The Cambridge Primary School

Year 3

Calculations Policy

YEAR 3

MAIN PRINCIPLES

What is maths mastery?

Teaching maths for mastery is a transformational approach to maths teaching which stems from high performing Asian nations such as Singapore. When taught to master maths, children develop their mathematical fluency without resorting to rote learning and are able to solve non-routine maths problems without having to memorise procedures.

Concrete, pictorial, abstract (CPA)

Concrete, pictorial, abstract (CPA) is a highly effective approach to teaching that develops a deep and sustainable understanding of maths. Developed by American psychologist, Jerome Bruner, the CPA approach is essential to maths teaching in Singapore.

Number bonds

Number bonds are a way of showing how numbers can be combined or split up. They are used to reflect the 'part-part-whole' relationship of numbers.

Bar modelling

The bar model method is a strategy used by children to visualise mathematical concepts and solve problems. The method is a way to represent a situation in a word problem, usually using rectangles.

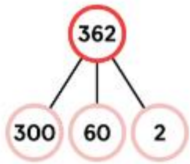
Fractions

In Singapore, the understanding of fractions is rooted in the Concrete, Pictorial, Abstract (CPA) model, where children use paper squares and strips to learn the link between the concrete and the abstract. At the heart of understanding fractions is the ability to understand that we're giving an equal part a name.

YEAR 3

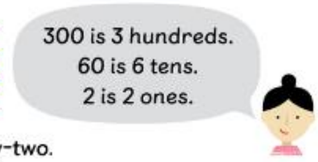
PLACE VALUE

hundreds	tens	ones
3	6	2



362 = 3 hundreds + 6 tens + 2 ones
362 = 300 + 60 + 2

The digit 3 stands for 3 0 0. → 3 0 0
The digit 6 stands for 6 0. → 3 6 0
The digit 2 stands for 2. → 3 6 2



362 is written as **three hundred and sixty-two.**

We can count on in tens, ones and hundredths within 3-digit numbers.

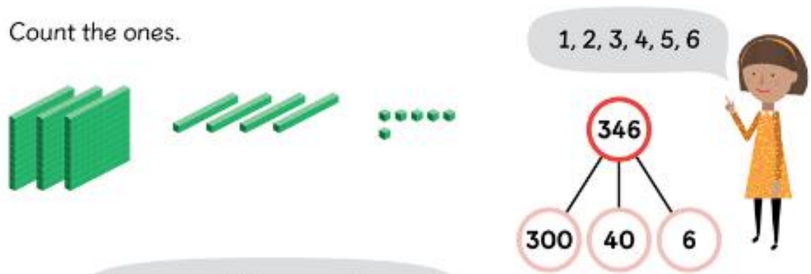
We partition our number to show understanding of one, tens and hundreds.

Count the hundreds.

We can partition out numbers to represent each value.

Count the tens.

Count the ones.

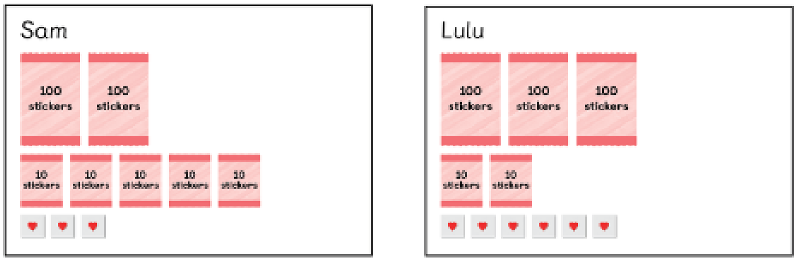


YEAR 3

PLACE VALUE

We compare three digit numbers to one another using concrete materials, and then move to pictorial and finally abstract.

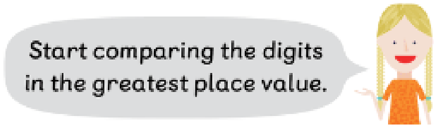
Compare 253 and 326. Which number is greater?



hundreds	tens	ones
2	5	3

hundreds	tens	ones
3	2	6

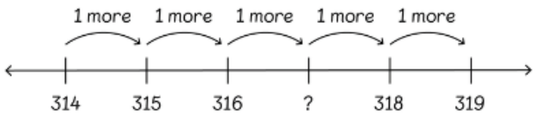
3 hundreds is greater than 2 hundreds.
326 is greater than 253.
Lulu has more stickers.

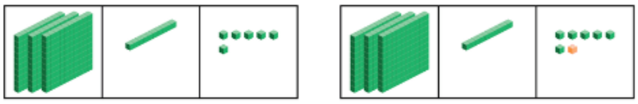


We recognise number patterns through adding one more or one less.

We use number lines and pictorial representations before abstract.

What is 1 more than 316?



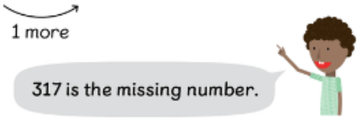


hundreds	tens	ones
3	1	6

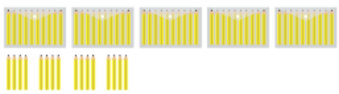
hundreds	tens	ones
3	1	7

1 more

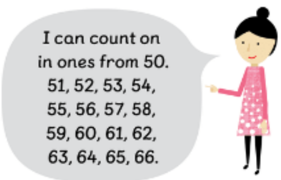
1 more than 316 is 317.

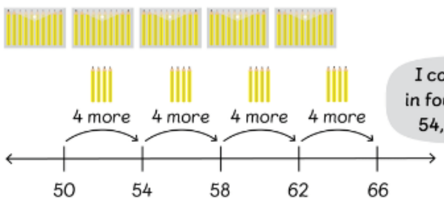


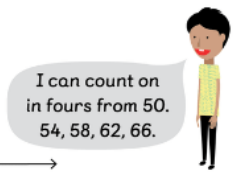
5 packs of 10 pencils is 50 pencils.

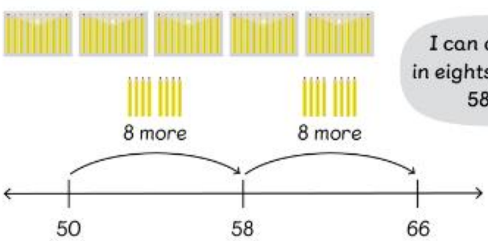


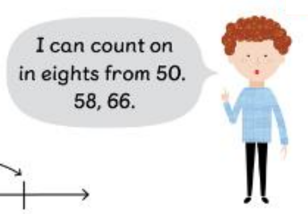
There are 66 pencils altogether.











We can count in fours and eights, recognising that this is repeated addition and identify the link between numbers.

We show this through number lines and repeated addition.

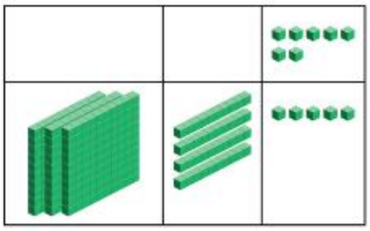
YEAR 3

ADDITION

When adding with renaming we teach/ use 3 different methods.

7 + 345 =

Method 1



Step 1 Add the ones.

7 + 5 = 12

	h	t	o
			7
+	3	4	5
		1	2

Step 2 Add the tens.

0 + 40 = 40

	h	t	o
			7
+	3	4	5
		1	2
+		4	0

Step 3 Add the hundreds.

0 + 300 = 300

Step 4 Add 12, 40 and 300.

300 + 40 + 12 = 352

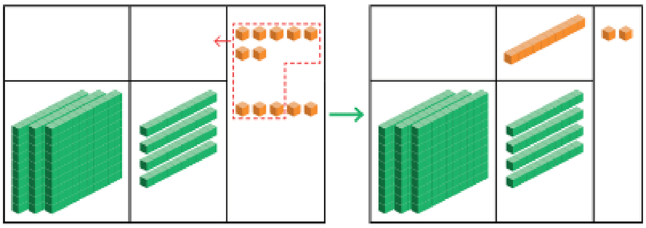
	h	t	o
			7
+	3	4	5
		1	2
		4	0
+	3	0	0
	3	5	2

7 + 345 = 352

Method 2

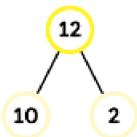
Step 1 Add the ones.

7 ones + 5 ones = 12 ones



Rename the ones.

12 ones = 1 ten + 2 ones



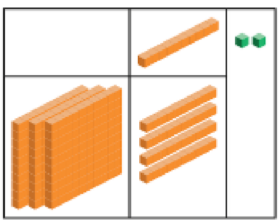
	h	t	o
			7
+	3	^{1}4	5
			2

Step 2 Add the tens.

1 ten + 4 tens = 5 tens

Add the hundreds.

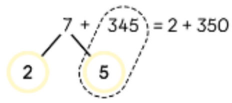
0 hundreds + 3 hundreds = 3 hundreds



	h	t	o
			7
+	3	^{1}4	5
	3	5	2

7 + 345 = 352

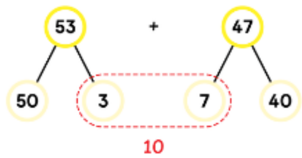
Method 3



7 + 345 = 352

There were 352 people at the fun run in total.

2 53 + 47 =



53 + 47 = 100

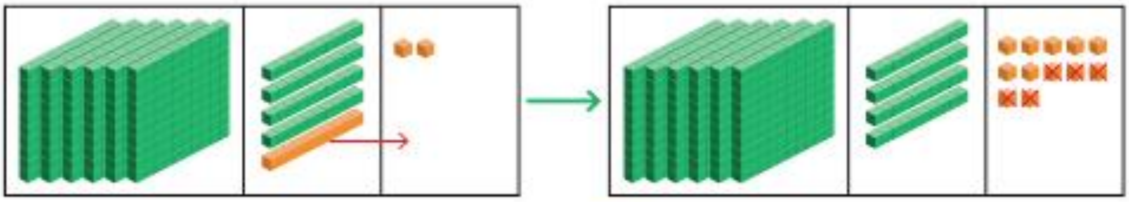
YEAR 3

SUBTRACTION

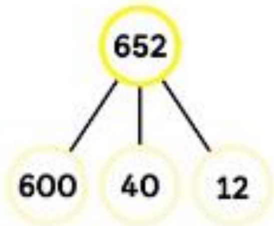
When subtracting with renaming it is rooted on the understanding that there are 10 ones in 10, 10 tens in 100 etc.

652 – 25 = ☐

Step 1 Rename 1 ten as 10 ones.
Subtract the ones.

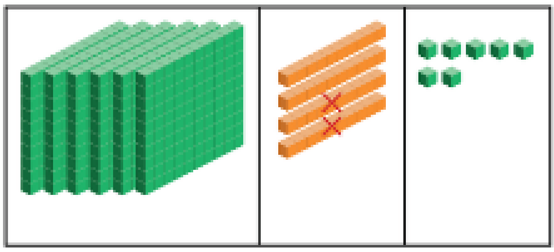


12 ones – 5 ones = 7 ones



$$\begin{array}{rccc} & h & t & o \\ & 6 & \overset{4}{\cancel{5}} & \overset{12}{\cancel{2}} \\ - & & 2 & 5 \\ \hline & & & 7 \\ \hline \end{array}$$

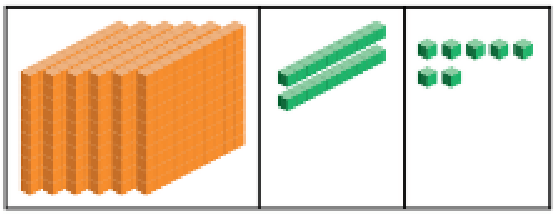
Step 2 Subtract the tens.



$$\begin{array}{rccc} & h & t & o \\ & 6 & \overset{4}{\cancel{5}} & \overset{12}{\cancel{2}} \\ - & & 2 & 5 \\ \hline & & 2 & 7 \\ \hline \end{array}$$

4 tens – 2 tens = 2 tens

Step 3 Subtract the hundreds.



$$\begin{array}{rccc} & h & t & o \\ & 6 & \overset{4}{\cancel{5}} & \overset{12}{\cancel{2}} \\ - & & 2 & 5 \\ \hline & 6 & 2 & 7 \\ \hline \end{array}$$

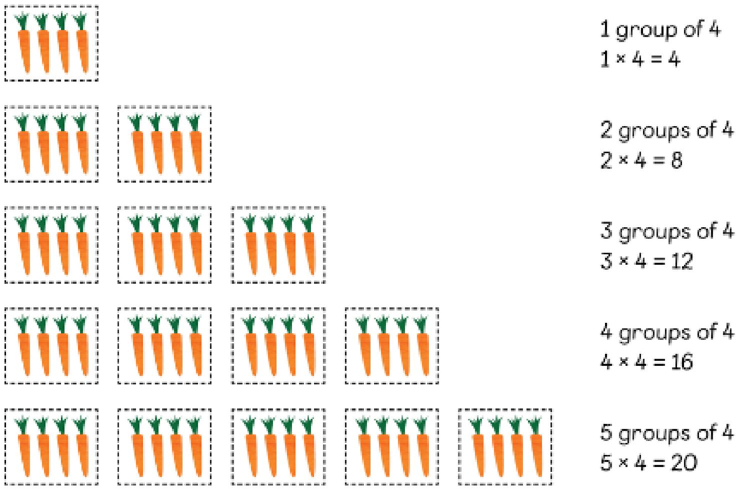
6 hundreds – 0 hundreds = 6 hundreds

652 – 25 = 627

YEAR 3

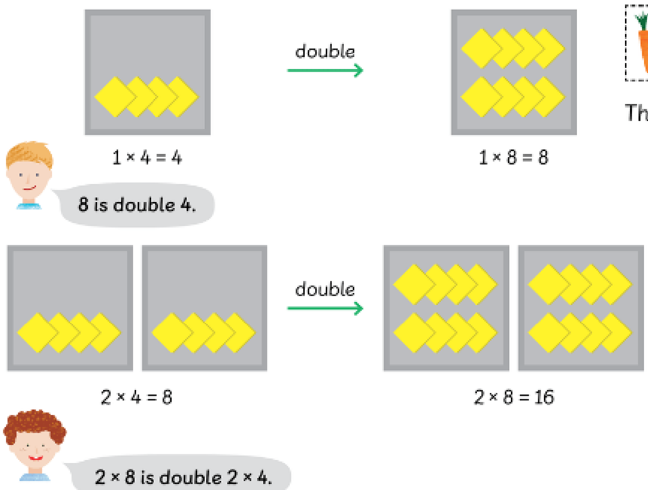
MULTIPLICATION

Multiplication in year 3 it is rooted on the deep understanding that multiplication is repeated addition.



There are 20 carrots in total.

Patterns are spotted and used as a tool to solve further multiplication questions.



There are 16 slices of cheese.

FURTHER MULTIPLICATION

<u>Multiplying 2-digit by 1-digit without renaming:</u>

32 × 3 = $\boxed{}$

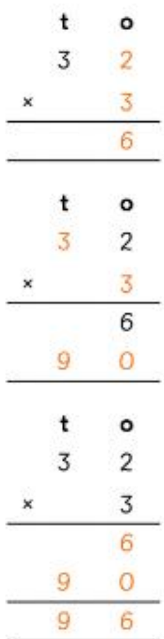
Step 1 Multiply 2 ones by 3.
2 ones × 3 = 6 ones

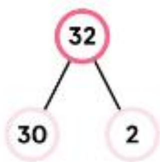
Step 2 Multiply 3 tens by 3.
3 tens × 3 = 9 tens

Step 3 Add the products.
6 + 90 = 96

32 × 3 = 96

There are 96 runners in 3 races.



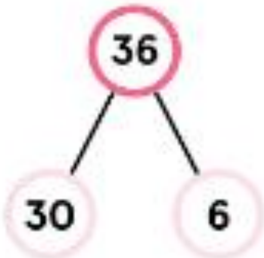


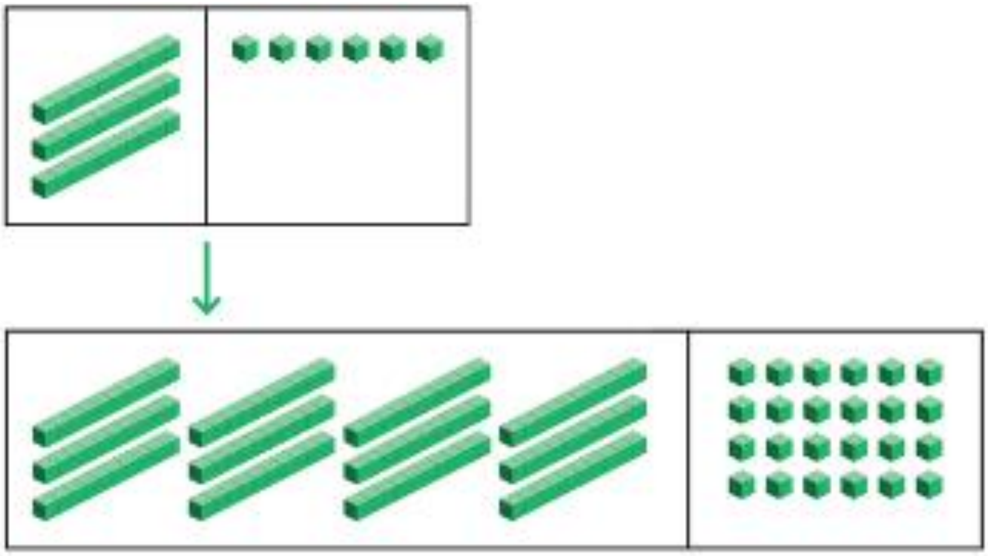
YEAR 3

FURTHER MULTIPLICATION

<u>Multiplying 2-digit by 1-digit with renaming:</u>

36 × 4 =





Step 1 Multiply the ones.

6 ones × 4 = 24 ones

24 ones = 2 tens + 4 ones

		t	o	
2 tens		$^{2}3$	6	
	×		4	
			4	4 ones

Step 2 Multiply the tens.

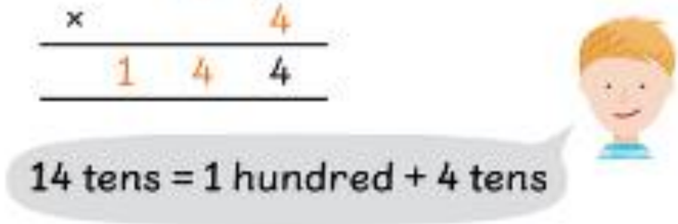
3 tens × 4 = 12 tens

12 tens + 2 tens = 14 tens

	h	t	o
		$^{2}3$	6
×			4
	1	4	4

36 × 4 = 144

Jacob is correct.



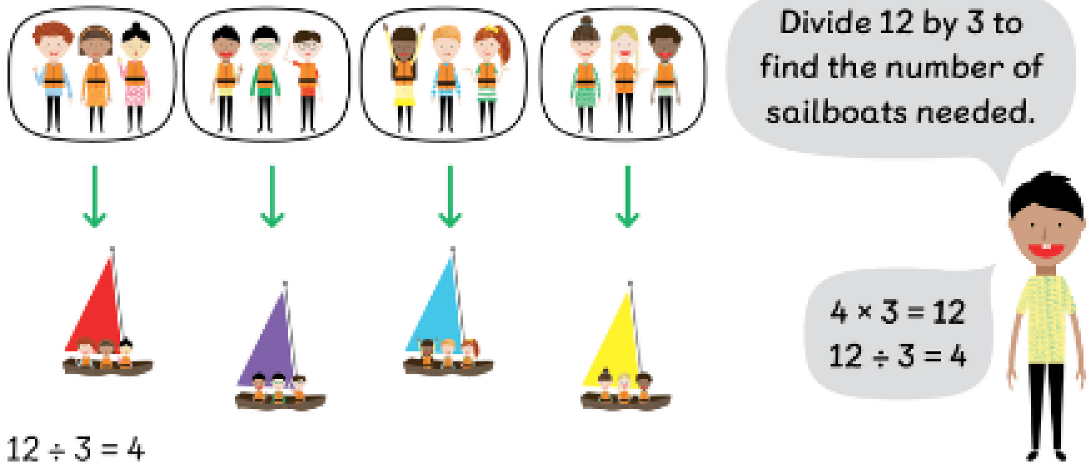
YEAR 3

DIVISION

Division in year 3 it is rooted on the deep understanding of multiplication knowledge and grouping and sharing.

Grouping

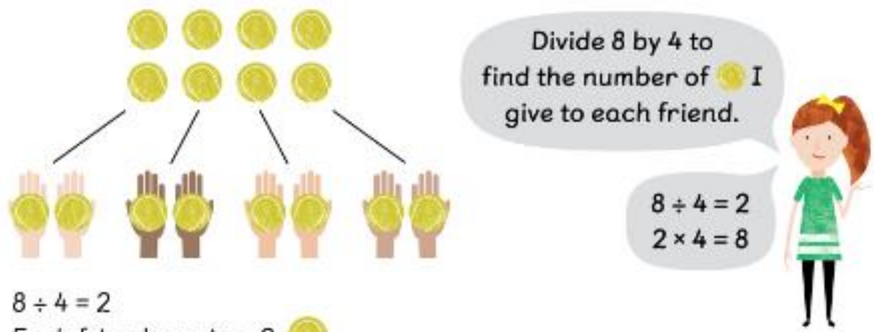
Put the children into groups of 3.



12 ÷ 3 = 4
If the children sail in groups of 3, they will use 4 sailboats.

Sharing

1



8 ÷ 4 = 2
Each friend receives 2 .

2 Holly puts the balls away in bags. If she puts 4 in each bag, how many bags will she use?

8 ÷ 4 = 2
Holly will use 2 bags.

YEAR 3

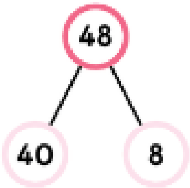
FURTHER DIVISION

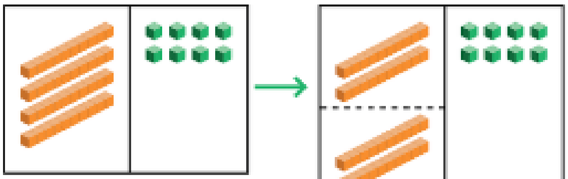
Dividing 2-digit number by 1 without renaming:

Divide 48 by 2 to find the number of berries they each get.

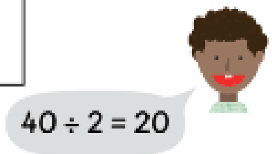
$48 \div 2 = \boxed{}$

Step 1 Divide 4 tens by 2.

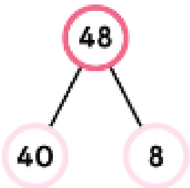


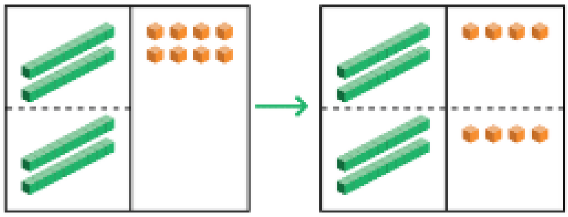


4 tens ÷ 2 = 2 tens

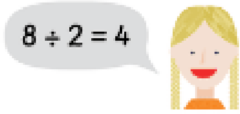


Step 2 Divide 8 ones by 2.





8 ones ÷ 2 = 4 ones

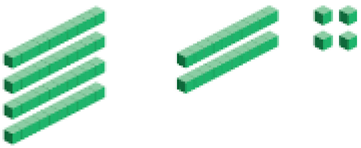


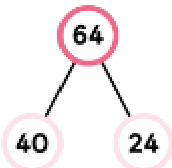
Step 3 Add the results.

$48 \div 2 = 20 + 4 = 24$

Holly and Emma get 24 berries each.

Dividing 2-digit number by 1 with renaming:





Step 1 Take 40 from 64. Divide it by 4.

$$
\begin{array}{r|rr}
 & 1 & \\
\hline
4 & 6 & 4 \\
- & 4 & 0 \\
\hline
 & 2 & 4
\end{array}
$$

1 ten

4 tens ÷ 4 = 1 ten

Step 2 Take the remaining 24. Divide it by 4.

$$
\begin{array}{r|rr}
 & 1 & 6 \\
\hline
4 & 6 & 4 \\
- & 4 & 0 \\
\hline
 & 2 & 4 \\
- & 2 & 4 \\
\hline
 & & 0
\end{array}
$$

6 ones

24 ones ÷ 4 = 6 ones

64 ÷ 4 = 1 ten + 6 ones

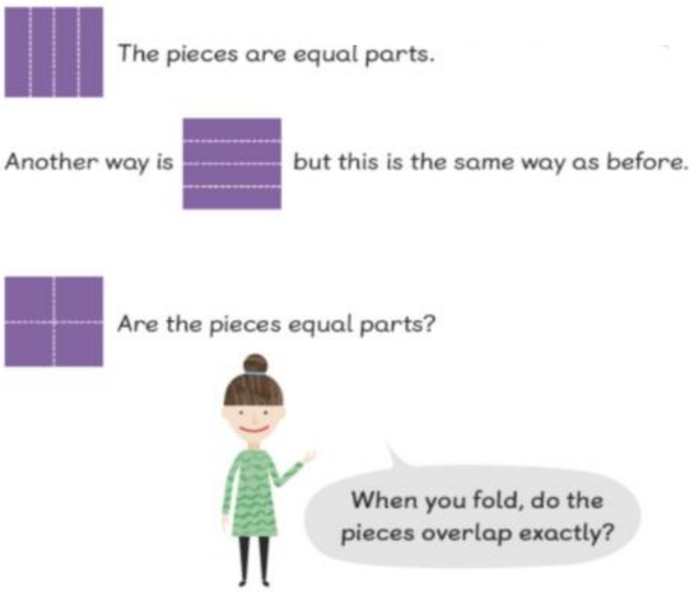
= 16

YEAR 3

FRACTIONS

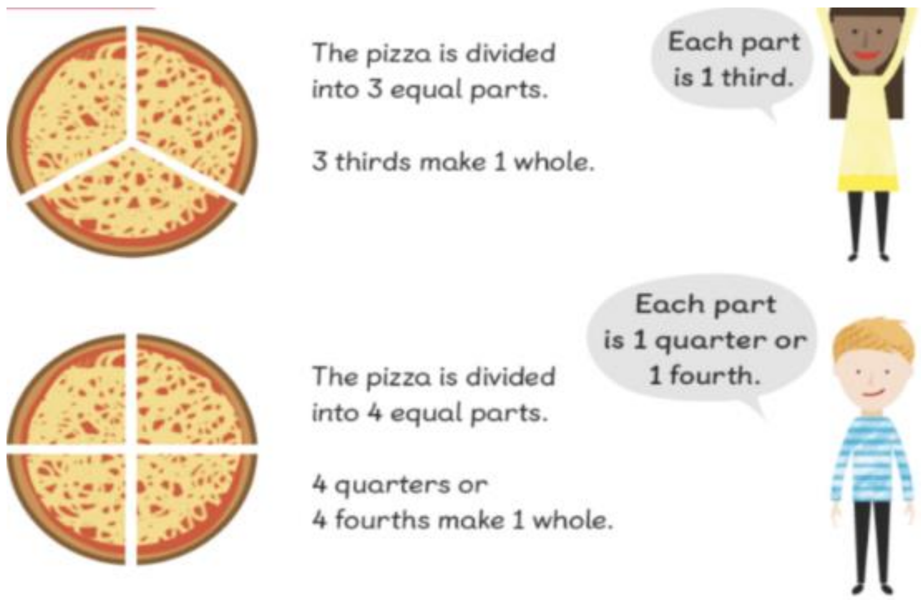
1. Finding equal parts

Children need to understand what a fraction is. When we divide a whole into equal parts we create fractions. A fraction is just an equal part.



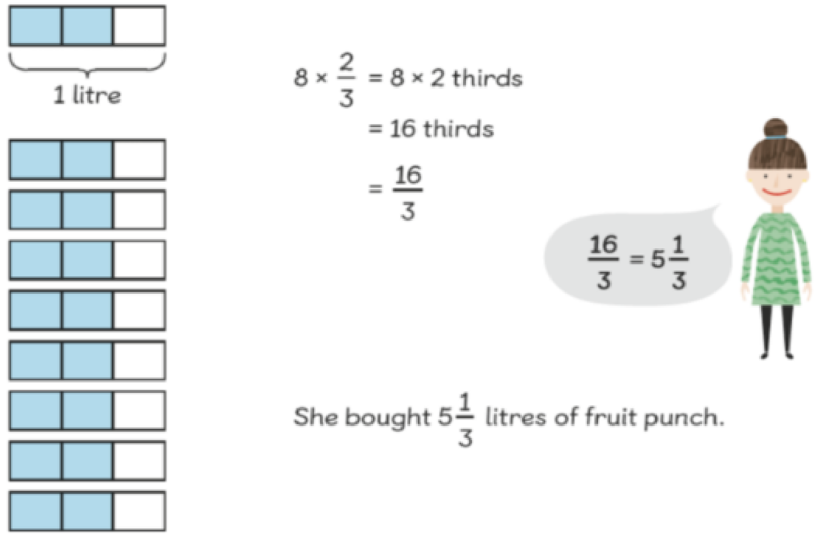
2. Naming equal parts

Once the children can make/identify equal parts (fractions), they need to give them a name.



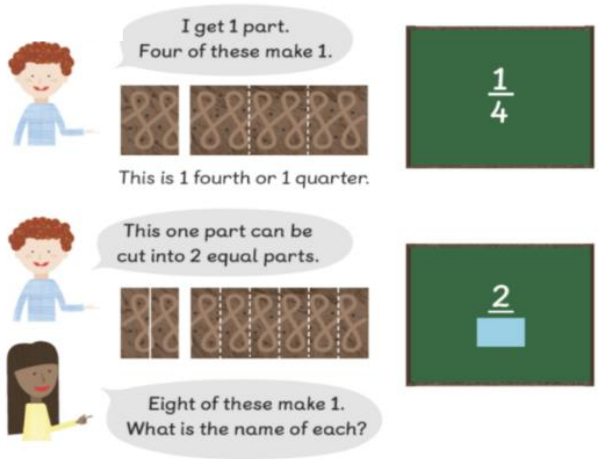
3. Operations involving equal parts

If children can name a fraction, they are ready to do calculations using like fractions (they have the same name).



4. What if the parts aren't equal?

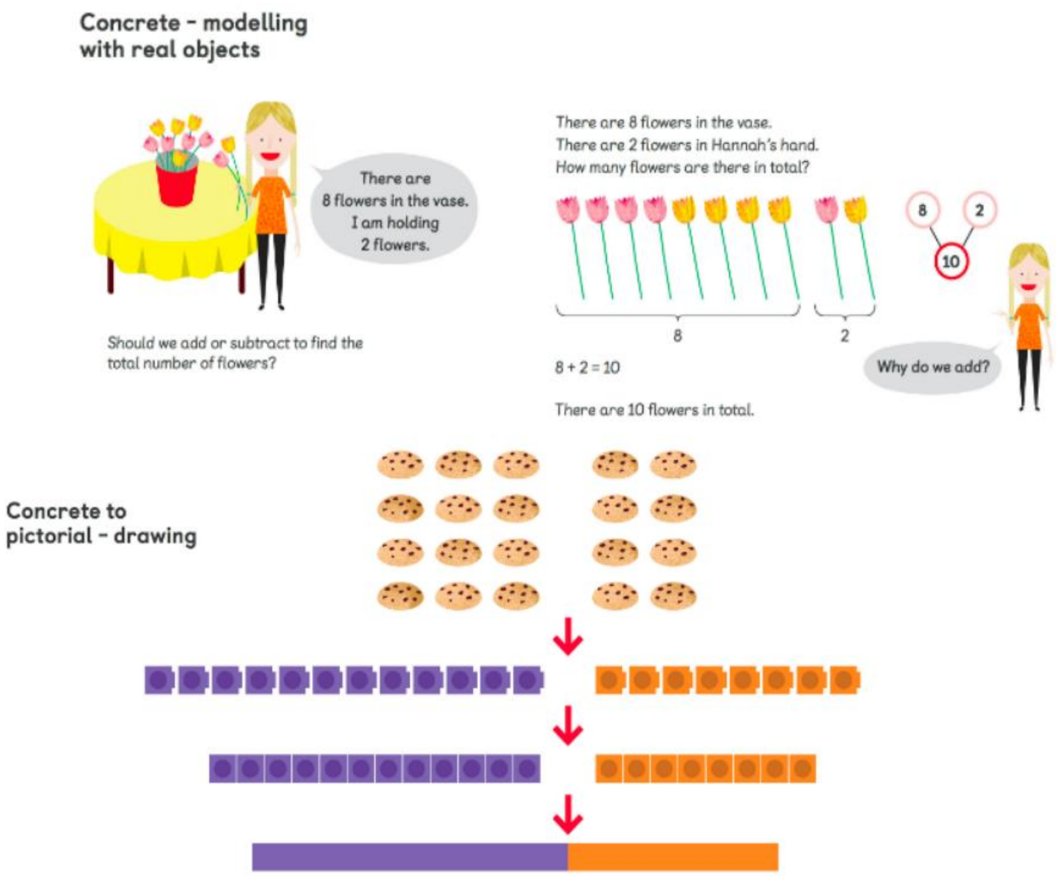
Can we add 3 apples and 2 oranges? Is it 5 apples? Is it 5 oranges? It is neither because we cannot add things with different names. We have to give them the same name, and in this case we could rename them as 'fruit'. They now all have the same name and so we can do the calculation (5 pieces of fruits). The same is true for fractions. We can't add 2 quarters and 1 eighth because they have different names, however, if we can give them the same name (equivalent) it is possible.



YEAR 3

PROBLEM SOLVING – BAR MODELLING

The bar model method draws on the Concrete, Pictorial, Abstract (CPA) approach — an essential maths mastery concept. The process begins with pupils exploring problems via concrete objects. Pupils then progress to drawing pictorial diagrams, and then to abstract algorithms and notations (such as the +, -, x and / symbols).The example below explains how bar modelling moves from concrete maths models to pictorial representations.



As shown, the bar method is primarily pictorial. Pupils will naturally develop from handling **concrete** objects, to drawing **pictorial** representations, to creating **abstract** rectangles to illustrate a problem. With time and practice, pupils will no longer need to draw individual boxes/units. Instead, they will label one long rectangle/bar with a number. At this stage, the bars will be somewhat proportional. So, in the example above, the purple bar representing 12 cookies is longer than the orange bar representing 8 cookies.