# Raddlebarn Primary and Nursery School
# Written Method Calculation Policy (Y1 – 6)

## Division

**Approved: April 2024**
**To be reviewed: April 2025**

At Raddlebarn Primary and Nursery School we follow White Rose Maths for our teaching of maths, therefore the calculation policy is in line with this scheme of work and uses the models and images outlined in White Rose Maths lessons.

This document is broken down into addition and subtraction, and multiplication and division.

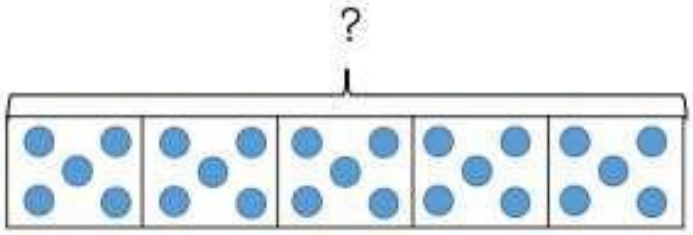
At the start of each policy, there is an overview of the different models and images that can support the teaching of different concepts. These provide explanations of the benefits of using these models and shows links between different operations.

Each operation is then broken down into skills and each skill has a dedicated page showing the different models and images that are to be used to effectively to teach that concept. At Raddlebarn, we have chosen 'Bar Modelling' as our primary problem-solving tool.

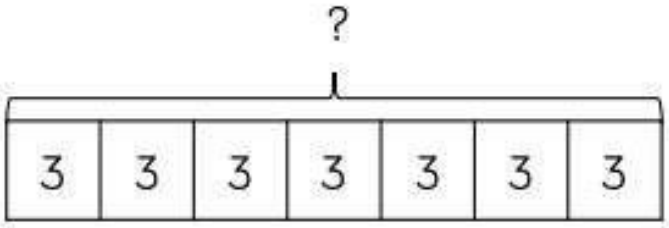
There is an overview of skills linked to year groups to support consistency throughout Raddlebarn. A glossary of terms is provided at the end of the calculation policy to support the understanding of key language used to teach the four operations.

The teaching of times tables is taught within maths lessons. Within this policy it has models and images that are used to explicitly teach the times tables. We also use an online platform called 'Times Table Rockstars (TTRS) to aid the teaching of times tables. Children are encouraged to use this at home and in class.

# Bar Model

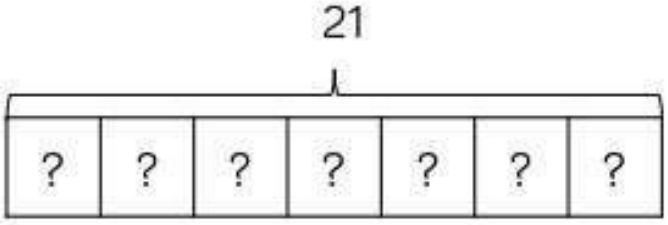



$5 \times 5 = 25$

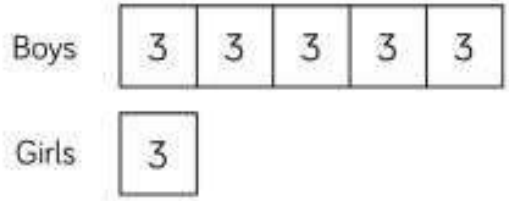



$3 \times 7 = 21$

$7 \times 3 = 21$




$21 \div 7 = 3$




## Benefits

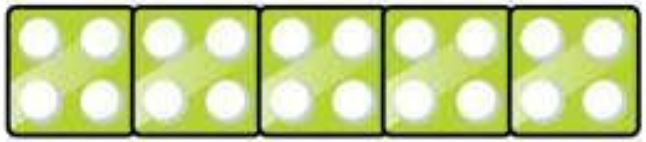
Children can use the single bar model to represent multiplication as repeated addition. They could use counters, cubes or dots within the bar model to support calculation before moving on to placing digits into the bar model to represent the multiplication.

Division can be represented by showing the total of the bar model and then dividing the bar model into equal groups.

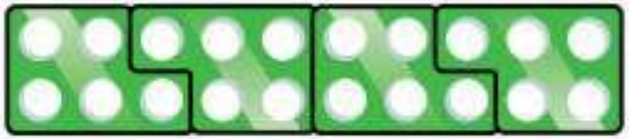
It is important when solving word problems that the bar model represents the problem.

Sometimes, children may look at scaling problems. In this case, more than one bar model is useful to represent this type of problem, eg. There are 3 girls in a group. There are 5 times more boys than girls. How many boys are there?
The multiple bar model provides an opportunity to compare the groups.

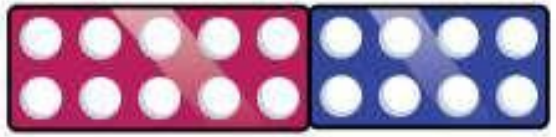
# Number Shapes



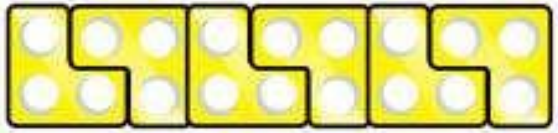
$5 \times 4 = 20$
$4 \times 5 = 20$



$5 \times 4 = 20$
$4 \times 5 = 20$



$18 \div 3 = 6$



## Benefits

Number shapes support children's understanding of multiplication as repeated addition.

Children can build multiplications in a row using the number shapes. When using odd numbers, encourage children to interlock the shapes so there are no gaps in the row. They can then use the tens number shapes along with other necessary shapes over the top of the row to check the total. Using the number shapes in multiplication can support children in discovering patterns of multiplication e.g. odd × odd = even, odd × even = odd, even × even = even.

When dividing, number shapes support children's understanding of division as grouping. Children make the number they are dividing and then place the number shape they are dividing by over the top of the number to find how many groups of the number there are altogether e.g. There are 6 groups of 3 in 18.

# Bead Strings

$5 \times 3 = 15$
$3 \times 5 = 15$

$15 \div 3 = 5$

$5 \times 3 = 15$
$3 \times 5 = 15$

$15 \div 5 = 3$

$4 \times 5 = 20$
$5 \times 4 = 20$

$20 \div 4 = 5$

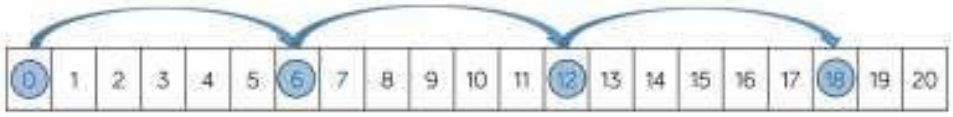
## Benefits

Bead strings to 100 can support children in their understanding of multiplication as repeated addition. Children can build the multiplication using the beads. The colour of beads supports children in seeing how many groups of 10 they have, to calculate the total more efficiently.
Encourage children to count in multiples as they build the number e.g. 4, 8, 12, 16, 20.

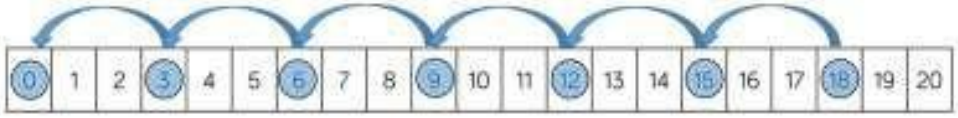
Children can also use the bead string to count forwards and backwards in multiples, moving the beads as they count.

When dividing, children build the number they are dividing and then group the beads into the number they are dividing by e.g. 20 divided by 4 – Make 20 and then group the beads into groups of four. Count how many groups you have made to find the answer.

# Number Tracks


$6 \times 3 = 18$
$3 \times 6 = 18$




$18 \div 3 = 6$

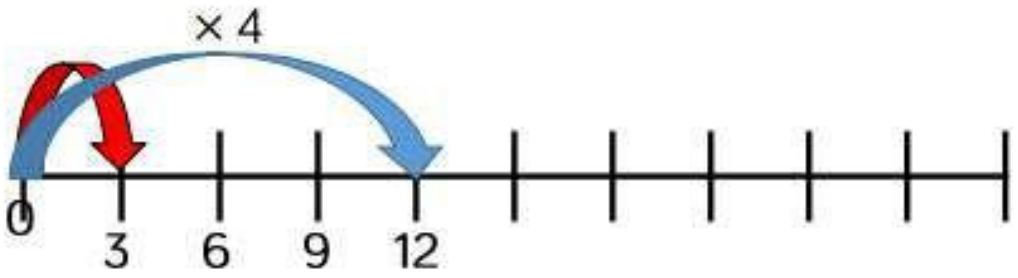
## Benefits

Number tracks are useful to support children to count in multiples, forwards and backwards. Moving counters or cubes along the number track can support children to keep track of their counting. Translucent counters help children to see the number they have landed on whilst counting.

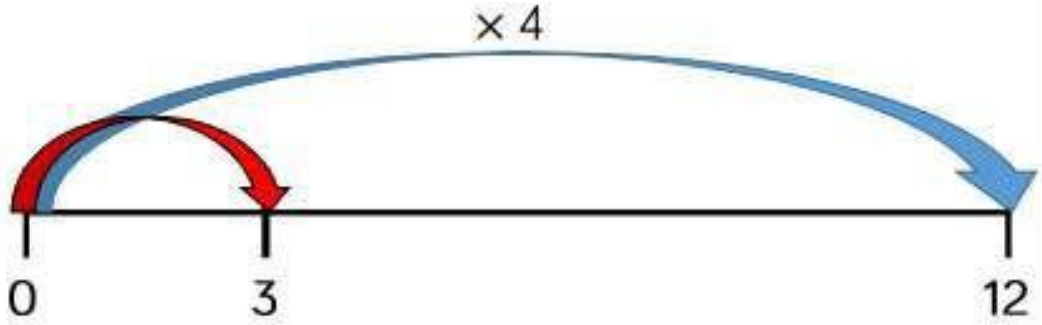
When multiplying, children place their counter on 0 to start and then count on to find the product of the numbers.
When dividing, children place their counter on the number they are dividing and the count back in jumps of the number they are dividing by until they reach 0. Children record how many jumps they have made to find the answer to the division.

Number tracks can be useful with smaller multiples but when reaching larger numbers they can become less efficient.

# Number Lines (blank)




A red car travels 3 miles.
A blue car 4 times further.
How far does the blue car travel?




A blue car travels 12 miles.
A red car 4 times less.
How far does the red car travel?

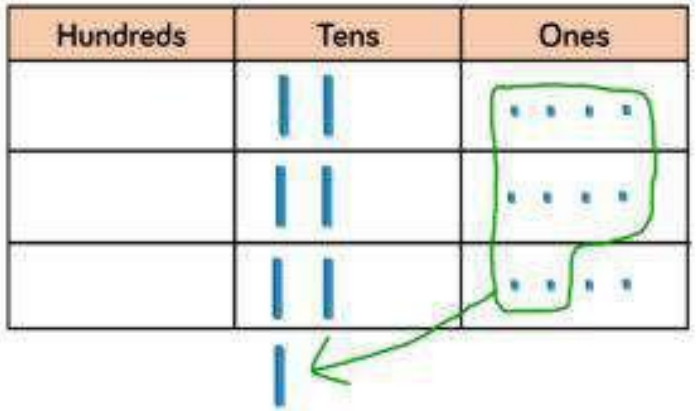
## Benefits

Children can use blank number lines to represent scaling as multiplication or division.

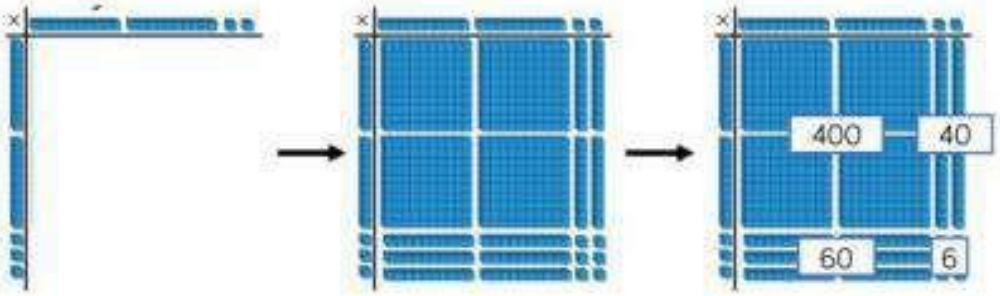
Blank number lines with intervals can support children to represent scaling accurately. Children can label intervals with multiples to calculate scaling problems.

Blank number lines without intervals can also be used for children to represent scaling.

# Base 10/Dienes (multiplication)




$$\begin{array}{r} 24 \\ \times\ 3 \\ \hline 72 \\ \hline 1 \end{array}$$



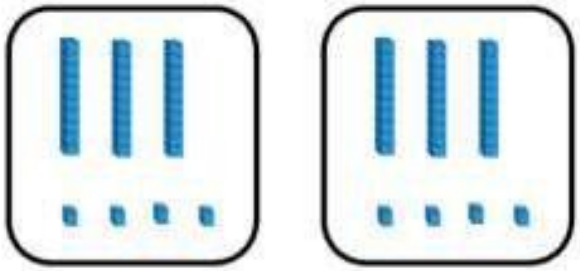

## Benefits

Using Base 10 or Dienes is an effective way to support children's understanding of column multiplication. It is important that children write out their calculation alongside the equipment so they can see how the concrete and written representations match.

As numbers become larger in multiplication or the amounts of groups becomes higher, Base 10 / Dienes becomes less efficient due to the amount of equipment and number of exchanges needed.

Base 10 also supports the area model of multiplication well. Children use the equipment to build the number in a rectangular shape which they then find the area of by calculating the total value of the pieces This area model can be linked to the grid method or the formal column method of multiplying 2-digits by 2-digits.

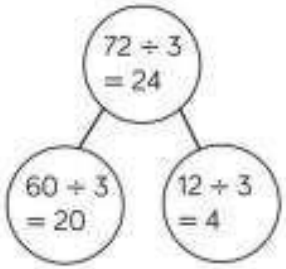
# Base 10/Dienes (division)



$68 \div 2 = 34$

| Tens | Ones |
|---|---|
| | |
| | |
| | |

$72 \div 3 = 24$



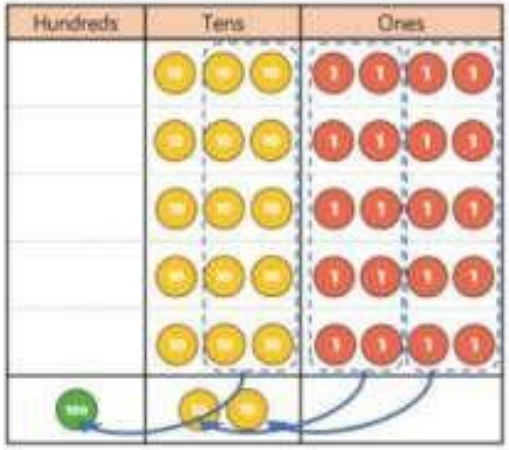

## Benefits

Using Base 10 or Dienes is an effective way to support children's understanding of division.

When numbers become larger, it can be an effective way to move children from representing numbers as ones towards representing them as tens and ones in order to divide. Children can then share the Base 10/ Dienes between different groups e.g. by drawing circles or by rows on a place value grid.

When they are sharing, children start with the larger place value and work from left to right. If there are any left in a column, they exchange e.g. one ten for ten ones. When recording, encourage children to use the part-whole model so they can consider how the number has been partitioned in order to divide. This will support them with mental methods.

# Place Value Counters (multiplication)




$$\begin{array}{r} 34 \\ \times\ 5 \\ \hline 170 \\ \hline 1\ 2 \end{array}$$


$$\begin{array}{r} 44 \\ \times\ 32 \\ \hline 8 \\ 80 \\ 120 \\ +\ 1200 \\ \hline 1408 \\ \hline 1 \end{array}$$

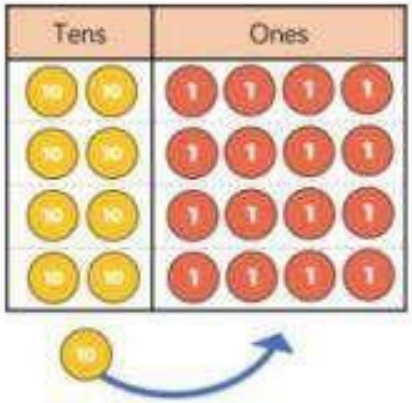
## Benefits

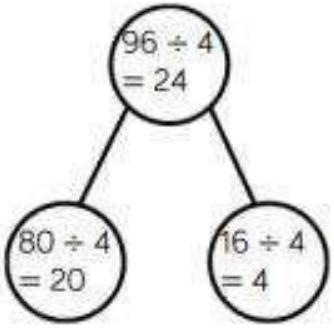
Using place value counters is an effective way to support children's understanding of column multiplication. It is important that children write out their calculation alongside the equipment so they can see how the concrete and written match.

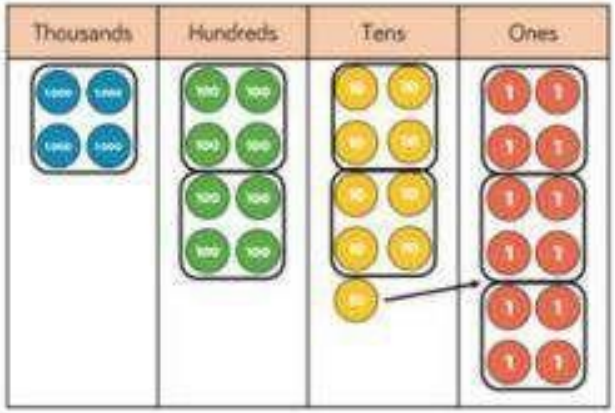
As numbers become larger in multiplication or the amounts of groups becomes higher, Base 10 / Dienes becomes less efficient due to the amount of equipment and number of exchanges needed The counters should be used to support the understanding of the written method rather than support the arithmetic.

Place value counters also support the area model of multiplication well. Children can see how to multiply 2-digit numbers by 2-digit numbers.

# Place Value Counters (division)




$$\begin{array}{r} 1223 \\ 4\overline{)4892^{1}} \end{array}$$

## Benefits

Using place value counters is an effective way to support children's understanding of division.

When working with smaller numbers, children can use place value counters to share between groups. They start by sharing the larger place value column and work from left to right. If there are any counters left over once they have been shared, they exchange the counter e.g. exchange one ten for ten ones. This method can be linked to the part-whole model to support children to show their thinking.

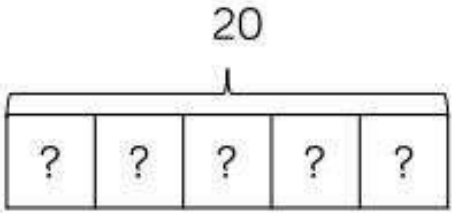
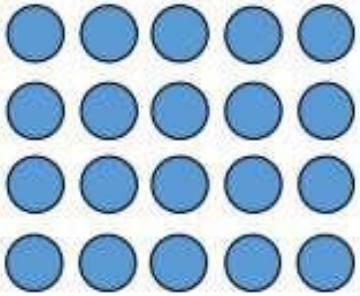
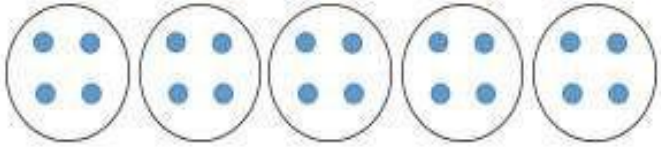
Place value counters also support children's understanding of short division by grouping the counters rather than sharing them. Children work from left to right through the place value columns and group the counters in the number they are dividing by. If there are any counters left over after they have been grouped, they exchange the counter e.g. exchange one hundred for ten tens.


# Division

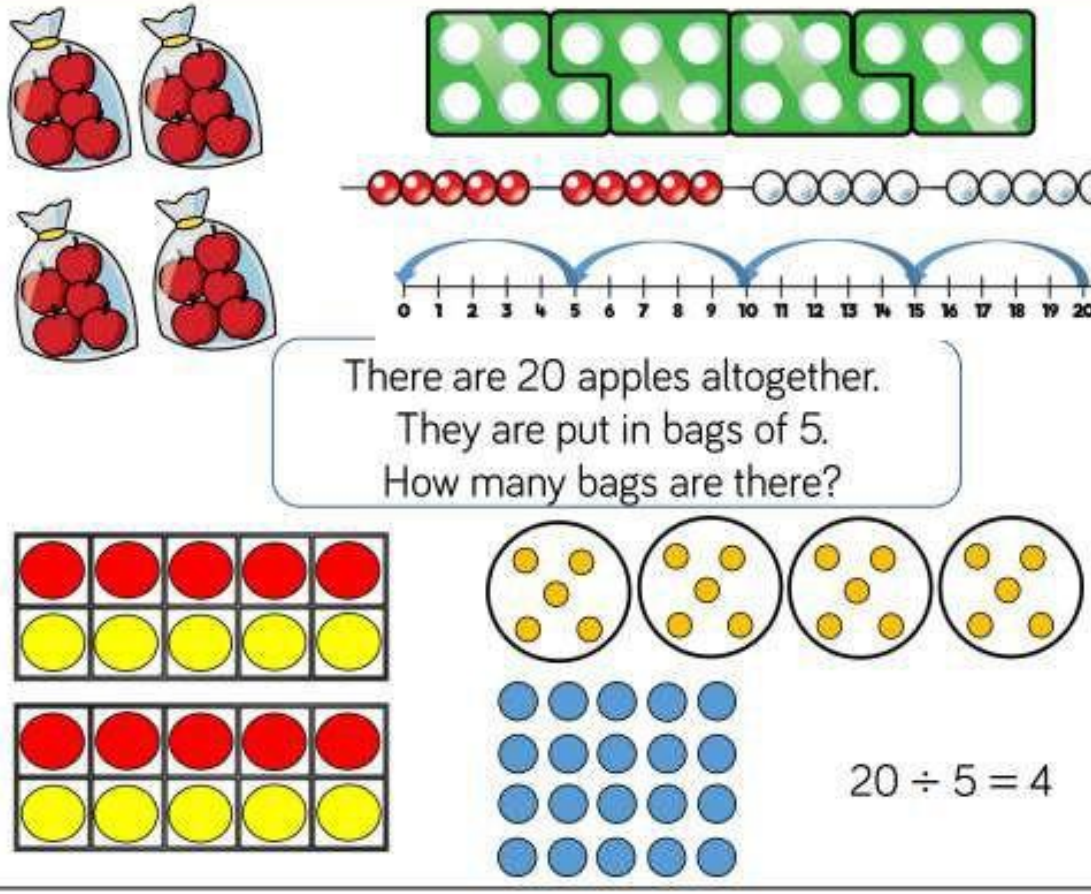
| Skill | Year | Representations and models | |
|---|---|---|---|
| Solve one-step problems with division (sharing) | 1/2 | Bar model<br>Real life objects | Arrays<br>Counters |
| Solve one-step problems with division (grouping) | 1/2 | Real life objects<br>Number shapes<br>Bead strings<br>Ten frames | Number lines<br>Arrays<br>Counters |
| Divide 2-digits by 1-digit (no exchange sharing) | 3 | Straws<br>Base 10<br>Bar model | Place value counters<br>Part-whole model |
| Divide 2-digits by 1-digit (sharing with exchange) | 3 | Straws<br>Base 10<br>Bar model | Place value counters<br>Part-whole model |

| Skill | Year | Representations and models | |
|---|---|---|---|
| Divide 2-digits by 1-digit (sharing with remainders) | 3/4 | Straws<br>Base 10<br>Bar model | Place value counters<br>Part-whole model |
| Divide 2-digits by 1-digit (grouping) | 4/5 | Place value counters<br>Counters | Place value grid<br>Written short division |
| Divide 3-digits by 1-digit (sharing with exchange) | 4 | Base 10<br>Bar model | Place value counters<br>Part-whole model |
| Divide 3-digits by 1-digit (grouping) | 4/5 | Place value counters<br>Counters | Place value grid<br>Written short division |

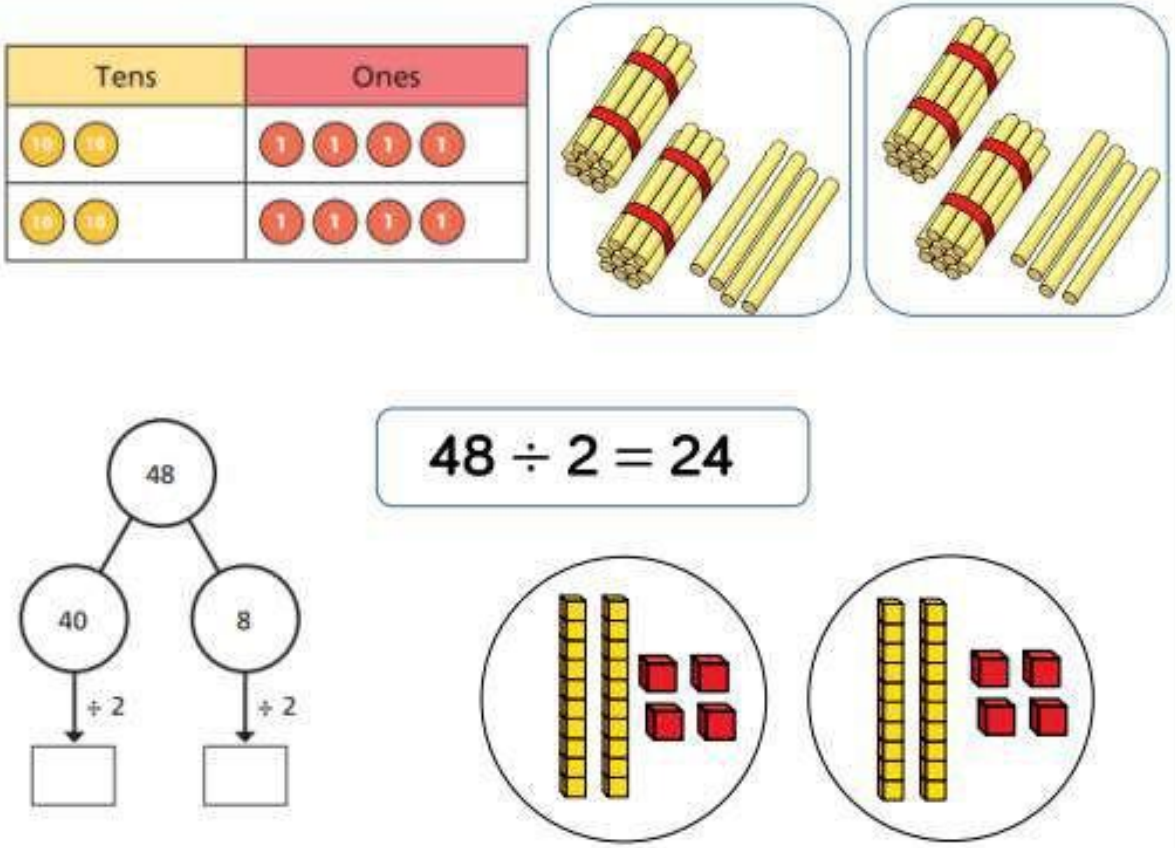
| Skill | Year | Representations and models | |
|---|---|---|---|
| Divide 4-digits by 1-digit (grouping) | 5 | Place value counters<br>Counters | Place value grid<br>Written short division |
| Divide multi-digits by 2-digits (short division) | 6 | Written short division | List of multiples |
| Divide multi-digits by 2-digits (long division) | 6 | Written long division | List of multiples |

| Skill: Solve 1-step problems using multiplication (sharing) | Year: 1/2 |
| --- | --- |
|  <br>  <br><br>There are 20 apples altogether.<br>They are shared equally between 5 bags.<br>How many apples are in each bag?<br>  <br>  <br>$20 \div 5 = 4$ | Children solve problems by sharing amounts into equal groups.<br><br>In Year 1, children use concrete and pictorial representations to solve problems. They are not expected to record division formally.<br><br>In Year 2, children are introduced to the division symbol. |

**By the end of Year 1,** children at expected standard will use concrete and pictorial representations to solve division problems.

| Skill: Solve 1-step problems using division (grouping) | Year: 1/2 |
| --- | --- |
|  | Children solve problems by grouping and counting the number of groups. Grouping encourages children to count in multiples and links to repeated subtraction on a number line. They can use concrete representations in fixed groups such as number shapes which helps to show the link between multiplication and division. |

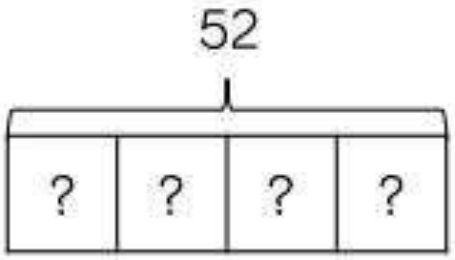
**By the end of Year 1**, children at expected standard will solve problems by grouping and counting using concrete representations

| Skill: Divide 2-digits by 1-digit (sharing with no exchange) | Year: 1/2 |
| --- | --- |
|  | When dividing larger numbers, children can use manipulatives that allow them to partition into tens and ones.<br><br>Straws, Base 10 and place value counters can all be used to share numbers into equal groups.<br><br>Part-whole models can provide children with a clear written method that matches the concrete representation. |

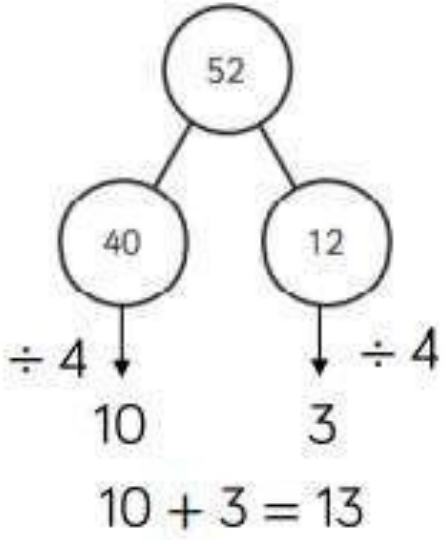
**By the end of Year 2,** children at expected standard will be introduced to the division symbol and be secure will the abstract representation e.g 48÷2 = 12

## Skill: Divide 2-digits by 1-digit (sharing with exchange)

## Year: 3/4

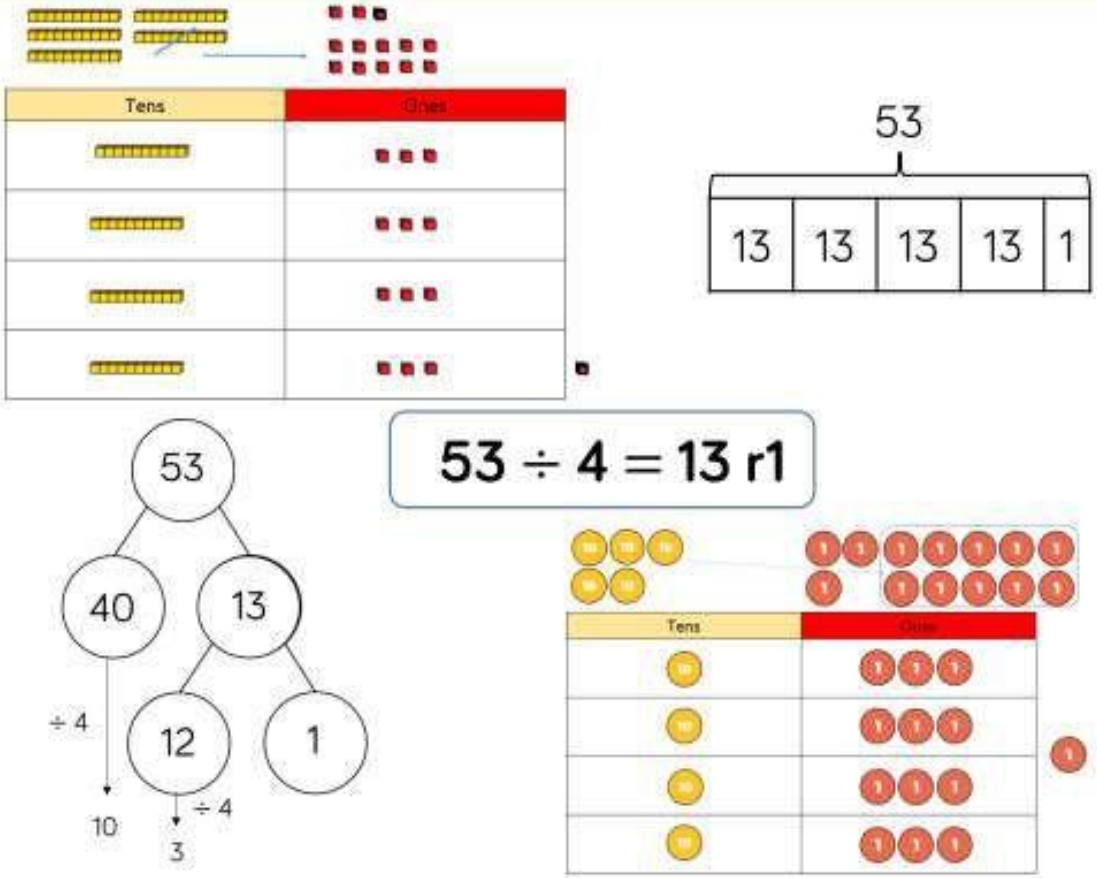

$$52 \div 4 = 13$$





When dividing numbers involving an exchange, children can use Base 10 and place value counters to exchange one ten for ten ones.
Children should start with the equipment outside the place value grid before sharing the tens and ones equally between the rows.

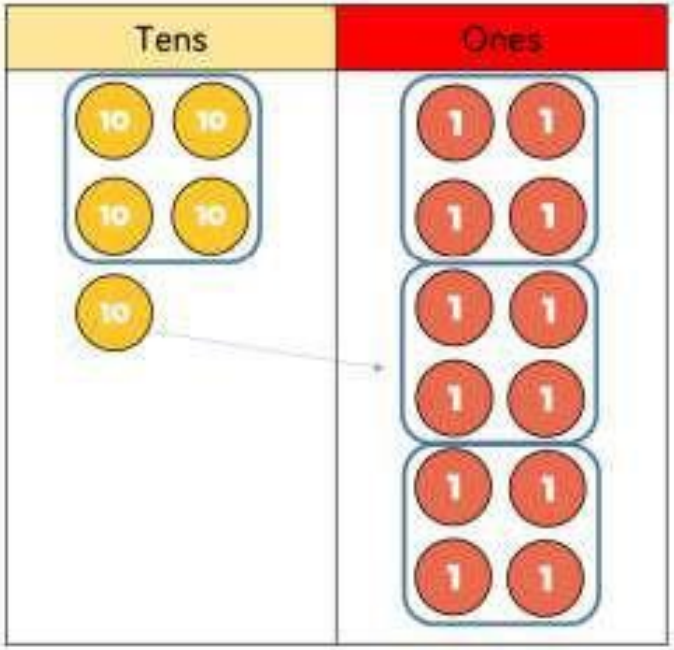
Flexible partitioning in a part-whole model supports this method.

| Skill: Divide 2-digits by 1-digit (sharing with remainders) | Year: 3/4 |
| --- | --- |
|  | When dividing numbers with remainders, children can use Base 10 and place value counters to exchange one ten for ten ones.<br>Starting with the equipment outside the place value grid will highlight remainders, as they will be left outside the grid once the equal groups have been made.<br>Flexible partitioning in a part-whole model supports this method. |

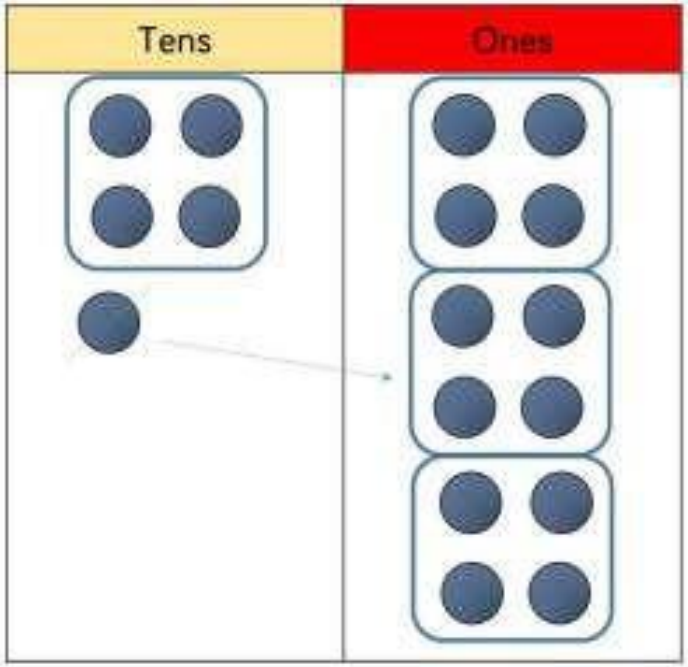
**By the end of Year 4**, children at expected standard will be secure with the abstract representation and being introduced to the written short division method.

## Skill: Divide 2-digits by 1-digit (grouping)

## Year: 4/5




| | | | | |
|---|---|---|---|---|
| | | 1 | 3 | |
| | 4 | 5 | 1 2 | |




$52 \div 4 = 13$

When using the short division method, children use grouping. Starting with the largest place value, they group by the divisor.

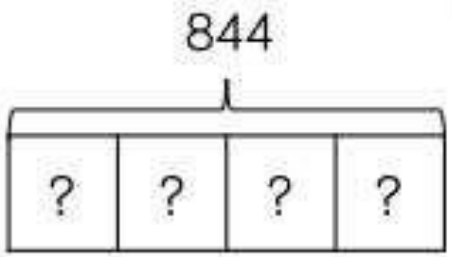
Language is important here. Children should consider 'How many groups of 4 tens can we make?' and 'How many groups of 4 ones can we make?'

Remainders can also be seen as they are left ungrouped.

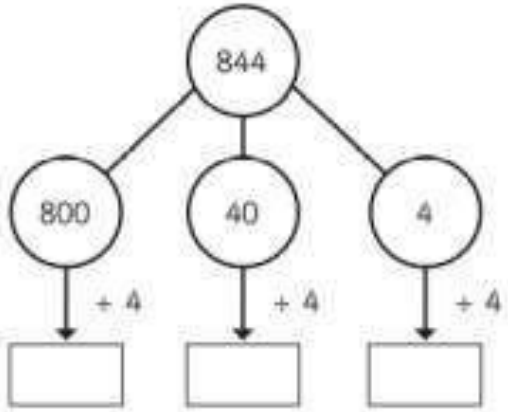
## Skill: Divide 3-digits by 1-digit (sharing)

## Year: 4

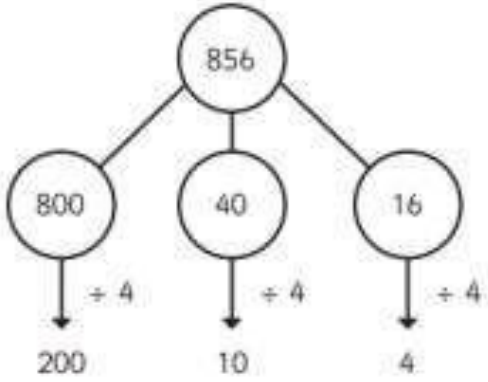
**844 ÷ 4 = 211**

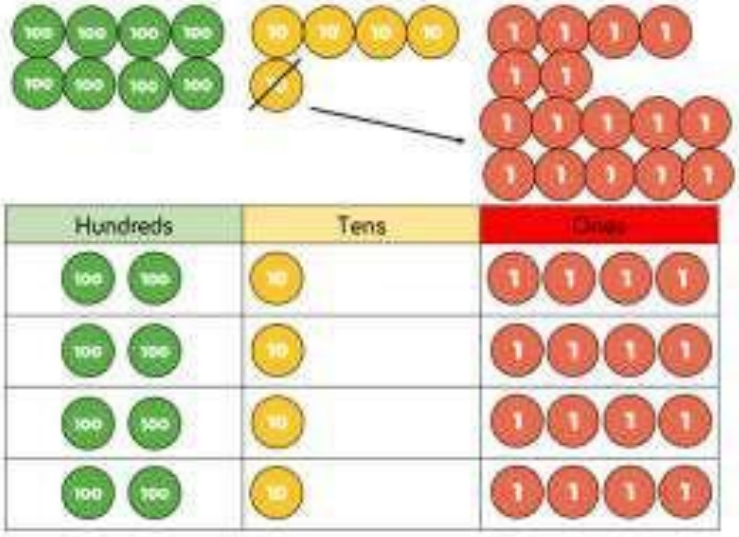







**844 ÷ 4 = 211**

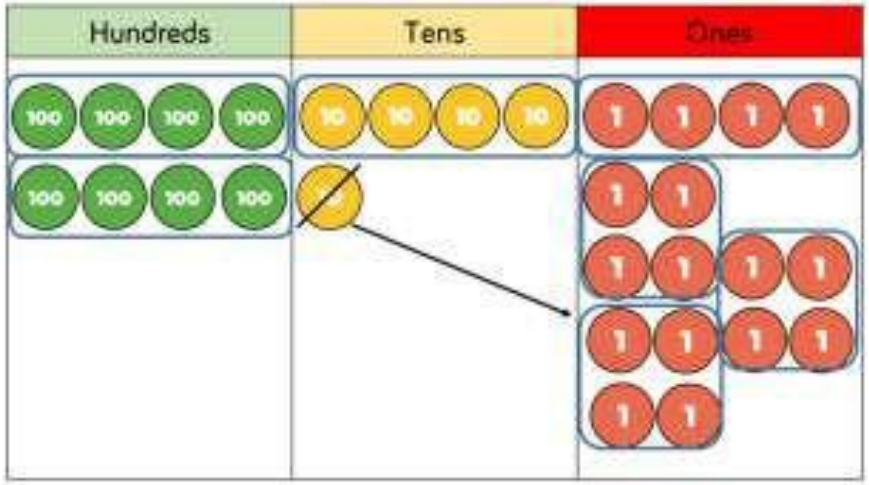


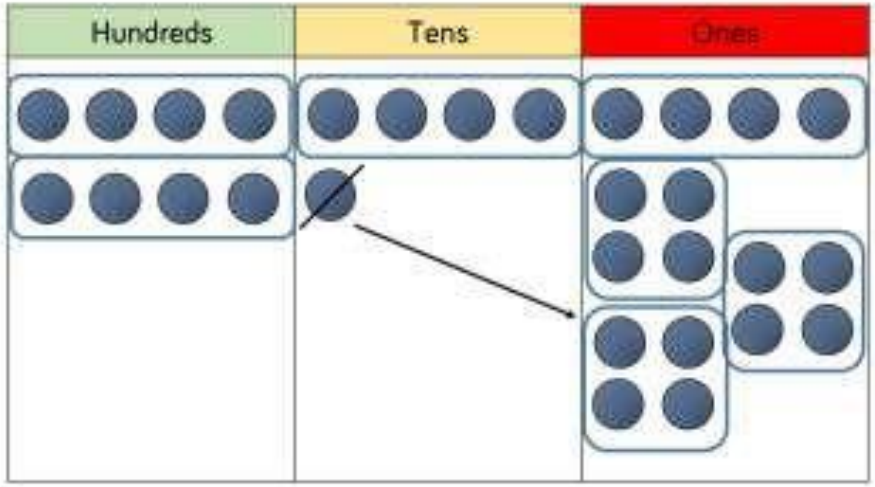

Children can continue to use place value counters to share 3-digit numbers into equal groups. Children should start with the equipment outside the place value grid before sharing the hundreds, tens and ones equally between the rows. This method can also help to highlight remainders. Flexible partitioning in a part-whole model supports this method.

## Skill: Divide 3-digits by 1-digit (grouping)

## Year: 5



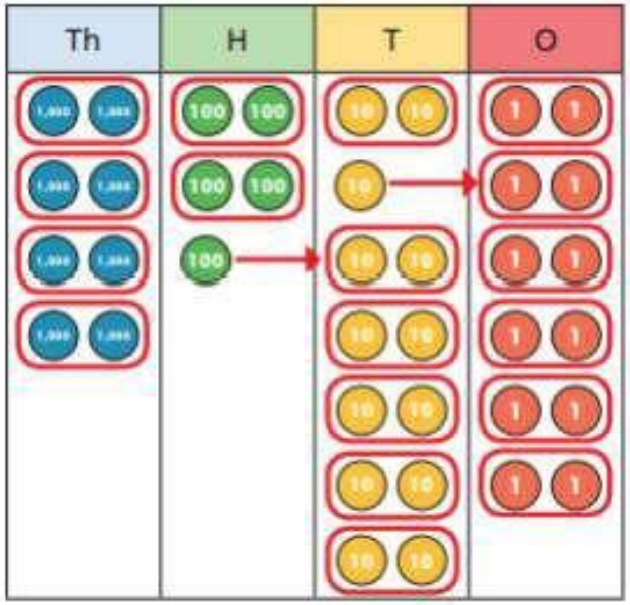

| | | | | |
|---|---|---|---|---|
| | | 2 | 1 | 4 |
| | 4 | 8 | 5 | $^{1}6$ |




$856 \div 4 = 214$

Children can continue to use grouping to support their understanding of short division when dividing a 3-digit number by a 1-digit number.

Place value counters or plain counters can be used on a place value grid to support this understanding. Children can also draw their own counters and group them through a more pictorial method.

| Skill: Divide 4-digits by 1-digit (grouping) | Year: 5 |
| --- | --- |
|  <br>$8{,}532 \div 2 = 4{,}266$ | Place value counters or plain counters can be used on a place value grid to support children to divide 4-digits by 1-digit. Children can also draw their own counters and group them through a more pictorial method.<br><br>Children should be encouraged to move away from the concrete and pictorial when dividing numbers with multiple exchanges. |

| | 4 | 2 | 6 | 6 |
| --- | --- | --- | --- | --- |
| 2 | 8 | 5 | $^{1}3$ | $^{1}2$ |

**By the end of Year 5**, children at expected standard will be secure with short written method and be encouraged to move away from the concrete and pictorial when dividing with multiple exchanges.

| Skill: Divide multi digits by 2-digits (short division) | Year: 6 |
|---|---|

| | | 0 | 3 | 6 |
|---|---|---|---|---|
| | 12 | 4 | $^{4}3$ | $^{7}2$ |

$$432 \div 12 = 36$$

$$7{,}335 \div 15 = 489$$

| | 0 | 4 | 8 | 9 |
|---|---|---|---|---|
| 15 | 7 | $^{7}3$ | $^{13}3$ | $^{13}5$ |

| 15 | 30 | 45 | 60 | 75 | 90 | 105 | 120 | 135 | 150 |
|---|---|---|---|---|---|---|---|---|---|

When children begin to divide up to 4-digits by 2-digits, written methods become the most accurate as concrete and pictorial representations become less effective. Children can write out multiples to support their calculations with larger remainders. Children will also solve problems with remainders where the quotient can be rounded as appropriate.

## Skill: Divide multi-digits by 2-digits (long division)

## Year: 6

| | | 0 | 3 | 6 |
|---|---|---|---|---|
| 1 | 2 | 4 | 3 | 2 |
| | – | 3 | 6 | 0 |
| | | | 7 | 2 |
| | – | | 7 | 2 |
| | | | | 0 |

(×30)

(×6)

$12 \times 1 = 12$
$12 \times 2 = 24$
$12 \times 3 = 36$
$12 \times 4 = 48$
$12 \times 5 = 60$
$12 \times 6 = 72$
$12 \times 7 = 84$
$12 \times 8 = 96$
$12 \times 7 = 108$
$12 \times 10 = 120$

$$432 \div 12 = 36$$

$$7{,}335 \div 15 = 489$$

| | 0 | 4 | 8 | 9 |
|---|---|---|---|---|
| 15 | 7 | 3 | 3 | 5 |
| – | 6 | 0 | 0 | 0 |
| | 1 | 3 | 3 | 5 |
| – | 1 | 2 | 0 | 0 |
| | | 1 | 3 | 5 |
| – | | 1 | 3 | 5 |
| | | | | 0 |

(×400

(×80)

(×9)

$1 \times 15 = 15$
$2 \times 15 = 30$
$3 \times 15 = 45$
$4 \times 15 = 60$
$5 \times 15 = 75$
$10 \times 15 = 150$

Children can also divide by 2-digit numbers using long division.

Children can write out multiples to support their calculations with larger remainders.

Children will also solve problems with remainders where the quotient can be rounded as appropriate.

| Skill: Divide multi digits by 2-digits (long division) | Year: 6 |
|---|---|

$372 \div 15 = 24\ r12$

| | | | 2 | 4 | r | 1 | 2 |
|---|---|---|---|---|---|---|---|
| 1 | 5 | 3 | 7 | 2 | | | |
| | − | 3 | 0 | 0 | | | |
| | | | 7 | 2 | | | |
| | − | | 6 | 0 | | | |
| | | | 1 | 2 | | | |

$1 \times 15 = 15$
$2 \times 15 = 30$
$3 \times 15 = 45$
$4 \times 15 = 60$
$5 \times 15 = 75$
$10 \times 15 = 150$

When a remainder is left at the end of a calculation, children can either leave it as a remainder or convert it to a fraction.
This will depend on the context of the question.

Children can also answer questions where the quotient needs to be rounded according to the context.

| | | | 2 | 4 | $\frac{4}{5}$ |
|---|---|---|---|---|---|
| 1 | 5 | 3 | 7 | 2 | |
| | − | 3 | 0 | 0 | |
| | | | 7 | 2 | |
| | − | | 6 | 0 | |
| | | | 1 | 2 | |

$372 \div 15 = 24\frac{4}{5}$

**By the end of Year 6**, children at expected standard will be secure with long division when dividing by 2 digits.

# Glossary of terms

| | |
|---|---|
| **Array** | An ordered collection of counters, cubes or other item in rows and columns |
| **Commutative** | Numbers can be multiplied in any order |
| **Dividend** | In division, the number that is divided |
| **Divisor** | In division, the number by which another number is divided |
| **Exchange** | Change a number or expression for another of an equal value |
| **Factor** | A number that multiplies with another to make a product |
| **Multiplicand** | In multiplication, a number to be multiplied by another |
| **Partitioning** | Splitting a number into its components |
| **Product** | The result of multiplying one number by another |
| **Quotient** | The result of a division |