St Mary's Catholic Primary School
KS1

07.12.20

This session will look at how we teach the four operations in school, so that you can help your children at home.

Before children can begin to calculate they need to be competent in counting

Counting Principles

The ‘How to count’ principles

- The stable order principle
- The 1-1 principle
- The cardinal principle

The ‘What to count’ principles

- The order-irrelevance principle
- The abstract principle

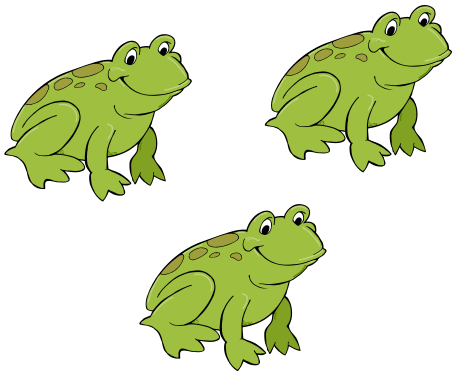
Gelman R and Gallistell CR. (1978)
‘The Child’s Understanding of Number’

I can say 1, 2, 3 (stable order)

1 2 3

I can count 1, 2, 3 frogs
(1:1 correspondence)

I can tell you that there are 3 frogs (cardinal)



I can tell you that there are still
3 frogs, I don't have to count them again
(order irrelevance)

I can count anything now! (abstraction)

They also need to:

- Know all about numbers to 10
- Subitise
- Recognise numbers to 10

Show me 4 in as many ways as you can.

What do you know about 4?

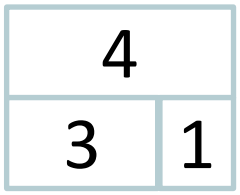
Odd or even?

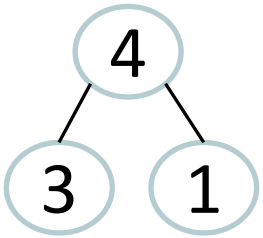
What is it greater than? What is it less than?

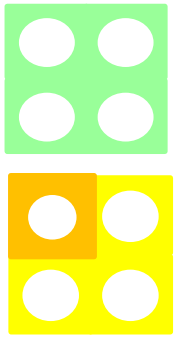
Can you count out 4 from a larger group?

Can you show the numeral?

Number pairs for 4: part, part, whole model leading to number facts and generalisation.







3 + 1 = 4

1 + 3 = 4

4 – 1 = 3

4 – 3 = 1

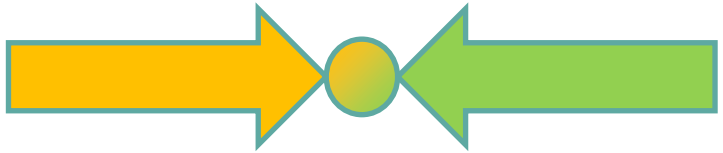
Structures for addition

Augmentation

Augend add addend equals sum

Aggregation

Addend add addend equals sum



Augmentation

Augend add addend equals sum

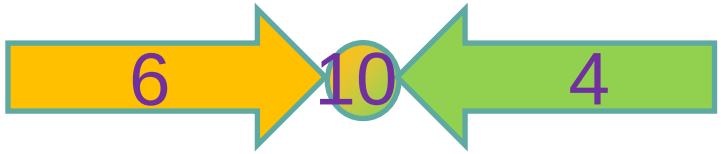
Sofia has 6 apples.

Her mother gave her 4 more.

How many apples does she have now?

Aggregation

Addend add addend equals sum



Sofia has 6 apples.

Her mother has 4.

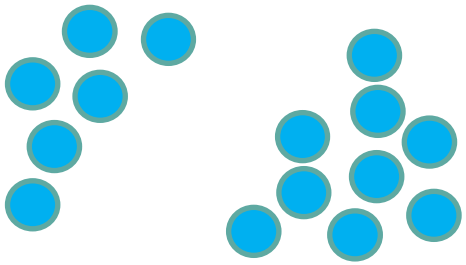
How many do they have altogether?

Structures for subtraction

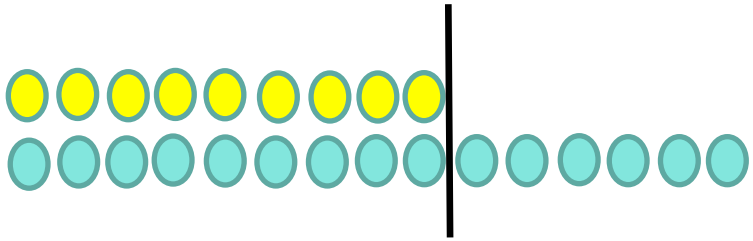
Reduction

Removing items from a set

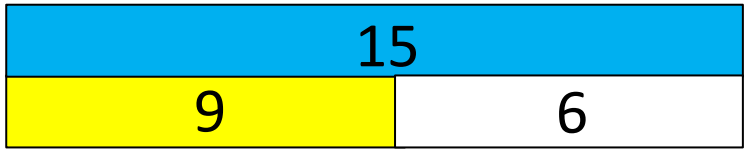
15 - 9



Comparison or difference

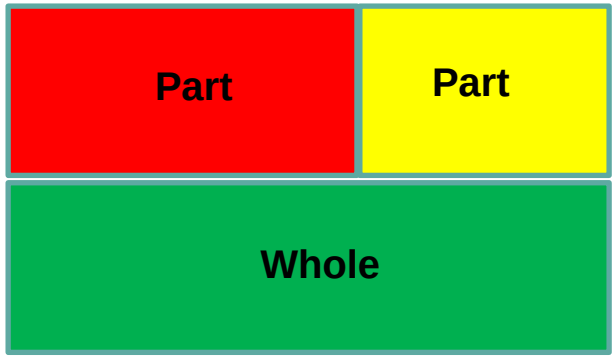


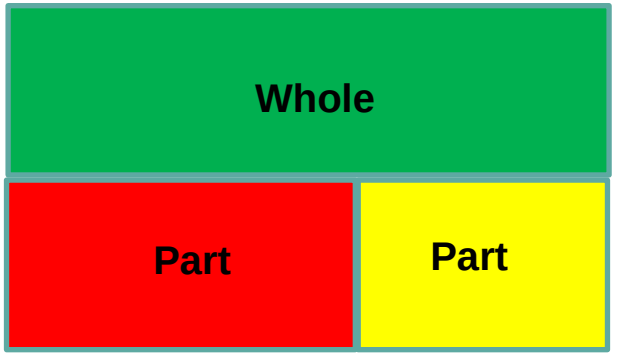
15 - 9

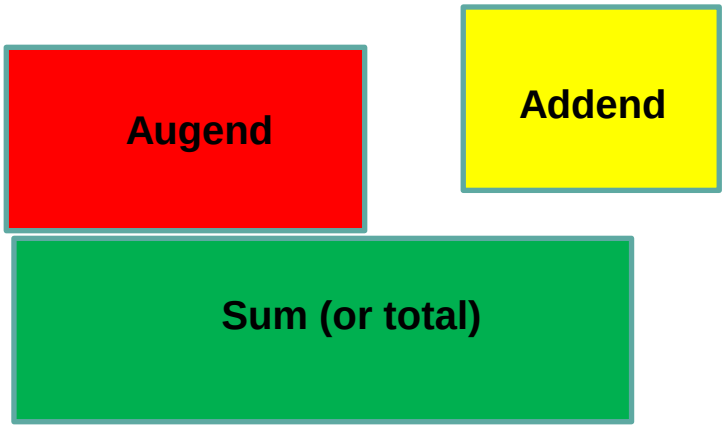


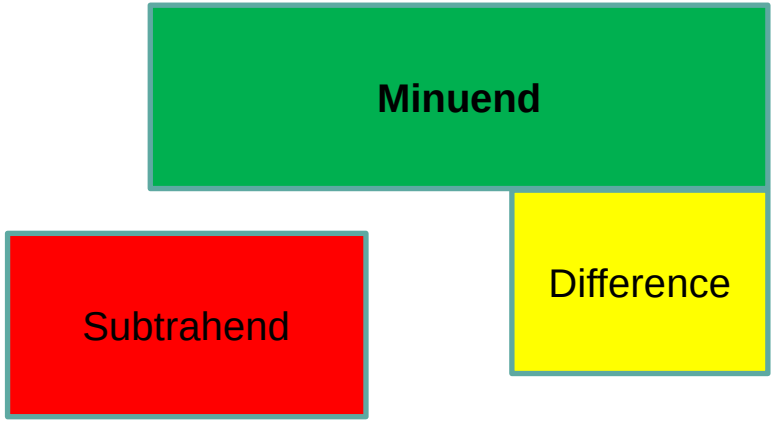
Minuend subtract subtrahend equals difference

When we calculate these are the models:









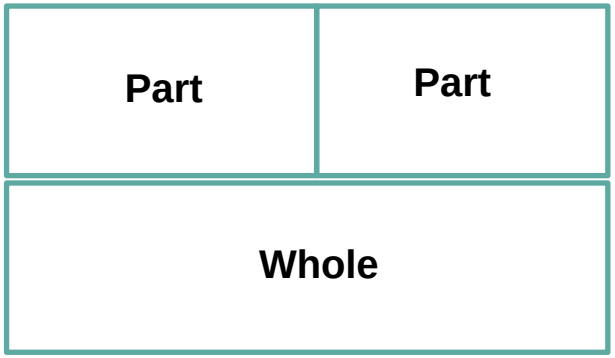
53 + 18 =

53 - 18 =

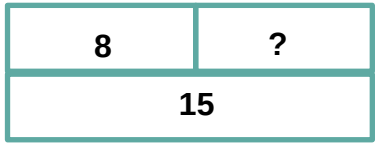
augend + addend = sum (or total)

minuend – subtrahend = difference

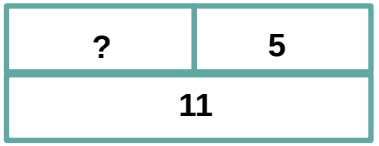
These models are particularly good for missing number problems



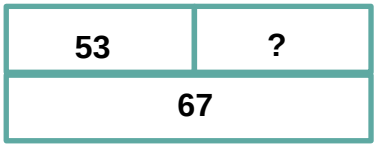
8 + ? = 15



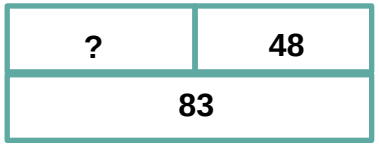
? + 5 = 11



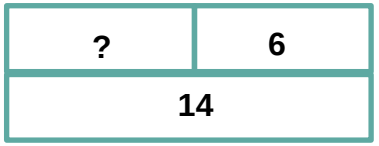
53 + ? = 67



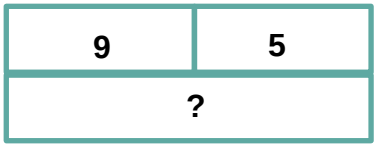
? + 48 = 83



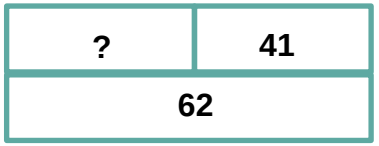
14 - ? = 6



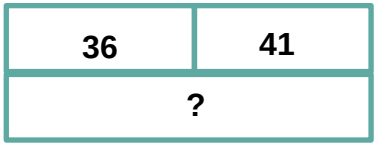
? - 9 = 5

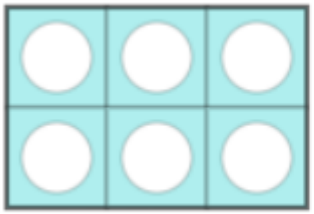


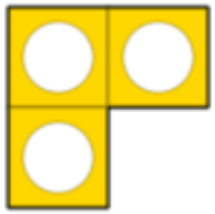
62 - ? = 41

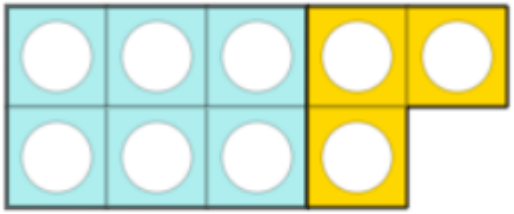


? - 36 = 41









6 + 3 = 9

If we know this what else do we know?

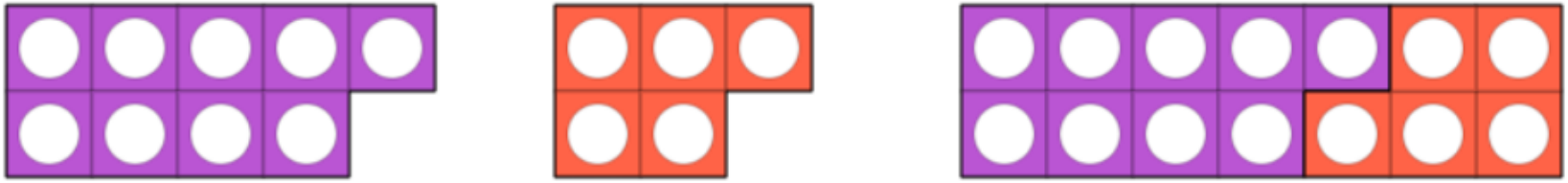
3 + 6 = 9

because addition is commutative

9 – 6 = 3

9 – 3 = 6

because subtraction is inverse



9 + 5 = 14

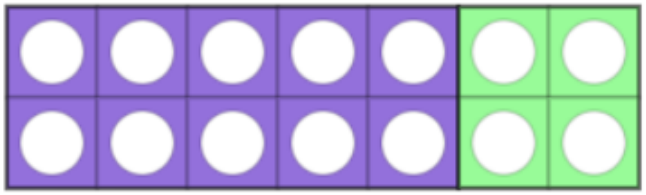
We also know:

5 + 9 = 14

14 – 9 = 5

14 – 5 = 9

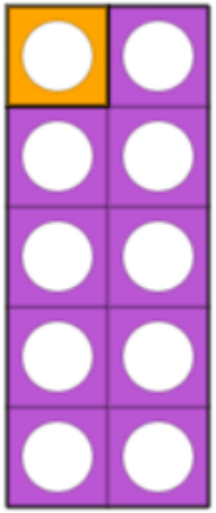
9 + 5 = 10 + 4 = 14



This is a mental calculation strategy that we call making 10.

It reinforces and applies knowledge of number bonds to 10.

Number bonds to 10

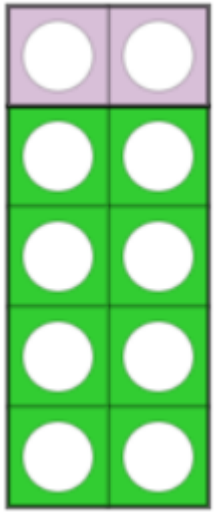


1 + 9 = 10

9 + 1 = 10

10 – 9 = 1

10 – 1 = 9

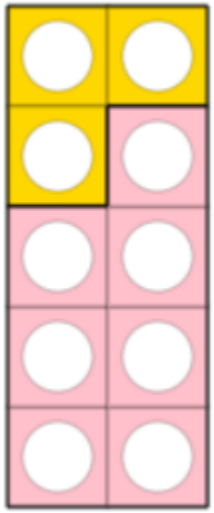


2 + 8 = 10

8 + 2 = 10

10 – 8 = 2

10 – 2 = 8

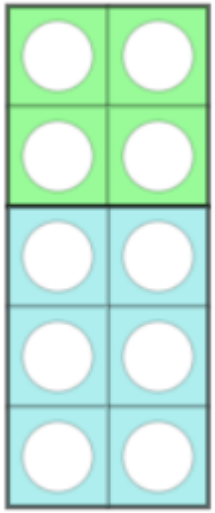


3 + 7 = 10

7 + 3 = 10

10 – 7 = 3

10 – 3 = 7

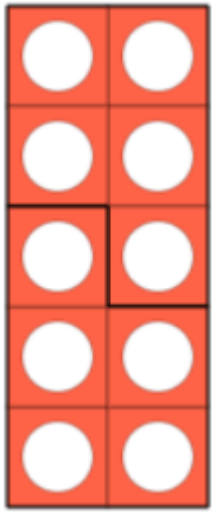


4 + 6 = 10

6 + 4 = 10

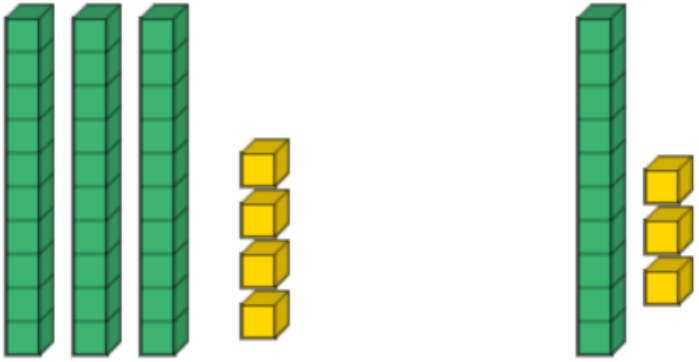
10 – 6 = 4

10 – 4 = 6



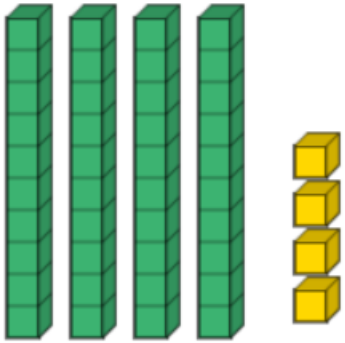
5 + 5 = 10

10 – 5 = 5

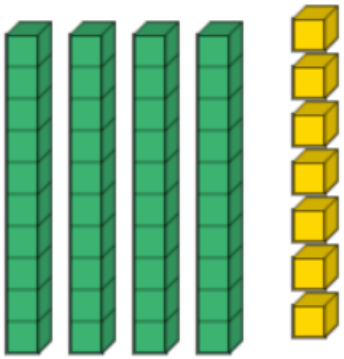


34 + 13

We check by subtracting the addend from the sum.



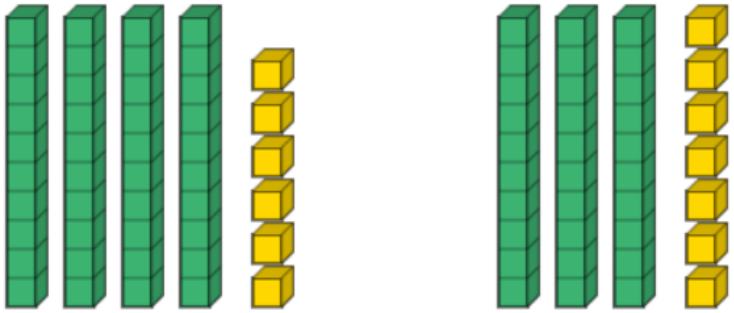
44 + 3



47

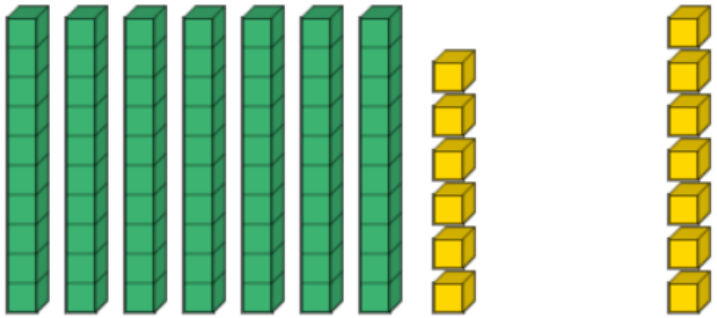
This is a mental calculation strategy that we call sequencing.

We add the tens first and then the ones.

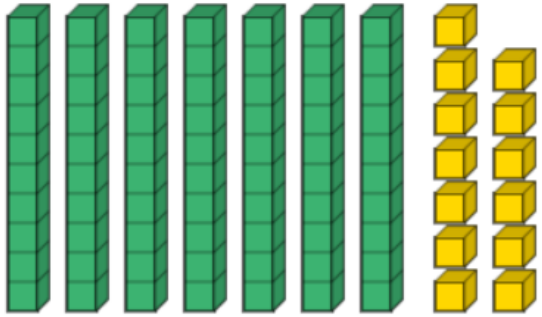


46 + 37

We check by subtracting the addend from the sum.



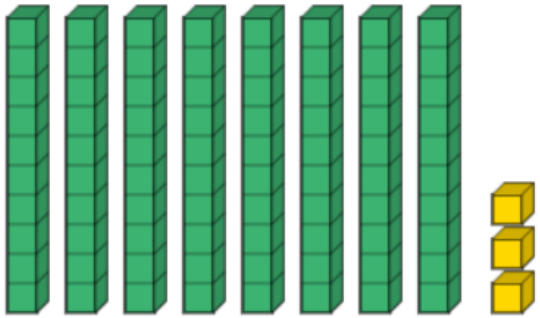
Add the tens first to give 76 + 7

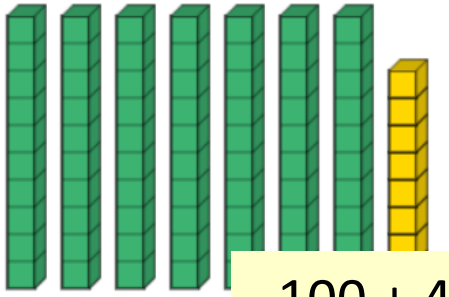


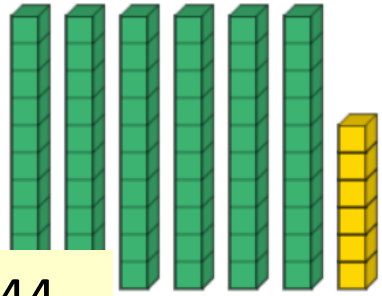
Add the ones to give 70 + 13

Exchange 10 ones to make one 10

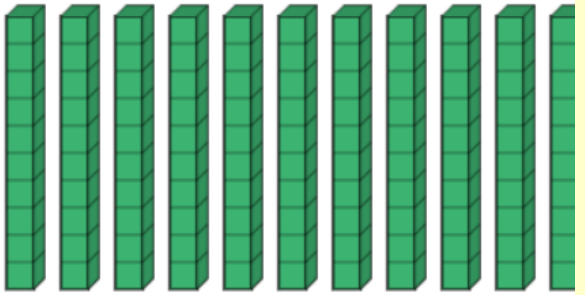
80 + 3 = 83



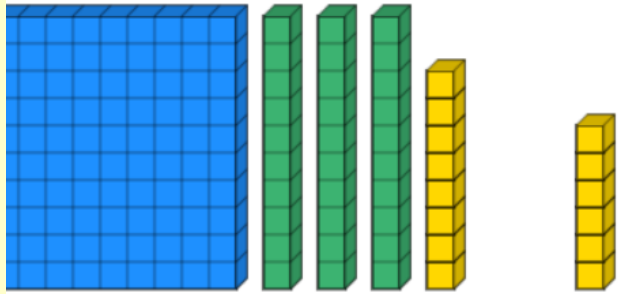




100 + 40 + 4 = 144

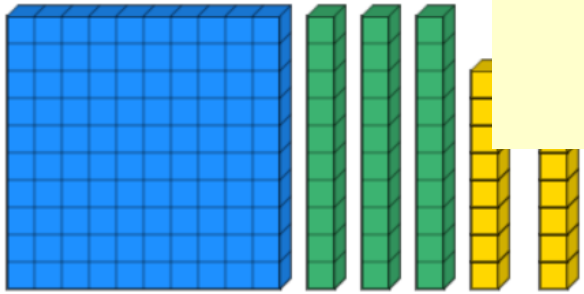


Add the 10s

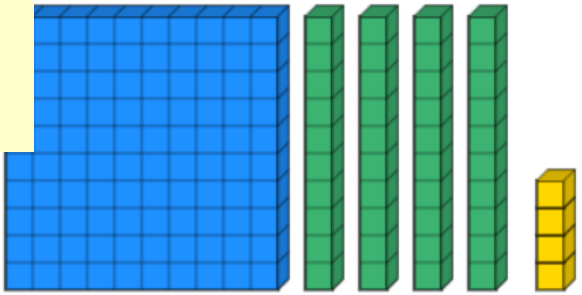


Exchange 10 tens for one 100

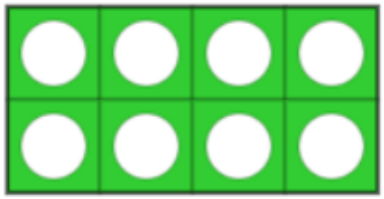
$$\begin{array}{r} 7\ 8 \\ +\ 6\ 6 \\ \hline 1\ 3\ 0 \\ \\ 1\ 4 \\ \hline 1\ 1\ 4 \end{array}$$

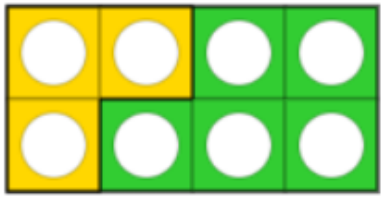


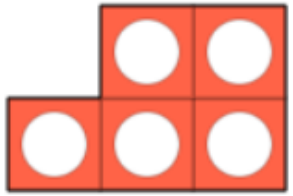
Add the 1s



Exchange 10 ones for one 10







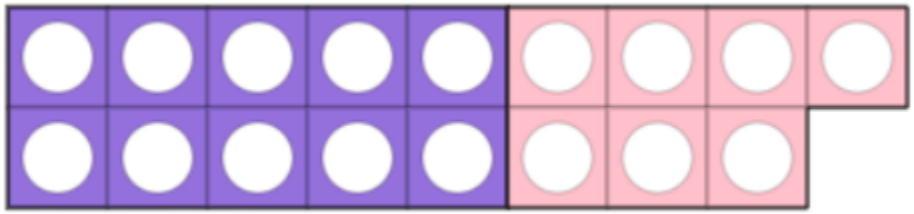
8 - 3 = 5

If we know this what else do we know?

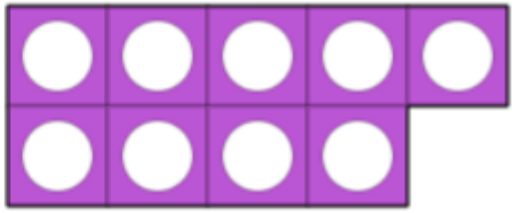
8 - 5 = 3

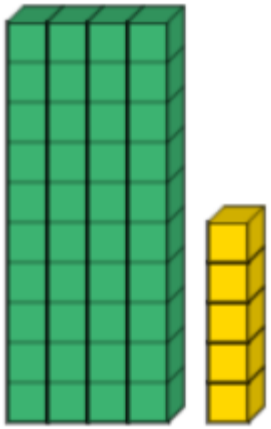
3 + 5 = 8

5 + 3 = 8



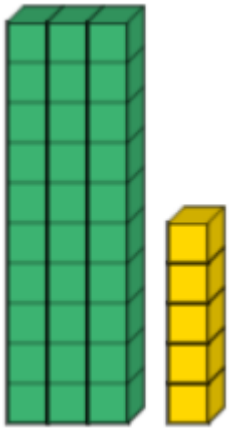
17 - 8 = 9





45 - 12

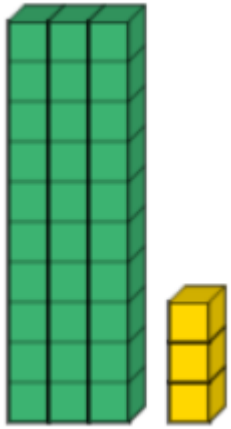
We check by adding the subtrahend and the difference.



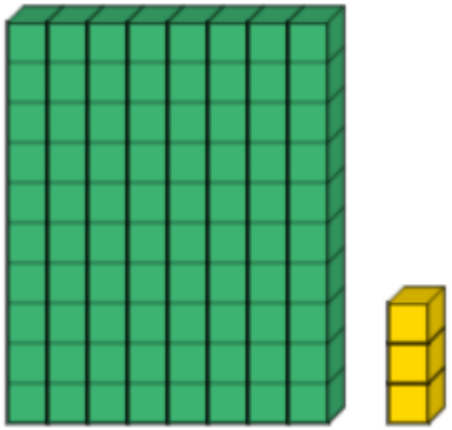
We use sequencing to subtract.

Subtract 10 first. Now we have

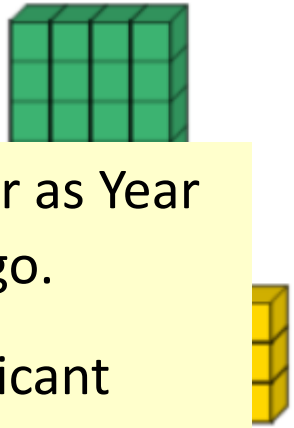
35 - 2



Next subtract 2 to give a difference of 33



83 - 48



Subtract four 10s first. Now we have

43 - 8

This is as far as Year 2 children go.

Most significant digits are always dealt with first.

We change one thing only. The thing that changes is the size of the number.

Written methods are introduced in Year 3.

We n

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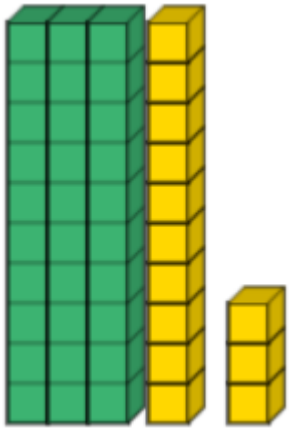
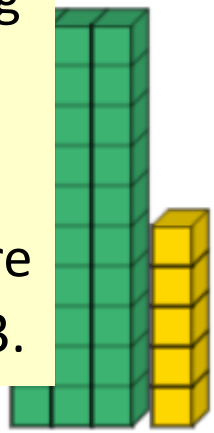
We exchange one 10 for 10 ones.





Now we can subtract 8.

That leaves a difference of 35.

We always apply addition and subtraction to measurement.

Measurement is the everyday application of the maths that we do. We want them to understand that the process of addition and subtraction is the same for anything.

Identify the coins.

How many pence are equivalent to £1?

How many ways can you make 10p? 20p? 15p?

Stacy had £24. Adam had £15.

How much money did they have altogether?

How much more money did Stacy have?

Draw the bar model to represent each calculation

£24	£15

£24	
£15	

Sophie had a piece of string with a length of 25cm.

Bobby had a length that was 38cm.

What is the total length of their string.

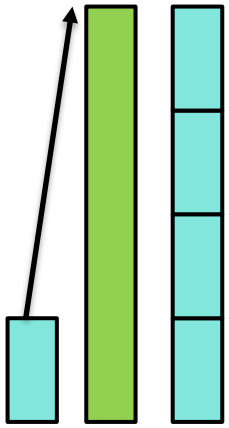
What is the difference in their lengths?

25cm	38cm

38cm	
25cm	

Structures for multiplication

Ratio (scaling)



4 times as many

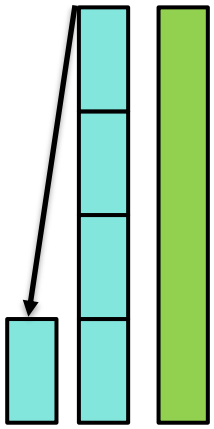
Repeated addition (grouping)

+ + + = 3 x 4 = 12

Multiplicand multiplied by multiplier equals product

Structures for division

Ratio (scaling)



$\frac{1}{4}$ of the size/amount

Repeated subtraction (grouping)

12 – 4 – 4 – 4 3 groups of 4

12 ÷ 4 = 3

Dividend divided by divisor equals quotient

Sharing – links well to fractions

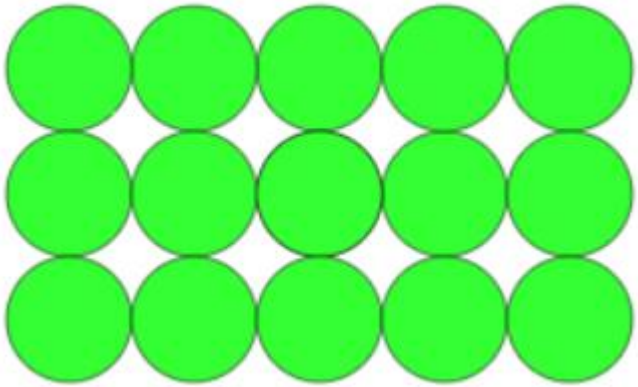
Year 1 (notes and guidance)

Through grouping and sharing small quantities, pupils begin to understand: multiplication and division; doubling numbers and quantities; and finding simple fractions of objects, numbers and quantities.

They make connections between arrays, number patterns, and counting in twos, fives and tens.

What can you see?

What else?



5 + 5 + 5 = 15

5 x 3 = 15

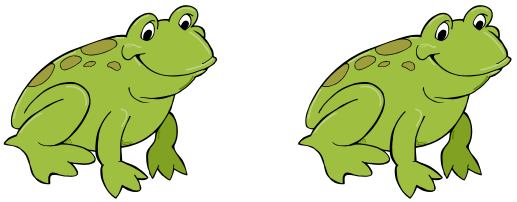
3 + 3 + 3 + 3 + 3 = 15

3 x 5 = 15

Like addition, multiplication is commutative.

What can you see?

What else?

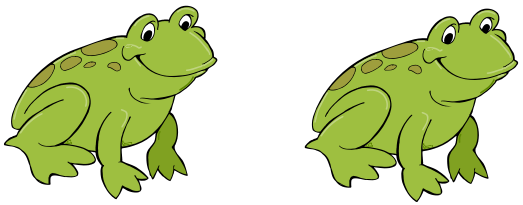


How many groups of 2 frogs?

$8 \div 2 = 4$

$2 + 2 + 2 + 2 = 8$

$2 \times 4 = 8$



How many groups of 4 frogs?

$8 \div 4 = 2$

$4 + 4 = 8$

$4 \times 2 = 8$

How many eyes? How many feet?

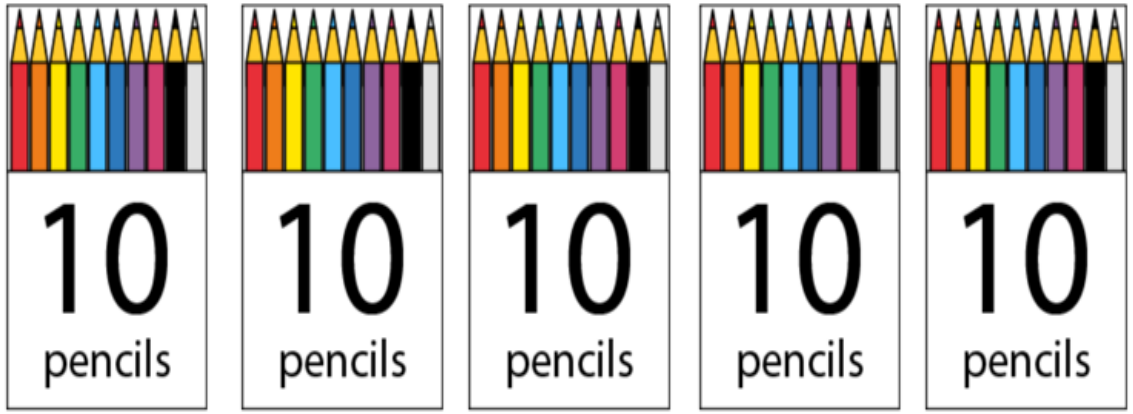
Counting in 5s

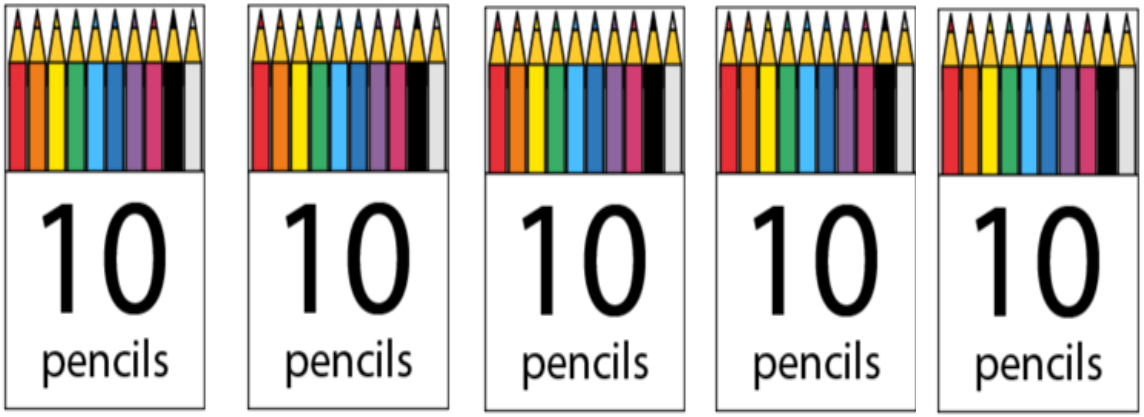
5, 10, 15, 20, 25, 30, 35, 40, 45…

5 x 9 = 45

How many groups
of 5 fingers?

25 ÷ 5 = 5





Counting in 10s

10, 20, 30, 40, 50…

10 x 5 = 50

In the top row, how many groups of 10 pencils?

50 ÷ 10 = 5

Year 2

- recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers
- calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication (×), division (÷) and equals (=) signs
- show that multiplication of two numbers can be done in any order (commutative) and division of one number by another cannot
- solve problems involving multiplication and division, using materials, arrays, repeated addition, mental methods, and multiplication and division facts, including problems in contexts.

What do you see?

What else?

3 lots of 4

4 lots of 3

4 + 4 + 4

3 + 3 + 3 + 3

1, 2, 3, 4, 5…..

4 x 3 = 12

3 x 4 = 12

4 - 4 – 4

12 ÷ 4 = 3

3 - 3 - 3 – 3

12 ÷ 3 = 4

What do you see?

What else?

How many bikes?

5 + 5 = 10

5 x 2 = 10

How many groups of 5 bikes?

10 ÷ 5 = 2

How many groups of 2 bikes?

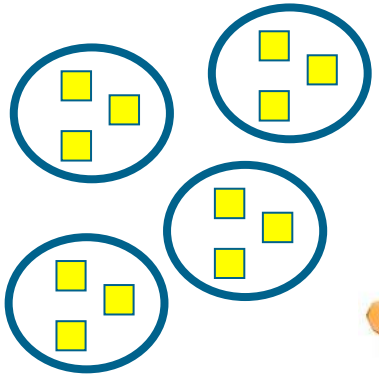
10 ÷ 2 = 5

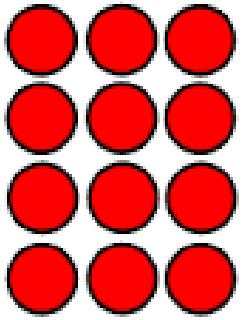
How many wheels?

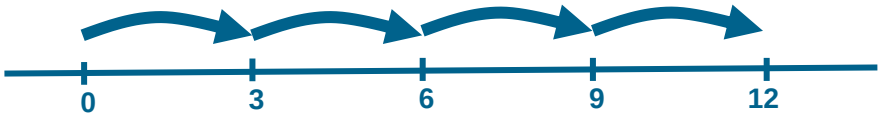
10 + 10 = 20

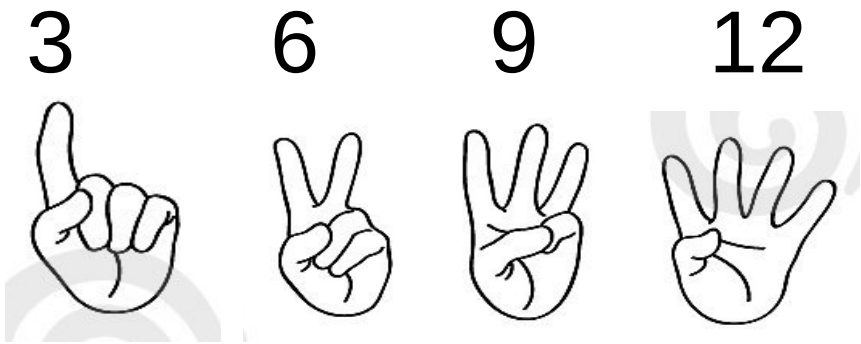
10 x 2 = 20

We encourage children to explore a variety of representations which is part of something we call variation.









Sammy's friend received 3 boxes of toy trucks.
In each box there were 5 trucks.
Sammy wants to know many trucks his friend had altogether.
Can you help him find out?

5 + 5 + 5 = 15

5 x 3 = 15

Sammy's friend wanted to put his 15 trucks into boxes.
He wanted to put 3 trucks in each box.
Sammy wants to know many boxes his friend needs.
Can you help him find out?

15 – 3 – 3 – 3 – 3 – 3

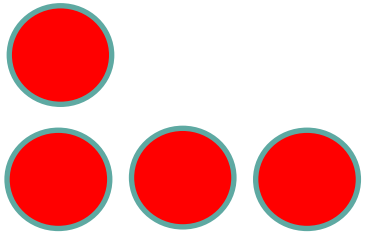
5 boxes

15 ÷ 3 = 5

Scaling up

Sam

Adam



Sam had 2 toy cars.

Adam had 3 times as many.

How many toy cars did Adam have?

How many more toy cars did Adam have?

How many toy cars did they have altogether?

What if Sam had 3 toy cars?

What if Sam had 4 toy cars?

What if Sam had 5 toy cars?

What if Sam had 6 toy cars?

Make up your own number of toy cars that Sam could have had.

Answer the questions.

Scaling down

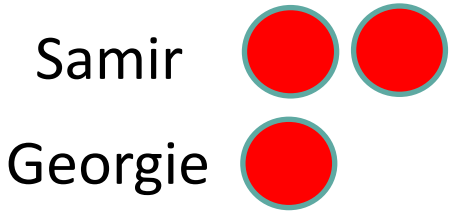
Samir saved £4.

Georgie saved $\frac{1}{2}$ of that amount.

How much did Georgie save?

How many more did Samir save?

How much did they save altogether?



What if Samir saved £6?

What if Samir saved £8?

What if Samir saved £10?

What if Samir saved £12?

Make up your own amounts of money.

Answer the questions.

Multiplication tables

2 x 1

2 x 2

2 x 3

2 x 4

2 x 5

2 x 6

2 x 7

2 x 8

2 x 9

2 x 10

These begin when children count in steps of different sizes.

They will have been counting in steps of 2, 5 and 10 in Reception.

Now the facts need to be learned. Frequently recite facts.

Let them use their fingers as support.

Link to number lines.

Interesting visuals for children to look at. Get to the stage when you ask ‘What are 6 twos?’

2 4 6 8

Multiplication tables

5 x 1

5 x 2

5 x 3

5 x 4

5 x 5

5 x 6

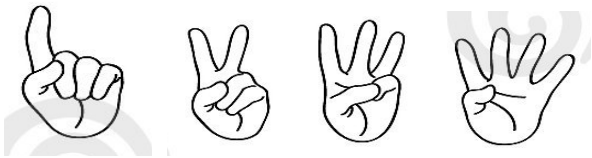
5 x 7

5 x 8

5 x 9

5 x 10

5 10 15 20



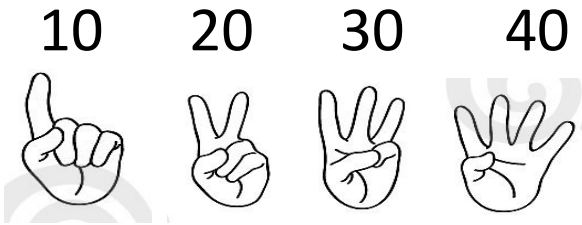
What are 6 fives?

What are 9 fives?

What are 3 fives?

What are 8 fives?

Multiplication tables



10 x 1

10 x 2

10 x 3

10 x 4

10 x 5

10 x 6

10 x 7

10 x 8

10 x 9

10 x 10

Division as sharing with links to fractions

Share the ladybirds equally onto each leaf.

There are 4 ladybirds on each leaf.

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

What about…

$\frac{1}{2}$ of 12? $\frac{1}{3}$ of 12? $\frac{2}{3}$ of 12? $\frac{3}{3}$ of 12?

$\frac{1}{4}$ of 12? $\frac{2}{4}$ of 12? $\frac{3}{4}$ of 12? $\frac{4}{4}$ of 12?

Ella has some cherries.

She eats one half of them.

She has 3 left.

How many did she have to begin with?

What if Ella has 4 cherries left?

What if Ella has 5 cherries left?

What if Ella has 10 cherries left?

What if Ella has 15 cherries left?

Make up your own numbers of cherries that Ella could have left.

$\frac{1}{2}$ of the sweets in the tin were chocolates.

$\frac{1}{4}$ were toffees.

The rest were strawberry creams.

There were 4 strawberry creams.

How many sweets were in the tin?

What if there were 10 strawberry creams?

What if there were 15 strawberry creams?

What if there were 20 strawberry creams?

Make up your own numbers of strawberry creams.

We also give children problems that involve adding and subtracting fractions.

If we know how to add and subtract whole numbers we can apply that to fractions.

2 + 3 = 5

2 apples + 3 apples = 5 apples

£2 + £3 = £5

Therefore…

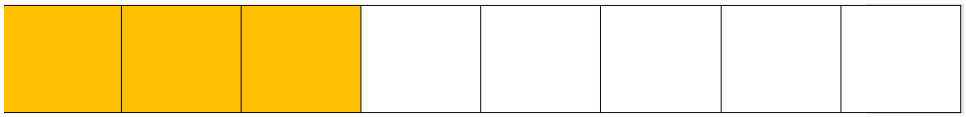
$$\frac{2}{5} + \frac{3}{5} = \frac{5}{5} \qquad \frac{3}{5} + \frac{2}{5} = \frac{5}{5}$$

$$\frac{5}{5} - \frac{3}{5} = \frac{2}{5} \qquad \frac{5}{5} - \frac{2}{5} = \frac{3}{5}$$

Peter buys a pie.

He cuts the pie into 8 equal parts.

He eats 3 pieces.



What fraction of the pie does he eat?

$$\frac{3}{8} + \frac{5}{8} = \frac{8}{8}$$

What fraction of the pie is left?

$$\frac{8}{8} - \frac{3}{8} = \frac{5}{8}$$

Ella eats $\frac{1}{5}$ of a pizza.

Tom eats $\frac{2}{5}$ of it.

What fraction do they eat altogether?

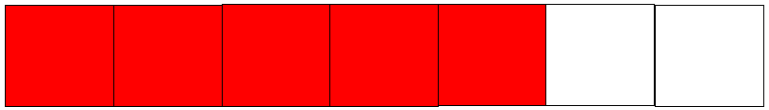
$$\frac{1}{5} + \frac{2}{5} = \frac{3}{5} \qquad \frac{2}{5} + \frac{1}{5} = \frac{3}{5}$$

What fraction is left?

$$\frac{5}{5} - \frac{3}{5} = \frac{2}{5}$$

Suzie reads $\frac{3}{7}$ of her book before dinner.

She reads $\frac{2}{7}$ after dinner.



What fraction of her book did she still have to read?

$$\frac{3}{7} + \frac{2}{7} = \frac{5}{7} \qquad \frac{2}{7} + \frac{3}{7} = \frac{5}{7}$$

$$\frac{7}{7} - \frac{5}{7} = \frac{2}{7}$$

Other key vocabulary

Bus stop

$3\overline{)135}$

Division bracket

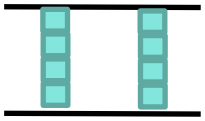
Greater than

$4 > 2$

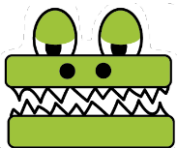
Less than

$2 < 4$

Crocodiles only eat meat!



equal to… equivalent… same as NOT



Numerator → $\frac{1}{10}$ ← Vinculum (line that separates the numerator and denominator)

Denominator → $\frac{1}{10}$

Commutative: doesn't matter which order you add/multiply the sum/product will be the same.

Inverse: addition and subtraction, multiplication and division are inverse operations, use one to check the other.

Inverse structures for multiplication and division: grouping (repeated addition and subtraction) and scaling (x times as many, a fraction of the amount).

Zero: indicates nothing, main role is as a place holder.

O v 0

Pence: use pence not p when referring to money, p is a little green vegetable!

Dot: dot, not a decimal point, separates the pounds and pence.

If referred to as a decimal point, it can confuse due to the convention of how we say decimals: 6.25m = 6 point two five metres

£6.25 = 6 pounds 25 pence **not** 6 point two five pounds

Precise mathematical **process** vocabulary

Compare, estimate, exchange, regroup, partition

Any questions?