



Alston Lane Catholic Primary **School**

Mental and Written **Multiplication and Division** **Policy**

Progression Towards a Mental and Written Method for Multiplication at Alston Lane Catholic Primary School

YR

MENTAL MULTIPLICATION AND DIVISION

Early Learning Goal:

Automatically recall number bonds up to 5 and some number bonds to 10, including double facts

Vocabulary

Sharing, halving, doubling, lots of

Rapid Recall

Children should be able to:

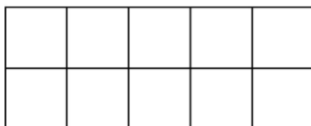
- Count in steps of one, forwards and backwards
- Verbally count beyond 20, recognising the pattern of the counting system

In the EYFS, children are encouraged to develop a mental picture of the number system in their heads to use for calculation. They should experience practical calculation opportunities using a wide variety of practical equipment, including small world play, role play, counters, cubes etc.

Solve problems involving doubling

Children may investigate items such as Lego bricks, ice cube trays and baking tins, paint boxes etc, which can show doubles, e.g. one side of the Lego brick is four, so double four is eight. Children explore a range of representations of numbers, including the 10 frame and see how doubles can be arranged into a 10 frame.

TEN FRAME



They may develop ways of recording calculations using pictures, etc.



A child's jotting showing the fingers on each hand as a double.

A child's jotting showing double three as three cookies on each plate.

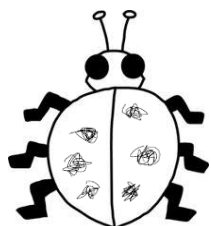


Solve problems involving halving and sharing

Children may investigate sharing items or putting items into groups using items such as egg boxes, ice cube trays and baking tins which are arrays. There is a focus on equal and unequal groups when comparing.

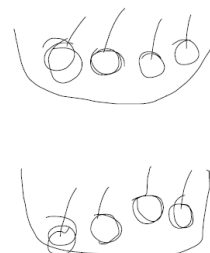


They may develop ways of recording calculations using pictures, etc.



A child's jotting showing halving six spots between two sides of a ladybird.

A child's jotting showing how they shared the apples at snack time between two groups.



YR WRITTEN MULTIPLICATION AND DIVISION

Early Learning Goal:

Automatically recall number bonds up to 5 and some number bonds to 10, including double facts

Children are encouraged to develop a mental picture of the number system in their heads to use for calculation. They should experience practical calculation opportunities using a wide variety of equipment, including small world play, role play, counters, cubes etc.

Children may also investigate putting items into resources such as egg boxes, ice cube trays and baking tins which are arrays.



They may develop ways of recording calculations using pictures, etc.



A child's jotting showing the fingers on each hand as a double.

A child's jotting showing double three as three cookies on each plate.



Y1

MENTAL MULTIPLICATION AND DIVISION

End of Year Objective:

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

Vocabulary

Sharing, halving, doubling, lots of , **count, equal steps, pattern, ones, twos, fives, tens, zero, every other, odd, even, double**

Rapid Recall

Children should be able to:

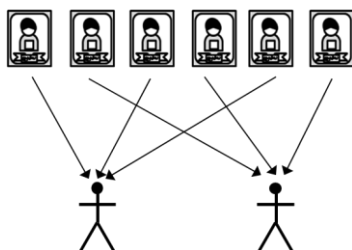
- Count in multiples of twos, fives and tens
- Recall and use doubles of all numbers to 10 and corresponding halves

Solve one-step problems involving multiplication

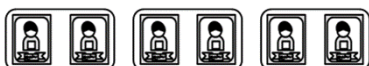
In Year One, children will continue to solve multiplication problems using practical equipment and jottings. They may use the equipment to make groups of objects. Children should see everyday versions of arrays, e.g. egg boxes, baking trays, ice cube trays, wrapping paper etc. and use this in their learning, answering questions such as 'How many eggs would we need to fill the egg box? How do you know?'

Solve one-step problems involving division

In Year One, children will continue to solve division problems using practical equipment and jottings. They should use the equipment to share objects **equally** and separate them into **equal** groups, answering questions such as 'If we share these six apples between the three of you, how many will you each have? How do you know?' or 'If six football stickers are shared between two people, how many do they each get?' They may solve both of these types of question by using a 'one for you, one for me' strategy until all of the objects have been given out.



Children will also answer questions that involve grouping rather than sharing, such as 'Pip puts two football stickers on each page of his sticker book. How many pages does he need?' This type of problem requires the children to make equal groups from the whole amount.



Y1

WRITTEN MULTIPLICATION AND DIVISION

End of Year Objective:

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

In Year One, children will continue to solve multiplication problems using practical equipment and jottings. They may use the equipment to make groups of objects. Children should see everyday versions of arrays, e.g. egg boxes, baking trays, ice cube trays, wrapping paper etc. and use this in their learning, answering questions such as 'How many eggs would we need to fill the egg box? How do you know?'



Y2

MENTAL MULTIPLICATION AND DIVISION

End of Year Objective:

Calculate mathematical statements for multiplication and division within the multiplication tables.

Vocabulary

count, equal steps, pattern, ones, twos, fives, tens, zero, every other, odd, even, double, **lots of, groups of, times, multiply, multiplied by, multiple of, once, twice, three times...as (big, long, wide etc.), repeated addition, array, row, column** share, **share equally, group in.... equal groups of ,÷, divide, divided by, divided into left, left over**

Rapid Recall

Children should be able to:

- Count in steps of 2, 3 and 5 from 0
- Recall and use multiplication facts for the 2, 5 and 10 multiplication tables
- Derive and use doubles of simple two-digit numbers (numbers in which the ones total less than 10)
- Derive and use halves of simple two-digit even numbers (numbers in which the tens are even)
- Recognise odd and even numbers

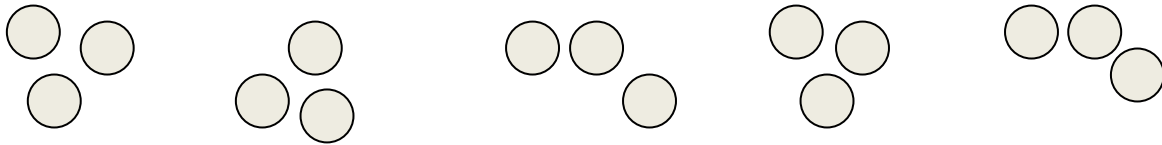
Mental Strategies

Children should be able to represent a variety of multiplication and division calculations for facts not limited to two, five and ten times tables. The image and its link to the meaning of multiplication or division needs to be securely understood. As children learn to recall more multiplication and division facts, they should make a choice about the calculations they need to represent to find the answer, and those they can recall.

Calculate mathematical statements for multiplication

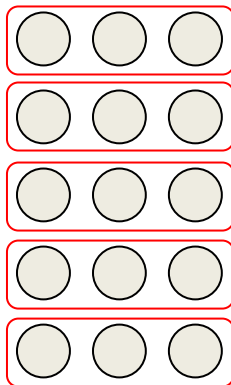
Repeated addition using practical equipment

Children should initially show multiplication as repeated addition in a random arrangement, e.g. 5×3 can be shown as five groups of three with counters.

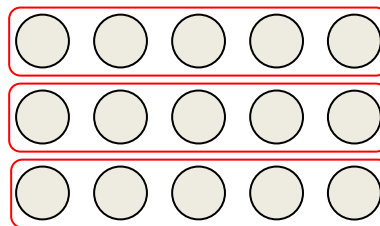


Repeated addition using arrays

Practical equipment can be used to represent 5×3 as an array in two forms (as it has commutativity).



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



$$5 + 5 + 5 = 15$$

Repeated addition using jottings

Children can develop their recordings of multiplication to using jottings.

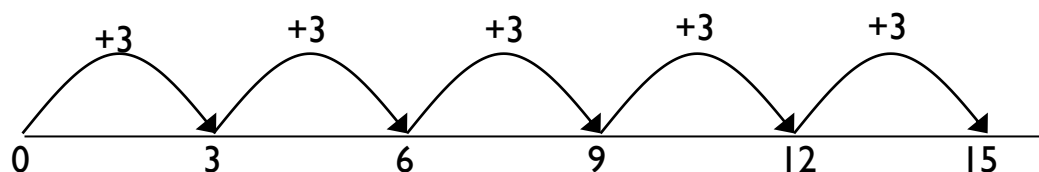


Repeated addition using a number line

Once children are familiar with the idea of repeated addition using arrays and jottings, they can begin to use a number line to show the counting steps.

$$5 \times 3 = 5 \text{ groups of } 3$$

$$5 \times 3 = 15$$



Examples of calculations

5×4 using commutativity to identify a recalled fact

3×10 recalled fact

7×3 using a representation

2×9 using knowledge that multiplying by 2 is doubling

6×6 using a representation

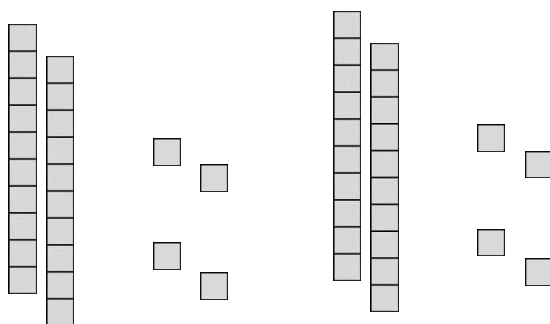
Prerequisite skills:

- Count forwards and backwards in ones
- Identifying equal groups

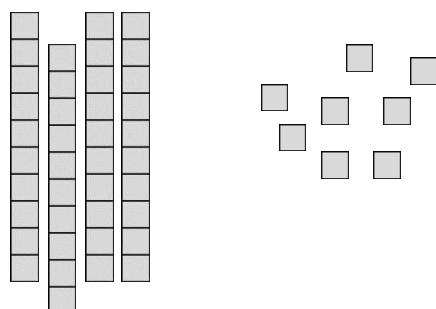
Doubling using partitioning and base 10 equipment

When deriving and using doubles of simple two-digit numbers where the ones total is less than 10, children should be taught to represent the number, and then repeat so they have two groups that are **equal in value**, developing their understanding that doubling is the same as multiplying by 2

e.g. double 24.



They should then put the tens together and the ones together:



Finally recombining the tens and ones to find the double, e.g. double 24 is 48.

Doubling using partitioning and jottings

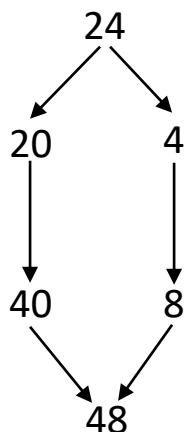
Children can then develop their use of jottings to represent the number, e.g. double 24, representing the number twice:



Finally, they can count in tens, and then ones to recombine the number, e.g. 10, 20, 30, 40, 41, 42, 43, 44, 45, 46, 47, 48.

Doubling using partitioning

e.g. double 24



The diagram above illustrates the way children should be thinking about doubling using partitioning, but it is not necessary for them to record in this way if it is not helpful to the child.

Examples of calculations

Double 43

Double 31

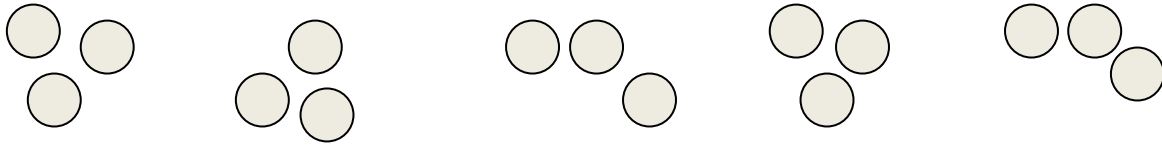
Prerequisite skills:

- Count forwards and backwards in ones and tens
- Represent a number using base ten equipment
- Partition a two digit number into tens and ones
- Recombine a multiple of ten and a multiple of one

Calculate mathematical statements for division

Repeated subtraction using practical equipment

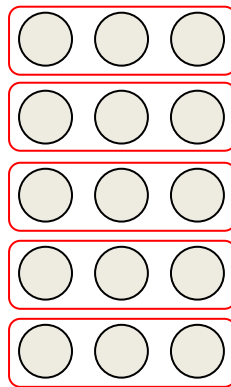
Children should initially show division as repeated subtraction in a random arrangement, e.g. $15 \div 3$ can be shown as fifteen divided into groups of three with counters.



$$15 \div 3 = 5 \text{ groups}$$

Repeated subtraction using arrays

Arrays can be used to help children to identify the groups of the divisor in a division calculation, e.g. the groups of 3 in the calculation $15 \div 3$.



$$15 \div 3 = 5 \text{ groups}$$

Repeated subtraction using jottings

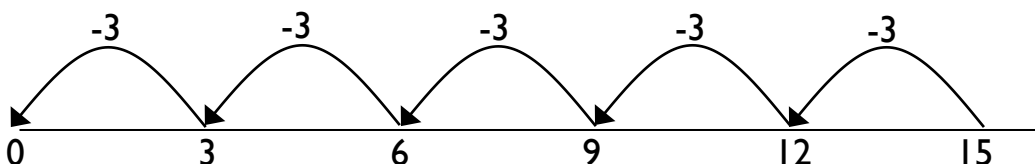
Children can develop their recordings of division to using jottings, e.g. $15 \div 3$,



Repeated subtraction using number line

Once children are familiar with the idea of repeated subtraction using arrays and jottings, they can begin to use a number line to show the counting steps.

$$15 \div 3 = 5 \text{ groups}$$



Examples of calculations

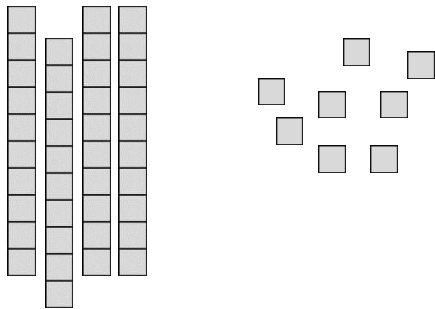
$20 \div 5$	recalled fact
$40 \div 10$	recalled fact
$18 \div 3$	using a representation
$12 \div 2$	using knowledge that dividing by 2 is halving

Prerequisite skills:

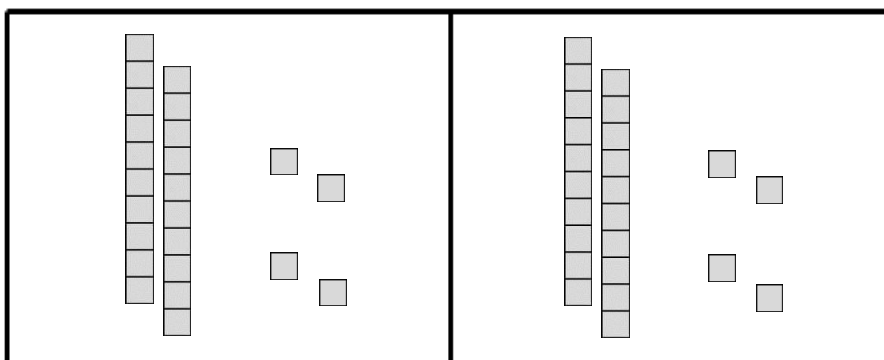
- Count forwards and backwards in ones
- Identifying equal groups

Halving using partitioning and base 10 equipment

When deriving and using halves of simple two-digit even numbers where the tens are even, children should first represent the number, e.g. Find half of 48



They should halve the tens and then halve the ones by sharing each of them into two equal groups, developing their understanding that halving is the same as dividing by 2. A diagram such as the one below might be useful:



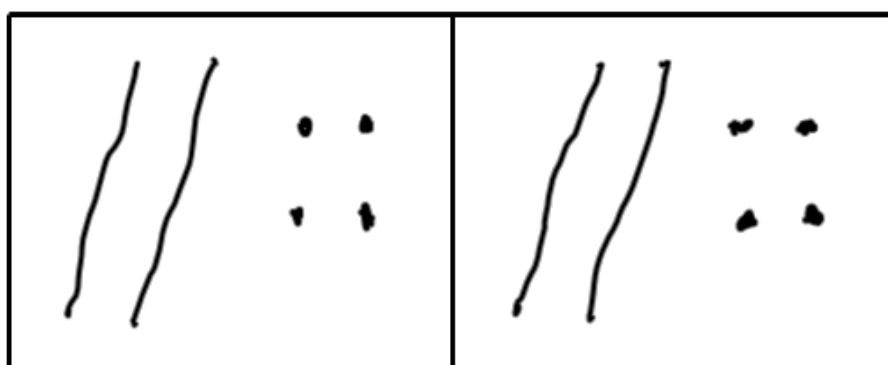
Finally, they identify what half of the whole number is, e.g. Half of 48 is 24

Halving using partitioning and jottings

Children can then develop their use of jottings to represent the number, e.g. Find half of 48



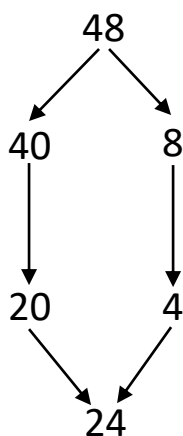
They then share each element of the number into two equal groups. A diagram such as the one below might be useful:



Finally, they identify what half of the whole number is, e.g. Half of 48 is 24.

Halving using partitioning

e.g. Find half of 48



The diagram above illustrates the way children should be thinking about halving using partitioning, but it is not necessary for them to record in this way if it is not helpful to the child.

Examples of calculations

Find half of 64

Find half of 28

Prerequisite skills:

- Count forwards and backwards in ones and tens
- Represent a number using base ten equipment
- Partition a two-digit number into tens and ones
- Recombine a multiple of ten and a multiple of ones

Y2

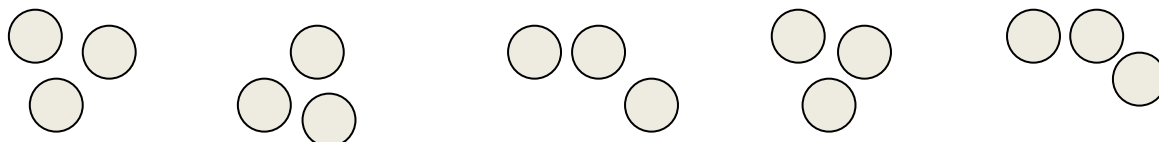
WRITTEN MULTIPLICATION AND DIVISION

End of Year Objective:

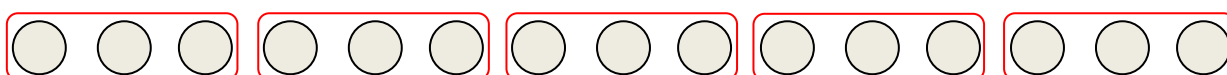
Calculate mathematical statements for multiplication (*using repeated addition*) and write them using the multiplication (x) and equals (=) signs.

Children should understand and be able to calculate multiplication as repeated addition, supported by the use of practical apparatus such as counters or cubes. e.g.

5×3 can be shown as five groups of three with counters, either grouped in a random pattern, as below:

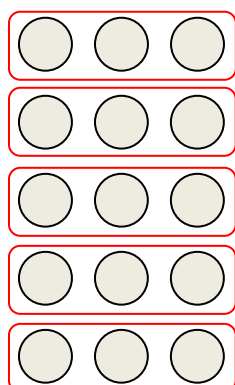


or in a more ordered pattern, with the groups of three indicated by the border outline:

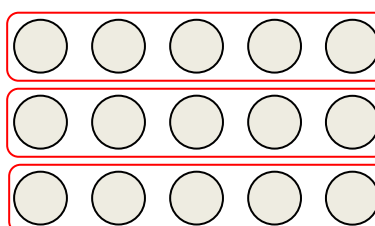


Children should then develop this knowledge to show how multiplication calculations can be represented by an array, (this knowledge will support with the development of the grid method in the future). Again, children should be encouraged to use practical apparatus and jottings to support their understanding, e.g.

5×3 can be represented as an array in two forms (as it has commutativity):



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



$$5 + 5 + 5 = 15$$

*For mathematical accuracy 5×3 is represented by the second example above, rather than the first as it is five, three times. However, because we use terms such as 'groups of' or 'lots of', children are more familiar with the initial notation. Once children understand the commutative order of multiplication the order is irrelevant).

Y3

MENTAL MULTIPLICATION AND DIVISION

End of Year Objective:

Write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including two-digit numbers times one-digit numbers.

Vocabulary

count, equal steps, pattern, ones, twos, fives, tens, zero, every other, odd, even, double, lots of, groups of, X times, multiply, **multiplication**, multiplied by, multiple of, once, twice, three times...as (big, long, wide etc.), repeated addition, array, row, column, **product**, double, halve, share, share equally. group in pairs, threes... tens, equal groups of $\div$, divide, **division**, divided by, divided into, left, left over, **remainder**

Rapid Recall

Children should be able to:

- Count in multiples of 4, 8, 50 and 100
- Recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables
- Derive and use doubles of all numbers to 100 and corresponding halves
- Derive and use doubles of all multiples of 50 to 500

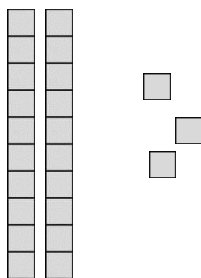
Mental Strategies

Children should be able to represent multiplication and division calculations, including two-digit numbers multiplied by one-digit numbers. As children learn to recall more multiplication and division facts, they should make a choice about the calculations they need to represent to find the answer, and those they can recall.

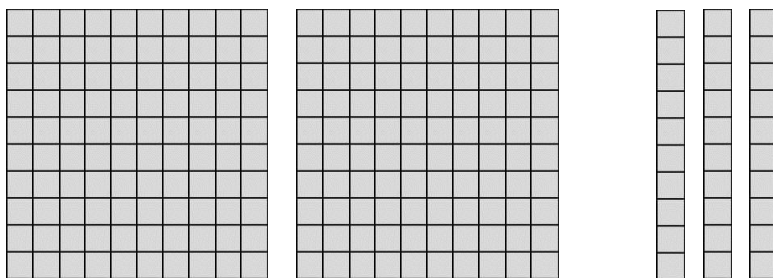
Calculate mathematical statements for multiplication

Multiply a one- or two-digit number by 10 and a one-digit number by 100 using base 10 equipment

Children should initially represent the calculation using base 10 equipment, e.g. 23×10



All of the base 10 pieces need to be made ten times greater.



The children should then compare the two numbers in place value columns.

H	T	O
	2	3
2	3	0

They should notice that each digit has moved one place to the left, i.e. become ten times greater.

Multiply a one- or two-digit number by 10 and a one-digit number by 100 using a place value chart

Building on their knowledge from using the base 10 equipment, children can use transparent counters to help them develop their understanding of multiplying by 10 and 100, e.g. 46×10

The children represent 46 on a place value chart using transparent counters.

00000	0000	000	00	0
10000	1000	100	10	1
20000	2000	200	20	2
30000	3000	300	30	3
40000	4000	400	40	4
50000	5000	500	50	5
60000	6000	600	60	6
70000	7000	700	70	7
80000	8000	800	80	8
90000	9000	900	90	9

They then move each counter one place to the left to multiply the number by 10.

00000	0000	000	00	0
10000	1000	100	10	1
20000	2000	200	20	2
30000	3000	300	30	3
40000	4000	400	40	4
50000	5000	500	50	5
60000	6000	600	60	6
70000	7000	700	70	7
80000	8000	800	80	8
90000	9000	900	90	9

They then recombine this number to create 460.

Examples of calculations

$$3 \times 10$$

$$7 \times 100$$

$$62 \times 10$$

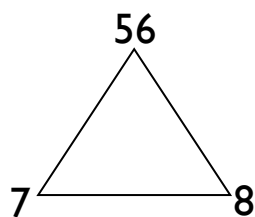
Prerequisite skills:

- Represent numbers up to three digits using base 10 equipment
- Partition a two digit number into tens and ones
- Recombine multiples of hundreds and tens

Within known tables, use related facts to multiply T0 by a one-digit number

NB T0 represents a two digit multiple of ten

Children should be encouraged to identify the **relationships** between numbers in multiplication calculations, e.g. $7 \times 8 = 56$ could be represented using a multiplication trio as this model allows children to see the **relationships** between the numbers:

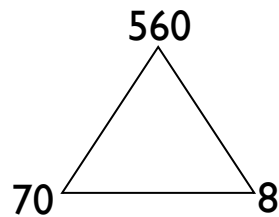


This can be used to derive the following calculations:

$$7 \times 8 = 56$$

$$8 \times 7 = 56$$

Children can then use the multiplication trio to derive related facts, e.g. $70 \times 8 =$



Children should be able to explain that because 70 is ten times greater than 7, the answer to 70×8 will be ten times greater than 56. They can then use their understanding of multiplying by 10 to calculate this.

Examples of calculations

$$60 \times 3$$

$$50 \times 4$$

$$30 \times 8$$

Prerequisite skills:

- Recall 2, 3, 4, 5, 8 and 10 multiplication tables
- Understand the effect of multiplying a one- or two-digit number by 10

Within known tables, use partitioning to multiply T1 by a one-digit number

NB T1 represents a two digit number with the number 1 as the ones

e.g. 31×4

$$30 \times 4 = 120$$

$$1 \times 4 = 4$$

$$31 \times 4 = 124$$

Examples of calculations

$$51 \times 3$$

$$61 \times 4$$

$$31 \times 8$$

Prerequisite skills:

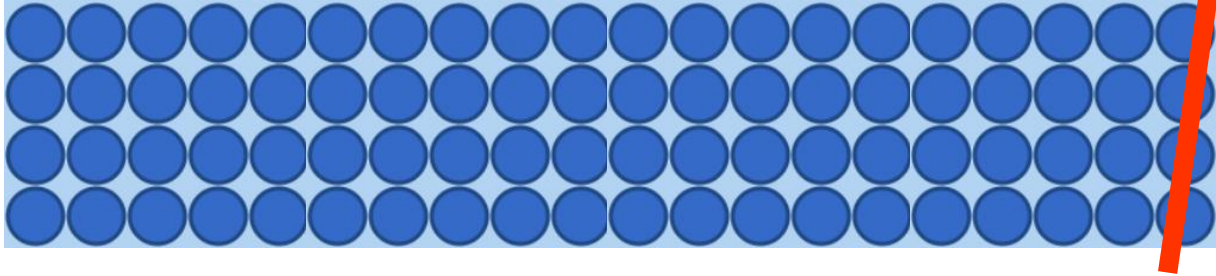
- Recall 2, 3, 4, 5, 8 and 10 multiplication tables
- Create an array to represent a multiplication calculation
- Understand the effect of multiplying a one- or two-digit number by 10
- Use related facts to multiply T0 by a one-digit number within known tables

Use compensation to multiply 19 by a one-digit number

Squared paper can be used to develop children's understanding of this calculation and how it is related to multiplying twenty by a one-digit number.

e.g. 19×4

Children make the calculation 20×4 using arrays:



They then cross out 1×4 to show that 19×4 is 1×4 less than 20×4

So $19 \times 4 = 20 \times 4$ subtract 1×4

$$19 \times 4 = 80 - 4$$

$$19 \times 4 = 76$$

Examples of calculations

$$19 \times 3$$

$$19 \times 5$$

$$19 \times 8$$

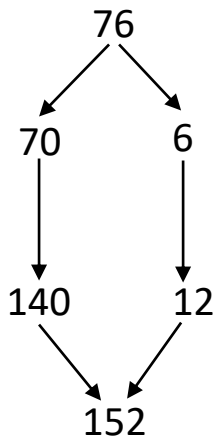
Prerequisite skills:

- Recall 2, 3, 4, 5, 8 and 10 multiplication tables
- Create an array to represent a multiplication calculation
- Understand the effect of multiplying a one- or two-digit number by 10
- Use related facts to multiply 20 by a one-digit number within known tables

Use partitioning to double any two-digit number

Children should continue to develop their understanding of doubling from Y2. They should use related facts to double two-digit multiples of 10. For example, double 7 is 14 so double 70 (ten times greater than 7) is 140 (ten times greater than 14).

e.g. double 76



The diagram above illustrates the way children should be thinking about doubling using partitioning, but it is not necessary for them to record in this way if it is not helpful to the child.

Examples of calculations

Double 39

Double 52

Double 85

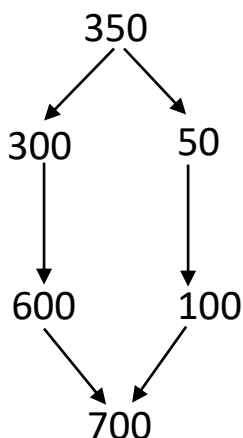
Prerequisite skills:

- Count forwards in ones and tens, crossing tens and hundreds boundaries
- Partition a two-digit number into tens and ones
- Use related facts to double a two-digit multiple of 10
- Recombine a multiple of ten and a multiple of one

Use related facts or partitioning to double any multiple of 50 to 500

Children should use related facts to double multiples of 100. For example, double 3 is 6 so double 300 is 600.

e.g. double 350



Examples of calculations

Double 250

Double 450

Double 150

Prerequisite skills:

- Count forwards in tens and hundreds
- Partition a multiple of 50 into hundreds and tens
- Use related facts to double a multiple of 100 which is less than 500

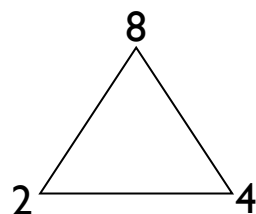
Calculate mathematical statements for division

Children in Year 3 are learning division by chunking at this point, so calculations should fit the method being taught.

Use related facts to divide T0 by a one-digit number

NB T0 represents a multiple of ten

Children should be encouraged to identify the **relationships** between numbers in division calculations, e.g. $8 \div 4 = 2$ could be represented using a division trio as this model allows children to see the **relationships** between the numbers:

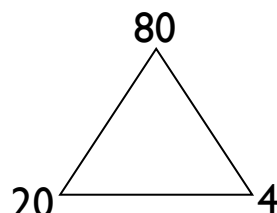


This can be used to derive the following calculations:

$$8 \div 4 = 2$$

$$8 \div 2 = 4$$

Children can then use the division trio to derive related facts, e.g. $80 \div 4 =$



Children should be able to explain that because 80 is ten times greater than 8, the answer to $80 \div 4$ will be ten times greater than 2.

Examples of calculations

$$60 \div 3$$

$$80 \div 2$$

$$90 \div 3$$

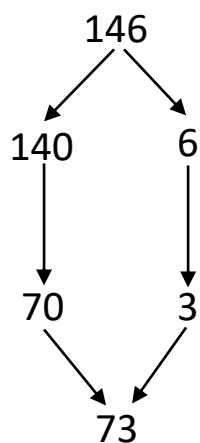
Prerequisite skills:

- Recall 2, 3 and 4 multiplication tables
- Understand the effect of multiplying a one-digit number by 10

Use partitioning to halve even numbers up to 200

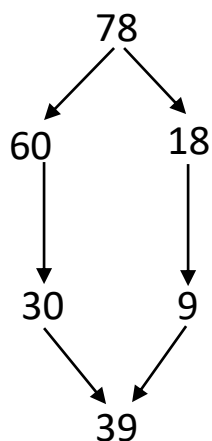
Where the tens digit is even, children can use related facts to halve the multiple of 10. For example, half of 14 is 7 so half of 140 (ten times greater than 14) is 70 (ten times greater than 7).

e.g. Find half of 146



Where the tens digit is odd, children can use partitioning in different ways to help them to calculate, recognising that partitioning the number into an even number of tens and the remainder will help them calculate more efficiently.

e.g. Find half of 78



The diagram above illustrates the way children should be thinking about halving using partitioning, but it is not necessary for them to record in this way if it is not helpful to the child.

Examples of calculations

Find half of 162 by partitioning into 160 and 2
Find half of 94 by partitioning into 80 and 14
Find half of 136 by partitioning into 120 and 16

Prerequisite skills:

- Partition a two-digit and three-digit number in different ways
- Use related facts to half a multiple of 10, where the tens digit is even, up to 200
- Recombine a multiple of ten and a multiple of one

Y3

WRITTEN MULTIPLICATION AND DIVISION

End of Year Objective:

Write and calculate mathematical statements for multiplication using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, progressing to formal written methods.*

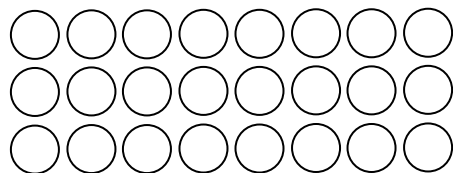
**Although the objective suggests that children should be using formal written methods, the National Curriculum document states "The programmes of study for mathematics are set out year-by-year for key stages 1 and 2. Schools are, however, only required to teach the relevant programme of study by the end of the key stage. Within each key stage, schools therefore have the flexibility to introduce content earlier or later than set out in the programme of study." p4*

It is more beneficial for children's understanding to go through the expanded methods of calculation as steps of development towards a formal written method.

Initially, children will continue to use arrays where appropriate linked to the multiplication tables that they know (2, 3, 4, 5, 8 and 10), e.g.

$$3 \times 8$$

They may show this using practical equipment:



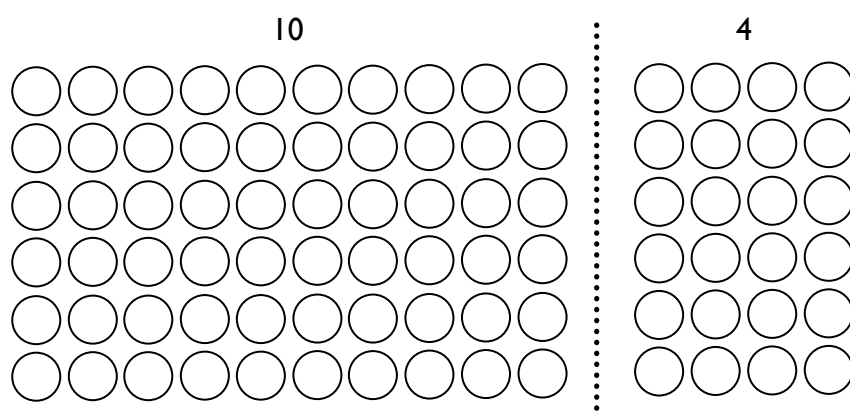
$$3 \times 8 = 8 + 8 + 8 = 24$$

or by jottings using squared paper:

	x	x	x	x	x	x	x	x	
	x	x	x	x	x	x	x	x	
	x	x	x	x	x	x	x	x	

$$3 \times 8 = 8 + 8 + 8 = 24$$

As they progress to multiplying a two-digit number by a single digit number, children should use their knowledge of partitioning two digit numbers into tens and ones to help them. For example, when calculating 14×6 , children should set out the array, then partition the array so that one array has ten columns and the other four.



Partitioning in this way, allows children to identify that the first array shows 10×6 and the second array shows 4×6 . These can then be added to calculate the answer:

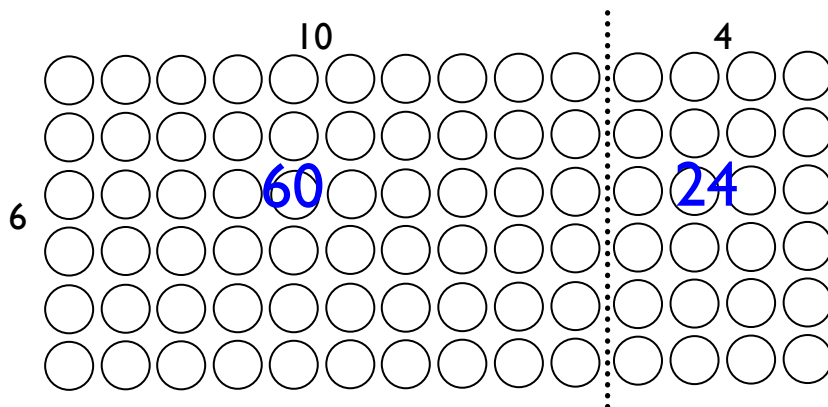
$$(6 \times 10) + (6 \times 4)$$

$$= 60 + 24$$

$$= 84$$

NB There is no requirement for children to record in this way, but it could be used as a jotting to support development if needed.

This method is the precursor step to the grid method. Using a two-digit by single digit array, they can partition as above, identifying the number of rows and the number of columns each side of the partition line.



By placing a box around the array, as in the example below, and by removing the array, the grid method can be seen.

x	10	4
6	60	24

It is really important that children are confident with representing multiplication statements as arrays and understand the rows and columns structure before they develop the written method of recording.

From this, children can use the grid method to calculate two-digit by one-digit multiplication calculations, initially with two digit numbers less than 20. Children should be encouraged to set out their addition in a column at the side to ensure the place value is maintained. When children are working with numbers where they can confidently and correctly calculate the addition mentally, they may do so.

$$13 \times 8$$

x	10	3
8	80	24

$$\begin{array}{r} 80 \\ + 24 \\ \hline 104 \end{array}$$

When children are ready, they can then progress to using this method with other two-digit numbers.

$$37 \times 6$$

x	30	7
6	180	42

$$\begin{array}{r} 180 \\ + 42 \\ \hline 222 \end{array}$$

Children should also be using this method to solve problems and multiply numbers in the context of money or measures.

Y4

MENTAL MULTIPLICATION AND DIVISION

End of Year Objective:

Use place value, known and derived facts to multiply and divide mentally, including:

- *multiplying by 0 and 1*
- *dividing by 1*
- *multiplying together three numbers*

Vocabulary

count, equal steps, pattern, ones, twos, fives, tens, zero, every other, odd, even, double, lots of, groups of, times, multiply, multiplied by, multiple of, once, twice, three times...as (big, long, wide etc.), repeated addition, array, row, column, product, group in pairs, threes... tens, equal groups of, divide, division, divided by, divided into remainder

factor, quotient, divisible by, inverse

Rapid Recall

Children should be able to:

- Count in multiples of 6, 7, 9, 25 and 1000

- Recall multiplication and division facts for multiplication tables up to 12×12
- Use partitioning to double or halve any number, including decimals to one decimal place
- Recognise and use factor pairs

Mental Strategies

Children should be able to represent multiplication and division calculations, including two-digit multiplied by one-digit numbers. As children learn to recall more multiplication and division facts, they should make a choice about the calculations they need to represent to find the answer, and those they can recall.

Use place value, known and derived facts to multiply mentally

Multiply a one- or two-digit number by 10 and 100

Building on their understanding from Year 3, children use place value columns to multiply one or two-digit numbers by 10 and 100.

e.g. $42 \times 100 =$

Th	H	T	O
		4	2
4	2	0	0

Examples of calculations

$$7 \times 10$$

$$9 \times 100$$

$$71 \times 10$$

$$63 \times 100$$

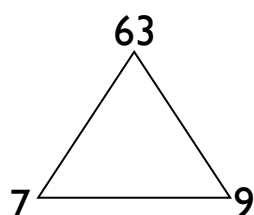
Prerequisite skills:

- Understand and use place value columns when representing numbers
- Understand the effect of multiplying a number by 10 or 100

Use related facts to multiply H00 by a one-digit number

NB H00 represents a multiple of 100

Children should be encouraged to identify the **relationships** between numbers in multiplication calculations, e.g. $7 \times 9 = 63$ could be represented using a multiplication trio as this model allows children to see the **relationships** between the numbers:

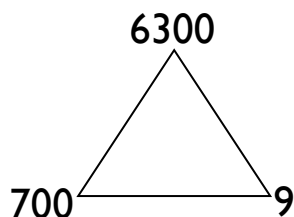


This can be used to derive the following calculations:

$$7 \times 9 = 63$$

$$9 \times 7 = 63$$

Children can then use the multiplication trio to derive related facts, e.g. $700 \times 9 =$



Children should be able to explain that because 700 is one hundred times greater than 7, the answer to 700×9 will be one hundred times greater than 63. They can then use their understanding of multiplying by 100 to calculate this.

Use factor pairs to multiply H00 by a one-digit number

Calculations that involve multiplying H00 by a one-digit number can be broken down into smaller steps by using factor pairs.

e.g. $700 \times 9 =$
becomes $7 \times 100 \times 9 =$ (using knowledge of factor pairs)
which becomes $7 \times 9 \times 100 =$ (using knowledge of commutativity/associativity)
which becomes $63 \times 100 = 6300$

Examples of calculations

$$600 \times 7$$

$$500 \times 8$$

$$900 \times 6$$

Prerequisite skills:

- Recall multiplication tables
- Understand the effect of multiplying a one- or two-digit number by 100
- Recognise and use factor pairs

Use compensation to multiply T9 by a one-digit number

NB T9 represents a two-digit number with 9 ones

Building on their understanding from Year 3 of multiplying 19 by a one-digit number using squared paper, children multiply by the nearest multiple of ten and then compensate appropriately.

e.g. $59 \times 4 =$

$$59 \times 4 = 60 \times 4 \text{ subtract } 1 \times 4$$

$$60 \times 4 = 240$$

So $59 \times 4 = 240 - 4$ (one group of 4 less than 240)

$$59 \times 4 = 236$$

Examples of calculations

$$49 \times 3$$

$$29 \times 7$$

$$89 \times 6$$

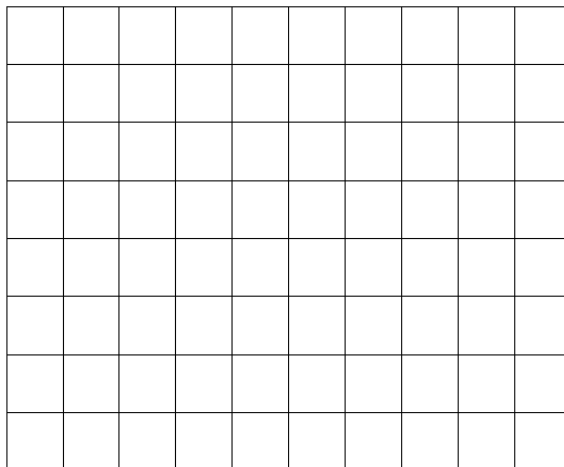
Prerequisite skills:

- Recall multiplication tables
- To understand how multiplying by 9 is related to multiplying by 10
- Use related facts to multiply T0 by a one-digit number

Use related facts to multiply T0 x 5 (by multiplying by 10 and halving)

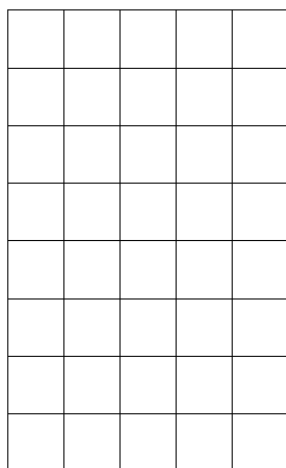
When learning multiplication tables, children should be encouraged to identify related facts.

e.g. $8 \times 10 = 80$



This can be used to calculate:

$$8 \times 5 = 40 \quad (\text{half of } 8 \times 10) \text{ because 5 is half of 10}$$



This strategy can then be applied to calculating $TO \times 5$.

e.g. $46 \times 5 =$

$$46 \times 10 = 460$$

so

$$46 \times 5 = 230$$

Examples of calculations

28 x 5

81×5

54 x 5

Prerequisite skills:

- Recall multiplication tables
- Understand the relationship between multiplying by 10 and multiplying by 5
- Multiply a two-digit number by 10
- Halve multiples of 10 up to three-digits

Use related facts to multiply $TO \times 20$ (by multiplying by 10 and doubling)

When learning multiplication tables, children should be encouraged to identify related facts.

e.g. $3 \times 10 = 30$

[illegible]

This can be used to calculate:

$3 \times 20 = 60$ (double 3×10) because 20 is double 10

[illegible]

This strategy can then be applied to calculating $TO \times 20$.

e.g. $46 \times 20 =$

$$46 \times 10 = 460$$

so

$$46 \times 20 = 920$$

Examples of calculations

$$34 \times 20$$

$$47 \times 20$$

$$68 \times 20$$

Prerequisite skills:

- Recall multiplication tables
- Understand the relationship between multiplying by 10 and multiplying by 20
- Multiply a two-digit number by 10
- Double multiples of 10 up to three-digits

Use partitioning to multiply TO by a one-digit number

Building on their understanding of the grid method of multiplication from Year 3, children in Year 4 may choose to multiply $TO \times O$ using partitioning, but without the use of the grid.

e.g. $67 \times 4 =$

$$60 \times 4 = 240$$

$$7 \times 4 = 28$$

$$67 \times 4 = 268$$

Examples of calculations

$$57 \times 4$$

$$36 \times 7$$

$$93 \times 6$$

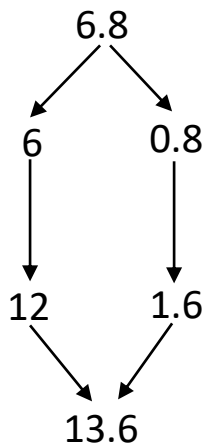
Prerequisite skills:

- Recall multiplication tables
- Partition a two-digit number into tens and ones
- Recombine a multiple of ten and a multiple of one

Use partitioning to double numbers including those with one decimal place

Children should use related facts to double numbers. For example, double 7 is 14 so double 0.7 (ten times smaller than 7) is 1.4 (ten times smaller than 14).

e.g. double 6.8



The diagram above illustrates the way children should be thinking about doubling using partitioning, but it is not necessary for them to record in this way if it is not helpful to the child.

Examples of calculations

Double 374

Double 4524

Double 7.6

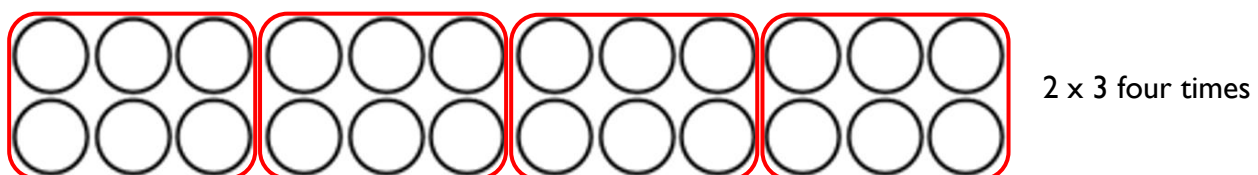
Prerequisite skills:

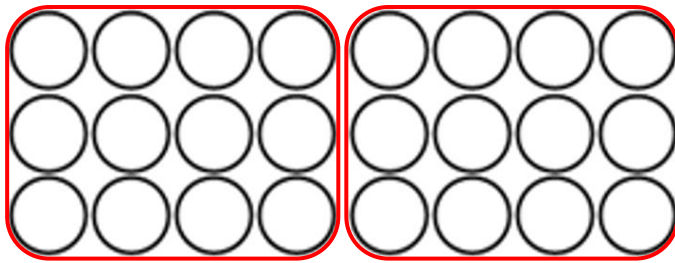
- Count forwards in tenths, ones, tens, hundreds and thousands
- Partition a number into thousands, hundreds, tens, ones and tenths
- Use related facts to double multiples of tenths, ones, tens, hundreds and thousands
- Recombine multiples of tenths, ones, tens, hundreds and thousands

Multiply together three numbers

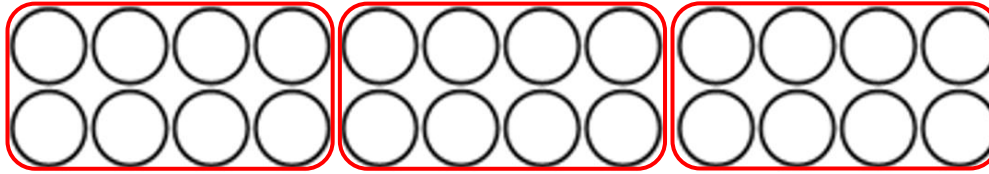
Children should be able to represent multiplying three numbers together practically, e.g. using counters

e.g. $2 \times 3 \times 4$ could be represented as:





3×4 two times



2×4 three times

Once children understand how the calculation can be shown practically or pictorially, they should then be encouraged to choose an appropriate order for calculating based on the numbers involved.

e.g. $5 \times 7 \times 4 =$

This could be calculated as:

$$\begin{array}{l} 5 \times 7 \times 4 = \\ \downarrow \\ 35 \end{array}$$

$$35 \times 4 = 140$$

$$\begin{array}{l} 5 \times 4 \times 7 = \\ \downarrow \\ 20 \end{array}$$

$$20 \times 7 = 140$$

$$\begin{array}{l} 4 \times 7 \times 5 = \\ \downarrow \\ 28 \end{array}$$

$$28 \times 5 = 140$$

Children may choose $5 \times 4 \times 7$ as the easiest calculation because 5×4 results in a multiple of 10.

Examples of calculations

$$3 \times 4 \times 6$$

$$7 \times 3 \times 9$$

$$5 \times 6 \times 8$$

Prerequisite skills:

- Represent a multiplication using an array
- Understand that multiplication can be done in any order
- Recall multiplication tables
- Multiply a two-digit number by a one-digit number

Multiply a number by 0 or 1

Children should realise through investigation that a calculation is not needed when multiplying by 0 or 1

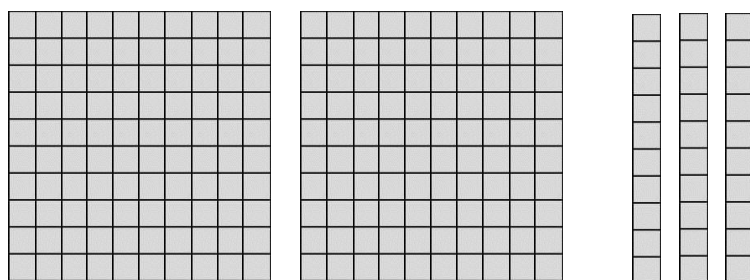
Any number multiplied by 0 will result in zero, e.g. $76 \times 0 = 0$ because any number of empty groups does not have a value.

Any number multiplied by 1 will result in the number itself, $356 \times 1 = 356$ because it is one group of the original amount.

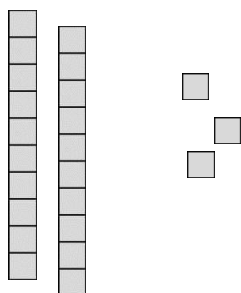
Use place value, known and derived facts to divide mentally

Divide a number by 10 and 100 using base 10 equipment

Children should initially represent the calculation using base 10 equipment, e.g. $230 \div 10$



All of the base 10 pieces need to be made ten times smaller.



The children should then compare the two numbers in place value columns.

H	T	O
2	3	0
	2	3

They should notice that each digit has moved one place to the right, i.e. become ten times smaller.

Divide a number by 10 and 100 using a place value chart

Building on their knowledge from using the base 10 equipment, children can use transparent counters to help them develop their understanding of dividing a number by 10 and 100.

e.g. $460 \div 10$

The children represent 460 on a place value chart using transparent counters.

00000	0000	000	00	0
10000	1000	100	10	1
20000	2000	200	20	2
30000	3000	300	30	3
40000	4000	400	40	4
50000	5000	500	50	5
60000	6000	600	60	6
70000	7000	700	70	7
80000	8000	800	80	8
90000	9000	900	90	9

00000	0000	000	00	0
10000	1000	100	10	1
20000	2000	200	20	2
30000	3000	300	30	3
40000	4000	400	40	4
50000	5000	500	50	5
60000	6000	600	60	6
70000	7000	700	70	7
80000	8000	800	80	8
90000	9000	900	90	9

Examples of calculations

$$120 \div 10$$

$$600 \div 100$$

$$850 \div 10$$

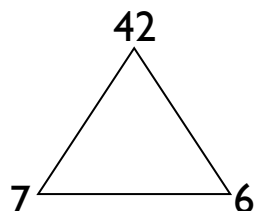
NB There is no requirement to divide numbers where the answer is a decimal.

Prerequisite skills:

- Represent numbers up to three digits using base 10 equipment
- Partition a number into hundreds and tens
- Recombine a multiple of ten and a multiple of one

Use related facts to divide HTO by a one-digit number

Children should be encouraged to identify the **relationships** between numbers in division calculations, e.g. $42 \div 7 = 6$ could be represented using a division trio:

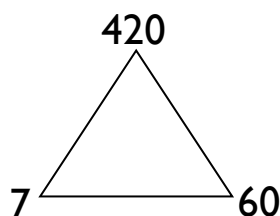


This can be used to derive the following calculations:

$$42 \div 7 =$$

$$42 \div 6 = 7$$

Children can then use the division trio to derive related facts, e.g. $80 \div 4 =$



Children should be able to explain that because 420 is ten times greater than 42, the answer to $420 \div 7$ will be ten times greater than 6.

Examples of calculations

$$480 \div 8$$

$$630 \div 9$$

$$300 \div 6$$

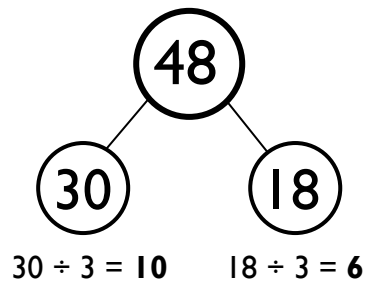
Prerequisite skills:

- Recall multiplication tables
- Understand the effect of multiplying a one or two-digit number by 10

Use partitioning to divide TO by a one-digit number

Building on their understanding of using chunking for division from Year 3, children decide how to partition a two-digit number to help them divide it by a one-digit number.

e.g. $48 \div 3 = 16$



Examples of calculations

$68 \div 4$ By partitioning into 40 and 28

$95 \div 5$ By partitioning into 50 and 45

$84 \div 6$ By partitioning into 60 and 24

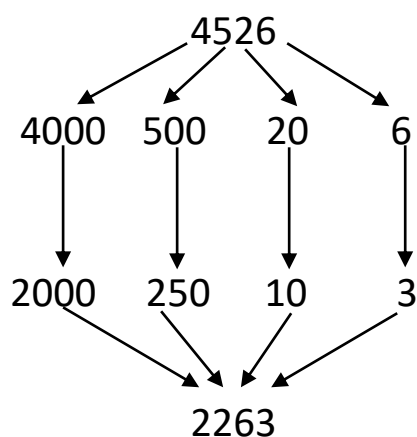
Prerequisite skills:

- Recall multiplication tables
- Understand division as repeated subtraction (chunking)
- Partition two-digit numbers in different ways

Use partitioning to halve any number including to one decimal place

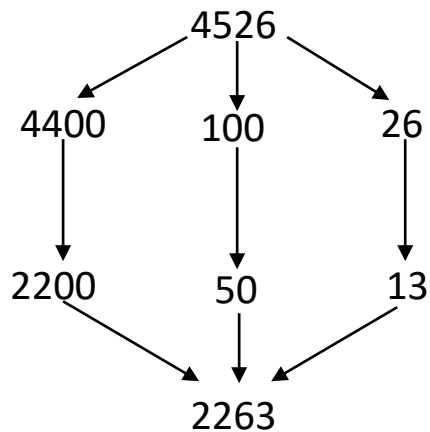
Children should be encouraged to decide the best way to partition a number to halve it.

e.g. Find half of 4526



An alternative way of partitioning would be:

Find half 4526



The diagrams above illustrate the way children should be thinking about halving using partitioning, but it is not necessary for them to record in this way if it is not helpful to the child.

Examples of calculations

Find half of 468

Find half of 7602

Find half of 8.2

Find half of 3.6

Prerequisite skills:

- Partition numbers (including in different ways for efficiency)
- Use related facts to halve a multiple of a tenth, one, ten, hundred and thousand
- Recombine multiples of one, ten, hundred and thousand
- Recombine multiples of a tenth and one

Divide a number by 1

Children should realise, through investigation, that a calculating process is not necessary when dividing by 1

Any number that is divided by 1 will result in the number itself, e.g. $542 \div 1 = 542$. This is because any quantity shared into one group will result in that group having the whole quantity in it; or any number grouped into ones will result in the original number of groups.

Y4

WRITTEN MULTIPLICATION AND DIVISION

End of Year Objective:

Multiply two-digit and three-digit numbers by a one-digit number using formal written layout.

Children will move to year 4 using whichever method they were using as they transitioned from year 3. They will further develop their knowledge of the grid method to multiply any two-digit by any single-digit number, e.g.

$$79 \times 8$$

x	70	9
8	560	72

$$\begin{array}{r} 560 \\ + 72 \\ \hline 632 \end{array}$$

To support the grid method, children should develop their understanding of place value and facts that are linked to their knowledge of tables. For example, in the calculation above, children should use their knowledge that $7 \times 8 = 56$ to know that $70 \times 8 = 560$.

By the end of the year, they will extend their use of the grid method to be able to multiply three-digit numbers by a single digit number, e.g.

$$346 \times 8$$

x	300	40	6
8	2400	320	48

$$\begin{array}{r} 2400 \\ + 320 \\ + 48 \\ \hline 2768 \end{array}$$

When children are working with numbers where they can confidently and correctly calculate the addition (or parts of the addition) mentally, they may do so.

Children should also be using this method to solve problems and multiply numbers in the context of money or measures.

Y5

MENTAL MULTIPLICATION AND DIVISION

End of Year Objective:

Multiply and divide numbers mentally drawing upon known facts

Vocabulary

**count, equal steps, pattern, ones, twos, fives, tens, zero, every other, odd, even,
double, lots of, groups of, times, multiply, multiplied by, multiplication, multiple of, once, twice,
three times...as (big, long, wide etc.), repeated addition, array, row, column, product,
double, halve, share, share equally
inverse, factor, common factor, factor pairs, square number, cube number, prime number**

Rapid Recall

Children should be able to:

- Recall related tables facts for multiples of 10 ($70 \times 6 = 420$ because $7 \times 6 = 42$)
- Using times tables, identify related unit fractions, e.g. $7 \times 9 = 63$ so one-ninth of 63 is 7 and one-seventh of 63 is 9
- Use partitioning to double or halve any number, including decimals to two decimal places
- Recall prime numbers up to 19
- Recall square (2) numbers up to 12×12

Mental Strategies

In Year 5 children build on their skills and understanding from previous year groups to multiply and divide mentally with larger numbers and numbers to two decimal places. Children should be encouraged to choose the most appropriate strategy based on the numbers involved in the calculation.

Multiply numbers mentally drawing upon known facts

Multiply whole numbers and decimals to two decimal places by 10, 100 and 1000 using a place value chart

Building on their knowledge of multiplying by 10 and 100 from Year 3 and Year 4, children can use transparent counters to help them develop their understanding of multiplying numbers to two decimal places by 10, 100 and 1000

e.g. 3.72×1000

The children represent 3.72 on a place value chart using transparent counters.

00000	0000	000	00	0	0.0	0.00
10 000	1000	100	10	1	0.1	0.01
20 000	2000	200	20	2	0.2	0.02
30 000	3000	300	30	3	0.3	0.03
40 000	4000	400	40	4	0.4	0.04
50 000	5000	500	50	5	0.5	0.05
60 000	6000	600	60	6	0.6	0.06
70 000	7000	700	70	7	0.7	0.07
80 000	8000	800	80	8	0.8	0.08
90 000	9000	900	90	9	0.9	0.09

They then move each counter three places to the left to multiply the number by 1000 because 1000 is $10 \times 10 \times 10$

00000	0000	000	00	0	0.0	0.00
10 000	1000	100	10	1	0.1	0.01
20 000	2000	200	20	2	0.2	0.02
30 000	3000	300	30	3	0.3	0.03
40 000	4000	400	40	4	0.4	0.04
50 000	5000	500	50	5	0.5	0.05
60 000	6000	600	60	6	0.6	0.06
70 000	7000	700	70	7	0.7	0.07
80 000	8000	800	80	8	0.8	0.08
90 000	9000	900	90	9	0.9	0.09

Examples of calculations

$$75.91 \times 10$$

$$5.07 \times 10$$

$$670.4 \times 100$$

$$360 \times 1000$$

$$0.76 \times 1000$$

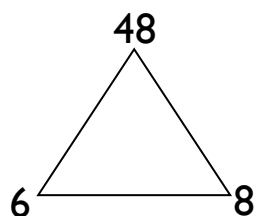
Prerequisite skills:

- Partition a number into thousands, hundreds, tens, ones, tenths and hundredths
- Recombine multiples of a hundred thousand, ten thousand, thousand, hundred, ten, one and tenth

Use related facts to multiply Th000 by a one-digit number

NB Th000 represents a multiple of 1 000

Children should be encouraged to identify the **relationships** between numbers in multiplication calculations, e.g. $6 \times 8 = 48$ could be represented using a multiplication trio as this model allows children to see the **relationships** between the numbers:

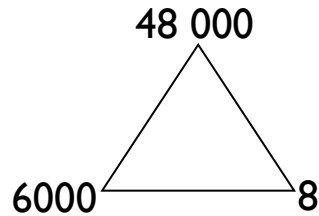


This can be used to derive the following calculations:

$$6 \times 8 = 48$$

$$8 \times 6 = 48$$

Children can then use the multiplication trio to derive related facts, e.g. $6000 \times 8 =$



Children should be able to explain that because 6000 is one thousand times greater than 6, the answer to 6000×8 will be one thousand times greater than 48. They can then use their understanding of multiplying by 1000 to calculate this.

Examples of calculations

$$3000 \times 3$$

$$7000 \times 5$$

$$8000 \times 9$$

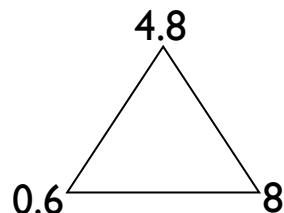
Prerequisite skills:

- Recall multiplication tables
- Understand the effect of multiplying a one- or two-digit number by 1000

Use related facts to multiply 0.t by a one-digit number

NB 0.t represents a multiple of a tenth

The multiplication trio from the previous strategy can also be used to derive 0.t multiplied by a one-digit number, e.g. 0.6×8



Children should be able to explain that because 0.6 is ten times smaller than 6, the answer to 0.6×8 will be ten times smaller than 48. They can then use their understanding of dividing by 10 to calculate this.

Examples of calculations

$$0.3 \times 7$$

$$0.6 \times 9$$

$$0.5 \times 4$$

Prerequisite skills:

- Recall multiplication tables
- Understand the effect of dividing a one- or two-digit number by 10

Use factor pairs to multiply $T0 \times T0$

Calculations that involve multiplying $T0 \times T0$ can be broken down into smaller steps by using factor pairs.

e.g. $60 \times 40 =$
becomes $6 \times 10 \times 4 \times 10 =$ (using knowledge of factor pairs)
which becomes $6 \times 4 \times 10 \times 10 =$ (using knowledge of commutativity/associativity)
which becomes $24 \times 100 = 2400$

Examples of calculations

$$30 \times 60$$

$$70 \times 80$$

$$50 \times 40$$

Prerequisite skills:

- Recall multiplication tables
- Understand the effect of multiplying a one- or two-digit number by 100
- Recognise and use factor pairs

Use compensation to multiply $H99$ by a one-digit number

NB $H99$ represents a three-digit number with 9 tens and 9 ones

Building on their understanding from Year 4 of multiplying $T9$ by a one-digit number, children multiply by the nearest multiple of a hundred and then compensate appropriately.

e.g. $699 \times 3 =$

$$699 \times 3 = 700 \times 3 \text{ subtract } 1 \times 3$$

$$700 \times 3 = 2100$$

So $699 \times 3 = 2100 - 3$ (one group of 3 less than 2100)

$$699 \times 3 = 2097$$

Examples of calculations

$$599 \times 4$$

$$399 \times 7$$

$$699 \times 9$$

Prerequisite skills:

- Recall multiplication tables
- Understand how multiplying by 99 is related to multiplying by 100
- Use related facts to multiply $H00$ by a one-digit number
- Subtract a one-digit number from a multiple of a hundred

Use partitioning to multiply 0.t by a one-digit number

Children should be encouraged to choose the most efficient method, which may be mental, rather than simply opting for a written method.

e.g. $3.8 \times 4 =$

$$3 \times 4 = 12$$

$$0.8 \times 4 = 3.2$$

$$3.8 \times 4 = 15.2$$

Examples of calculations

$$6.7 \times 4$$

$$3.2 \times 7$$

$$8.5 \times 6$$

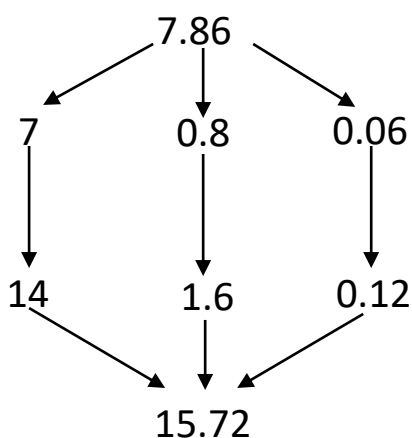
Prerequisite skills:

- Recall multiplication tables
- Partition U.t into ones and tenths
- Use related facts
- Add numbers with different amounts of digits

Use partitioning to double numbers including those with two decimal places

Children should use related facts to double numbers. For example, double 9 is 18 so double 0.09 (a hundred times smaller than 9) is 0.18 (a hundred times smaller than 18).

e.g. double 7.86



The diagram above illustrates the way children should be thinking about doubling using partitioning, but it is not necessary for them to record in this way if it is not helpful to the child.

Examples of calculations

Double 56.7

Double 485.6

Double 8.59

Double 36 742

Prerequisite skills:

- Count forwards in hundredths, tenths, ones, tens, hundreds and thousands
- Partition a number into thousands, hundreds, tens, ones, tenths and hundredths
- Use related facts to double multiples of hundredths, tenths, ones, tens, hundreds and thousands
- Recombine multiples of hundredths, tenths, ones, tens, hundreds and thousands

Divide numbers mentally drawing upon known facts

Divide whole numbers and decimals by 10, 100 and 1000 using a place value chart

Building on their knowledge of dividing by 10 and 100 from Year 3 and Year 4, children can use transparent counters to help them develop their understanding of dividing numbers by 10, 100 and 1000. Answers should include decimals up to two decimal places.

e.g. $35\ 600 \div 1000 =$

The children represent 35 600 on a place value chart using transparent counters.

00000	0000	000	00	0	0.0	0.00
10 000	1000	100	10	1	0.1	0.01
20 000	2000	200	20	2	0.2	0.02
30 000	3000	300	30	3	0.3	0.03
40 000	4000	400	40	4	0.4	0.04
50 000	5000	500	50	5	0.5	0.05
60 000	6000	600	60	6	0.6	0.06
70 000	7000	700	70	7	0.7	0.07
80 000	8000	800	80	8	0.8	0.08
90 000	9000	900	90	9	0.9	0.09

They then move each counter three places to the right to divide the number by 1000
 1000 is $10 \times 10 \times 10$ so dividing by 1000 is the same as $\div 10 \div 10 \div 10$

00000	0000	000	00	0	0.0	0.00
10 000	1000	100	10	1	0.1	0.01
20 000	2000	200	20	2	0.2	0.02
30 000	3000	300	30	3	0.3	0.03
40 000	4000	400	40	4	0.4	0.04
50 000	5000	500	50	5	0.5	0.05
60 000	6000	600	60	6	0.6	0.06
70 000	7000	700	70	7	0.7	0.07
80 000	8000	800	80	8	0.8	0.08
90 000	9000	900	90	9	0.9	0.09

Examples of calculations

$$874 \div 10$$

$$60.1 \div 10$$

$$7043 \div 100$$

$$48\,750 \div 1000$$

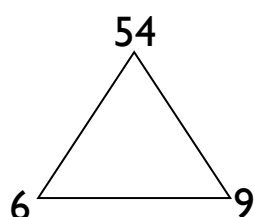
Prerequisite skills:

- Partition a number into hundred thousands, ten thousands, thousands, hundreds, tens, ones and tenths
- Recombine multiples of ten thousand, thousand, hundred, ten, one, tenth and hundredth

Use related facts to divide ThH00 by a one-digit number

NB ThH00 represents a four-digit multiple of 100

Children should be encouraged to identify the **relationships** between numbers in division calculations, e.g. $54 \div 6 = 9$ could be represented using a division trio:

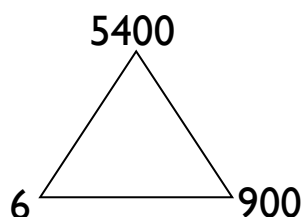


This can be used to derive the following calculations:

$$54 \div 6 = 9$$

$$54 \div 9 = 6$$

Children can then use the division trio to derive related facts, e.g. $5400 \div 6 = 900$



Children should be able to explain that because 5400 is a hundred times greater than 54, the answer to $5400 \div 6$ will be a hundred times greater than 9. They can then use their understanding of multiplying by 100 to calculate this.

Examples of calculations

$$8100 \div 9$$

$$3000 \div 6$$

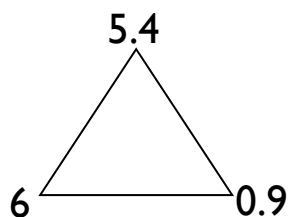
$$9600 \div 8$$

Prerequisite skills:

- Recall multiplication tables
- Understand the effect of multiplying a one or two-digit number by 100

Use related facts to divide O.t by a one-digit number

The division trio from the previous strategy can also be used to derive U.t divided by a one-digit number, e.g. $5.4 \div 6 =$



Children should be able to explain that because 5.4 is ten times smaller than 54, the answer to $5.4 \div 6$ will be ten times smaller than 9. They can then use their understanding of dividing by 10 to calculate this.

Examples of calculations

$$2.1 \div 7$$

$$3.6 \div 9$$

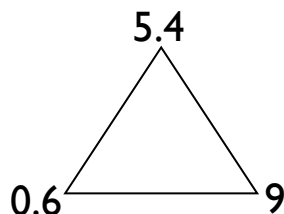
$$4.8 \div 4$$

Prerequisite skills:

- Recall multiplication tables
- Understand the effect of dividing a one- or two-digit number by 10

Use related facts to divide O.t by a 0.t

The division trio from the previous strategy can also be used to derive U.t divided by 0.t, e.g. $5.4 \div 0.6 =$



Children should be able to explain that 5.4 is ten times smaller than 54 and 0.6 is ten times smaller than 6. This means that both numbers have been scaled down by the same amount, so the relationship between the numbers stays the same. The answer to $5.4 \div 0.6$ will therefore be 9 because there are 9 groups of 0.6 in 5.4

Examples of calculations

$$2.1 \div 0.7$$

$$3.6 \div 0.9$$

$$4.8 \div 0.4$$

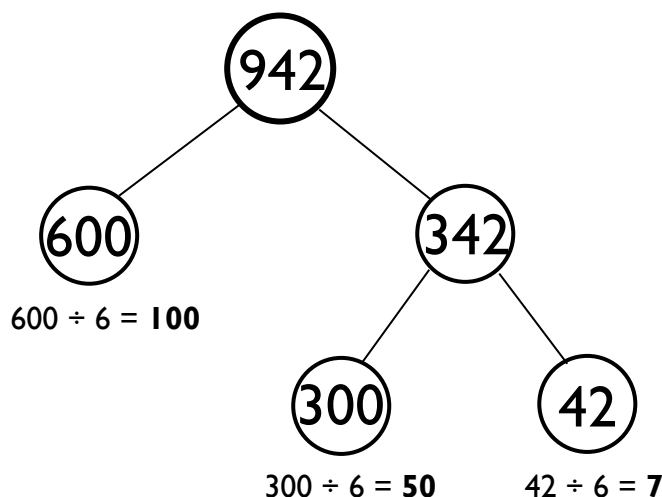
Prerequisite skills:

- Recall multiplication tables
- Understand division as repeated subtraction
-

Use partitioning to divide HTO by a one-digit number

Building on their understanding of using partitioning to divide TO by a one-digit number from Year 4, children decide how to partition HTO to help them divide it by a one-digit number.

e.g. $942 \div 6 = 157$



The diagram above illustrates the way children should be thinking about dividing using partitioning, but it is not necessary for them to record in this way if it is not helpful to the child.

Examples of calculations

$756 \div 9$ By partitioning into 720 and 36

$765 \div 5$ By partitioning into 500 and 250 and 15

$861 \div 7$ By partitioning into 700 and 140 and 21

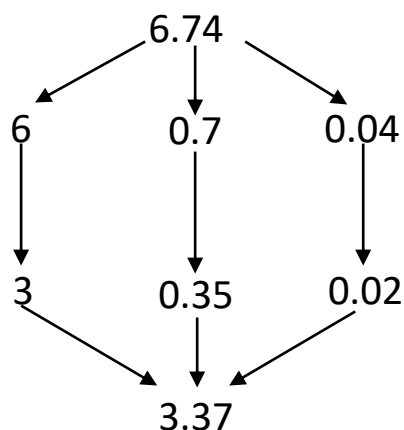
Prerequisite skills:

- Recall multiplication tables
- Understand division as repeated subtraction
- Partition three-digit numbers in different ways

Use partitioning to halve any number including to two decimal places

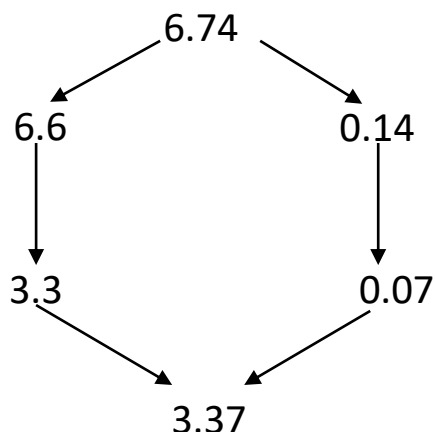
Children should be encouraged to decide the best way to partition a number to halve it.

e.g. Find half of 6.74



An alternative way of partitioning would be:

Find half of 6.74



The diagrams above illustrate the way children should be thinking about halving using partitioning, but it is not necessary for them to record in this way if it is not helpful to the child.

Examples of calculations

Find half of 4.62

Find half of 18.46

Find half of 8.94

Find half of 17.92

Find half of 32 784

Prerequisite skills:

- Partition numbers (including in different ways for efficiency)
- Use related facts to halve a multiple of a hundredth, tenth, ten, hundred and thousand
- Recombine multiples of one, ten, hundred and thousand
- Recombine multiples of a tenth and a hundredth

Y5

WRITTEN MULTIPLICATION AND DIVISION

End of Year Objective:

Multiply numbers up to 4 digits by a one- or two-digit number using a formal written method, including long multiplication for two-digit numbers.

Children should continue to use the grid method and extend it to multiplying numbers with up to four digits by a single digit number, e.g.

$$4346 \times 8$$

x	4 000	300	40	6
8	32 000	2400	320	48

$$\begin{array}{r}
 32000 \\
 + 2400 \\
 + 320 \\
 + 48 \\
 \hline
 34768
 \end{array}$$

and numbers with up to four digits by a two-digit number, e.g.

$$2693 \times 24$$

x	2000	600	90	3
20	40000	12000	1800	60
4	8000	2400	360	12

$$\begin{array}{r}
 40000 \\
 + 8000 \\
 + 12000 \\
 + 2400 \\
 + 1800 \\
 + 360 \\
 + 60 \\
 + 12 \\
 \hline
 64632
 \end{array}$$

The long list of numbers in the addition part can be used to check that all of the answers from the grid have been included, however, when children are working with numbers where they can confidently and correctly calculate the addition (or parts of the addition) mentally, they should be encouraged to do so. For example,

x	2000	600	90	3	
20	40000	12000	1800	60	= 53 860
4	8000	2400	360	12	= 10 772 +
					<u>64 632</u>

Adding across mentally, leads children to finding the separate answers to:

$$2\ 693 \times 20$$

$$2\ 693 \times 4$$

Children should also be using this method to solve problems and multiply numbers in the context of money or measures.

During Year 5, the transition from the grid method into the formal vertical method for multiplication could take place. The traditional vertical compact method of written multiplication is a highly efficient way to calculate, but it has a very condensed form and needs to be introduced carefully.

It is most effective to begin with the grid method, moving to an expanded vertical layout, before introducing the compact form. This allows children to see, and understand, how the processes relate to each other and where the individual multiplication answers come from e.g.

$$368 \times 6$$

x	300	60	8	
6	1 800	360	48	

$$\begin{array}{r}
 1800 \\
 + 360 \\
 + 48 \\
 \hline
 2208
 \end{array}$$

Th	H	T	O
3	6	8	
x			6
	4	8	(8 × 6)
	3	6	0 (60 × 6)
+	1	8	0 0 (300 × 6)
	2	2	0 8

becomes

Th	H	T	O
3	6	8	
x			6
	4	8	
	3	6	0
+	1	8	0 0
	2	2	0 8

Th	H	T	O
3	6	8	
x			6
	4	8	(8 × 6)
	3	6	0 (60 × 6)
+	1	8	0 0 (300 × 6)
	2	2	0 8

The place value columns are labelled to ensure children understand the size of the partitioned digits in the original number(s) and in the answer.

It is vital that the teacher models the correct language when explaining the process of the compact method.

The example shown should be explained as:

“Starting with the least significant digit... 8 multiplied by 6 is 48, put 8 in the ones and carry 4 tens (40).

6 tens multiplied by 6 are 36 tens. Add the 4 tens carried over to give 40 tens (which is the same as 4 hundreds and 0 tens). Put 0 in the tens place of the answer and carry 4 hundreds.

3 hundreds multiplied by 6 are 18 hundreds. Add the 4 hundreds carried over to give 22 hundreds (which is the same as 2 thousands and 2 hundreds). Write 2 in the hundreds place of the answer and 2 in the thousands place of the answer.”

Children should recognise that the answer is close to an estimated answer of $400 \times 6 = 2\,400$

Long multiplication could also be introduced by comparing the grid method with the compact vertical method. Mentally totalling each row of answers is an important step in children making the link between the grid method and the compact method.

x	600	90	3	
20	12000	1800	60	= 13 860
4	2400	360	12	= 2 772 +
				<u>16 632</u>

Children should only be expected to move towards this next method if they have a secure understanding of place value. It is difficult to explain the compact method without a deep understanding of place value.

The example shown should be explained as:

“Starting with the least significant digit... 3 multiplied by 4 is 12; put 2 in the ones and carry 1 ten (10).

9 tens multiplied by 4 are 36 tens. Add the 1 ten carried over to give 37 tens (which is the same as 3 hundreds and 7 tens). Put 7 in the tens place of the answer and carry 3 hundreds.

6 hundreds multiplied by 4 are 24 hundreds. Add the 3 hundreds carried over to give 27 hundreds (which is the same as 2 thousands and 7 hundreds). Write 7 in the hundreds place of the answer and 2 in the thousands place of the answer. We have now found the answer to 693×4 . Step 1 is complete so to avoid confusion later, we will cross out the carried digits 3 and 1.”

Notice this answer can clearly be seen in the grid method example.

Step 1

$$\begin{array}{r}
 \text{TTh Th H T O} \\
 6\ 9\ 3 \\
 \times\ 2\ 4 \\
 \hline
 2\ 7\ 7\ 2 \quad (693 \times 4) \\
 \text{\scriptsize 3\ 1}
 \end{array}$$

Step 2

$$\begin{array}{r}
 \text{TTh Th H T O} \\
 6\ 9\ 3 \\
 \times\ 2\ 4 \\
 \hline
 2\ 7\ 7\ 2 \quad (693 \times 4) \\
 +\ 1\ 3\ 8\ 6\ 0 \quad (693 \times 20) \\
 \hline
 \text{\scriptsize 1\ 1}
 \end{array}$$

Now we are multiplying 693 by 20. Starting with the least significant digit of the top number... 3 multiplied by 20 is 60. Write this answer in.

90 multiplied by 20 is 1 800. There are no ones and no tens in this answer, so write 8 in the hundreds place and carry 1 in the thousands.

600 multiplied by 20 is 12 000. Add the 1 (thousand) that was carried to give 13 000. There are no ones, no tens and no hundreds in this answer, so write 3 in the thousands place and 1 in the ten thousands place.

Step 3

$$\begin{array}{r}
 \text{TTh Th H T O} \\
 6\ 9\ 3 \\
 \times\ 2\ 4 \\
 \hline
 2\ 7\ 7\ 2 \quad (693 \times 4) \\
 +\ 1\ 3\ 8\ 6\ 0 \quad (693 \times 20) \\
 \hline
 1\ 6\ 6\ 3\ 2
 \end{array}$$

The final step is to total both answers using efficient columnar addition.

When using the compact method for long multiplication, all carried digits should be placed below the line of that answer e.g. 3×4 is 12, so the 2 is written in the ones column and the 10 is carried as a small 1 in the tens column.

This carrying below the answer is in line with the written addition policy in which carried digits are always written below the answer/line.

Y6

MENTAL MULTIPLICATION AND DIVISION

End of Year Objective:

Perform mental calculations, including with mixed operations and large numbers

Vocabulary

count, equal steps, pattern, ones, twos, fives, tens, zero, every other, odd, even, double, lots of, groups of, times, multiply, multiplied by, multiple of, once, twice, three times...as (big, long, wide etc.), repeated addition, array, row, column, product, share, share equally, group in pairs, threes... tens, equal groups of, divide, division, divided by, divided into, remainder inverse, factor, common factor, factor pairs, square number, prime number, **prime factor, common multiples, order of operations**

Rapid Recall

Children should be able to:

- Recall related tables facts decimal numbers ($0.7 \times 6 = 4.2$ because $7 \times 6 = 42$)
- Use partitioning to double or halve any number
- Recall prime numbers up to 100
- Recall squares of the corresponding multiples of 10 (i.e. 40^2 is 1600)

Mental Strategies

In Year 6 children build on their skills and understanding from previous year groups to multiply and divide mentally with larger numbers and numbers to three decimal places. Children should be encouraged to choose the most appropriate strategy based on the numbers involved in the calculation.

Perform mental calculations – Multiplication

Multiply whole numbers and decimals to three decimal places by 10, 100 and 1000

Building on their knowledge of multiplying by 10, 100 and 1000 from Year 5, children use place value columns to multiply numbers to three decimal places by 10, 100 and 1000

e.g. $43.721 \times 100 =$

Th	H	T	O • t	h	th
		4	3 • 7	2	1
4	3	7	2 • 1		

Examples of calculations

$$4562 \times 1000$$

$$9.682 \times 10$$

$$25.784 \times 100$$

Prerequisite skills:

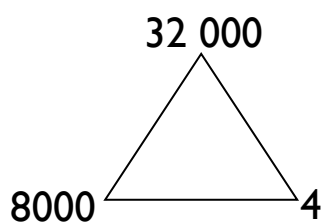
- Understand and use place value columns when representing numbers
- Understand the effect of multiplying a number by 10, 100 or 1000

Identify and use all related facts that link to tables

Children should be encouraged to select the most appropriate strategy based on the numbers involved in the calculation.

e.g. $8000 \times 4 =$

Using related facts in a multiplication trio could help with this calculation:



Children should be able to explain that because 8000 is a thousand times greater than 8, the answer to 8000×4 will be a thousand times greater than 32.

e.g. $8000 \times 40 =$

Using factor pairs could help with this calculation:

	$8000 \times 40 =$	
becomes	$8000 \times 4 \times 10 =$	(using knowledge of factor pairs)
which becomes	$32\ 000 \times 10 = 320\ 000$	

Examples of calculations

$$7000 \times 6$$

$$500 \times 40$$

$$900 \times 300$$

$$3000 \times 80$$

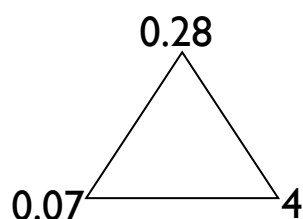
Prerequisite skills:

- Recall multiplication tables
- Understand the effect of multiplying a number by 10, 100 or 1000
- Recognise and use factor pairs

Use related facts to multiply 0.0t by a one-digit number

NB 0.0t represents a multiple of a hundredth

Children can use a multiplication trio to derive related facts, e.g. 0.07×4



Children should be able to explain that because 0.07 is a hundred times smaller than 7, the answer to 0.07×4 will be a hundred times smaller than 28. They can then use their understanding of dividing by 100 to calculate this.

Examples of calculations

$$0.03 \times 7$$

$$0.06 \times 9$$

$$0.05 \times 4$$

Prerequisite skills:

- Recall multiplication tables
- Understand the effect of dividing a one- or two-digit number by 100

Use compensation to multiply 0.9 and 0.99 by a one-digit number

Building on their understanding from Year 5 of multiplying H99 by a one-digit number, children multiply by the nearest whole number and then compensate appropriately.

e.g. $6.9 \times 4 =$

$$6.9 \times 4 = 7 \times 4 \text{ subtract } 0.1 \times 4$$

$$7 \times 4 = 28$$

So $6.9 \times 4 = 28 - 0.4$

$$6.9 \times 4 = 27.6$$

e.g. $6.99 \times 4 =$

$$6.99 \times 4 = 7 \times 4 \text{ subtract } 0.01 \times 4$$

$$7 \times 4 = 28$$

So $6.99 \times 4 = 28 - 0.04$

$$6.99 \times 4 = 27.96$$

Examples of calculations

$$5.9 \times 4$$

$$3.99 \times 7$$

$$9.99 \times 6$$

Prerequisite skills:

- Recall multiplication tables
- Understand how multiplying by 0.9 is related to multiplying by 1
- Understand how multiplying by 0.99 is related to multiplying by 1
- Subtract a 0.t or 0.0h from a whole number

Use partitioning to multiply 0.th by a one-digit number

Children should be encouraged to choose the most efficient method, which may be mental, rather than simply opting for a written method.

e.g. $0.67 \times 4 =$

$$0.6 \times 4 = 2.4$$

$$0.07 \times 4 = 0.28$$

$$0.67 \times 4 = 2.68$$

Examples of calculations

$$0.76 \times 3$$

$$0.28 \times 7$$

$$0.54 \times 6$$

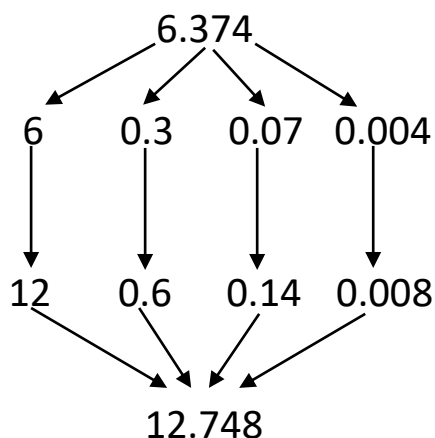
Prerequisite skills:

- Recall multiplication tables
- Partition 0.th into tenths and hundredths
- Use related facts
- Add numbers with different amounts of digits

Use partitioning to double numbers including those with three decimal places

Children should use related facts to double numbers. For example, double 9 is 18 so double 0.009 (a thousand times smaller than 9) is 0.018 (a thousand times smaller than 18).

e.g. double 6.374



The diagram above illustrates the way children should be thinking about doubling using partitioning, but it is not necessary for them to record in this way if it is not helpful to the child.

Examples of calculations

Double 3.421

Double 6.705

Double 12.594

Double 54 672

Double 674 960

Prerequisite skills:

- Count forwards in steps of powers of 10
- Partition a number appropriately
- Use related facts to double multiples of powers of 10
- Recombine multiples of powers of 10

Perform mental calculations – Division

Divide whole numbers and decimals to three decimal places by 10, 100 and 1000

Building on their knowledge of dividing by 10, 100 and 1000 from Year 5, children use place value columns to divide numbers by 10, 100 and 1000. Answers should include decimals up to three decimal places.

e.g. $356.7 \div 100 =$

Th	H	T	O • t	h	th
	3	5	6 • 7		
			3 • 5	6	7

Examples of calculations

$9.83 \div 10$

$7.04 \div 10$

$860.2 \div 100$

$56\,789 \div 1000$

Prerequisite skills:

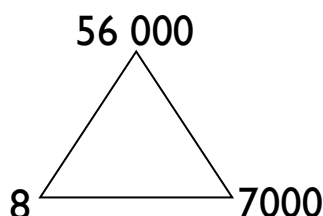
- Understand and use place value columns when representing numbers
- Understand the effect of dividing a number by 10, 100 or 1000

Identify and use all related facts that link to tables

Children should be encouraged to select the most appropriate strategy based on the numbers involved in the calculation.

e.g. $56\ 000 \div 8 =$

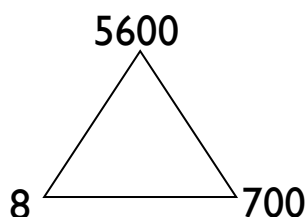
Using related facts in a division trio could help with this calculation:



Children should be able to explain that because 56 000 is a thousand times greater than 56, the answer to $56\ 000 \div 8$ will be a thousand times greater than 7. They can then use their understanding of multiplying by 1000 to calculate this.

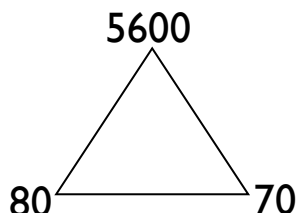
e.g. $5600 \div 80 =$

The following division trio could be used as a starting point for this calculation:



Children should be able to explain that because 5600 is a hundred times greater than 56, the answer to $5600 \div 8$ will be a hundred times greater than 7. They can then use their understanding of multiplying by 100 to calculate this.

The following division trio could then be derived:



Children should be able to explain that because 80 is ten times greater than 8, the answer to $5600 \div 80$ will be ten times smaller than the answer to $5600 \div 8$ because there will be ten times fewer groups.

Examples of calculations

$$81\,000 \div 9$$

$$270 \div 30$$

$$3000 \div 50$$

$$9600 \div 800$$

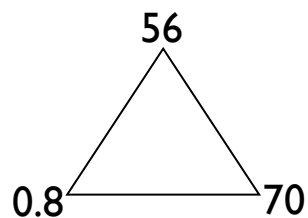
Prerequisite skills:

- Recall multiplication tables
- Understand division as repeated subtraction
- Understand the effect of multiplying or dividing by 10, 100 or 1000

Use related facts to divide TO by 0.t

e.g. $56 \div 0.8 =$

Using related facts in a division trio could help with this calculation:



Children should be able to explain that because 0.8 is ten times smaller than 8, the answer to $56 \div 0.8$ will be ten times greater than the answer to $56 \div 8$ because there will be ten times more groups.

Examples of calculations

$$21 \div 0.7$$

$$36 \div 0.9$$

$$48 \div 0.4$$

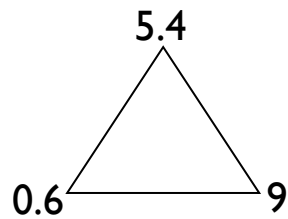
Prerequisite skills:

- Recall multiplication tables
- Understand division as repeated subtraction
- Understand the effect of multiplying or dividing by 10

Use related facts to divide 0.th by 0.t

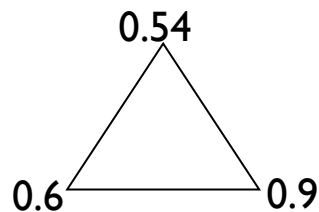
e.g. $0.54 \div 0.6 =$

The following division trio from Year 5 could be used as a starting point for this calculation:



Children should be able to explain that 5.4 is ten times smaller than 54 and 0.6 is ten times smaller than 6. This means that both numbers have been scaled down by the same amount, so the relationship between the numbers stays the same. The answer to $5.4 \div 0.6$ will therefore be 9 because there are 9 groups of 0.6 in 5.4

The following division trio could then be derived:



Children should be able to explain that because 0.54 is ten times smaller than 5.4, the answer to $0.54 \div 0.6$ will be ten times smaller than 9. They can then use their understanding of dividing by 10 to calculate this.

Examples of calculations

$$0.32 \div 0.4$$

$$0.64 \div 0.8$$

$$0.45 \div 0.9$$

Prerequisite skills:

- Recall multiplication tables
- Understand division as repeated subtraction
- Understand the effect of multiplying and dividing by 10

Use related facts to divide by 50

Dividing by 50 is the same as dividing by 100 and then doubling because 50 is half of 100. Children can investigate this using simple calculations.

e.g. $200 \div 100 = 2$

$$2 \times 2 = 4$$

So $200 \div 50 = 4$

Children can then use this in more complex calculations.

e.g. $3200 \div 50 =$

$$3200 \div 100 = 32$$

$$32 \times 2 = 64$$

So $3200 \div 50 = 64$

Examples of calculations

$$4100 \div 50$$

$$7800 \div 50$$

$$530 \div 50$$

Prerequisite skills:

- Understand the effect of dividing by 100
- Double numbers including those with one decimal place

Use related facts to divide by 25

Dividing by 25 is the same as dividing by 100 and then multiplying by 4 because 25 is one quarter of 100. Children can investigate this using simple calculations.

e.g. $200 \div 100 = 2$

$$2 \times 4 = 8$$

So $200 \div 25 = 8$

Children can then use this in more complex calculations.

e.g. $4800 \div 25 =$

$$4800 \div 100 = 48$$

$$48 \times 4 = 192$$

So $4800 \div 25 = 192$

Examples of calculations

$$3200 \div 25$$

$$7600 \div 25$$

$$360 \div 25$$

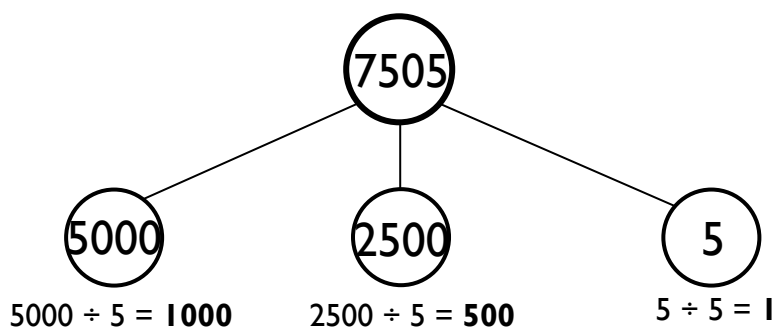
Prerequisite skills:

- Understand the effect of dividing by 100
- Multiply numbers up to one decimal place by 4

Use partitioning to divide ThHTO by a one-digit number

Building on their understanding of using partitioning to divide TO by a one-digit number from Year 4, children decide how to partition ThHTO to help them divide it by a one-digit number.

e.g. $7505 \div 5 = 1501$



The diagram above illustrates the way children should be thinking about dividing using partitioning, but it is not necessary for them to record in this way if it is not helpful to the child.

Examples of calculations

- | | |
|---------------|--|
| $5035 \div 5$ | By partitioning into 5000 and 35 |
| $1236 \div 4$ | By partitioning into 1200 and 36 |
| $9240 \div 6$ | By partitioning into 6000 and 3000 and 240 |

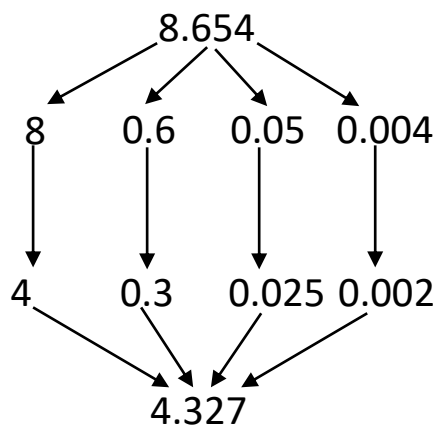
Prerequisite skills:

- Recall multiplication tables
- Understand division as repeated subtraction
- Partition four-digit numbers in different ways

Use partitioning to halve any number including to three decimal places

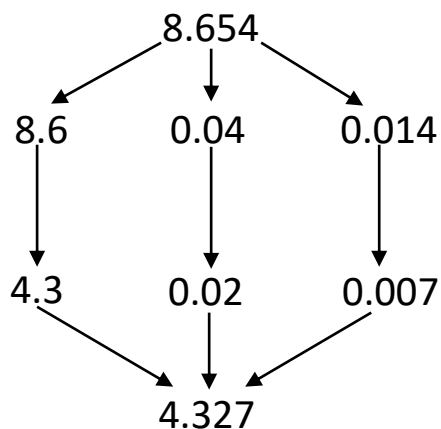
Children should be encouraged to decide the best way to partition a number to halve it.

e.g. Find half of 8.654



An alternative way of partitioning would be:

Find half of 8.654



The diagrams above illustrate the way children should be thinking about halving using partitioning, but it is not necessary for them to record in this way if it is not helpful to the child.

Examples of calculations

Find half of 4.684

Find half of 12.826

Find half of 6.942

Find half of 15.674

Find half of 478 612

Prerequisite skills:

- Partition numbers (including in different ways for efficiency)
- Use related facts to halve a multiple of a thousandth, hundredth, tenth, ten, hundred and thousand
- Recombine multiples of one, ten, hundred and thousand

Recombine multiples of a tenth, hundredth

Y6

WRITTEN MULTIPLICATION AND DIVISION

End of Year Objective:

Multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication.

Multiply one-digit numbers with up to two decimal places by whole numbers.

By the end of year 6, children should be able to use the grid method to multiply any number by a two-digit number. They could also develop the method to be able to multiply decimal numbers with up to two decimal places, but having been introduced to expanded and compact vertical methods in Year 5, it may be appropriate to use the expanded vertical method when introducing multiplication involving decimals.

$$4.92 \times 3$$

$$\begin{array}{r} \text{T O . t h} \\ 4.92 \\ \times \quad 3 \\ \hline 0.06 \quad (0.02 \times 3) \\ 2.7 \quad (0.9 \times 3) \\ + 12 \quad (4 \times 3) \\ \hline 14.76 \end{array}$$

becomes

$$\begin{array}{r} \text{T O . t h} \\ 4.92 \\ \times \quad 3 \\ \hline 14.76 \\ \hline \end{array}$$

Children should also be using this method to solve problems and multiply numbers, including those with decimals, in the context of money or measures, e.g. to calculate the cost of 7 items at £8.63 each, or the total length of six pieces of ribbon of 2.28m each.