Blackmore Calculation Guidance

This guidance has been developed to show progression in number/place value and calculation (addition, subtraction, multiplication and division) and how this works in line with the National Curriculum. The consistent use of the CPA (concrete, pictorial, abstract) approach helps develop mastery across all the operations in an efficient and reliable way. This document aims to provide a greater understanding of what our maths curriculum looks like in the classroom and what the expectation is for our pupils.

Class 1

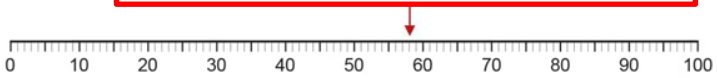
Blackmore Calculation Guidance

Can you count within 100, forwards and backwards, starting with any number?

100 square

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

Number lines & Number tracks



Which numbers come before/after a specific number?

67	68			71						

Can you complete the missing numbers?

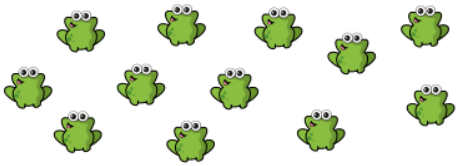
0	1	2	3	4	5	6	7	8	9	10

We always include 0 in our number tracks.

Objects

4 + 3 = 7

Can you circle 8 frogs?



How many more cherries does Rosie have than Dora?

Who has the most cherries?

Year 1 Maths Curriculum

In year 1, pupils learn to recite number names fluently forwards and backwards to 100. They will learn to identify and represent numbers using objects and pictures, such as dice and dominoes.

100 square & Number line

These resources support pupil's counting skills. By using a 100 square or number line, children are drawn to pay attention the patterns in the number system, such as counting in multiples of 10.

Number tracks are very useful to help pupils to add and subtract successfully by counting on and counting back.

Objects

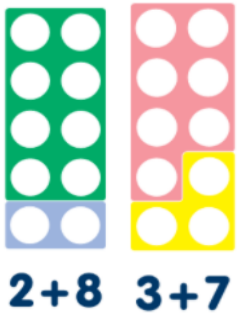
Concrete objects are used regularly in year 1 in order for pupils to count, add, subtract, group and share effectively in their learning.

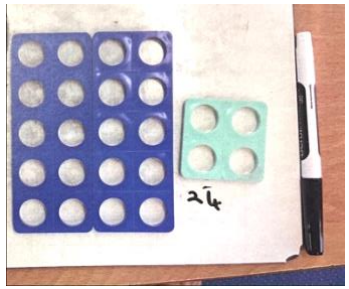
When adding two numbers together using cubes, pupils are encouraged to use two different colours – they can see how two parts come together to make the whole.

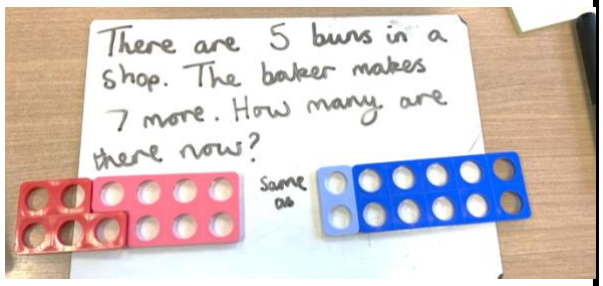
Pupils learn to compare and reason mathematically about groups of objects.

Blackmore Calculation Guidance

Numicon

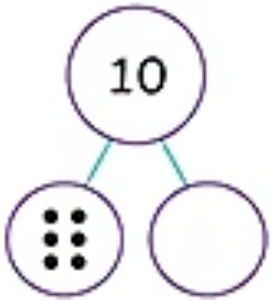




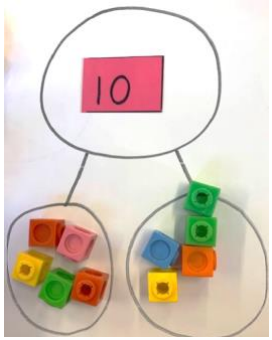


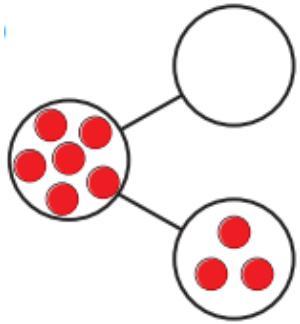
Part Whole Model

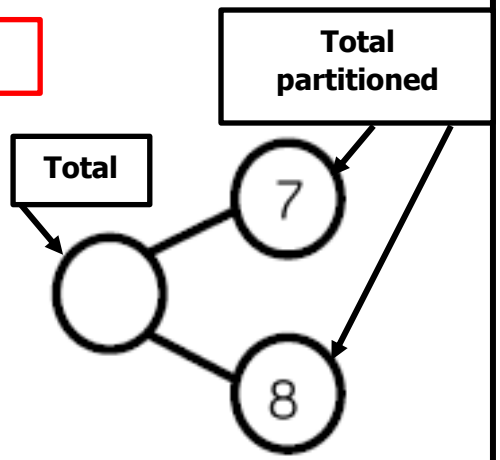
10 = 6 + 4

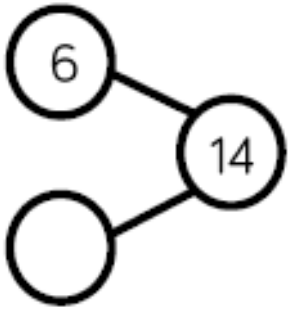


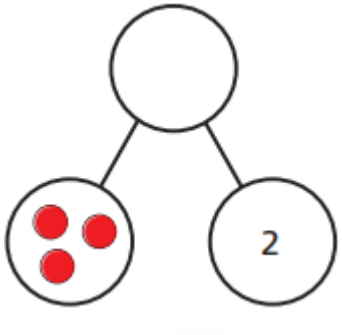
10 = 5 + 5











Numicon

Numicon is used to explore aggregation, partitioning, number bonds and doubling. Our pupils become competent users of Numicon in Reception and continue to use these skills to subitise the total in year 1. Their familiarity of the shapes helps them to recognise patterns between numbers, for example place value patterns or consider why odd numbers are odd and even numbers are even. When adding numbers, children can see how the parts come together to equal the total. When subtracting numbers, children start with the whole and then overlay the shape they are subtracting to find out how many is left.

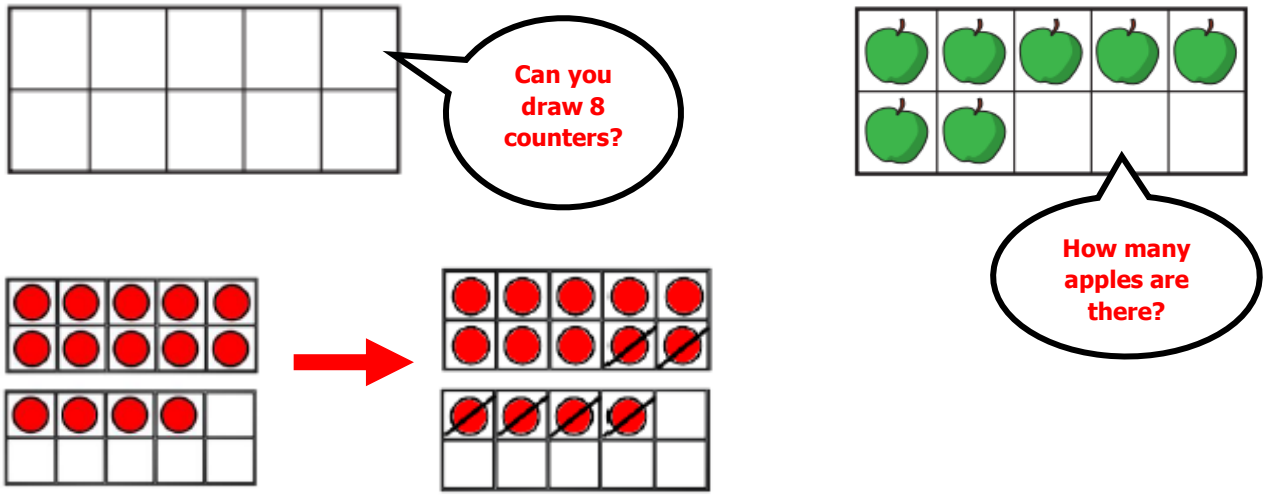
Part Whole Model

The part whole model supports pupil's understanding of place value and partitioning. The part whole model is represented in a variety of ways; using images, concrete resources, numicon or numbers.

Pupil's learn to compose quantities of two (and sometimes three) parts. When the parts are complete and the whole is empty, children use aggregation to add the parts together to find the total. When the whole is complete and at least one of the parts are empty children use partitioning (a form of subtraction) to find the missing part.

Blackmore Calculation Guidance

Ten Frame



Ten Frame

The ten frame supports children's addition and subtraction skills. They are used to support pupil's fluency to recall addition and subtraction facts to 10 (and beyond.) Fluency in number facts to 10 allows pupils to more easily master addition and subtraction with 2-digit numbers in year 2, and underpins all future calculation.

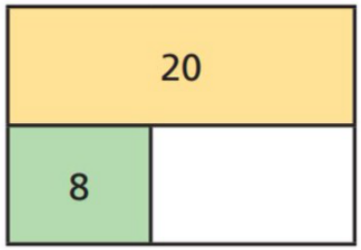
By combining ten frames together, children can explore place value beyond 10 and practise adding and subtracting beyond 10.

When the ten frame is used to add two numbers together, different coloured counters are used to represent the number problem clearly.

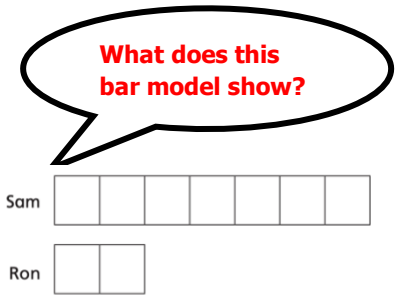
As pupils progress through the year 1 curriculum, the ten frame is used to combine multiples of ten. They should leave year 1 understanding that when objects are grouped equally, it is more efficient to skip count than to count in ones. Recognising that a group of 5, for example, can be treated as a single unit is called unitising, and is the basis of multiplicative reasoning.

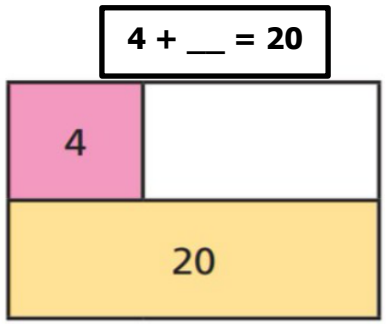
Blackmore Calculation Guidance

Bar Model

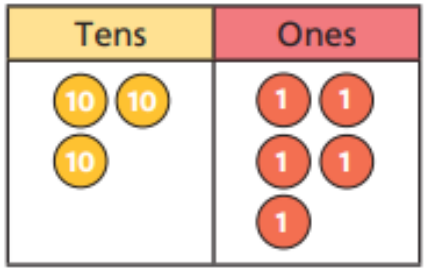


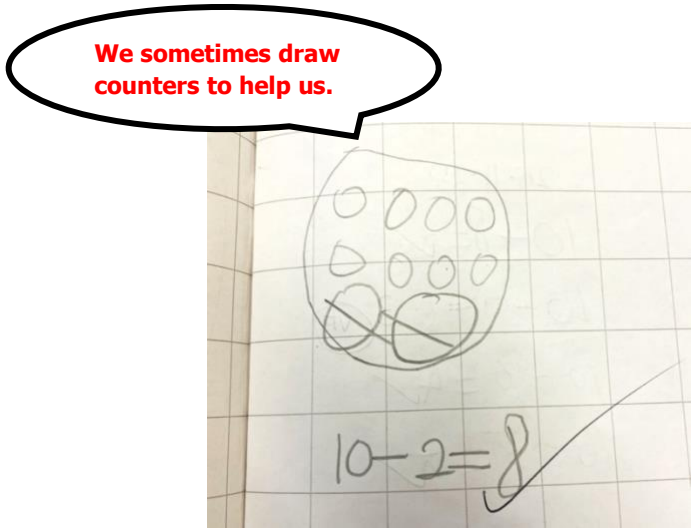
20 – 8 = ____



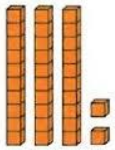


Place Value Counters

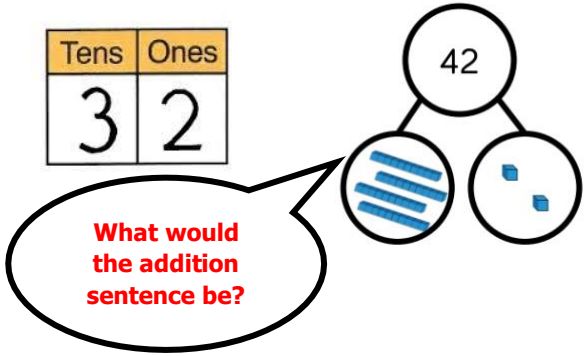


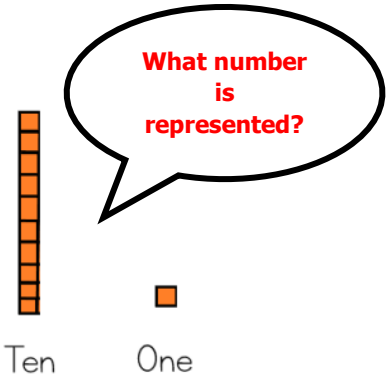


Base Ten



Tens	Ones
3	2





Bar Model

A bar model can be used to represent addition problems, as well as a number of other aspects of maths. The top bar usually represents the total and the children are taught to understand that the bottom parts need to add to make the total, although this can be reversed. This helps children work out subtraction problems.

Place Value Counters: Place value counters and place value grids are useful tools for pupils to work mathematically through place value problems, such as addition and subtraction. Place value counters are used in a similar way to base ten, except the counter is the same size and the number is printed on it.

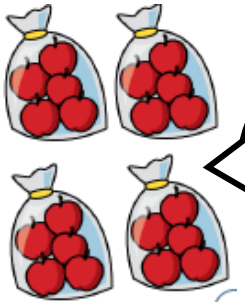
Base 10 Equipment:

Base 10 equipment exposes the structures of numbers. In year 1 it can be used to help pupils determine place value, solve addition and subtraction problems and to partition numbers.

Pupils will learn to add and subtract numbers using concrete objects, pictorial representations, and mentally, including: a two-digit number and ones, a two-digit number and tens, two two-digit numbers and adding three one-digit numbers.

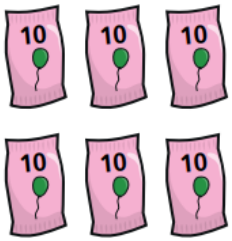
Blackmore Calculation Guidance

Multiplication & Division



Can you write a repeated addition statement to match this representation?

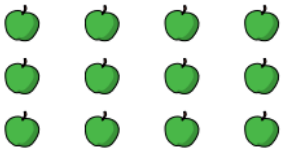
How many muffins are there altogether?



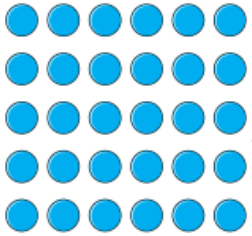
How many spots are there altogether?

Tom needs 70 balloons. Does he have enough?

Arrays



Can you share the apples between 4 boxes?



Can you share the counters between 5 friends?

Multiplication & Division

In year 1 pupils use concrete and pictorial maths to carry out repeated addition. This is a vital stage in a pupil's maths development that then supports them understanding the structure of multiplication and division.

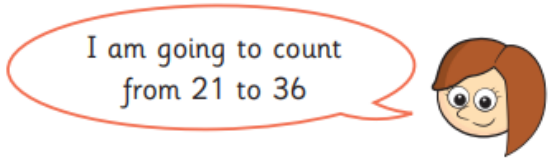
In year 1, pupils learn to count in multiples of 2s, 5s and 10s. This skill prepares them for the year 2 maths curriculum. In year 2, pupils are taught the multiplication sign formally and are expected to recall and use multiplication and division facts confidently for the 2, 5 and 10 multiplication tables.

An Array

An array is an arrangement of objects in rows or columns. Arrays are used to help pupils understand multiplication and division.

In year 1, arrays are used to help pupils share equally into groups. Sharing equally into groups helps children to understand the structure of division.

Blackmore Calculation Guidance



Will Rosie say the number 29?

How do you know?

Use the digit cards.

0	1	2	3	4	5	6

Make a number greater than 25

Make a number less than 72

Make a number greater than 59

Talk about your answers.

Mo and Kim each have some marbles.

a) How many marbles does Mo have?

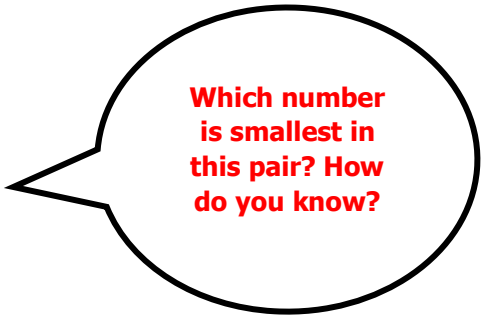
b) How many marbles does Kim have?

c) Who has more marbles?

How do you know?

Tens	Ones
4	6

Tens	Ones
5	1

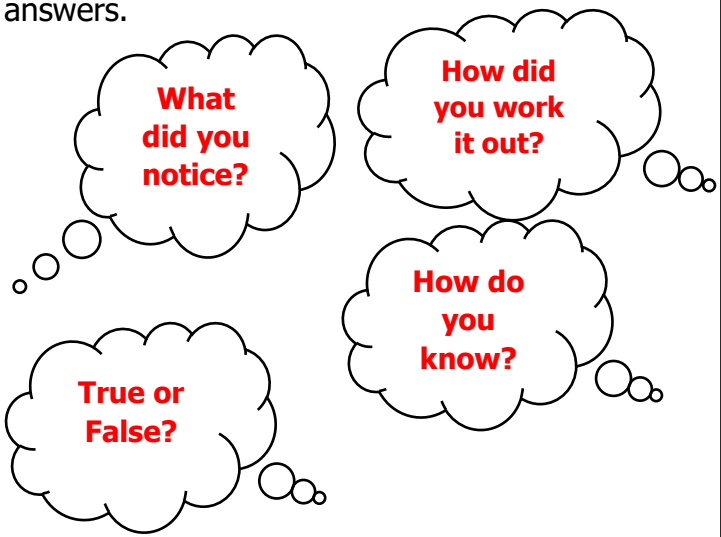


Problem Solving & Reasoning

Pupils are encouraged to draw on their mathematical knowledge to solve one or two step number problems.

They will encounter a range of mathematical problems that involve using concrete, pictorial and abstract representations.

Pupils are encouraged to talk about their maths verbally in class discussions. With the support of the class teacher, pupils are always encouraged to use mathematical vocabulary to explain their answers.



Acknowledgements:

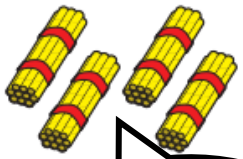
Some representations have been taken from White Rose Maths, NCETM and Twinkl. These are a sample of questions that the children use in class.

Class 2

Blackmore Calculation Guidance

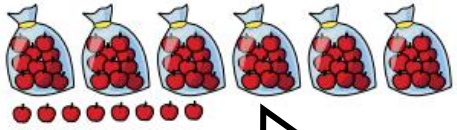
Groups of objects

4 tens = 40



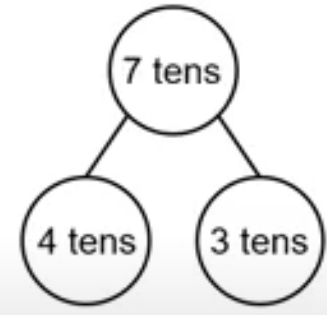
How many straws are there?

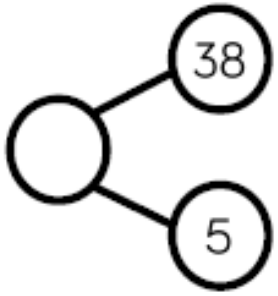
4 tens and 1 one is 41

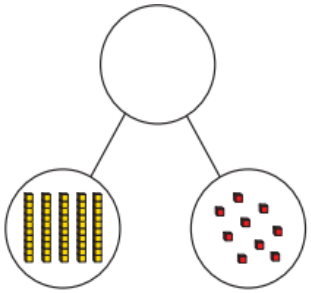


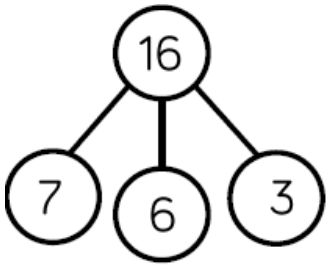
How can you count this?

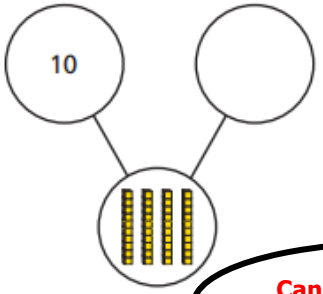
Part Whole Model

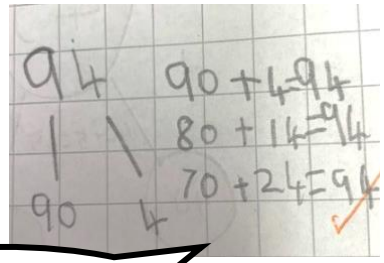












Can we represent it in different ways?

The Year 2 Maths Curriculum

In year 2, pupils learn to work mathematically and solve problems with two-digit numbers. They use concrete, pictorial and abstract maths to develop their understanding of place value.

Groups of objects:

These concrete and pictorial representations support pupil's understanding of tens and ones. They will explore how to solve problems by counting in multiples of 2s, 5s, and 10s.

Part Whole Model:

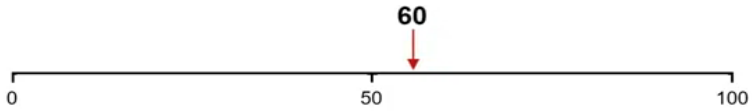
The part whole model can be represented using images, concrete resources or numbers. Pupils learn to compose quantities of two or more parts.

When the parts are complete and the whole is empty, children use aggregation to add the parts together to find the total. When the whole is complete and at least one of the parts are empty pupils use partitioning (a form of subtraction) to find the missing part. There are various ways that a part whole model can be represented.

When pupils add three single digit numbers, they should be encouraged to look for number facts to help them solve the problem more efficiently, for example doubles or number bonds.

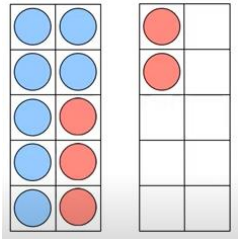
Blackmore Calculation Guidance

Number lines & Number tracks

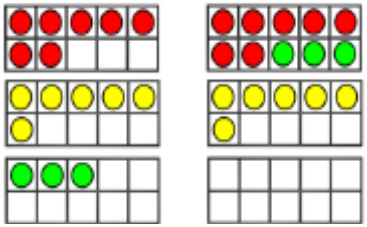


Can you count in steps of 3?

Ten Frame

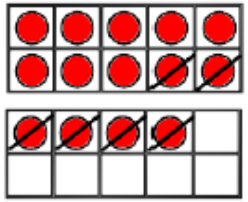


7 + 5 = 12

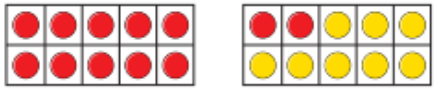


7 + 6 + 3 = 16

Can you recall and use addition and subtraction facts to 20 fluently?



14 - 6 = 8



12 + 8 = 20

Number lines and Number tracks

Number lines and number tracks develop pupil's counting, sequencing and estimating skills. They learn to label numbers on labelled and partially labelled numbered number lines.

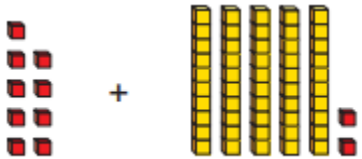
They are also useful to help pupils solve addition and subtraction problems, count forwards and backwards and count in steps of 2,3,5 and 10.

Ten Frame

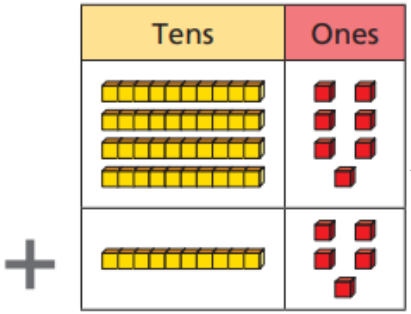
The ten frame supports pupil's understanding of the different structures of addition and subtraction**.** By combining ten frames together, they can explore addition and subtraction beyond 10. When multiple ten frames are used, pupils begin to explore place value in more depth (numbers beyond 20).

Blackmore Calculation Guidance

Base 10 Equipment

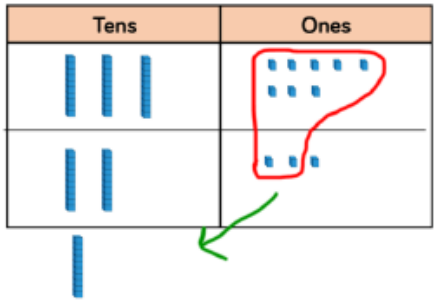


9 + 52 =



47 + 15 =

Base 10 equipment set out in this place value grid helps children to see the structure of each two-digit number before they begin the calculation.

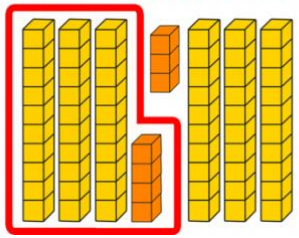


$$\begin{array}{r} 38 \\ +\ 23 \\ \hline 61 \\ \hline 1 \end{array}$$

Why did you make an exchange in this calculation?

With Base Ten, children begin with their amount and subtract the cubes. They might sometimes draw this as lines and dots.

67 - 33 = 34



Base 10 Equipment:

Base 10 equipment exposes the structures of numbers. In year 2 it can be used to help pupils determine place value, solve addition and subtraction problems, to partition and to exchange. Our pupils become familiar with these concrete resources and progress to representing them pictorially.

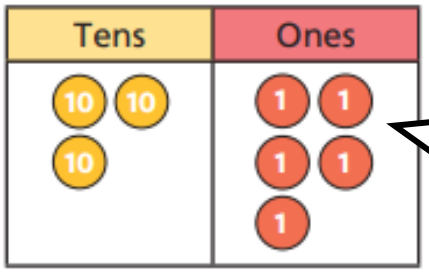
Pupils will learn to add and subtract numbers using concrete objects, pictorial representations, and mentally, including: a two-digit number and ones, a two-digit number and tens, two two-digit numbers and adding three one-digit numbers.

As pupils learn to add and subtract larger numbers crossing multiples of 10, they also learn to exchange.

Pictorial Representations: In year 2, our pupils become confident in using pictures to represent their maths. Through securing their understanding of place value using concrete resources they move onto solving number problems independently using pictures.

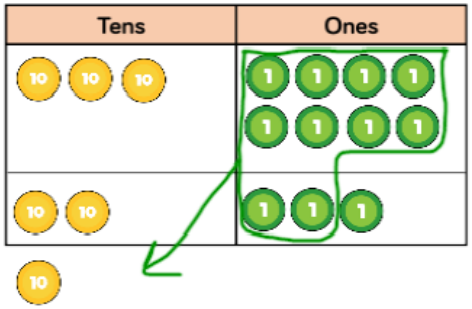
Blackmore Calculation Guidance

Place Value Counters & Place Value Grids

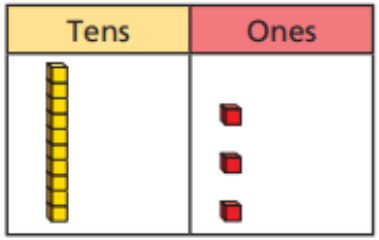


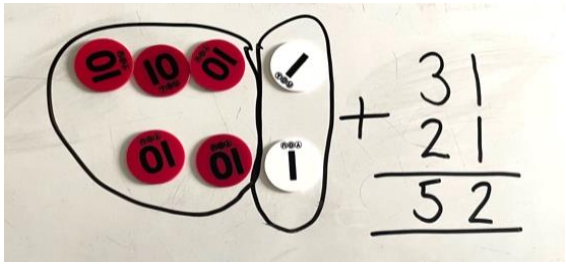
What number is being represented here?

38 + 23 =

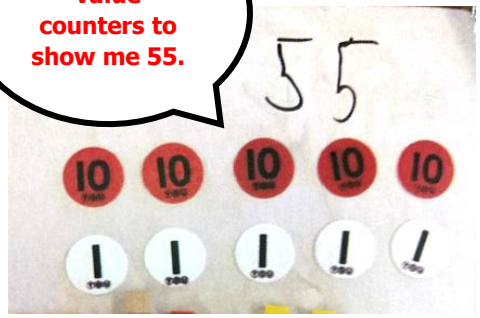


Can you complete the place value grid to show number 47?

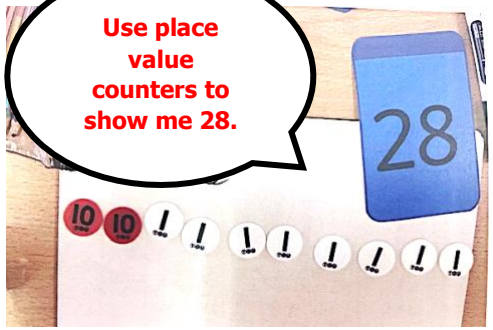




Use place value counters to show me 55.



Use place value counters to show me 28.



Place Value Counters: Place value counters and place value grids are useful tools for pupils to work mathematically through place value problems, such as addition and subtraction. As pupils learn to add and subtract larger numbers crossing multiples of 10, they also learn to exchange. This creates the foundation for children to carry out column addition and subtraction.

Children learn to see clear links between the concrete, pictorial and abstract processes.

Blackmore Calculation Guidance

Multiplication & Division

Here is an array.

Calculations

5 + 5 + 5 =15

3 x 5 = 15

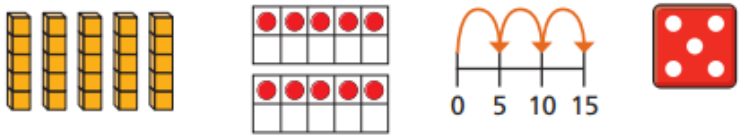
5 x 3 = 15

Can you write a multiplication to match this array?

How much would it costs to buy 4 trains?

How many cookies are there altogether?

Can you match the picture to the correct multiplication fact?



3 × 5 2 × 5 1 × 5 5 × 5

An Array

An array is an arrangement of objects in rows or columns. Arrays are used to help pupils understand multiplication and division facts. Pupils will learn to match an array with multiplication, division, and repeated addition statements.

Multiplication

In year 2, pupils will recall and use multiplication facts for the 2, 5 and 10 multiplication tables.

They will use these facts across of a range of contexts in Maths, including problem solving.

When pupils know these multiplication facts confidently, it frees up their working memory so that they can solve problems more efficiently.

Blackmore Calculation Guidance

Multiplication & Division

Can you share the sweets equally between the party bags?

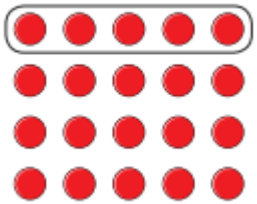
There are 10 muffins.

There are ☐ muffins in each group.

There are ☐ groups.

10 ÷ 2 = ☐ ☐ × 2 = 10

Can you solve this word problem? What do you notice about the division and multiplication facts?



☐ × 5 = 20

20 ÷ 5 = ☐

Can you complete the number sentences for each array?

Tommy has 100 stickers for his sticker book.

He can fit 10 stickers on each page.

How many pages can Tommy fill?

Can you solve this word problem? What do you notice about the division and multiplication facts?

Division

In year 2, pupils are introduced to the division symbol formally. They will recall and use division facts for the 2, 5 and 10 multiplication tables.

They will use these facts across of a range of contexts in Maths, including problem solving.

When pupils know these division facts confidently, it frees up their working memory so that they can solve problems more efficiently.

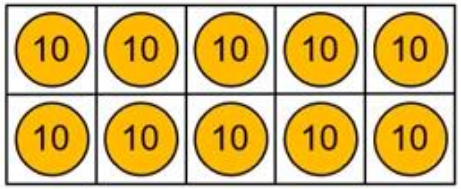
Acknowledgements:

Some representations have been taken from White Rose Maths, NCETM and Twinkl. These are a sample of questions that the children use in class.

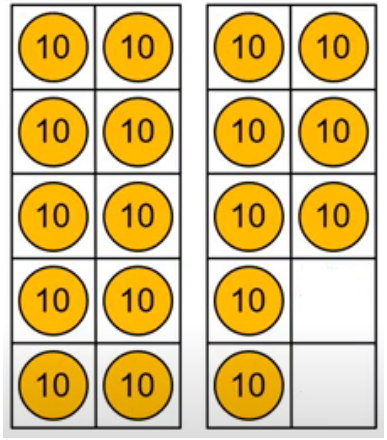
Class 3

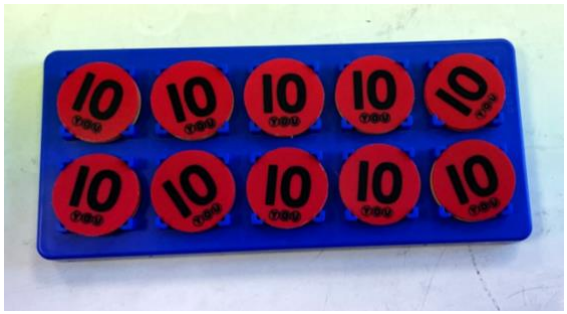
Blackmore Calculation Guidance

Ten Frame



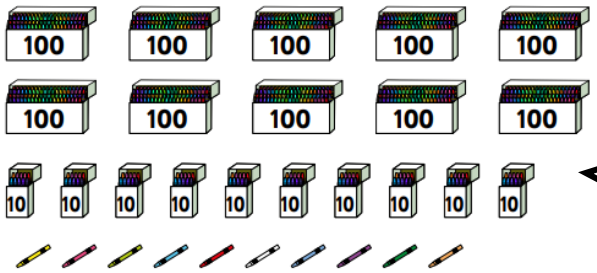
Did you know that 10 lots of 10 is equivalent to 100?





What is 18 lots of ten is equal to ....?

How many sweets are there?



Can you circle 316 crayons?

The Year 3 Maths Curriculum

In year 3, our pupils continue to build on mastering their maths skills from key stage 1. They are equipped with a better understanding of place value from using a variety of concrete resources in key stage 1. They continue to apply these skills to represent and solve problems with three-digit numbers.

Ten Frame

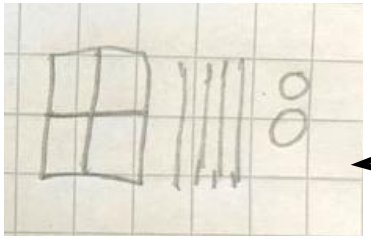
Using multiple ten frames and place value counters enables pupils to work with increasing confidence with numbers beyond 100, showing an increasing awareness and understanding of three-digit multiples of ten.

Pupils will need to be able to discuss, compare and sequence numbers to a 1000 confidently.

They learn to count confidently in multiples and apply this skill when solving pictorial maths problems.

Blackmore Calculation Guidance

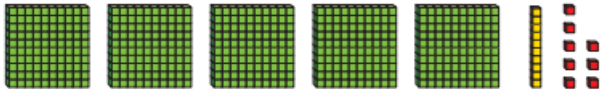
Base 10 Equipment

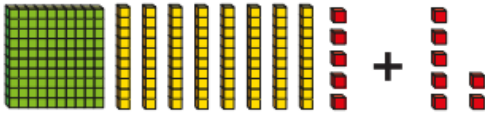


142

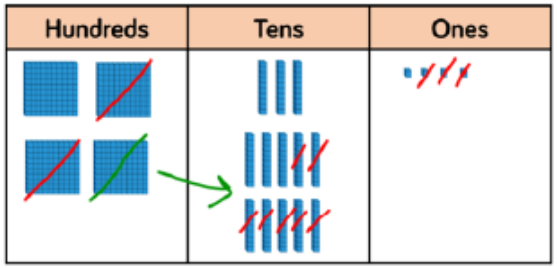
Here a pupil has completed a calculation. They have represented their maths pictorially.

This represents 418? True or False?

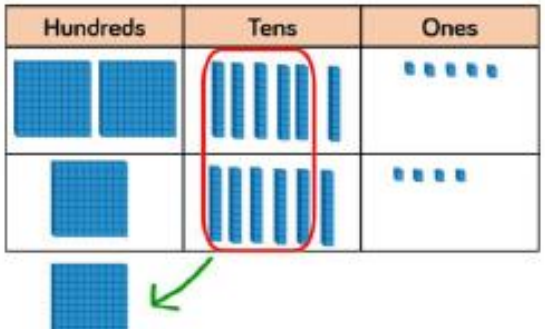




Can you complete the calculation?



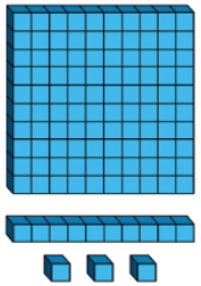
$$\begin{array}{r} {}^{3}\not{4}{}^{1}35 \\ -\ 273 \\ \hline 262 \end{array}$$



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

Base 10 Equipment:

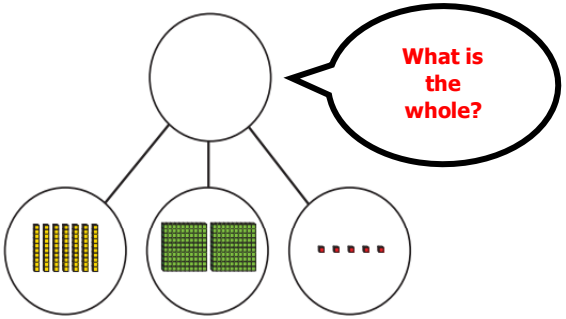
Base 10 equipment exposes the structures of numbers. In year 3, pupils use base 10 equipment efficiently to represent the value of 100, 10 and 1.

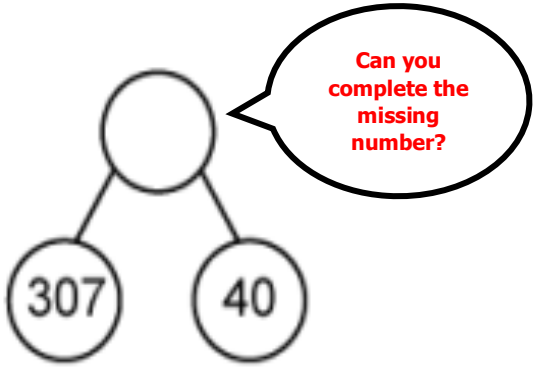


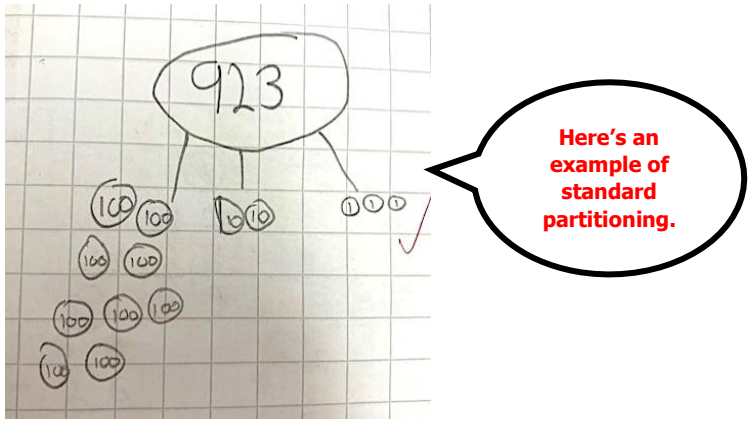
In year 3, pupils will learn to add and subtract using a formal method. They will explore this through using concrete resources first and then progress to a written method. As they add and subtract three-digit numbers, they will cross multiples of 10. They learn to do this by making an exchange. Base 10 is an excellent manipulative in order for children to be able to calculate three-digit numbers concisely.

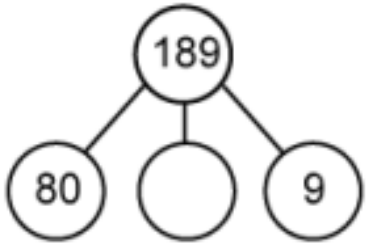
Blackmore Calculation Guidance

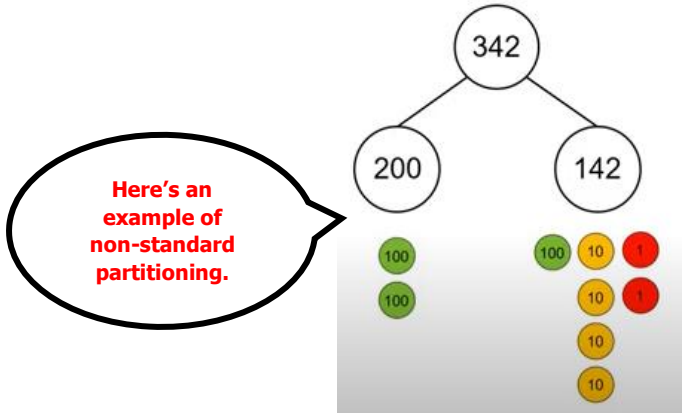
Part Whole Model

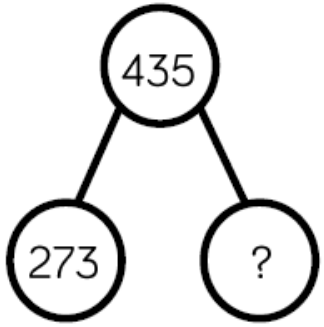












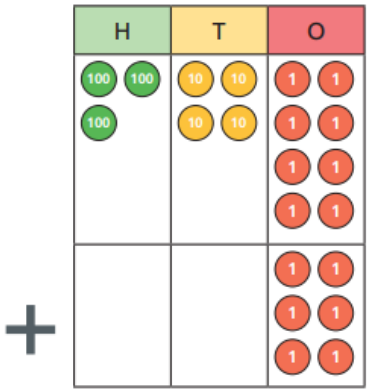
Part Whole Model:

The part whole model can be represented using images, concrete resources or numbers. Pupils learn to compose quantities of two or more parts. When the parts are complete and the whole is empty, pupils use aggregation to add the parts together to find the total. When the whole is complete and at least one of the parts are empty pupils use partitioning (a form of subtraction) to find the missing part.

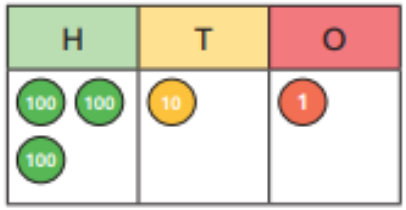
Pupils will learn to expand their understanding of three-digit numbers; they will compose and decompose three-digit numbers using a part whole model. They will partition numbers using standard and non-standard partitioning.

Blackmore Calculation Guidance

Place Value Counters

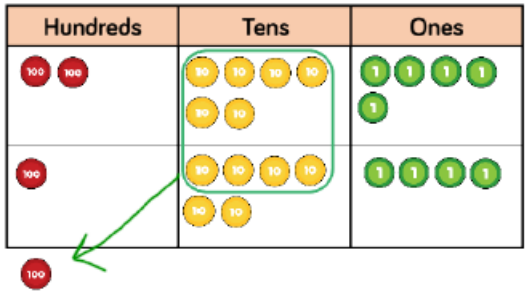


Here's an example of a place value grid and place value counters being used to add two numbers together using the column method. In this calculation the pupil will need to make an exchange.

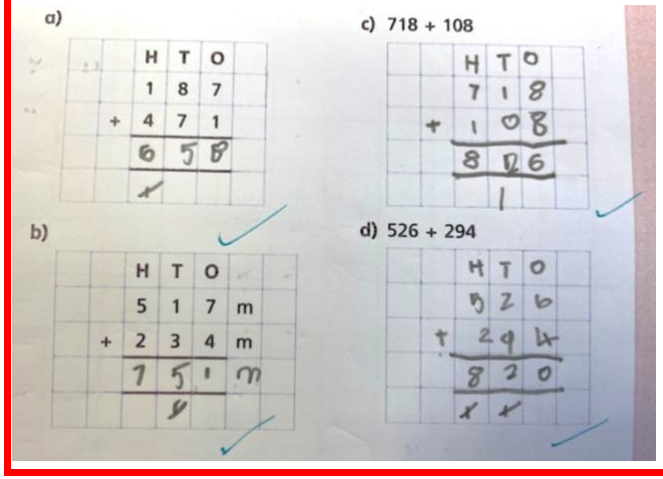


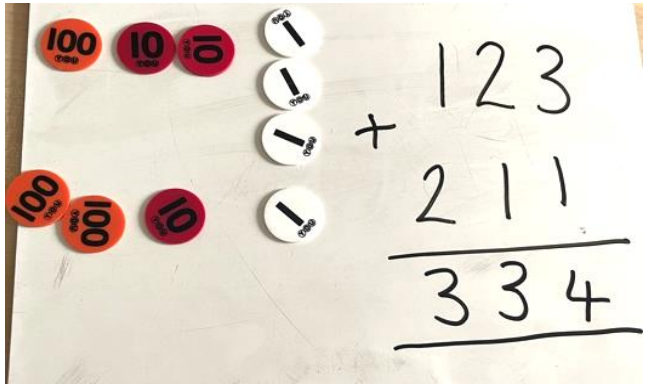
317 – 7 =

In this calculation the pupil will need to make an exchange.



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





Place Value Counters

Place value counters are a well-used resource in year 3 and make an excellent tool to support pupil's mathematics.

By using a place value grid and place value counters, the value of each digit is very explicit. Place value counters (as well as Base 10) are an excellent manipulative for pupils to use in order to add and subtract three-digit numbers concisely.

As pupils develop a secure understanding of place value, they learn to add and subtract numbers mentally, including: a three-digit number and ones, a three-digit number and tens, a three-digit number and hundreds.

Blackmore Calculation Guidance

Problem Solving & Reasoning

Ron is thinking of a number.

My number has an even number of tens. There are 2 more hundreds than there are ones. One of the digits is a 6

Circle the numbers that Ron could be thinking of.

286	462	385
614	604	328

8 × 8 is greater than two lots of 4 × 8

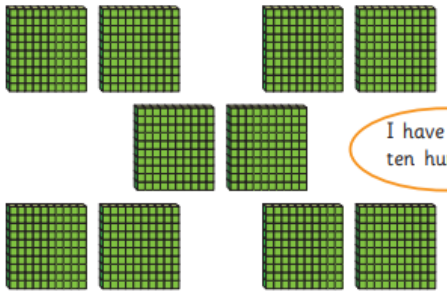
Dora wants to buy a new computer.

She has saved £287

Each month she saves another £100

How many more months will it take Dora to save enough to buy the computer?

Jack makes this number.



I have made ten hundred.

Is Jack correct?

6 lots of 3 is 6 more than 5 lots of 3

Do you agree with Dora?

Is this true or false? How do you know?

Problem Solving & Reasoning

As pupils develop a secure understanding of place value and number, they develop the ability to reason mathematically and solve multi-step number problems.

They will encounter a range of mathematical problems that involve using concrete, pictorial and abstract representations.

Pupils are encouraged to talk about their maths verbally in class discussions. With the support of the class teacher, pupils are always encouraged to use mathematical vocabulary to explain their answers.

True or False?

Can you prove it?

Is that true sometimes, always or never?

How do you know that?

Blackmore Calculation Guidance

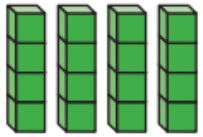
Multiplication & Division

What do you notice?

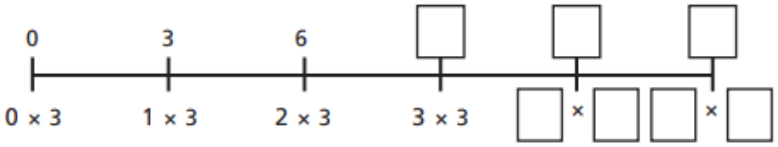
How many pencils are there altogether?

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

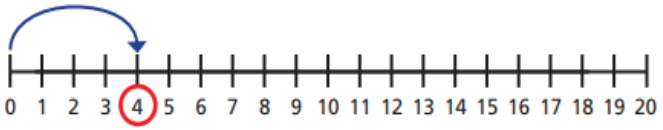
Complete the number sentence.



4 × 3 = ☐



Complete the number line.



Can you circle all of the numbers in the 4 times tables?

Which numbers divide exactly by 8? How did you work that out?

23 28 32 64 65

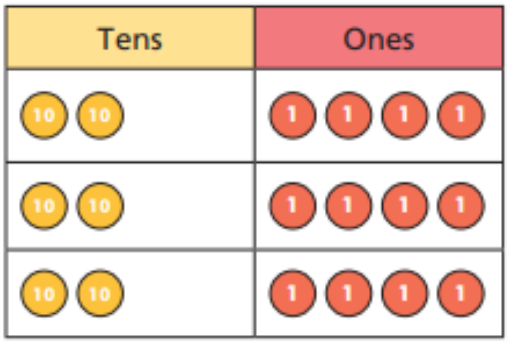
Multiplication & Division

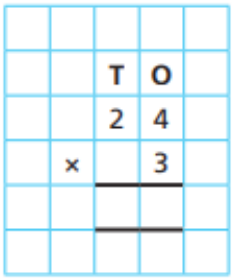
In year 3, pupils will learn to recall the 2, 5, 10, 4, 8 and 3 multiplication tables, as well as know the corresponding division facts. They use and apply this knowledge across a range of contexts.

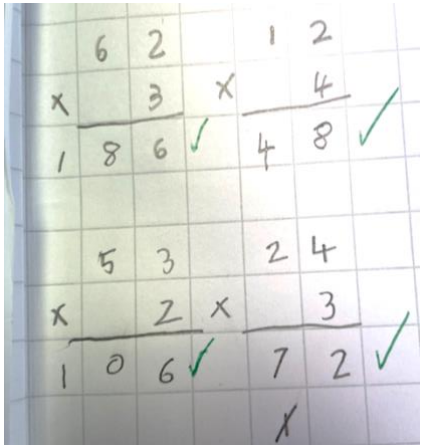
Pupils are encouraged to solve problems by counting in multiples. When a pupil knows their multiplication facts fluently, they are able to solve multiplication and division problems more efficiently.

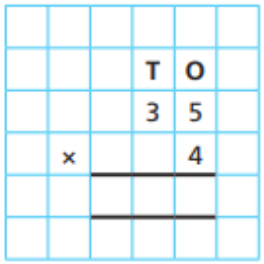
They will be taught to look for patterns in the multiplication tables, for example noticing how the multiples in the 8 times tables is double the multiples in the 4 times tables.

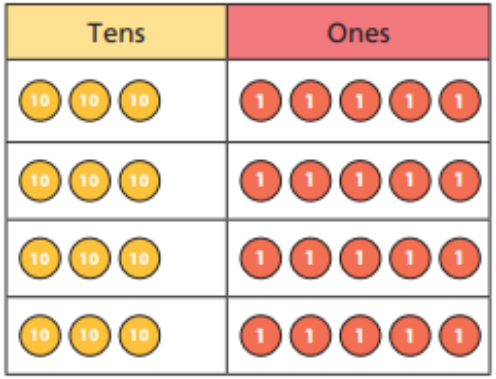
Blackmore Calculation Guidance



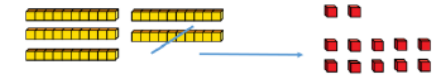








$52 \div 4 = 13$



Multiplication & Division

In year 3, pupils will learn to multiply two-digit numbers by one-digit numbers using concrete and pictorial representations and then progressing to a written formal method.

Place value counters and Base 10 are excellent tools for pupils to use when multiplying and dividing.

By using maths manipulatives first, pupils will have a greater understanding of the abstract process (written formal methods.)

Acknowledgements:

Some representations have been taken from White Rose Maths, NCETM and Twinkl. These are a sample of questions that the children use in class.

Class 4

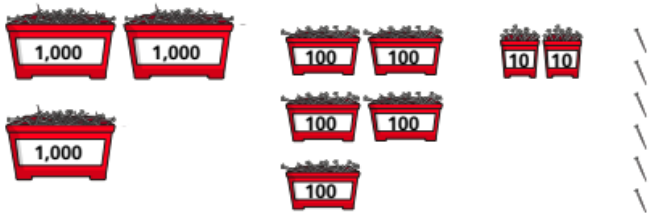
Blackmore Calculation Guidance

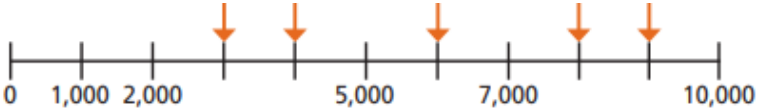
Place Value, Addition & Subtraction

2,000	3,000			6,000		
9,000		7,000		5,000		

Can you complete the number tracks?

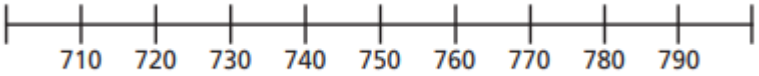
How many nails are there?





What numbers are the arrows pointing to?

Can you label 733 on the number line?



Can you round this number to the nearest 100?

Year 4 Maths Curriculum

In year 4, pupils will practise counting forwards and backwards to numbers up to and including 4 digits. This includes negative numbers beyond 0.

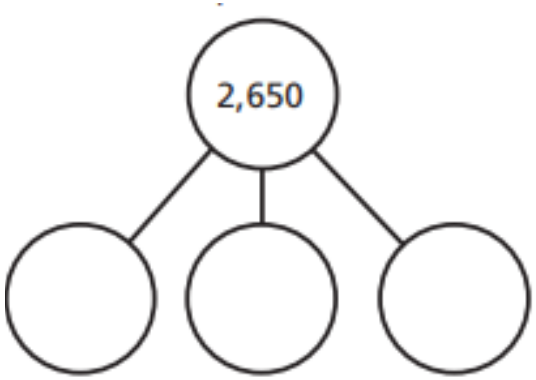
They will learn to identify the place value of each digit in a four-digit number. They will learn to combine units of ones, tens, hundreds and thousands to compose four-digit numbers and partition four-digit numbers.

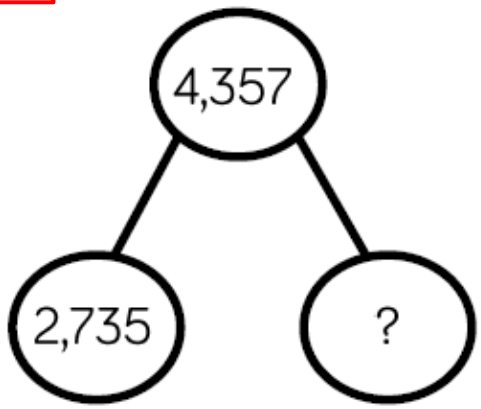
They will learn to recognise and write numbers in words up to 4-digits.

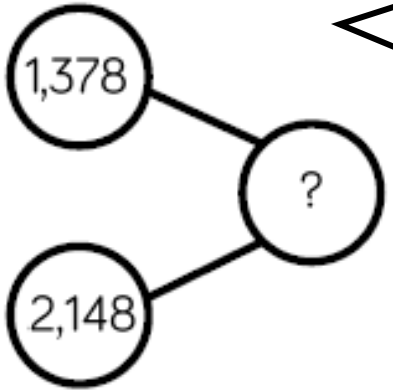
They will reason mathematically about four-digit numbers in a linear number line and learn to round numbers to the next 10, 100 or 1000.

Blackmore Calculation Guidance

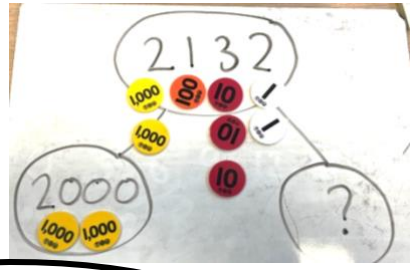
Part Whole Model



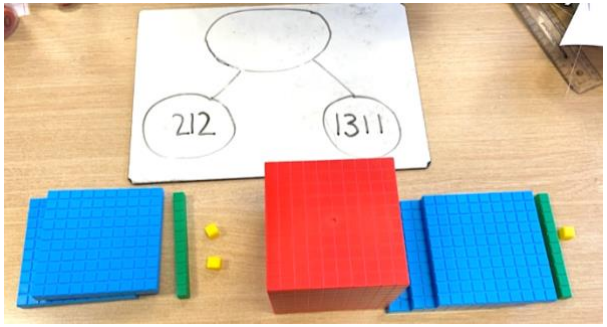


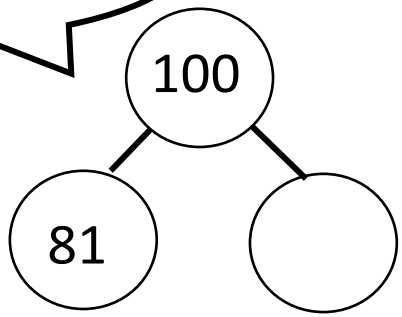


Can you complete the part whole models?



Here is an example of a non-standard partition. Can you fill in the missing number?





Part Whole Model

Pupils will learn to partition four-digit numbers in a standard and non-standard way and carry out related addition and subtraction facts.

The part whole model can be used to partition a number into two or more parts or to partition numbers into place value columns. When the parts are complete and the whole is empty, pupils use aggregation to add the parts together to find the total. When the whole is complete and at least one of the parts are empty pupils use partitioning (a form of subtraction) to find the missing part.

This can be partitioned in several ways, for example- 2,650 can be partitioned in to:

Standard:

2000, 600, 50, 0

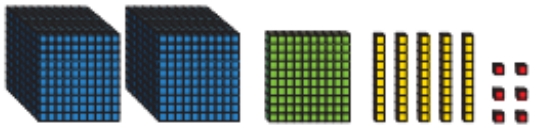
Non-Standard:

1600, 1000, 25, 25

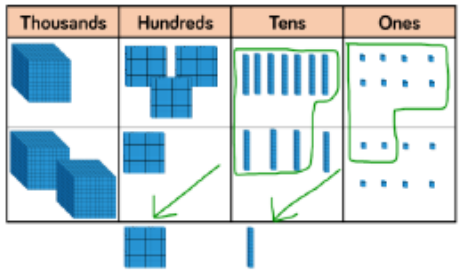
2000, 530, 120, 0.

Blackmore Calculation Guidance

Base 10

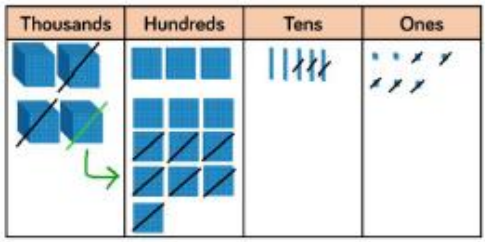


2,156 = 2,000 + ☐ + ☐ + ☐



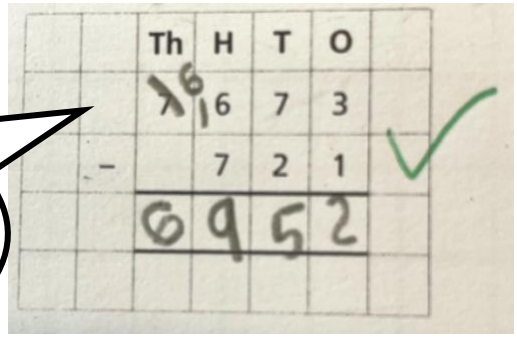
	1	3	7	8
+	2	1	4	8
	3	5	2	6
	1	1		

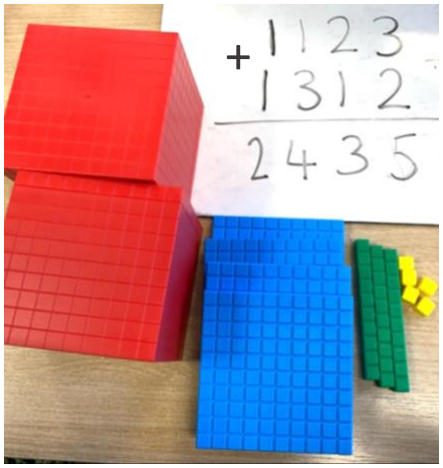
In both calculation's the pupil has made an exchange.



3 1
4357
− 2735
1622

This is how formal subtraction is written. The exchanges are demonstrated by crossing through and 'carrying' over.





Base 10

Base 10 is a very effective manipulative for pupils to use when calculating four-digit numbers as it clearly exposes the structure of place value. A place value grid can be used with the manipulatives to enhance children's understanding of place value during the calculation process.

Pupils continue to build on their maths experiences from year 3 (calculating three-digit numbers using Base 10) by exploring the use of the 1000 block and how to use the manipulatives to calculate four-digit numbers accurately.

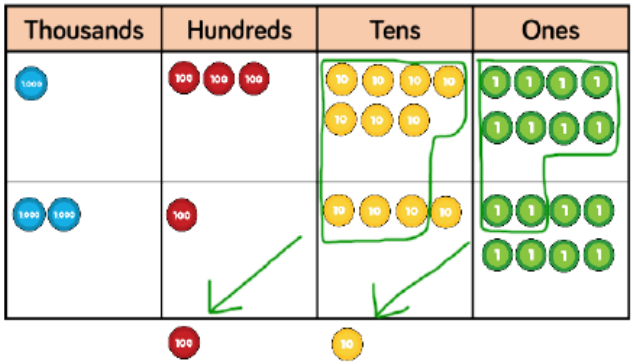
Pupils will learn to record addition and subtraction of four-digit numbers using a formal written method. By this stage in their learning pupils will have greater understanding of the exchange process – they will explore this in greater detail in year 4 as they exchange between hundreds and thousands.

Using manipulatives alongside their written formal methods enables pupils to see links between the two processes.

Exchange: Change a number or expression for another of an equal value.

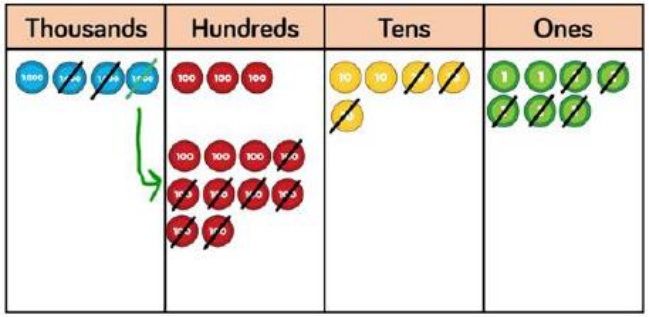
Blackmore Calculation Guidance

Place Value Counters



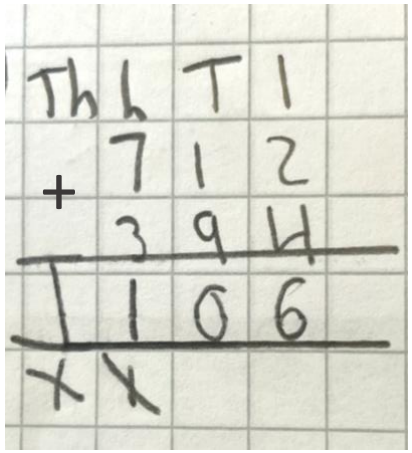
	1	3	7	8
+	2	1	4	8
	3	5	2	6
		1	1	

In both calculation's the pupil has made an exchange.



$$\begin{array}{r} {}^{3}\not{4}\,{}^{1}357 \\ -\ 2735 \\ \hline 1622 \end{array}$$

Place value counters are used before and alongside formal methods.



Place Value Counters & Flip Stands

Place value counters are another very effective manipulative for year 4 pupils to use when calculating four-digit numbers. Unlike Base 10, it clearly exposes the structure of place value and can be used with a place value grid.

Children often use flip stands to demonstrate their understanding, particularly when adding 10, 100 or 1000.

They will explore the manipulatives thoroughly before moving to a written formal method. Using manipulatives alongside their written formal methods enables pupils to see links between the two processes; this is a critical stage in children's maths development.

Blackmore Calculation Guidance

Problem Solving & Reasoning

Who has the smallest amount of drink? Explain how you know.

Talk about your findings with a partner.

Alex has 4 digit cards.

1	2	7	9

She makes a 4-digit number.

Her number has 7 thousands and 1 ten.

What numbers could Alex have made?

There are 10 teams with 7 players on each team.

There are 10 red flowers and 7 yellow flowers.

There are 7 ten frames with 10 counters in each.

Which statement is the odd one out? Explain how you know.

Problem Solving & Reasoning

As pupils develop a secure understanding of place value and four-digit numbers, they develop the ability to reason mathematically and solve multi-step number problems.

They will encounter a range of mathematical problems that involve using concrete, pictorial and abstract representations.

Pupils are encouraged to talk about their maths verbally in class discussions. With the support of the class teacher, pupils are always encouraged to use mathematical vocabulary to explain their answers.

True or False?

Can you prove it?

Is that true sometimes, always or never?

How do you know that?

Blackmore Calculation Guidance

Multiplication & Division

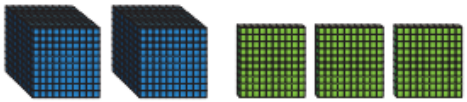
Can you write a calculation to match the images?

Balloons come in bags of 10

Huan has 130 balloons.

How many bags does he have?

Teddy makes 2,300 using base 10



Complete the sentences.

2,300 = 2 thousands + ☐ hundreds

1 thousand = ☐ hundreds

2 thousands = ☐ hundreds

Teddy has ☐ hundreds altogether.

2,300 ÷ 100 = ☐

Make 3,700 using base 10

Complete the sentences.

3,700 = 3 thousands + ☐ hundreds

3 thousands = ☐ hundreds

There are ☐ hundreds altogether.

3,700 ÷ 100 = ☐

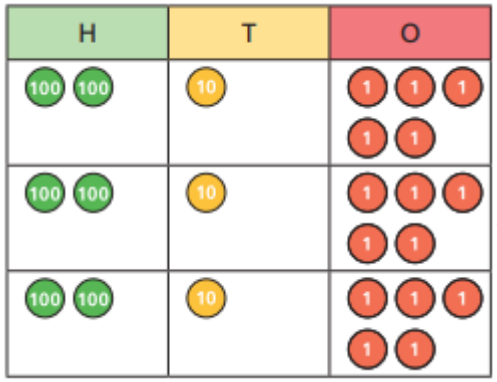
Multiplication & Division

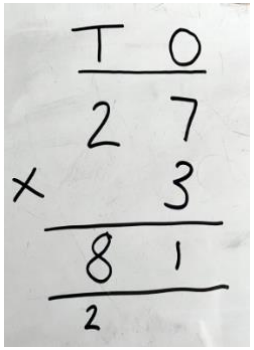
In year 4, pupils will learn to multiply and divide whole numbers by 10 and 100. They will learn to apply a scaling approach; knowing that by multiplying a number by 10 makes the number 10 times the size and by dividing the number by ten makes the number one-tenth of the size.

The same rule applies when multiplying and dividing by 100; by multiplying a number by 100 makes the number 100 times the size and by dividing the number by 100 makes the number one-hundredth of the size. This process will prepare pupils for learning about decimals in year 5.

Blackmore Calculation Guidance

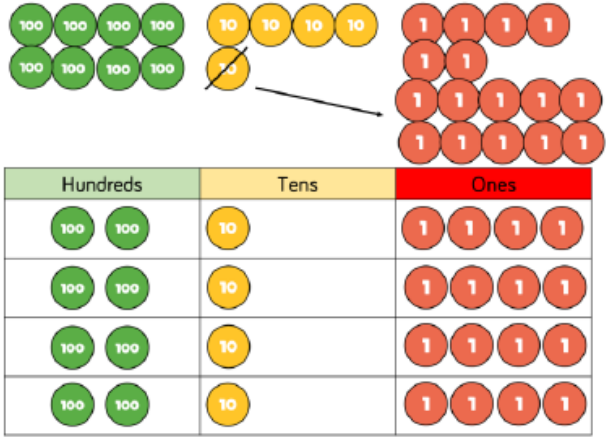
Multiplication & Division





Rosie works out 4 × 37 using a written method.

		H	T	O						
			3	7						
	×			4						
			2	8			(7	x	4)	
		1	2	0		(3	0	x	4)	
		1	4	8						



Calculate 856 divided by 4

Notice how the pupil needed to make an exchange in the calculation in order to be able to share 856 equally – exchanging one ten for 10 ones.

Multiplication & Division

In year 4, pupils will learn to become fluent in using a formal written method to multiply two-digit and three-digit numbers by a one-digit number. They will also learn to divide two-digit and three-digit numbers by a one-digit number.

They will use maths manipulatives to explore these calculations first, before learning to record their maths formally.

Here, a formal method is being used. We call it the 'short method'.

Step 1: Begin on the right- 3x7=21

Step 2: Carry over the 2 tens, put the 1 in the ones column.

Step 3: 2 x 3 = 6

Step 4= Add the 2 tens to the 6

Step 5: Place your answer in the box.

The children also learn long multiplication, which is the next step from linear multiplication.

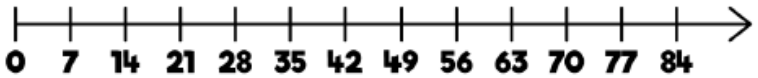
When dividing pupils start with the place value counters outside of the grid before sharing them equally into the rows. This method helps to highlight the exchange process and any remainders, consequently developing their understanding and precision when recording division formally.

Blackmore Calculation Guidance

Times tables

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

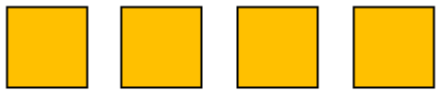
What do you notice about the pattern of odd and even numbers in the 7 times tables?

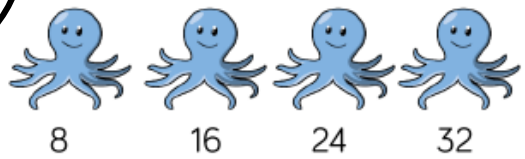


1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

What do you notice about the tens and ones in the 11 times tables?

What do you notice about the multiples in the 4 and 8 times tables?





Times tables

In year 4, pupils are expected to recall the multiplication tables to 12 x 12, including corresponding division facts. They will practise their multiplication skills daily so that they are able to develop fluency and precision. Pupils will be encouraged to count and chant in multiples, as well as encounter a variety of mathematical representations. They will explore multiplication and division using maths manipulatives and be encouraged to look for and discuss patterns and links.

Through exploring multiplication and division using maths manipulatives and looking for patterns and links, pupils continue to enhance their fluency and understanding. For example, using the 100 square or a number line to notice patterns in the tens and ones.

Pupils will be encouraged to discuss whether multiples are odd or even and how they can use this information to aid their memory.

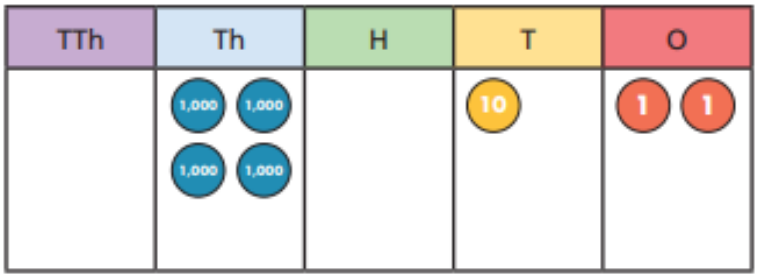
Fluency in multiplication is particularly important for pupil's progression to the year 5 maths curriculum.

Acknowledgements:

Some representations have been taken from White Rose Maths, NCETM and Twinkl. These are a sample of questions that the children use in class.

Class 5

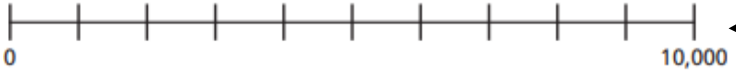
Blackmore Calculation Guidance



What numbers are being represented?

Circle the numbers that round to 12,000 when rounded to the nearest 1,000

12,475 **11,780** **12,399** **12,111** **11,999** **11,501**



Draw an arrow to show 2554 on the number line.

What is the value of 3 in each number?

a) 387
b) 5,306
c) 7,903
d) 307,612
e) 531,476
f) 603,956

Which decimals round to 2?

6.32 **6.23** **6.27** **6.17** **6.12** **6.25**

Year 5 Maths Curriculum

In year 5, pupils learn to read, write, order and compare numbers to at least 1,000,000 and determine the value of each digit. They will learn to count forwards and backwards to 1,000,000 and round any number to the nearest 10, 100, 1000, 10,000 and 100,000. Pupils will also learn to round any number up to 1,000,000 to the nearest 10, 100, 1000, 10,000 and 100,000.

They will use concrete manipulatives, pictorial and abstract maths in their learning in order to develop fluency and precision in number and place value and to calculate across the four operations (addition, subtraction, multiplication and division.)

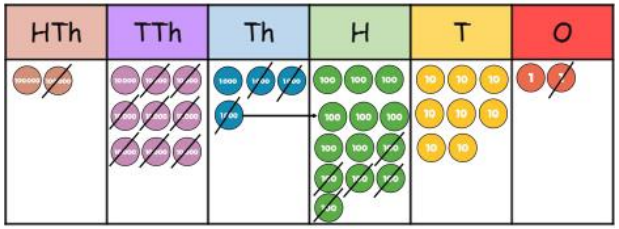
In year 5, pupils expand their place value knowledge to include one-tenths and one-hundredths. They will learn to combine tenths and hundredths and write the numeral in digits using a decimal point.

Blackmore Calculation Guidance

Addition, Subtraction, Multiplication & Division

Place value counters are an effective manipulative for children to use alongside their calculations. Place value counters and place value grids are used to enhance children's understanding of place value so that they can exchange between the columns, particularly when calculating numbers beyond 4-digits or decimal numbers.

	2	9	$^{3}\not{4}$	$^{1}3$	8	2
−	1	8	2	5	0	1
	1	1	1	8	8	1



A football stadium holds 2,214 people.

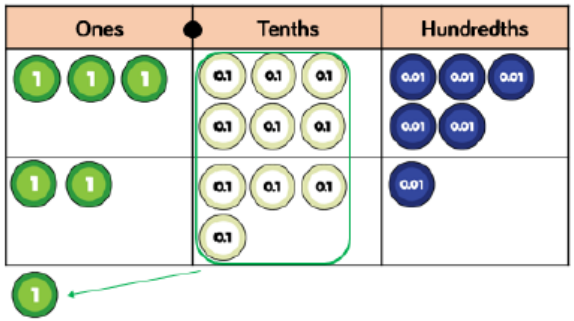
The stadium is full for 4 matches in a row.

What was the attendance for all 4 matches?

			2	2	1	4
	×					4

Place value counters can be used alongside word problems.

The attendance for all 4 matches was ☐



$$\begin{array}{r} 3.65 \\ +\ 2.41 \\ \hline 6.06 \\ \hline 1 \end{array}$$

Addition, Subtraction, Multiplication & Division

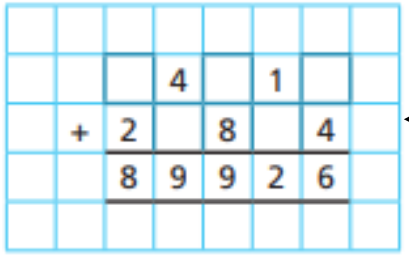
In year 5 pupils will learn to add and subtract whole numbers with more than 4-digits using a formal written method. They will also add and subtract increasingly larger numbers mentally and use rounding to check their answers to calculations and determine, in the context of a problem, levels of accuracy.

Pupils will learn to multiply numbers with up to 4-digits by a one or 2-digit number using a written formal method, including long multiplication for 2-digit numbers. They will multiply and divide numbers mentally drawing upon known facts. They will divide numbers up to 4-digits by a 1-digit number using the formal written method of short division and interpret remainders. They will also multiply and divide whole numbers and those involving decimals by 10, 100 and 1000. They will identify multiples and factors, including finding all factor pairs of a number and common factors of two numbers.

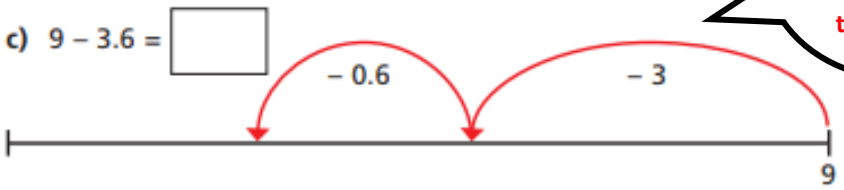
At this stage in their learning, our pupils are equipped with and have acquired the skill of using a variety of mathematical manipulatives in order to carry out calculations and solve problems efficiently. By the time pupils reach year 5, they are able to determine whether they require manipulatives, which manipulatives to use and to use them accordingly as and when needed. They will encounter a variety of multi-step problems in a variety of contexts and will need to decide which operations and methods to use and why.

Blackmore Calculation Guidance

The part whole model is used to encourage children to partition numbers into two or more parts or into their place value columns. When the parts are complete and the whole is empty, pupils use aggregation to add the parts together to find the total. When the whole is complete and at least one of the parts are empty pupils use partitioning (a form of subtraction) to find the missing part.

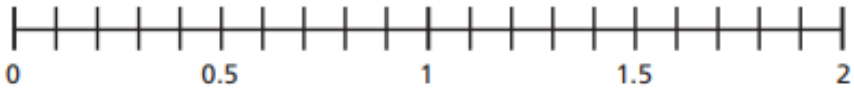


Complete the missing digits.



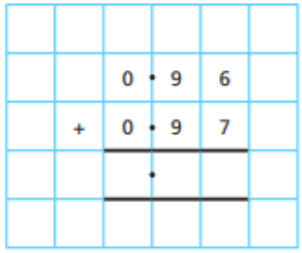
Use the number line to help you to calculate.

A number line is an effective tool for pupils to count on or count back. By year 5 pupils are familiar with a variety of styles; blank, numbered or partially numbered. It provides pupils with a structure in order to carry out calculations efficiently.



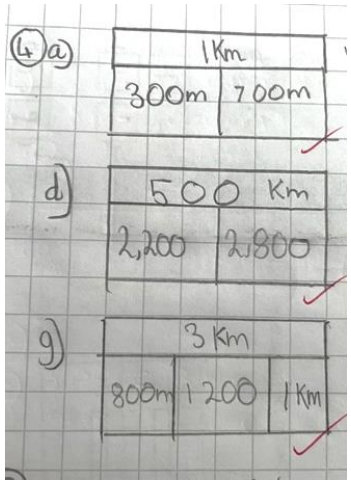
Use the number line to help you to calculate

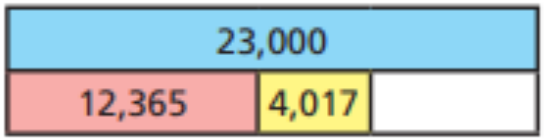
0.7 + 0.7 =



Pupils will use a written formal method to add and subtract decimal numbers.

Blackmore Calculation Guidance





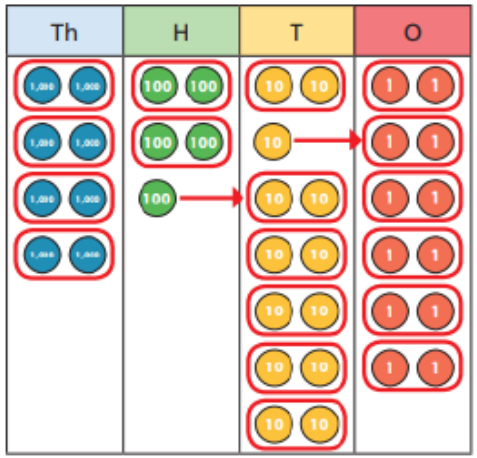
What is the missing value?

The bar model is used to represent calculations or solve problems. It supports a child's understanding of the relationship between addition and subtraction and multiplication and division.

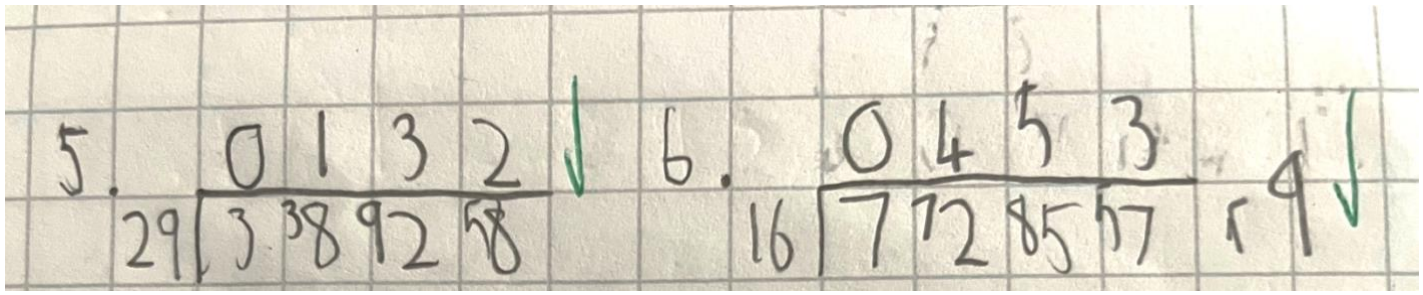
Diving 4-digits by 1-digit.

	4	2	6	6
2	8	5	1^{3}	1^{2}

Place value counters can be used to support pupils to divide 4-digit numbers. You can see that multiple exchanges took place. Pupils will be encouraged to move away from using manipulatives when dividing larger numbers with multiple exchanges.



Children then use a formal method of division. The method below is called the bus stop method/short division method.



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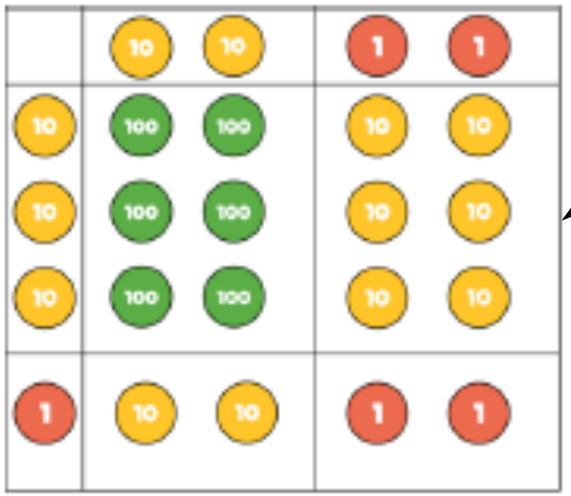


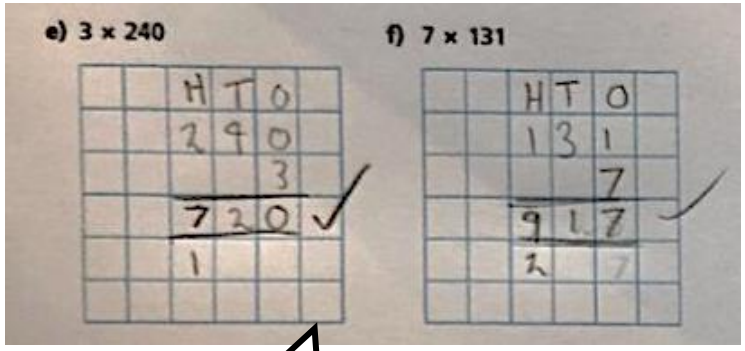
This is called the area/grid method. Each number is partitioned to enable children to multiply using smaller numbers.

When multiplying a multi-digit number, the area model (also known as the grid method) can be used. **Place value counters** can be used to support this process. It clearly exposes the structure of place value in the calculation and consequently enhances pupils understanding of the written formal method, long multiplication.

Children will then use their knowledge of times tables to multiply increasingly large numbers using short and long methods.

This method is called the 'long method' of multiplication. Children partition the number being multiplied (e.g. 1 x 22 then 30 x 22). They then add the two answers to get their total.

	H	T	O
		2	2
x		3	1
		2	2
	6	6	0
	6	8	2



We call this method the 'short method'. Children use columns to show this method.

We call this red 0 a place holder. It helps the children understand that the number is getting 10 times bigger.

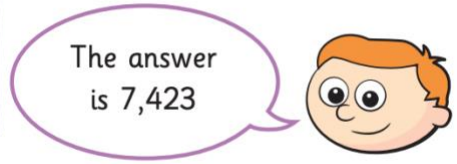
			4	3		
	×		1	3		
		1_1	2	9		(43 × 3)
		4	3	0		(43 × 10)

Blackmore Calculation Guidance

Problem Solving & Reasoning

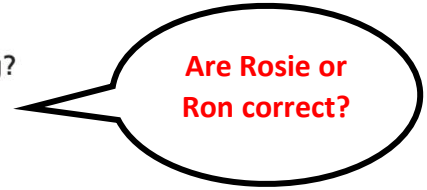
Ron is working out 7,423 × 0

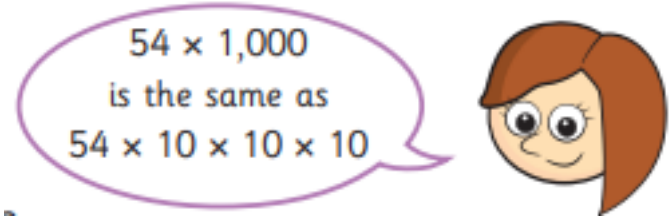
$$\begin{array}{r} 7\ 4\ 2\ 3 \\ \times \qquad 0 \\ \hline 7\ 4\ 2\ 3 \end{array}$$



Do you agree with Ron? _____

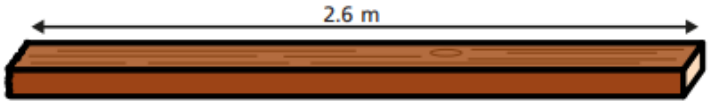
Did Ron have to use a column method? Is there a quicker way?





A plank of wood measures 2.6 m.

A carpenter cuts a piece of wood from the plank that is 0.52 m long.



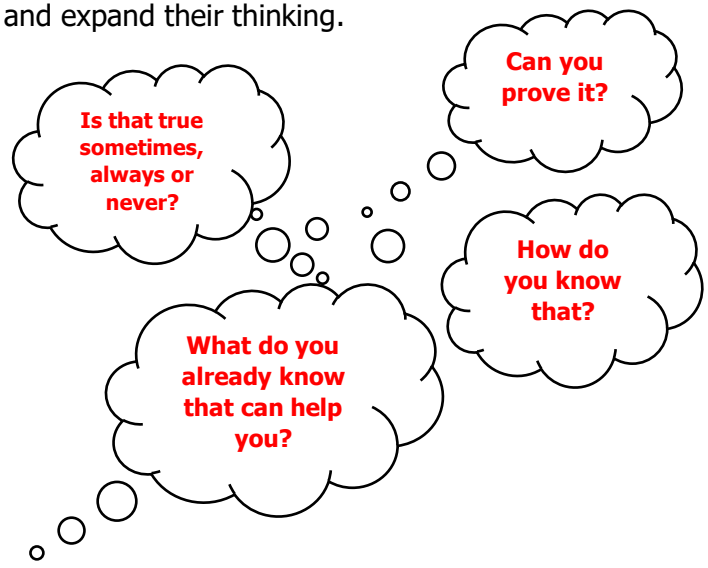
a) What is the length of the remaining plank?

b) The carpenter cuts a second piece of wood from the plank.
She now has 0.3 m of the plank remaining.
What is the length of the second piece of wood that she cut?

Problem Solving & Reasoning

In year 5 our pupils are encouraged to think deeply about their mathematics. They will encounter a variety of multi-step maths problems throughout year 5. These may involve concrete, pictorial and abstract representations.

Pupils are encouraged to talk about their maths verbally in class discussions. With the support of the class teacher, pupils are always encouraged to use mathematical vocabulary to explain their answers and expand their thinking.



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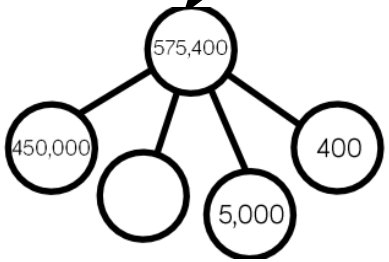
Class 6

Blackmore Calculation Guidance

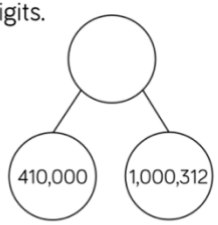
Fill in the missing numbers



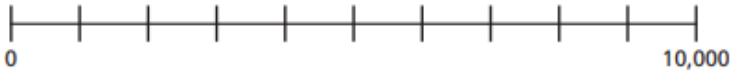
Match the representations to the numbers in digits.

One million, four hundred and one thousand, three hundred and twelve.

M	HTh	TTh	Th	H	T	O
●		●●	●	●●	●	●●



1,401,312 | 1,041,312 | 1,410,312



Draw an arrow to show 2554 on the number line.

What is the value of 3 in each number?

a) 387
b) 5,306
c) 7,903
d) 307,612
e) 531,476
f) 603,956

Start Number	Rounded to the nearest 10	Rounded to the nearest 100	Rounded to the nearest 1,000
			
			
DCCLXIX			

Which decimals round to 2?

6.32 6.23 6.27 6.17 6.12 6.25

Year 6 Maths Curriculum

In year 6, pupils learn to read, write, order and compare numbers to at least 10,000,000 and determine the value of each digit. They will learn to round any whole number (including Roman Numerals) to a required degree of accuracy and use negative numbers in context, whilst calculating intervals across zero. Pupils will also solve number and practical problems involving all of the above.

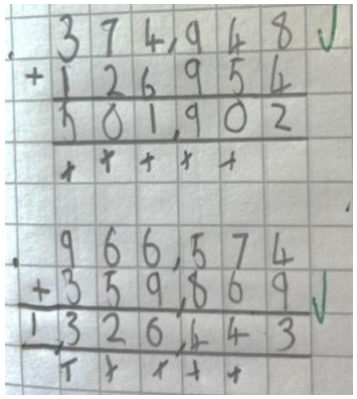
By year 6, pupils are expected to have a solid understanding of mathematical concepts, including fluency and precision in number, place value and the four operations. Using concrete and pictorial representations through KS1 and KS2 really supports this. Year 6 pupils are encouraged to use abstract methods to solve problems, although concrete/pictorial representations are available if needed.

In year 6, pupils expand their place value knowledge to include one-thousandths. They will learn to combine tenths and hundredths and write the numeral in digits using a decimal point.

Blackmore Calculation Guidance

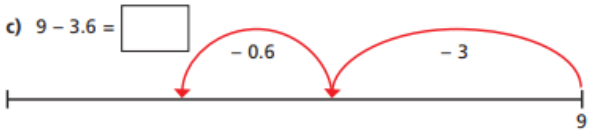
Addition & Subtraction

Formal Addition Method:



Formal Subtraction Method:

	2	9	3 ~~4~~	1 3	8	2
–	1	8	2	5	0	1
	1	1	1	8	8	1



Complete the missing digits.

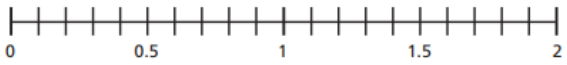
			4		1	
	+	2		8		4
		8	9	9	2	6

A number line is an effective tool for pupils to count on or count back. By year 6, pupils are familiar with a variety of styles; blank, numbered or partially numbered. It provides pupils with a structure in order to carry out calculations efficiently.

Use the number line to help you to calculate.

Use the number line to help you to calculate

0.7 + 0.7 =



$$\begin{array}{r} 3.65 \\ +\ 2.41 \\ \hline 6.06 \\ \hline 1 \end{array}$$

Addition & Subtraction

In year 6, pupils will continue to use formal methods to add and subtract whole numbers and decimal numbers.

They will use estimations to check answers to calculations and determine (in contact) an appropriate degree of accuracy, as well as performing mental calculations including mixed operations and increasingly large numbers.

In year 6, pupils will also solve addition and subtraction multi-step problems in context, deciding which operations and methods to use and why.

Blackmore Calculation Guidance

Multiplication & Division

Short Multiplication & Grid Method:

	Th	H	T	O
	1	3	2	5
×				4

Can you complete this calculation?

Example Question: 23 X 34

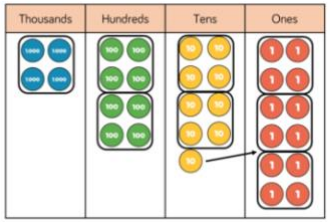
X	20	3
30	20 X 30 **600** Box 1	3 X 30 **90** Box 2
4	20 X 4 **80** Box 3	3 X 4 **12** Box 4

Box 1 600 + Box 2 + 90 = 690

Box 3 80 + Box 4 + 12 = 92

Boxes (1+2) 690 + Boxes (3+4) + 92 = 782

Short Division:



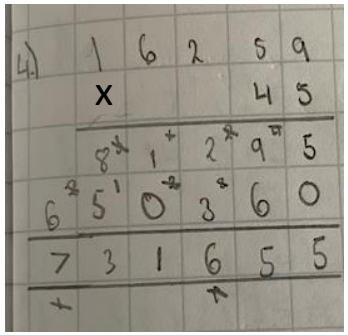
		1	2	2	3
	4	4	8	9	12

Long Multiplication:

		1	3	2
×			1	4
		5	2 (1)	8
	1	3	2	0

(132 × 4)

(132 × 10)



Long Division:

Long division

432 ÷ 15 becomes	432 ÷ 15 becomes	432 ÷ 15 becomes
2 8 r 12	2 8	2 8 · 8
1 5 | 4 3 2	1 5 | 4 3 2	1 5 | 4 3 2 · 0
3 0 0	3 0 0 15×20	3 0 ↓
1 3 2	1 3 2	1 3 2
1 2 0	1 2 0 15×8	1 2 0 ↓
1 2	1 2	1 2 0
	$\frac{12}{15} = \frac{4}{5}$	1 2 0
		0
Answer: 28 remainder 12	Answer: $28\frac{4}{5}$	Answer: 28·8

Multiplication & Division

Pupils will multiply multi-digit numbers up to a 4-digit number by a two-digit whole number using a formal method of short and long multiplication. When dividing up to 4-digit numbers by two-digit numbers, children will use a formal written method of both short and long division, as well as interpreting the remainders as whole numbers, fractions or by rounding, as appropriate for the context.

They will identify common factors, common multiples and prime numbers.

In year 6, pupils will encounter a variety of multi-step problems in a variety of contexts and will need to decide which operations and methods to use and why.

Blackmore Calculation Guidance

Fractions including Decimals & Percentages

$\frac{1}{2} + \frac{1}{3} = ?$

Find the LCM, convert the fractions so they have the same denominator and add the fractions.

$\frac{1}{2} \times\frac{3}{3} = \frac{3}{6}$ $\quad$ $\frac{1}{3} \times\frac{2}{2} = \frac{2}{6}$

$\frac{3}{6} + \frac{2}{6} = \frac{5}{6}$

$1\frac{1}{2} + 2\frac{1}{6} = 1\frac{3}{6} + 2\frac{1}{6} = 3\frac{4}{6} = 3\frac{2}{3}$

Alex is simplifying $\frac{8}{12}$ by dividing the numerator and denominator by their highest common factor.

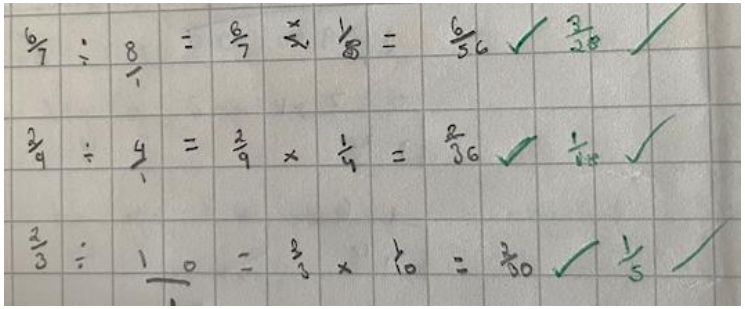
Factors of 8: 1, 2, 4, 8
Factors of 12: 1, 2, 3, 4, 6, 12
4 is the highest common factor.

$\frac{8}{12} = \frac{2}{3}$ (÷ 4 above and ÷ 4 below)

Use Alex's method to simplify these fractions:

$\frac{6}{9}$ $\quad$ $\frac{6}{18}$ $\quad$ $\frac{10}{18}$ $\quad$ $\frac{10}{15}$ $\quad$ $\frac{15}{50}$

To divide fractions by whole numbers, the children are encouraged to make the whole number a fraction.



Convert the mixed number to an improper fraction to multiply.

$2\frac{3}{5} \times 3 = \frac{13}{5} \times 3 = \frac{39}{5} = 7\frac{4}{5}$

Fractions including Decimals & Percentages

Pupils will compare and order fractions, including fractions above one. They will learn to convert between mixed number fractions (1 ½) and improper fractions (5/2). They will use common factors to simplify fractions and use common multiples to express fractions in the same denomination.

Pupils will add and subtract fractions with different denominators and mixed numbers, using the concept of equivalent fractions. They will also multiply simple pairs of proper fractions, writing the answer in its simplest form (4/4 x ¼ = 4/16 = ¼). They will also multiply fractions by whole numbers (1/2 x 5 = 5/2 = 2 ½). They will also divide proper fractions by whole numbers.

The pupils will identify fraction, decimal and percentage equivalents (2/10, 0.2, 20%) in different contexts.

They will continue to use their place value knowledge of decimals to multiply and divide numbers by 10, 100 and 1000, giving answers up to 3 decimal places. The pupils will multiply one-digit numbers with up to 2 decimal places by whole numbers using a formal multiplication method (1.32 x 4). They will solve problems which require answers to be rounded.

Blackmore Calculation Guidance

Problem Solving & Reasoning

At the start of June, there were 1,793 toy cars in the shop.

During June,

- 8,728 more toy cars were delivered
- 9,473 toy cars were sold.

How many toy cars were left in the shop at the end of June?

How do we solve a question with multi-steps?

9 Jack chose a number.

He multiplied the number by 7

Then he added 85

His answer was 953

What number did Jack choose?

Show your method

Can you prove he is wrong?

Alex calculated 1,432 × 4

Here is her answer.

	Th	H	T	O
	1	4	3	2
×				4
	4	16	12	8

1,432 × 4 = 416,128

u explain what Alex has done

2 mark

This is an example of a SATS question (2019).

Problem Solving & Reasoning

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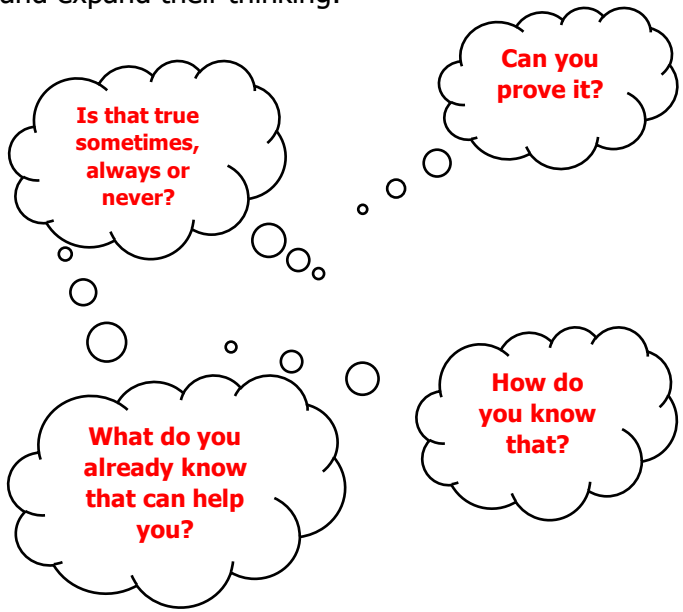

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