Calculation Policy

Review Date: Spring 2023

The Ferrars Academy
Calculation Policy

Policy Aim

The aim of this policy is to ensure all children leave our school with a secure understanding of the four operations and can confidently use both written and mental calculation strategies in a range of contexts. The policy aims to ensure consistent strategies, models and images are used across the school to embed and deepen children's learning and understanding of mathematical concepts.

Implementation

This policy has been designed to support the teaching and planning of mathematics in our academy. The document is arranged into 4 sections; addition, subtraction, multiplication and division. The policy details a wide range of strategies and teachers must plan opportunities for pupils to apply these; for example, when solving problems. The examples and illustrations are not exhaustive but provide and overall picture of what the mathematics in our academy should look like.

Each operation is divided into 6 stages and the strategies shown are designed to be fluid. The strategies are taught in a progressive sequence and as a new strategy is taught, it builds on prior learning to enable children to have a variety of tools to select from. As children become increasingly independent, they will be able to and must be encouraged to select those strategies which are most efficient for the task.

Monitoring

Senior Leadership Team and Mathematics Subject Leader will monitor the effectiveness of this policy through observations, learning walks and book scrutiny.

Concrete—Pictorial—Abstract

All children, when introduced to a new concept, should have the opportunity to build competency by taking this approach. The consistent use of the CPA (concrete, pictorial, abstract) approach helps children develop mastery across all the operations in an efficient and reliable way.

Concrete – children should have the opportunity to use concrete objects and manipulatives to help them understand what they are doing.

Pictorial – alongside this children should use pictorial representations. These representations can then be used to help reason and solve problems.

Abstract – both concrete and pictorial representations should support children's understanding of abstract methods.

Addition

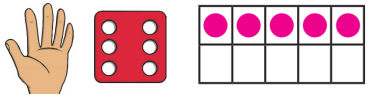
Stage 1

Counting

Counting how many objects in the pot
Counting out the certain amount of objects needed
Counting by rote - Children saying the number names in order
Counting jumps, claps, steps etc
Sing counting songs and number rhymes

Subitise

Show small quantities in familiar patterns and random arrangements.



Number recognition

1:1 correspondence

Matching the digit to the amount

Count Beyond 10

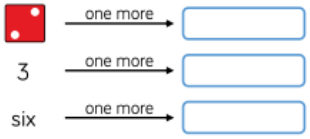
Count verbally beyond 10, pausing at each multiple of 10.

Compare numbers

Provide collections of objects to compare using vocabularies such as more than, less than, fewer , equal to etc.

Finding one more than

Practically and with a number line.



Stage 2

Explore the composition of numbers to 10

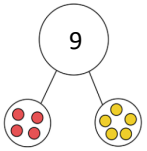
Provide a range of visual models of numbers.

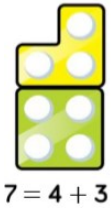
Recall number bonds for numbers 0-10

Use opportunities for children to use number bonds. Make visual and practical displays in the classroom.

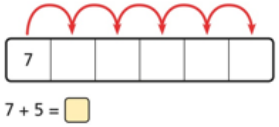
Add by combining

Count out a certain amount of objects and another and put them together to find the total.





Add by counting on



Jottings

Add by drawing images and finding the total.

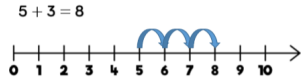
5 + 4 = 9

5 + 4 = 9

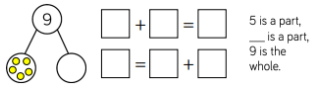
Stage 3

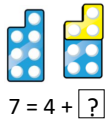
Number line

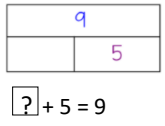
Draw the jumps on a caliberated number line



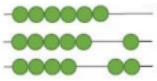
Find a part / missing number



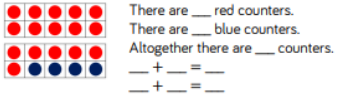




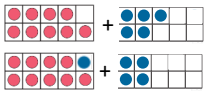
Find and make number bonds

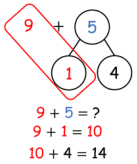


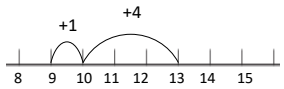
6 = 6 + 0
6 = 5 + 1
6 = 4 + 2



Add by making 10

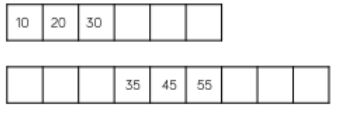






Find 10 more than

Number	10 more
12	22



Addition

Stage 4

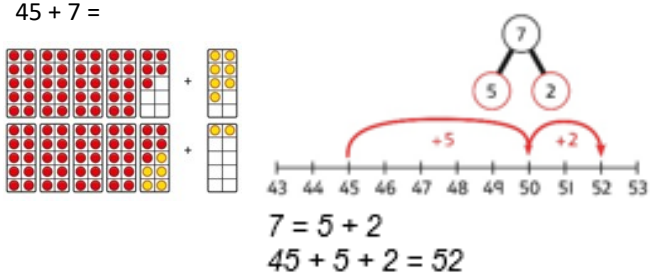
Adding a 1 digit number to a two digit number not crossing 10

34 is 3 tens and 4 ones.
4 ones and 5 ones are 9 ones.
The total is 3 tens and 9 ones.

34 + 5 = 39

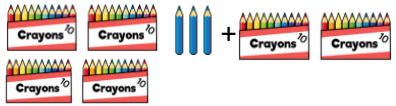
Adding a 1 digit number to a two digit number crossing 10

45 + 7 =



7 = 5 + 2
45 + 5 + 2 = 52

Add multiples of 10



43 + 20 = 63

43 + 20 = ?

40 + 20 = 60

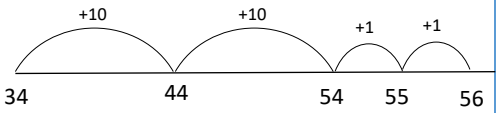
60 + 7 = 67

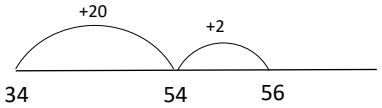
Stage 5

Adding a 2 digit number to a two digit number not crossing 10

35 + 23 = 58

34 + 22 = 56





64 + 12 = ____

4 ones + 2 ones = ____

6 tens + 1 ten = ____

____ tens + ____ ones = ____

36 + 43 = ?

6 + 3 = 9

30 + 40 = 70

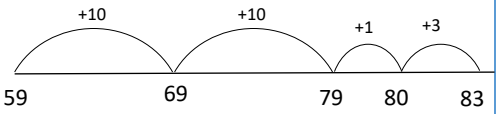
70 + 9 = 79

36 + 43 = ?

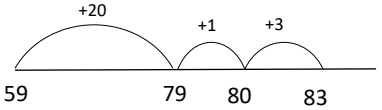
36 + 40 = 76

76 + 3 = 76

Adding a 2 digit number to a two digit number crossing 10



59 + 24 = 56



59 + 24 = ?

59 + 20 = 79

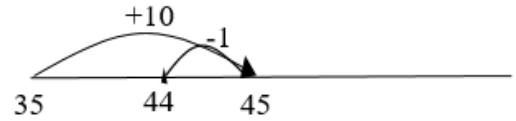
79 + 1 = 80

80 + 3 = 83

Stage 6

Add a near multiple of 10 to a two-digit number

35 + 9 =



35 + 9 =

35 + 10 = 45

45 - 1 = 44

Adding a 3 digit number to a three digit number

287 + 129 =

$$\begin{array}{r} 200 + 100 = 300 \\ 80 + 20 = 100 \\ 7 + 9 = 16 \\ \hline 300 + 100 = 400 \\ 400 + 16 = 416 \end{array}$$

- refine to partitioning the second number only:

287 + 129 =

$$\begin{array}{r} 287 + 100 = 387 \\ 387 + 20 = 407 \\ 407 + 9 = 416 \end{array}$$

Subtraction

Stage 1

Counting

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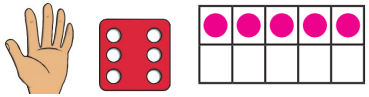

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1:1 correspondence
Matching the digit to the amount

Count Beyond 10

Count verbally beyond 10, pausing at each multiple of 10.

Compare numbers

Provide collections of objects to compare using vocabularies such as more than, less than, fewer , equal to etc.

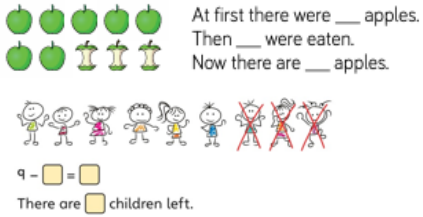
Finding one more than

Practically and with a number line.

Stage 2

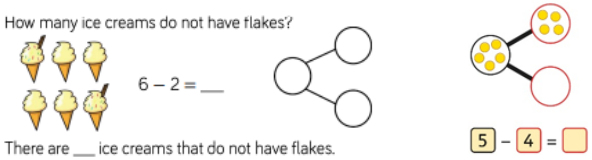
Subtract by taking objects away

Count out a certain amount of objects and take some away to find what is left.



Subtract by breaking apart

Break apart a number into two parts using concrete and pictorial representations for support.

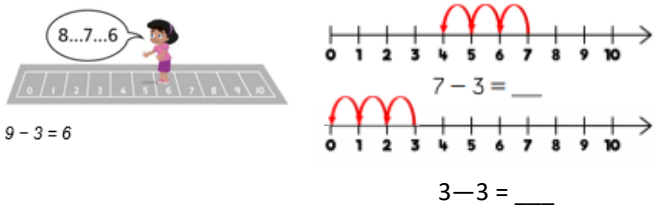


Subtract using jottings

Subtract by drawing images and then crossing out the second number.

Subtract by counting back

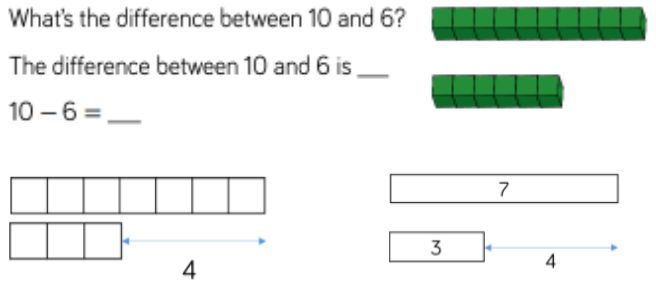
Find the starting number on a number line and count backwards the second number.



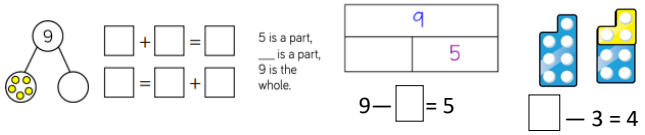
Stage 3

Finding the difference

Children to visually see, and find, the difference through concrete objects and pictures

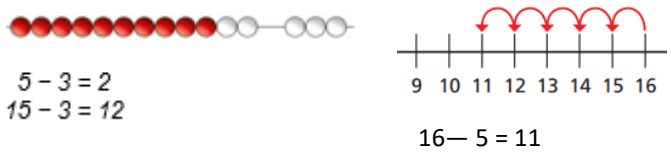


Missing numbers



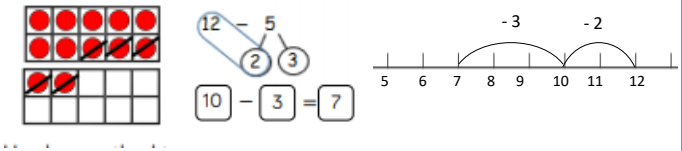
Subtraction within 20 not crossing 10

Understand when and how to subtract 1s efficiently.



Subtraction within 20 crossing 10

Children to focus on the strategy of partitioning to make ten.



Subtraction

Stage 4

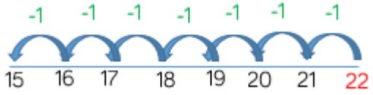
Subtract multiples of 10

10 less	Number
2	12

41—20 = 21

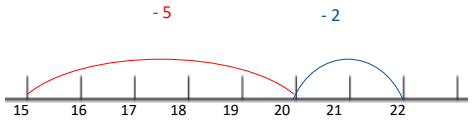
Subtraction 1 digit from 2 digits crossing 10

22—7 = 15

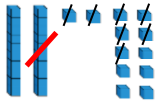


22- 7 = 15

2 5



exchange method



Stage 5

Subtraction 2 digit from 2 digits not crossing 10

78—34 = 21

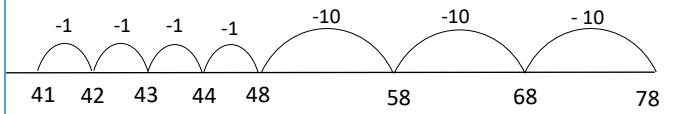
Tens	Ones

78 minus 34 = ____

8 ones – 4 ones = ____

7 tens – 3 tens = ____

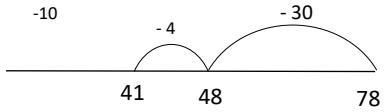
We have ____ tens and ____ ones.



78—34 =

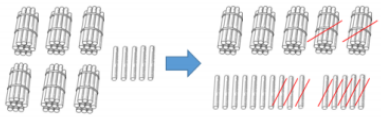
78— 30 = 48

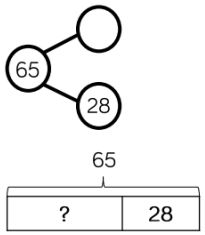
48—4 = 41



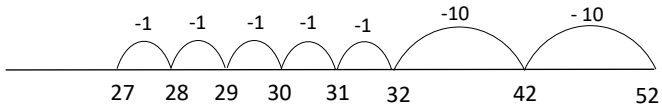
Subtraction 2 digit from 2 digits crossing 10

65—28 = 37





52—25 = 27

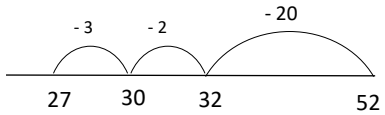


52—24 = 27

52— 20 =32

32— 2 = 30

30—3 = 27

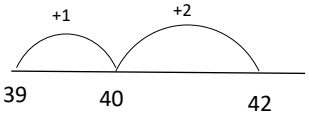


Stage 6

Finding difference by counting on

42-39=

These numbers are close together so finding the difference is easier.



Subtract 3 digit numbers

654—219 =

645 – 200 = 445

445 – 10 = 435

435 – 9 = 426

Multiplication

Stage 1

Where possible, concepts should be taught in the context of real life.

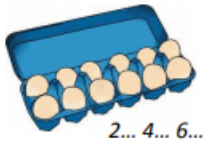
Counting in repeated groups of the same size using real-life contexts and practical apparatus.

2... 4... 6 socks

Sing, count and chant in twos, fives and tens with and without objects

Use of the 100 square to identify patterns .

Introduce simple arrays using real objects. E.g. real eggs in a box, Numicon pieces, Numicon peg board, sorting trays.

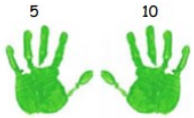


Two, four, six, eight

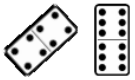
2... 4... 6... 8... 10... 12 eggs

Understand doubling as adding the same number.

Double 2 is 4



Begin to recall doubles using songs and games. E.g. songs with actions - 'Mr Double -Trouble'; doubling machine games; finding doubles in dominoes



Stage 2

Count in 2s, 5s and 10s

Children count in groups of 2s, 5s and 10s

How many birds are there altogether?

There are ____ birds in each tree.
There are ____ trees.
There are ____ birds altogether.

Making equal groups

They will recognise and explain how they know when the groups are equal or not.

Are the groups equal or unequal? Write a label for each.

Josh is drawing equal groups of 3

Complete his drawing.

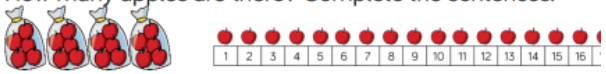
Add equal groups

Children to use and count equal groups to find a total.

How many wheels altogether?

2 + 2 + 2 + 2 + 2 =

How many apples are there? Complete the sentences.



5 + 5 + 5 + 5 = ____

There are ____ apples.

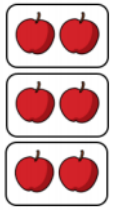
There are ____ groups of ____ apples which is equal to ____

Stage 3

Make arrays

Children begin to make arrays by making equal groups and building them up in columns or rows

There are ____ apples in each row.
There are ____ rows.
____ + ____ + ____ = ____
There are ____ apples altogether.



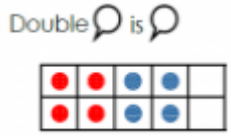
Array	Description - columns
	5 columns 2 cookies in each column

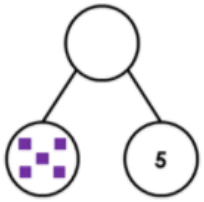
Description - rows	Totals
2 rows 5 cookies in each row	2 + 2 + 2 + 2 + 2 = 10 5 + 5 = 10

Making doubles

Reinforce understanding that 'double' is two groups of a number or an amount.

Double ____ is ____



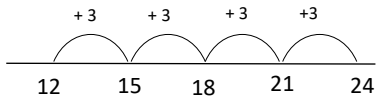


Multiplication

Stage 4

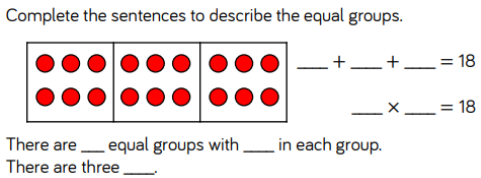
Count in 2s, 3s, 5s and 10s

Children count in groups of 2s, 3s, 5s and 10s



Introduce x symbol through calculations

Children are introduced to the multiplication symbol. They should link repeated addition and multiplication together, using stem sentences to support their understanding.



Use <, > or = to make the statements correct

3 × 5	◯	5 + 5 + 5 + 5
2 × 2	◯	2 + 2
10 × 2	◯	5 + 5 + 5

Multiply using pictures and jottings

Children will use the multiplication symbol and work out the total from pictures and jottings.

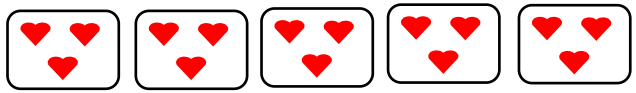
___ × ___ = ___

___ lots of 3 = ___

___ multiplied by ___ = 12

5 x 3 =

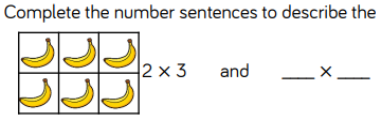
5 groups of 3



Stage 5

Use arrays

Children explore arrays to see the commutativity of multiplication facts e.g. 5 × 2 = 2 × 5



2, 3, 5 and 10 times table

Children should be comfortable with the concept of multiplication so they can apply this to multiplication tables.

Missing number problems

Children to use jottings, arrays or their knowledge of multi0plication tables to solve missing number problems

5 x 2 = □	□ = 2 x 10
5 x □ = 15	70 = □ x 7
□ x 2 = 10	30 = 10 x □
□ x ∇ = 10	4 = □ x ∇

Learn 2, 3, 4, 5, 8, 10 times tables

Stage 6

Partitioning numbers

Mental methods

23 x 4 =

20 x 4 = 80

3 x 4 = 12

80 + 12 = 92

Learn all times tables to 12

Use known facts close to multiples of 10

9 x 12 =

I know… 10 x 12 = 120

So … 120 – 12 = 108

Division

Stage 1

Children will solve problems in a practical way in the context of real life. They need to see and hear representations of division as sharing and grouping. Pictorial representations are used alongside concrete apparatus.

Solve real-life problems using the sharing and grouping models of division.

Sharing. Share real objects (e.g. fruit) equally between a number of children, teddy bears etc.

Eight strawberries are shared equally between 4 children. How many strawberries will each child have?

8 shared between 4 is 2.
Each child will have two strawberries.

Grouping. Repeatedly subtract equal groups of objects until the total is exhausted.

I have six socks and I group them into pairs. How many pairs do I have?

I have three groups of two socks.
I have three pairs of socks.

I have 15 apples. If I put 5 apples into each bag, how many bags can I fill?

There are 3 groups of 5 apples.
I can fill 3 bags of apples.

Begin to recall halves using songs and games.

Begin counting backwards in 2s

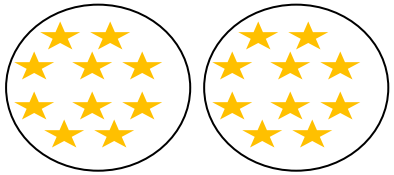
Stage 2

Make equal groups—Grouping

Children use objects and pictorial representations to make equal groups from a whole and find how many equal groups of a certain size can be made .

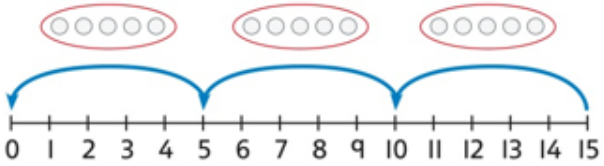
There are 10 children altogether.
There are 2 in each group.
There are 5 groups.

Take 20 cubes. Complete the sentences.
I can make ___ equal groups of 2



There are 20 altogether.
There are 10 in each group.
There are 2 groups.

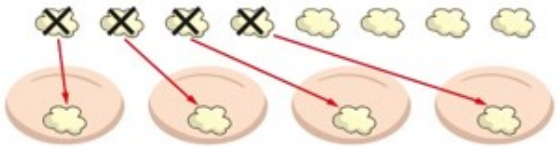
Children may relate this to counting back in steps of 2, 5 or 10.



Stage 3

Make equal groups—Sharing

Children use 1 : 1 correspondence to share concrete objects into equal groups and work out how many are in each group.

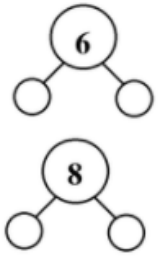


There are 8 cookies altogether.
There are 4 groups.
There are 2 in each group.

Collect 20 cubes. Use hoops to represent your friends.
Can you share the cubes between 5 friends?
20 shared between 5 equals ___

Finding halves

Half of 4 is .....



Use cubes to find half of the given amount.

Division

Stage 4

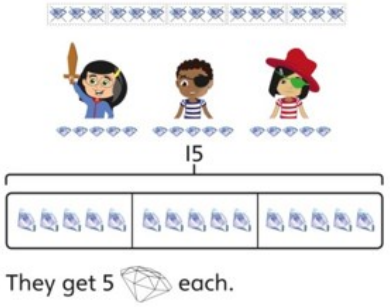
Introduce ÷ symbol through calculations

They will begin to see the link between division and multiplication.

Make equal groups—Sharing

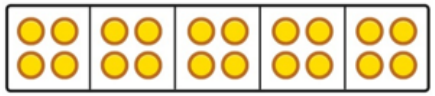
Start with a whole and share into equal parts, one at a time practically, using jottings and bar models.

15 ÷ 3 = 5

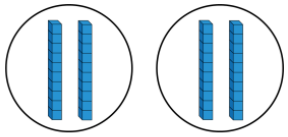


15 shared equally between 3.
They get 5 each.

20 ÷ 5 = 4



20 shared into 5 equal parts.
There are 4 in each part.



Stage 5

Make equal groups—Grouping

Children divide by making equal groups. They then count on to find the total number of groups.

They need to recognise the link between **division, multiplication and repeated addition.**

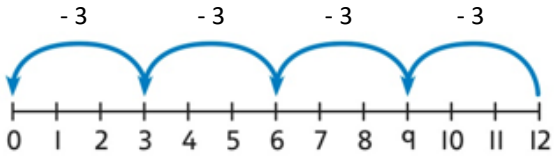
8 ÷ 4 = 2

8 divided into 4 equal groups.
There are 2 in each group.

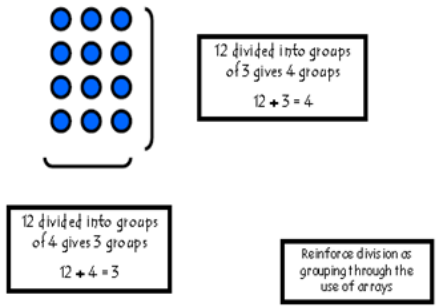
12 ÷ 3 = 4

12 ÷ 4 = 3

20 ÷ 3 = 4



Using arrays



Stage 6

Use known times tables to solve divisions

Understand the relationship between multiplication facts and division.

30 ÷ 10 = 3

1 × 10 = 10
2 × 10 = 20
3 × 10 = 30
4 × 10 = 40
5 × 10 = 50
6 × 10 = 60
7 × 10 = 70
8 × 10 = 80

I used the 10 times-table to help me. 3 × 10 = 30.

I know that 3 groups of 10 makes 30, so I know that 30 divided by 10 is 3.

3 × 10 = 30 so 30 ÷ 10 = 3

Solve missing number problems

6 ÷ 2 = □
6 ÷ □ = 3
□ ÷ 2 = 3
□ ÷ ∇ = 3

□ = 6 ÷ 2
3 = 6 ÷ □
3 = □ ÷ 2
3 = □ ÷ ∇

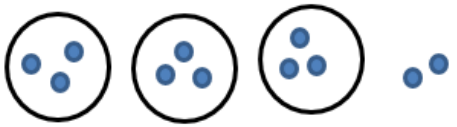
Fill in the missing numbers.

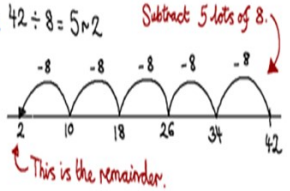
- 70 ÷ 10 = ___
- 6 tens ÷ 1 ten = ___
- 5 = ___ ÷ 10
- There are ___ tens in 40

Finding remainders

Making own groups and finding remainders

11 ÷ 3 = 3r2





17 ÷ 5 =

Counting on fingers: 5, 10, 15 = 3r2

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