Clifton Primary School

Calculation Policy
February 2022

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Mastery approach

True mastery aims to develop all children's mathematical understanding at the same pace. As much as possible, children should be accessing the same learning. Differentiation should primarily be through support, scaffolding and deepening, not through task. Consistency in language is essential for pupils to understand the concepts presented in mathematics. If other, 'child-friendly' terminology is used, this must be alongside the current terminology recommended by maths specialists. Using this will support children with their examinations and throughout secondary school. Evidence repeatedly shows that mixed ability seating increases less confident pupils' perception of mathematical capability, which impacts positively upon outcomes. While not a school policy, it is recommended to avoid ability groups. This presents a challenge in ensuring the more confident mathematicians are being extended. An extension tasks to deepen understanding is the most simplistic way around this. Concrete, pictorial, abstract (CPA) concepts should not be confused as differentiation for lower, middle, higher attaining children. CPA is an approach to be used with the whole class and teachers should promote each area as equally valid. Manipulatives in particular must not be presented as a resource to support the less confident or lower attaining pupils.

EYFS Calculation Policy

One-to-one correspondence:

Children first learn to count using one to one correspondence.

Children will be encouraged to say a number each time they touch an object.

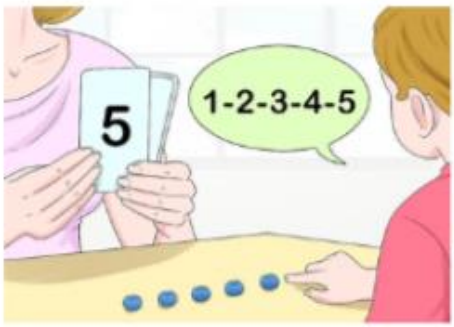
Using physical resources:

Children begin by practically taking away one or adding one more. They will also be able to use drawings to support them.

Numicon:

Children will be able to use Numicon to count, as well ordering them from smallest to biggest to create their own number line. Children should be able to see which Numicon shape is one more or one less.

Recognising numerals:



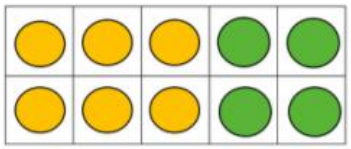
Children learn to recognise numerals to 20.

They are beginning to match the numeral with the correct corresponding quantity.

Number bonds using Tens frame:

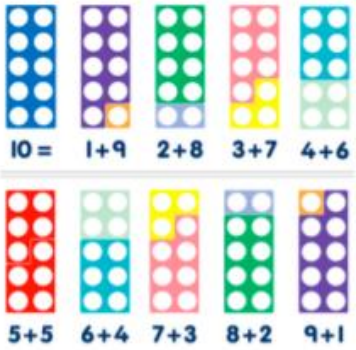
Tens frame:

Children will be able to use a tens frame to find number bonds to 10.



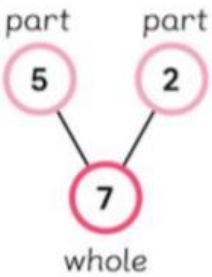
The tens frame shows 6 + 4 = 10

Number bonds using Numicon:



Children will be able to use Numicon to find number bonds to 10.

Part-part-whole model:



Children will use the part-part-whole diagram to add and subtract numbers.

Number lines:

Children will be able to use a number line to count, a
well as using it to take away or add one.
This will be for numbers up to 20.

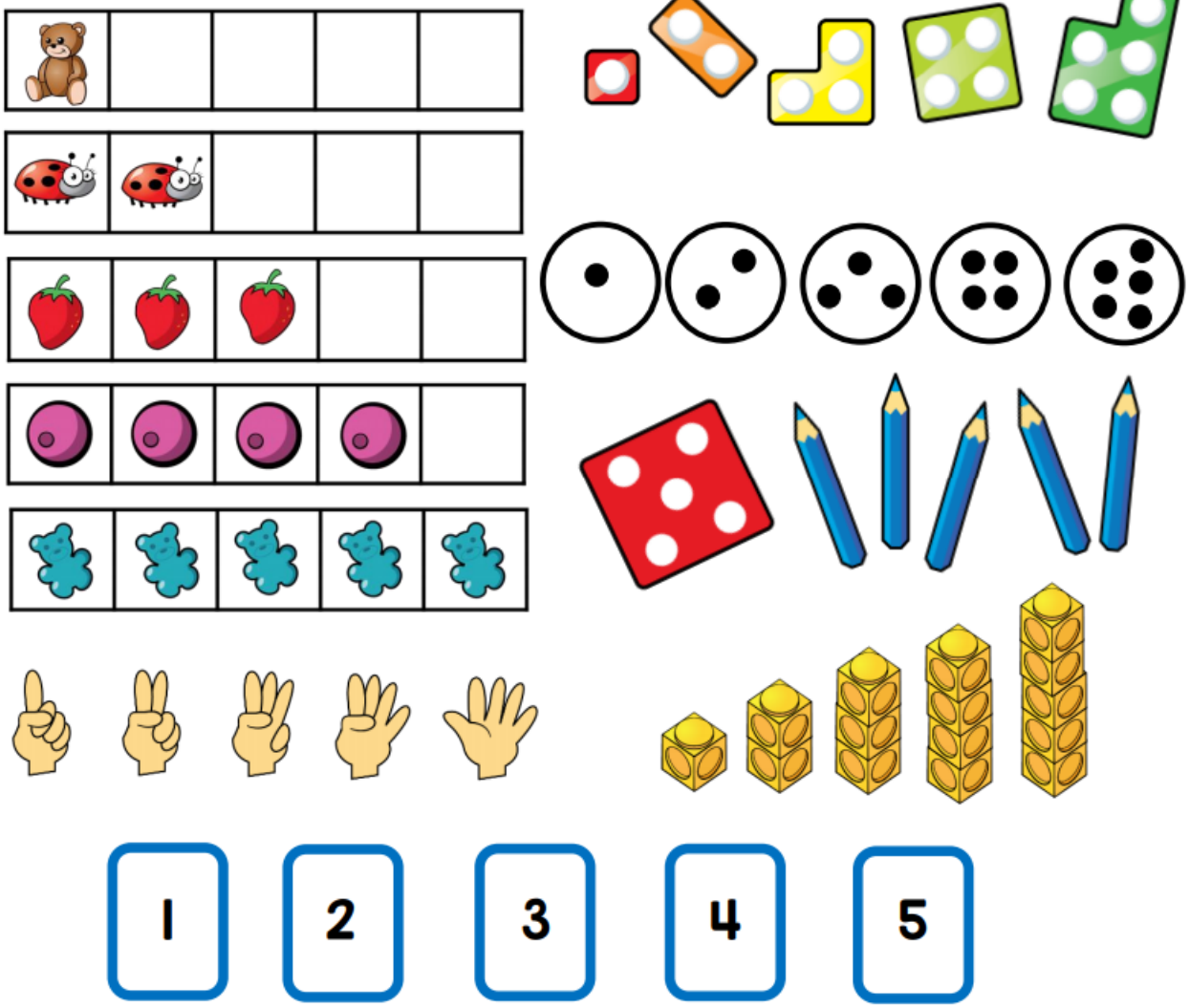
Part-part-whole model:

Alongside the part-part-whole diagram, children will use Numicon and practical resources to add and subtract numbers.

Children will be confident to say and write calculations using the + and – signs.

EYFS also follow the White Rose Maths Scheme.

Key Representations



Four operations

Following observations in October 2021, there was a variation in the way that teachers were carrying when exchanging.

I completed a staff questionnaire on where people carried when completing a long multiplication.

Following a discussion with the headteacher, we decided that staff should follow their scheme and ensure that they carry where their scheme does and their phase.

Staff should have a discussion within their phase to create consistency across each phase.

CLIFTON PRIMARY SCHOOL

Years 1 - 5

Year 1 – 5

Maths- No Problem!

Maths – No Problem! is an evidence – based approach developed in Singapore. It is fully aligned with the 2014 English National Curriculum for Maths.
The Maths – No Problem! Primary Series was assessed by the DfE's expert panel, which judged that it met the core criteria for a high quality textbook to support teaching for mastery.

By incorporating established learning research into a highly effective approach, Singapore has become a "laboratory of maths teaching". The Primary Maths Series is founded on the international research of Piaget, Dienes, Bruner, Skemp and Vygotsky and has been tested and refined over the last 30 years in Singapore.

Teaching Maths for Mastery

The whole class works through the programme of study at the same pace with ample time on each topic before moving on. Ideas are revisited at higher levels as the curriculum spirals through the years.

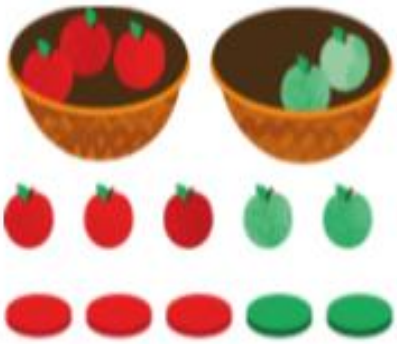
Differentiated activities

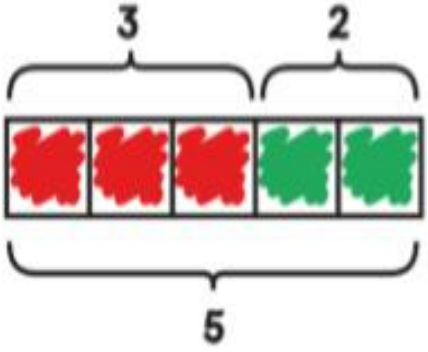
Tasks and activities are designed to be easy for children to enter while still containing challenging components. For advanced learners, the textbooks also contain non-routine questions for children to develop their higher-order thinking skills.

Problem Solving

Lessons and activities are designed to be taught using problem-solving approaches to encourage children's higher-level thinking. The focus is on working with children's core competencies, building on what they know to develop their relational understanding.

Concrete, Pictorial, Abstract (CPA) approac





$3 + 2 = \boxed{5}$

Concrete

Concrete is the "doing" stage. This stage brings concepts to life by allowing children to experience and handle physical (concrete) objects.
For example, if a problem involves adding pieces of fruit, children can first handle actual fruit.

Pictorial

Pictorial is the "seeing" stage. Here, the visual representations of concrete objects are used to model problems. This stage encourages children to make a mental connection between the physical object they just handles and the abstract pictures, diagrams or models that represent the objects from the problem.

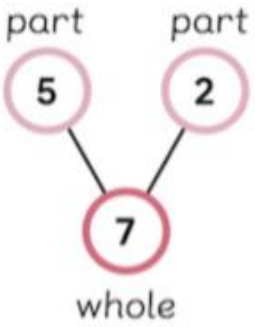
Abstract

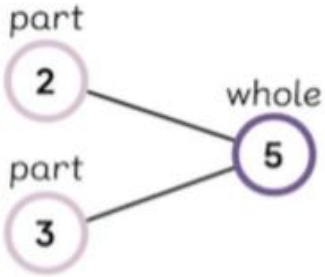
Abstract is the "symbolic" stage. Children use abstract symbols to model problems and need a solid understanding of the concrete and pictorial stages of the problem. Children are introduced to the concept at a symbolic level, using only numbers, notation, and mathematical symbols.

Number Bonds

Number bonds show how numbers are split or combined.

An essential strategy of Singapore maths, number bonds reflect the 'part – part – whole' relationship of numbers.





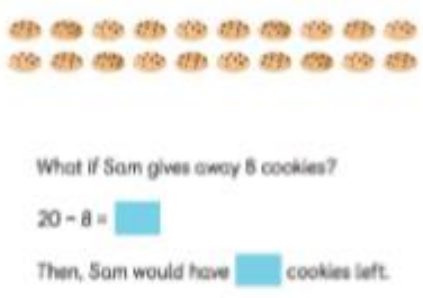
Number bonds are represented by circles connected by lines.

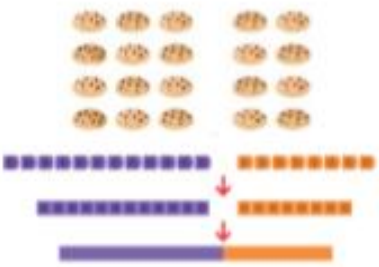
The **'whole'** is written in the first circle, while the **'parts'** are in the adjoining circles.

Bar Modelling

Bar modelling is an essential maths mastery strategy.

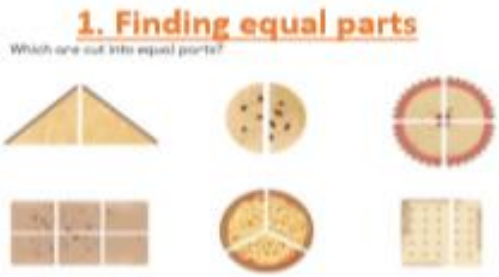
A Singapore-style of maths model, bar modelling, allows children to draw and visualise

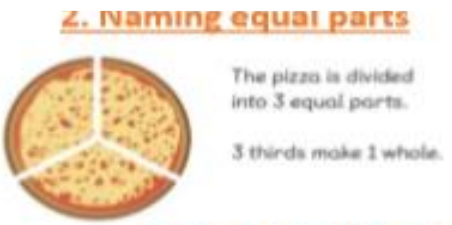


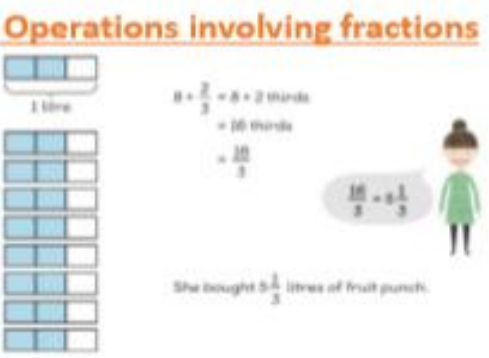


Fractions

In Singapore, the understanding of fractions is rooted in the (CPA) model, where children use paper squares and strips to learn the link between the concrete and the abstract.







MNP Children:

Variation

The questions and examples are carefully varied by expert authors to encourage children to think about the maths. Rather than provide mechanical repetition, the examples are designed to deepen children's understanding and reveal misconceptions.

Year 3

Name: _____ Class: ____ Date: ____

Worksheet 6

Number Patterns

1 Fill in the blanks.

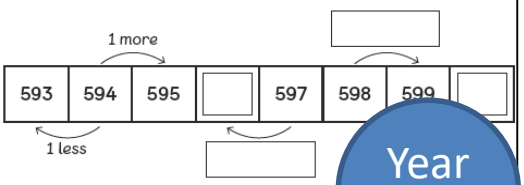
(a) 1 more than 99 is ☐. (b) 1 more than 200 is ☐.

(c) 10 more than 234 is ☐. (d) 10 more than 635 is ☐.

(e) 1 less than 580 is ☐. (f) 10 less than 580 is ☐.

2 Look at each number pattern and fill in the blanks.

(a)



(b)

Year 3

3 Complete the number pattern

(a) 169, 170, 171, ☐, ☐, 174

(b) 623, ☐, 621, 620, ☐, 618, 6

(c) 180, 190, 200, ☐, 220, 230, ☐

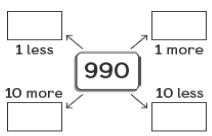
(d) ☐, 400, 401, 402, ☐, 404

(e) ☐, ☐, 880, 870, 860, 850

4 Fill in the blanks.

(a)

(b)



Numbers to 1000 Page 16

Year 4

Name: _____ Class: ____ Date: ____

Worksheet 8

Making Number Patterns

1 Complete the table.

Number	1 more than the number	10 more than the number	100 more than the number
5938			
8999			

Number	1 less than the number	10 less than the number	100 less than the number
4818			
2791			

2 Complete the number patterns.

(a) 430, 530, ☐, ☐, 830, ☐

(b) 7560, ☐, ☐, 7590, ☐, 7610

3 Find the missing numbers.

(a) 1429 is ☐ more than 1419.

(b) 3299 is 1 less than ☐.

(c) ☐ is 100 more than 1923.

(d) ☐ more than 5550 is 5650.

(e) 10 less than 2903 is ☐.

Numbers to 10 000 Page 11

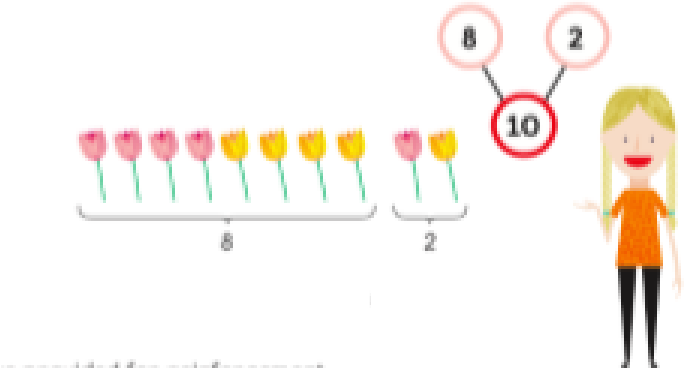
Structure of lessons

In Focus

Includes questions related to various lesson objectives as an introductory activity for pupils.

Let's Learn

Introduces new concepts through CPA approach with the use of engaging pictures and manipulatives. Guided examples are provided for reinforcement.

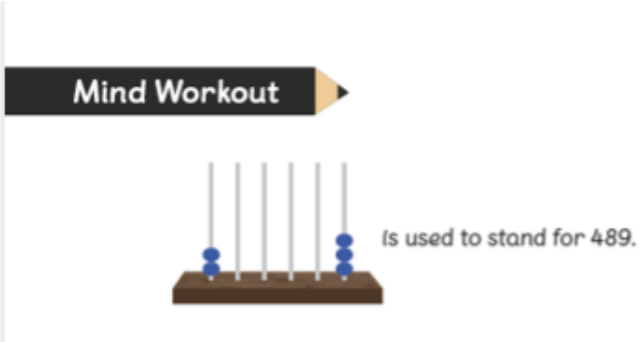


Guided Practice

Comprises questions for further consolidation and for the immediate evaluation for children's learning.

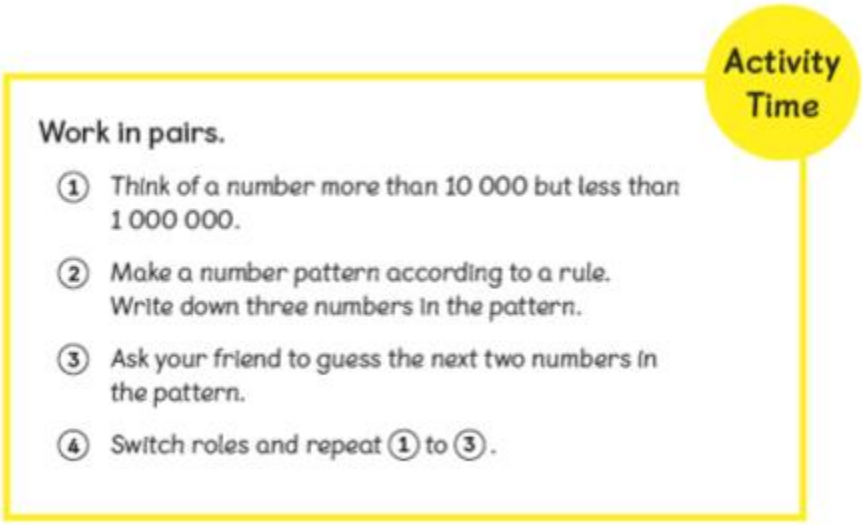
Mind Workout

Challenging non-routine questions for pupils to apply relevant heuristics and to develop higher-order thinking skills.



Activity Time

Provides pupils with opportunities to work as individuals or in small groups to explore mathematical concepts or to play games.



Maths Journal

Provides children with opportunities to show their understanding of the mathematical concepts learnt.

Self Check

Allows children to assess their own learning after each chapter.

What does the National Curriculum say?

KS1

Key stage 1 - years 1 and 2

• The principal focus of mathematics teaching in key stage 1 is to ensure that pupils develop confidence and mental fluency with whole numbers, counting and place value. This should involve working with numerals, words and the 4 operations, including with practical resources.

• At this stage, pupils should develop their ability to recognise, describe, draw, compare and sort different shapes and use the related vocabulary. Teaching should also involve using a range of measures to describe and compare different quantities.

• By the end of year 2, pupils should know the number bonds to 20 and be precise in using and understanding place value.

• Pupils should read and spell mathematical vocabulary, at a level consistent with their increasing word reading and spelling knowledge at key stage 1.

What does the National Curriculum say?

Lower KS2

• The principal focus of mathematics teaching in lower key stage 2 is to ensure that pupils become increasingly fluent with whole numbers and the 4 operations, including number facts and the concept of place value. This should ensure that pupils develop efficient written and mental methods and perform calculations accurately with increasingly large whole numbers.

• Pupils should develop their ability to solve a range of problems, including with simple fractions and decimal place value.

• Pupils are encouraged to draw with increasing accuracy and develop mathematical reasoning so they can analyse shapes and their properties. It should ensure that they can use measuring instruments with accuracy and make connections between measure and number.

• By the end of year 4, pupils should have memorised their multiplication tables up to and including the 12 multiplication table and show precision and fluency in their work.

• Pupils should read and spell mathematical vocabulary correctly and confidently, using their growing word reading knowledge and their knowledge of spelling

What does the National Curriculum say?

Upper KS2

- The principal focus of mathematics teaching in upper key stage 2 is to ensure that pupils extend their understanding of the number system and place value to include larger integers. This should develop the connections that pupils make between multiplication and division with fractions, decimals, percentages and ratio.
- Pupils should develop their ability to solve a wider range of problems, including increasingly complex properties of numbers and arithmetic, and problems demanding efficient written and mental methods of calculation. With this foundation in arithmetic, pupils are introduced to the language of algebra as a means for solving a variety of problems.
- Teaching in geometry and measures should consolidate and extend knowledge developed in number. Teaching should also ensure that pupils classify shapes with increasingly complex geometric properties and that they learn the vocabulary they need to describe them.
- By the end of year 6, pupils should be fluent in written methods for all 4 operations, including long multiplication and division, and in working with fractions, decimals and percentages.
- Pupils should read, spell and pronounce mathematical vocabulary correctly.

Year 1 Calculation Policy

Year 1
Place Value - Counting

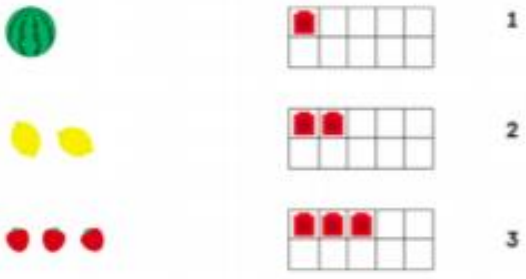
Counting to 10:

We can count on....

We can count back....

Then we learn about 0.

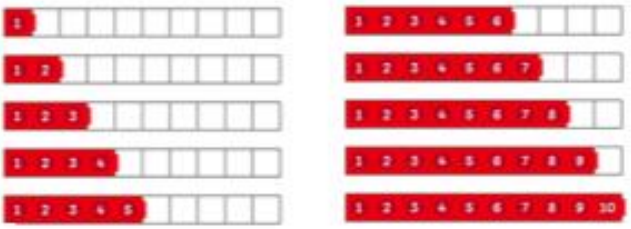
Counting with objects:



Physical objects

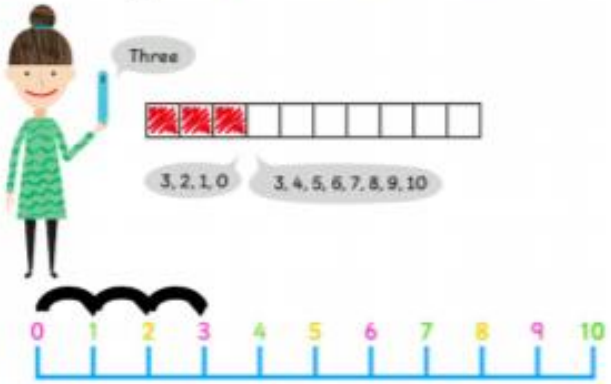
Tens squares

Counting with objects:



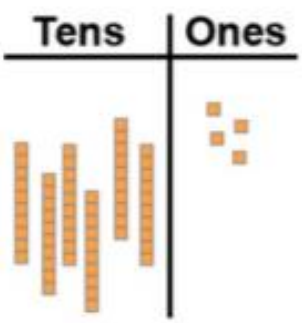
Counting with number lines:

Using multilink cubes



Year 1
Place Value - Counting

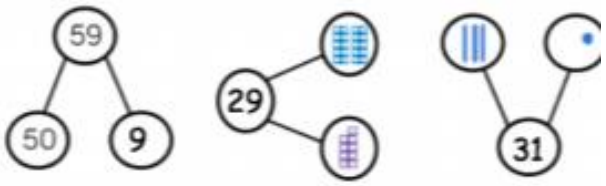
Dienes to represent numbers:



The dienes show **6 tens** and **4 ones**.

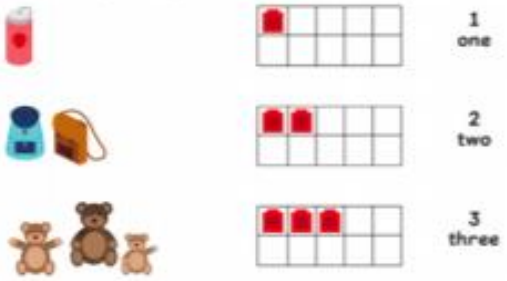
This shows the number **64**.

Number bond method:

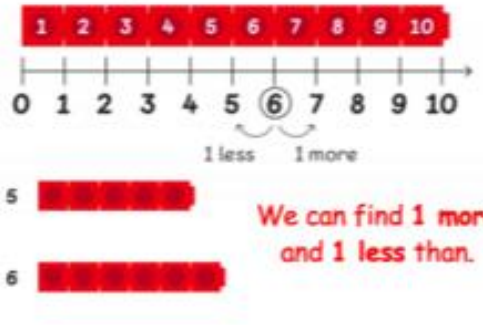


Separating the numbers apart like this is called **partitioning**.

Writing numbers to 10:



Ordering numbers:



We can find **1 more** and **1 less** than.

Comparing numbers:

There are 3 cupcakes.

There are 5 cookies.

There are 7 doughnuts.

Which number is more than the others?
Which number is less than the others?

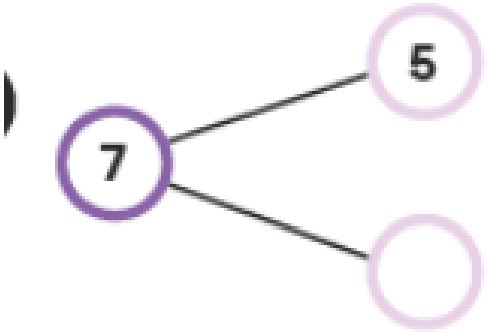
7 is more than 5.
7 is more than 3.
7 is the **greatest**.

3 is less than 7.
3 is less than 5.
3 is the **smallest**.

1	2	3	4	5	6	7	8	9	10

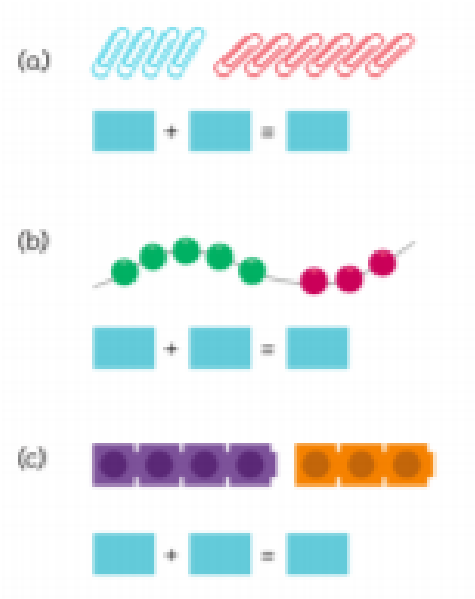
Year 1 Addition

Abstract calculations:



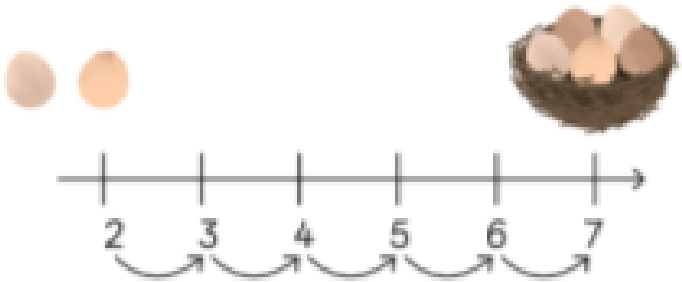
$7 = 5 + \square$

Pictorial Method:



Number line method:

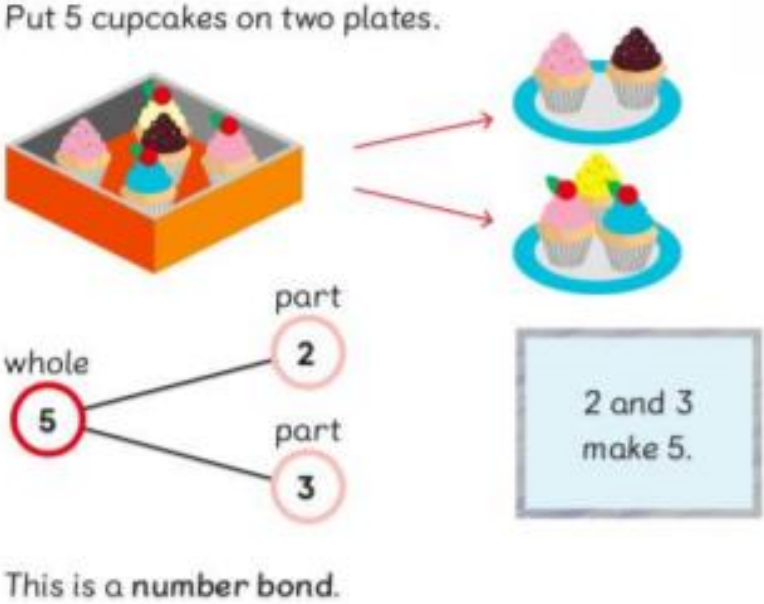
How many eggs are there in total?



2 + 5 = 7

Number bond method:

Put 5 cupcakes on two plates.



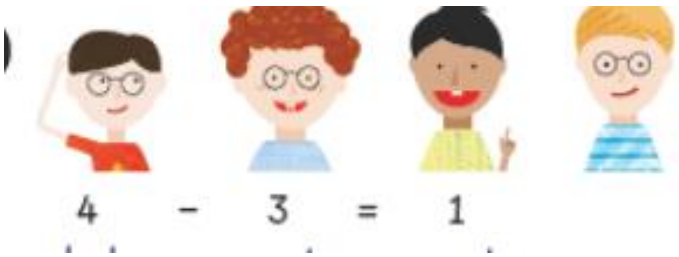
This is a **number bond**.

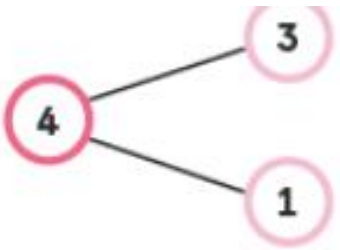
Year 1 Subtraction

Subtract by crossing out:

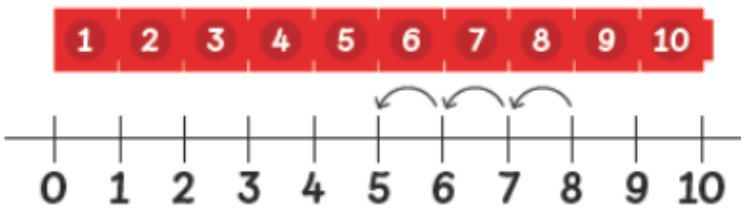
7 – 2 = 5

Subtract by number bonds:





Subtract by counting back:



8 – 3 = 5
There are 5 books in the bag.

Subtract by writing stories:

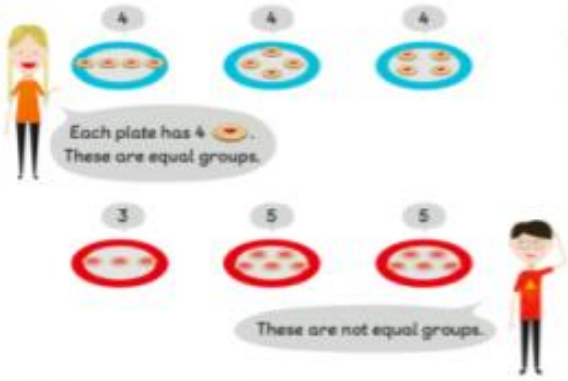
At first, there were 10 carrots in the ground.

Then, the rabbits pulled 7 carrots out.

10 – 7 = 3
3 carrots remained in the ground.

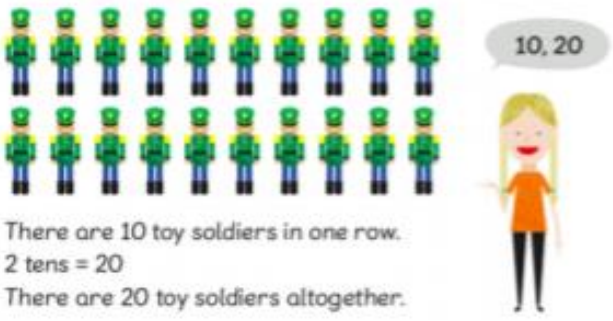
Year 1
Multiplication and Division

Making equal groups



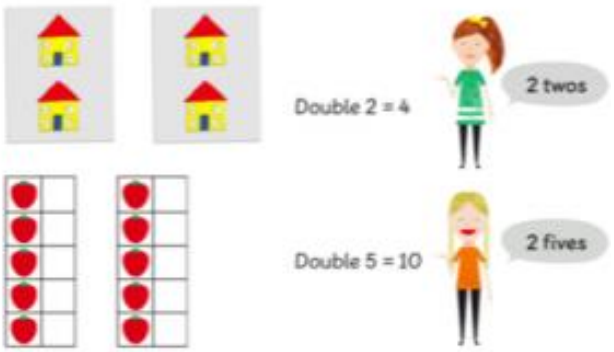
Adding equal groups

Making equal rows



There are 10 toy soldiers in one row.
2 tens = 20
There are 20 toy soldiers altogether.

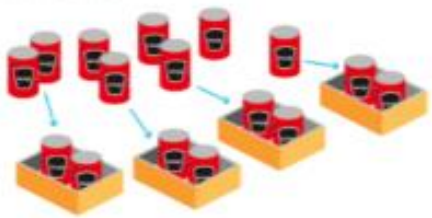
Making doubles



DIVISION

Grouping equally

There are 8 cans.



There are 4 boxes of 2 cans.

Sharing equally

There are 6 cookies and 3 children.
Each child takes one cookie.

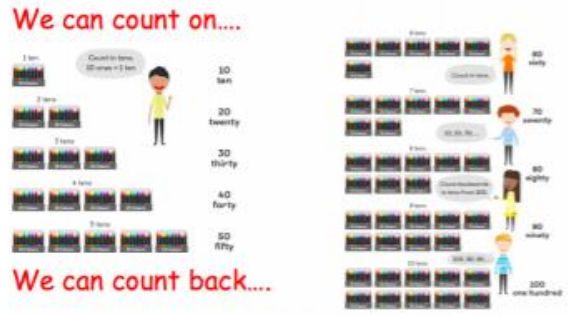
Each child takes one more cookie.

Each child gets 2 cookies.

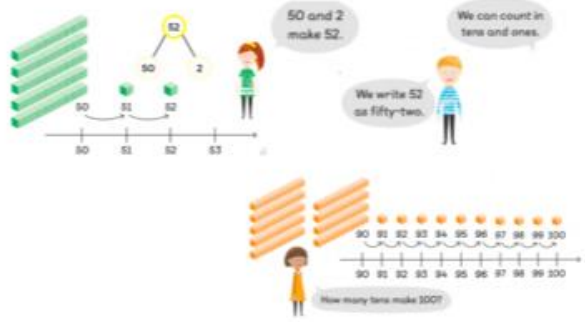
Year 2
Calculation Policy

Year 2
Place Value

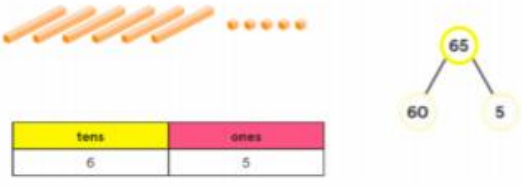
Counting in tens to 100:



Counting in tens and ones:



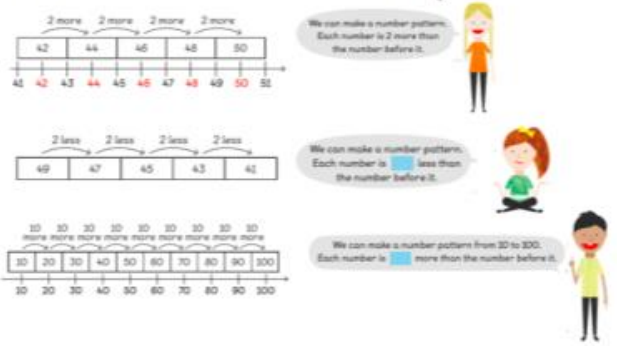
We can represent two-digit numbers in these ways:



We can make numbers using different number bonds:

Comparing numbers:

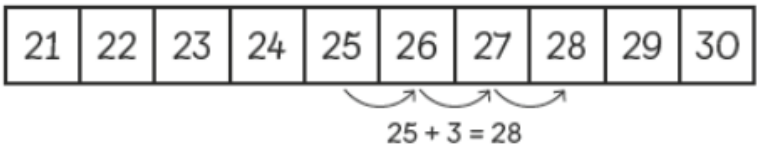
We can extend number patterns:



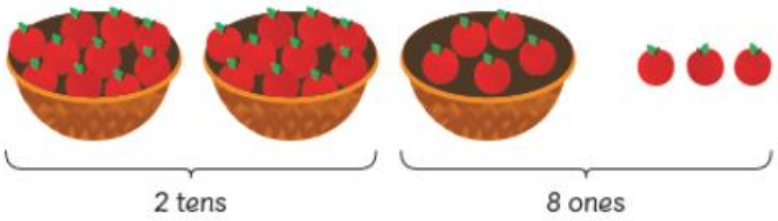
We can find the missing numbers in patterns:

Year 2 Addition

Number line method:

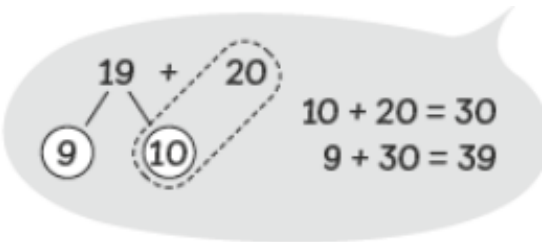


Pictorial method:



25 + 3 = 28

Partitioning method:

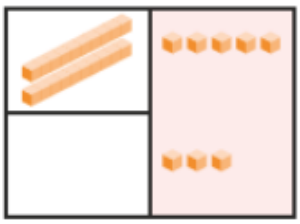


19 + 20 = 39

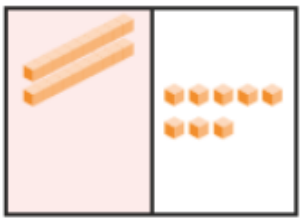
Deines method:

Step 1 Add the ones.

5 ones + 3 ones = 8 ones



Step 2 Add the tens.



25 + 3 = 28

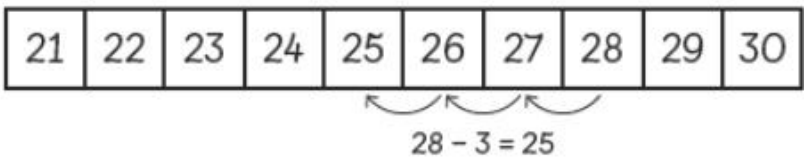
Column method:

	tens	ones
	2	5
+		3
		8

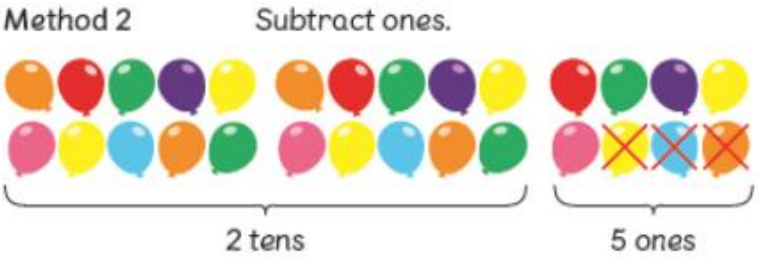
	tens	ones
	2	5
+		3
	2	8

Year 2 Subtraction

Number line method:

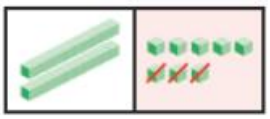


Pictorial method:

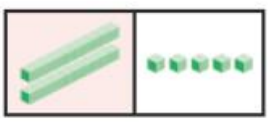


Deines method:

Step 1 Subtract the ones.
8 ones – 3 ones = 5 ones



Step 2 Subtract the tens.



28 – 3 = 25

Column method:

	tens	ones
	2	8
–		3
		5

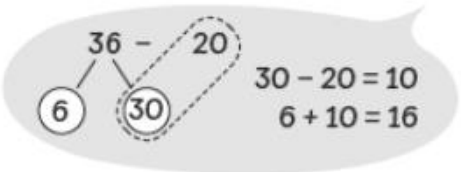
	tens	ones
	2	8
–		3
	2	5

Partitioning method:

Count back in tens from 36.

36 – 20 = 16

Subtract tens.



36 – 20 = 16

Year 2 Multiplication

Repeated addition

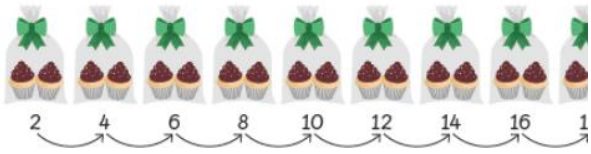
$3 + 3 + 3 + 3 = 12$

4 threes = 12

4 groups of 3 = 12

$4 \times 3 = 12$

Pictorial to abstract:

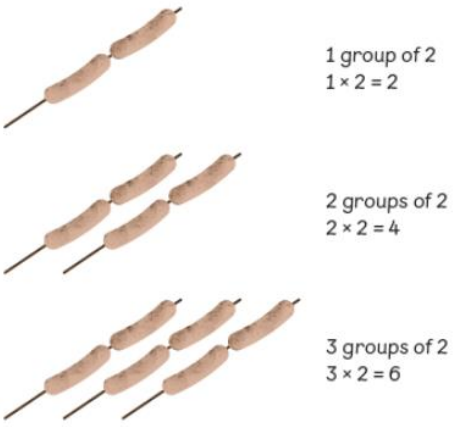


1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

Grouping method:

How many cupcakes are there altogether?

1 stick has 2 sausages.



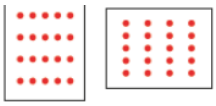
1 group of 2
$1 \times 2 = 2$

2 groups of 2
$2 \times 2 = 4$

3 groups of 2
$3 \times 2 = 6$

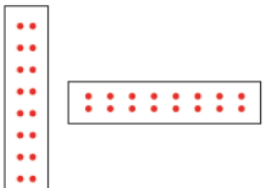
(a) $4 \times 5 =$ ☐

$5 \times 4 =$ ☐



(b) $8 \times 2 =$ ☐

$2 \times 8 =$ ☐



Abstract Method:

Multiply.

(a) $2 \times 5 =$ ☐

$3 \times 5 =$ ☐

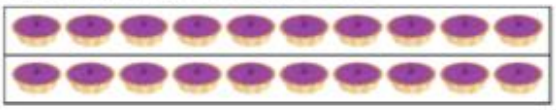
(b) $4 \times 5 =$ ☐

$5 \times 5 =$ ☐

Year 2
Division

Make a family of multiplication and division facts:

Look at the picture.
Make a family of multiplication and division facts.



2 x 10 = 20 ——— 20 ÷ 2 = 10

10 x 2 = 20 ——— 20 ÷ 10 = 2

Solving Problems

Ruby has 15 marshmallows.
She packs 5 marshmallows into each bag.
How many bags does Ruby need?

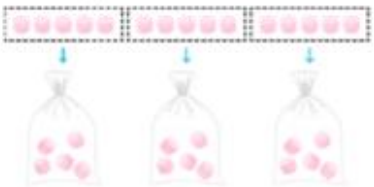
Method 1 Use  to stand for .

Use  for each bag.

Solving Problems:

Ruby has 15 marshmallows.
She packs 5 marshmallows into each bag.
How many bags does Ruby need?

Method 2 Draw a picture.



Solving Problems:

Ruby has 15 marshmallows.
She packs 5 marshmallows into each bag
How many bags does Ruby need?

Method 3 Use a division equation.

15 ÷ 5 = 3

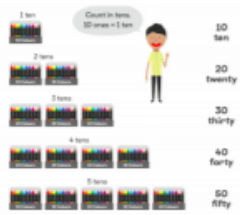
Ruby needs 3 bags.

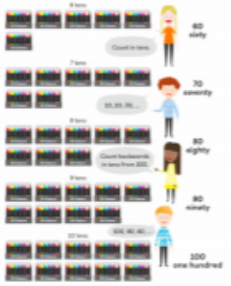
Year 3
Calculation Policy

Year 3
Place value

Counting in tens to 100:

We can count on....



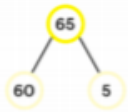


We can count back....

Counting in tens and ones:

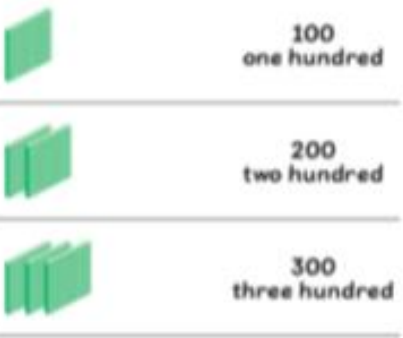
We can represent two-digit numbers in these ways:

tens	ones
6	5

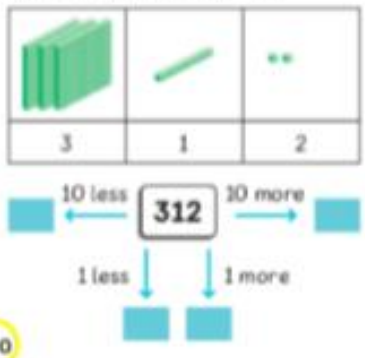


We can make numbers using different number bonds:

Numbers to 1000



Fill in the missing numbers.



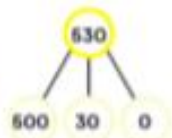
What is the value of each digit in 530?

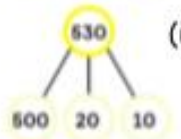
hundreds	tens	ones
5	3	0

530 = ▢ hundreds + ▢ tens + ▢ ones

530 = ▢ + ▢ + ▢

The value of the digit 5 is 500.
The value of the digit 3 is 30.
The value of the digit 0 is 0.





Number patterns (in 1, 2, 5, 10, 3, 4 and 8)

Year 3
Addition

Recapping methods taught in Year 1 and 2

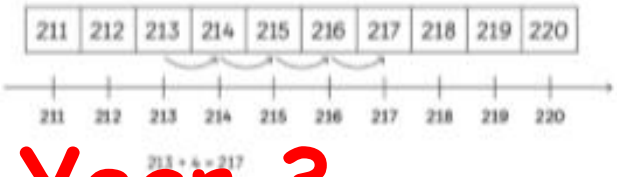
Adding numbers to 1000

How many chairs are there altogether?

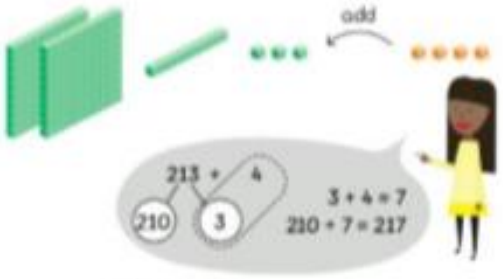
We can write a family of addition and subtraction facts.

6 + 12 = 18 18 − 12 = 6

12 + 6 = 18 18 − 6 = 12

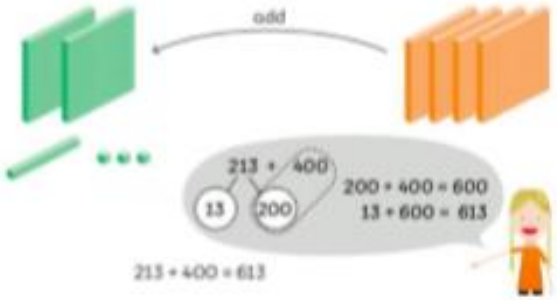


Adding ones, tens and hundreds



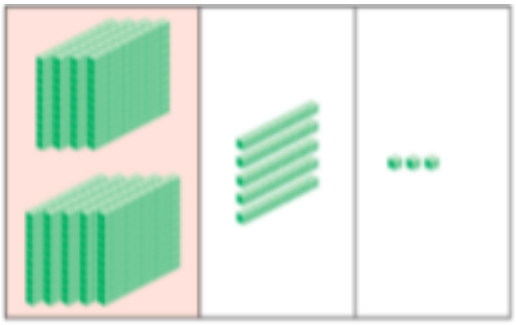
213 + 4 = 217

There were 217 books in the bookcase.



213 + 400 = 613

Year 3
Addition – no renaming



	h	t	o
	4	3	2
+	5	2	1
	9	5	3

432 + 521 = 953

Beginning practically with dienes before moving onto column addition
Number bond method is taught alongside both methods

Year 3
Addition – with renaming

Expected to solve a larger number of abstract calculatons

1 (a) 153 + 2 =

(b) 153 + 20 =

(c) 153 + 200 =

2 (a) 214 + 3 =

(b) 214 + 30 =

(c) 214 + 300 =

3 (a) 325 + 14 =

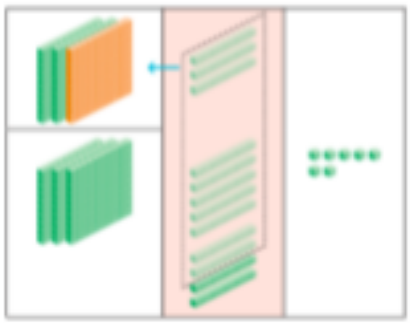
h	t	o
3	2	5
+	1	4

(b) 236 + 543 =

h	t	o
2	3	6
+ 5	4	3

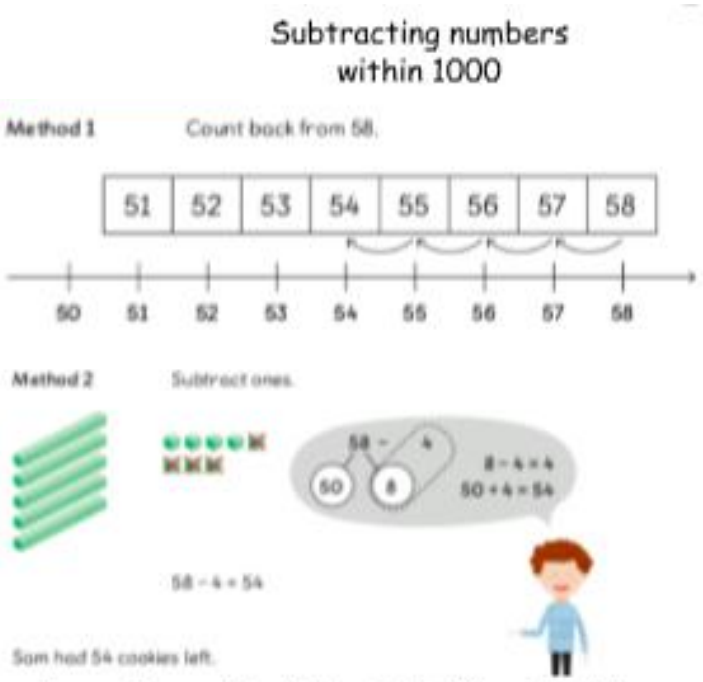
Add the tens.
3 tens + 9 tens = 12 tens
Regroup the tens.
12 tens = 1 hundred + 2 tens

Secure understanding of place value to 1000



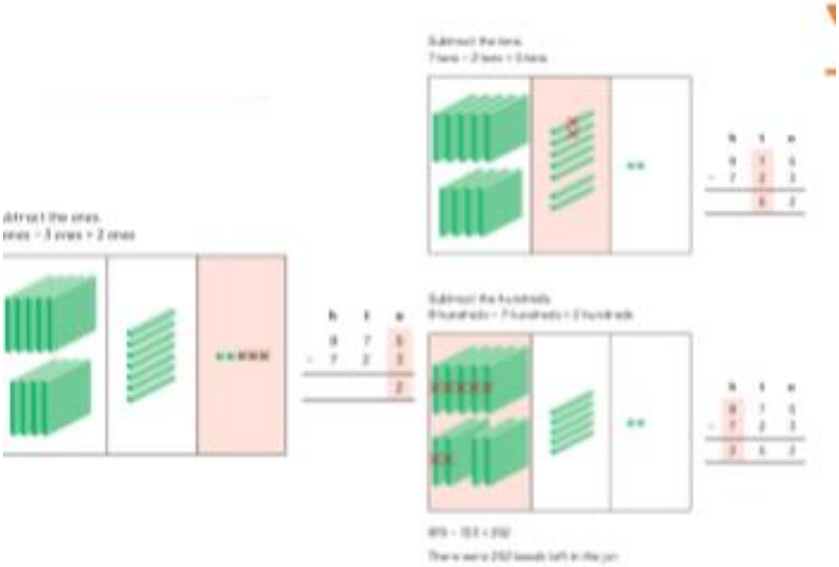
h	t	o
1		
2	3	6
+ 3	9	1
	2	7

Year 3 Subtraction



Recapping methods taught in Year 1 and 2

Year 3 Subtraction – no regrouping

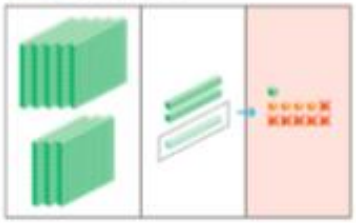


Beginning practically with dienes before moving onto column subtraction

Number bond method is taught alongside both methods

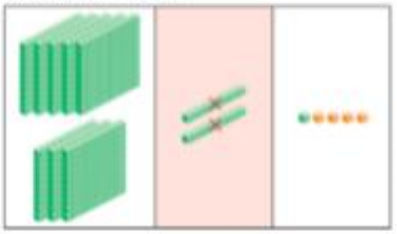
Year 3
Subtraction – with regrouping

Step 1 Regroup 1 ten into 10 ones.
Subtract the ones.
11 ones − 6 ones = 5 ones



	h	t	o
	8	~~2~~ 1	~~1~~ 11
−		2	6
			5

Step 2 Subtract the tens.
2 tens − 2 tens = 0 tens



	h	t	o
	8	~~2~~ 1	~~1~~ 11
−		2	6
		0	5

Step 3 Subtract the hundreds.

	h	t	o
	8	~~2~~ 1	~~1~~ 11
−		2	6
	8	0	5

Beginning practically with dienes before moving onto column subtraction

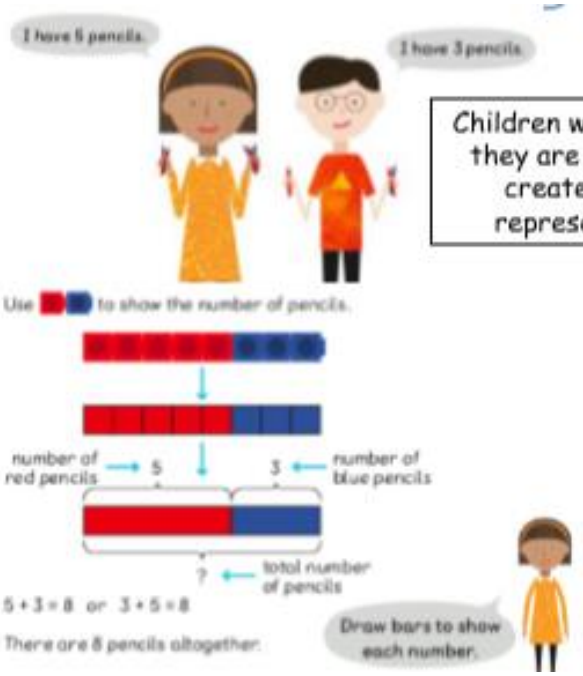
Number bond method is taught alongside both methods

Year 3
Bar Model methods

Concrete

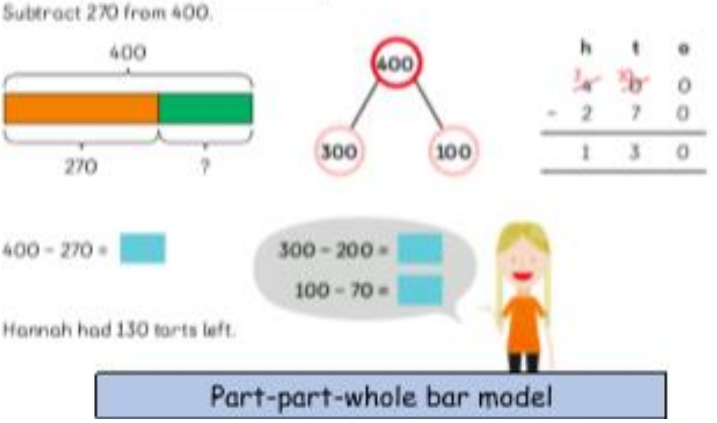
Pictorial

Abstract

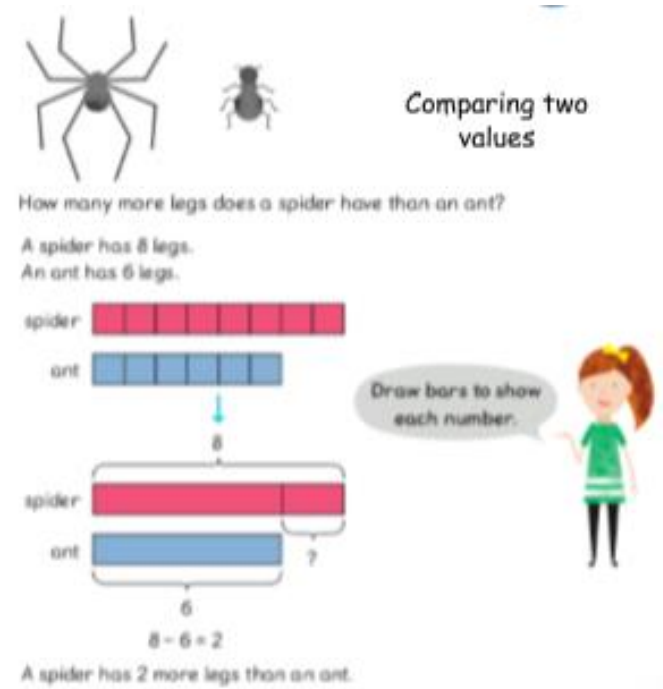


Applying addition and subtraction skills to word problems with bar models to assist

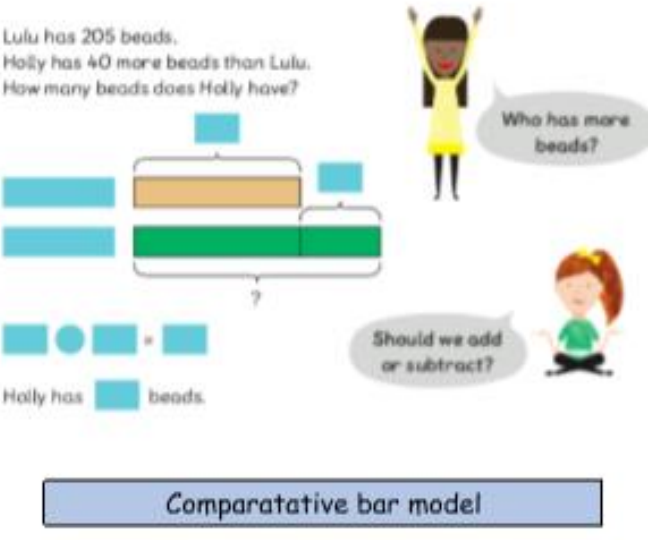
Children will be taught that the numbers they are working with are too large to create practically so a bar model represents these numbers instead



Part-part-whole bar model



Applying addition and subtraction skills to word problems with bar models to assist



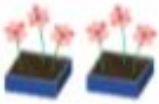
Comparatative bar model

Year 3 Multiplication

3, 4 and 8 times tables

Equal groups

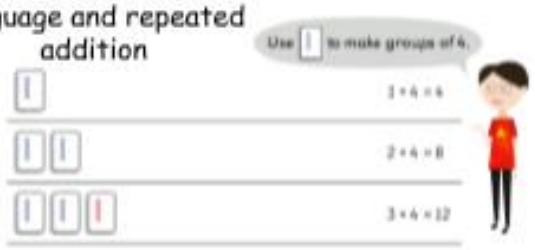
1 group of 3
1 × 3 = 3



2 groups of 3
2 × 3 = 6

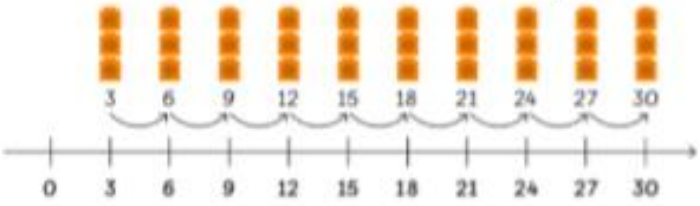
3 groups of 3
3 × 3 = 9

Language and repeated addition

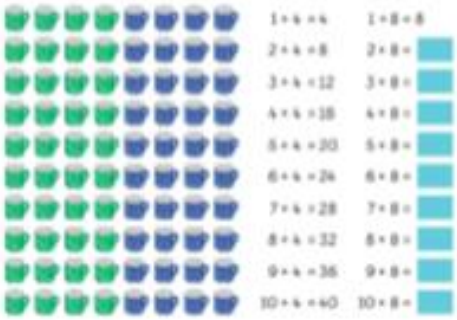


Count in threes.

Number lines and hundred squares



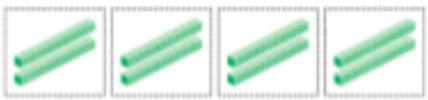
Arrays



1. Using place value

Multiply 2 ones by 4
2 × 4 = 8

	o
	2
×	4
	8

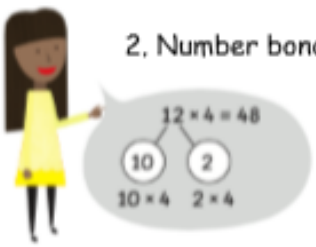


Multiply 2 tens by 4
20 × 4 = 80

	t	o
	2	0
×		4
	8	0

There are 80 oranges in the 4 boxes altogether.

2. Number bond method



3. Bridged column multiplication

	t	o
	2	3
×		4
	1	2
+	8	0
	9	2

4. Short multiplication

Step 1

	t	o
	2	3
×		8
		4

3 ones × 8 = 24 ones
24 ones = 2 tens + 4 ones

Step 2

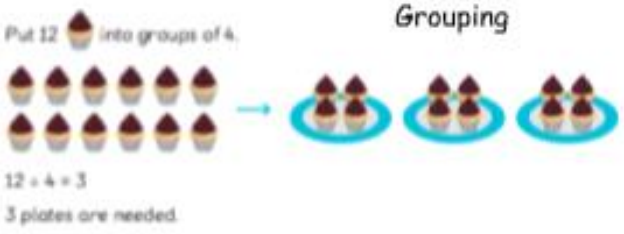
	h	t	o
		2	3
×			8
	1	8	4

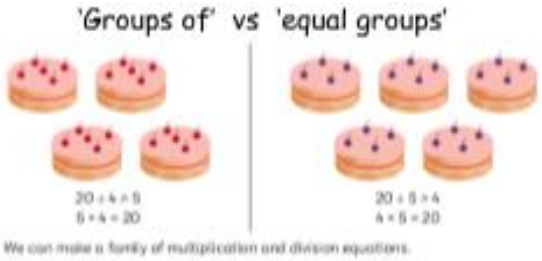
2 tens × 8 = 16 tens
16 tens + 2 tens = 18 tens

23 × 8 = 184

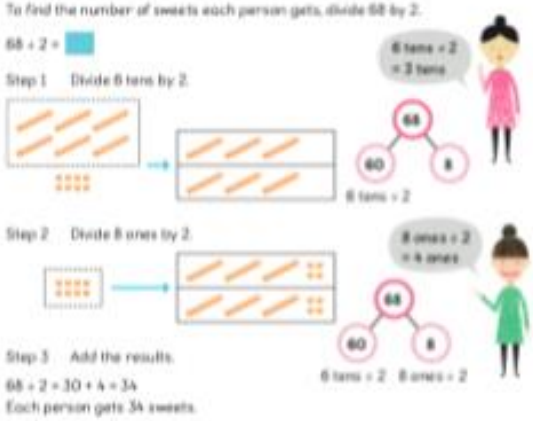
The product of 23 and 8 is 184.

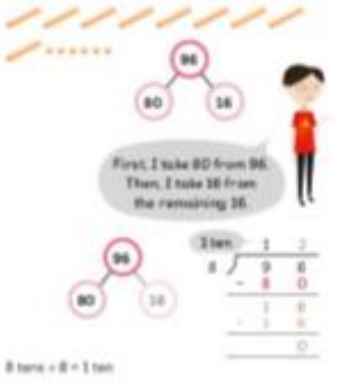
Year 3 Division

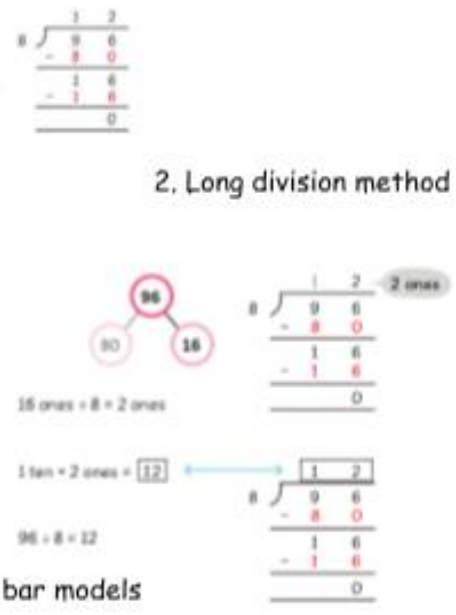




Family of commutative and inverse calculations



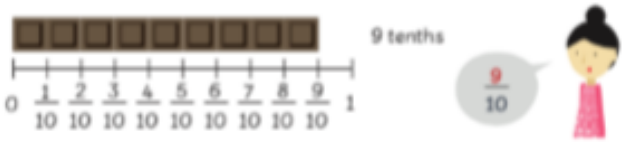




3. Move onto problem solving involving these methods and bar models

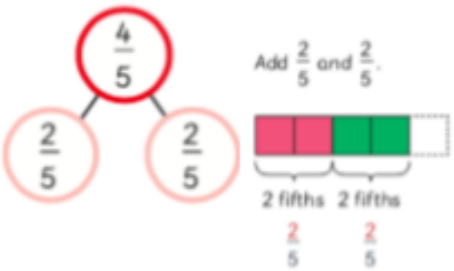
Year 3 Fractions

Tenths



Finding equivalent and simplifying fractions

Adding fractions

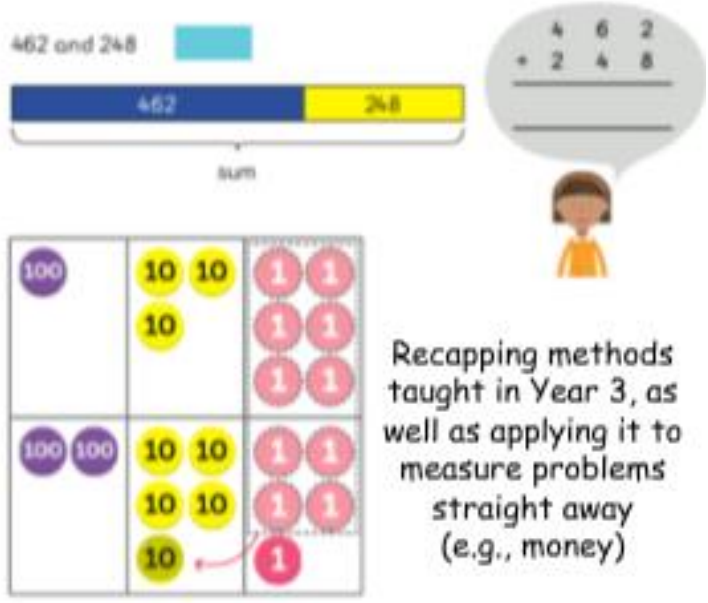


Finding fractions of amounts and sharing more than one

Move onto problem solving involving these methods and bar models

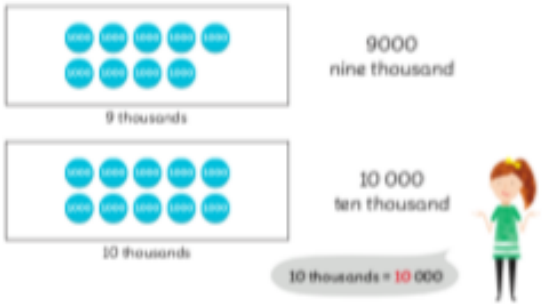
Year 4
Calculation Policy

Year 4
Place Value



Recapping methods taught in Year 3, as well as applying it to measure problems straight away (e.g., money)

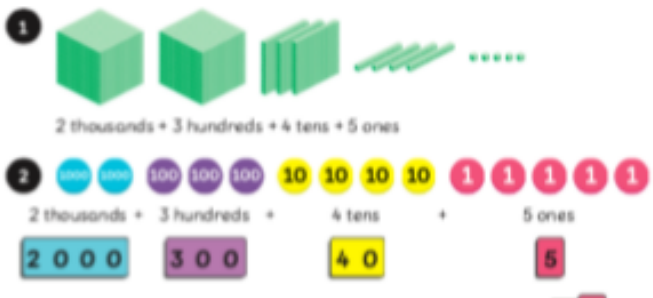
Numbers to 10,000



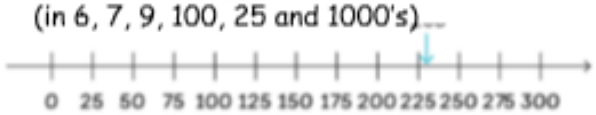
Use a place-value chart.

2 thousands + 3 hundreds + 4 tens + 5 ones

thousands	hundreds	tens	ones
2	3	4	5



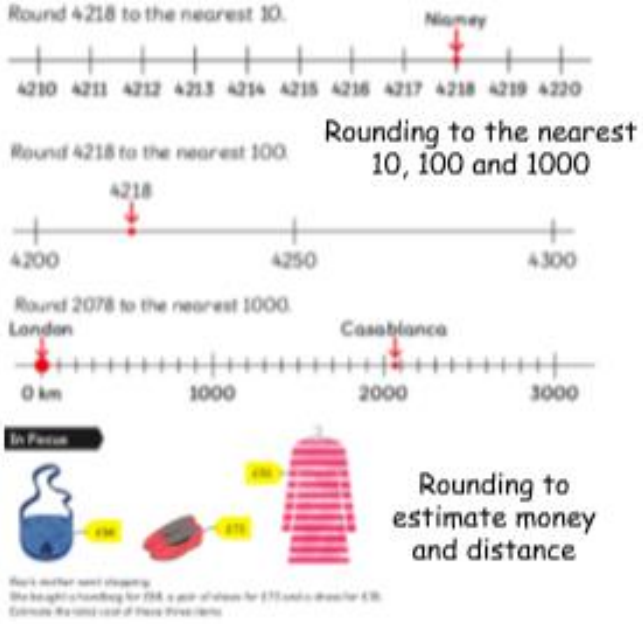
Number patterns
(in 6, 7, 9, 100, 25 and 1000's)

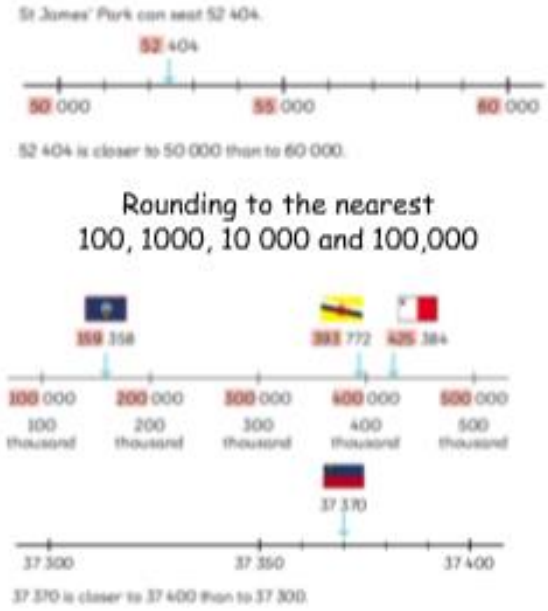


2345 = 2000 + 300 + 40 + 5

We write 2345 as two thousand, three hundred and forty-five.

Year 4
Place Value





Year 4
Addition

Year 4

Children are expected to be secure in methods taught in Year 3

Find the sum of 2034 and 9.

2034 + 10 = 2044

2034 + 9 = 2043 — 1 less

Why is the sum 1 less?

Learning mental strategies to add

Find the sum of 98 and 4142 by adding mentally.

98 + 4142 = ☐

make 100

98 + 4142 = 100 + 4140

= 4240

Let's estimate.

$$\begin{array}{r} 5\,7\,0\,0 \\ +\ 1\,2\,0\,0 \\ \hline 6\,9\,0\,0 \end{array}$$

Children are expected to estimate answers to check accuracy

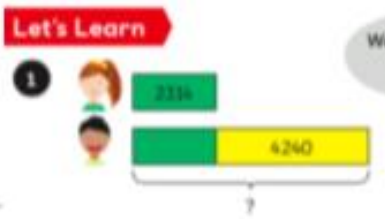
Year 4
Addition – No renaming

Let's Learn

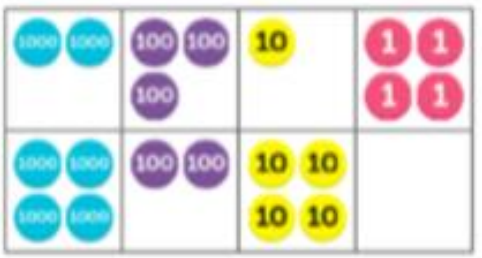
saved £2314.

saved £4240 more than  saved.

How much did  save?



Find the sum of 2314 and 4240.



$$\begin{array}{r} 2\,3\,1\,4 \\ +\ 4\,2\,4\,0 \\ \hline 6\,5\,5\,4 \end{array}$$

Step 1 — Add the ones.
4 ones + 0 ones = 4 ones

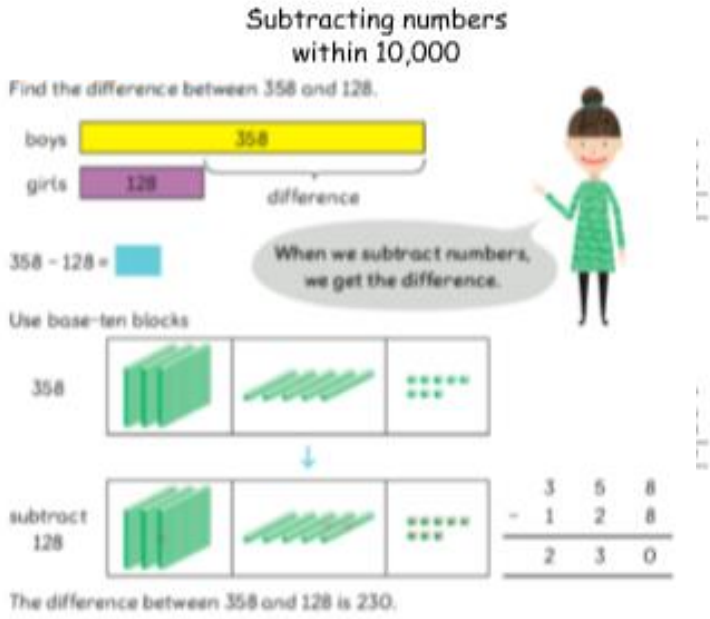
Step 2 — Add the tens.
1 tens + 4 tens = 5 tens

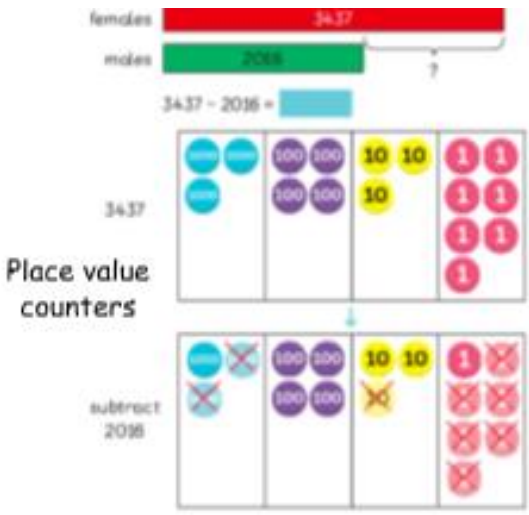
Step 3 — Add the hundreds.
3 hundreds + 2 hundreds = 5 hundreds

Step 4 — Add the thousands.
2 thousands + 4 thousands = 6 thousand

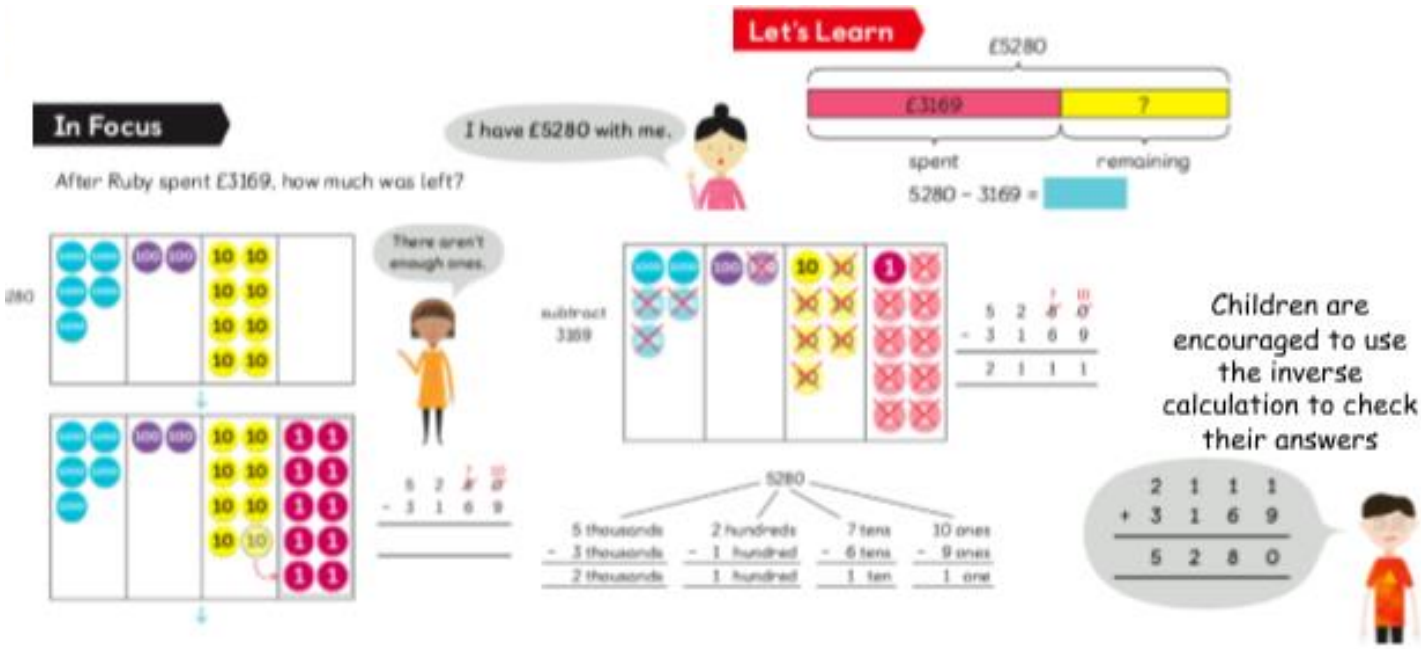
2314 + 4240 = 6554

Year 4
Subtraction – no regrouping





Year 4
Subtraction – with regrouping



Year 4
Bar Model method

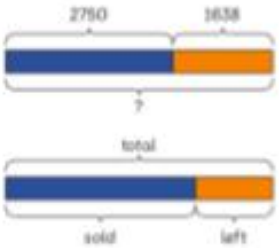
In Focus

A baker made 2750 chocolate cookies and 1638 vanilla cookies.
He sold 3195 cookies altogether.
How many cookies did he have left?

Understand the problem

Who?	baker
What?	cookies

Make a plan



Complex multi-step word problems

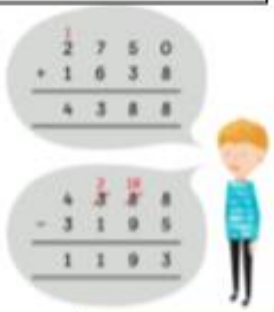
2750 + 1638 = 4388

The baker baked 4388 cookies.

4388 − 3195 = 1193

He had 1193 cookies left.

Column addition and subtraction



Skill of checking

Check

Cookies sold	3195
Cookies left	1193
Cookies baked	4388

```
  3 1 9 5
+ 1 1 9 3
-------
  4 3 8 8
```

Part-part-whole bar model

In Focus

On Saturday, 3018 people attended a funfair.
850 more people attended the funfair on Saturday than attended it on Sunday.

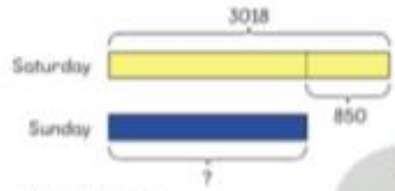
Altogether, how many people attended the funfair over the two days?

Understand the problem

Who?	 people
What?	funfair

Make a plan

Carry out the plan



3018 − 850 = 2168

2168 people attended the funfair on Sunday.

```
Saturday  3 0 1 8
Sunday  + 2 1 6 8
        -------
          5 1 8 6
```

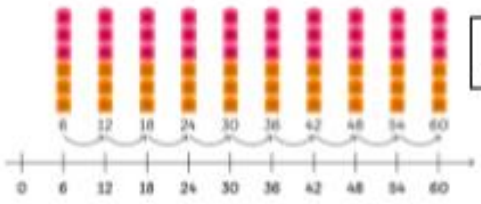
3018 + 2168 = 5186

Comparatative bar model

Year 4 Multiplication

2 groups of 6
2 × 6 = 12

3 groups of 6
3 × 6 = 18



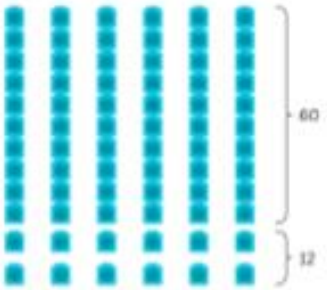
By the end of Year 4, children are expected to know ALL of their times tables

3 × 10 = 30
3 × 1 = 3
3 × 11 = 30 + 3
= 33

2 × 7 = 14
3 × 7 = 21

6 × 12 = 72

10 rows of 9 = 90
10 × 9 = 90



Recap: bridged and short multiplication

		2	3
×			6
		1	8
+	1	2	0
	1	3	8

			1	
		2	3	
×				6
	1	3	8	

New: multiplying 3 numbers

$2 \times 5 \times 6 = 10 \times 6 = 60$

2 × 5 × 6

2 × 5 = 10

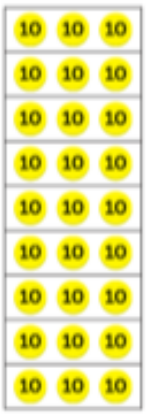
2 × 5 × 6 = 10 × 6 = 60

What is the product of 9 and 30?

9 × 30 = ☐

Method 1	Method 2	Method 3
30	9 × 3 = 27	9 × 30 = 9 × 3 × 10
30	9 × 3 tens = 27 tens	= 9 × 3 × 10
30	9 × 30 = 270	= 27 × 10
30		= 27 tens
30		= 270
30		
30		
30		
+ 30		

Which method is best?



Recap multiplying by a multiple of 10

Year 4
Multiplication

Recap:
Bridged and short multiplication

multiplying by multiples of 100

7 × 300 = ☐

Method 1

300
300
300
300
300
300
300
+ 300
2100

Method 2

7 × 3 = 21
7 × 3 hundreds = 21 hundreds
7 × 300 = 2100

21 hundreds = 2100

Method 3

7 × 300 = 7 × 3 × 100
= 7 × 3 × 100
= 21 × 100
= 21 hundreds
= 2100

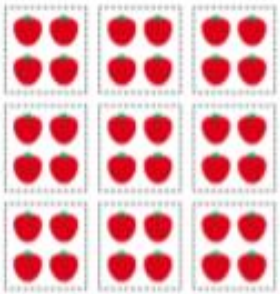
Which method is best?

Year 4 Division

$36 \div 9 = ?$

'equal groups' **vs** 'groups of'

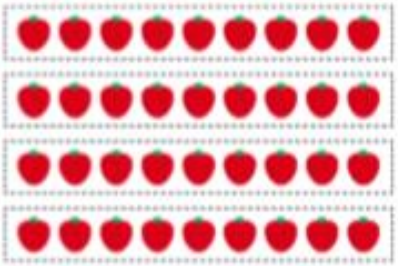
Placing into 9 equal groups



$36 \div 9 = 4$

Each group has 4 strawberries.

Placing in groups of 9



$36 \div 9 = 4$

There are 4 groups.

There were 11 balloons.

$11 \div 2 = 5$ remainder 1

The quotient is 5 and the remainder is 1.
Each friend got 5 balloons.
There was 1 balloon left over.

Children are introduced to the concept of remainders

$4 \div 4 =$ ☐

$4 \div 4 = 1$

$40 \div 4 =$ ☐

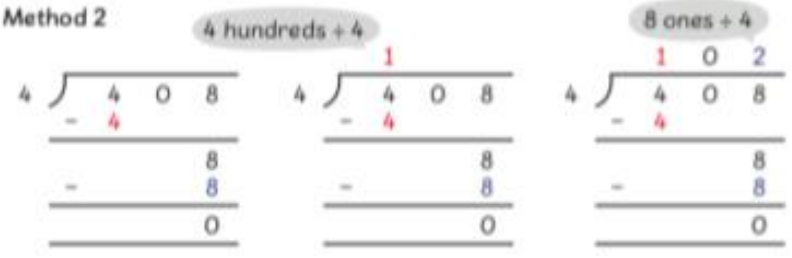
$40 \div 4 = 10$

$400 \div 4 =$ ☐

$400 \div 4 = 100$

Method 1

Method 2



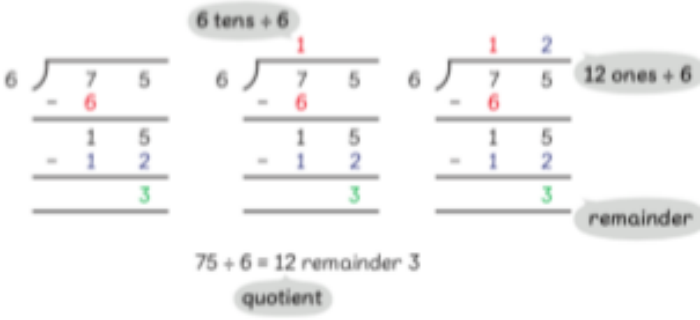
$408 \div 4 = 102$

Year 4
Division

Once confident with the partitioning and long division methods, remainders are introduced using these methods

Method 1

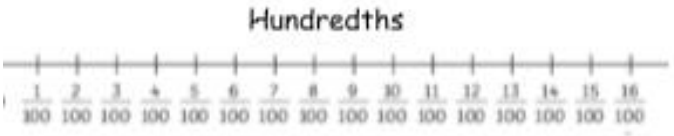
Method 2

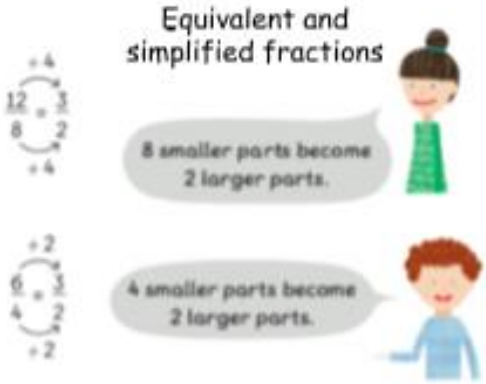


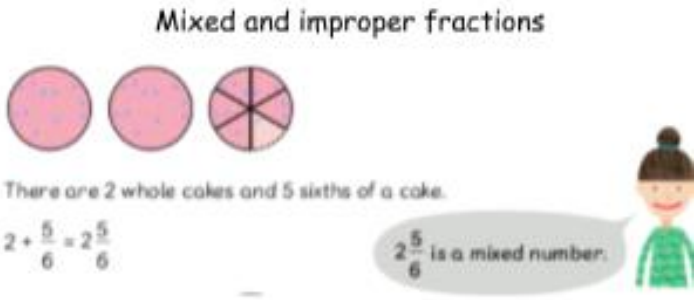
It is not possible to put 75 children into 6 equal groups.

Move onto problem solving involving these methods and bar models

Year 4 Fractions



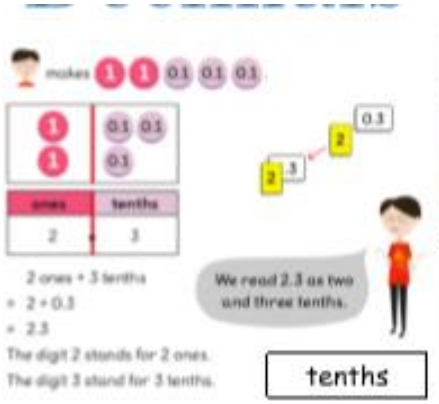


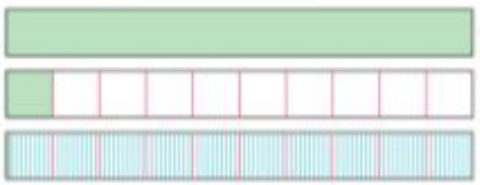


Also: adding and subtracting fractions then finding the simplified form of the answer

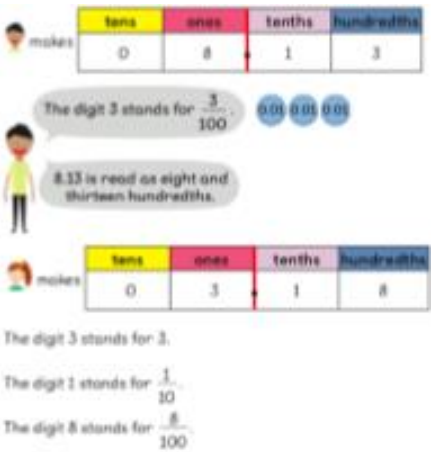
Move onto problem solving involving these methods and bar models

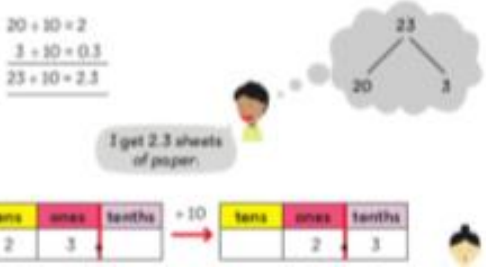
Year 4 Decimals

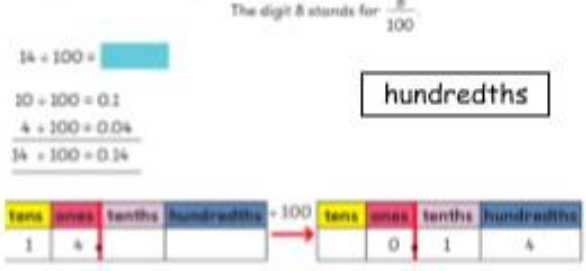




Other areas covered by decimals:
- Comparing and ordering
- Rounding
- Number patterns
- Dividing whole numbers



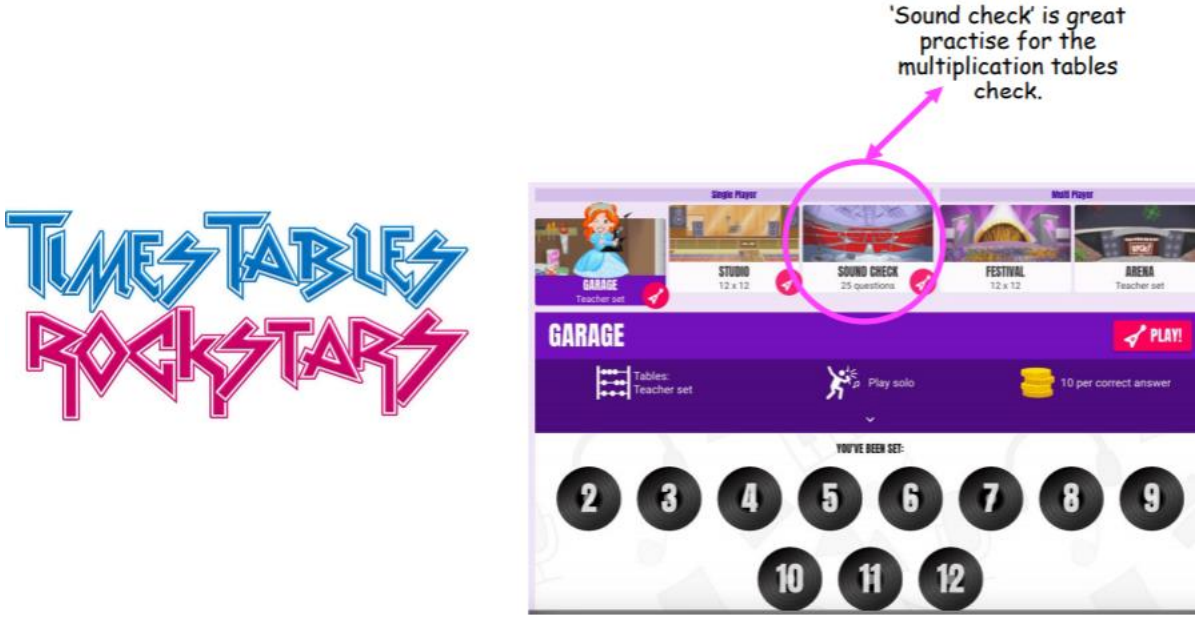




YEAR 4 - Multiplication tables check

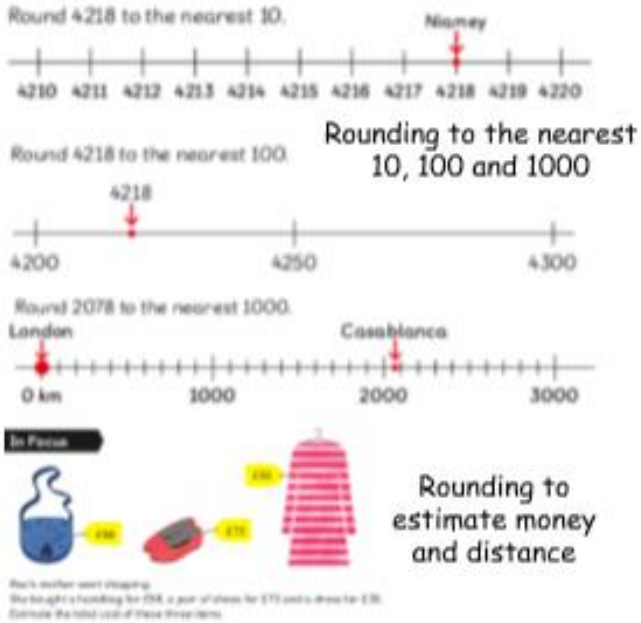
• From the 2019/20 academic year onwards , schools in England will be required to administer an online multiplication tables check (MTC) to year 4 children.
• The national curriculum specifies that children should be taught to recall the multiplication tables up to and including 12 × 12 by the end of year 4.
• The purpose of the MTC is to determine whether pupils can recall their times tables fluently, which is essential for future success in mathematics. It will help schools to identify pupils who have not yet mastered their times tables, so that additional support can be provided

Here at Clifton, we use Times Table Rockstars to best support the children in the lead up to this. The Sound Check area mirrors the layout in which the MTC will have.

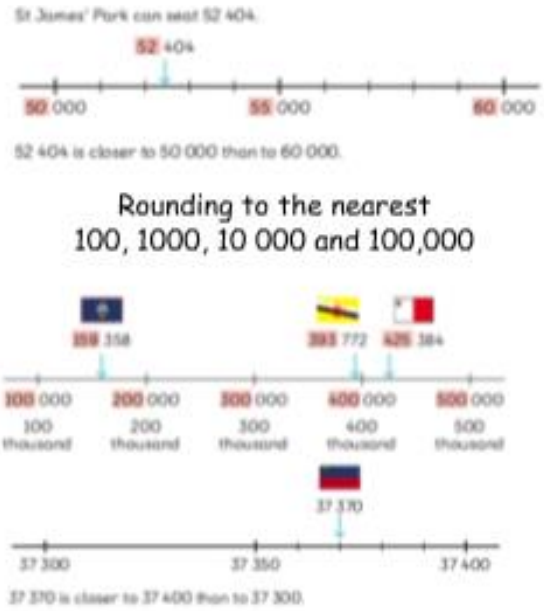


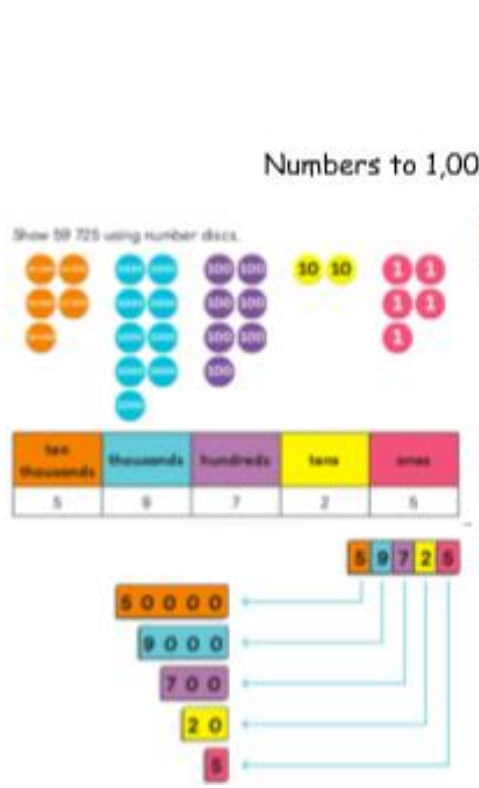
Year 5 Calculation Policy

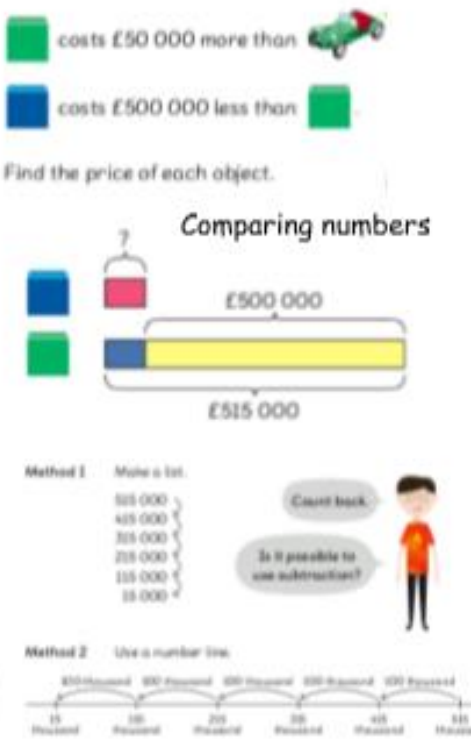
Year 5
Place Value



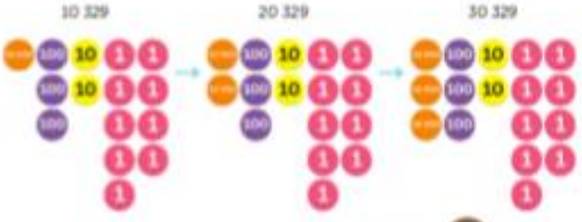
Rounding to the nearest 10, 100 and 1000



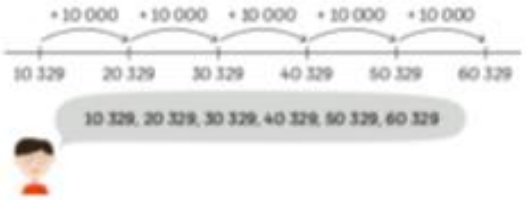




Year 5
Addition



Adding by counting on



	A	B	C
1	Date	Trip	Fare
2	13 September	Airport to Hotel	150 000
3	14 September	Hotel to Office	40 000
4		Office to Hotel	45 000
5	15 September	Hotel to Office	43 000
6		Office to Hotel	42 000
7		Hotel to Restaurant	25 000
8		Restaurant to Hotel	21 000
9	16 September	Hotel to Office	46 000
10		Office to Airport	150 000
11			
12		Total for Taxi Fare	582 000

I round each amount to the nearest 10 000.

40 000
40 000
+ 40 000
120 000

Rounding to add by estimate

37 + 12 = ☐

$$\begin{array}{r} 37\,000 \\ +\,12\,000 \\ \hline \\ \hline \end{array}$$

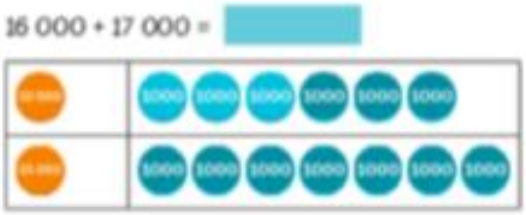
Adding key facts to simplify

120 + 120 = ☐

$$\begin{array}{r} 120\,000 \\ +\,120\,000 \\ \hline \\ \hline \end{array}$$

Year 5
Addition – with renaming

16 000 + 17 000 = ☐



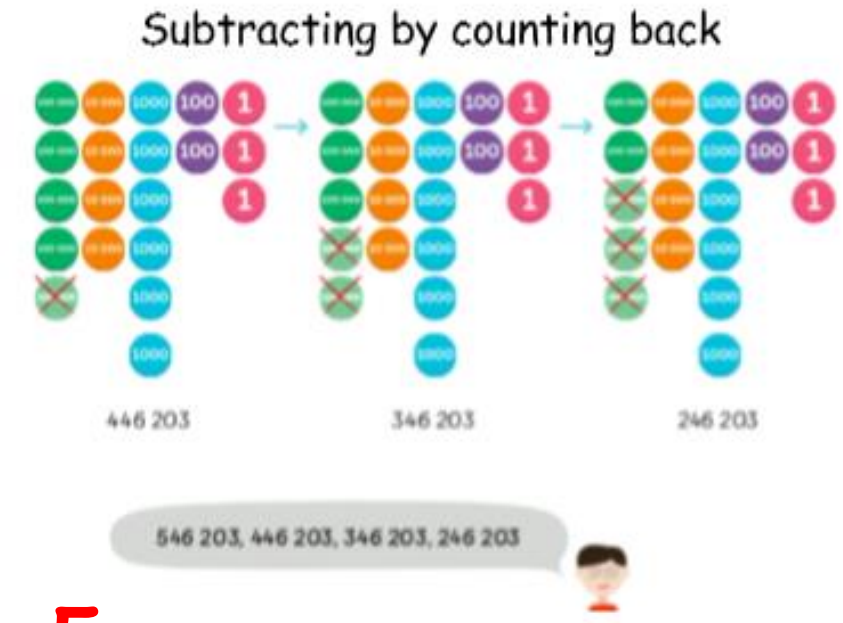
$$\begin{array}{r} 16\,000 \\ +\,17\,000 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} {\scriptstyle 1} \\ 16\,000 \\ +\,17\,000 \\ \hline 3\,000 \\ \hline \end{array}$$

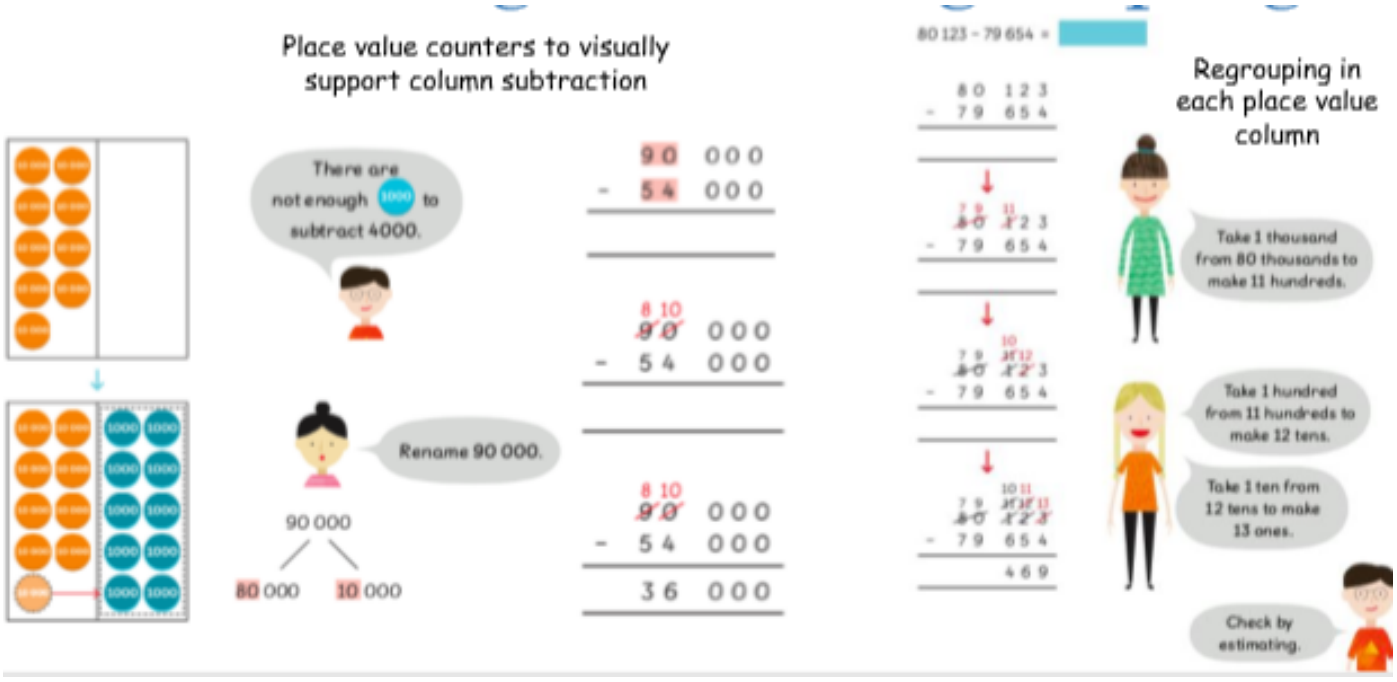
$$\begin{array}{r} {\scriptstyle 1} \\ 16\,000 \\ +\,17\,000 \\ \hline 33\,000 \\ \hline \end{array}$$

Place value counters to visually support column addition

Year 5
Subtraction



Year 5
Subtraction – with regrouping



Year 5 Multiplication

Finding multiples

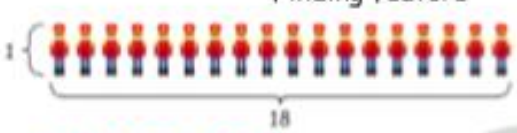
1 × 6 = 6

2 × 6 = 12

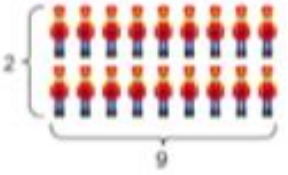
3 × 6 = 18

1	2	3	4	5	6
7	8	9	10	11	12
13	14	15	16	17	18
19	20	21	22	23	24

Finding fcators



18 = 1 × 18



18 = 2 × 9

1, 2, 9 and 18 are factors of 18.

Prime numbers

number	factors
5	1 and 5
7	1 and 7
4	1, 2 and 4
9	1, 3 and 9
6	1, 2, 3 and 6
8	1, 2, 4 and 8

5 and 7 are prime numbers.

4, 9, 6 and 8 are not prime numbers.

Common factors

Find the common factors of 48 and 64.

48 = (1) × 48 64 = (1) × 64

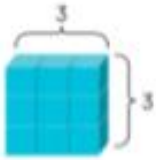
48 = (2) × 24 64 = (2) × 32

48 = 3 × (16) 64 = (4) × (16)

48 = (4) × 12 64 = (8) × 8

48 = 6 × (8)

The common factors of 48 and 64 are 1, 2, 4, 8 and 16.



9 = 3 × 3 = 3²

Square and cube numbers

27 = 3 × 3 × 3 = 3³

27 is a cube

12 × 10	12 × 100	12 × 1000
10 10 10 10 10 10 10 10 10 10 10 10	100 100 100 100 100 100 100 100 100 100 100 100	1000 1000 1000 1000 1000 1000 1000 1000 1000 1000 1000 1000
12 × 10 = 12 × 1 ten = 12 tens	12 × 100 = 12 × 1 hundred = 12 hundreds	12 × 1000 = 12 × 1 thousand = 12 thousands

120

1200

12 000

Year 5 Multiplication

$$\begin{array}{r} 2718 \\ \times \quad 4 \\ \hline 32 \\ 40 \\ 2800 \\ +\,8000 \\ \hline 10872 \\ \hline \end{array}$$

$$\begin{array}{r} {\scriptstyle 3} \\ 2718 \\ \times \quad 4 \\ \hline 2 \\ \hline \end{array} \qquad \begin{array}{r} {\scriptstyle 3} \\ 2718 \\ \times \quad 4 \\ \hline 72 \\ \hline \end{array} \qquad \begin{array}{r} {\scriptstyle 2\ 3} \\ 2718 \\ \times \quad 4 \\ \hline 872 \\ \hline \end{array} \qquad \begin{array}{r} {\scriptstyle 2\ 3} \\ 2718 \\ \times \quad 4 \\ \hline 10872 \\ \hline \end{array}$$

Recap:
Bridged and short multiplication but with larger numbers

Place value counters are initially used alongside the column method to support pictorially

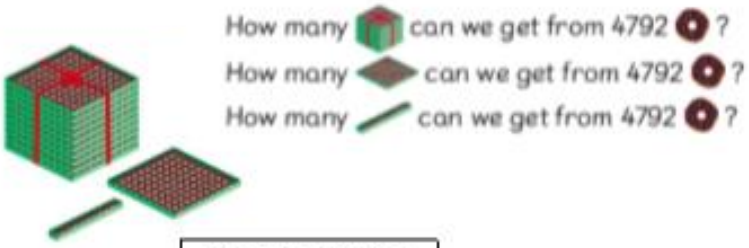
$2718 \times 4 = 10\,872$

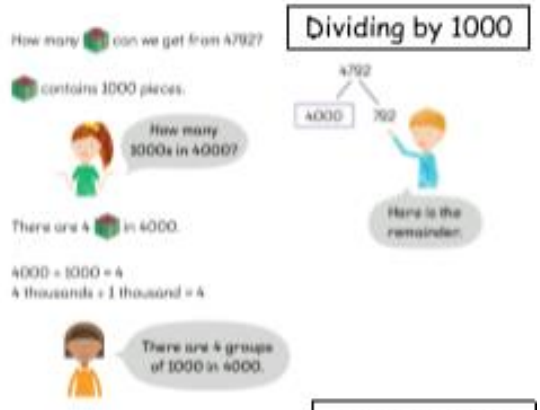
$$\begin{array}{r} {\scriptstyle 1} \\ {\scriptstyle 4} \\ 28 \\ \times \quad 26 \\ \hline 168 \longrightarrow 28 \times 6 \\ +\,56 \longrightarrow 28 \times 20 \\ \hline 728 \\ \hline \end{array}$$

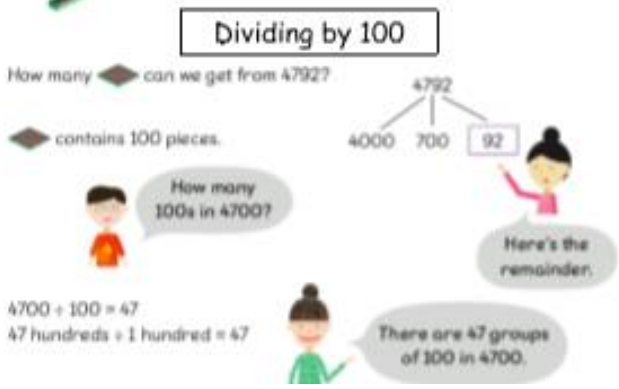
Multiplying 2 and 3 digit numbers by 2-digit numbers

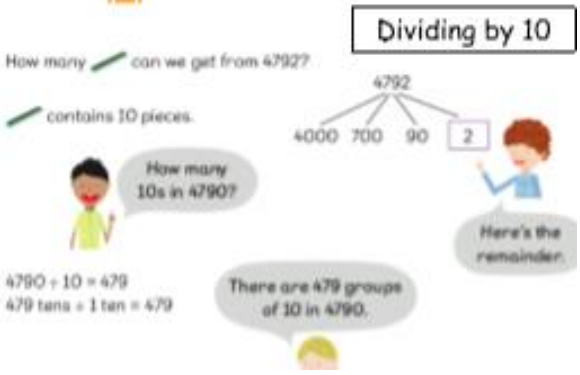
$$\begin{array}{r} {\scriptstyle 4} \\ 28 \\ \times 26 \\ \hline 8 \\ \hline \end{array} \longrightarrow \begin{array}{r} {\scriptstyle 4} \\ 28 \\ \times 26 \\ \hline 168 \\ \hline \end{array} \longrightarrow \begin{array}{r} {\scriptstyle 1} \\ 28 \\ \times 26 \\ \hline 168 \\ 6 \\ \hline \end{array} \longrightarrow \begin{array}{r} {\scriptstyle 1} \\ 28 \\ \times 26 \\ \hline 168 \\ 56 \\ \hline \end{array}$$

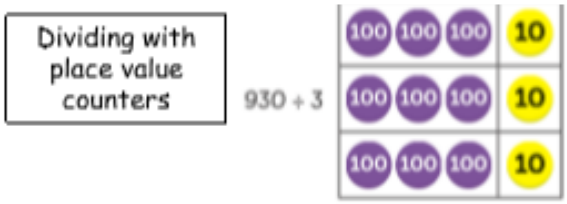
Year 5 Division

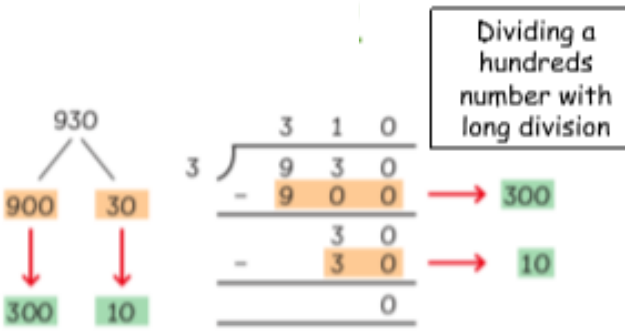


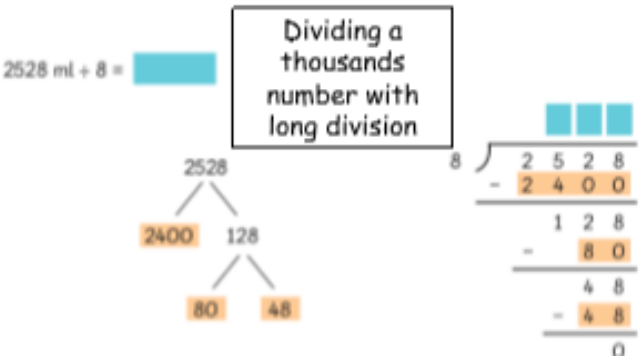


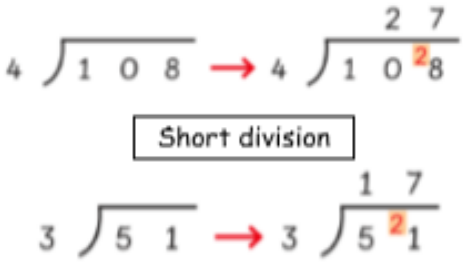






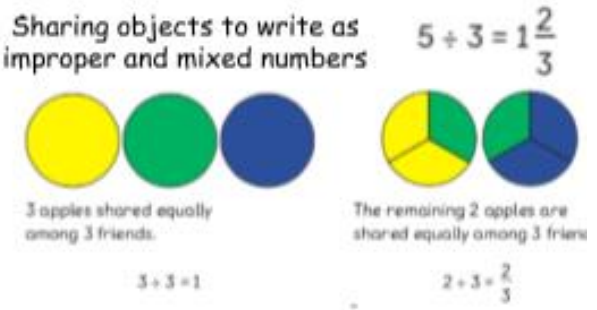


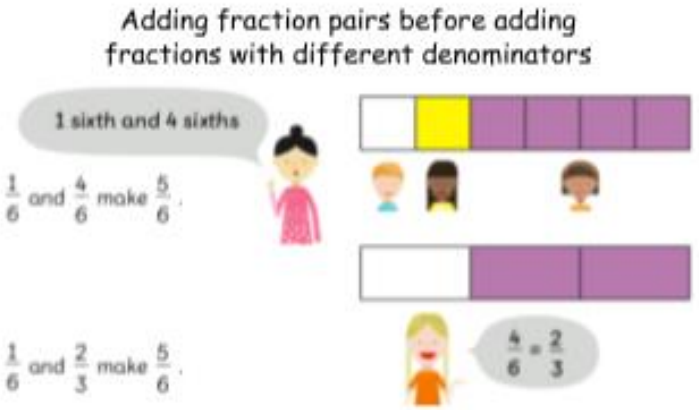


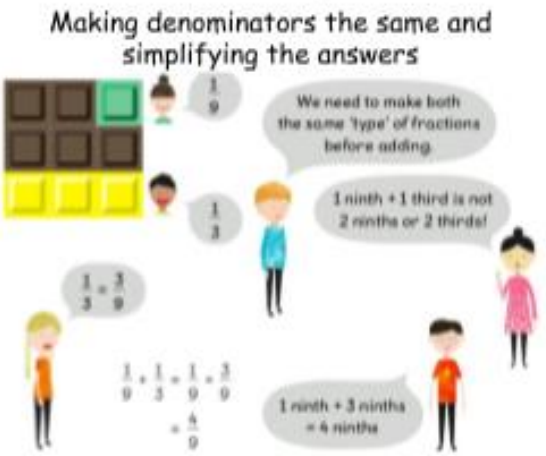


Year 5 Fractions

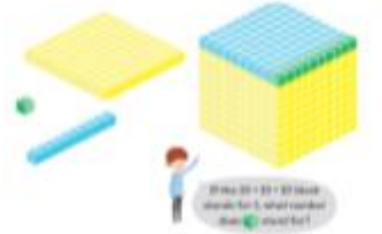
Improper fractions, mixed numbers and simplifying







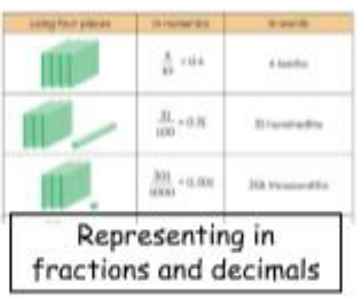
Year 5 Decimals



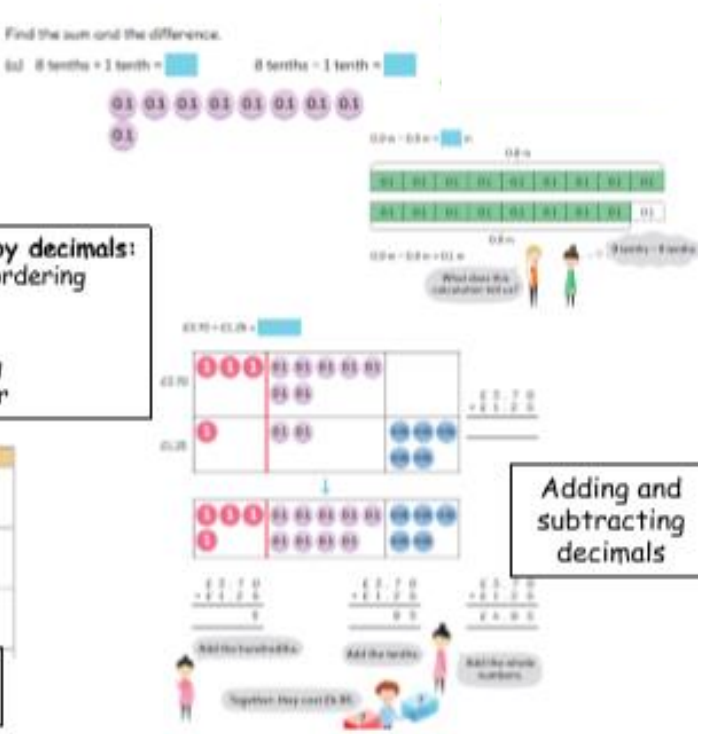
thousandths

Other areas covered by decimals:

- Comparing and ordering
- Money
- Weight
- Rounding
- Perimeter



Representing in fractions and decimals



Adding and subtracting decimals

Year 6

Year 6

Year 6 teachers use the White Rose Maths scheme of work in order to best suit the children in preparation for their SATs.

Year 6 Maths lessons are built using the assessment of weekly arithmetic tests in order to provide the children with follow up lessons tailored to their needs whilst ensuring all objectives taken from the National Curriculum are being met.

Year 6 pupils use the printed White Rose Maths booklets, which fully cover the Year 6 National Curriculum and the 'Racing to Progress' documentation following the Coronavirus pandemic.

The Concrete-Pictorial-Abstract (CPA) approach ties into White Rose Maths mastery and deep learning. Children are given the chance to understand and explain what they've learned by 'doing' first of all, using concrete objects.

Then they'll move on to using pictorial representations such as images, graphs or diagrams to solve problems. And finally, once they have a good understanding of the topic, they should be able to take an abstract approach and solve mathematical problems using abstract concepts and symbols.

All children are accessing fluency, reasoning and problem solving questions through White Rose Maths, leading to mastery.

Aim: shaping assured, happy and resilient mathematicians who relish the challenge of maths. They become independent, reflective thinkers, whose skills not only liberate them in maths but also support them across the curriculum.

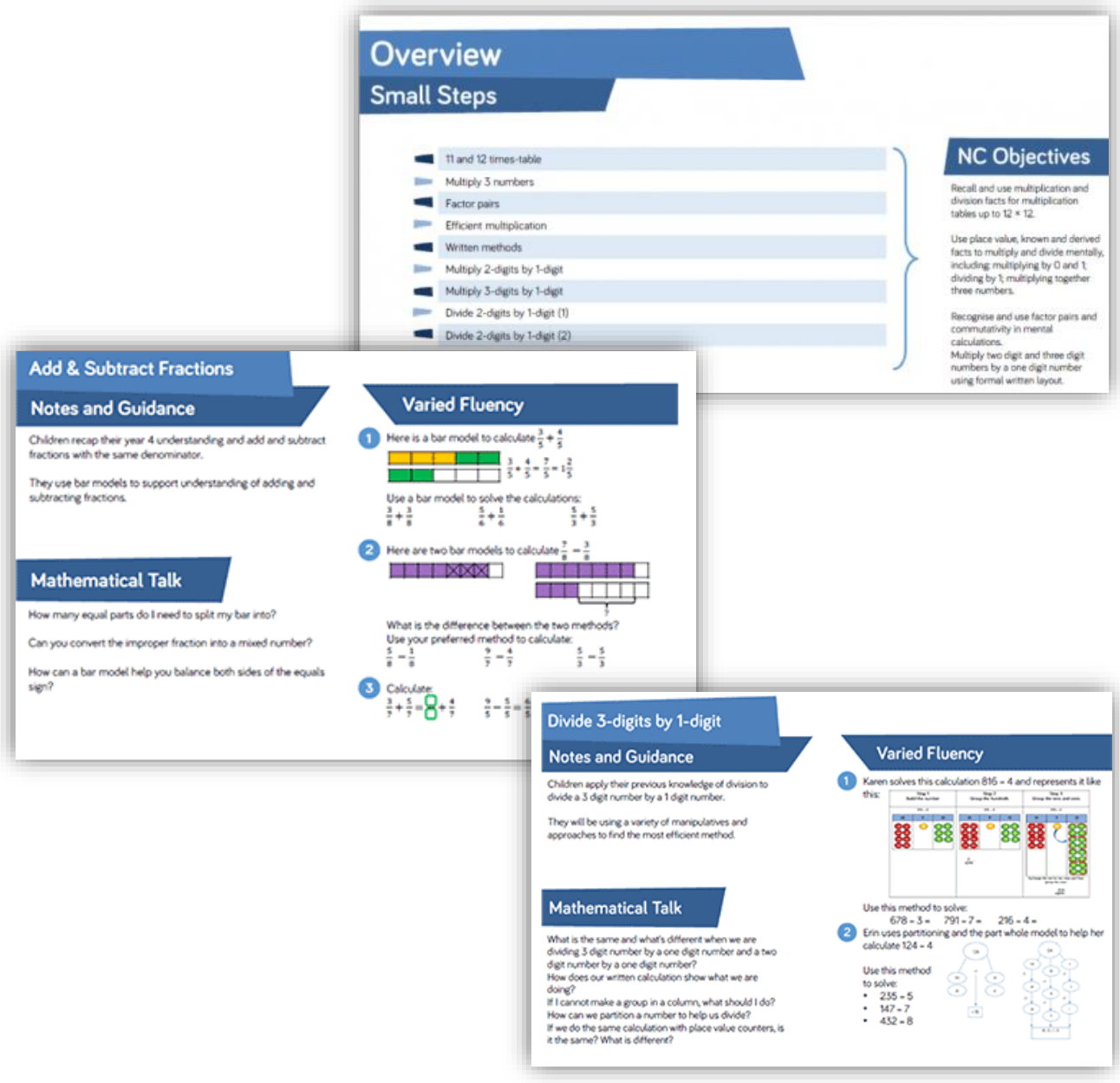
Scheme of work – Long term plan – Year 6

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
Autumn	Number: Place Value		Number: Addition, Subtraction, Multiplication and Division				Number: Fractions					Geometry: Position and Direction
Spring	Number: Decimals		Number: Percentages		Number: Algebra		Measurement: Converting Units	Measurement: Perimeter, Area and Volume		Number: Ratio		Statistics
Summer	Geometry: Properties of Shape			Consolidation or SATs preparation		Consolidation, investigations and preparations for KS3						

Small Steps:

The objectives in each block are broken down into a series of carefully planned small steps.

- Notes & Guidance
- Mathematical talk
- Varied fluency
- Reasoning and problem solving



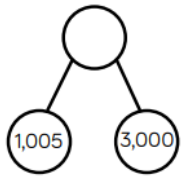
Autumn - Place value

- Numbers to 10,000
- Numbers to 100,000
- Numbers to a million
- Numbers to ten million
- Compare and order any number
- Round numbers to 10, 100 and 1,000
- Round any number
- Negative numbers

Varied Fluency

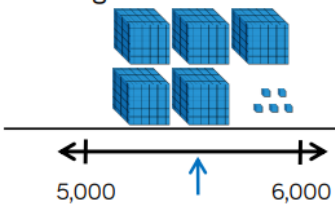
R

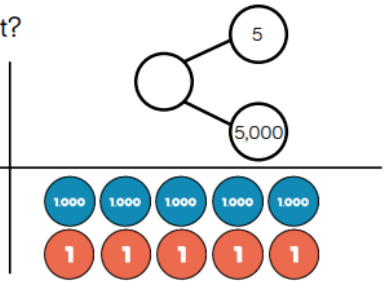
Match the diagram to the number.



4,005 | 4,500 | 4,050

Which diagram is the odd one out?





Complete the table.

	Add 10	Add 100	Add 1,000
2,506			
7,999			
		6,070	

Reasoning and Problem Solving

R

Dora has made five numbers, using the digits 1, 2, 3 and 4

She has changed each number into a letter.

Her numbers are

aabcd
acdbc
dcaba
cdadc
bdaab

Here are three clues to work out her numbers:

- The first number in her list is the greatest number.
- The digits in the fourth number total 12
- The third number in the list is the smallest number.

44,213
43,123
13,424
31,413
21,442

Tommy says he can order the following numbers by only looking at the first three digits.

12,516 | 12,832 | 12,679 | 12,538 | 12,794

Is he correct?

Explain your answer.

He is incorrect because two of the numbers start with twelve thousand, five hundred therefore you need to look at the tens to compare and order.

Autumn - Four operations

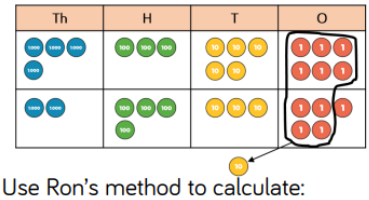
- Add whole numbers with more than 4 digits (R)
- Subtract whole numbers with more than 4 digits (R)
- Inverse operations (addition and subtraction) (R)
- Multi-step addition and subtraction problems (R)
- Add and subtract integers
- Multiply 4-digits by 1-digit (R)
- Multiply 2-digits (area model) (R)
- Multiply 2-digits by 2-digits (R)
- Multiply 3-digits by 2-digits (R)
- Multiply up to a 4-digit number by 2-digit number
- Divide 4-digits by 1-digit (R)
- Divide with remainders (R)
- Short division
- Division using factors
- Long division (1)
- Long division (2)
- Long division (3)
- Long division (4)
- Factors (R)
- Common factors
- Common multiples
- Primes to 100
- Squares and cubes
- Order of operations
- Mental calculations and estimation
- Reason from known facts

Autumn - Four operations

Varied Fluency

R

Ron uses place value counters to calculate 4,356 + 2,435



	Th	H	T	O
	4	3	5	6
+	2	4	3	5
	6	7	9	1
			1	

Use Ron's method to calculate:

	3	2	4	6	1
+		4	3	5	2

	4	8	2	7	6
+		5	6	1	3

Mathematical Talk

Will you have to exchange? How do you know which columns will be affected?

Does it matter that the two numbers don't have the same amount of digits?

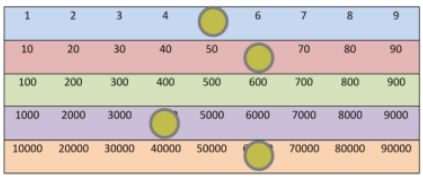
Which number goes on top in the calculation? Does it affect the answer?

Reasoning and Problem Solving

R

Amir is discovering numbers on a Gattegno chart.

He makes this number.



Amir moves one counter three spaces on a horizontal line to create a new number.

When he adds this to his original number he gets 131,130

Which counter did he move?

He moved the counter on the thousands row, he moved it from 4,000 to 7,000

Work out the missing numbers.

	?	4	?	3	?
+	2	?	5	?	2
	7	8	5	2	9

54,937 + 23,592 = 78,529

Year 6

On the lead up to SATs, the children should be encouraged to use formal written methods for all four of the operations.

Addition and Subtraction

789 + 642 becomes

$$\begin{array}{r} {\scriptstyle 1\ 1\ \ } \\ 7\ 8\ 9 \\ +\ 6\ 4\ 2 \\ \hline 1\ 4\ 3\ 1 \end{array}$$

874 – 523 becomes

$$\begin{array}{r} \\ 8\ 7\ 4 \\ -\ 5\ 2\ 3 \\ \hline 3\ 5\ 1 \end{array}$$

932 – 457 becomes

$$\begin{array}{r} {\scriptstyle 8\ \ 12\ \ 1} \\ 9\ \not{3}\ \not{2} \\ -\ 4\ 5\ 7 \\ \hline 4\ 7\ 5 \end{array}$$

932 – 457 becomes

$$\begin{array}{r} {\scriptstyle \ \ 1\ \ 1} \\ 9\ 3\ 2 \\ -\ \not{4}\ \not{5}\ 7 \\ {\scriptstyle \ \ 5\ \ 6} \\ \hline 4\ 7\ 5 \end{array}$$

Multiplication

24 × 16 becomes

$$\begin{array}{r} {\scriptstyle 2\ \ } \\ 2\ 4 \\ \times\ 1\ 6 \\ \hline 2\ 4\ 0 \\ 1\ 4\ 4 \\ \hline 3\ 8\ 4 \end{array}$$

124 × 26 becomes

$$\begin{array}{r} {\scriptstyle 1\ 2\ \ } \\ 1\ 2\ 4 \\ \times\ \ 2\ 6 \\ \hline 2\ 4\ 8\ 0 \\ 7\ 4\ 4 \\ \hline 3\ 2\ 2\ 4 \\ {\scriptstyle 1\ 1\ \ } \end{array}$$

124 × 26 becomes

$$\begin{array}{r} {\scriptstyle 1\ 2\ \ } \\ 1\ 2\ 4 \\ \times\ \ 2\ 6 \\ \hline 7\ 4\ 4 \\ 2\ 4\ 8\ 0 \\ \hline 3\ 2\ 2\ 4 \\ {\scriptstyle 1\ 1\ \ } \end{array}$$

Division

98 ÷ 7 becomes

$$\begin{array}{r} 1\ 4 \\ 7\overline{)\ 9\ 8} \\ {\scriptstyle 2\ \ } \end{array}$$

432 ÷ 5 becomes

$$\begin{array}{r} 8\ \ 6\ \ r\,2 \\ 5\overline{)\ 4\ 3\ 2} \\ {\scriptstyle \ \ 3\ \ } \end{array}$$

496 ÷ 11 becomes

$$\begin{array}{r} 4\ \ 5\ \ r\,1 \\ 1\ 1\overline{)\ 4\ 9\ 6} \\ {\scriptstyle \ \ 5\ \ } \end{array}$$

Autumn - Fractions

- Equivalent fractions
- Simplify fractions
- Improper fractions to mixed numbers
- Mixed numbers to improper fractions
- Fractions on a number line
- Compare and order (denominator)
- Compare and order (numerator)
- Add and subtract fractions (1)
- Add and subtract fractions (2)
- Add mixed numbers
- Add fractions
- Subtract mixed numbers
- Subtract fractions
- Mixed addition and subtraction
- Multiply fractions by integers
- Multiply fractions by fractions
- Divide fractions by integers (1)
- Divide fractions by integers (2)
- Four rules with fractions
- Fraction of an amount
- Fraction of an amount – find the whole

Autumn - Fractions

Mathematical Talk

What equivalent fractions can we find by folding the paper? How can we record these?

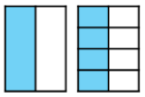
What is the same and what is different about the numerators and denominators in the equivalent fractions?

How does multiplication and division help us find equivalent fractions? Where can we see this in our model?

Varied Fluency

R

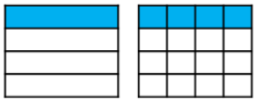
Take two pieces of paper the same size.
Fold one piece into two equal pieces.
Fold the other into eight equal pieces.
What equivalent fractions can you find?



$\frac{1}{2} = \frac{4}{8}$

Use the models to write equivalent fractions.

Eva uses the models and her multiplication and division skills to find equivalent fractions.



Use this method to find equivalent fractions to $\frac{2}{4}$, $\frac{3}{4}$ and $\frac{4}{4}$ where the denominator is 16

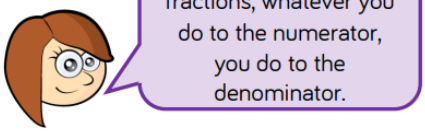
Eva uses the same approach to find equivalent fractions for these fractions. How will her method change?

$\frac{4}{12} = \frac{\square}{3}$ $\frac{6}{12} = \frac{\square}{4}$ $\frac{6}{12} = \frac{\square}{2}$

Reasoning and Problem Solving

R

Rosie says,



Using her method, here are the equivalent fractions Rosie has found for $\frac{4}{8}$

$\frac{4}{8} = \frac{8}{16}$ $\frac{4}{8} = \frac{6}{10}$

$\frac{4}{8} = \frac{2}{4}$ $\frac{4}{8} = \frac{1}{5}$

Are all Rosie's fractions equivalent?
Does Rosie's method work?
Explain your reasons.

$\frac{4}{8} = \frac{1}{5}$ and $\frac{4}{8} = \frac{6}{10}$ are incorrect.

Rosie's method doesn't always work. It works when multiplying or dividing both the numerator or denominator but not when adding or subtracting the same thing to both.

Ron thinks you can only simplify even numbered fractions because you keep on halving the numerator and denominator until you get an odd number.

Do you agree?
Explain your answer.

Ron is wrong. For example $\frac{3}{9}$ can be simplified to $\frac{1}{3}$ and these are all odd numbers.

Here are some fraction cards.
All of the fractions are equivalent.

$\frac{4}{A}$ $\frac{B}{C}$ $\frac{20}{50}$

A + B = 16
Calculate the value of C.

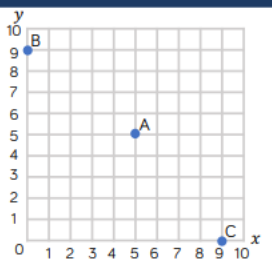
A = 10
B = 6
C = 15

Autumn - Geometry, position and direction

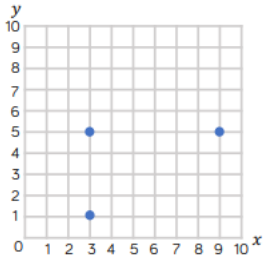
- The first quadrant
- Four quadrants
- Translations
- Reflections

Varied Fluency

Whitney plots three coordinates.
Write down the coordinates of points A, B and C.



Tommy is drawing a rectangle on a grid.
Plot the final vertex of the rectangle.
Write the coordinate of the final vertex.



Draw the vertices of the polygon with the coordinates (7, 1), (7, 4) and (10, 1)
What type of polygon is the shape?

Mathematical Talk

Which axis do we look at first?

Does joining up the vertices already given help you to draw the shape?

Can you draw a shape in the first quadrant and describe the coordinates of the vertices to a friend?

Autumn - Geometry, position and direction

Reasoning and Problem Solving

Eva is drawing a trapezium.
She wants her final shape to look like this:

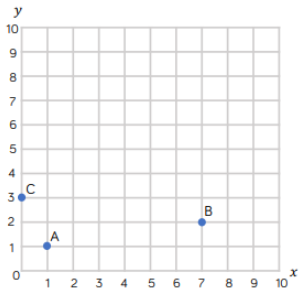
Eva uses the coordinates (2, 4), (4, 5), (1, 6) and (5, 6).
Will she draw the shape that she wants to?
If not, can you correct her coordinates?

Eva has plotted the coordinate (4, 5) incorrectly. This should be plotted at (4, 4) to make the trapezium that she wanted to draw (an isosceles trapezium).

Mo has written the coordinates of points A, B and C.

A (1, 1) **B** (2, 7) **C** (3, 0)

Mark Mo's work and correct his mistakes.



Explain why Mo could not make the same mistake for point A as he made for points B and C.

A is correct.

B and C have been plotted incorrectly because Mo has plotted the x and y coordinates the wrong way round.

Because the coordinates for point A are both the same number it does not matter if Mo incorrectly reads the y coordinate as the first and the x coordinate as the second.

Spring - Decimals

- Decimals up to 2 decimal places
- Understand thousandths
- Three decimal places
- Multiply by 10, 100 and 1,000
- Divide by 10, 100 and 1,000
- Multiply decimals by integers
- Divide decimals by integers
- Division to solve problems
- Decimals as fractions
- Fractions to decimals (1)
- Fractions to decimals (2)

Varied Fluency

R

Which number is represented on the place value chart?

Ones	Tenths	Hundredths
	0.1	0.01 0.01
0	1	2

There are ____ ones, ____ tenths and ____ hundredths.

The number is ____

Represent the numbers on a place value chart and complete the stem sentences.

0.28 | 0.65 | 0.07 | 1.26

Make the numbers with place value counters and write down the value of the underlined digit.

2.45 | 3.04 | 4.44 | 43.34

0.76 = 0.7 + 0.06 = 7 tenths and 6 hundredths.
Fill in the missing numbers.

0.83 = ____ + 0.03 = _____ and 3 hundredths.

0.83 = 0.7 + ____ = 7 tenths and _____

How many other ways can you partition 0.83?

Mathematical Talk

How many ones/tenths/hundredths are in the number?
How do we write this as a decimal? Why?

What is the value of the ____ in the number _____?

When do we need to use zero as a place holder?

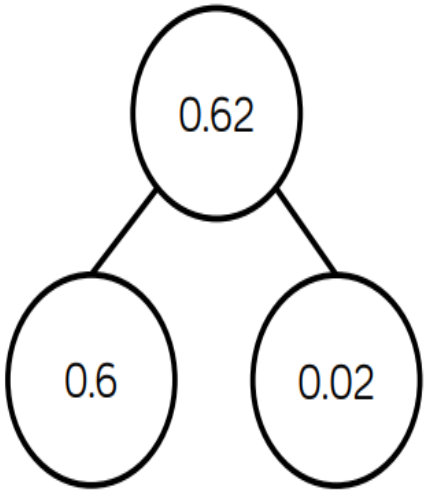
How can we partition decimal numbers in different ways?

Spring - Decimals

Reasoning and Problem Solving

R

Dexter says there is only one way to partition 0.62



Prove Dexter is incorrect by finding at least three different ways of partitioning 0.62

0.62 = 0.12 + 0.5

0.62 = 0.4 + 0.22

0.62 = 0.3 + 0.32

0.62 = 0.42 + 0.2

0.62 = 0.1 + 0.52

0.62 = 0.03 + 0.59

etc.

Match each description to the correct number.

My number has the same amount of tens and tenths.

Teddy

My number has one decimal place.

Amir

My number has two hundredths.

Rosie

My number has six tenths.

Eva

46.2	2.64	46.02	40.46

Teddy – 40.46
Amir – 46.2
Rosie – 46.02
Eva – 2.64

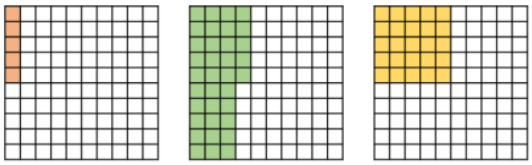
Spring – Percentages

- Understand percentages
- Fractions to percentages
- Equivalent FDP
- Order FDP
- Percentage of an amount (1)
- Percentage of an amount (2)
- Percentages – missing values

Varied Fluency

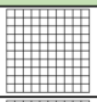
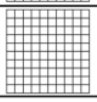
R

Complete the sentence stem for each diagram.

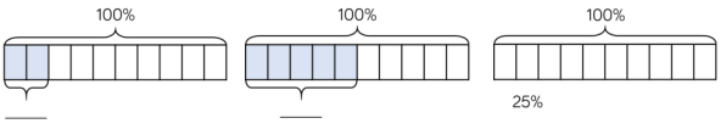


There are ____ parts per hundred shaded. This is ____%

Complete the table.

Pictorial	Parts per hundred	Percentage
	There are 51 parts per hundred.	
		75%

Complete the bar models.



Mathematical Talk

How many parts is the square split in to?

How many parts per hundred are shaded/not shaded?

Can we represent this percentage differently?

Look at the bar model, how many parts is it split into?

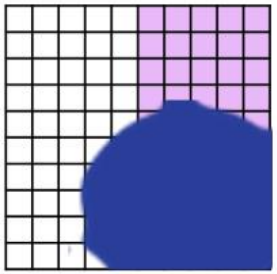
If the bar is worth 100%, what is each part worth?

Spring – Percentages

Reasoning and Problem Solving

R

Oh no! Dexter has spilt ink on his hundred square.



Complete the sentence stems to describe what percentage is shaded.

It could be...

It must be...

It can't be...

Some possible answers:

It could be 25%

It must be less than 70%

It can't be 100%

Mo, Annie and Tommy all did a test with 100 questions. Tommy got 6 fewer questions correct than Mo.

Name	Score	Percentage
Mo	56 out of 100	
Annie		65%
Tommy		

Complete the table.
How many more marks did each child need to score 100%?

56%
65 out of 100
50 out of 100
50%

Mo needs 44
Annie needs 35
Tommy needs 50

Dora and Amir each have 100 sweets. Dora eats 65% of hers. Amir has 35 sweets left.
Who has more sweets left?

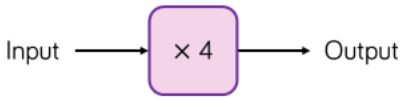
Neither. They both have an equal number of sweets remaining.

Spring – Algebra

- Find a rule – one step
- Find a rule – two step
- Forming expressions
- Substitution
- Formulae
- Forming equations
- Solve simple one-step equations
- Solve two-step equations
- Find pairs of values
- Enumerate possibilities

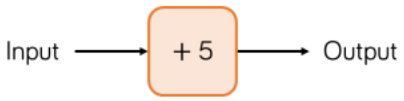
Varied Fluency

Here is a function machine.



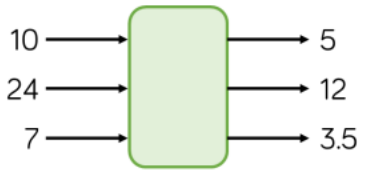
- What is the output if the input is 2?
- What is the output if the input is 7.2?
- What is the input if the output was 20?
- What is the input if the output was 22?

Complete the table for the function machine.



Input	5	5.8	10	– 3	– 8			
Output						9	169	0

Find the missing function.



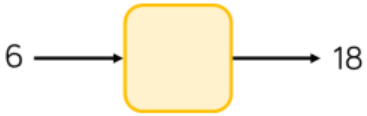
Mathematical Talk

What do you think "one-step function" means?
What examples of functions do you know?
Do some functions have more than one name?
What do you think input and output mean?
What is the output if ….?
What is the input if ….?
How many sets of inputs and outputs do you need to be able to work out the function? Explain how you know.

Spring – Algebra

Reasoning and Problem Solving

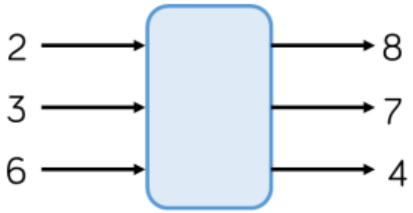
Eva has a one-step function machine.
She puts in the number 6 and the number 18 comes out.



What could the function be?
How many different answers can you find?

The function could be + 12, × 3

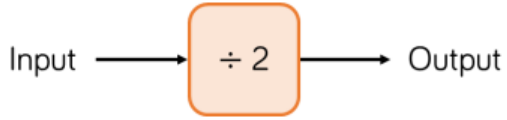
Amir puts some numbers into a function machine.



What is the output from the function when the input is 16?

The function is subtract from 10 so the output is −6

Dora puts a number into the function machine.



Dora's number is:
- A factor of 32
- A multiple of 8
- A square number

What is Dora's input?
What is her output?

Can you create your own clues for the numbers you put into a function machine for a partner to solve?

Dora's input is 16

Her output is 8

Spring – Converting units

- Metric measures
- Convert metric measures
- Calculate with metric measures
- Miles and kilometres
- Imperial measures

Varied Fluency

Choose the unit of measure that would be the most appropriate to measure the items.

cm kg km g tonnes ml mm litres

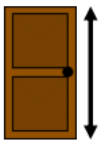
- The weight of an elephant
- The volume of water in a bath
- The length of an ant
- The length of a football pitch
- The weight of an apple

Estimate how much juice the glass holds:

250 ml 2 litres 0.5 litres $\frac{1}{2}$ kg

Estimate the height of the door frame:

20 mm 20 cm 20 m 2 km 2 m 0.2 km



Mathematical Talk

Which units measure length? Mass? Capacity?

When would you use km instead of m? When would you use mm instead of cm?

Which is the most appropriate unit to use to measure the object? Explain your answer.

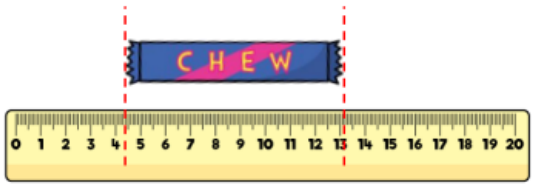
Why do you think _____ is not an appropriate estimate?

Spring – Converting units

Reasoning and Problem Solving

Teddy thinks his chew bar is 13.2 cm long.

Do you agree? Explain why.



Teddy is wrong because he has not lined up the end of his chew bar with zero.
It is actually 8.8 cm long.

Ron's dog is about $\frac{1}{4}$ of the height of the door.
Ron is three times the height of his dog.
Estimate the height of Ron and his dog.

Door = 2 m (200 cm)
Dog = 50 cm
Ron = 150 cm

Here is a train timetable showing the times of trains travelling from Halifax to Leeds.

Halifax	Leeds
07:33	08:09
07:49	08:37
07:52	08:51

An announcement states all trains will arrive $\frac{3}{4}$ of an hour late.
Which train will arrive in Leeds closest to 09:07?

The first train from Halifax, which will now arrive in Leeds at 08:54.

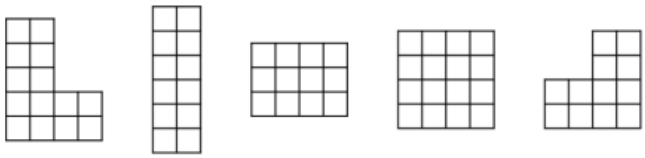
Area, perimeter and volume

- Shapes – same area
- Area and perimeter
- Area of a triangle (1)
- Area of a triangle (2)
- Area of a triangle (3)
- Area of parallelogram
- What is volume?
- Volume – counting cubes
- Volume of a cuboid

Varied Fluency

Sort the shapes into the Carroll diagram.

	Quadrilateral	Not a quadrilateral
Area of 12 cm^2		
Area of 16 cm^2		



Now draw another shape in each section of the diagram.

How many rectangles can you draw with an area of 24 cm^2 where the side lengths are integers?

What do you notice about the side lengths?

Using integer side lengths, draw as many rectangles as possible that give the following areas:

17 cm^2 25 cm^2 32 cm^2

Mathematical Talk

What do we need to know in order to work out the area of a shape?

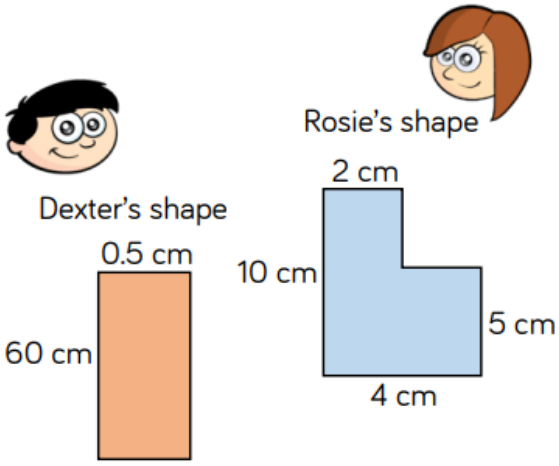
Why is it useful to know your times-tables when calculating area?

Can you have a square with an area of 48 cm^2? Why?

How can factors help us draw rectangles with a specific area?

Reasoning and Problem Solving

Rosie and Dexter are drawing shapes with an area of 30cm^2



Who is correct?

Explain your reasoning.

Both are correct.

Dexter's shape:
60 cm × 0.5 cm
= 30 cm^2

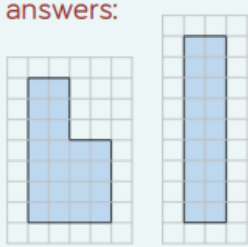
Rosie's shape:
2 cm × 10 cm
= 20 cm^2
5 cm × 2 cm
= 10 cm^2
20 cm^2 + 10 cm^2
= 30 cm^2
Could be split differently.

Three children are given the same rectilinear shape to draw.

Amir says, "The smallest length is 2 cm."
Alex says, "The area is less than 30 cm^2."
Annie says, "The perimeter is 22 cm."

What could the shape be?
How many possibilities can you find?

Children can use squared paper to explore. Possible answers:



Always, Sometimes, Never?

If the area of a rectangle is odd then all of the lengths are odd.

Sometimes –
15 cm^2 could be 5 cm and 3 cm or 60 cm and 0.25 cm

Ratio

- Using ratio language
- Ratio and fractions
- Introducing the ratio symbol
- Calculating ratio
- Using scale factors
- Calculating scale factors
- Ratio and proportion problems

Using Ratio Language

Notes and Guidance

Children will understand that a ratio shows the relationship between two values and can describe how one is related to another.

They will start by making simple comparisons between two different quantities. For example, they may compare the number of boys to girls in the class and write statements such as, "For every one girl, there are two boys".

Mathematical Talk

How would your sentences change if there were 2 more blue flowers?

How would your sentences change if there were 10 more pink flowers?

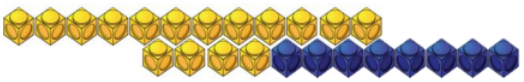
Can you write a "For every..." sentence for the number of boys and girls in your class?

Varied Fluency

Complete the sentences.

For every two blue flowers there are ___ pink flowers.
For every blue flower there are ____ pink flowers.

Use cubes to help you complete the sentences.



For every ___ , there are ___

For every 8 , there are ___

For every 1 , there are ___

How many "For every..." sentences can you write to describe these counters?

Reasoning and Problem Solving

Whitney lays tiles in the following pattern

If she has 16 red tiles and 20 yellow tiles remaining, can she continue her pattern without there being any tiles left over?

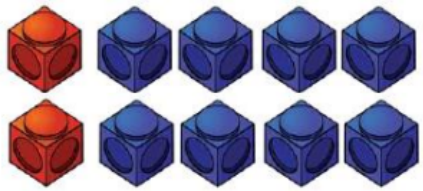
Explain why.

Possible responses:

For every two red tiles there are three yellow tiles. If Whitney continues the pattern she will need 16 red tiles and 24 yellow tiles. She cannot continue the pattern without there being tiles left over.

20 is not a multiple of 3

True or False?



- For every red cube there are 8 blue cubes.
- For every 4 blue cubes there is 1 red cube.
- For every 3 red cubes there would be 12 blue cubes.
- For every 16 cubes, 4 would be red and 12 would be blue.
- For every 20 cubes, 4 would be red and 16 would be blue.

False

True

True

False

True

Statistics

- Read and interpret line graphs
- Draw line graphs
- Use line graphs to solve problems
- Circles
- Read and interpret pie charts
- Pie charts with percentages
- Draw pie charts
- The mean

Read and Interpret Line Graphs

Notes and Guidance

Children will build on their experience of interpreting data in context from Year 5, using their knowledge of scales to read information accurately. Examples of graphs are given but it would be useful if real data from across the curriculum e.g. Science, was also used. Please note that line graphs represent continuous data not discrete data. Children need to read information accurately, including where more than one set of data is on the same graph.

Mathematical Talk

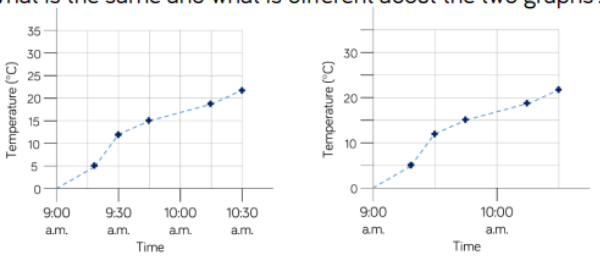
Where might you see a line graph used in real life?

Why is the 'Water Consumption' graph more difficult to interpret?

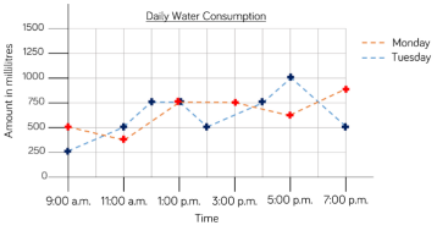
How can you make sure that you read the information accurately?

Varied Fluency

What is the same and what is different about the two graphs?



Here is a graph showing daily water consumption over two days.



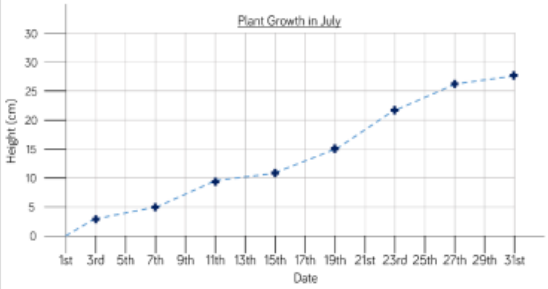
At what times of the day was the same amount of water consumed on Monday and Tuesday?

Was more water consumed at 2 p.m. on Monday or Tuesday morning? How much more?

Statistics

Reasoning and Problem Solving

Eva has created a graph to track the growth of a plant in her house.



Eva recorded the following facts about the graph.

a) On the 9th of July the plant was about 9 cm tall.

b) Between the 11th and 19th July the plant grew about 5 cm.

c) At the end of the month the plant was twice as tall as it had been on the 13th .

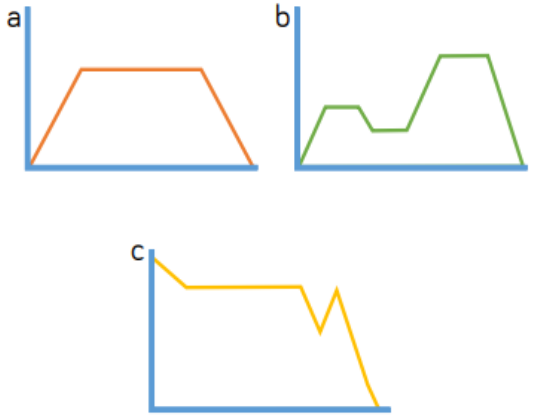
Can you spot and correct Eva's mistakes?

a) On the 9th July a more accurate measurement would be 7.5 cm.

b) Correct.

c) On the 31st the plant was approximately 28 cm tall, but on the 13th it was only 10 cm which is not half of 28 cm. The plant was closer to 14 cm on the 17th July.

Write a story and 3 questions for each of the 3 graphs below.



Possible context for each story:

a) A car speeding up, travelling at a constant speed, then slowing down.

b) The height above sea level a person is at during a walk.

c) Temperature in an oven when you are cooking something.

Properties of shape

- Measure with a protractor
- Draw lines and angles accurately
- Introduce angles
- Angles on a straight line
- Angles around a point
- Calculate angles
- Vertically opposite angles
- Angles in a triangle
- Angles in a triangle – special cases
- Angles in a triangle – missing angles
- Angles in special quadrilaterals
- Angles in regular polygons
- Draw shapes accurately
- Draw nets of 3-D shapes

Notes and Guidance

This step revisits measuring angles using a protractor from Year 5

Children recap how to line up the protractor accurately, and identify which side of the scale to read. They link this to their understanding of angle sizes.

Children read the measurement and practise measuring angles given in different orientations.

Angles are also related to compass points.

Mathematical Talk

Can we name and describe the 4 different types of angles? (right angle, obtuse, acute, reflex)

What unit do we use to measure angles?

Does it matter which side of the protractor I use?

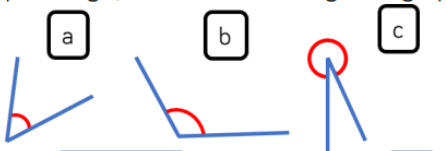
What mistakes could we make when measuring with a protractor?

How would I measure a reflex angle?

Look at a compass, what angles can we identify using the compass?

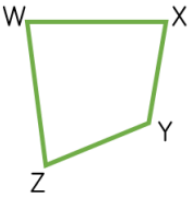
Varied Fluency

Identify the type of angle, and measure the angle using a protractor.



Angle ☐ is an ☐ angle. It measures ☐

Estimate, then measure each of the angles at the vertices of the quadrilateral.

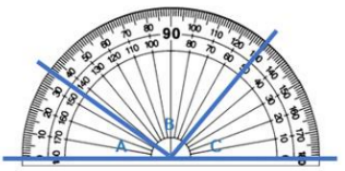


W: ☐ X: ☐

Y: ☐ Z: ☐

Work out the size of each angle.

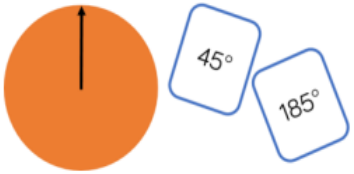
Explain how you found your answers.



Properties of shape

Reasoning and Problem Solving

Cut out a circle and draw a line from the centre to the edge. Add a spinner in the centre.



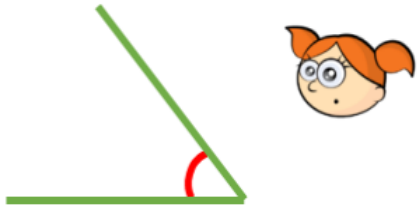
Put the arrow in the starting position as shown above. Turn over a flash card with an angle on.

Estimate the given angle by moving the spinner.

Check how close you are using a protractor.

Children could work in pairs and get a partner to check the accuracy of the angles made.

Alex measures this angle:



She says it is 130°

Explain what she has done wrong.

Alex is wrong because 130° is an obtuse angle and the angle indicated is acute.
She has used the wrong scale on the protractor. She should have measured the angle to be 50°