KS1 Calculation Policy

Concrete, Pictorial, Abstract Approach

One of the key principles behind the Singapore Maths approach and Maths Mastery is based on the concrete, pictorial, abstract approach. This approach identifies three steps (or representations) that are necessary for pupils to develop an understanding of different concepts.

1. Concrete Representation

Pupils are first introduced to an idea or skill using real objects. In division, for example, this might be done by separating apples amongst children. This is a 'hands on' approach and all classrooms have a wide range of practical resources available for pupils to use.

2. Pictorial Representation

Pupils are encouraged to relate their concrete understanding to pictorial representations. These representations may be a diagram or a picture of the Mathematical problem.

3. Abstract Representation

This is the symbolic stage – the pupils use Mathematical symbols to represent problems, for example 12 x 2 = 24. Whilst this Calculation Policy aims to show the Concrete / Pictorial / Abstract approach to the different calculations, it is not always noted further up the year groups. However, it is expected that the Concrete / Pictorial / Abstract approach is used continuously in all new learning and calculations, even when not noted.

Year 1 – Addition
Jersey Curriculum for Mathematics – Statutory Requirements for Year 1: Number – Addition and Subtraction
Pupils should be taught to: • Read, write and interpret mathematical statements involving addition (+), subtraction (−) and equals (=) signs   • Represent and use number bonds and related subtraction facts within 20   • Add and subtract one-digit and two-digit numbers to 20, including zero   • Solve one-step problems that involve addition and subtraction, using concrete objects and pictorial representations, and missing number problems such as 7 = − 9.
Key Vocabulary

number bonds, add, more, plus, make, sum, total, altogether, equals, put together, distance between, difference between, more than, double, is the same as, one more, ten more etc., How many more to make …?, How much more is … ? How many more is … than … ?

In Year 1, pupils will learn different methods of addition, including those outlined below. Pupils will use the part-whole model and begin to lay the foundations of inverse addition. Concrete and Pictorial Representations are used to develop understanding at this stage. Pupils will be taught to use simple bar modelling strategies to represent word problems.

Method 1 – Addition by using number bonds and using the part-whole model.

part   part

3   4

7

whole

We can also write
3 + 4 = 7.

3   +   4   =   7

There are 7 buckets on the beach.

Method 2 – Addition by counting on in ones and using a number line

5 + 3 =

Start from 5, then count 3 more.

Box of Blocks

0   1   2   3   4   5   6   7   8

5 + 3 = 8
There are 8 blocks altogether.

6, 7, 8

Mental Strategies

- Know that addition can be carried out in any order (commutative).
- Add one and two-digit numbers to twenty, including zero.
- Number bonds to twenty.
- Doubles of numbers up to and including double ten.
- Adding ten to a single digit number.
- Identify one more than a given number.

Assessment Examples

30
+20

50
+20

70
+20
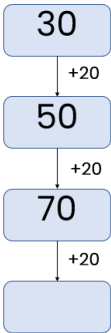
I cycled 4km to get to my friend's house, and then cycled another 3km with my friend. How far have I cycled?

I have 1 metre of red ribbon. I have 5 metres of blue ribbon. How many metres of ribbon do I have altogether?

Year 1 – Subtraction

Jersey Curriculum for Mathematics – Statutory Requirements for Year 1: Number – Addition and Subtraction

Pupils should be taught to:

- Read, write and interpret mathematical statements involving addition (+), subtraction (−) and equals (=) signs
- Represent and use number bonds and related subtraction facts within 20
- Add and subtract one-digit and two-digit numbers to 20, including zero
- Solve one-step problems that involve addition and subtraction, using concrete objects and pictorial representations, and missing number problems such as 7 = − 9.

Key Vocabulary

subtract, take away, minus, leave, How many fewer is ... than ... ?, How much less is .... ?, half, halve, How many are left / left over ?, How many are gone ?, one less, two less, ten less etc., equals, is the same as, count back, difference between.

In Year 1, pupils will learn different methods of subtraction, including those outlined below. Pupils will use subtraction by crossing out to get used to the idea of one less / taking something away. Concrete and Pictorial Representations are used to develop understanding at this stage. Pupils will be taught to use simple bar modelling strategies to represent word problems.

Method 1 – Subtraction by crossing out

There are 7 snakes. 4 go to hide.
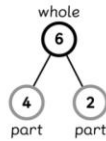How many snakes are not hiding?

7 – 4 = 3
There are 3 snakes not hiding.

I crossed out 4 snakes.

Method 2 – Subtraction by using number bonds and the part-whole diagram

6 – 4 = 2

whole
6
4 part   2 part

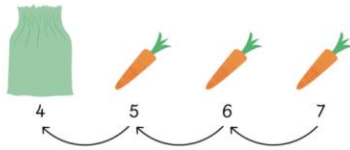There are 6 elephants.

4 elephants are adults.

2 elephants are not adults.

Method 3 – Subtraction by counting back

7 – 3 = 4

There are 4 carrots left in the bag.

Let's count back 3 from 7.

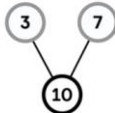## Method 4 – Subtraction using inverse operations.

There are 10 bears. 3 bears are black and 7 bears are brown.

3   7
10

There are 10 bears altogether.
3 + 7 = 10   or   7 + 3 = 10

There are 3 black bears.
10 – 7 = 3

There are 7 brown bears.
10 – 3 = 7

These equations make up an addition and subtraction fact family.

Mental Strategies

- Subtract one and two-digit numbers to twenty, including zero.
- Know that subtraction is not commutative and that the larger number must always come first.
- Use knowledge of number bonds to ten and twenty to reason $(9 + 1 = 10$ so $10 - 9 = 1$ and $10 - 1 = 9)$.

Assessment Examples

There are 9 children. 6 of them have scooters and the rest do not. How many of the children do not have scooters?

Sarah had £6. Then she spent £3. How much money does she have left?

Year 1 – Multiplication
Jersey Curriculum for Mathematics – Statutory Requirements for Year 1: Multiplication and Division

Pupils should be taught to:

- Solve one-step problems involving multiplication and division, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.

Key Vocabulary

odd, even, count in twos, fives, tens (forwards from and backwards from), How many times ?, lots of, groups of, once, twice, five times, ten times, multiple of, times, multiply, multiply by, array, row, column, double.

In Year 1, pupils will be taught the foundations of equal groupings, repeated addition, arrays and doubling. Pupils will be taught to apply that knowledge to solve word problems.

Method 1 – Multiplication by making and then adding equal groups.

There are 4 groups of 10 ——→ .

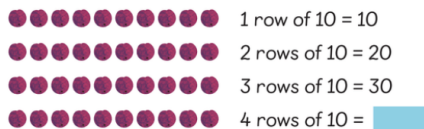10   10   10   10
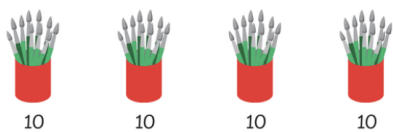
4 groups of 10 = 40
4 tens = 40

There are 40 ——→ .

10, 20, 30, 40

Method 2 – Multiplication by making equal rows.
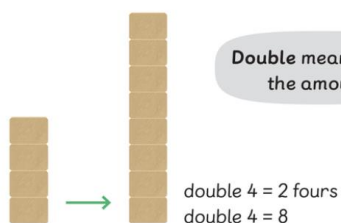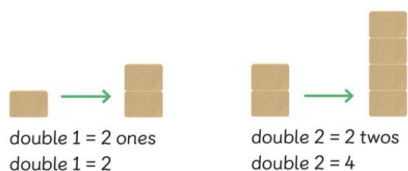
How many plums are there in total?

1 row of 10 = 10
2 rows of 10 = 20
3 rows of 10 = 30
4 rows of 10 =

There are 4 rows.

4 rows of 10
4 tens = 40

There are 40 plums in total.

Method 3 – Multiplication by making doubles.

double 1 = 2 ones
double 1 = 2

double 2 = 2 twos
double 2 = 4

Double means twice the amount.

Jacob uses 8 blocks next.
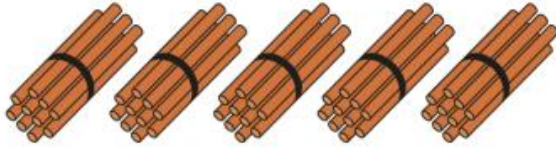
double 4 = 2 fours
double 4 = 8

Mental Strategies
- Count forwards and backwards in multiples of 2s, 5s and 10s.
- Recall doubles of numbers up to and including ten.

Assessment Examples

These sticks are grouped into bundles of 10. How many sticks are there altogether?

How many wheels are there altogether? Count in groups of 2.

Year 1 - Division

Jersey Curriculum for Mathematics – Statutory Requirements for Year 1: Multiplication and Division
Pupils should be taught to:
- Solve one-step problems involving multiplication and division, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.

Key Vocabulary
halve, share, share equally, groups, equal groups of, divide, divided by, left, left over

In Year 1, pupils will be taught how to divide even numbers equally into groups and then to be able to determine how many objects will be included in each group in order to share equally. Pupils will be learning about making halves and quarters before moving on to making the connection between fractions and division.

Method 1 – Division by grouping equally.

Holly has 10 stickers.
She puts 2 stickers on each page.

I can **divide** 10 stickers into groups of 2.
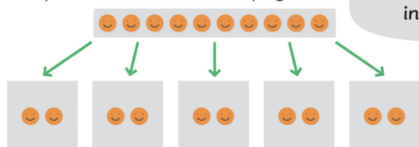
Holly uses 5 pages in her sticker book.

Method 2 – Division by sharing equally.

Emma takes one sticker for herself and gives one sticker to Charles.

She takes another sticker for herself and gives another to Charles.

Emma does this until she has finished sharing the 8 stickers.

Emma and Charles each have 4 stickers.

Mental Strategies

- Count forwards and backwards in multiples of 2s, 5s and 10s.

Assessment Examples

Task: Provide each pupil with an even number of counters up to 20, then ask pupils to put the counters into groups of 2. How many groups are there altogether?

Year 2 – Addition

Jersey Curriculum for Mathematics – Statutory Requirements for Year 2: Number – Addition and Subtraction

Pupils should be taught to:

- Solve problems with addition and subtraction:
  - Using concrete objects and pictorial representations, including those involving numbers, quantities and measures
  - Applying their increasing knowledge of mental and written methods
- Recall and use addition and subtraction facts to 20 fluently, and derive and use related facts up to 100.
- Add and subtract numbers using concrete objects, pictorial representations, and mentally, including:
  - a two-digit number and ones
  - a two-digit number and tens
  - two two-digit numbers
  - adding three one-digit numbers
- Show that addition of two numbers can be done in any order (commutative) and subtraction of one number from another cannot.
- Recognise and use the inverse relationship between addition and subtraction and use this to check calculations and solve missing number problems.

Key Vocabulary

add, addition, more, plus, make, sum, total, altogether, score, double, one more, two more, a hundred more etc., How many more to make … ?, How many more is … than … ?, How much more is … ?

In Year 2, pupils will learn a range of different methods for addition including number bond diagrams as well as the standard column method. Pupils will use concrete objects and pictorial

representations to add a two-digit number and ones, a two-digit number and tens, two two-digit numbers and three one-digit numbers. The following methods will be amongst those used:

Method 1 – Addition by counting on using a number line
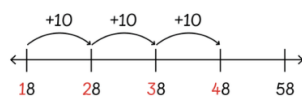
Count on in ones

Count on in ones.

+1 +1 +1 +1 +1

41 42 43 44 45 46 47 48 49 50
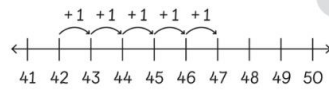
I added 5 to 42 by counting on.

43, 44, ___ , ___ , ___

42 and 5 make 47.
42 + 5 = 47

Count on in tens

Count on in tens.

+10 +10 +10

18 28 38 48 58

Each number increases by 10.

28, 38, 48

18 + 30 = 48

Addition of three numbers

6 + 4 + 2 = ___

add 4   add 2

6 7 8 9 10 11 12 13

Count on from 6.
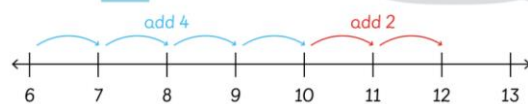
6 + 4 + 2 = 12

Method 2 - Addition by using a part–whole diagram

Adding ones

42 + (5) = 47

40   2
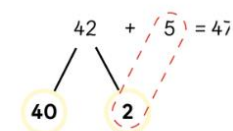
I started by adding the ones.

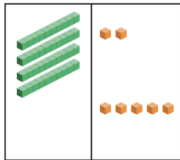2 + 5 = 7
42 + 5 = 47

Adding tens

18 + (30) = ___

8   10
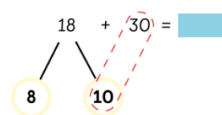
I started by adding the tens.

10 + 30 = 40
40 + 8 = 48

18 + 30 = 48

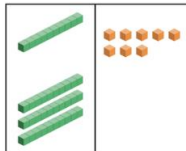## Method 3 – Addition using the column method

Adding ones

We can show 42 + 5 another way.

Start by adding the ones.

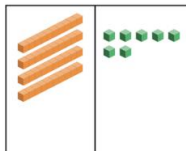| tens	ones
4	2
+	5
	7

2 ones + 5 ones = 7 ones
2 + 5 = 7

Adding tens

I start by adding the ones.

tens	ones
1	8
+ 3	0
	8

8 ones + 0 ones = 8 ones
8 + 0 = 8

Then I add the tens.

tens	ones
1	8
+ 3	0
4	8

1 ten + 3 tens = 4 tens
10 + 30 = 40
18 + 30 = 48

Adding with renaming

43 + 8 = ☐

Start by adding the ones.
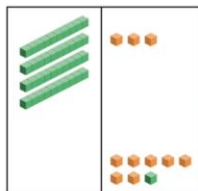
tens	ones
4	3
+	8
1	1

3 ones + 8 ones = 11 ones
11 ones = 1 ten and 1 one
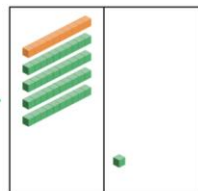
Rename 10 ones as 1 ten.

tens	ones
4	3
+	8
1	1
+ 4	0
5	1
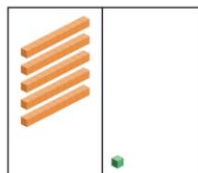
Then add the tens.

4 tens + 1 ten = 5 tens
40 + 10 = 50

43 + 8 = 51

There are 51 bottles of water in total.

Method 4 – Addition of three numbers using number bonds

<u>Tens frames</u>
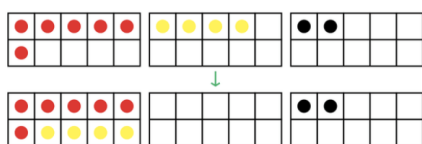
$(6 + 4) + 2 = 10 + 2$

$= 12$

<u>Doubling</u>

$8 + 8 + 7 = $ ▮

$8 + 8 + 7 = 16 + 7$

$= 23$

<u>Mental Strategies</u>

- Know that addition is the inverse of subtraction.
- Add two numbers mentally, including a two-digit number and units, a multiple of ten to a two-digit number, two two-digit numbers and three one-digit numbers.
- Use knowledge of inverse to check calculations and solve missing number problems.
- Use knowledge of number bonds to ten to calculate number bonds to one hundred.
- Count on in ten from any given number, eg: 19 – 29 – 39 etc.

<u>Assessment Examples</u>

Amisha spends £5 on a book and £8 on a T-shirt. How much does she spend altogether?

A garden fence was 8m long. Then the gardener added 7 more metres of fencing. How long is the garden fence now?

Year 2 – Subtraction

<u>Jersey Curriculum for Mathematics – Statutory Requirements for Year 2: Number – Addition and Subtraction</u>

Pupils should be taught to:

- Solve problems with addition and subtraction:
  - Using concrete objects and pictorial representations, including those involving numbers, quantities and measures
  - Applying their increasing knowledge of mental and written methods
- Recall and use addition and subtraction facts to 20 fluently, and derive and use related facts up to 100.
- Add and subtract numbers using concrete objects, pictorial representations, and mentally, including:
  - a two-digit number and ones
  - a two-digit number and tens
  - two two-digit numbers
  - adding three one-digit numbers

- Show that addition of two numbers can be done in any order (commutative) and subtraction of one number from another cannot.
- Recognise and use the inverse relationship between addition and subtraction and use this to check calculations and solve missing number problems.

<u>Key Vocabulary</u>

subtract, minus, leave, How many are left / left over ?, How many less is … than … ?, How much fewer is …?, difference between, half, halve, equals, sign, is the same as, partition, inverse, count back, one less, two less, ten less etc.

In Year 2, pupils are taught a range of methods to subtract including subtracting ones and subtracting multiples of 10 in the column method and using their knowledge of number bonds to solve subtraction problems. Pupils will use bar modelling as a visual model to solve subtraction calculations in word problems.

<u>Method 1 – Subtraction by counting back and a number line</u>

<u>Counting back in ones</u>

$37 - 5 = $

① subtract 5

Start counting back from 37.

31 32 33 34 35 36 37 38 39 40

$37 - 5 = 32$

<u>Subtraction from multiples of 10</u>

$30 - 4 = $

subtract 4

0 1 2 3 4 5 6 7 8 9 10

subtract 4

20 21 22 23 24 25 26 27 28 29 30

$10 - 4 = 6$
$30 - 4 = 26$

<u>Method 2 – Subtraction using part–whole diagram</u>

<u>Subtracting ones</u>

10 screws   10 screws   10 screws

Start by subtracting the ones.

$37 - 5 = 32$

30   7

$7 - 5 = 2$
$37 - 5 = 32$

Subtraction with renaming

$31 - 6 = $ ▢
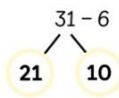
There are not enough ones.

1 Take 6 away from 10.

$31 - 6$

21   10

$10 - 6 = 4$
$4 + 21 = 25$

$31 - 6 = 25$

Subtraction from multiples of 10

$30 - 4 = $ ▢

30

20   10
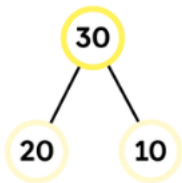
$10 - 4 = 6$
$20 + 6 = 26$
$30 - 4 = 26$

Method 3 – Subtraction using the column method

Subtracting ones

Subtract the ones.
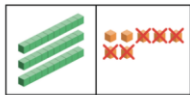
tens	ones
3	7
−	5
	2

7 ones − 5 ones = 2 ones

Then subtract the tens.
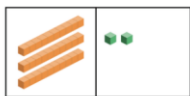
tens	ones
3	7
−	5
3	2

3 tens − 0 tens = 3 tens

$37 - 5 = 32$

32 screws are left.

Subtraction with renaming

Rename 1 ten as 10 ones.
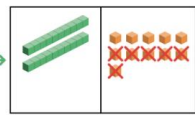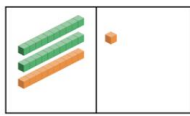
Then subtract the ones.

tens ones

11 ones − 6 ones = 5 ones
11 − 6 = 5

Subtract the tens.
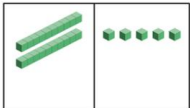
tens ones

2 tens − 0 tens = 2 tens
20 − 0 = 20

31 − 6 = 25

Mental Strategies

- Know that subtraction is the inverse of addition.
- Use knowledge of inverse to check calculations and solve missing number problems.
- Subtract numbers mentally, including subtracting units from a two-digit number, a multiple of ten from a two-digit number, a two-digit number from another two-digit number.
- Recall and use subtraction facts to twenty fluently. Use knowledge of number bonds to one hundred (multiples of ten) to reason (40 + 60 = 100 so 100 − 60 = 40 and 100 − 40 = 60).

Assessment Examples

I have a 15cm length of ribbon. I cut off 6cm. How much ribbon is left?

I have 17 pencils. 9 have been sharpened. How many have not been sharpened?

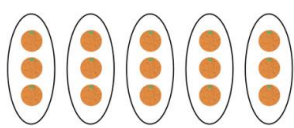| **Year 2 – Multiplication** |
| --- |
| Jersey Curriculum for Mathematics – Statutory Requirements for Year 2: Number – Multiplication and Division
Pupils should be taught to:
- Recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers.
- Calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication (×), division (÷) and equals (=) signs.
- Show that multiplication of two numbers can be done in any order (commutative) and division of one number by another cannot. |

- Solve problems involving multiplication and division, using materials, arrays, repeated addition, mental methods, and multiplication and division facts, including problems in contexts.

Key Vocabulary

odd, even, twos, fives, tens, threes, lots of, groups of, once, twice, three times, five times, ten times, multiple of, times, multiply, multiply by, repeated addition, array, row, column, double.

In Year 2, pupils will build on the previous learning of equal groupings, repeated addition, arrays and doubling. They will use a variety of methods, some of which are outlined below. Pupils will be taught to apply that knowledge to solve word problems by using concrete and pictorial representations.

Method 1 – Multiplication as equal groups.

There are 5 groups of 3 oranges.

$3 + 3 + 3 + 3 + 3 = 15$

There are 15 oranges in total.

5 threes = 15
5 groups of 3 = 15
$5 × 3 = 15$
5 times 3 equals 15

We read $5 × 3 = 15$ as 5 times 3 equals 15.

× means to multiply.

Method 2 – Multiplication using 2, 5 and 10 times tables - understanding the operation of multiplication

Counting in groups

There are 2 pieces of sushi in 1 box.

1 group of 2
$1 × 2 = 2$

2 groups of 2
$2 × 2 = 4$

3 groups of 2
$3 × 2 = 6$

4 groups of 2
$4 × 2 = 8$

5 groups of 2
$5 × 2 = 10$
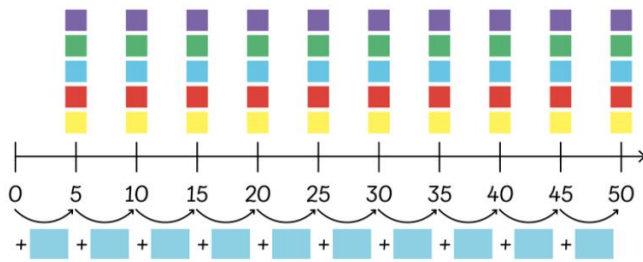
6 groups of 2
$6 × 2 = 12$

Emma made 12 pieces of sushi altogether.

Counting up in multiples

Can you help Amira count in fives?

5, 10, 15, 20, 25, 30, ...

0 5 10 15 20 25 30 35 40 45 50

+ □ + □ + □ + □ + □ + □ + □ + □ + □ + □

There are 10 pine cones in each row. There are 4 rows.

4 groups of 10
4 × 10 = 40

There are 4 pine cones in each column. There are 10 columns.

10 groups of 4
10 × 4 = 40
4 × 10 = 40
They are equal.

Why are 4 groups of 10 equal to 10 groups of 4?

Amira has collected 40 pine cones.

Method 3 – Solving word problems involving multiplication using concrete objects and pictorial representatives.

- Children will be taught various methods that could be used to solve word problems – counting one by one, counting in twos and multiplying by 2. Pupils should know all methods are acceptable but that the multiplication method is the most efficient as they can find the answer quickly, particularly if they have memorised their multiplication facts.

How many children are there eating lunch in the hall?

6 × 5 = 30

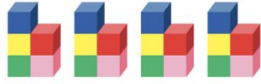There are 6 groups of 5.

Each table has [ ] children.

There are 30 children eating lunch in the hall.

Charles uses 5 cubes to make each [cube].

How many cubes does he use?

5 × 4 = [ ]

Charles uses [ ] cubes.

Charles has made 4 [cube] so far.

Mental Strategies

- Count forwards and backwards in multiples of three.
- Know the 2s, 5s and 10s times tables (in and out of order).
- Recognise odd and even numbers.

Assessment Examples

Mrs Patel buys 3 boxes of eggs. There are 6 eggs in each box. How many eggs does she buy altogether?

Write these addition expressions as multiplication expressions. The first one has been completed for you.

There are 7 year-groups in Winterdale School. Each year-group has 2 classes. How many classes are in the school?

Write a story to go with this equation. 6 X 10 = 60

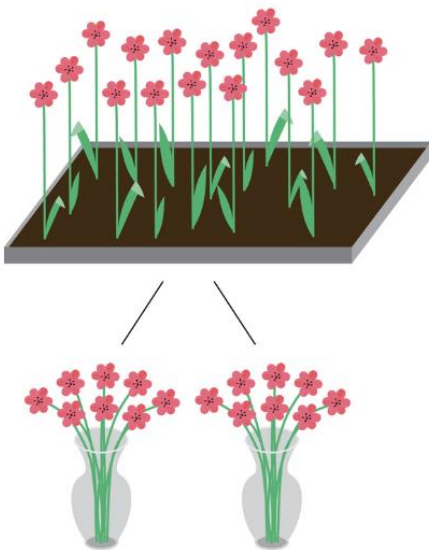| Year 2 – Division |
| --- |
| Jersey Curriculum for Mathematics – Statutory Requirements for Year 2: Number – Multiplication and Division
Pupils should be taught to:

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

groups of, equal groups of, halve, share, share equally, divide, divided by, divided into, repeated subtraction, inverse

In Year 2, pupils will be taught how to divide even numbers equally into groups and then to be able to determine how many objects will be included in each group in order to share equally. Pupils will be building on previous learning about making halves and quarters before moving on to making the connection between fractions and division. Children will be taught to solve problems involving division, using materials, arrays, repeated addition, mental methods, and multiplication and division facts, including problems in contexts. Children will also be taught that division is not commutative. Please see some of the methods used in teaching below.

Method 1 – Division by sharing equally

There are 16 flowers.
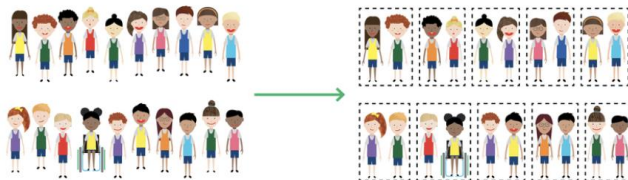Elliott cuts the flowers and puts them equally into 2 vases.

There are 8 flowers in each vase.

$16 \div 2 = 8$

Method 2 – Division using times tables
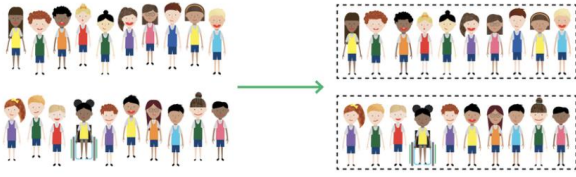
20 children can be put into teams of 2.

There are 10 groups of 2 children.

$20 \div 2 = 10$
There are 10 equal teams.

$10 \times 2 = 20$

20 children can be put into teams of 10.

$20 \div 10 = 2$

There are 2 equal teams.

There are 2 groups of 10 children.

$2 \times 10 = 20$

$10 \times 2 = 20$	$20 \div 2 = 10$
$2 \times 10 = 20$	$20 \div 10 = 2$

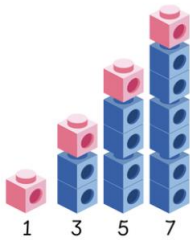There is a relationship between the multiplication and division facts.

This is a multiplication and division fact family.

Method 3 – Division odd and even numbers

2 cubes can be put into a group of 2.
4 cubes can be put into groups of 2.
6 cubes can be put into groups of 2.

2, 4 and 6 are even numbers.

2   4   6

1 cube cannot be put into a group of 2.
3 cubes cannot be put into groups of 2.
5 cubes cannot be put into groups of 2.
7 cubes cannot be put into groups of 2.

1, 3, 5 and 7 are odd numbers.

1   3   5   7

1	2	3	4	5	6	7	8	9	10
odd	even	odd	even	odd	even	odd	even	odd	even
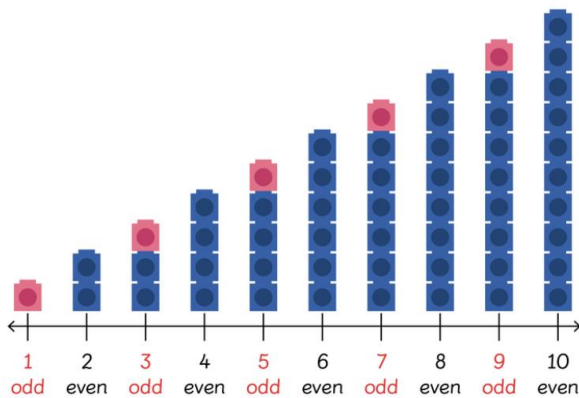
$8 \div 2 = 4$
$10 \div 2 = 5$

8 and 10 are even numbers.

We can divide even numbers exactly by 2.

Mental Strategies
- To know that division in the inverse of multiplication.
- Recall division facts for the 2, 5 and 10 times tables.

• Recall halves for even numbers up to and including twenty.

There are 20 children at the sports club. They get into groups of 4. How many groups are there altogether?

$$\blacksquare \div 2 = 8$$

Miss Robinson asked Harry to get 60 apples from the kitchen. The apples come in bags of 10. How many bags does Harry need to get?

Diego has some 5p coins. He has 40p altogether. How many 5p coins does Diego have?