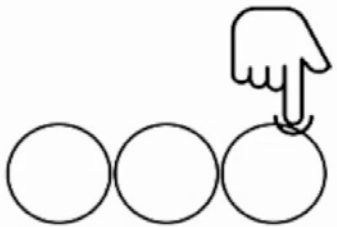
Hampton Vale
Primary Academy

# Maths
# Calculation Policy

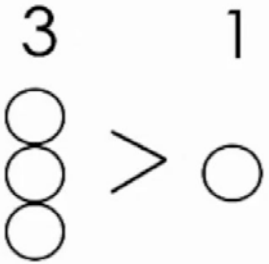
# Contents

# Early Maths

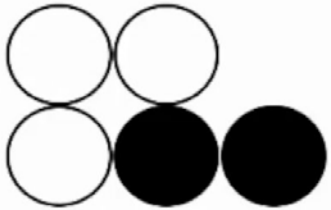
# Number Sense



counting

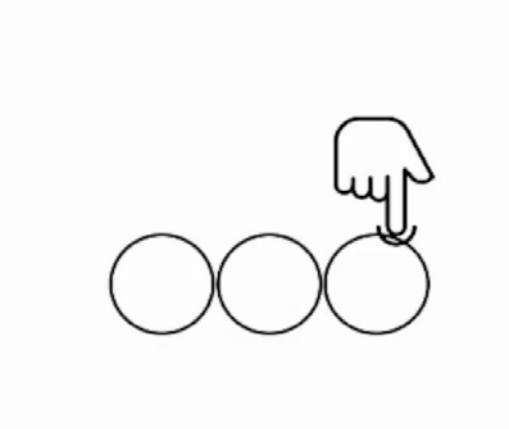



comparing



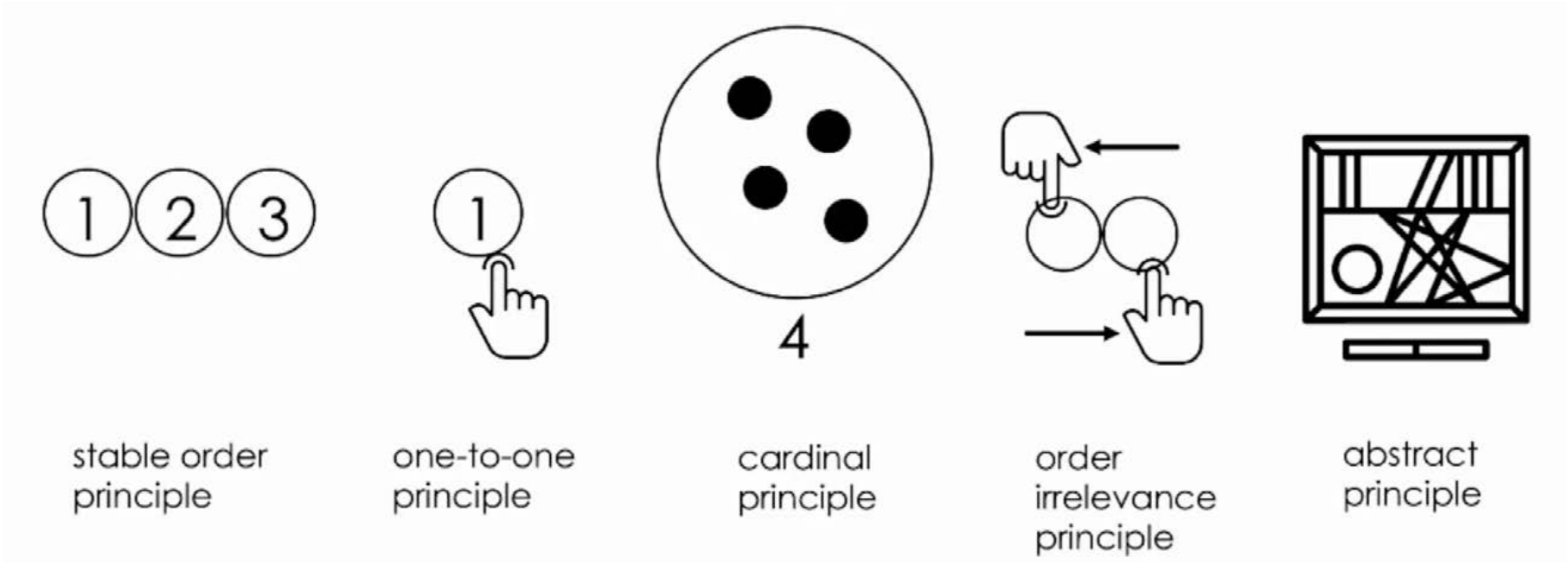
composition

# Counting



# The Five Principles of Counting

What are they?



# The Five Principles of Counting

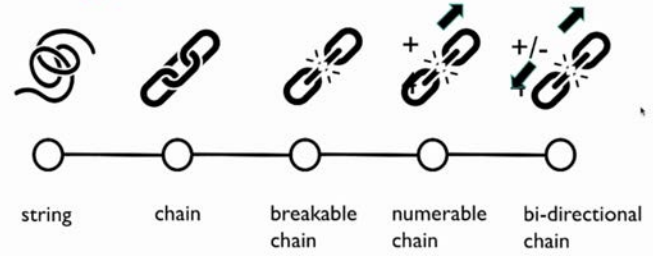
## 1. The Stable Order Principle

Children understand when counting the numbers have to be said in a certain order.

Children need to understand that, when counting, each number represents a different value.

This principle is split into 5 stages:

1. **String** - recalling a counting song or rhyme
2. **Chain** - counting from 1 understanding each number represents a certain value
3. **Breakable Chain** - starting from any number and counting on
4. **Numerable chain** - start at a number and count so many more
5. **Bi-directional Chain** - start at a number and count so many less.



# The Five Principles of Counting

## 2. The One-to-One Principle

This involves children assigning one number name to each object that is being counted. Children need to ensure that they count each object only once ensuring they have counted every object.

Children will sometimes count objects more than once or miss an object out that needs to be counted.

Encourage children to line up objects and touch each one as they count saying one number name per object.

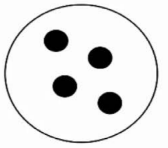
This will also help to avoid children counting more quickly than they touch the objects which again shows they have not grasped one-to-one correspondence.

Other ideas; count linear, circular, mixed.

A video example of the One-to-One principle with a child.

# The Five Principles of Counting

## 3. The Cardinal Principle




Children understand that the number name assigned to the final object in a group is the total number of objects in that group.

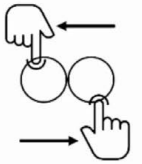
In order to grasp this principle, children need to understand the one-one and stable-order principle.

After counting a group of objects and asking 'how many?', children should be able to recall the final number they said.

Children who have not grasped this principle will recount the whole group again.

# The Five Principles of Counting

## 4. The Order-Irrelevance Principle



This involves children understanding that the order we count a group of objects is irrelevant. There will still be the same number.

Encourage children to count objects, left to right, right to left, top to bottom and bottom to top.

Once children have counted a group, move the objects and ask children how many there are, if they count them all again they have not fully grasped this principle.

# The Five Principles of Counting

## 5. The Abstraction Principle

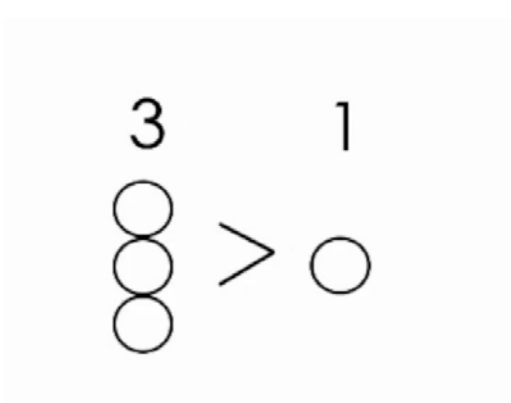
This involves children understanding that anything can be counted including things that cannot be touched including sounds and movements, e.g. jumps.

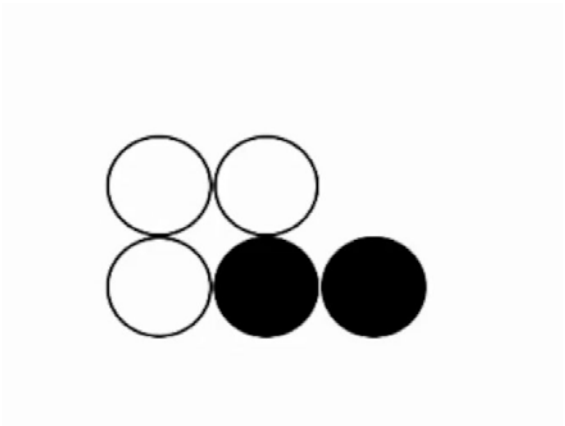
When starting to count, many children rely on touching the objects in order to count accurately.

Teachers can encourage abstraction on a daily basis by counting claps or clicks.

They can also count imaginary objects in their head to encourage counting on, this involves the children visualising objects.

# Comparing & Composition



## Comparing

Children look at numbers or groups of objects and can see which are bigger/greater and which are smaller/less.

## Composition

Composition is the understanding that a number contains within it other numbers.

Composition and comparing numbers/objects is built on a foundation of children being able to subitise.

# Subitising

# Subitising

## Perceptual Subitising

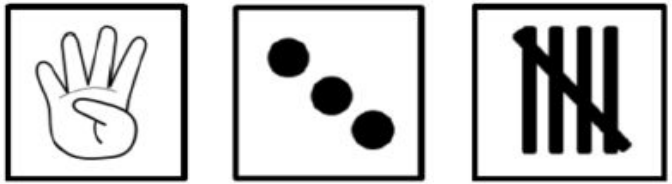
perceptual

Perceptual Subitising is being able to recognise immediately what number is represented.

Subitising can help children to build images for numbers, to visualise and to learn number facts.

We need to regularly show children different ways of representing numbers to 5, in order for them to be able to subitise.

We should use a range of representations to show this; cubes, numicon, bead strings, dice, fingers, cubes, everyday objects.



# Subitising

## Conceptual Subitising

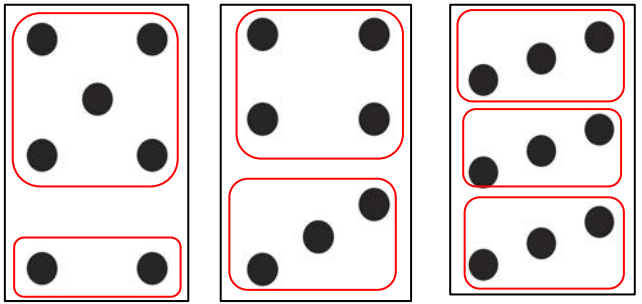
conceptual

Conceptual Subitising is immediately recognising smaller amounts and putting them together in your head to find the total.

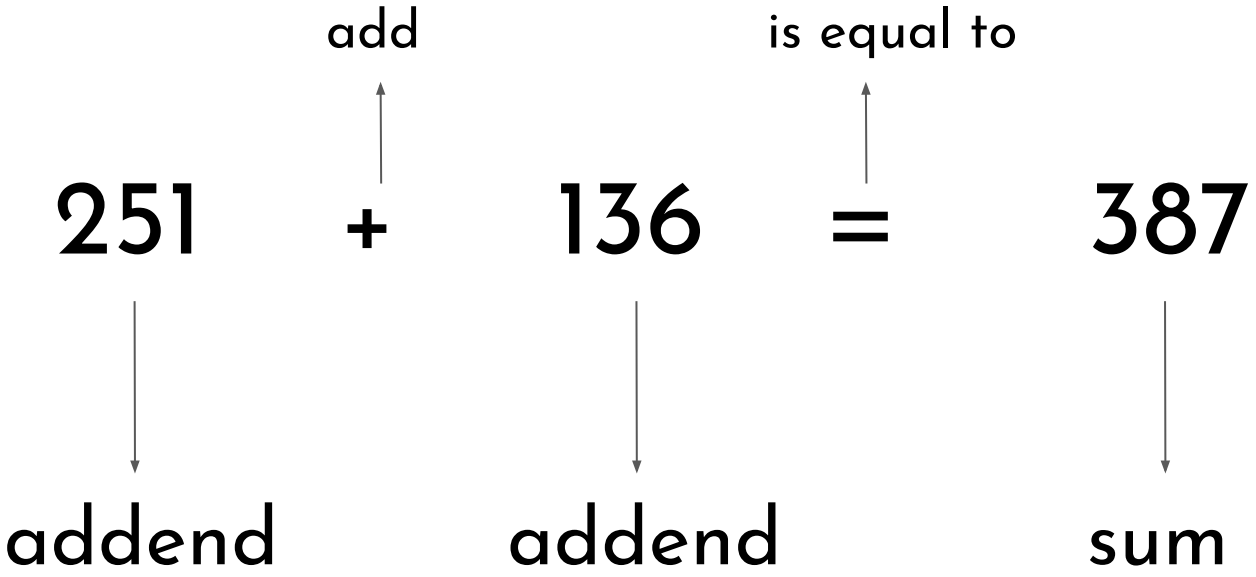
Subitising can also help children learn addition and subtraction facts.

This involves part-whole awareness, which enables children to simultaneously see the whole number and numbers which make it up.

Seeing numbers as combinations of other numbers helps build familiarity with number combinations. It is also much more effective than giving children number sentences to complete by counting cubes and hoping they will remember the numbers involved.



# Addition


add
is equal to
251
+
136
=
387
addend
addend
sum

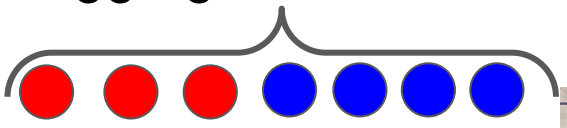
# Mental Strategies

# Aggregation

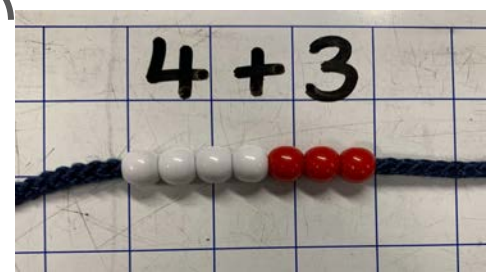
**Keywords** Altogether Total Sum

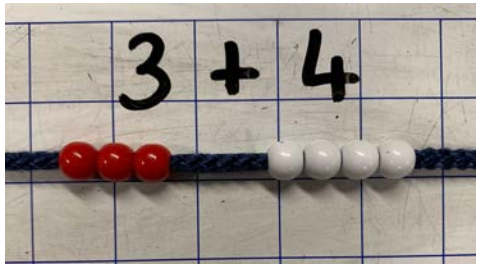
# KS1

## Aggregation



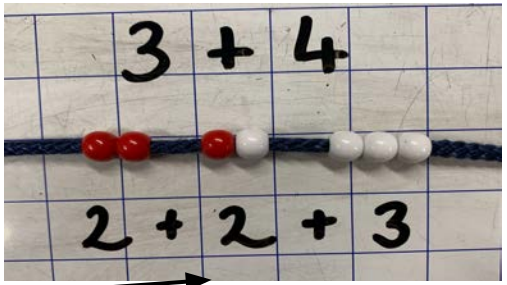
## Commutativity

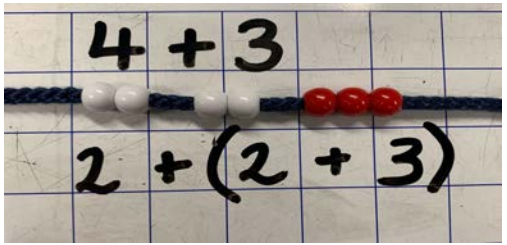


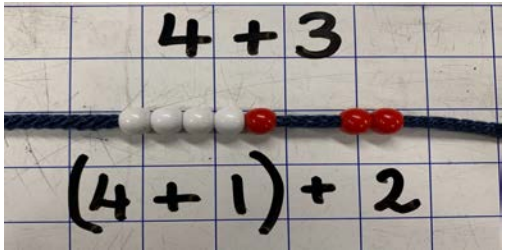




## Partitioning & Associative Law

Subitising



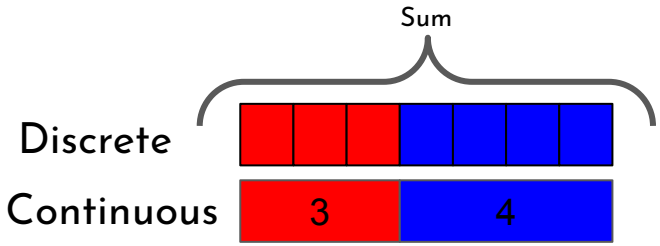




## Word problem

Gracie has 3 stickers in her pocket and 4 stickers in her hand.

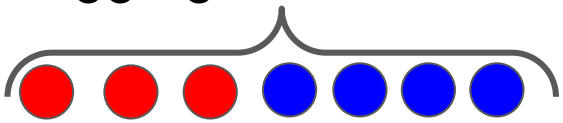
How many does she have altogether?



**Keywords** Altogether Total Sum

# KS2

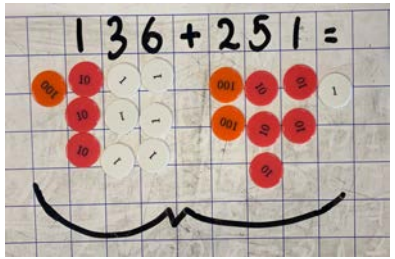
## Aggregation

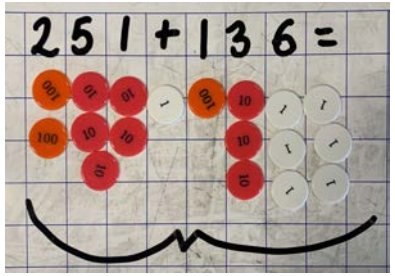


## Word problem

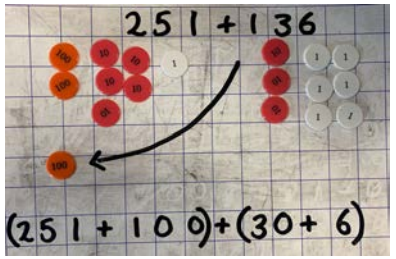
Piotr takes 251 conkers, followed by a further 136 conkers.
What is the total amount of conkers?

## Commutativity

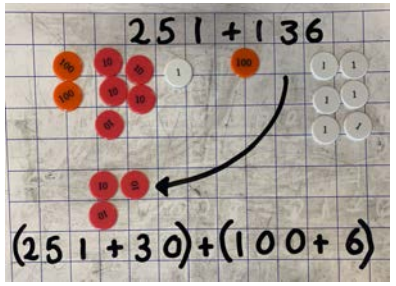


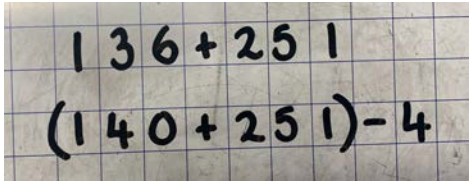

## Partitioning & Associative Law



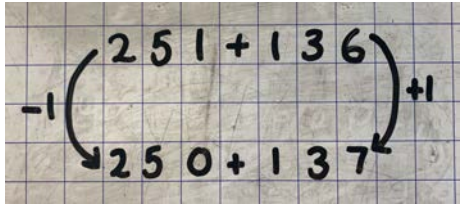

## Associative Law



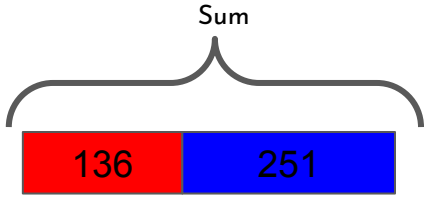

## Compensation




## Constant difference




Continuous

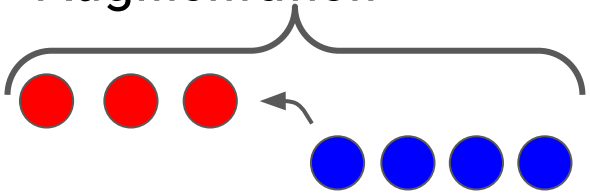


# Augmentation

# KS1

**Keywords** Increase How many more More Greater Taller Longer Heavier

## Augmentation

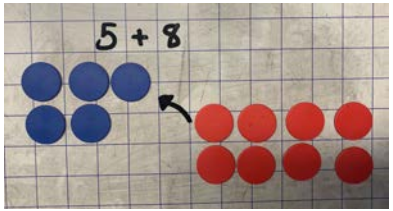


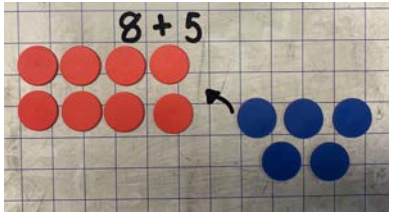
## Word problem

Raul wants to pay the shopkeeper with five coins. He doesn't have enough. His mother gives him 8 more.

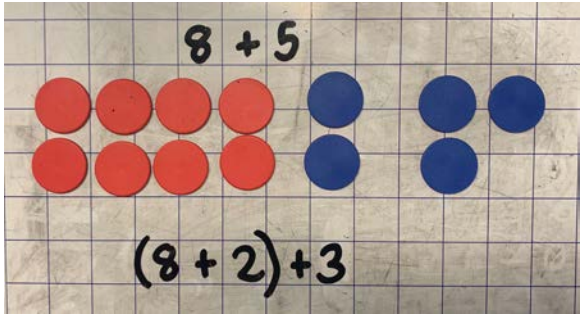
How many coins does he have now?

## Commutativity

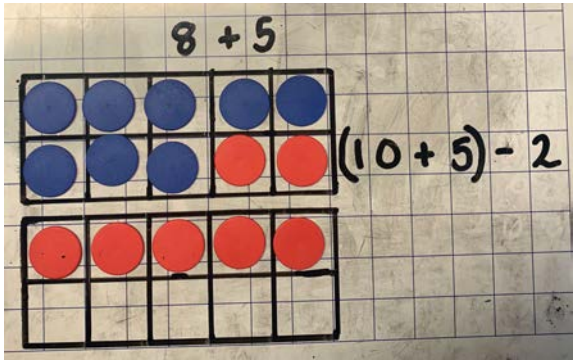



## Partitioning & Associative Law



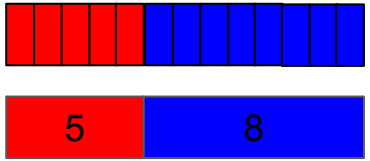

## Compensation




Sum

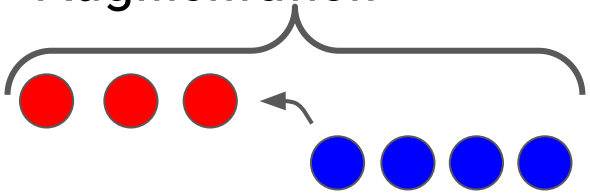
Discrete

Continuous



# KS2

## Augmentation



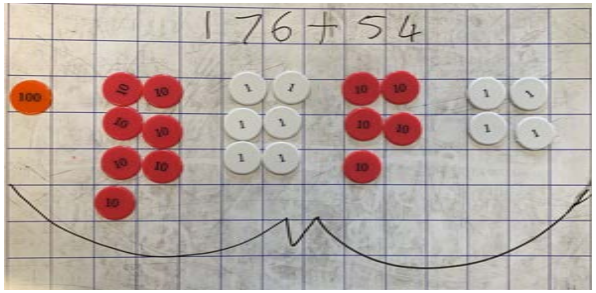
**Keywords** Increase How many more More Greater Taller Longer Heavier

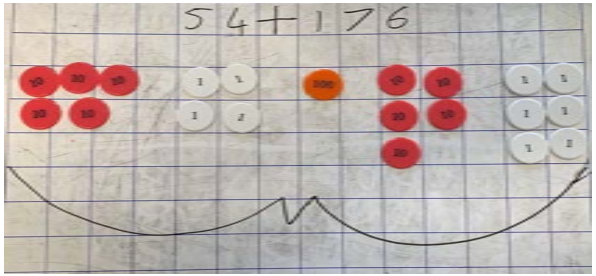
### Word problem

Sebastian has £176 and receives an increase of £54.

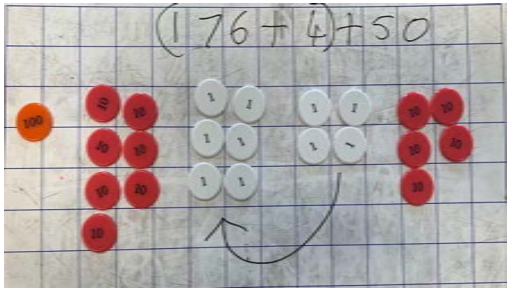
How much does he have now?

### Commutativity

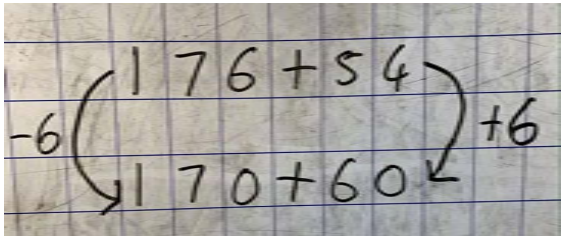



### Partitioning & Associative Law

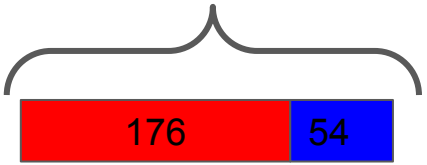



### Constant difference




Sum

Continuous

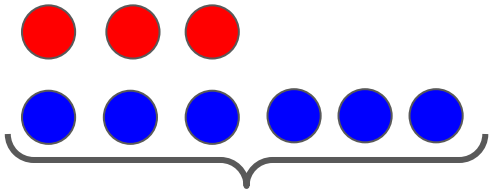


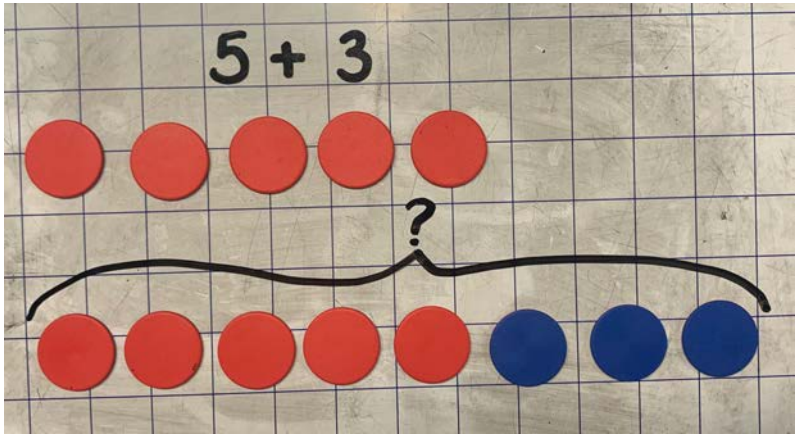
# Comparison

**Keywords** Altogether Total Sum

# KS1

## Comparison



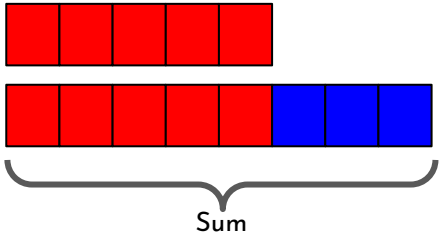



## Word problem

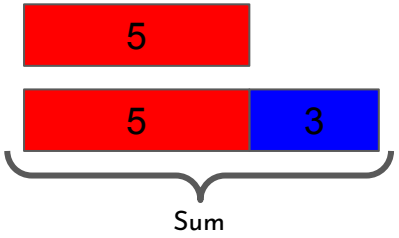
Benjamin has 5 tickets in Folder A and 3 more in Folder B than in Folder A.

How many does he have in Folder B?

Discrete



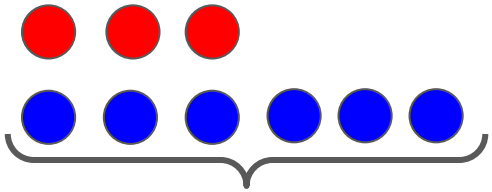

Concrete

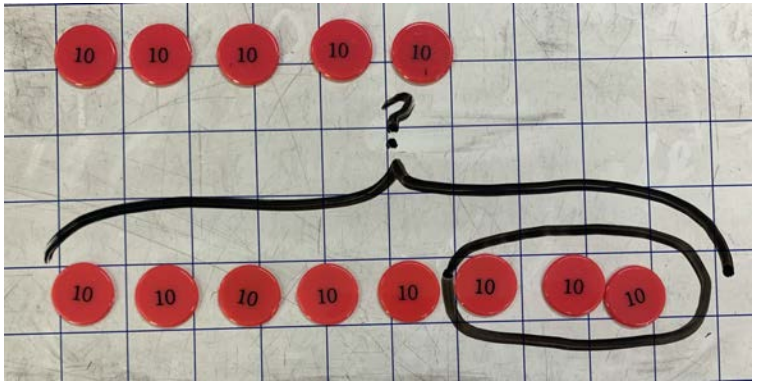


**Keywords** Altogether Total Sum

# KS2

## Comparison



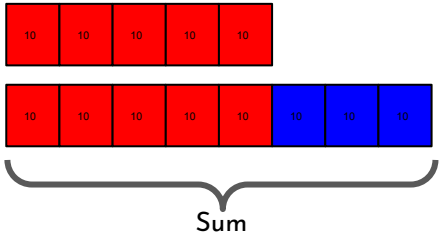



Word problem

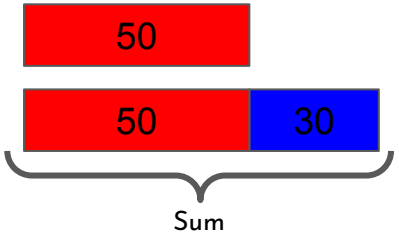
Susan has 50 golf balls in her green bag and 30 more in her black bag than in her green bag.

How many does she have in her black bag?

Discrete

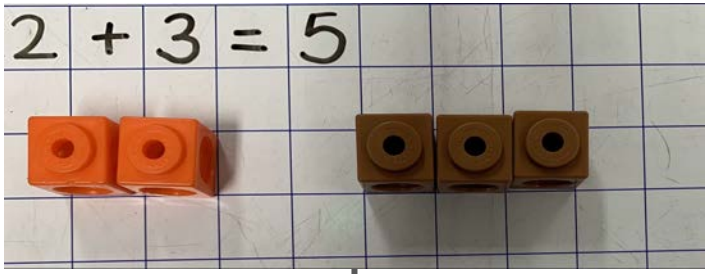



Concrete

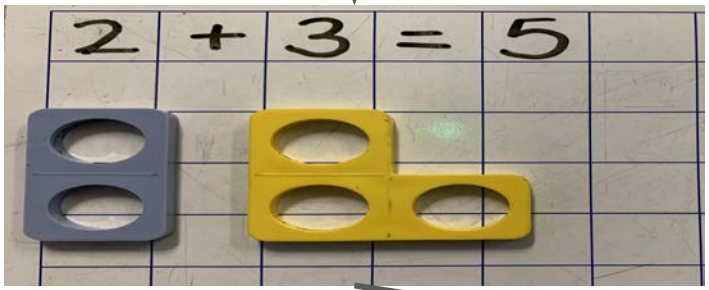


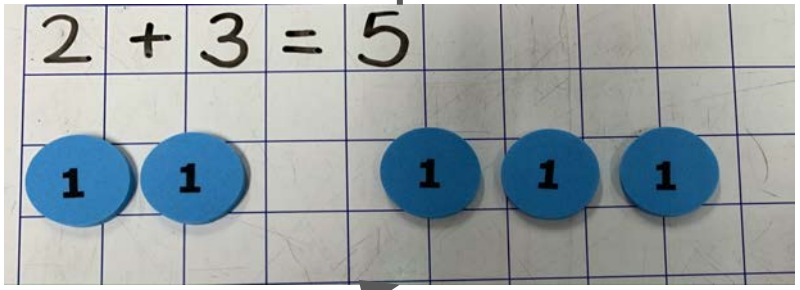
# Progression with written methods

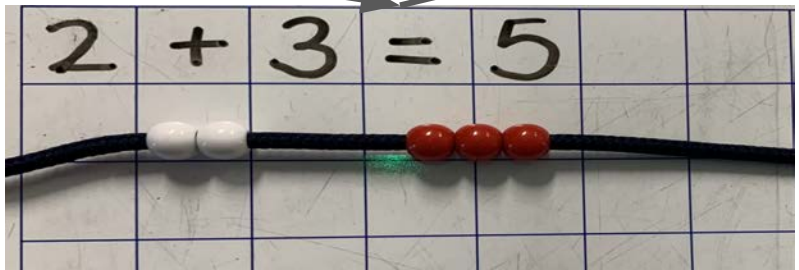
# Adding single digit numbers within 10



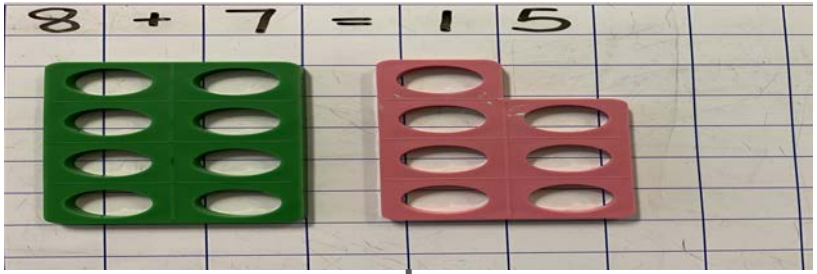


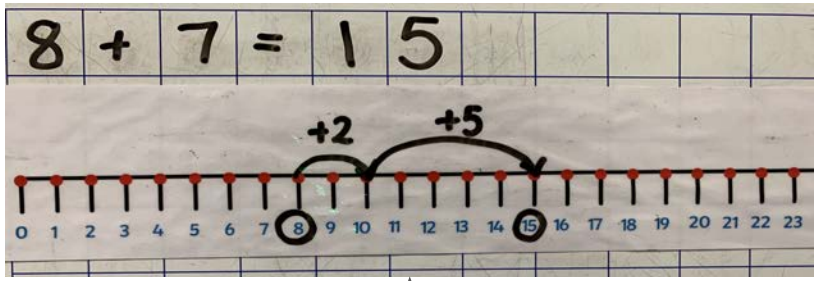


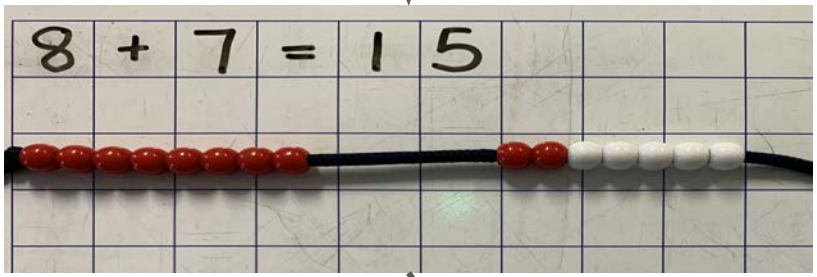



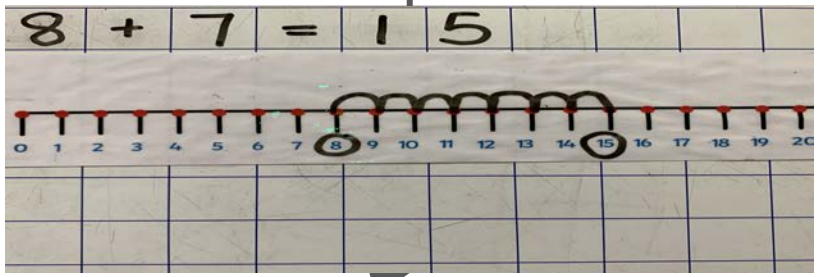



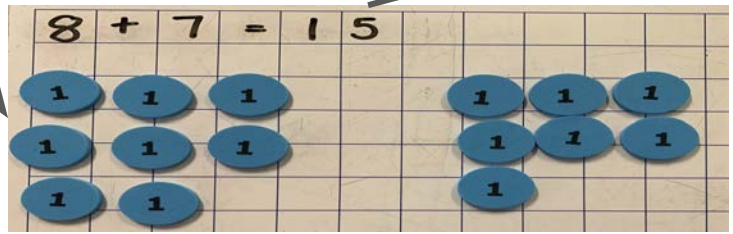
# Adding 2 1 digit numbers (bridging 10)



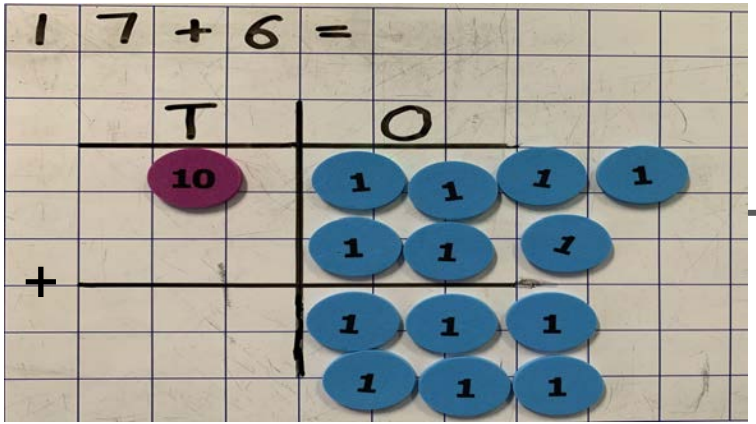



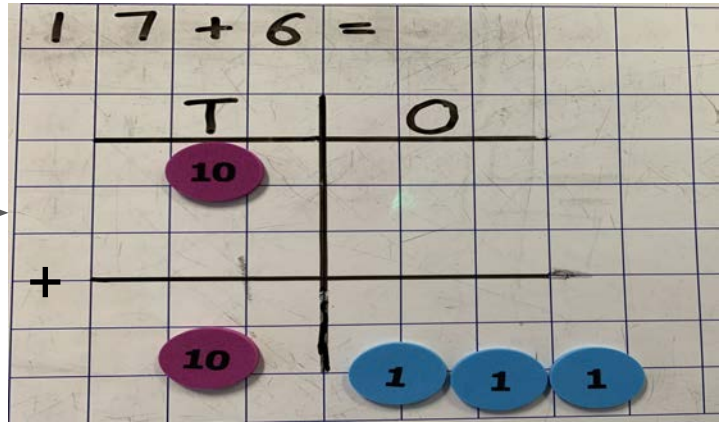



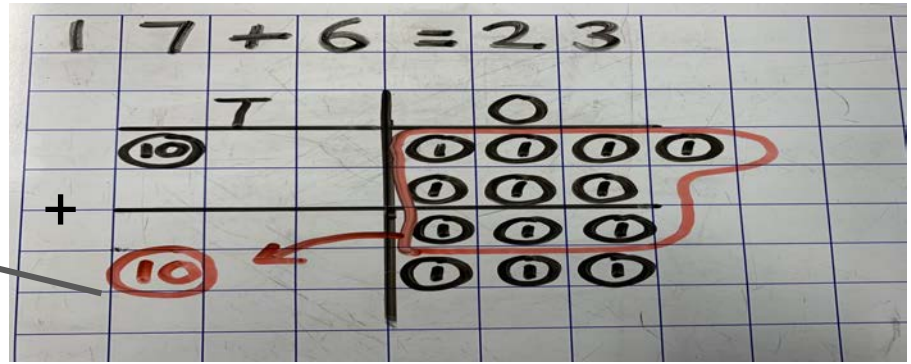



# Adding a 1 digit number and 2 digit number (bridging 10)



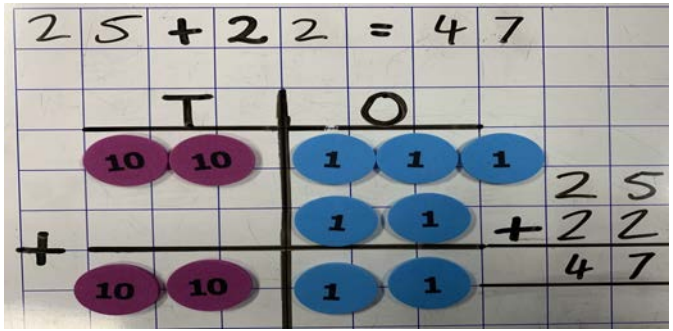

**Vocabulary**
'Carrying a ten'



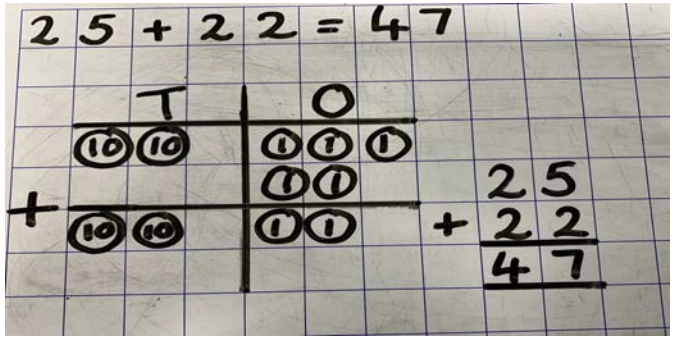

In book example

## Adding 2 digit numbers

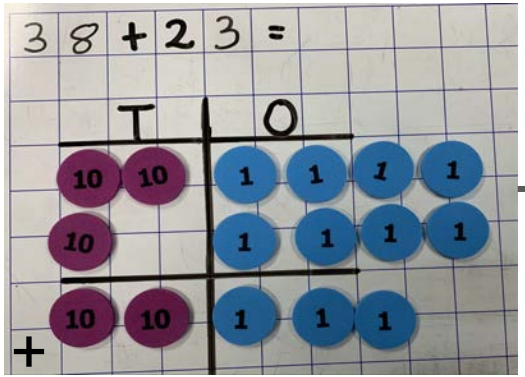
### Not bridging 10

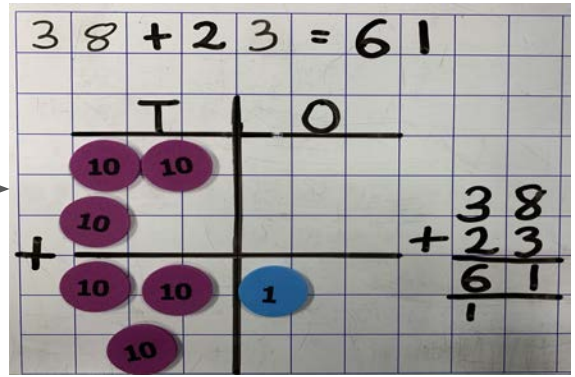



In book example

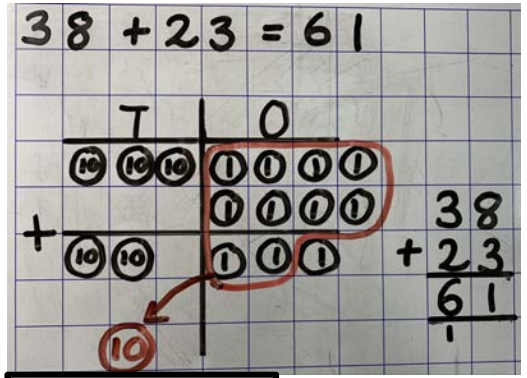



### Bridging 10




In book example

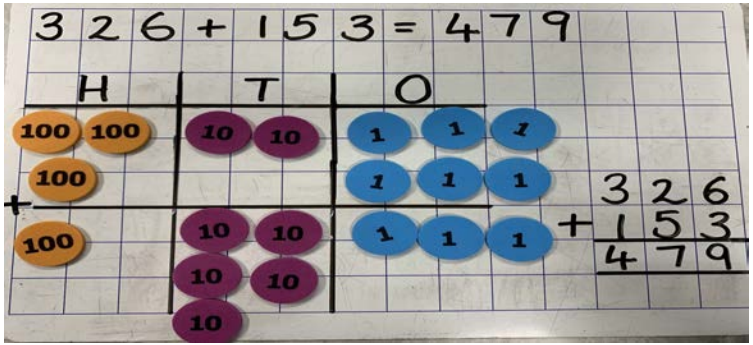



**Vocabulary**

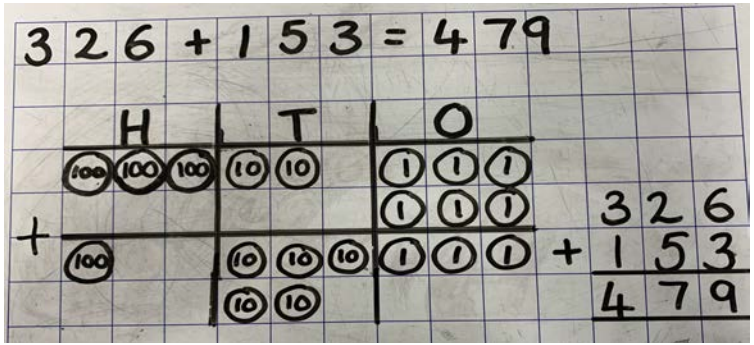
'Carrying a ten'

# Adding 3 digit numbers

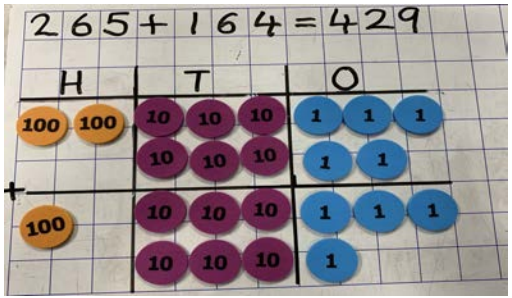
## Not bridging 10

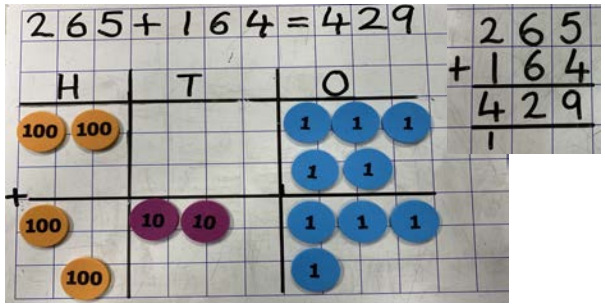



In book example

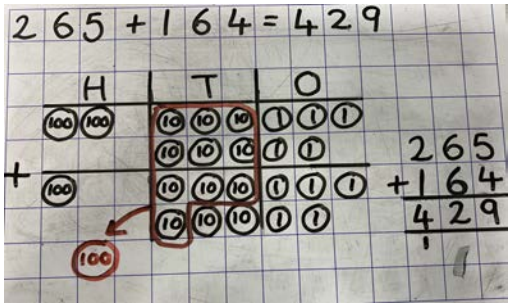



## Bridging 10



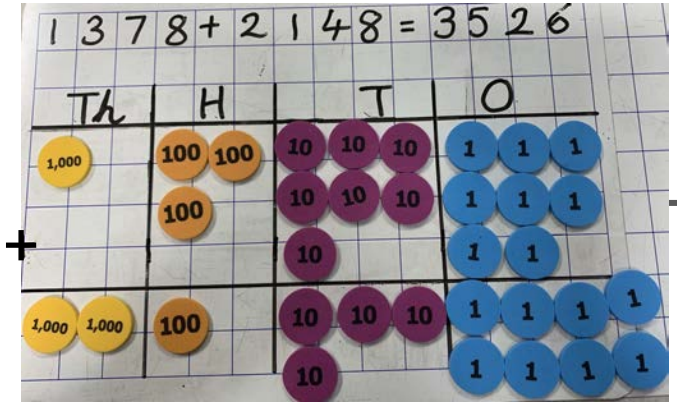

In book example

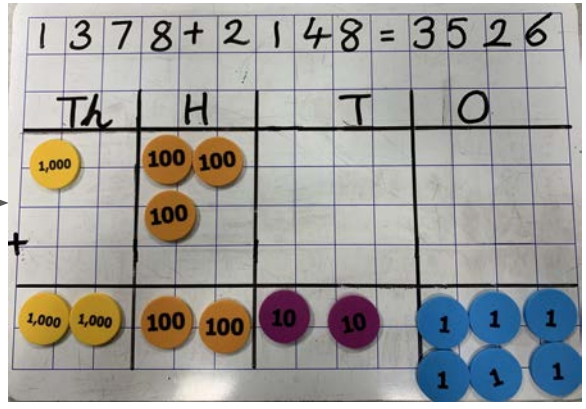



**Vocabulary**

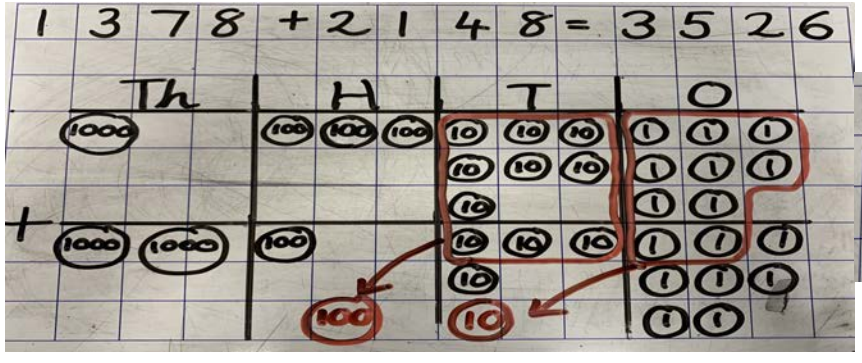
'Carrying a ten'

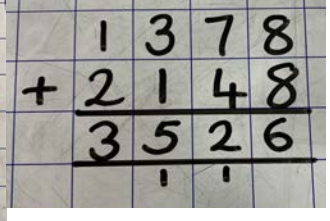
# Adding numbers with 4 or more digits (bridging 10s)



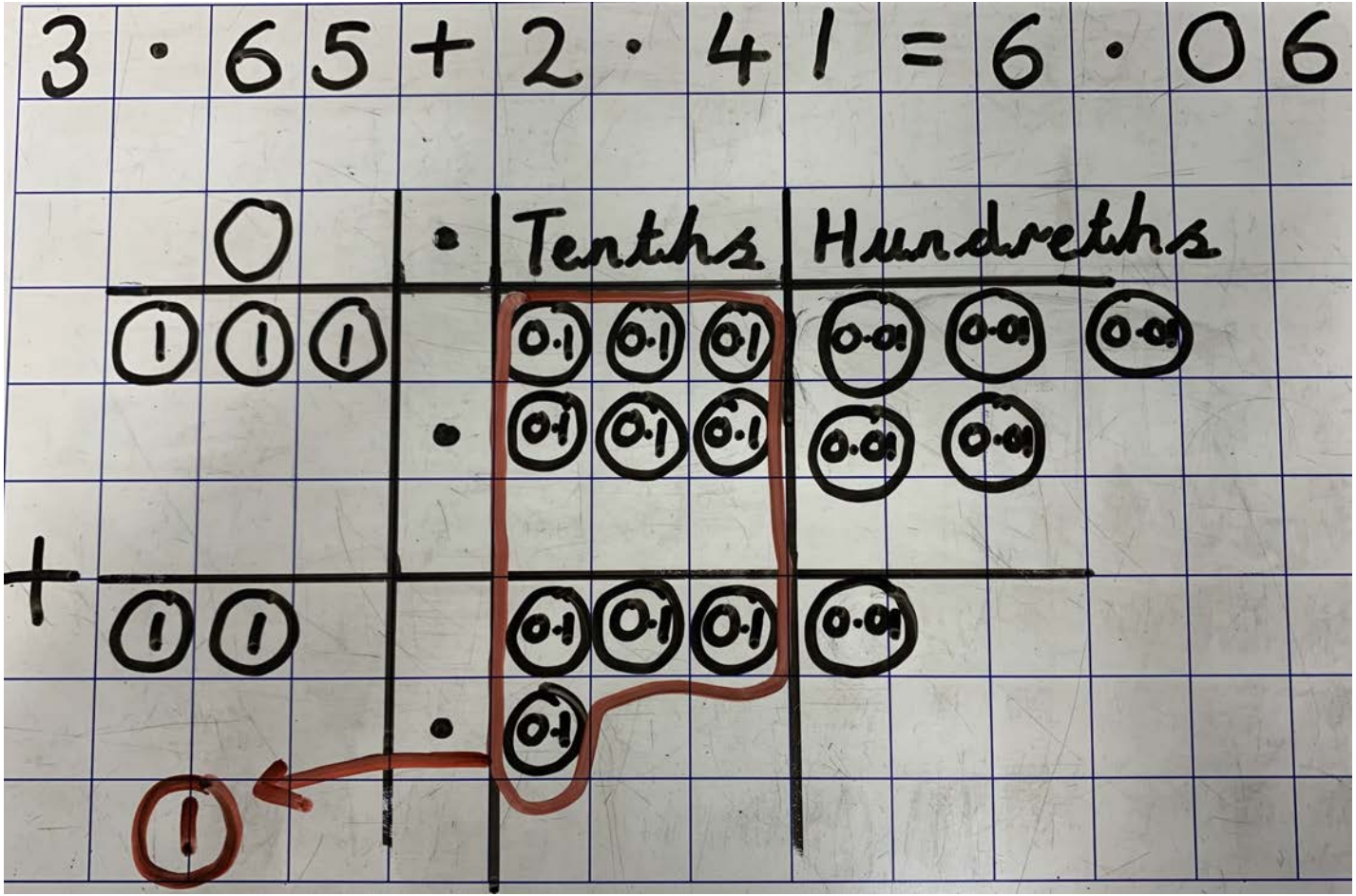




In book example

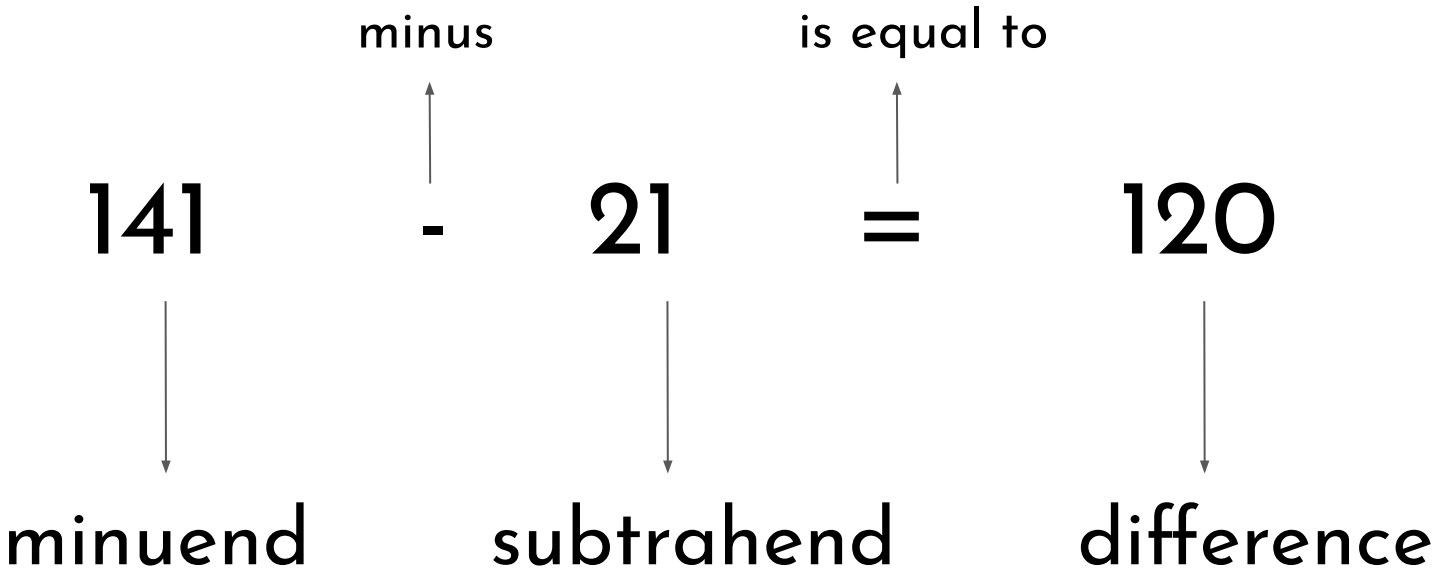


# Adding decimals



# Subtraction


minus
is equal to
141
-
21
=
120
minuend
subtrahend
difference

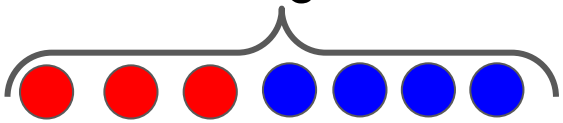
# Mental Strategies

# Partitioning

| **Keywords** | Take away | how many left | given | sold |
|---|---|---|---|---|

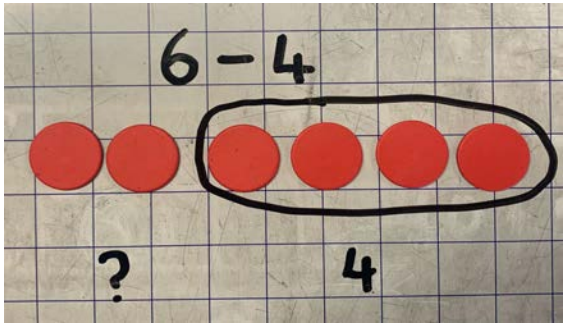
# KS1

## Partitioning

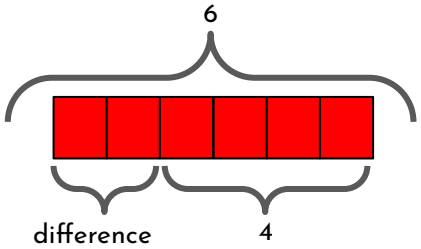


## Word problem

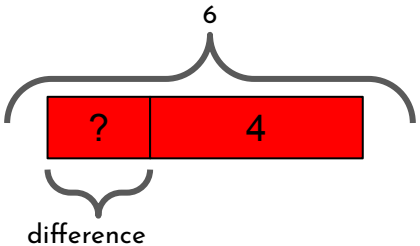
Benny has 6 toy giraffes. He took 4 with him on holiday. How many were left behind?



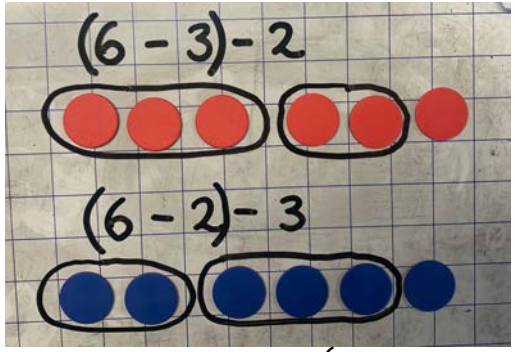

Discrete



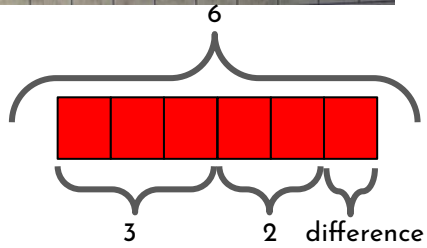

Continuous



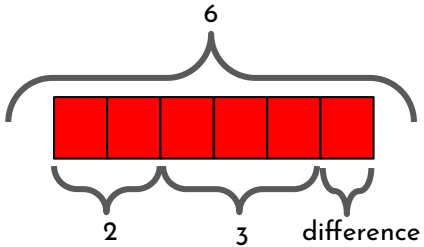

## Commutativity (only with subtrahends)




Discrete



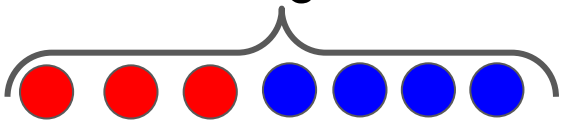

Continuous



| **Keywords** | Take away | how many left | given | sold |
|---|---|---|---|---|

# KS2

## Partitioning



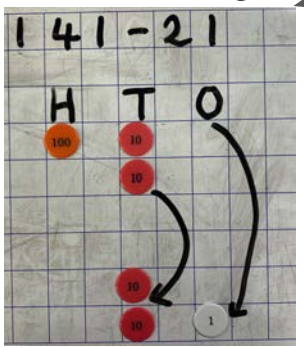
Word problem

Jemal has 141 car magazines. He can allocate 21 in one tray, and the rest in another.

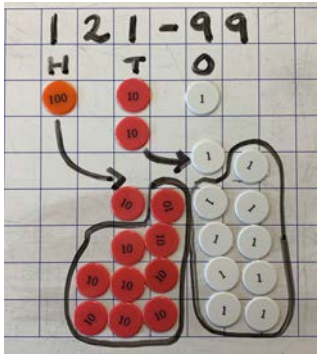
How many are in the other tray?

Partitioning

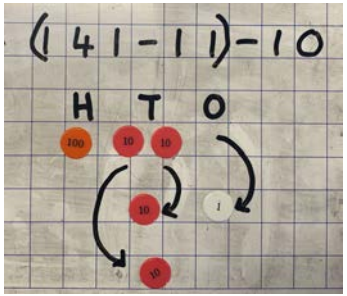
No exchange

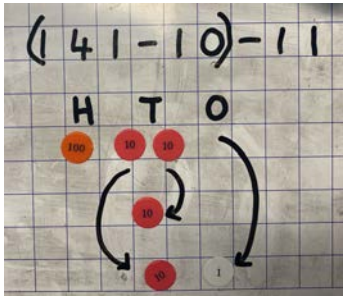



With exchange

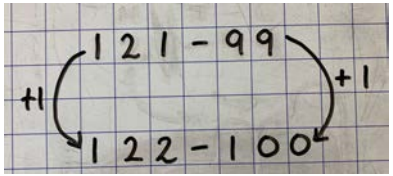



Commutativity
(only with subtrahends)

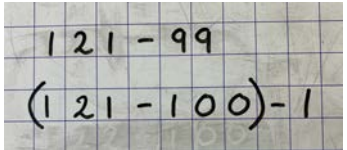



Constant difference




Compensation

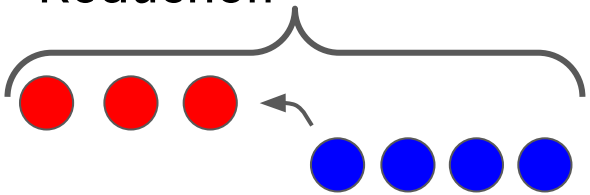


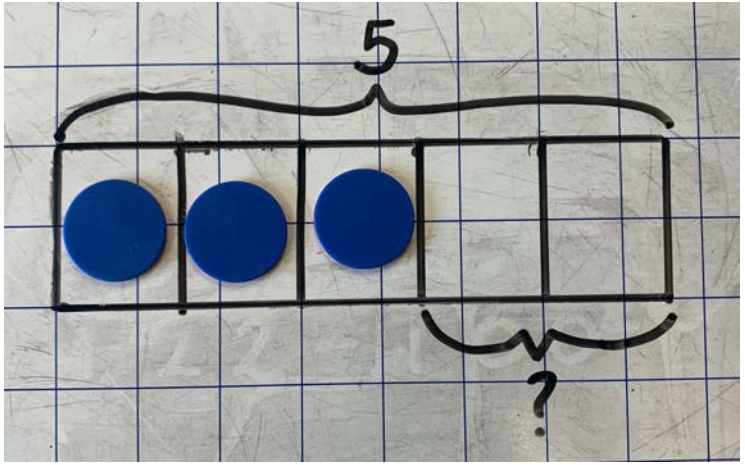
# Reduction

**Keywords** Reduced left Decreased Given away Lost Eaten

# KS1

## Reduction



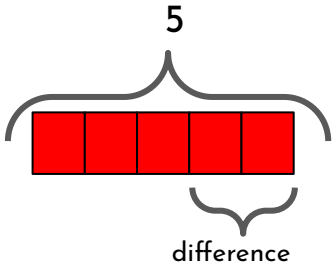



Word problem

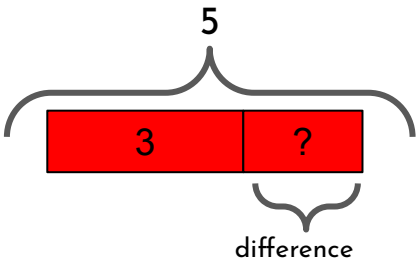
Trudy is holding 5 lollisticks but decides to throw 2 of them away.

How many does she have left?

Discrete



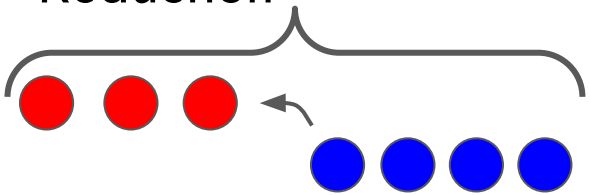

Continuous

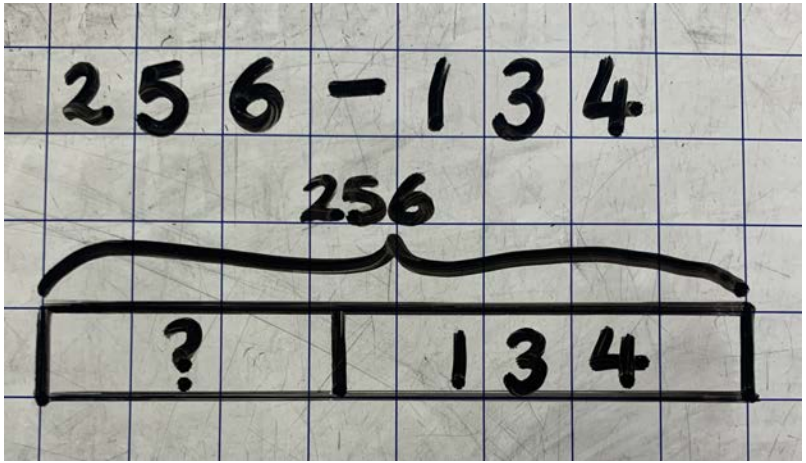


**Keywords** Reduced Decreased Given away Lost Eaten

# KS2

## Reduction



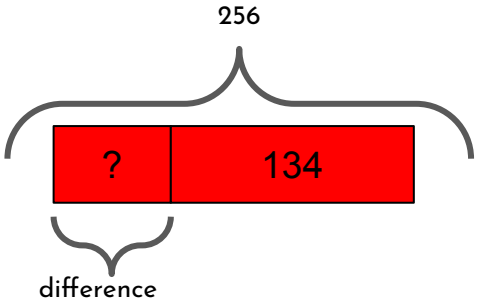



Word problem

Chen has collected 256 stamps but in order to organise her collection, she needs to file 134 of them away.

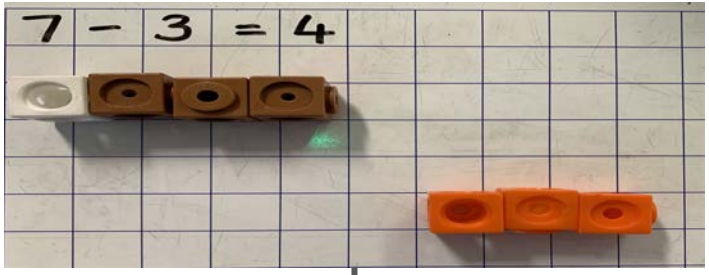
How many stamps does she have loose now?

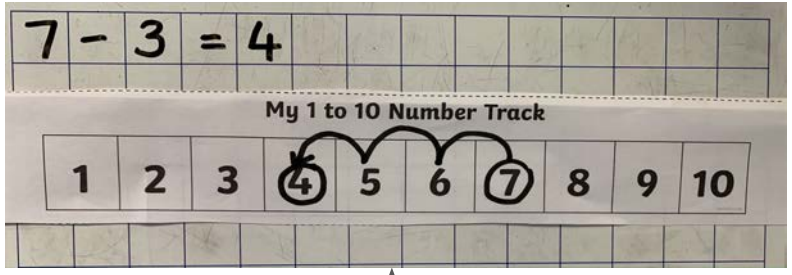
Continuous

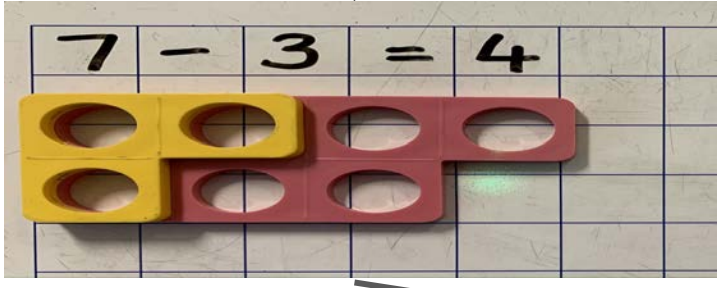


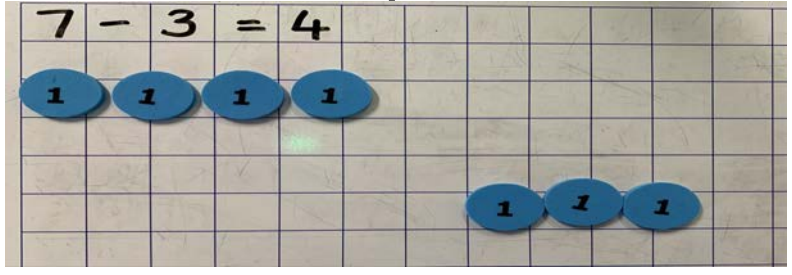
# Progression with written methods

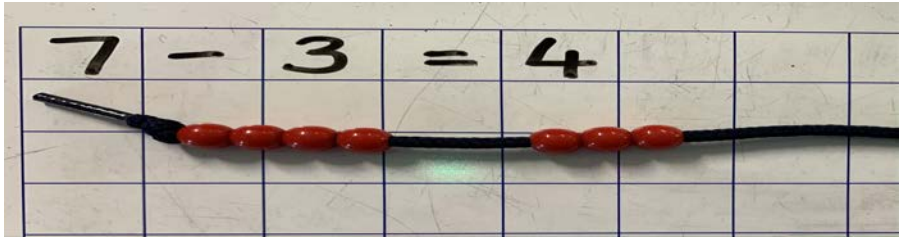
# Subtracting single digit numbers within 10



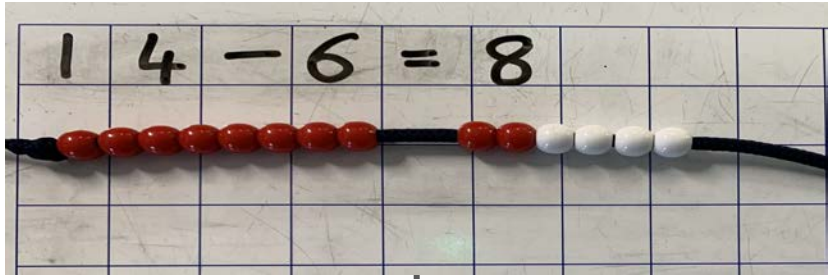



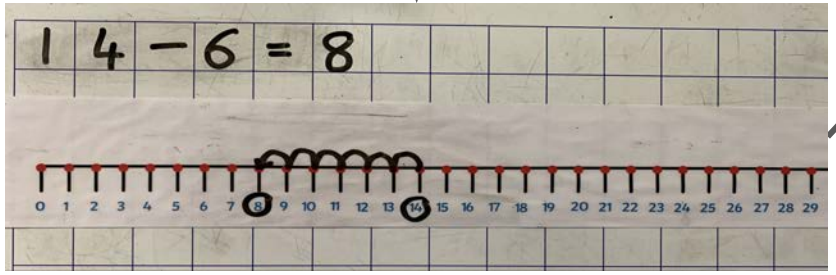



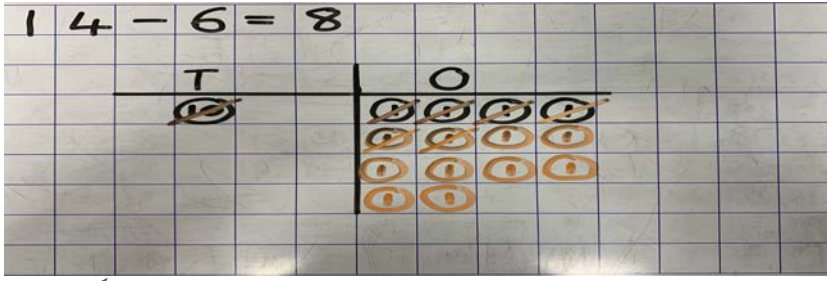



# Subtracting a 1 digit number from a 2 digit number (bridging 10)

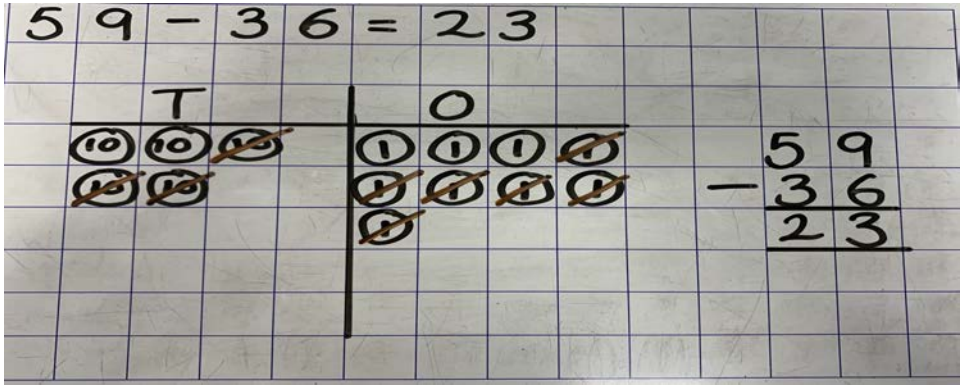


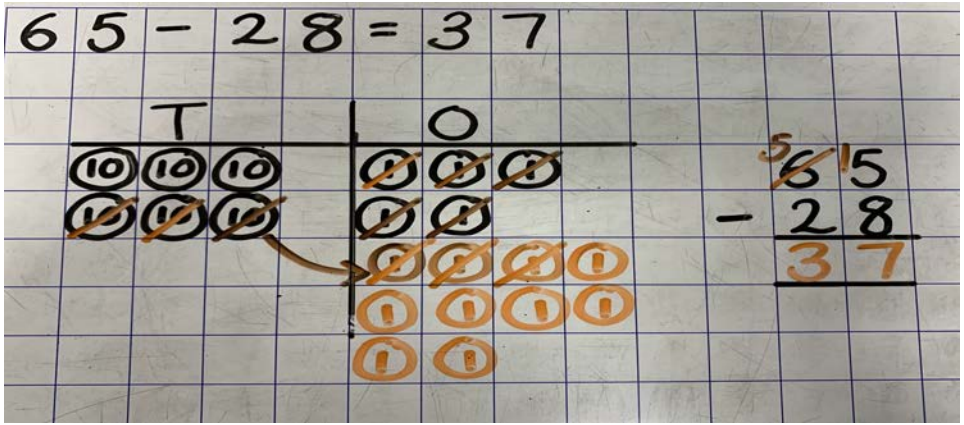



## Subtracting 2 digit numbers

Not bridging 10



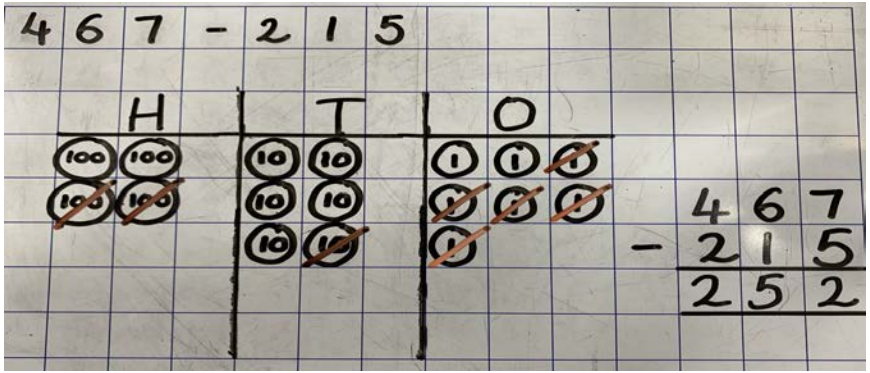

Bridging 10



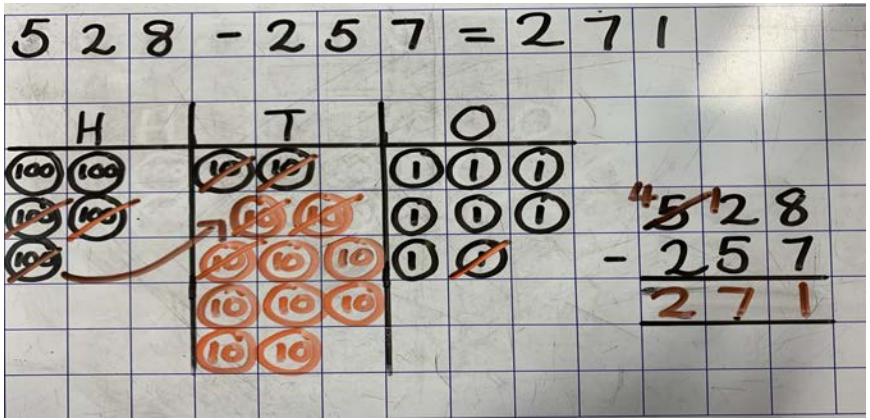

**Vocabulary**
'Exchanging a ten'

## Subtracting 3 digit numbers

Not bridging 10

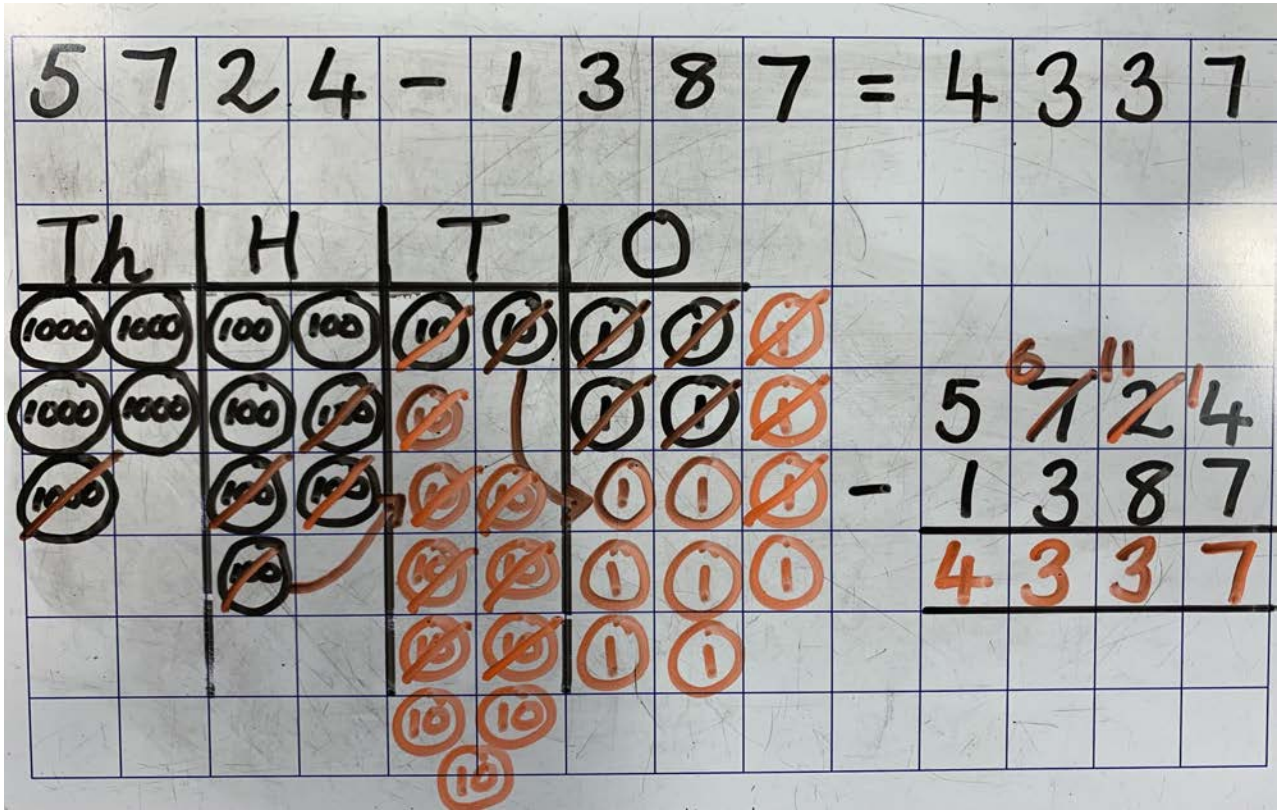



Bridging 10



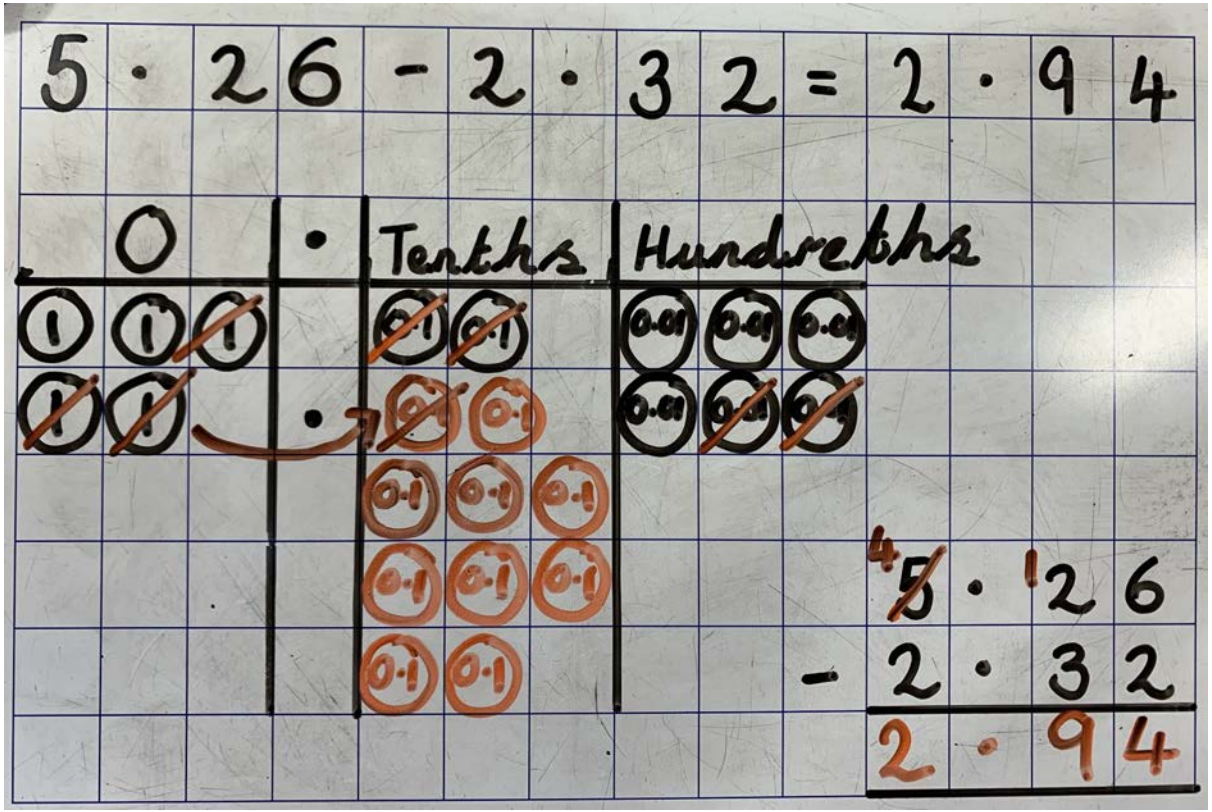

**Vocabulary**
'Exchanging a ten'

# Subtracting 4 digit numbers



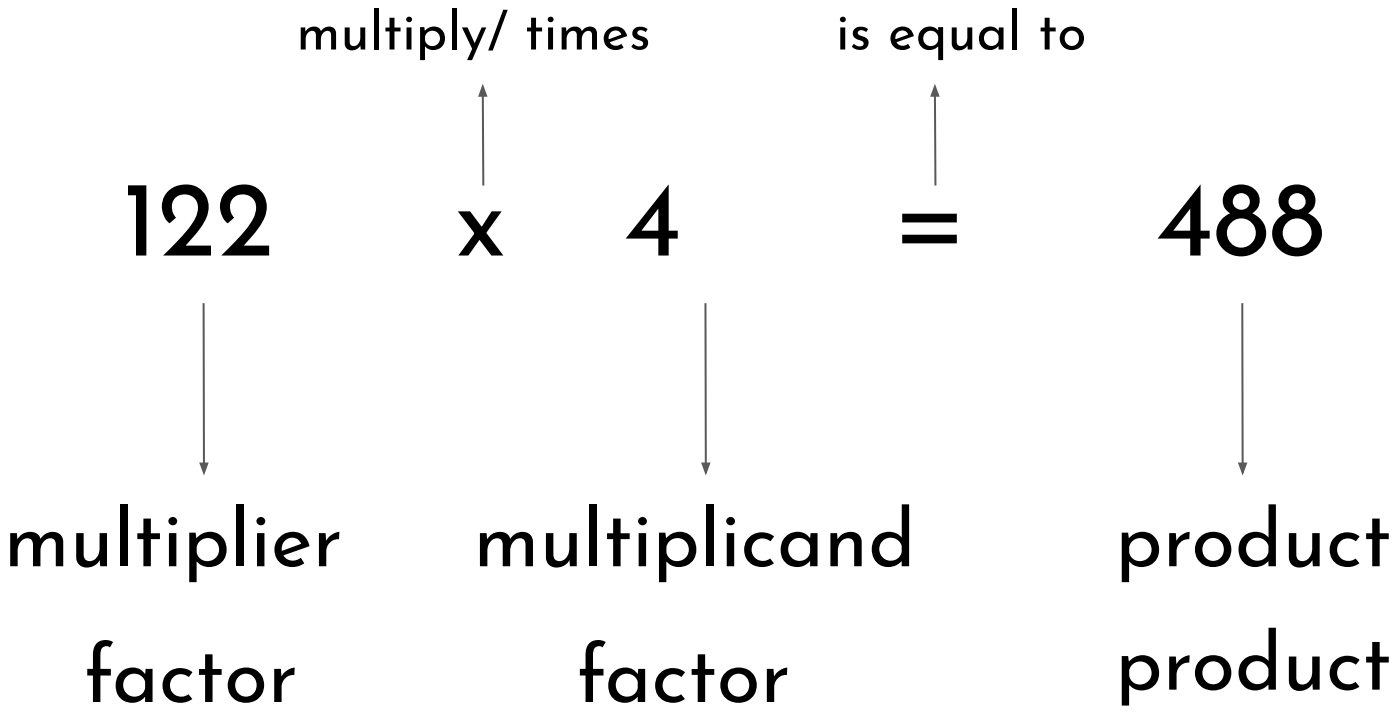

**Vocabulary**
'Exchanging a ten'

# Subtracting decimals




**Vocabulary**
'Exchanging a ten'

# Multiplication


multiply/ times
is equal to
122
x
4
=
488
multiplier
factor
multiplicand
factor
product
product

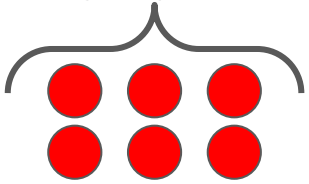
# Mental Strategies

# Repeated addition

# KS1

**Keywords** altogether lots of more product

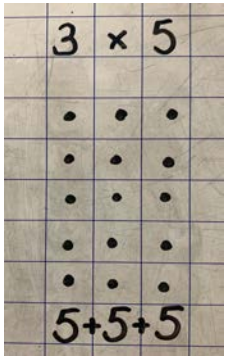
## Repeated aggregation structure



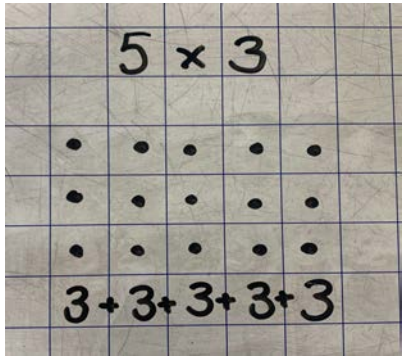
## Word problem

Dylan bought a pack containing 3 cards from the shop.
For his birthday, his mother bought him 5 more packs.
How many does he have altogether?

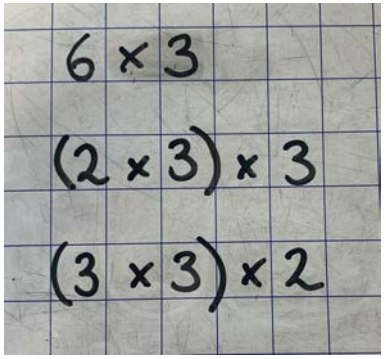
## Commutativity



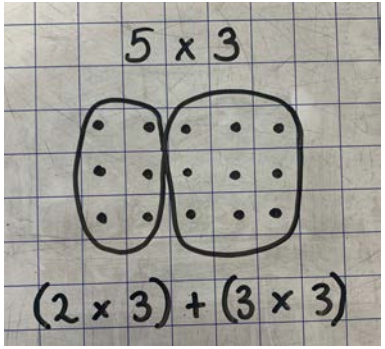

## Arrays



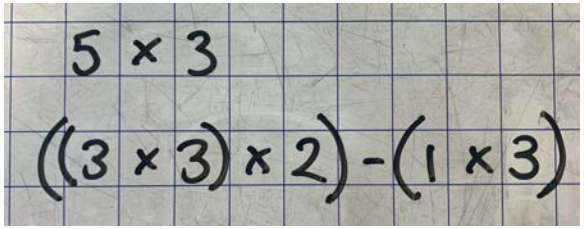

## Associativity




## Distributive law with addition

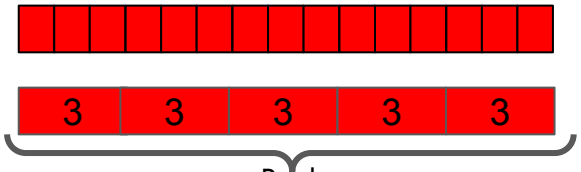



## Distributive law with subtraction




Discrete

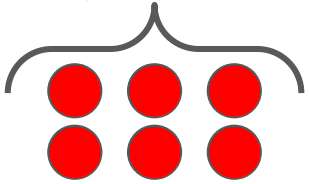
Concrete



# KS2

**Keywords** altogether lots of more product

## Repeated aggregation structure

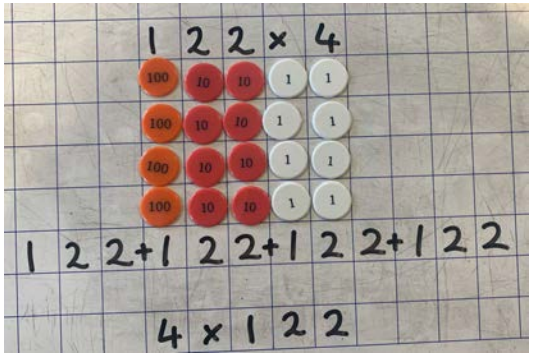


## Word problem

Thomas bought a bag containing 4 lemons from the shop.
For his lemonade stall, his mother bought him 122 lots.

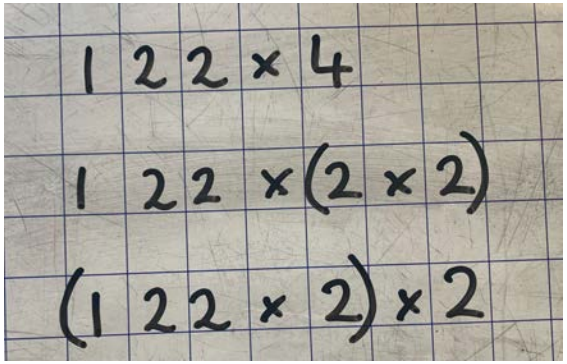
How many does he have altogether?

## Commutativity

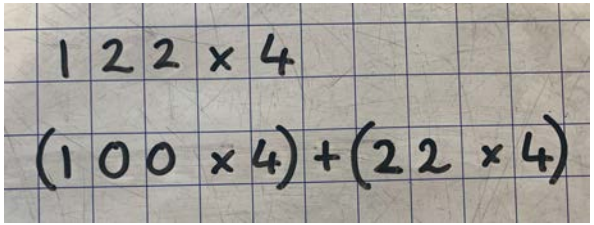



## Arrays

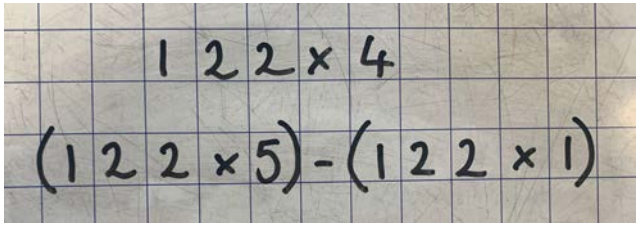
## Associativity



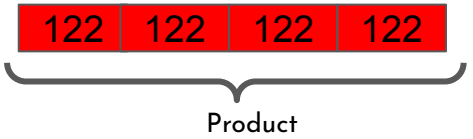

## Distributive law with addition




## Distributive law with subtraction




## Concrete

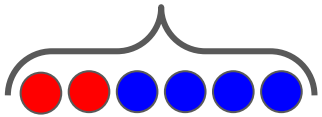


# Scaling

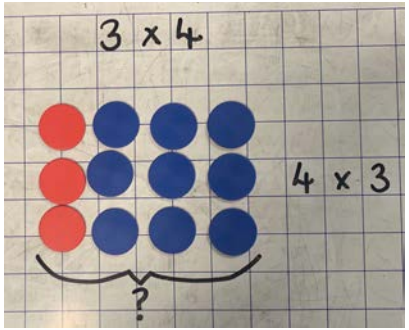
# KS1

**Keywords** scale factor doubling trebling so many times bigger

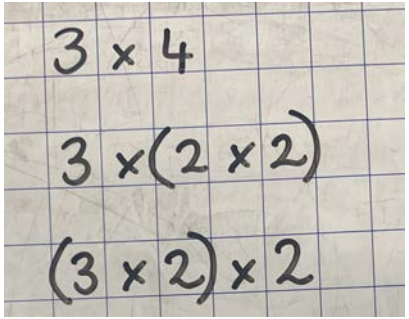
## Scaling



## Commutativity



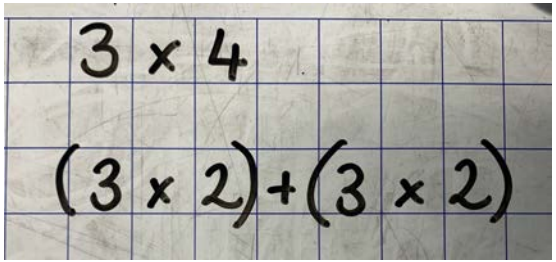

## Associativity



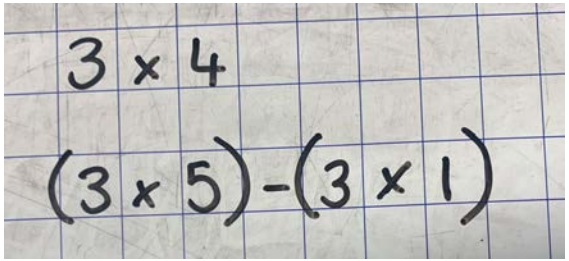

## Word problem

My tower is 3 blocks tall. I built another tower 4 times higher.
How tall is my new tower?

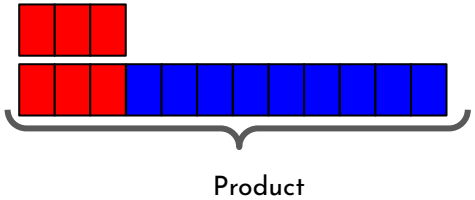
## Distributive law with addition



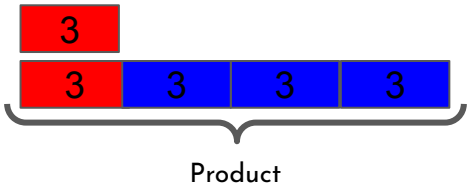

## Distributive law with subtraction




Discrete



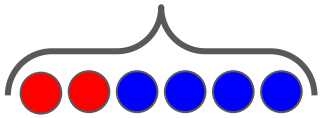

Concrete



# KS2

**Keywords** scale factor doubling trebling so many times bigger

## Scaling

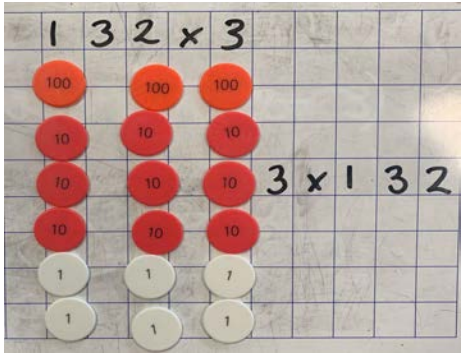


## Word problem

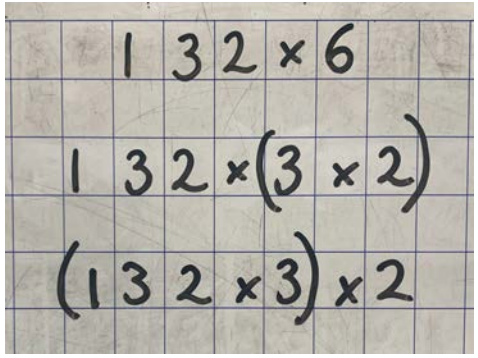
Tom's puppy was 132 cm in January. By the end of the year, his puppy had grown three times greater.

How tall is the puppy now?

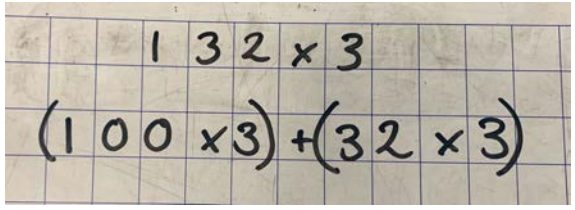
## Commutativity



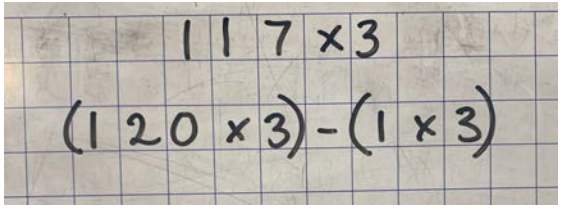

## Associativity



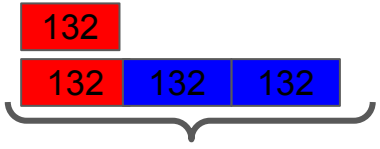

## Distributive law with addition



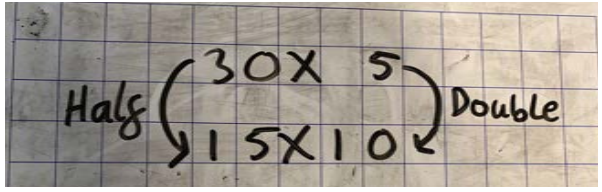

## Distributive law with subtraction




## Concrete

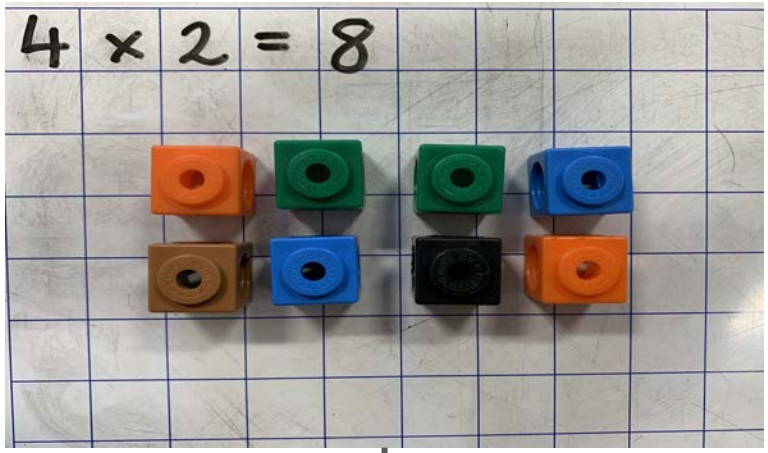


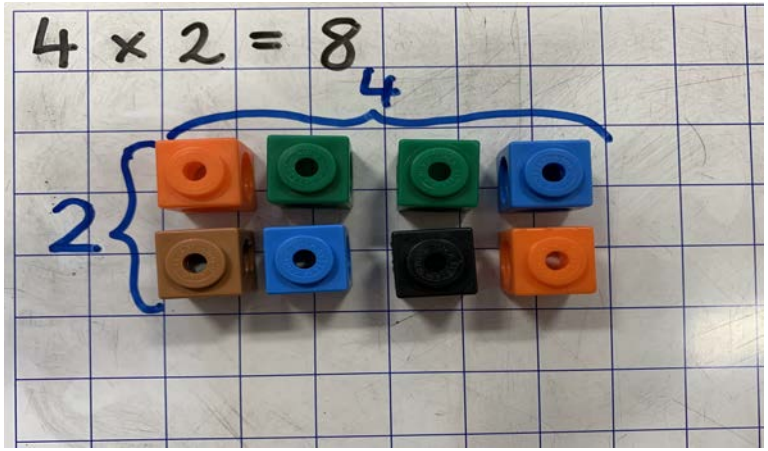

## Doubles and Halves

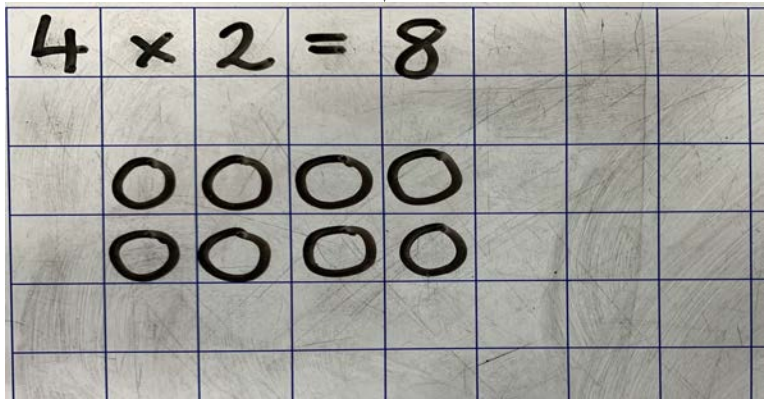


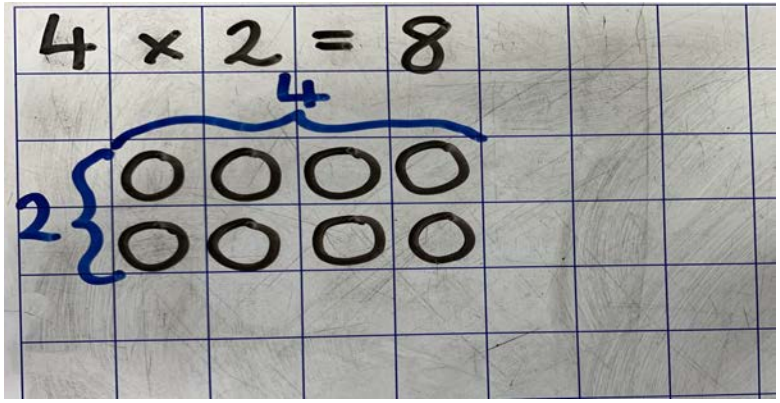
# Progression with written methods

**Arrays**

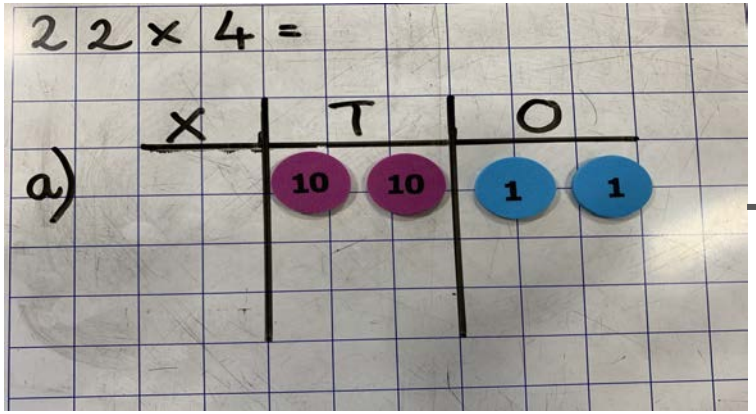


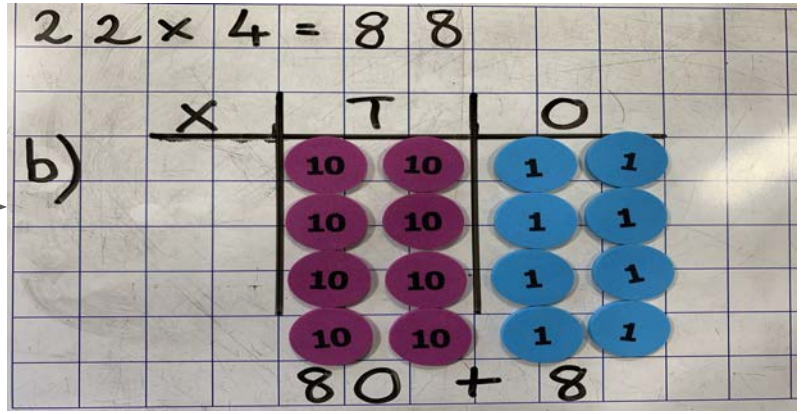



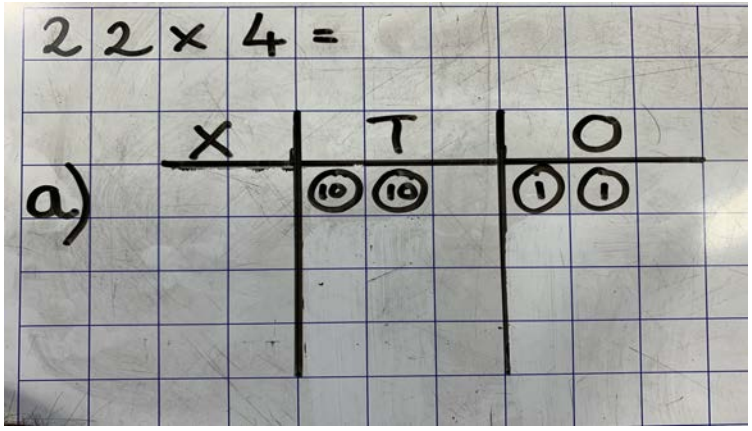



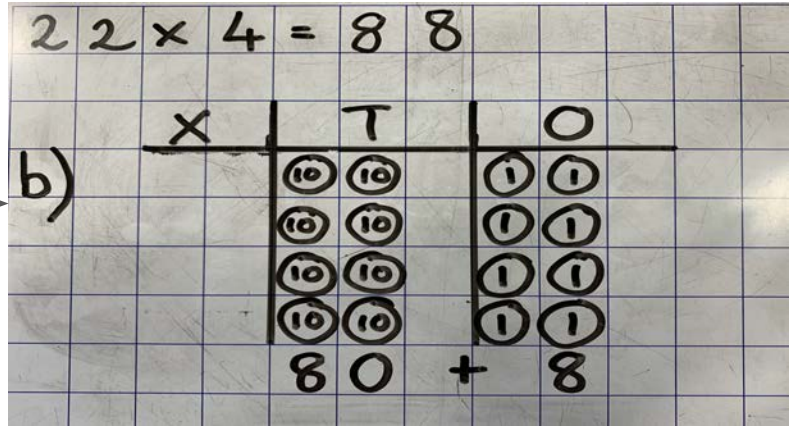
# Arrays to grid method (no exchange)



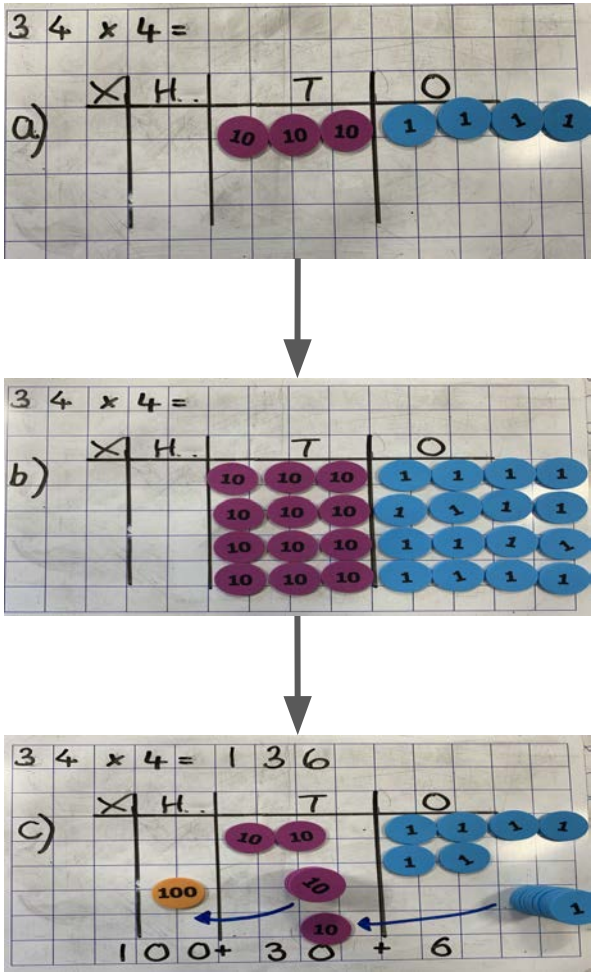




In book example

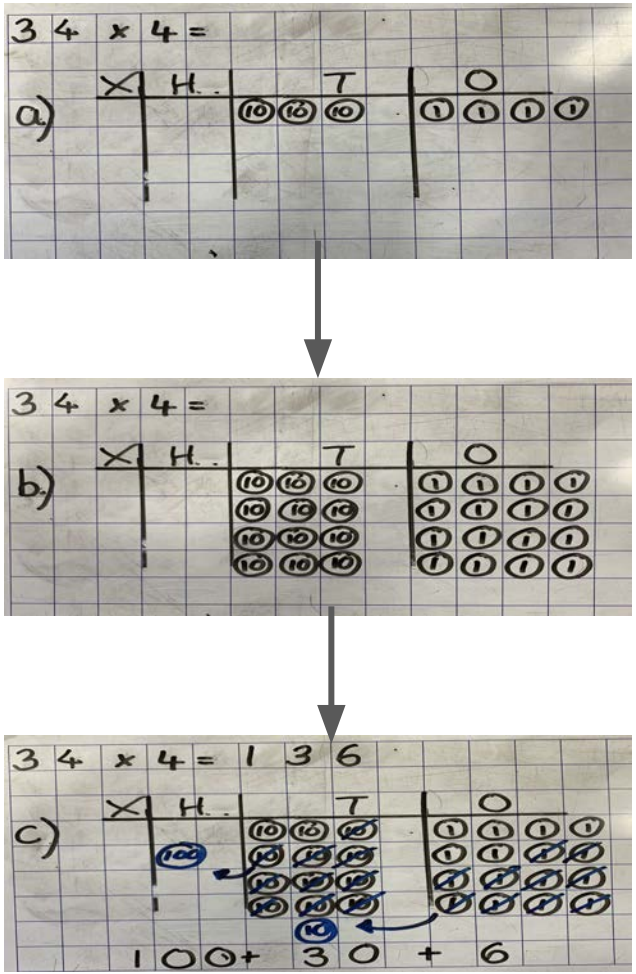


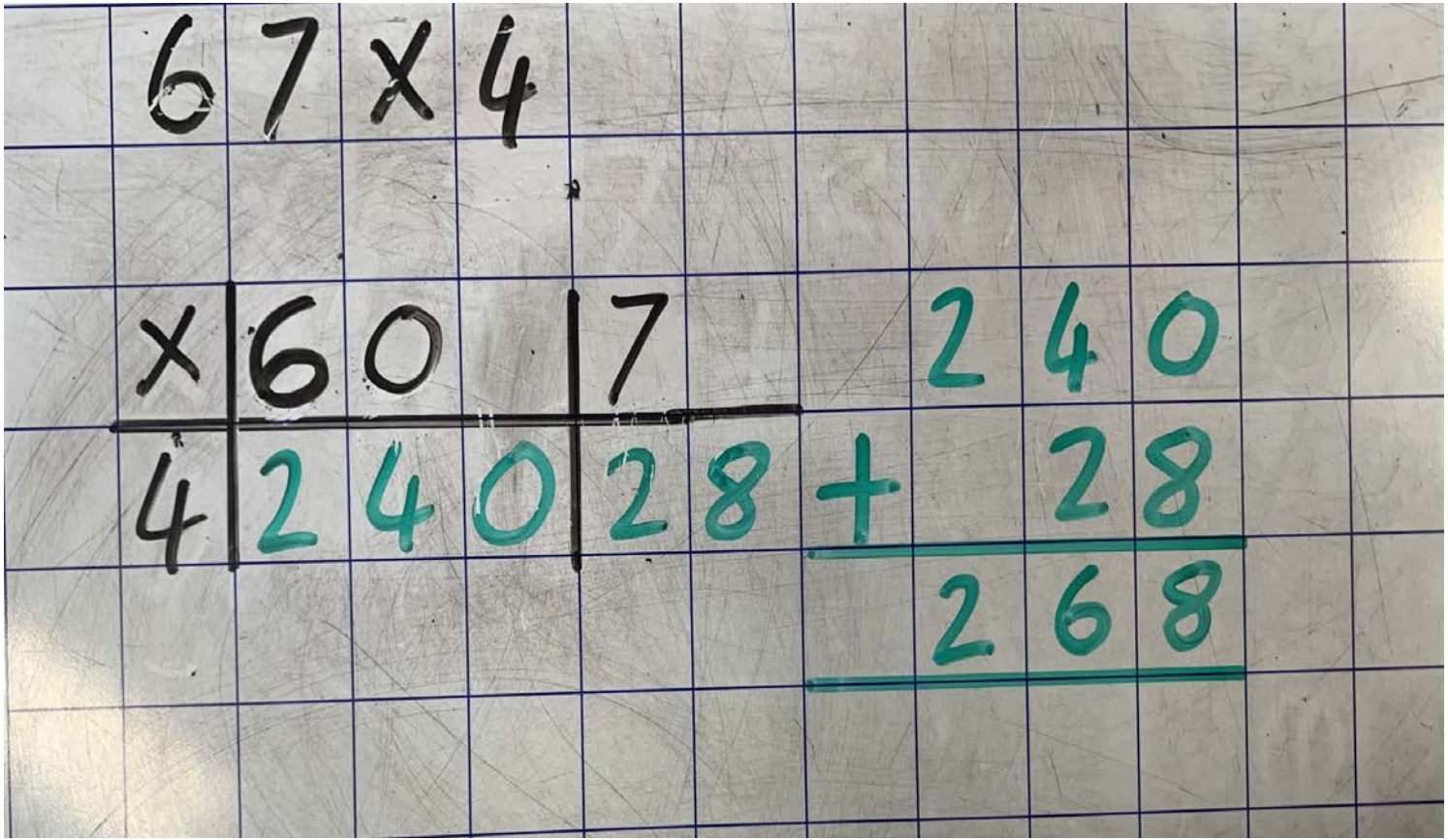
# Arrays to grid method (with exchange)



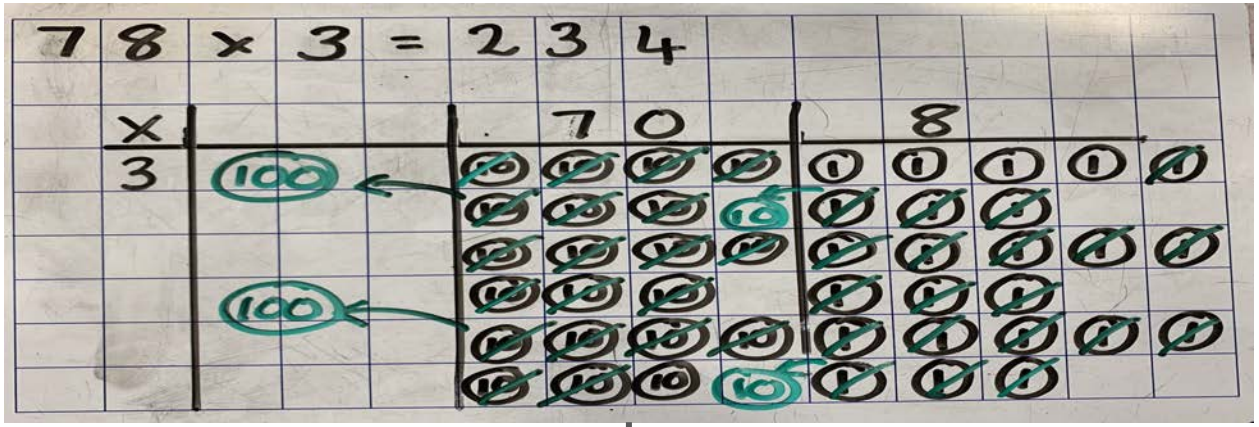

In book example

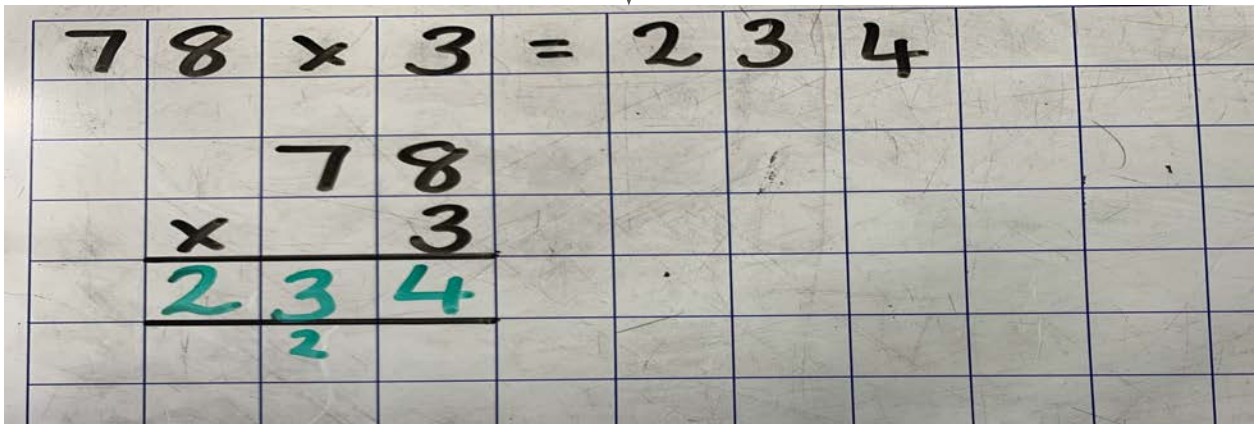


# Grid Method (multiplying by 1 digit numbers)

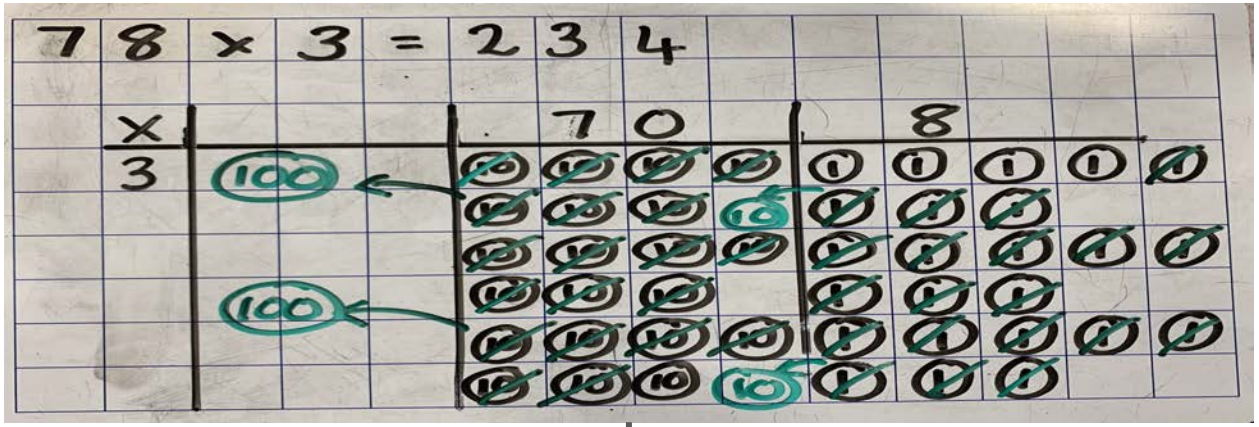


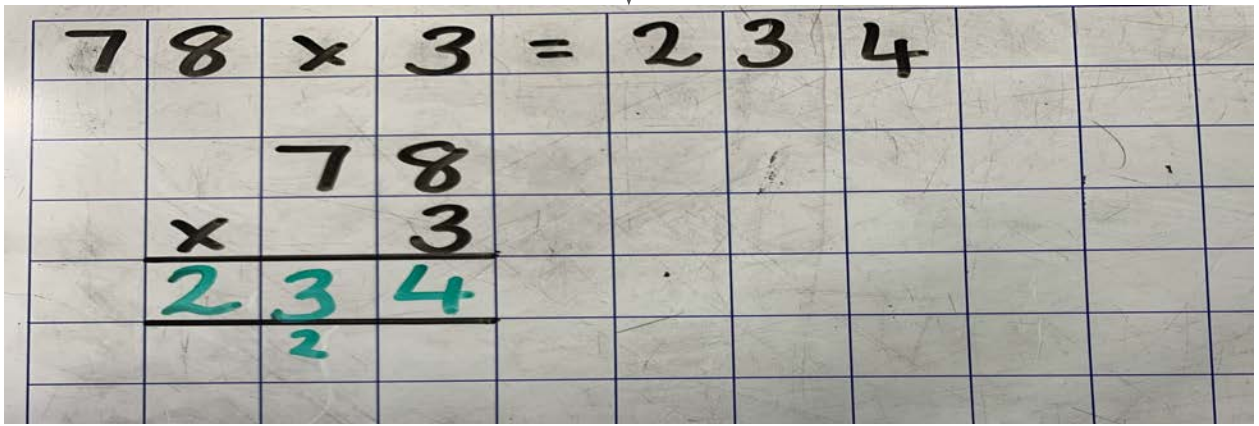
# Grid to column method (multiplying by 1 digit numbers



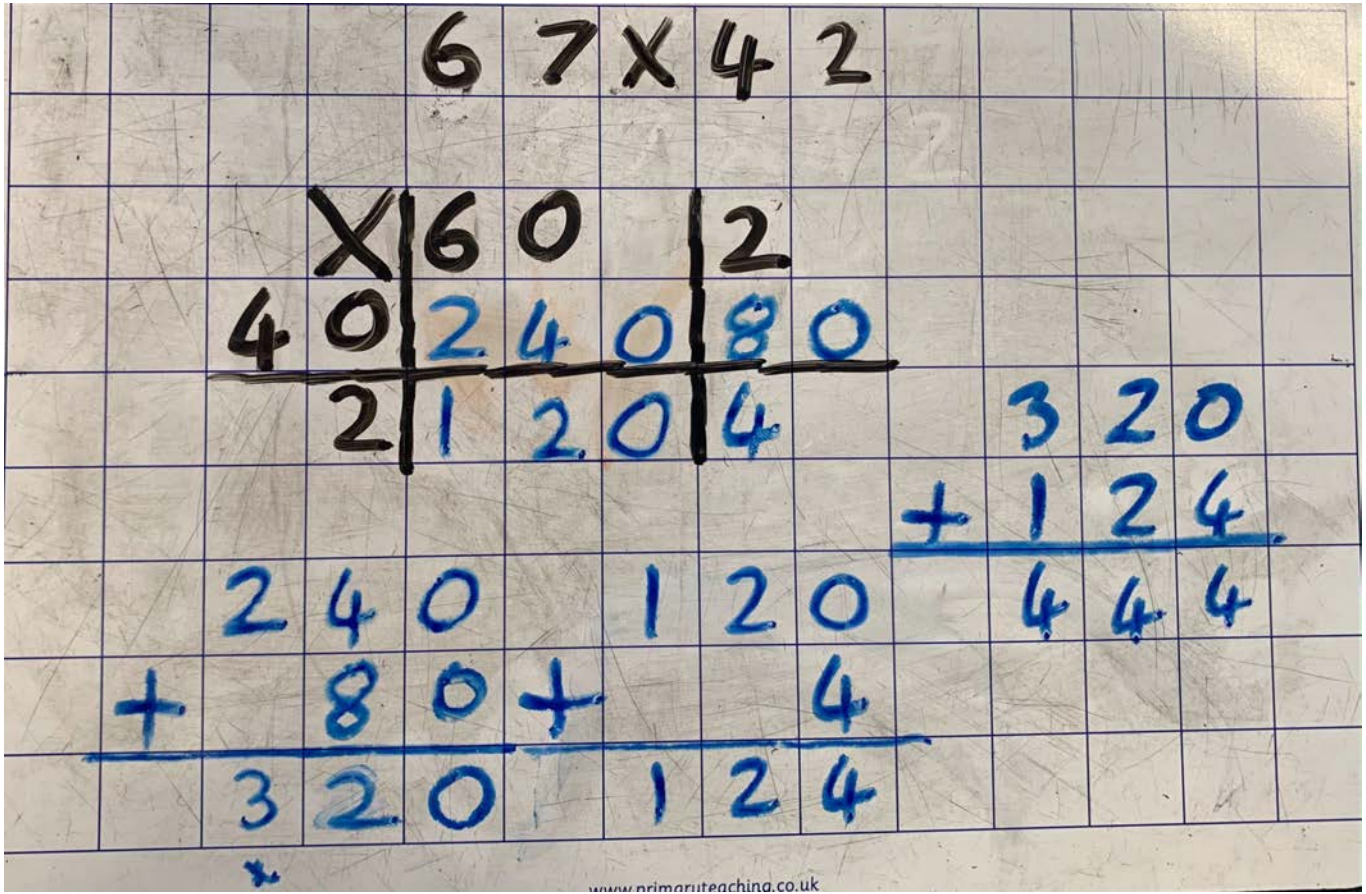



# Grid to column method (multiplying by 1 digit numbers

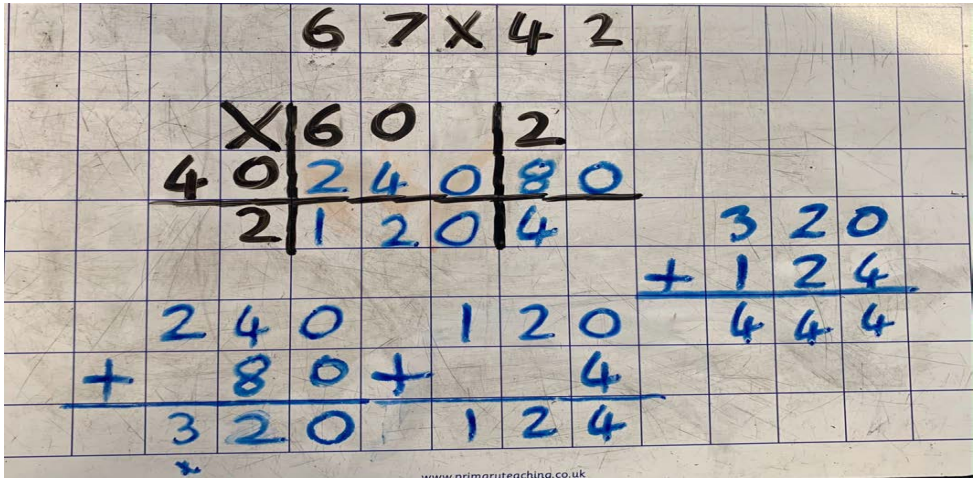


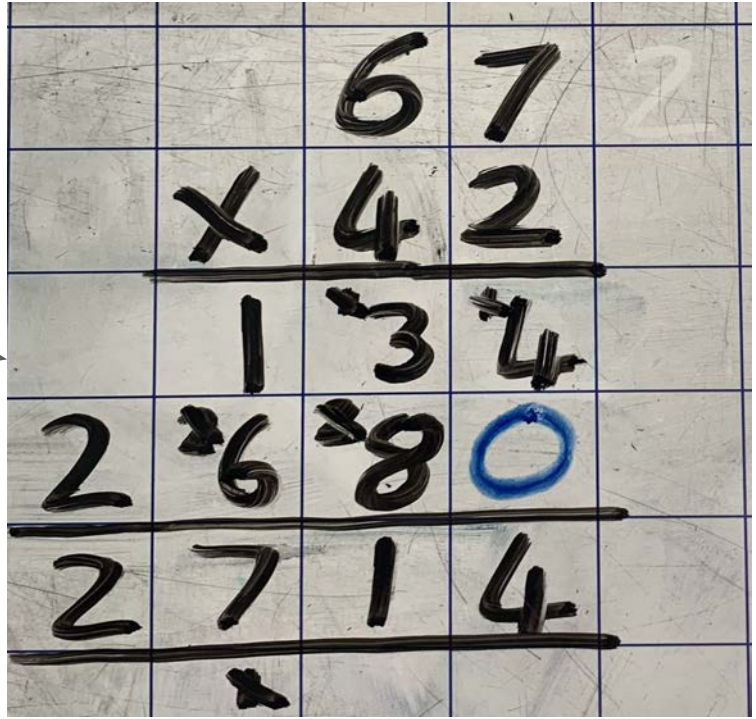



# Grid Method (multiplying by 2 digit numbers)

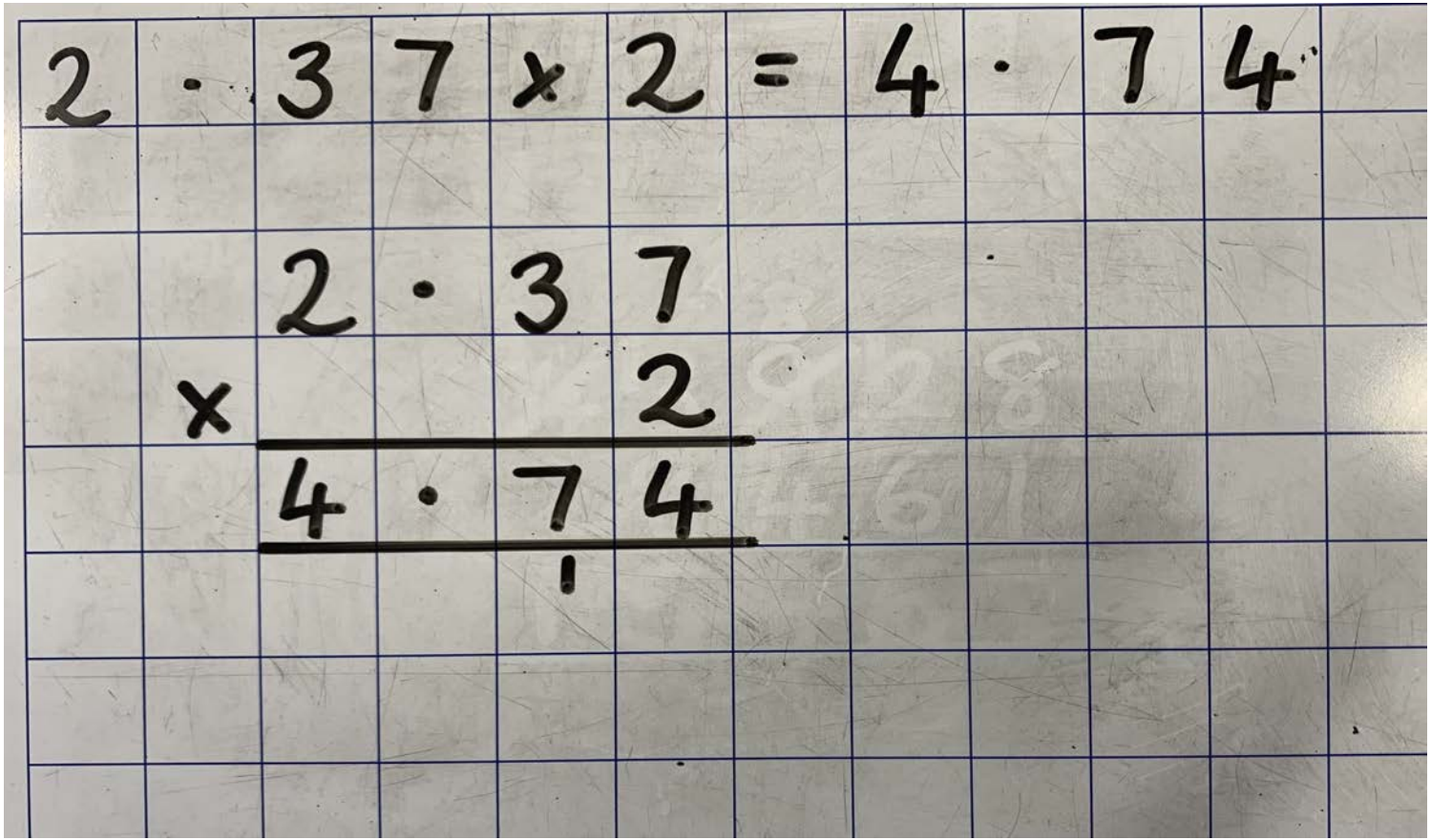


# Grid to column method (multiplying by 2 digit numbers)

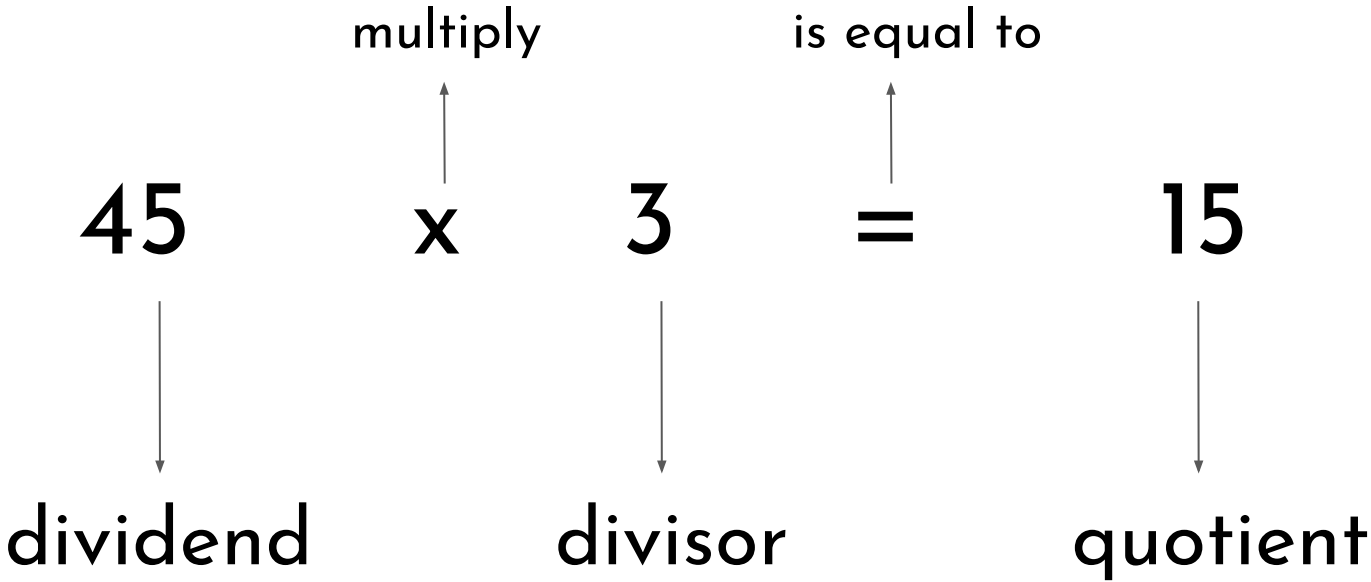


# Multiplying decimals



# Division


multiply
is equal to
45
x
3
=
15
dividend
divisor
quotient

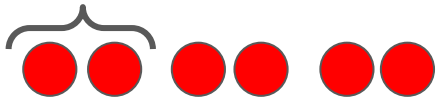
# Mental Strategies

# Equal sharing

# KS1

**Keywords** share group equally

## Equal sharing-between Structure

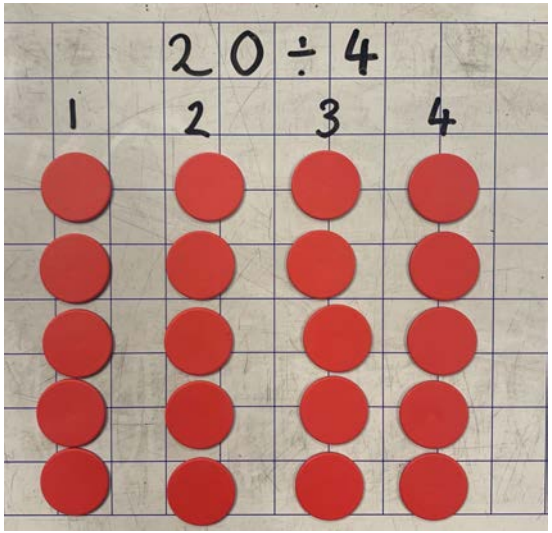


Word problem - sharing

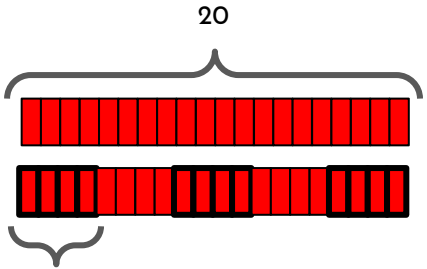
Jennifer had 20 stickers leftover. She shared her stickers with four of her friends.

How many did each friend receive?

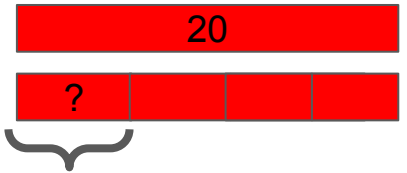
Sharing




Discrete



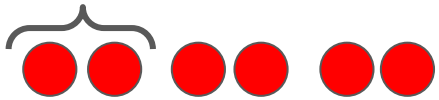

Concrete



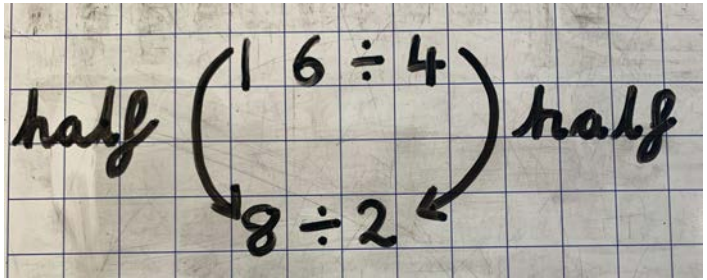
# KS1

**Keywords** share group equally

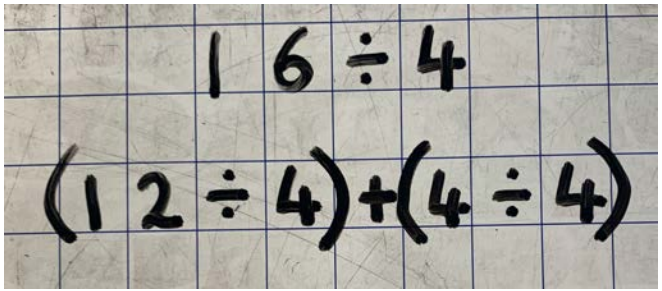
## Equal sharing-between Structure



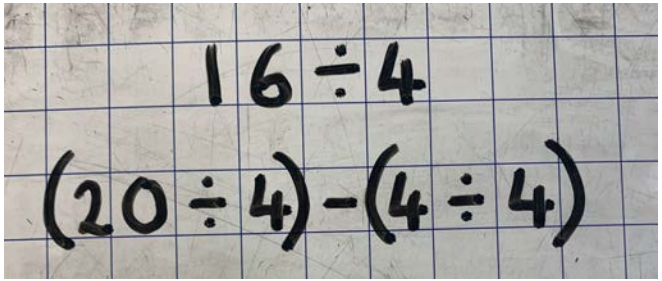
## Halves




## Distributive Law with addition



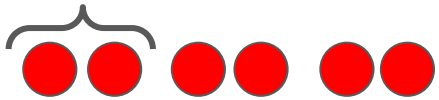

## Distributive law with subtraction



**KS2**

**Keywords** share group equally

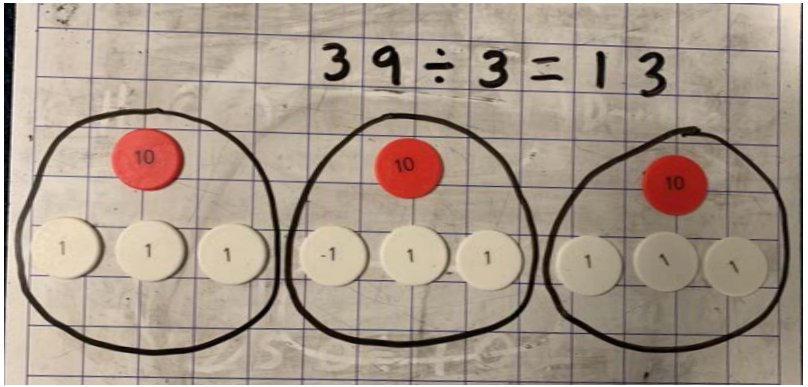
# Equal sharing-between Structure



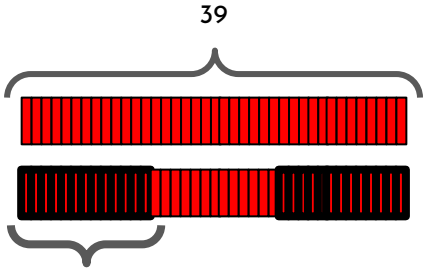
Word problem - share

Mohammed was in charge of the 39 crayons in the class tray. He shared these crayons with 3 of his friends.

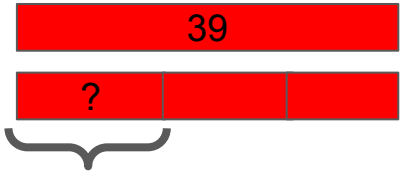
How many did each friend receive?




Discrete

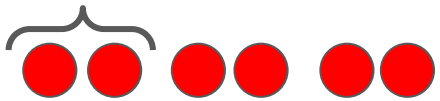



Concrete

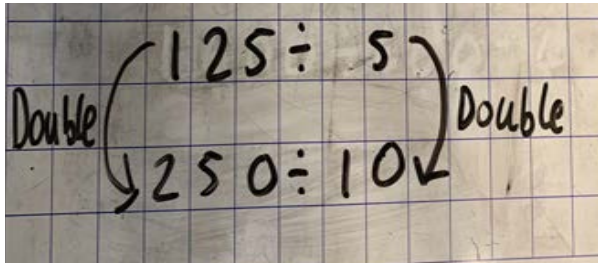


# KS2

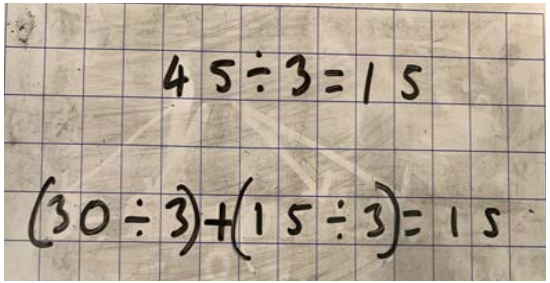
**Keywords** share group equally

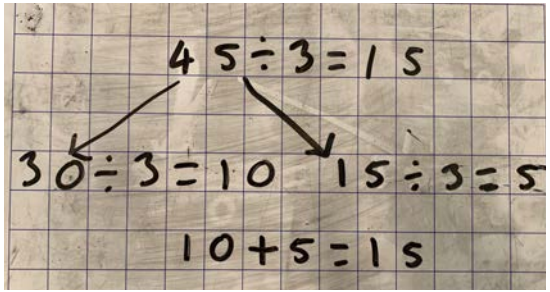


## Doubles and Halves

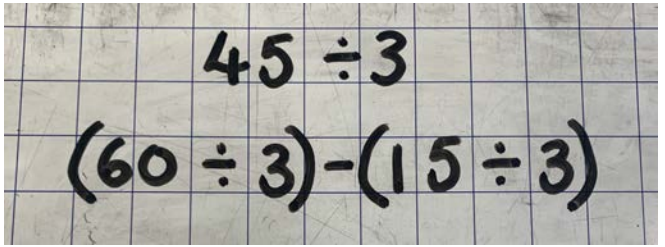



## Distributive Law of addition




## Distributive Law of subtraction

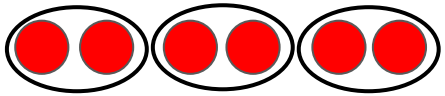


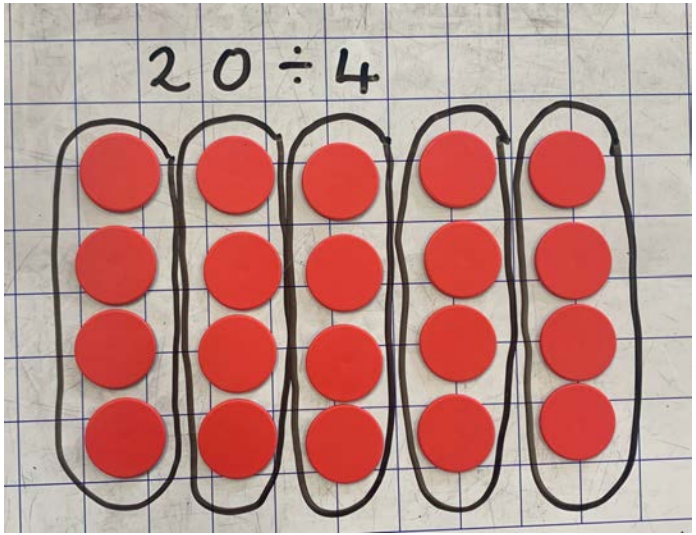
# Inverse of multiplication/ grouping

# KS1

**Keywords** share group equally lots of

## Inverse-of-multiplication Structure






Word problem - grouping

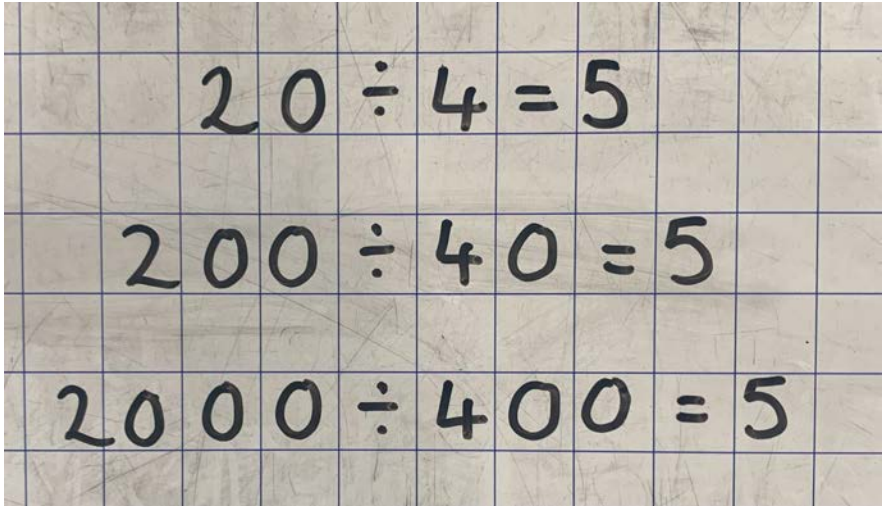
Jennifer had 20 stickers leftover. She gave out her stickers in groups of 4.

How many groups were there?

**KS1**

| **Keywords** | share | group | equally | lots of |
|---|---|---|---|---|

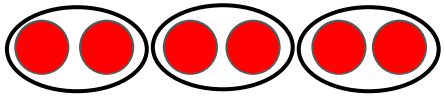
## Constant Ratio

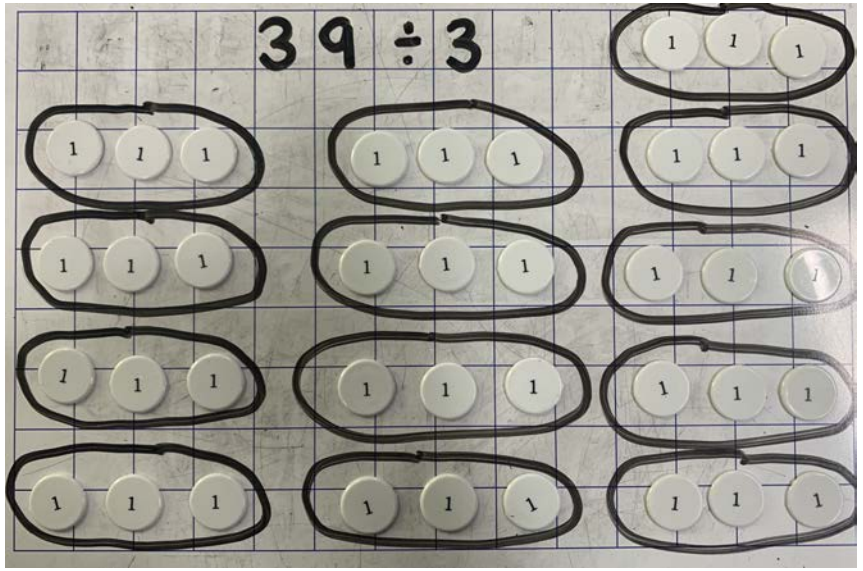


# KS2

**Keywords** share group equally lots of

## Inverse-of-multiplication Structure



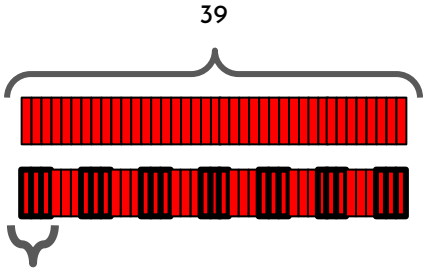



Word problem - group

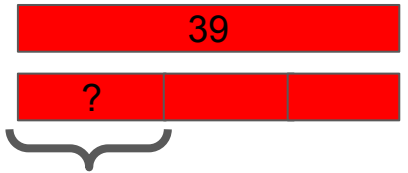
Mohammed was in charge of the 39 crayons in the class tray. He grouped the crayons into boxes of 3.

How many boxes did he use?

Discrete



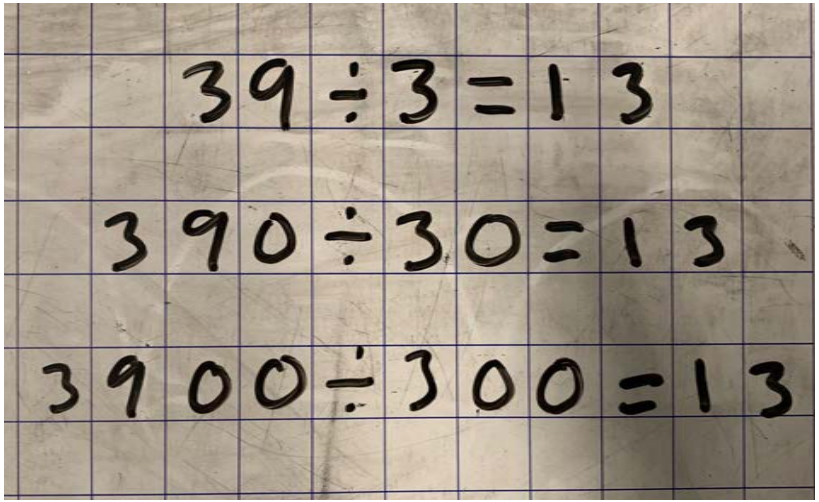

Concrete



**KS2**

| **Keywords** | share | group | equally | lots of |
|---|---|---|---|---|

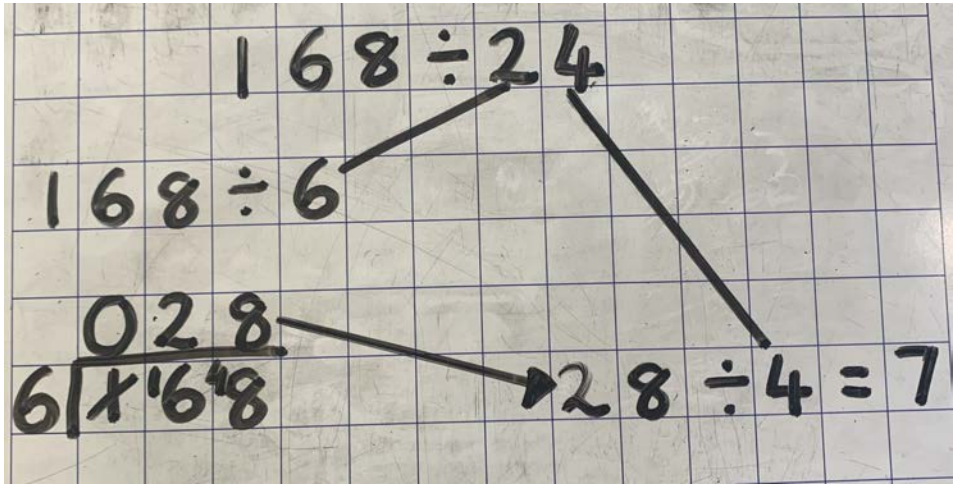
## Constant Ratio



**KS2**

| **Keywords** | share | group | equally | lots of |
|---|---|---|---|---|

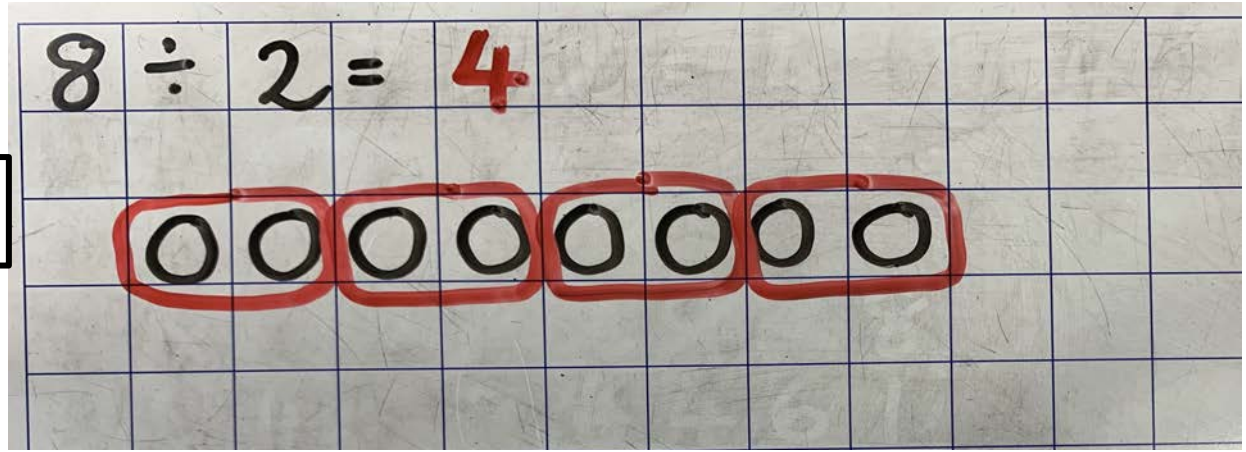
## Factorising

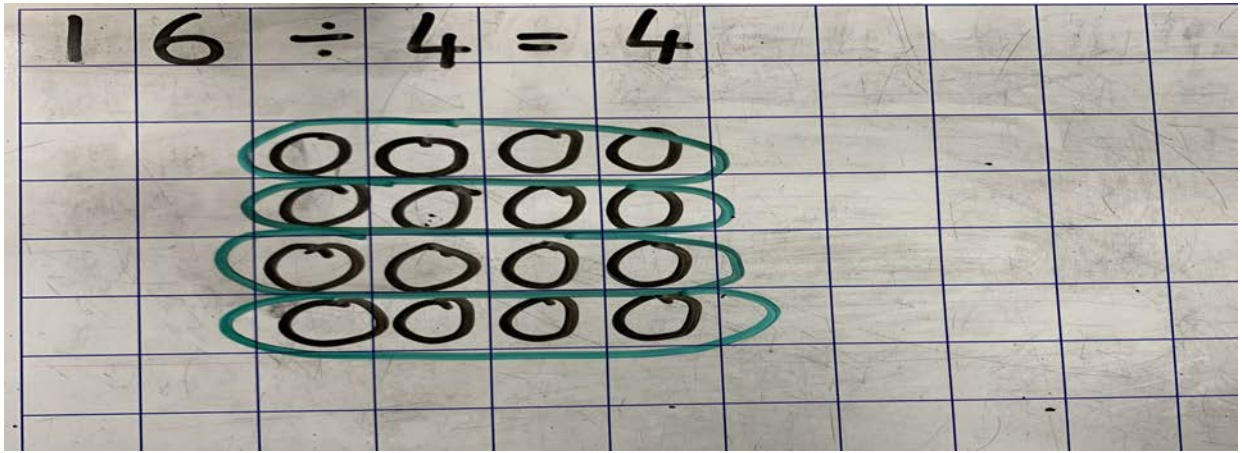


# Progression with written methods

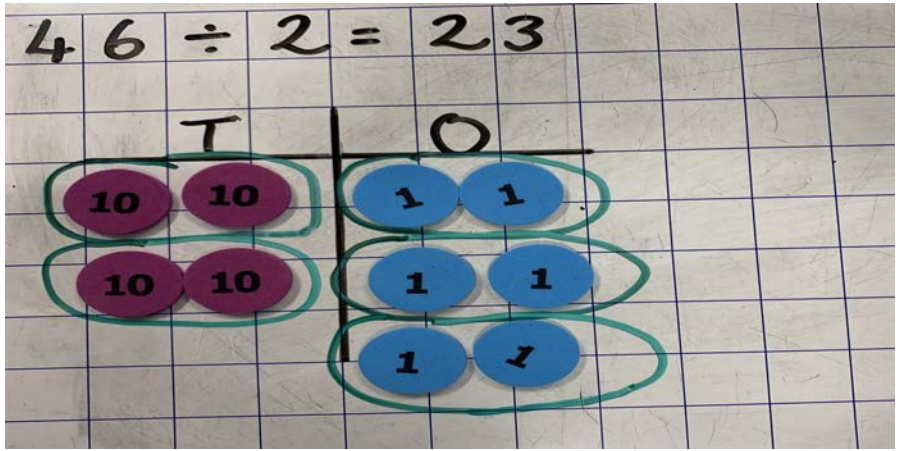
# Arrays

**Vocabulary**
‘4 groups of 2”

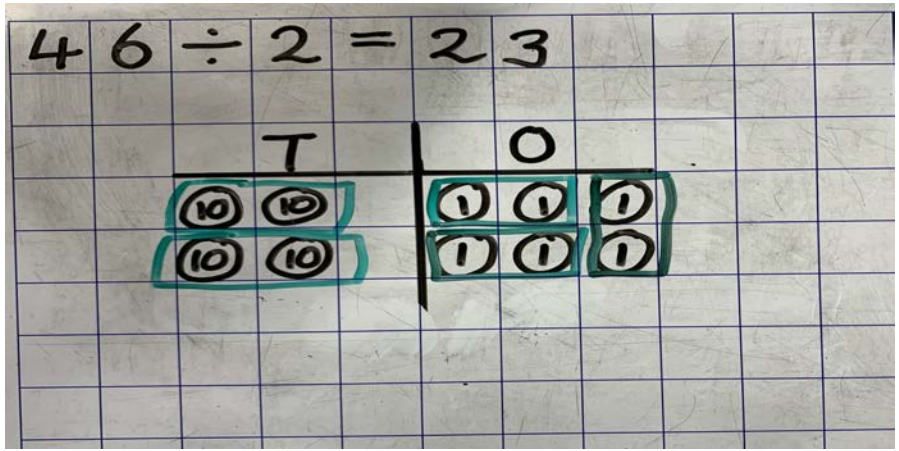


**Grid**

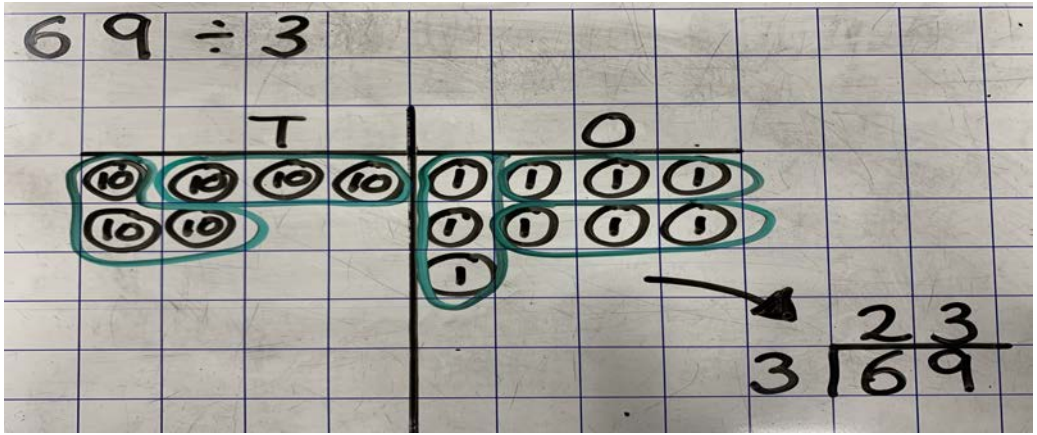



In book example

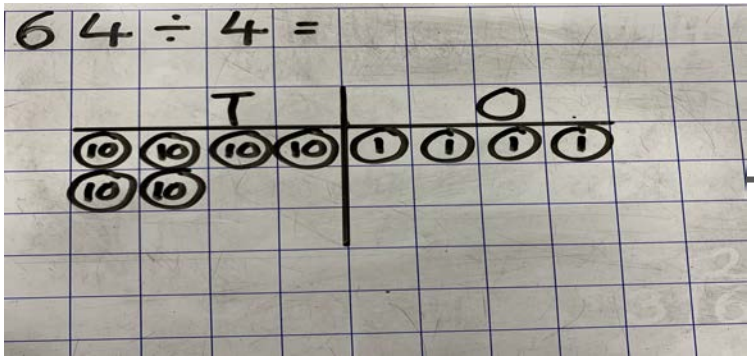


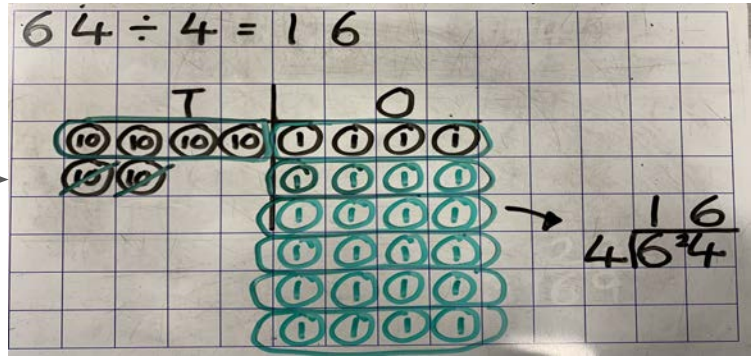
**Grid to short division (no remainders)**

No exchange



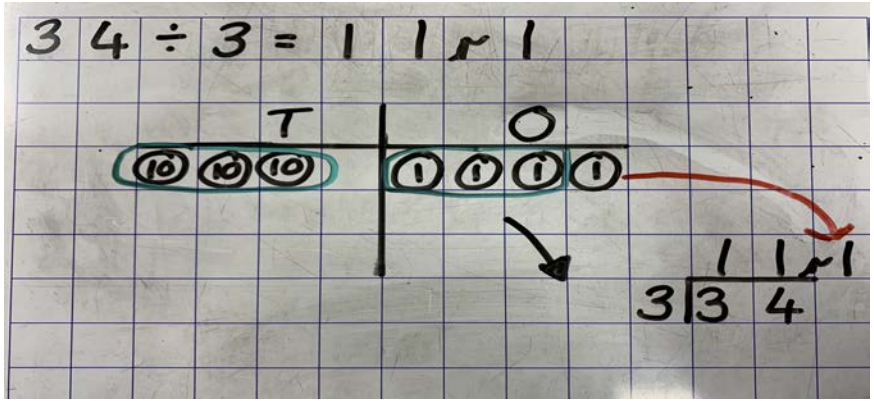

With exchange



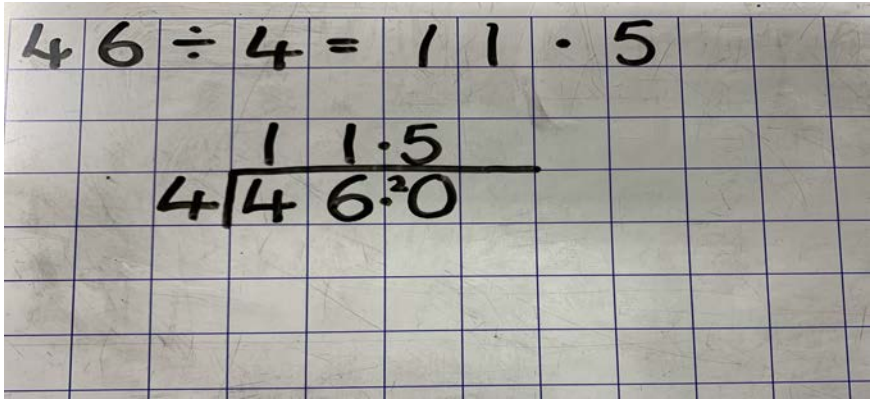



# Grid to short division (with remainders)

## Remainders as whole numbers

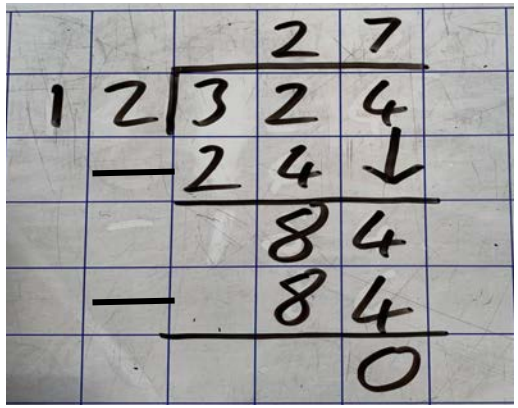



## Remainders as a decimal

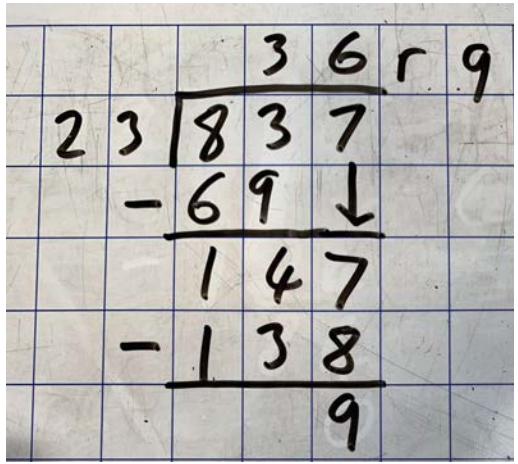


# Long Division

Without remainders




With remainders



# Key Term Definitions

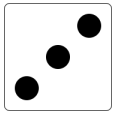
# Key Terms

| | |
|---|---|
| Associativity | The associative law says that when we add or multiply numbers, it doesn't matter how we group them (which we calculate first).<br><br>**For example, (7 + 5) + 3 = 7 + (5 + 3) or (4 x 5) x 2 = 4 x (5 x 2)** |
| Commutativity | The commutative law states that addition and multiplication calculations can be carried out with the numbers in any order, whereas for subtraction and division, the numbers must be in a particular order.<br><br>**For example, 8 x 9 = 72 or 9 x 8 = 72** |
| Compensation | The deeper understanding that there are multiple ways to generate a sum to make a simpler problem to solve.<br><br>**For example, 278 + 203 = (278 + 200) + 3** |

# Key Terms

| | |
|---|---|
| Constant Difference | Constant difference refers to the idea that the difference between two numbers does not change after adding or subtracting the same quantity to both numbers.<br><br>**For example, 134 - 98 = 136 - 100** |
| Constant Ratio | Constant ratio refers to the scaling of the dividend and divisor by the same number, with the answer then always remaining the same.<br><br>**For example, 12 ÷ 3 = 4, 120 ÷ 30 = 4** |
| Distributive | The distributive property states that multiplying a number by a group of numbers added together is the same as doing each multiplication separately.<br><br>**For example, 5 x (2 x 6) = 5 x 2 + 5 x 6** |

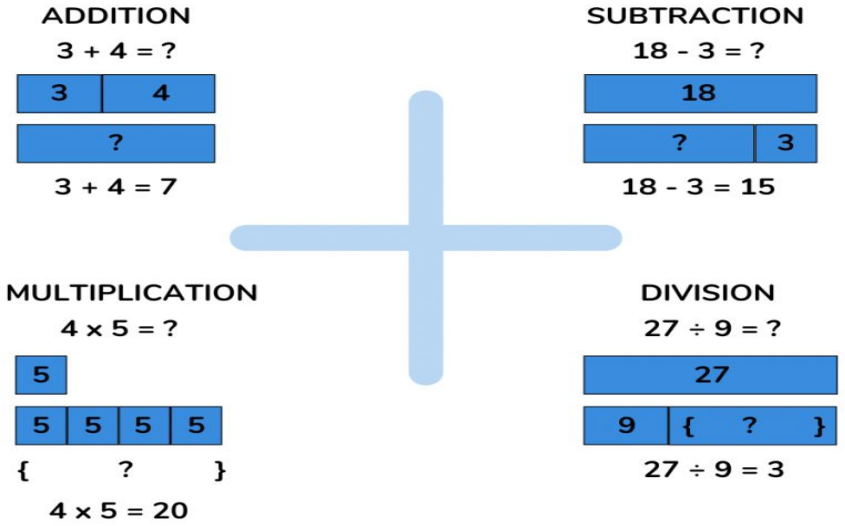
# Key Terms

| | |
|---|---|
| Doubles and Halves (Division) | Doubles and halves, applicable to division only, is when you double or half both the divisor and the dividend to achieve the same answer.<br>**For example, 72 ÷ 6 = 12, 36 ÷ 3 = 12** |
| Doubles and Halves (Multiplication) | Doubles and halves, applicable to only multiplication, is when you double or half the multiplier and then do the opposite (half it if doubled the multiplier) to the multiplicand to achieve the same answer.<br>**For example, 20 x 6 = 120, 10 x 12 = 120** |
| Subitising | The strategy of seeing a group as a unit without counting.<br>**For example,**  **= 3** |

# Appendix

# Representing questions in various ways

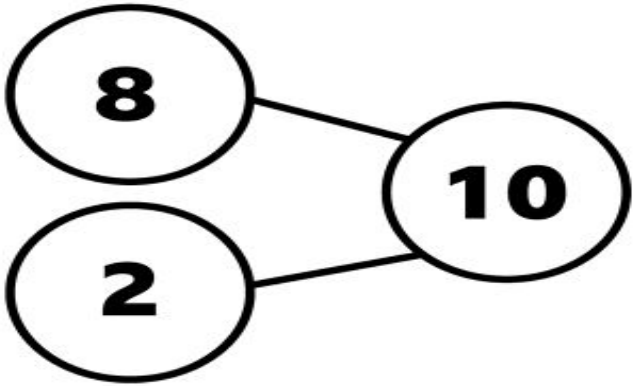
## Bar Model




## Abstract

$$67 + 25 = 92$$

## Part-Whole Model



## My 1 to 10 Number Track

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|


## My 1 to 10 Number Track

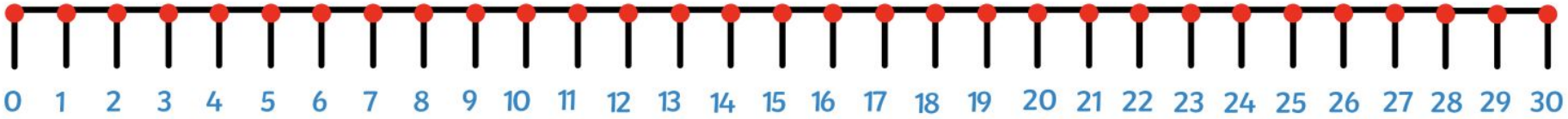
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|

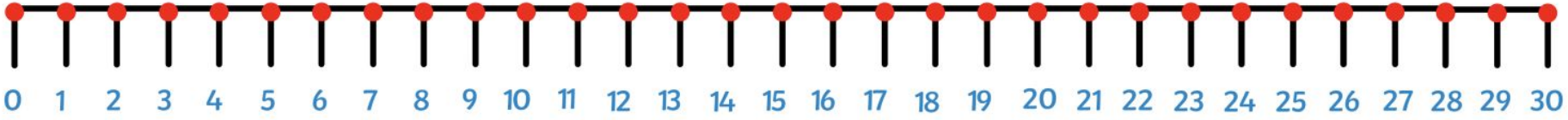
## My 1 to 10 Number Track

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|

## My 1 to 10 Number Track

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|


0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30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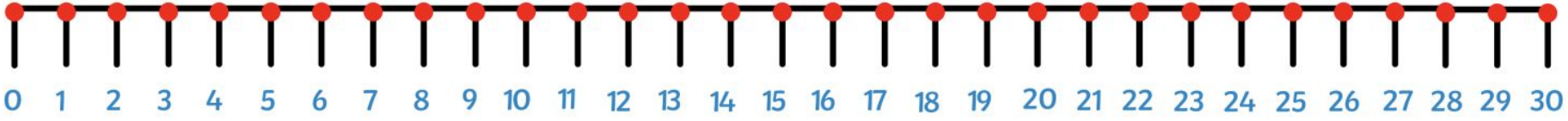
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