated, they often have 2 separate calculations to work out in order to solve the whole problem. It is best to encourage children to draw pictures to solve these kind of questions.

So $4 \times 3 = 12$

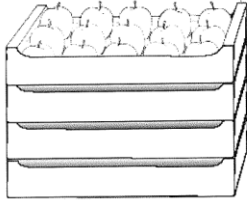


Then eat two of the carrots.
So there are 10 carrots left.

Children learn that multiplication is repeated addition and so can use this to solve larger problems.

There are 15 apples in a tray.

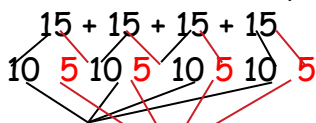
Ling has 4 trays of apples.



or recognising doubles

How many apples does Ling have altogether?

Can either use repeated addition

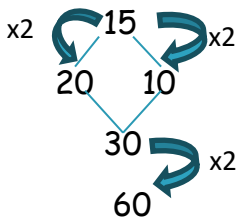


$$40 + 20 = 60$$

Or doubling using partitioning and doubling again

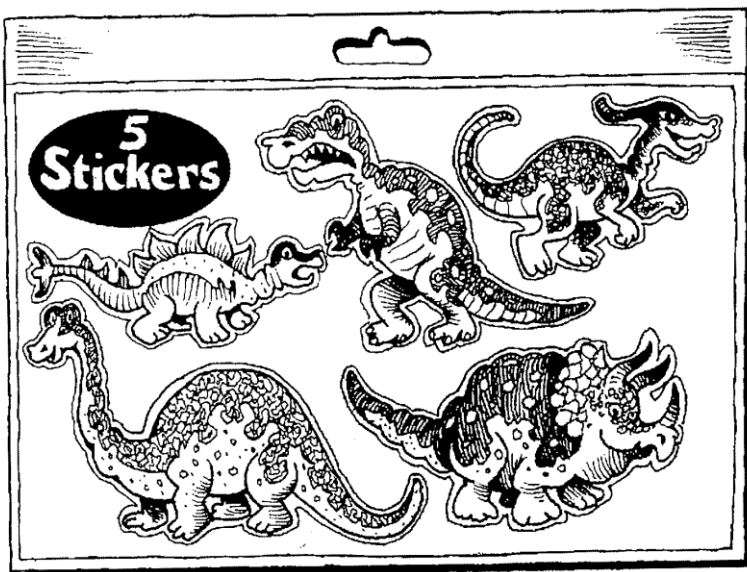
$$15 + 15 + 15 + 15$$

$$30 + 30 = 60$$

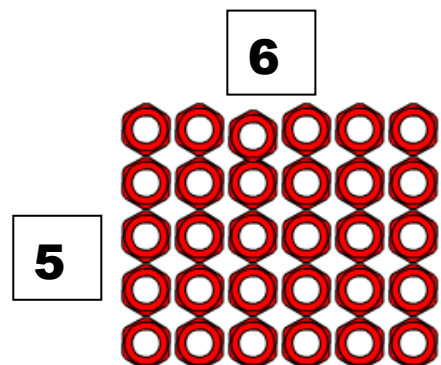


Alex buys 6 packets of stickers.

There are 5 stickers in each packet.

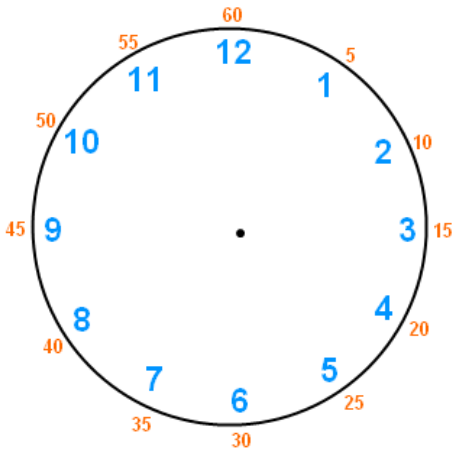


Use arrays - we encourage children to draw pictures to solve problems like this.



(a) How many stickers does he buy?

Or knowledge of times tables $5 \times 6 = 30$.



The clock is a good way to remember your 5x table.

Count around the clock to help you know your 5x table.

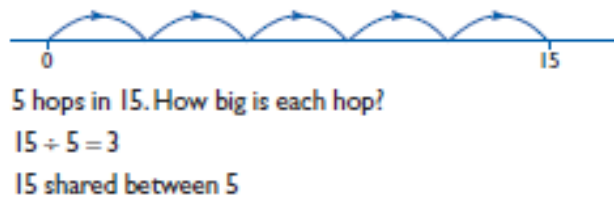
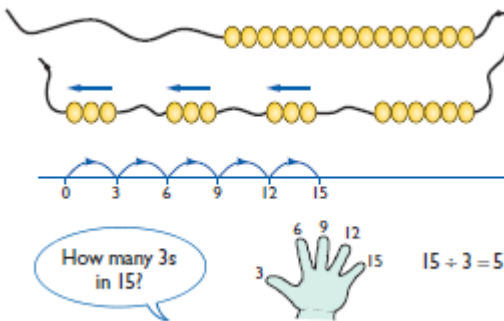
Use the known times to support you - you know that when the minute hand is on the 6 it is 30 minutes past - so $5 \times 6 = 30$.

KS1

Arithmetic question

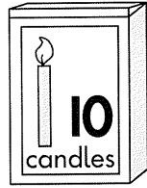
$$35 \div 5 = \boxed{}$$

We relate division to repeated subtraction.



We link division to real life to support children's understanding. So that when we put children into groups for PE we discuss the mathematics behind it. It is important to focus on the fact that dividing has to be in **equal groups**.

Count up in 10s until you get to 50.

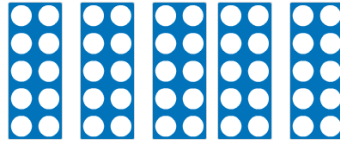


There are **10** candles in a packet.

Abi needs **50** candles.

How many **packets** does Abi need altogether?

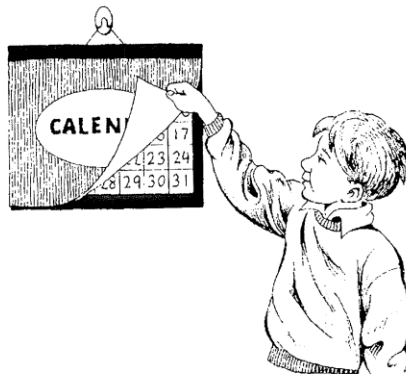
Draw pictures to help understand what the question is asking.



For this kind of question children will often not realise that it is a division question, but will still come to the correct answer.

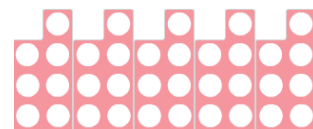
By Year 2 the children are expected to know their 5x table and so could be able to use these times tables to solve problems.

A week has 7 days.



How many weeks are there in **35** days?

weeks



Can count in groups of 7

Or if you know your 5x table very well, you know that $5 \times 7 = 35$, so 5 lots of 7 is 35, so 5 weeks of 7 days would be 35 days.

Year 3 Children are expected to:


- Recall and use multiplication and division facts for 2x, 3x, 4x, 5x, 8x and 10x tables.
- Know what multiples are.
- Begin to use the grid method for multiplying 2 digit numbers (TO).
- Multiply and divide any number by 10.

John says,
'Every multiple of 5 ends in 5'



Is he correct?

Circle Yes or No.

 Yes / No

Explain how you know.

.....
.....
.....

Children need to be able to explain how they know about a concept to fully demonstrate a deep understanding. So we ask a lot of 'how do you know' questions in class.

Write the **three** missing numbers in this multiplication grid.



Children require swift recall to know their times tables well.

×	8	5	
4		20	28
5	40		35
3	24	15	21

Grid Method for multiplication

Write the answer.

$$24 \times 4 =$$

Use doubling and doubling again

$$\begin{array}{c} 24 \\ / \quad \backslash \\ 40 \quad + \quad 8 \\ / \quad \backslash \\ 80 \quad + \quad 16 = 96 \end{array}$$

Partitioning

$$\begin{array}{c} 24 \\ / \quad \backslash \\ 20 \quad 4 \\ / \quad \backslash \quad / \quad \backslash \\ x4 \quad 80 \quad + \quad 16 \quad = \quad 96 \quad x4 \end{array}$$

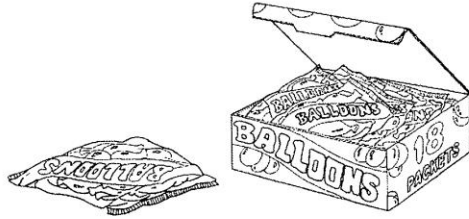
Grid method

x	20	4	
4	80	16	Use known facts - so 2×4 is 8, therefore $20 \times 4 = 80$
			Add the columns together $80 + 16 = 96$

1. There are 5 balloons in a packet.

There are 18 packets in a box.

$$\begin{array}{r|l} \times & 10 & 8 \\ \hline 5 & 50 & 40 = 90 \end{array}$$



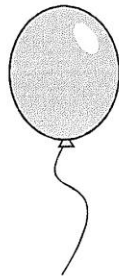
How many balloons are there altogether in a box?

$$\begin{array}{r} 10 & 8 \\ / & \backslash \\ 50 & 40 \\ + & \\ \hline 90 \end{array}$$



1 mark

There are 5 balloons in a packet.

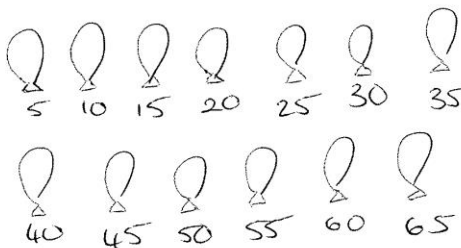


If you know your
5x table:
 $5 \times 12 = 60$
so $5 \times \square = 65$

Kofi needs 65 balloons.

How many packets does he need?

Draw the problem.



Count how many
balloons you have
drawn.



1 mark

Year 4 Children are expected to:

- Recall and use multiplication and division facts for 2x, 3x, 4x, 5x, 6x, 8x, 9x, 10x, and 12x.
- Use related facts to multiply multiples of 10 and 100 (see question below).
- Use grid method or expanded vertical method for 3 digit numbers (HTO)
- To divide HTO with increasingly accurate written methods.
- Begin formal vertical multiplication for TO and HTO by a 1 digit number (O) and multiply up to 2 decimal places by O.

Examples of arithmetic expectations

$24 \div 4 =$

$4 \times 9 =$

$96 \div 8 =$

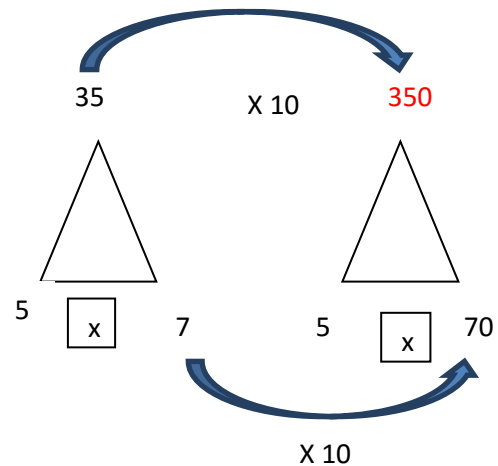
$5 \times 3 \times 5 =$

Write in the missing numbers.



$5 \times 70 = \boxed{}$

$4 \times \boxed{} = 200$



This problem involves children knowing their times tables and being able to multiply and divide any number by 10.

Chunking method for division

Calculate $56 \div 4$

By knowing their 4x table, children can also work out division facts.

$$\begin{array}{r} 4 \overline{)56} \\ \underline{40} \\ 16 \\ \underline{16} \\ 0 \end{array}$$

$$\begin{array}{l} 4 \times 10 \\ 4 \times 4 \end{array}$$

Choose the easiest 4x table that you know that is near to 56 (usually from the 10x table).

Subtract 40 from the 56

Add the numbers multiplied by 4 to find how many lots of 4 go into 56.

$56 \div 4 = 14$

Multiplying HTO using the Grid Method

$154 \times 7 =$

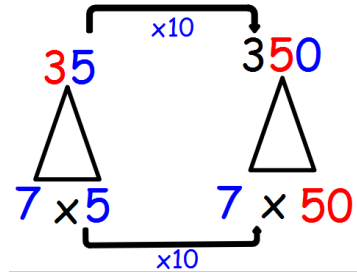
First draw the grid and partition the numbers into Hundreds, Tens and Ones. Use related facts to multiply by 100. If $1 \times 7 = 7$, so $100 \times 7 = 700$.

x	100	50	4
7	700		

9Next multiply 50 by 7.



Tip - Use related number facts to work out 7×50 .



x	100	50	4
7	700	350	28

Once all the grid is full, you need to add up each section. To add mentally use your knowledge of number bonds to know that:

$700 + 300 = 1\ 000.$

$50 + 28 = 78$

$1\ 000 + 78 = 1\ 078$

Tricky Area - remember the place value so the 78 goes in the correct columns.

Multiplying by the expanded vertical method

$$\begin{array}{r} 214 \\ \times 5 \\ \hline \end{array}$$



Tip - Start with the ones column and show the place value and the workings out to prevent mistakes.

Add up the answers using your knowledge of number bonds and place value.

$20 + 50 = 70$

$1\ 000 + 70 = 1\ 070$

$$\begin{array}{r} 214 \times \\ \underline{5} \\ 20 \quad 4 \times 5 \\ 50 \quad 10 \times 5 \\ \underline{1\ 000} \quad 200 \times 5 \end{array}$$

Tricky Area - make sure that the 70 goes into the correct column.

Formal written method for multiplication by 0

$$\begin{array}{r} 214 \\ \times 5 \\ \hline \end{array}$$

Start with the ones column and multiply each number by 5. Remember to say the value of each digit - so the 1 is 1 ten or 10 and the 2 is 2 hundreds or 200.

When multiplying 4 by 5, put the 2 (to show 2 tens) **above** the 1 ten, so that you do not forget about it.

$$\begin{array}{r} 214 \\ \times 5 \\ \hline 0 \end{array}$$

$$\begin{array}{r} 214 \\ \times 5 \\ \hline 70 \end{array}$$

Move on to the tens column and $5 \times 10 = 50$. Don't forget to add on the 2 tens (carried over from the 4×5).

Multiply 5 by 200, to make 1 000. Make sure that you put each digit in the correct column.

$$\begin{array}{r} 214 \\ \times 5 \\ \hline 1070 \end{array}$$

The same methods can be used for multiplying by decimals - just make sure that the child is confident of the value of each digit and keeps the decimal point in its own column, so that can't move around. Often when calculating with numbers to 2 decimal places it will be using money. Reminding children to think of decimals as money helps them to make sense of decimals.

$$\begin{array}{r} \text{£}1.27 \\ \times 3 \\ \hline 1 \end{array}$$

Multiply 3 by 7p to get 21p. Carry the 20p into the 10p column.

$$\begin{array}{r} \text{£}1.27 \\ \times 3 \\ \hline .81 \end{array}$$



$3 \times 20\text{p} = 60\text{p}$.

Don't forget to add on the 20p already carried over to make 80p. Remember the decimal point needs to be in the correct place.

$$\begin{array}{r} \text{£}1.27 \\ \times 3 \\ \hline \text{£}3.81 \end{array}$$

3 multiplied by £1 is £3, so make sure it goes into the correct column.

It is important to remember that although the level of arithmetic expected of the children is high, they must also use it to solve problems which involve many of the different methods taught.

End of **Year 4** reasoning question

A pack of paper has 150 sheets.

4 children each take 7 sheets.

How many sheets of paper are left in the packet?

Show your method

Work out how many sheets of paper have been taken first.

A pack of paper has 150 sheets.

4 children each take 7 sheets.

How many sheets of paper are left in the packet?

Show your method

$4 \times 7 = 28$

Now you need to work out how many sheets are left. By estimating you should know that it will be over 100.



Tip - Use the counting on method to find out how many are left.

A pack of paper has 150 sheets.

4 children each take 7 sheets.

How many sheets of paper are left in the packet?

Show your method

$4 \times 7 = 28$

28 $+2$ 30 $+20$ 50 $+100$ 150

122

Tricky Area - children can forget to do the second part of the question. Or they can work out $50 - 28$ as 32, because they do not use the counting on method.

A bag of 5 lemons costs £1.

A bag of 4 oranges costs £1.80.



How much **more** does one orange cost than one lemon?

Show your method

By the end of **Year 4** children are expected to be able to divide £1 by both 4 and 5 (linking with fractions $\frac{1}{4}$ or $\frac{1}{5}$ of £1). If they are unsure please use money as a resource to support them.

$$£1 \div 5 = 20p$$

Partition the oranges into £1 and 80p.

$$\begin{array}{r} £1 \\ \div 4 \\ \hline 25p \end{array}$$

$$\begin{array}{r} 80p \\ \div 4 \\ \hline 20p \end{array}$$

So 1 orange costs 25p + 20p.

$$20p + 20p = 40p$$

$$40p + 5p = 45p.$$



Tip - Do not forget the second part of the question.

How much **more**?

With the partitioning you can see that if a lemon costs 20p then an orange is 25p more.

Year 5 Children are expected to:

- Know all tables to 12 x 12 and use them confidently in larger calculations.
- Multiply 2 digit number (TO) by a 2 digit number (TO) using the expanded vertical method or the grid method.
- To multiply TO by TO using long multiplication.
- Divide 3 and 4 digit numbers by O using short division.
- Multiply fractions.

Sometimes knowledge of times tables leads to children needing to use trial and improvement to solve a problem.

Write **one** number which fits **all three** of these statements.

- It is a multiple of 4
- It is a multiple of 6
- It ends in '8'

4	6
8	12
12	18
16	24
20	30
24	36
28	42
32	48
36	
40	
44	
48	

Or use knowledge of the two times tables that end in '8'

4	8	28	48
6	18	48	

Multiply TO by TO (Expanded Vertical Method)

The number you are *multiplying by* is called the **multiplier**.

The number that is *being multiplied* is called the **multiplicand**.

$$\begin{array}{r} 78 \\ \times 26 \\ \hline \end{array}$$

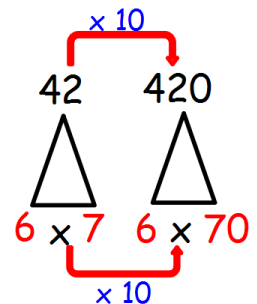
Start with the multiplier in the ones column (in this case the 6) to multiply the whole of the multiplicand (in this case the 78). Start with 6×8 and move onto 6×70 .

$$\begin{array}{r} 78 \\ \times 26 \\ \hline 48 \\ 420 \end{array}$$

6×8
 6×70



Tip - use related facts to work out 6×70 .

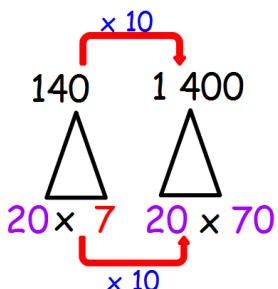


Move onto multiplying by the 20.

If you know 20×7 , you can work out 20×70 .



Tip - Use the triangle (left) to make sure that you don't make a mistake with the place value.



$$\begin{array}{r} 78 \\ \times 26 \\ \hline 48 \\ 420 \\ 160 \\ 1400 \end{array}$$

6×8
 6×70
 20×8
 20×70

The final stage is to add up the calculations. You can either use the column method or your mental skills. I would encourage mental addition and writing numbers down to keep track. So add 1 400 and 160 = 1 560.

$$\begin{array}{r}
 48 \\
 420 \\
 160 \\
 \text{1 1}400 \\
 \hline
 2028
 \end{array}$$

If you do choose to add using the column method, start at the ones column and be careful when carrying the 1 000. Remember to put it above the other thousand.

Tricky area - make sure you estimate what the answer will be near, so you don't make simple errors with the method.

Long Multiplication

Always start with the expanded version for multiplication and only when children are confident with this move onto the formal method for long multiplication. Make sure that you use the same vocabulary for long multiplication as with the expanded method (referring to the actual value of the digit - i.e. 60 and not 6).

$$\begin{array}{r}
 67 \\
 \times 25 \\
 \hline
 \end{array}$$

Start with the ones column so $5 \times 7 = 35$. Remember to put the ones in the ones column and the tens can be carried over to the tens column. A common mistake is to put the tens in the ones and the carry the ones (i.e. 3 gets put in the answer and the 5 gets carried over) so it is important to say the answer is **thirty** five.

$$\begin{array}{r}
 \text{3} \\
 67 \\
 25 \times \\
 \hline
 5
 \end{array}$$

$$\begin{array}{r}
 \text{3} \\
 67 \\
 25 \times \\
 \hline
 335
 \end{array}$$

Next multiply 5 by 60. Use the triangles in the same way as earlier (see pg 50) to help you. $5 \times 6 = 30$, so $5 \times 60 = 300$.

Now move onto the tens. So 20×7 . Again you can use the triangle to help if required. $2 \times 7 = 14$, so $20 \times 7 = 140$.



Tip - Make sure you say that you are multiplying by 20, as otherwise children can forget to put the 0 in the ones column. Remember to carry the 100 above the hundreds column.

$$\begin{array}{r}
 \text{1 3} \\
 67 \\
 25 \times \\
 \hline
 335 \\
 40
 \end{array}$$

$$\begin{array}{r}
 13 \\
 67 \\
 25 \times \\
 \hline
 335 \\
 1340 \\
 \hline
 \end{array}$$

20 x 60 can be worked out by using known facts - 2 x 6 = 12, so 20 x 6 = 120 therefore 20 x 60 = 1 200.

Don't forget to add on the hundred carried over.

Finally add up the products. This can be done mentally or using the column method.

If adding mentally I would start with 1340 + 300 = 1 640. 1 640 + 35 = 1 675.
For the column method see above.

Short division

(often called the bus stop method, as the sign looks a little bit like a bus stop)

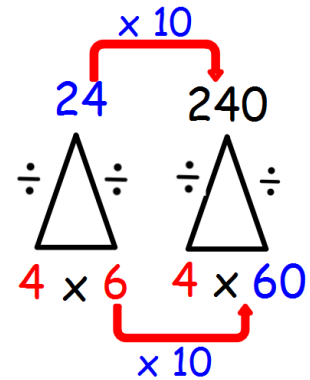
- Divide 3 and 4 digit numbers by 0 using short division.

For more simple questions like:

$$240 \div 4 =$$

I would suggest that you use your knowledge of times tables, so that this can be done mentally.

Only use short division for those calculations that cannot be worked out mentally.



Short division is where all the hard work on place value goes out of the window, so only start using this method when children are completely secure with their place value.

$$3500 \div 4 =$$

$$4 \overline{) 3500}$$

Ask how many times 4 goes into 3 - none so put a dot above to show that there are no thousands in the answer.

Then see how many 4s go into 35. Encourage children to draw a line under the number so that they are clear about what they are doing. If the 4 does not divide perfectly into the

number, find the closest number in the times tables and work out the remainder. $4 \times 8 = 32$, which leaves a remainder of 3.

$$4 \overline{) 3500}$$

$$4 \overline{) 3500} \begin{array}{r} .8 \\ 3 \end{array}$$

Put the 8 in the hundreds column and put a small 3 next to the 0 in the tens column, to show the remainder. Next you will be working on

how many 4s go into 30. $4 \times 7 = 28$, which leaves a remainder of 2.

Put the 7 in the tens column and put a small 2 next to the 0 in the ones column, to show the remainder.

Now work out $20 \div 4$.

$$4 \overline{) 3500} \begin{array}{r} .87 \\ 32 \end{array}$$

$$4 \overline{) 3500} \begin{array}{r} .875 \\ 32 \end{array}$$

Year 6 Children are expected to:

- multiply ThHTO by TO using long multiplication
- divide numbers ThHTO by TO using the formal written method of long division find remainders
- divide numbers ThHTO by TO using the formal written method of short division find remainders
- identify common factors, common multiples and prime numbers
- express the quotient (answer to division calculation) as a fraction, decimal or rounded up according to context.
- Multiply numbers with up to 2 decimal places by a whole number.

Reasoning question using long multiplication.

$$\begin{array}{r}
 \square \\
 \times \square 6 \\
 \hline
 2 6 \\
 8 0 \\
 \hline
 1 6 6
 \end{array}$$

This question requires a good knowledge of the long multiplication algorithm and times tables.

Looking at the top row of the answer, shows that 40 something multiplied by 6 equals 246.

If you know your 6 times tables you know that $6 \times 4 = 24$, so $6 \times 40 = 240$. Therefore 6 multiplied by what equals 6?

$$\begin{array}{r}
 \square \color{red}{1} \\
 \times \square 6 \\
 \hline
 2 6 \\
 8 0 \\
 \hline
 1 6 6
 \end{array}$$

Now we can look at the second line of the answer, which tells us that $41 \times \square = 820$. If you know your doubles and halves you can see that double 41 is 82 and therefore $41 \times 20 = 820$.

Chunking Method

Calculate $364 \div 7$

- Requires children to know their times tables and multiply by 10.

$364 \div 7$ Use your knowledge of $7 \times$ tables to know that $35 \div 7 = 5$, $350 \div 7 = 50$


350 $50 \times 7 = 350$ Subtract this from 364

14 $2 \times 7 = 14$ Add up the numbers multiplied by 7

$$364 \div 7 = 52$$

Or if you are less confident with your $7 \times$ table you can count up in 70s until you get close to 364.

Write in the missing numbers in this multiplication grid.

 ×	5	<input type="text"/>	<input type="text"/>
4	20	36	32
<input type="text"/>	35	63	56
<input type="text"/>	30	54	48

Level 4

- Requires children to know both their times tables and division facts quickly.

Explain why a number which ends in '3' **cannot** be a multiple of 4

- Children must be able to explain what they know about multiplication and use their knowledge of number facts. This is the beginning of being able to *prove* mathematical ideas.
- Children must know the meaning of the word multiple.

Possible answers:

- No number that ends in 3 can be in the 4 times table, because all multiples of 4 end with 4, 8, 2, 6 or 0.
- Any number that ends in '3' is an odd number and all multiples of 4 are even numbers.

Calculate 602×57

x	600	0	2	
50	30 000	0	100	$6 \times 5 = 30$, $60 \times 5 = 300$, $600 \times 5 = 3\ 000$ so $600 \times 50 = 30\ 000$
7	4 200	0	14	$6 \times 7 = 42$, $60 \times 7 = 420$, so $600 \times 7 = 4\ 200$
	34 200	0	114	Add up the columns, preferably by using mental methods.
	34 314			

Calculate $848 \div 16$

$$848 \div 16$$

$$800 \quad 16 \times 50 = 800 \quad 16 \times 10 = 160, \text{ so } 16 \times 20 = 320, \text{ so } 60 \times 40 = 640, \text{ so } 16 \times 50 = 800$$

$$48 \quad 16 \times 3 = 48 \quad \text{Subtract 800 from 848}$$

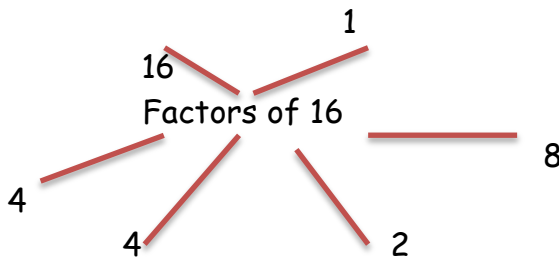
Add up the number of times that you have multiplied 16.

$$848 \div 16 = 53$$

Or use known facts to make it easier -

$$848 \div 16 = \frac{848}{2} \div \frac{16}{2} = \frac{424}{2} \div \frac{8}{2} = \frac{212}{2} \div \frac{4}{2} = 106 \div 2 = 53$$

Or use factors:



Knowing the factors of 16, we can choose an easy pair to divide by, so 4 and 4. We would first divide by 4

$$848 \div 4 = 212$$

And then that answer by 4 again.

$$\begin{array}{r} 212 \div 4 \\ 200 \quad 12 \end{array} \quad 200 \div 4 = 50 \quad 12 \div 4 = 3, \text{ so } = 53$$

Reasoning questions can lead to algebra by Year 6.

Liam thinks of a number.



He **multiplies the number by 5** and then **subtracts 60** from the result.

His answer equals the number he started with.

What was the number Liam started with?

- Use known facts

You know that $12 \times 5 = 60$, so it must be close to 12.

You know that all multiples of 5 end with a 5 or a 0,

Therefore when you multiply by 5 the answer will end with 5 or a 0.

So when you subtract 60 it must also end with a 5 or a 0. Therefore the answer is 15, double check it to make sure you are correct.

- Trial and improvement - you know $12 \times 5 = 60$, so start with 12.

$$(12 \times 5) - 60 = 60 - 60 = 0$$

$$(13 \times 5) - 60 = 65 - 60 = 5$$

$$(14 \times 5) - 60 = 70 - 60 = 10$$

$$(15 \times 5) - 60 = 75 - 60 = 15$$

- Algebra

Encourage children to write out the problem as a calculation, so call the number he thinks of n . When he multiplies n by 5 it would be $5n$,

$$5n - 60 = n$$

$$5n = n + 60$$

$$4n = 60$$

$$n = 15$$

(+ 60)

(-n)

(\div 4)



So the beginning calculation would be $5n - 60 = n$


When dealing with equations it is essential that the same process be done to both sides of the equation, so encourage children to write out what they are doing at each step.

Tip - keep the equals sign in the same place to show the balance element of the equation.


Ways to help learn the times tables

Use doubling:

When you know your 2x table you can double it for your 4x and double again for your 8x.

$$3 \times 2 = 6 \quad \text{so} \quad 3 \times 4 = 12 \quad \text{and} \quad 3 \times 8 = 24$$


Double and double again

$$7 \times 3 = 21 \quad \text{so} \quad 7 \times 6 = 42$$


Use triangles to show the inverse:

$$\begin{array}{ccc} & 10 & \\ \div & \triangle & \div \\ 2 & & 5 \\ & \times & \end{array}$$

$$\begin{array}{ccc} & 12 & \\ \div & \triangle & \div \\ 3 & & 4 \\ & \times & \end{array}$$

So if you know 2×5 , you also know $10 \div 5$ etc.