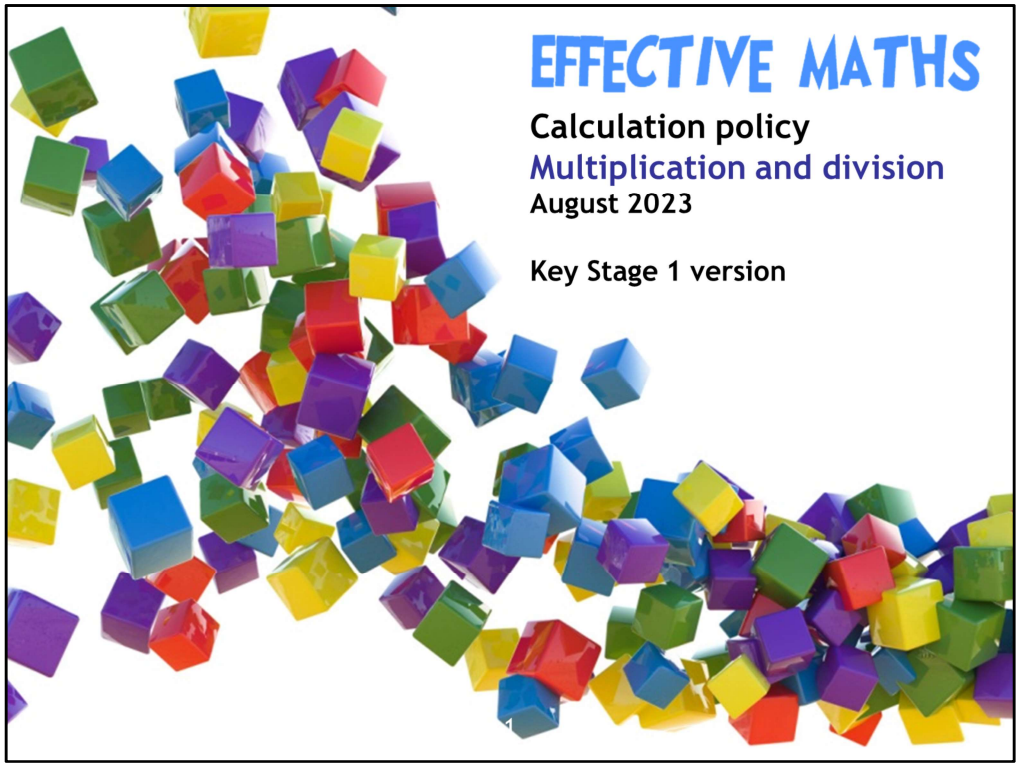

EFFECTIVE MATHS
Calculation policy
Multiplication and division
August 2023
Key Stage 1 version

CALCULATION POLICY FOR MULTIPLICATION AND DIVISION

INTRODUCTION

This document provides an overview of the content and methods encountered in each year group from Year 1 to Year 6.

For each year group in Years 1-6 the document provides:

i. a content summary section;
ii. details about the approaches used for teaching the above;
iii. the representations used.

Each section includes content from:

- calculation unit 6 (Y1); multiplication and division units 1 and 2 (Y2); multiplication and division units 1 to 3 (KS2);
- the Block 3 calculation unit;
- money and decimals units;
- fractions units (Years 2-6).

The document is provided in several versions:

- whole school version;
- year group specific versions;
- a Key Stage 1 only version (for infant schools).

CALCULATION POLICY FOR MULTIPLICATION AND DIVISION

YEAR 1

Year 1			
	Block 1	Block 2	Block 3
Calculation content			CALCULATION (UNIT 6) • Identifying groups • Equal groups • Repeated addition • Making equal rows (arrays) • Doubles • Multiplication stories • Equal groups (division) • Equal sharing

CALCULATION POLICY FOR MULTIPLICATION AND DIVISION

YEAR 1

Year 1			
	Block 1	**Block 2**	**Block 3**
Strategies/ methods			Children begin their work on multiplication with an understanding that a unit does not have to be one. In place value units and fluency sessions they have counted in twos, fives and tens. This provides some support with understanding the concept of multiplication. <u>Identifying groups</u> Initial learning about groups focuses on deepening understanding about what the term 'group' means. They identify whether a collection of objects can/cannot form a group. <u>Equal groups</u> Children learn to identify objects grouped into equal or unequal groups. Where the groups are not equal, they are encouraged to think about how to rearrange the objects to make equal groups. At this stage the focus is on the structures: number of groups and number in each group. The focus is *not* on the total amount.

CALCULATION POLICY FOR MULTIPLICATION AND DIVISION

YEAR 1

Year 1			
	Block 1	**Block 2**	**Block 3**
Strategies/ methods			Repeated addition The next step involves describing equal groups using repeated addition. Children use repeated addition expressions to describe equal group situations. An expression is different from an equation as there is no equals sign. Children devise repeated addition expressions such as 3 + 3 + 3. At this stage they do not need to give the total amount. So they do not need to say things like 3 + 3 + 3 = 9. They also describe the groups, starting with the number of groups, then giving the group size. For example: *There are three groups. There are three dolls in each group.*

CALCULATION POLICY FOR MULTIPLICATION AND DIVISION

YEAR 1

Year 1			
	Block 1	**Block 2**	**Block 3**
Strategies/ methods			Making equal rows (arrays) Children's learning about groups becomes more structured as they make equal rows. This means that they are building arrays. An array is a powerful structure to provide conceptual understanding for multiplication and, later, division. They describe the number of items in each row, the number of columns, and then the total. After this, children use counters to build arrays. They describe the arrays in two ways: • the number of rows followed by the number of counters in each row; • the number of columns followed by the number of counters in each column. Doubles Doubling has been encountered previously. Teaching now emphasises that 'double' is two groups of a number or an amount. Children's knowledge of doubles is extended from doubles of 1-5 to doubles of 1-10.

CALCULATION POLICY FOR MULTIPLICATION AND DIVISION

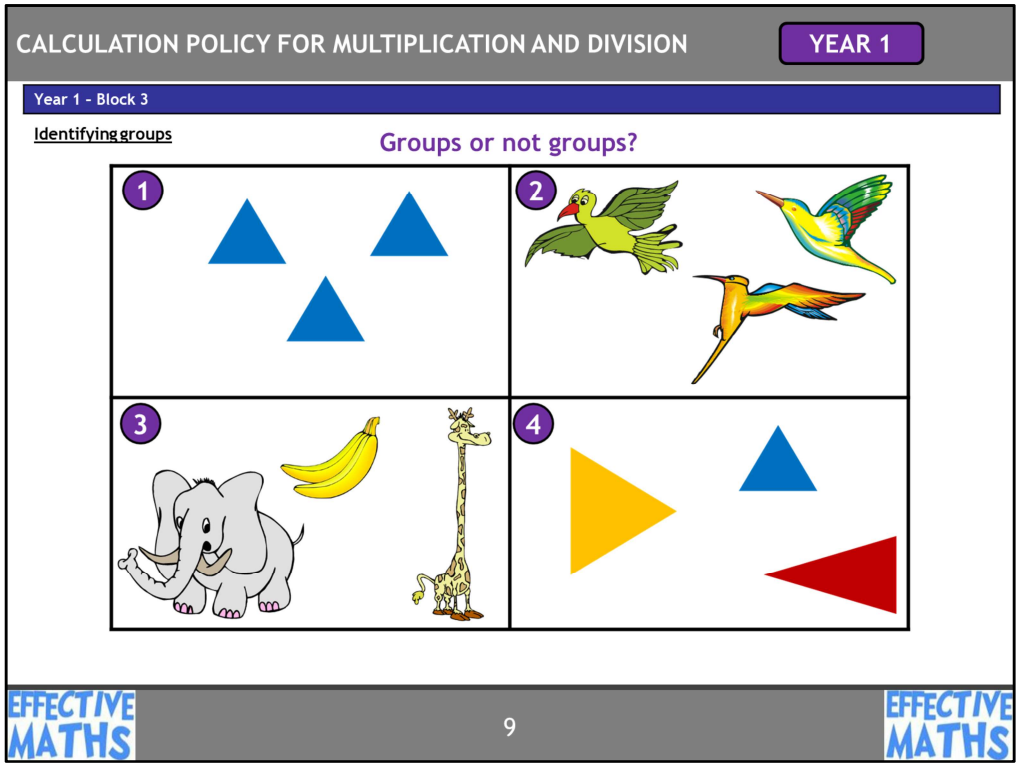
YEAR 1

Year 1			
	Block 1	**Block 2**	**Block 3**
Strategies/ methods			Multiplication stories Year 1 work on multiplication concludes by consolidating children's understanding about ways to describe equal groups. They do this by stating the number of groups, then the number in each group. They also use repeated addition. For example: *There are 2 trees with apples on.* *There are 5 apples on each tree.* *5 + 5 = 10.* Equal groups (division) Children's understanding about equal groups is now applied to learning about division. They take an amount and divide it into equal groups. Division as grouping is also known as quotitive division. The language used is important. We are not saying 12 'divided by' 3. We are saying '12 put into groups of 3 makes 4 groups'. In division as grouping the quotient (the answer) is the number of equal groups.

CALCULATION POLICY FOR MULTIPLICATION AND DIVISION

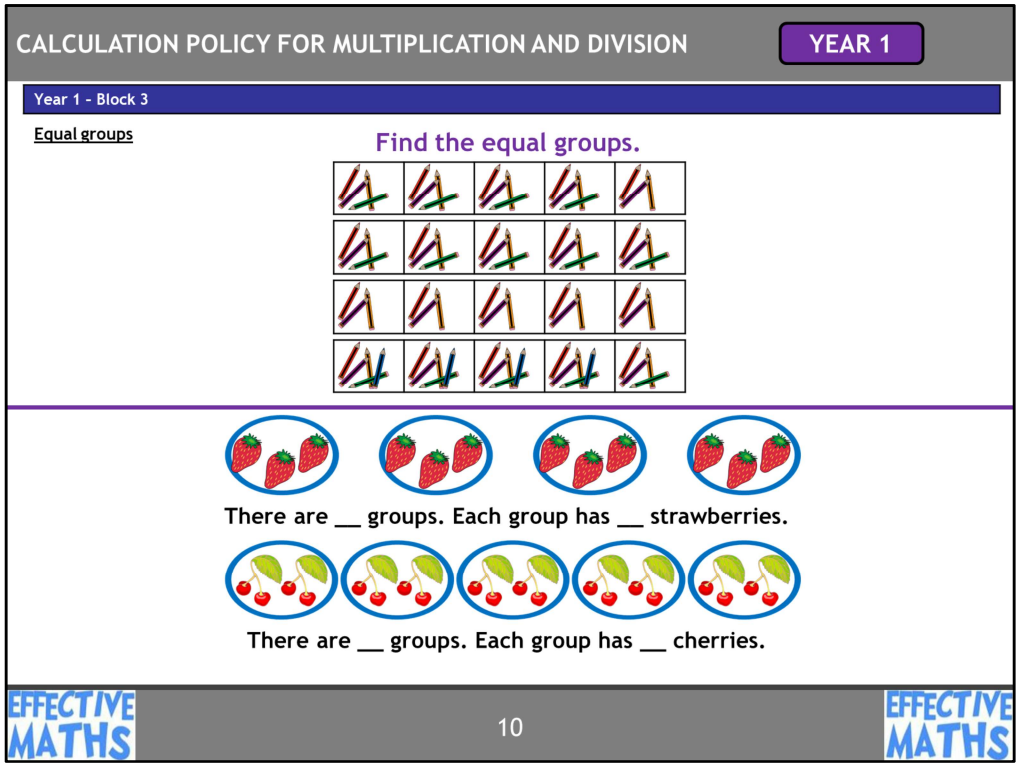
YEAR 1

Year 1			
	Block 1	**Block 2**	**Block 3**
Strategies/ methods			<u>Equal sharing</u> Finally, the division structure of sharing is introduced. (This is also known as partitive division.) Here, the total amount is split between a number of people/objects etc. Using the language of grouping is avoided as it is not appropriate for sharing contexts. In division as sharing the quotient (the answer) is the number of items each person has.



BLOCK 3
CALCULATION UNIT 6

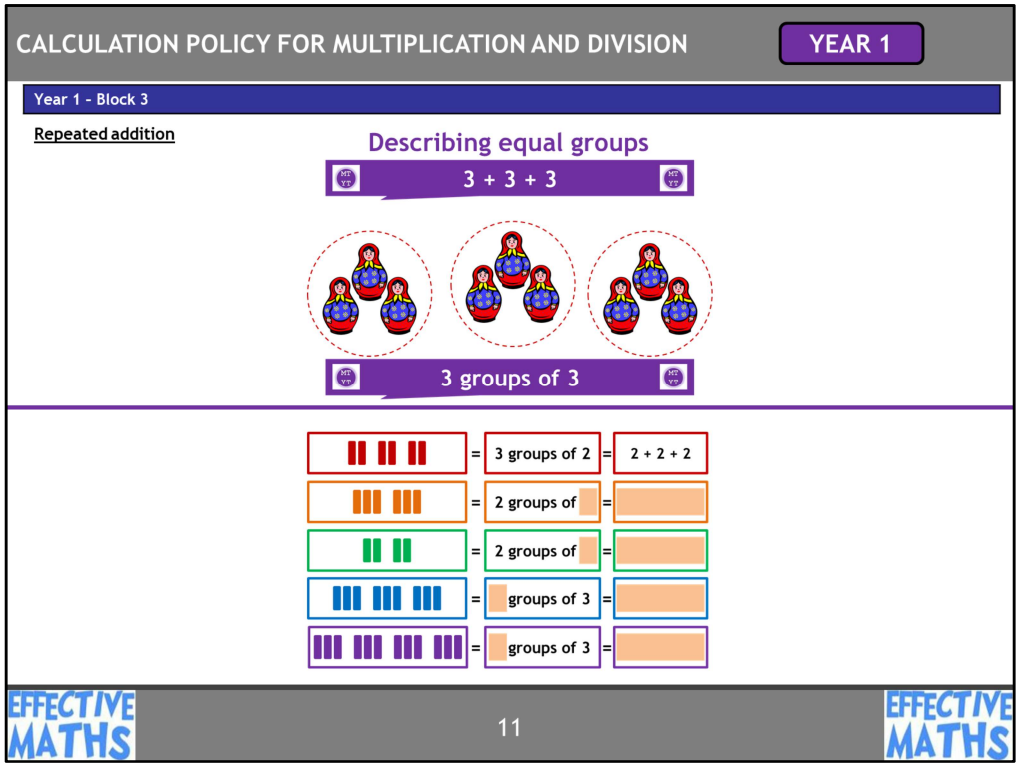
Identifying groups
Initial learning about groups focuses on deepening understanding about what the term 'group' means.
They identify whether a collection of objects can/cannot form a group.



Equal groups

Children learn to identify objects grouped into equal or unequal groups. Where the groups are not equal, they are encouraged to think about how to rearrange the objects to make equal groups.

At this stage the focus is on the structures: number of groups and number in each group. The focus is *not* on the total amount; we do not say things like, 'There are twelve strawberries altogether'.



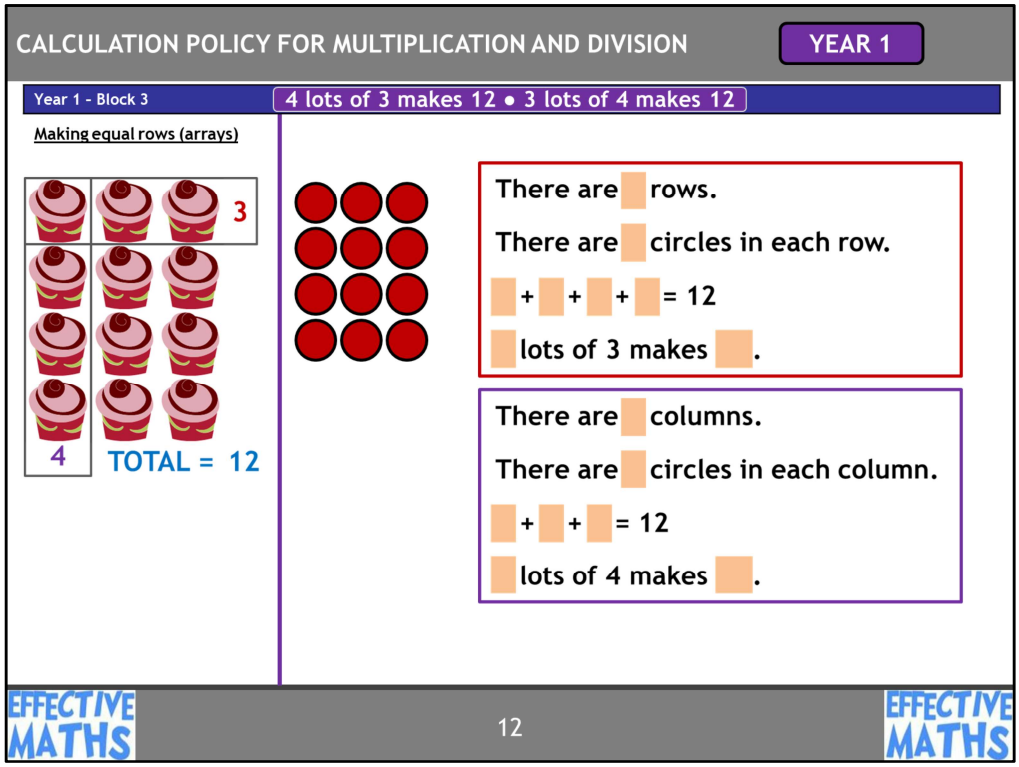
Repeated addition

The next step involves describing equal groups using repeated addition. Children use repeated addition expressions to describe equal group situations. An expression is different from an equation as there is no equals sign.

Children devise repeated addition expressions such as 3 + 3 + 3. At this stage they do not need to give the total amount. So they do not need to say things like 3 + 3 + 3 = 9.

They also describe the groups, starting with the number of groups, then giving the group size. For example:

There are three groups. There are three dolls in each group.



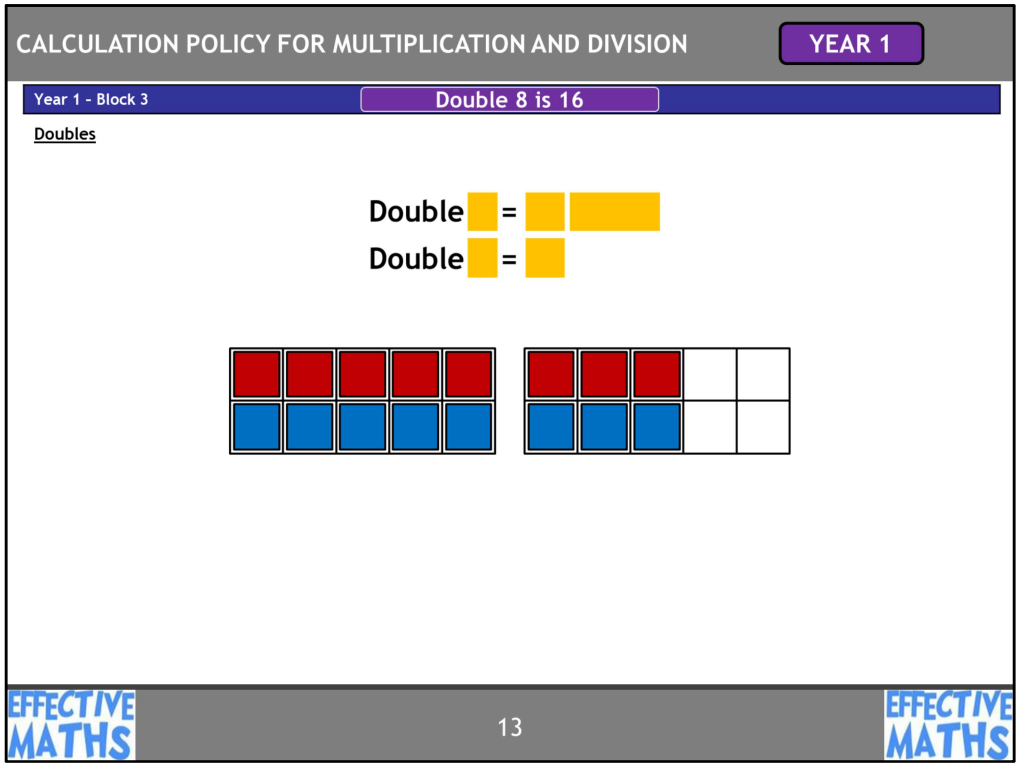
Making equal rows (arrays)

Children's learning about groups becomes more structured as they make equal rows. This means that they are building arrays. An array is a powerful structure to provide conceptual understanding for multiplication and, later, division. They describe the number of items in each row, the number of columns, and then the total.

After this, children use counters to build arrays. They describe the arrays in two ways:

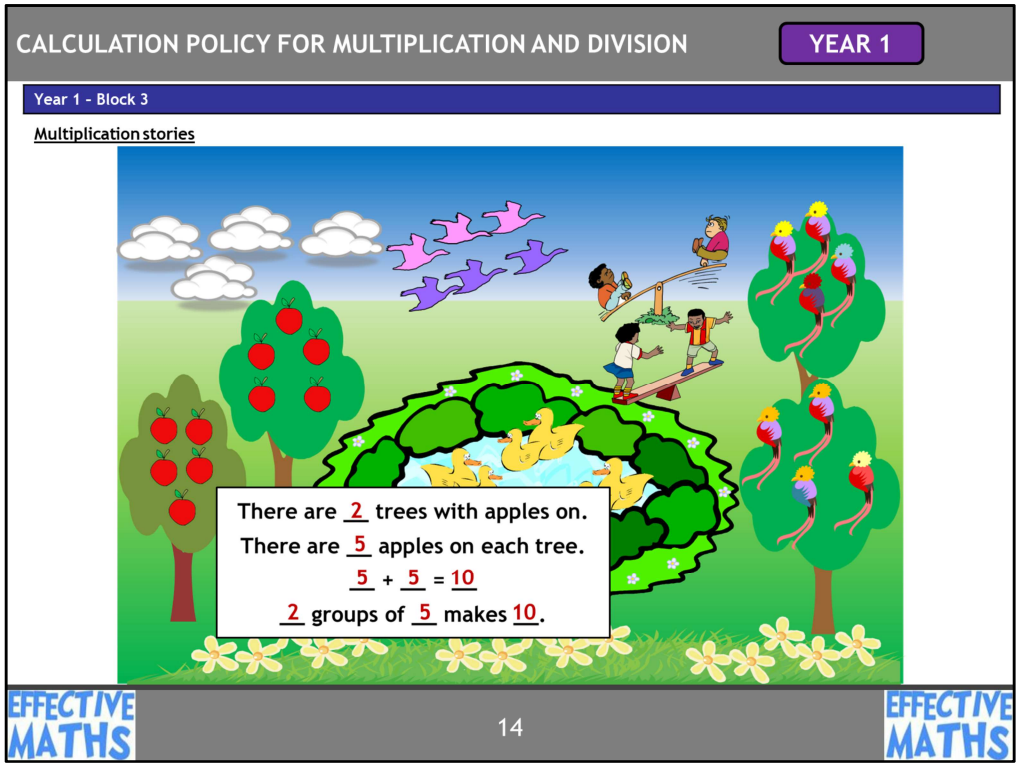
the number of rows followed by the number of counters in each row;

the number of columns followed by the number of counters in each column.



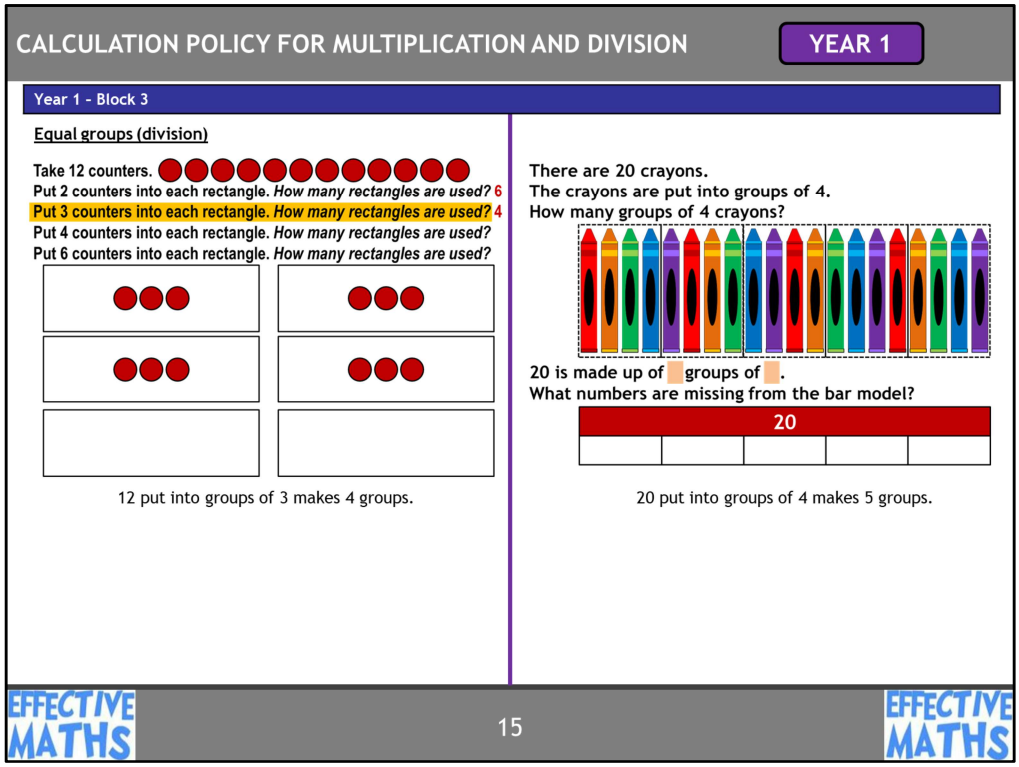
Doubles

Doubling has been encountered previously. Teaching now emphasises that 'double' is two groups of a number or an amount. Children's knowledge of doubles is extended from doubles of 1-5 to doubles of 1-10.



Multiplication stories

Year 1 work on multiplication concludes by consolidating children's understanding about ways to describe equal groups. They do this by stating the number of groups, then the number in each group. They also use repeated addition. For example:
There are 2 trees with apples on.
There are 5 apples on each tree.
5 + 5 = 10.



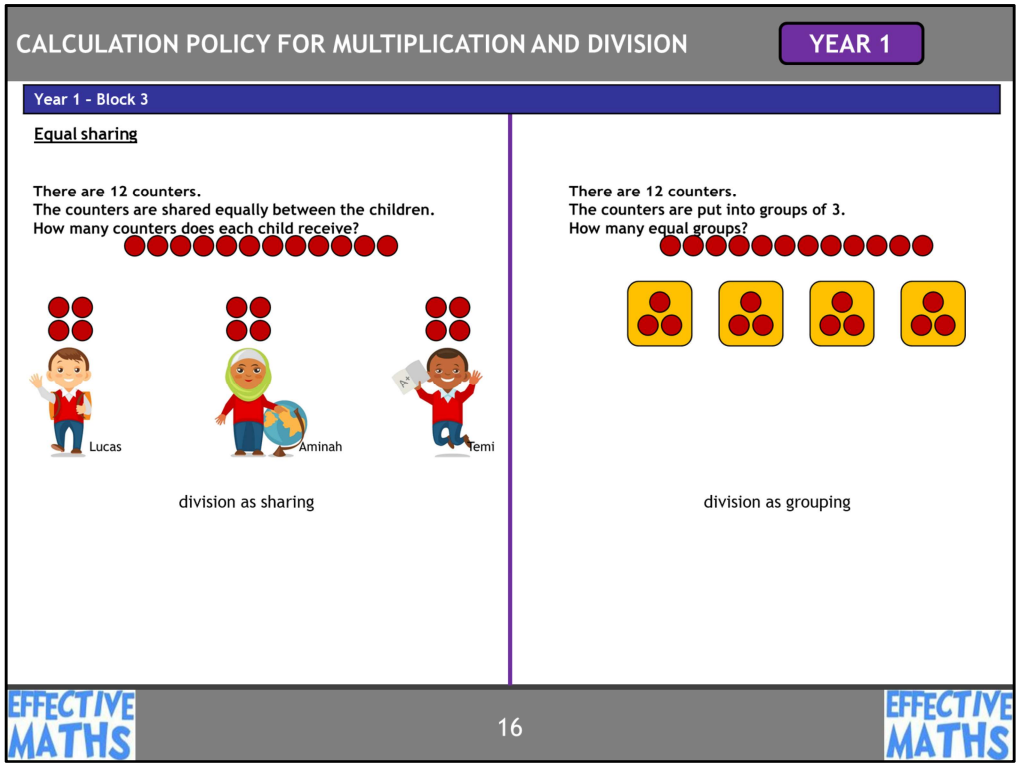
Equal groups (division)

Children's understanding about equal groups is now applied to learning about division. They take an amount and divide it into equal groups.

Division as grouping is also known as quotitive division.

The language used is important. We are not saying 12 'divided by' 3. We are saying '12 put into groups of 3 makes 4 groups'.

In division as grouping the quotient (the answer) is the number of equal groups.



Equal sharing

Finally, the division structure of sharing is introduced. (This is also known as partitive division.) Here, the total amount is split between a number of people/objects etc. Using the language of grouping is avoided as it is not appropriate for sharing contexts.

In division as sharing the quotient (the answer) is the number of items each person has.

CALCULATION POLICY FOR MULTIPLICATION AND DIVISION

YEAR 2

Year 2			
	Block 1	**Block 2**	**Block 3**
Calculation content	MULTIPLICATION AND DIVISION (UNIT 1) • Groups and equal groups • 5 × table • 10 × table • 2 × table • Division: sharing by 2 • Division: making groups of 2 • Odd and even numbers • Dividing by 5 • Dividing by 10 FRACTIONS (UNIT 1) • Finding half	MONEY AND DECIMALS (UNIT 1) n/a MULTIPLICATION AND DIVISION (UNIT 2) • 10 × table (r) • Dividing by 10 (r) • 5 × table (r) • Dividing by 5 (r) • 2 × table (r) • Dividing by 2 (r) FRACTIONS (UNIT 2) • Finding half (r) • Finding one quarter • Finding quarters • Finding thirds	CALCULATION UNIT • Doubling and halving MONEY AND DECIMALS (UNIT 2) • Multiplying amounts of money • Dividing amounts of money

CALCULATION POLICY FOR MULTIPLICATION AND DIVISION

YEAR 2

Year 2			
	Block 1	**Block 2**	**Block 3**
Strategies/ methods	Groups and equal groups In Y1 children learnt about equal and unequal groups. They began to understand the equivalence between a repeated addition expression and a multiplication expression exists due to equal groups, eg: 10 + 10 + 10 = 3 × 10 Teaching shows how the numbers in '3 × 10' relate to the numbers in '10 + 10 + 10'. 5 × table Children's knowledge about multiplication is developed by learning about the 5 × table. The array is introduced as a key tool for conceptual understanding. Pictures are used as prompts for writing multiplication equations, eg: 4 × 5 = 20. Teaching encourages children to explain how each term links to the context.	10 × table (r) and dividing by 10 (r) Block 2 begins with revision of the 10 × table and the related division facts. There are no new representations. Children continue to work with arrays, including arrays that support early understanding of the distributive property of multiplication. There is an emphasis on strengthening connections between multiplication and division and this is echoed in fluency sessions.	Doubling and halving Understanding of doubling and halving is extended to finding double/half of two-digit numbers beyond 20. The strategy modelled is to partition the two-digit number into tens and ones, find half of each part, and then combine. Children need to know half of multiples of 10 to 90 and half of the even numbers 2, 4, 6 and 8. Multiplying amounts of money Children's knowledge of multiplication facts is applied to the context of money. Visual representations emphasise the repeated addition structure of multiplication. Children find missing amounts on a money multiplication grid and develop the ability to represent problems with bar models.

CALCULATION POLICY FOR MULTIPLICATION AND DIVISION

YEAR 2

Year 2			
	Block 1	**Block 2**	**Block 3**
Strategies/ methods	10 × table Learning about the 10 × table continues to make use of arrays and the interpretation of pictorial representations. Links between the 5 × table and 10 × table are also explored. 2 × table Learning about the 2 × table also continues to make use of arrays. An early introduction to the distributive property of multiplication (not referred to as such) deepens understanding about multiplication. For example: 3 × 2 = 6 2 × 2 = 4 5 × 2 = 10	5 × table (r) and dividing by 5 (r) As with the 10 × table, there are no new representations. Again, there is an emphasis on strengthening connections between multiplication and division and this is echoed in fluency sessions. Throughout Block 2 there is a focus on applying knowledge of multiplication and division to solve problems.	Dividing amounts of money The money multiplication grid is used for division. Teaching makes explicit links with multiplication. 3 × __ = 6p 6p ÷ 3 = 2p Children continue to develop the ability to represent problems with bar models.

CALCULATION POLICY FOR MULTIPLICATION AND DIVISION

YEAR 2

Year 2			
	Block 1	**Block 2**	**Block 3**
Strategies/ methods	Division: sharing by 2 Learning about division begins by understanding that the term divide can be used when something is separated into equal parts. Learning to divide by 2 begins with the partitive (sharing) division structure. Children are introduced to the division symbol: ÷. Connections are made between division and multiplication, supported by the relationship triangle, eg: 10 ÷ 2 = 5 5 × 2 = 10 Division: making groups of 2 The quotitive division structure is introduced next and children learn to make equal groups. Links between multiplication and division continue to be supported by the relationship triangle.	2 × table (r) Learning about the 2 × table does introduce a new representation: the multiplication grid. The core purpose of the lesson is to familiarise children with how the grid works as it is likely something they will encounter. Teaching introduces the commutative property and shows how we obtain the same product regardless of the order of the factors. The multiplication grid may look a bit like a 100 square, but it works in a very different way. The multiplication grid is actually arrays. The first grid shows 7 rows of 2. The second shows 2 columns of 7.	

CALCULATION POLICY FOR MULTIPLICATION AND DIVISION

YEAR 2

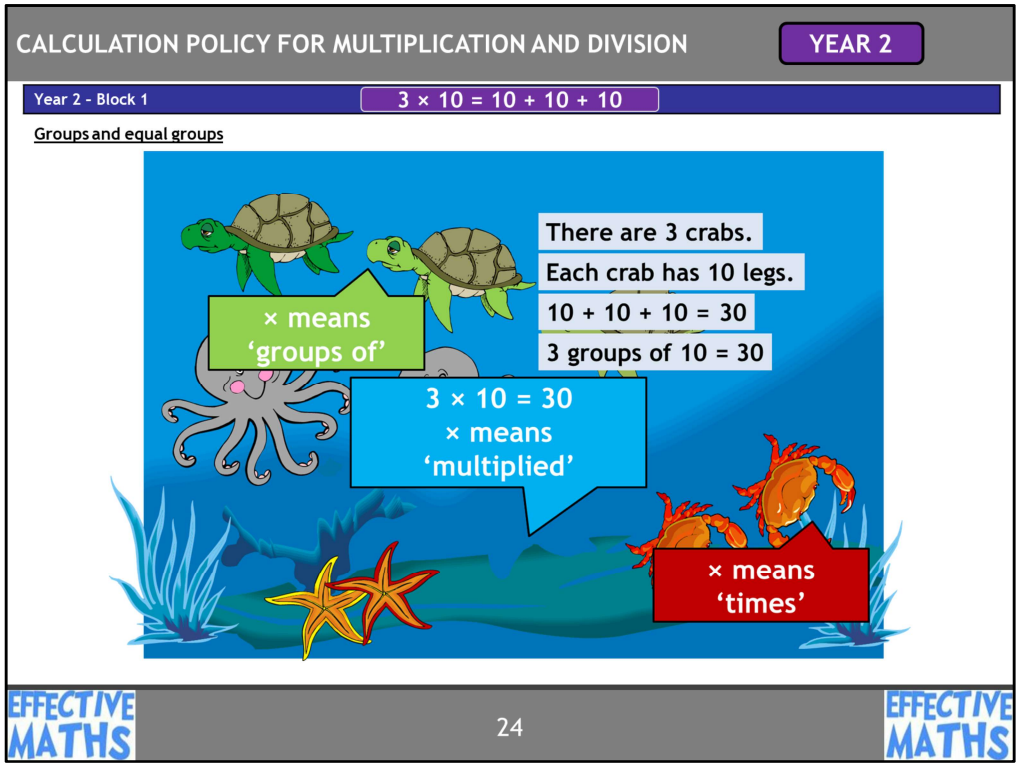
Year 2			
	Block 1	**Block 2**	**Block 3**
Strategies/ methods	<u>Odd and even numbers</u> Learning explores dividing by 2 using the context of odd and even numbers and children learn that even numbers can be divided exactly by 2. <u>Dividing by 5</u> Learning to divide by 5 involves both sharing and grouping structures. Teaching seeks to help children to see where the quotient is in each structure: for sharing - the number in each group; for grouping - the number of groups. The relationship triangle is used to help make links between multiplication and division. <u>Dividing by 10</u> Block 1 concludes with learning to divide by 10, using both sharing and grouping structures.	<u>Dividing by 2</u> Solving problems involving dividing by 2 introduces the concept of inverse. Children will need to learn the term, but understanding of it is best achieved by talking about *working forwards* or *working backwards*. In the case of 7 × 2 = __ we are working forwards. In the case of 14 = __ × 2 we are working backwards or using the inverse. In the examples shown in the representations section, we can solve row 1 and row 2 by working forwards. To solve row 3 we need to work backwards.	

CALCULATION POLICY FOR MULTIPLICATION AND DIVISION

YEAR 2

Year 2			
	Block 1	**Block 2**	**Block 3**
Strategies/ methods	Finding half Learning to find half of a number, a group of objects or a shape begins by revisiting the connections between the 2 × table and its related division facts. The focus is on finding half of numbers to 20. Children engage in a range of contexts that involve finding half of even numbers to 20.	Finding half (r) Revision of finding half of numbers to 20 continues to make connections between the 2 × table and its related division facts. Activities include shading shapes to show one-half and also drawing lines on grids to divide shapes into halves. Finding one quarter Children learn that one quarter of a set of objects occurs when the whole is split into 4 equal parts. Note that the 4 × table has not been taught in Year 2 - it is taught in Year 3 - so children cannot use their knowledge of division facts to obtain one quarter. A range of approaches are used, including using concrete resources, encouraging the use of drawing and linking to knowledge of finding half.	

Year 2			
	Block 1	Block 2	Block 3
Strategies/ methods		<u>Finding three-quarters</u> Finding three-quarters of a set is initially done through using concrete resources. Connections are also made to finding one quarter: if one quarter is 5, then two-quarters is 10 and three-quarters is 15. <u>Finding thirds</u> Children learn that one third of a set of objects occurs when the whole is split into 3 equal parts. Note that the 3 × table has not been taught in Year 2 - it is taught in Year 3 - so children cannot use their knowledge of division facts to obtain one third. Nor can they make links to other maths facts they know. They have had experience of counting in threes and the use of concrete resources, visual representations and drawing are the prime strategies for finding thirds. As for learning to find three-quarters, children apply their knowledge of finding one-third to finding two-thirds.	



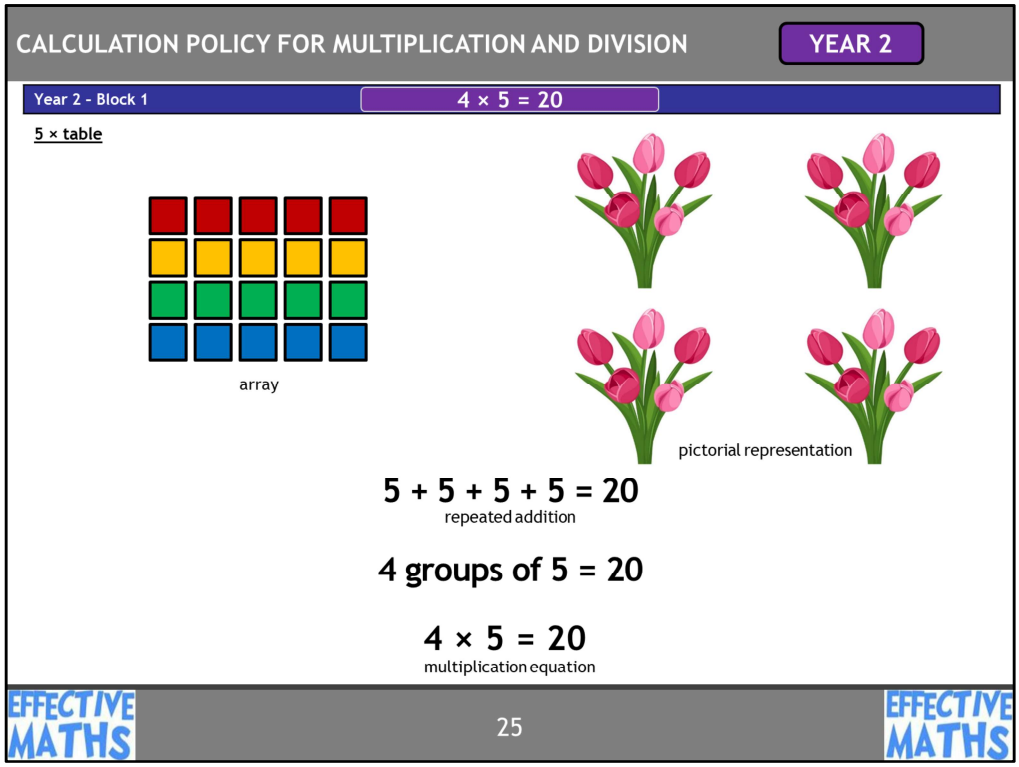
BLOCK 1
× and ÷ UNIT 1

Groups and equal groups

In Y1 children learnt about equal and unequal groups. They began to understand the equivalence between a repeated addition expression and a multiplication expression exists due to equal groups, eg:

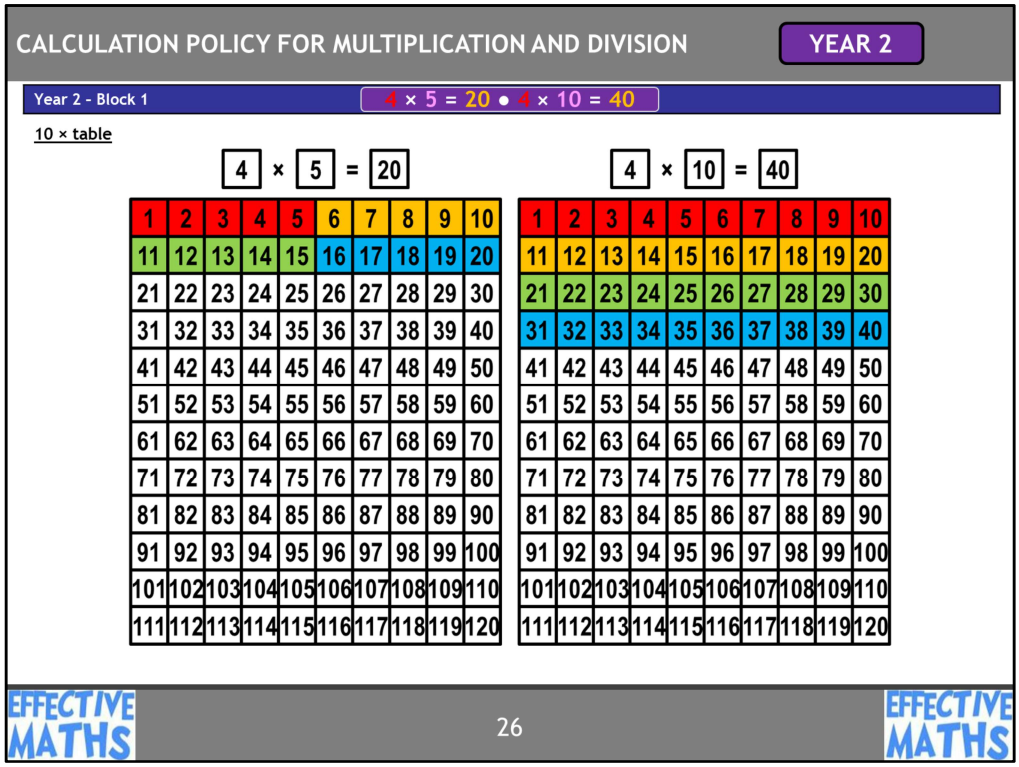
10 + 10 + 10 = 3 × 10

Teaching shows how the numbers in '3 × 10' relate to the numbers in '10 + 10 + 10'.



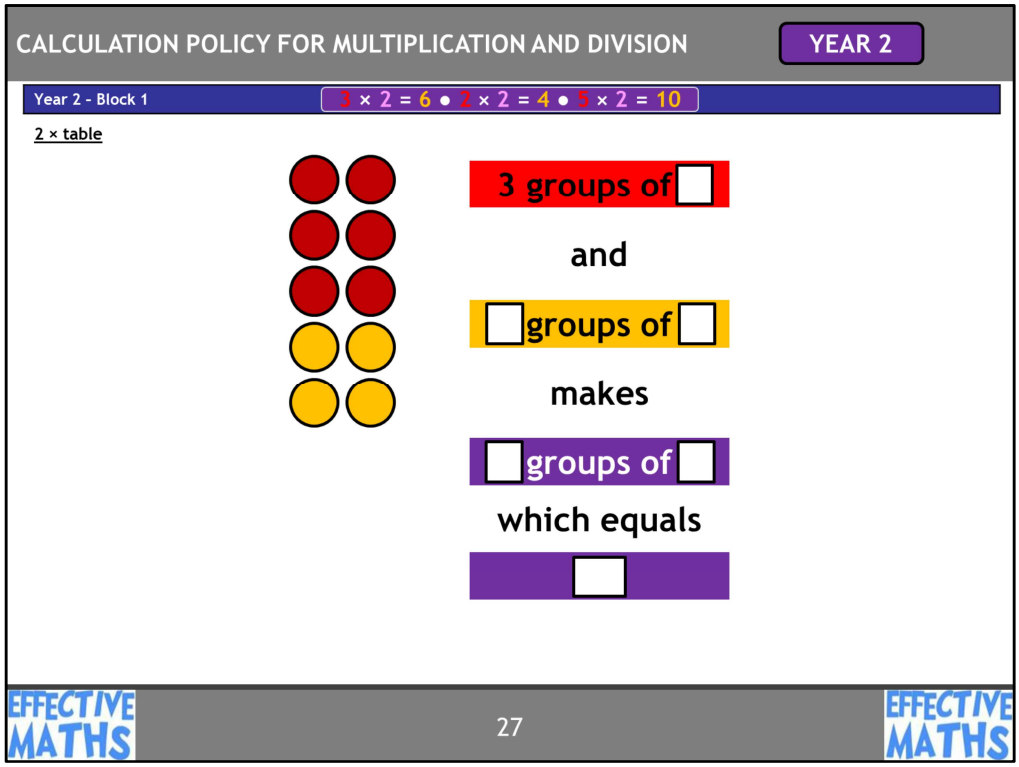
5 × table

Children's knowledge about multiplication is developed by learning about the 5 × table. The array is introduced as a key tool for conceptual understanding. Pictures are used as prompts for writing multiplication equations, eg:
4 × 5 = 20.
Teaching encourages children to explain how each term links to the context.



10 × table

Learning about the 10 × table continues to make use of arrays and the interpretation of pictorial representations. Links between the 5 × table and 10 × table are also explored.



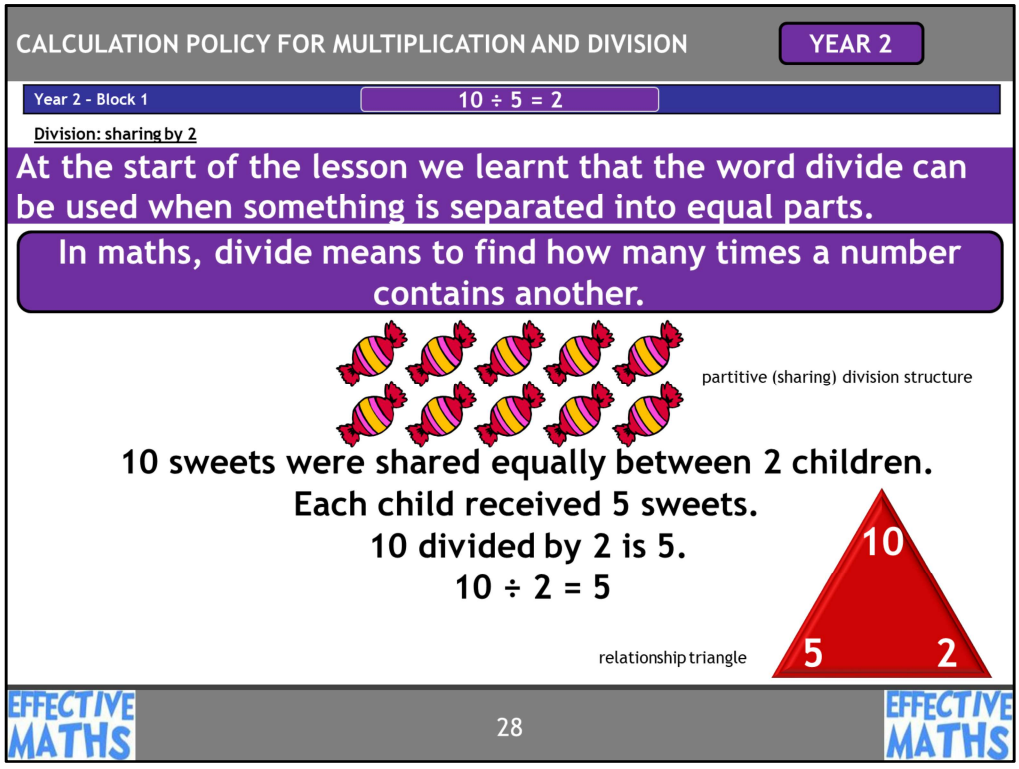
2 × table

Learning about the 2 × table also continues to make use of arrays. An early introduction to the distributive property of multiplication (not referred to as such) deepens understanding about multiplication. For example:

3 × 2 = 6

2 × 2 = 4

5 × 2 = 10

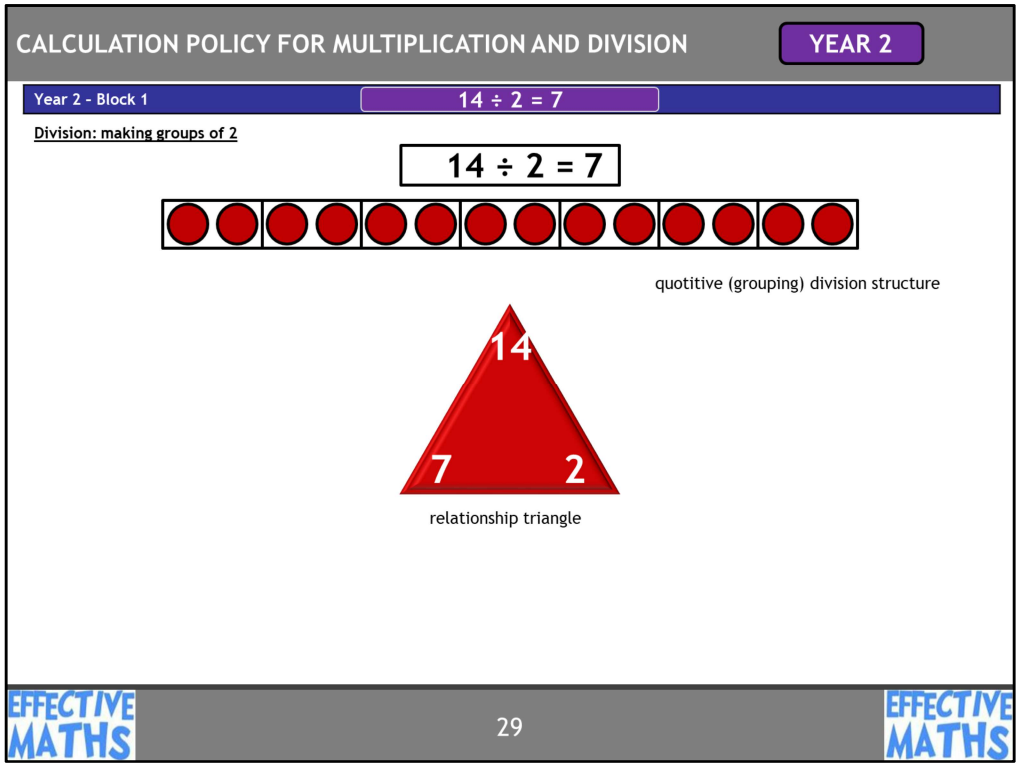


Division: sharing by 2

Learning about division begins by understanding that the term divide can be used when something is separated into equal parts. Learning to divide by 2 begins with the partitive (sharing) division structure. Children are introduced to the division symbol: ÷. Connections are made between division and multiplication, supported by the relationship triangle, eg:

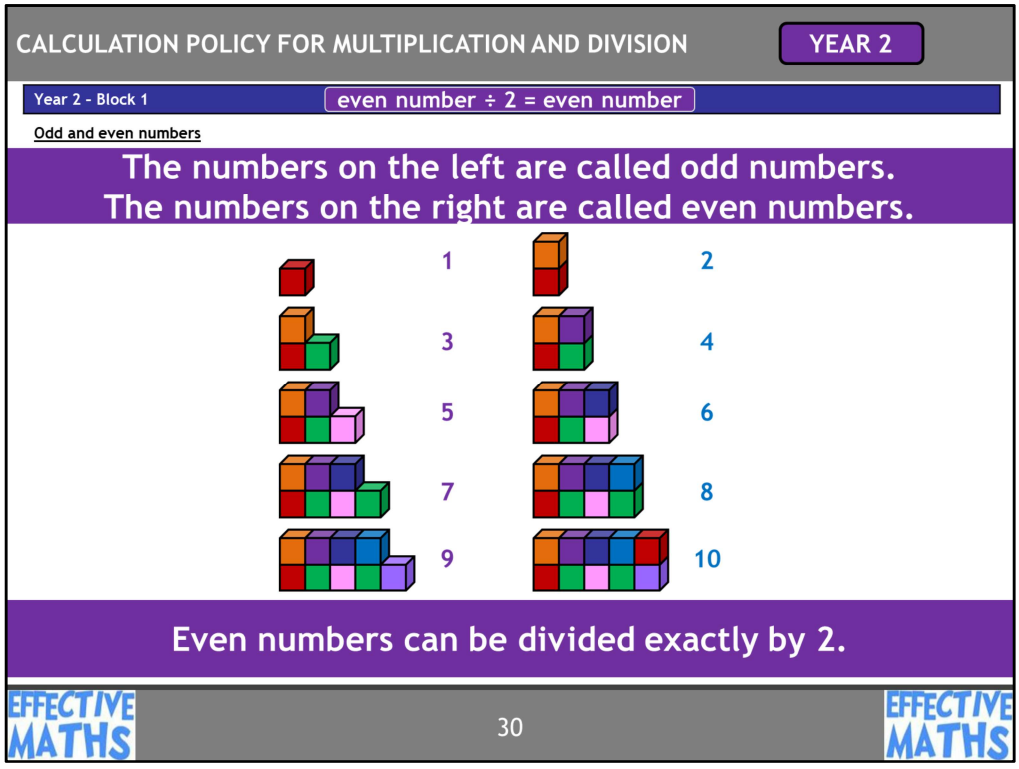
10 ÷ 2 = 5

5 × 2 = 10



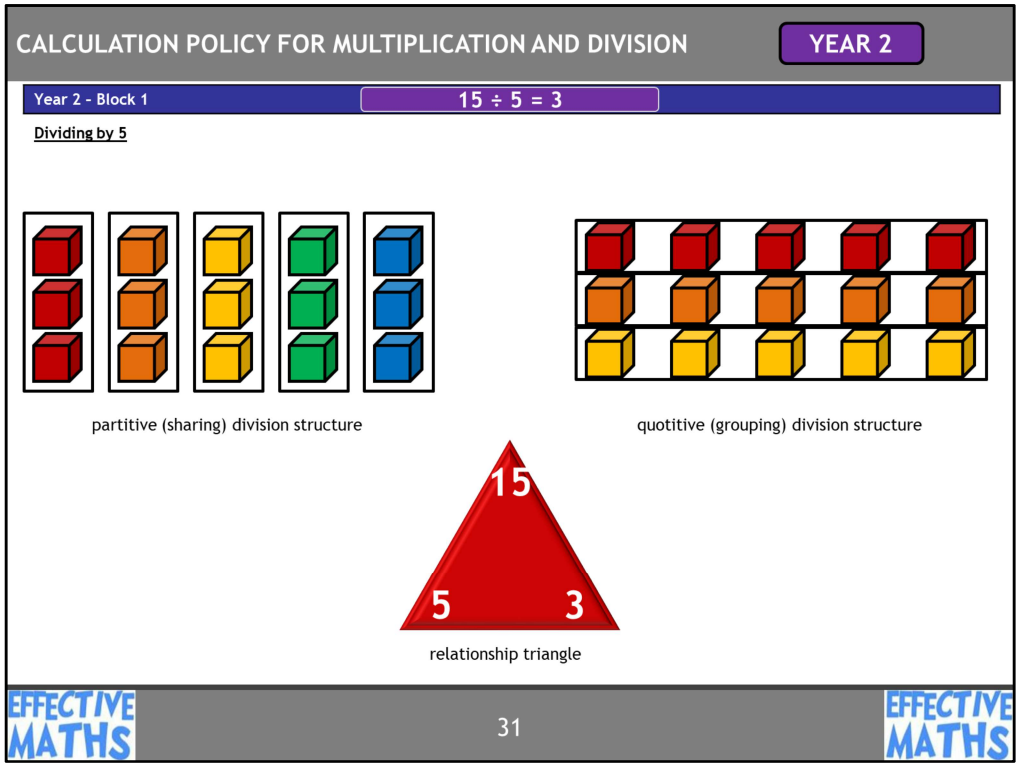
Division: making groups of 2

The quotitive division structure is introduced next and children learn to make equal groups. Links between multiplication and division continue to be supported by the relationship triangle.



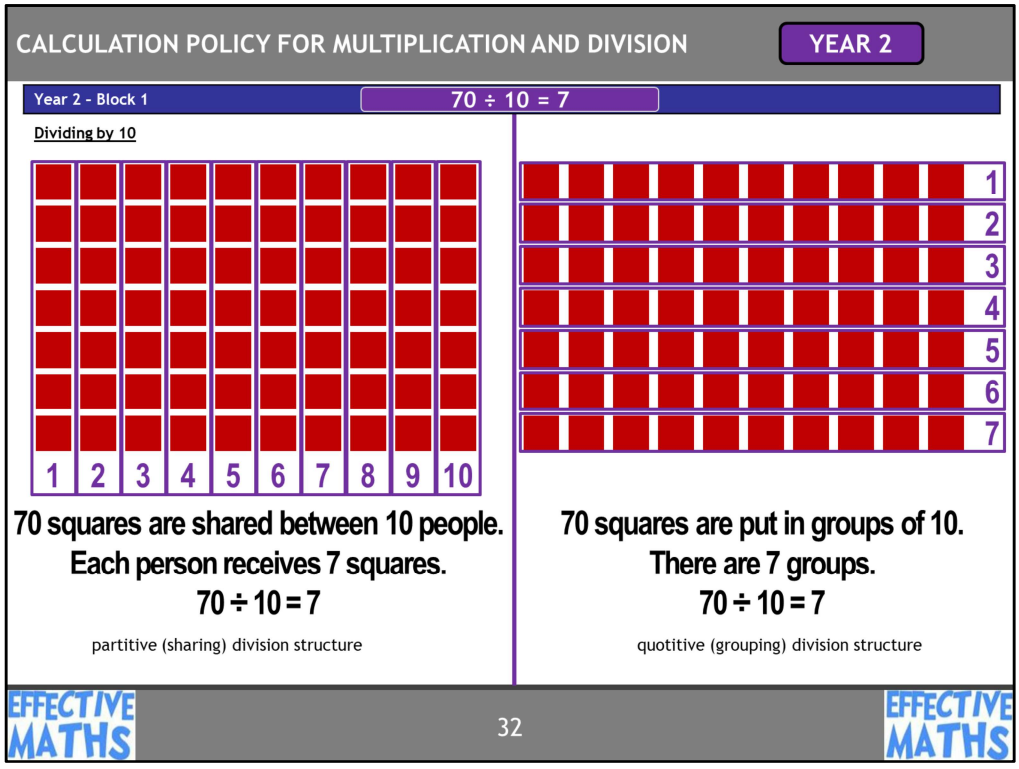
Odd and even numbers

Learning explores dividing by 2 using the context of odd and even numbers and children learn that even numbers can be divided exactly by 2.



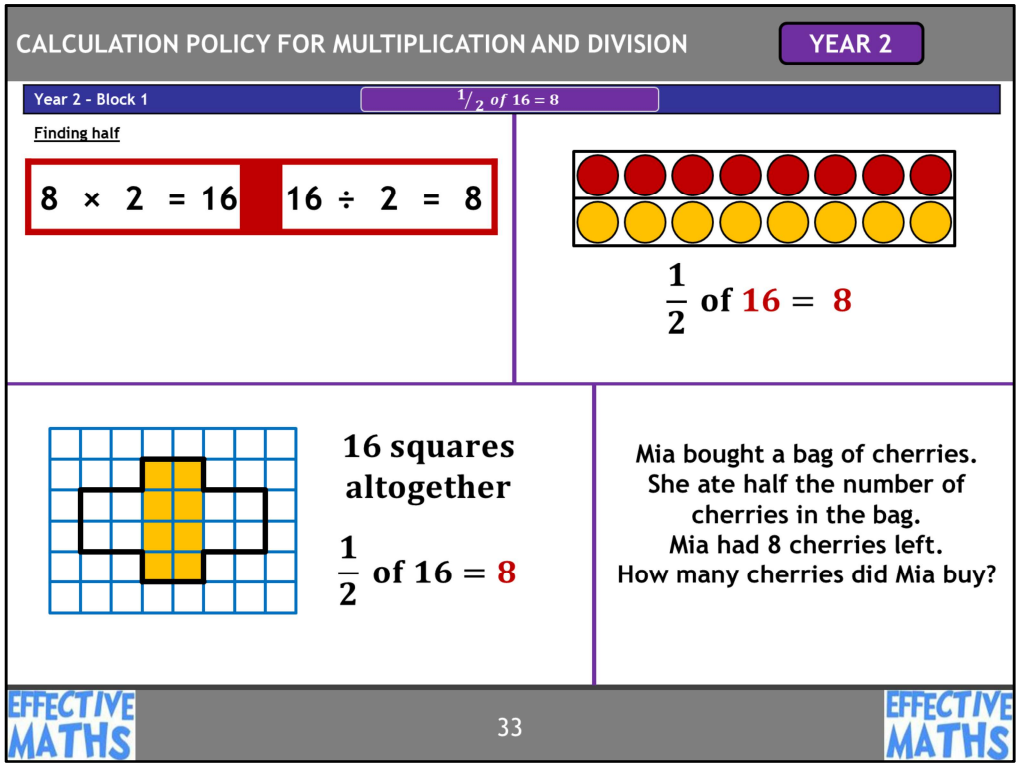
Dividing by 5

Learning to divide by 5 involves both sharing and grouping structures. Teaching seeks to help children to see where the quotient is in each structure:
for sharing - the number in each group;
for grouping – the number of groups.
The relationship triangle is used to help make links between multiplication and division.



Dividing by 10

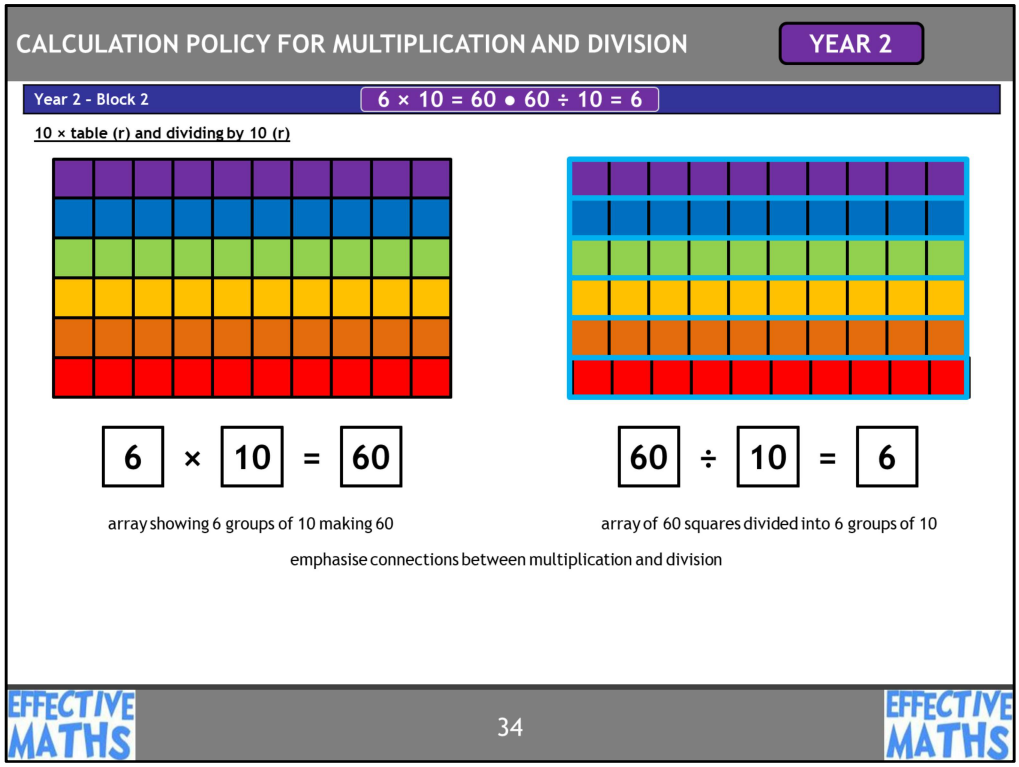
Block 1 concludes with learning to divide by 10, using both sharing and grouping structures.



BLOCK 1
FRACTIONS UNIT 1

Finding half

Learning to find half of a number, a group of objects or a shape begins by revisiting the connections between the 2 × table and its related division facts. The focus is on finding half of numbers to 20. Children engage in a range of contexts that involve finding half of even numbers to 20.

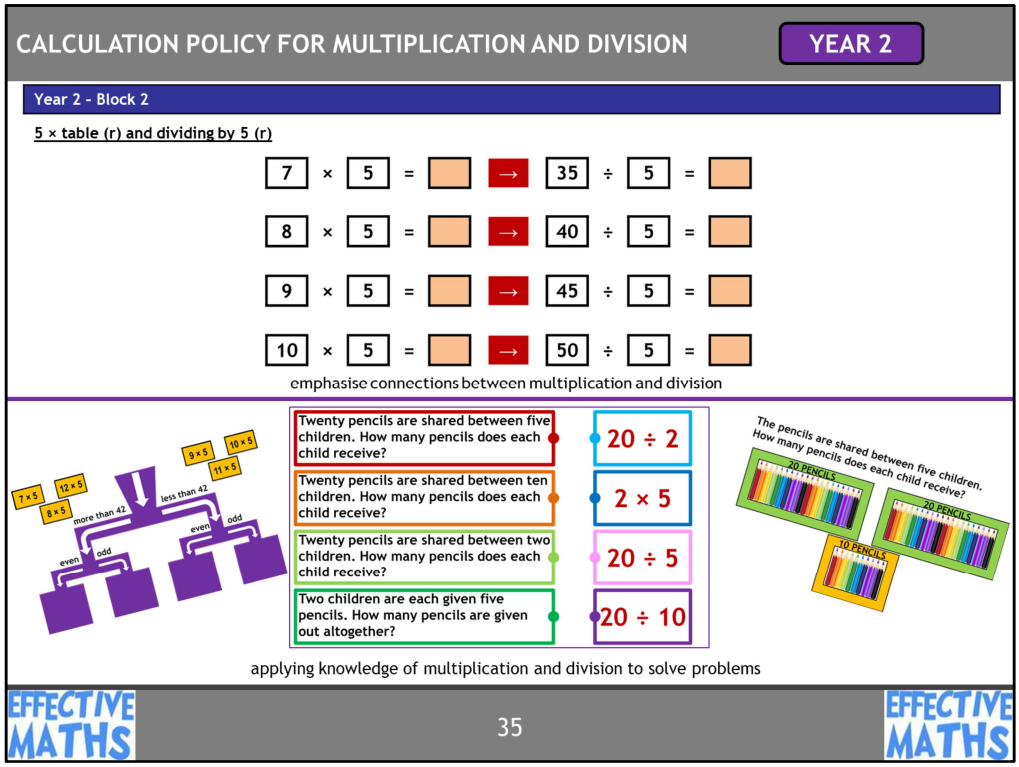


BLOCK 2
× AND ÷ UNIT 2

10 × table (r) and dividing by 10 (r)

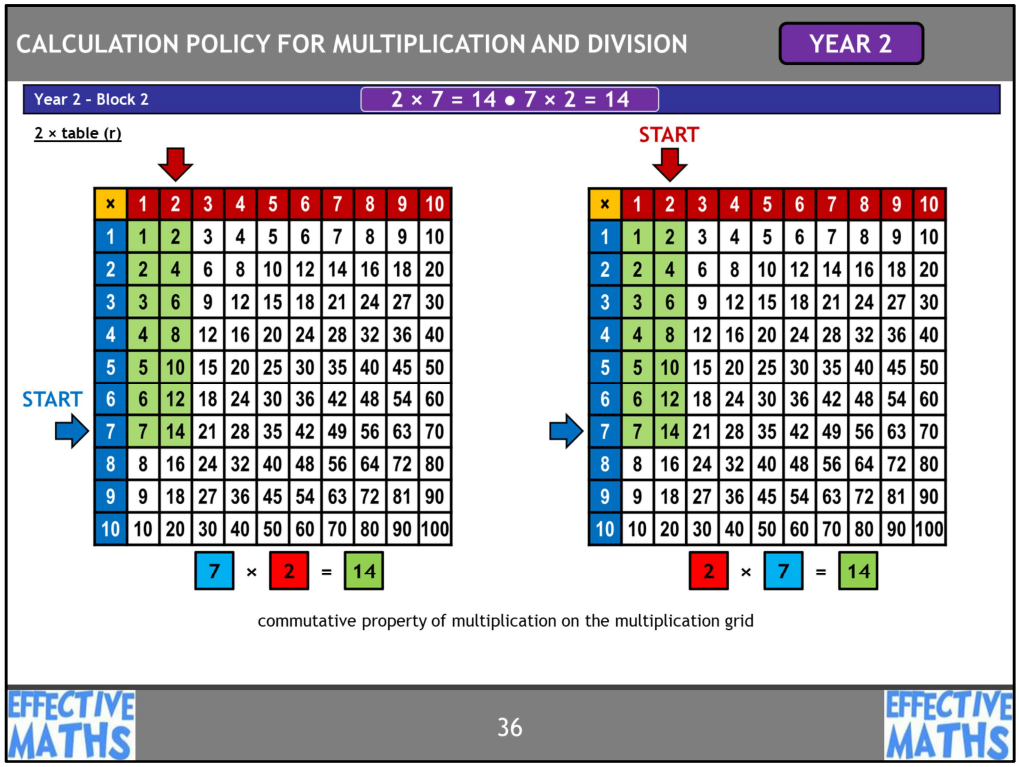
Block 2 begins with revision of the 10 × table and the related division facts. There are no new representations. Children continue to work with arrays, including arrays that support early understanding of the distributive property of multiplication.

There is an emphasis on strengthening connections between multiplication and division and this is echoed in fluency sessions. Children have had considerable exposure to the key concepts about multiplication and division and there should be a focus on committing multiplication and division facts to memory.



5 × table (r) and dividing by 5 (r)

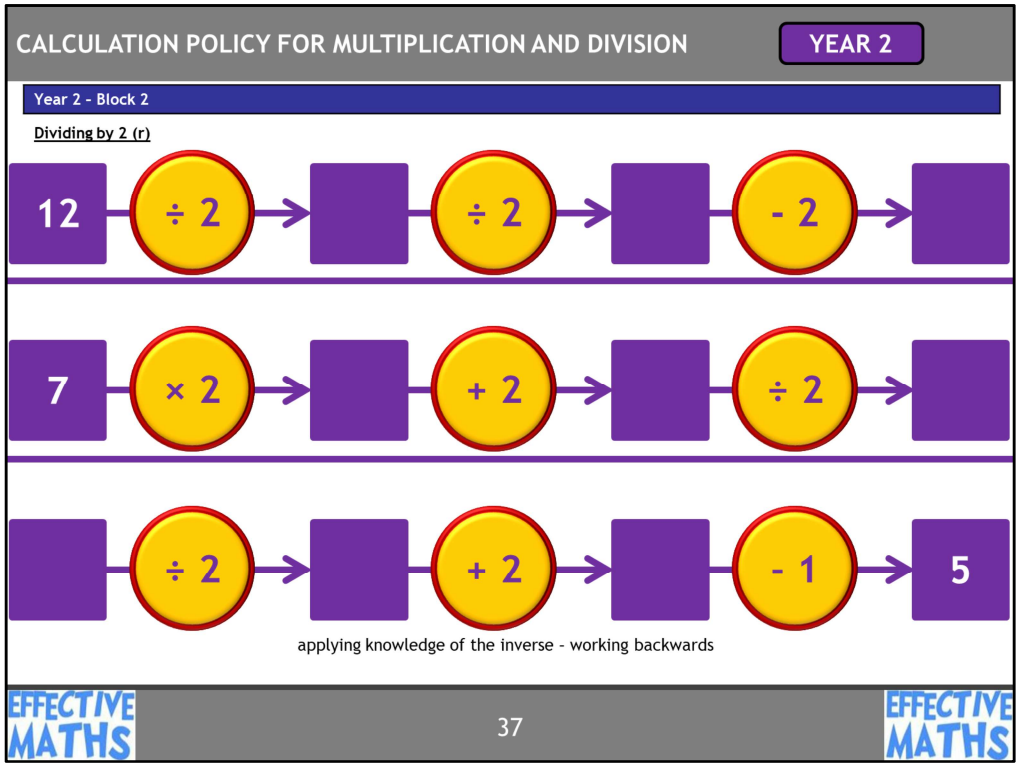
As with the 10 × table, there are no new representations. Again, there is an emphasis on strengthening connections between multiplication and division and this is echoed in fluency sessions. Throughout Block 2 there is a focus on applying knowledge of multiplication and division to solve problems.



2 × table (r)

Learning about the 2 × table does introduce a new representation: the multiplication grid. The core purpose of the lesson is to familiarise children with how the grid works as it is likely something they will encounter. Teaching introduces the commutative property and shows how we obtain the same product regardless of the order of the factors.

The multiplication grid may look a bit like a 100 square, but it works in a very different way. The multiplication grid is actually arrays. The first grid shows 7 rows of 2. The second shows 2 columns of 7.



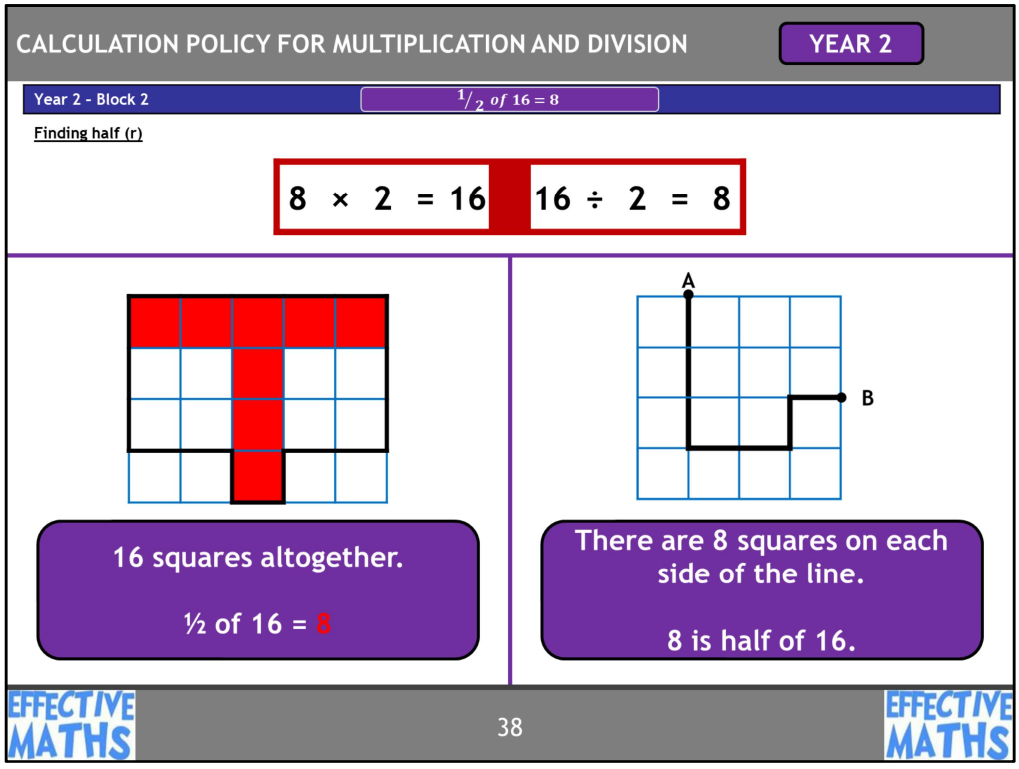
Dividing by 2 (r)

Solving problems involving dividing by 2 introduces the concept of inverse. Children will need to learn the term, but understanding of it is best achieved by talking about *working forwards* or *working backwards*.

In the case of 7 × 2 = __ we are working forwards.

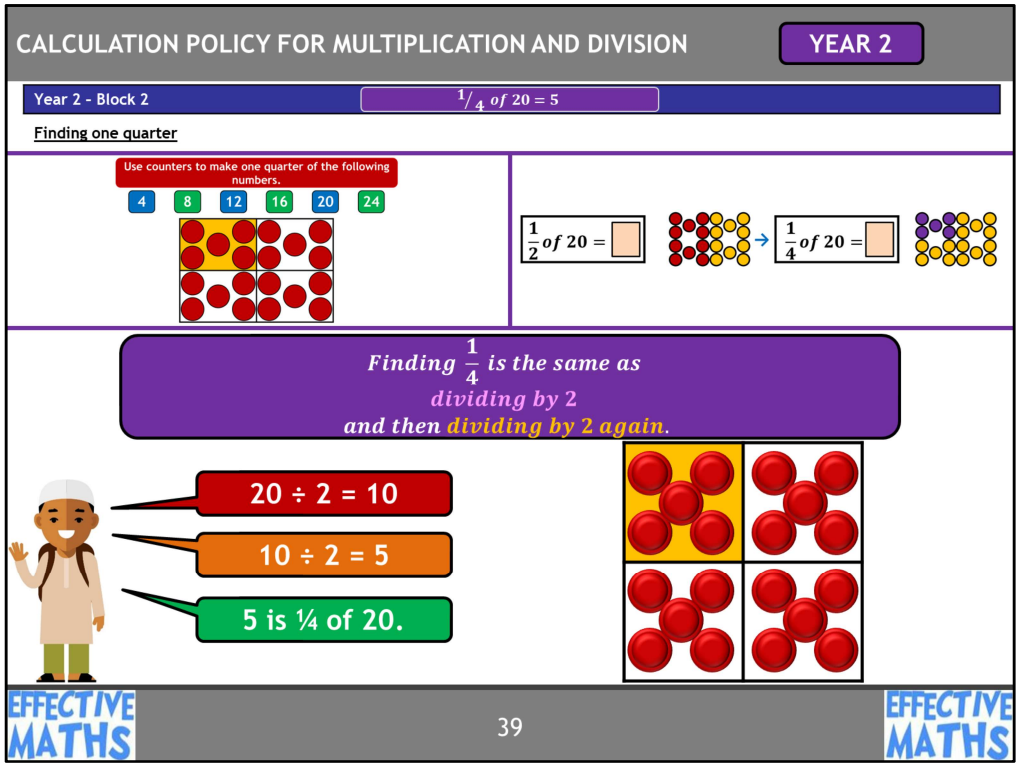
In the case of 14 = __ × 2 we are working backwards or using the inverse.

In the examples shown, we can solve row 1 and row 2 by working forwards. To solve row 3 we need to work backwards.



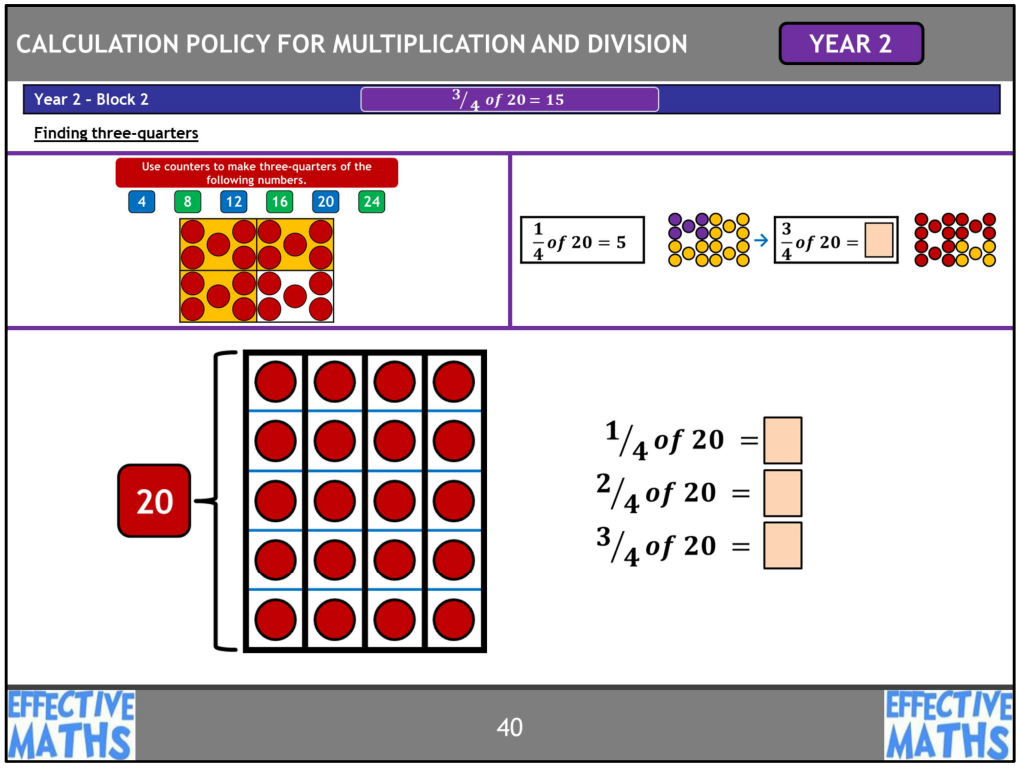
BLOCK 2
FRACTIONS UNIT 2

Finding half (r)
Revision of finding half of numbers to 20 continues to make connections between the 2 × table and its related division facts. Activities include shading shapes to show one-half and also drawing lines on grids to divide shapes into halves.



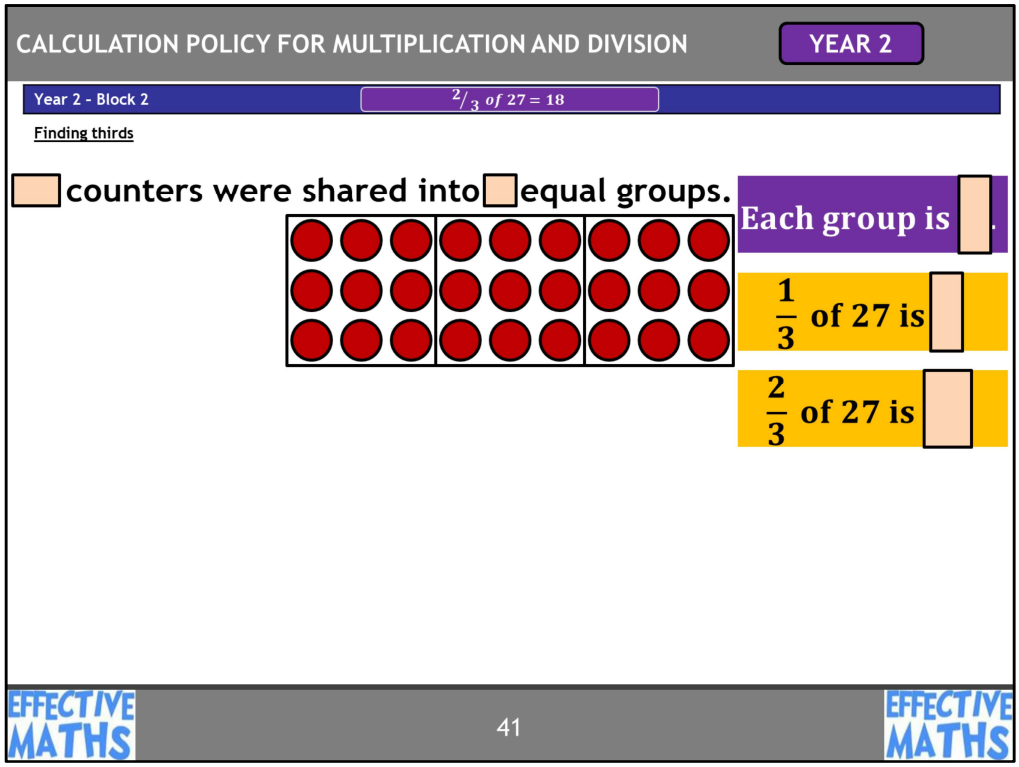
Finding one quarter

Children learn that one quarter of a set of objects occurs when the whole is split into 4 equal parts. Note that the 4 × table has not been taught in Year 2 – it is taught in Year 3 – so children cannot use their knowledge of division facts to obtain one quarter. A range of approaches are used, including using concrete resources, encouraging the use of drawing and linking to knowledge of finding half.



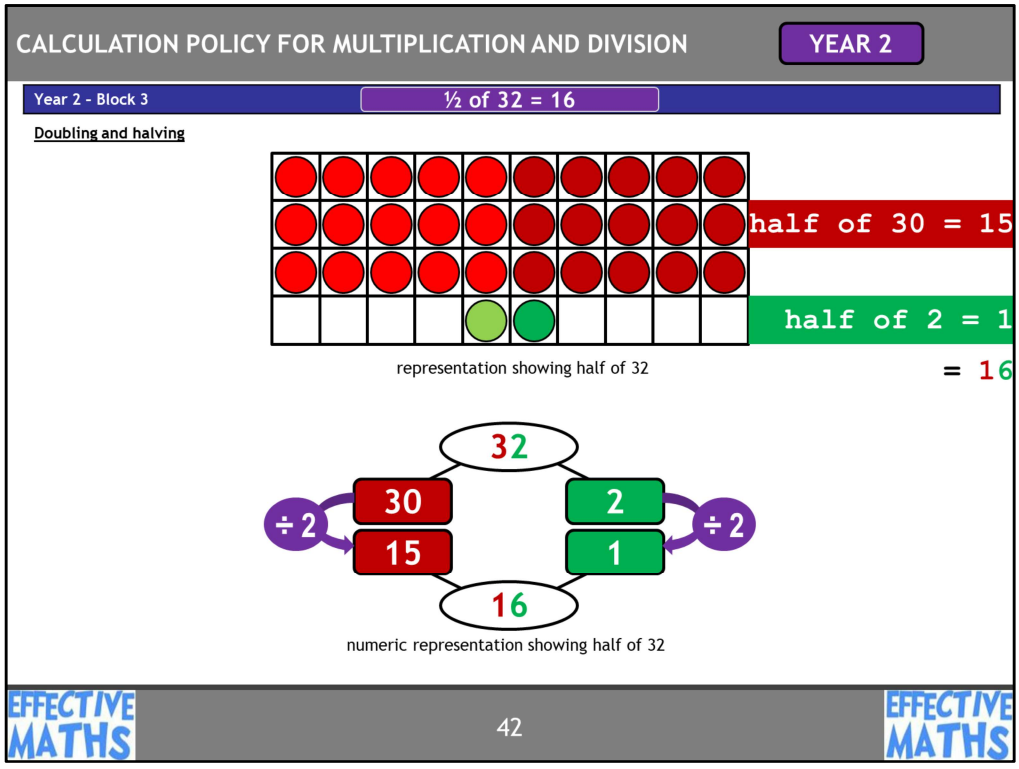
Finding three-quarters

Finding three-quarters of a set is initially done through using concrete resources. Connections are also made to finding one quarter: *if one quarter is 5, then two-quarters is 10 and three-quarters is 15.*



Finding thirds

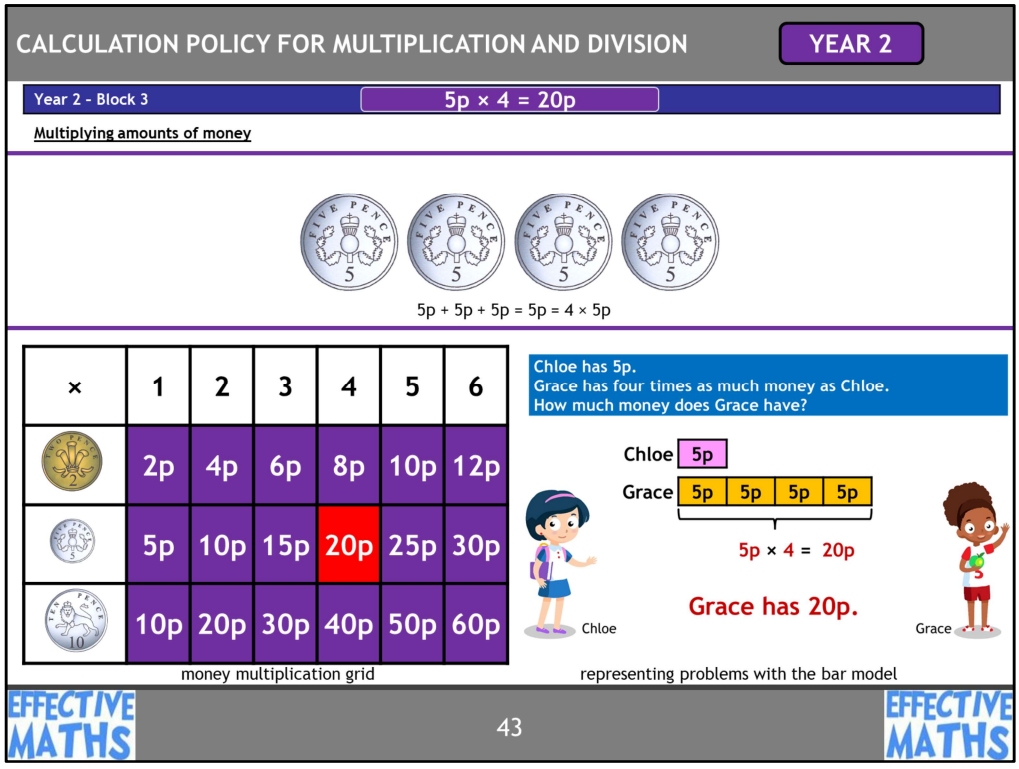
Children learn that one third of a set of objects occurs when the whole is split into 3 equal parts. Note that the 3 × table has not been taught in Year 2 – it is taught in Year 3 – so children cannot use their knowledge of division facts to obtain one third. Nor can they make links to other maths facts they know. They have had experience of counting in threes and the use of concrete resources, visual representations and drawing are the prime strategies for finding thirds. As for learning to find three-quarters, children apply their knowledge of finding one-third to finding two-thirds.



BLOCK 3
CALCULATION UNIT

Doubling and halving

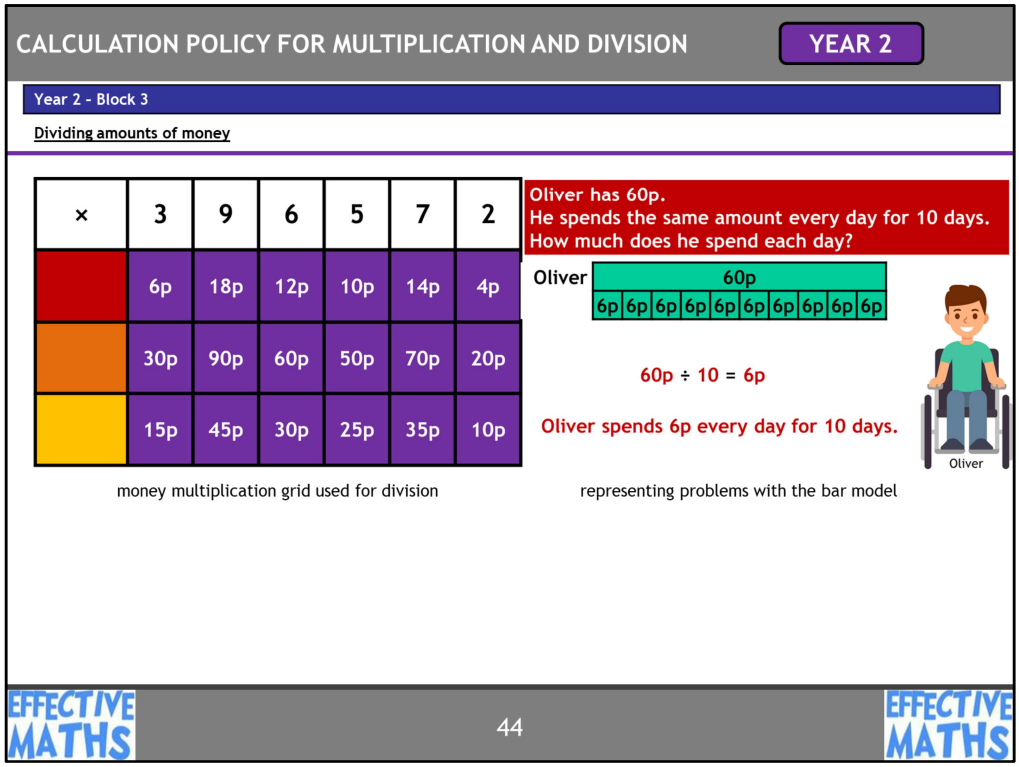
Understanding of doubling and halving is extended to finding double/half of two-digit numbers beyond 20. The strategy modelled is to partition the two-digit number into tens and ones, find half of each part, and then combine. Children need to know half of multiples of 10 to 90 and half of the even numbers 2, 4, 6 and 8.



BLOCK 3
MONEY UNIT 2

Multiplying amounts of money

Children's knowledge of multiplication facts is applied to the context of money. Visual representations emphasise the repeated addition structure of multiplication. Children find missing amounts on a money multiplication grid and develop the ability to represent problems with bar models.



Dividing amounts of money

The money multiplication grid is used for division. Teaching makes explicit links with multiplication.

3 × __ = 6p

6p ÷ 3 = 2p

Children continue to develop the ability to represent problems with bar models.