Multiplication & Division

Year 7

#MathsEveryoneCan

2019-20

White Rose Maths

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
Autumn	**Algebraic Thinking**						**Place Value and Proportion**					
	Sequences		Understand and use algebraic notation		Equality and equivalence		Place value and ordering integers and decimals			Fraction, decimal and percentage equivalence		
Spring	**Applications of Number**						**Directed Number**			**Fractional Thinking**		
	Solving problems with addition & subtraction		Solving problems with multiplication and division			Fractions & percentages of amounts	Operations and equations with directed number			Addition and subtraction of fractions		
Summer	**Lines and Angles**						**Reasoning with Number**					
	Constructing, measuring and using geometric notation			Developing geometric reasoning			Developing number sense		Sets and probability		Prime numbers and proof	

Spring 1: Application of Number

Weeks 1 & 2: Solving problems with addition & subtraction

The focus for these two weeks is building on the formal methods of addition and subtraction students have developed at Key Stage 2. All students will look at this in the context of interpreting and solving problems, for those for whom these skills are secure, there will be even more emphasis on this. Problems will be drawn from the contexts of perimeter, money, interpreting bar charts and tables and looking at frequency trees; we believe all these are better studied alongside addition and subtraction rather than separately. Calculators should be used to check and/or support calculations, with significant figures and equations explicitly revisited.

National curriculum content covered:

- use formal written methods, applied to positive integers and decimals
- recognise and use relationships between operations including inverse operations
- derive and apply formulae to calculate and solve problems involving: perimeter
- construct and interpret appropriate tables, charts, and diagrams, including frequency tables, bar charts and pictograms for categorical data, and vertical line (or bar) charts for ungrouped numerical data

Weeks 3 to 5: Solving problems with multiplication & division

The rest of the term is dedicated to the study of multiplication and division, so allowing for the study of forming and solving of two-step equations both with and without a calculator. Unit conversions will be the main context as multiplication by 10, 100 and 1000 are explored. As well as distinguishing between multiples and factors, substitution and simplification can also be revised and extended. Again, the emphasis will be on solving problems, particularly involving area of common shapes and the mean. Choosing the correct operation to solve a problem will also be a focus. There will also be some exploration of the order of operations, which will be reinforced alongside much of this content next term when studying directed number.

National curriculum content covered:

- use formal written methods, applied to positive integers and decimals
- select and use appropriate calculation strategies to solve increasingly complex problems
- recognise and use relationships between operations including inverse operations
- use the concepts and vocabulary factors (or divisors), multiples, common factors, common multiples, highest common factor, lowest common multiple
- change freely between related standard units [time, length, area, volume/capacity, mass]
- derive and apply formulae to calculate and solve problems involving: perimeter and area of triangles, parallelograms, and trapezia **(H)**
- substitute numerical values into formulae and expressions, including scientific formulae
- use algebraic methods to solve linear equations in one variable (including all forms that require rearrangement)
- describe, interpret and compare observed distributions of a single variable through: the mean

Week 6: Fractions and percentages of amounts

This short block focuses on the key concept of working out fractions and percentages of quantities and the links between the two. This is studied in depth in Year 8

National curriculum content covered:

- use the four operations, including formal written methods, applied to integers, decimals, proper and improper fractions
- interpret fractions and percentages as operators

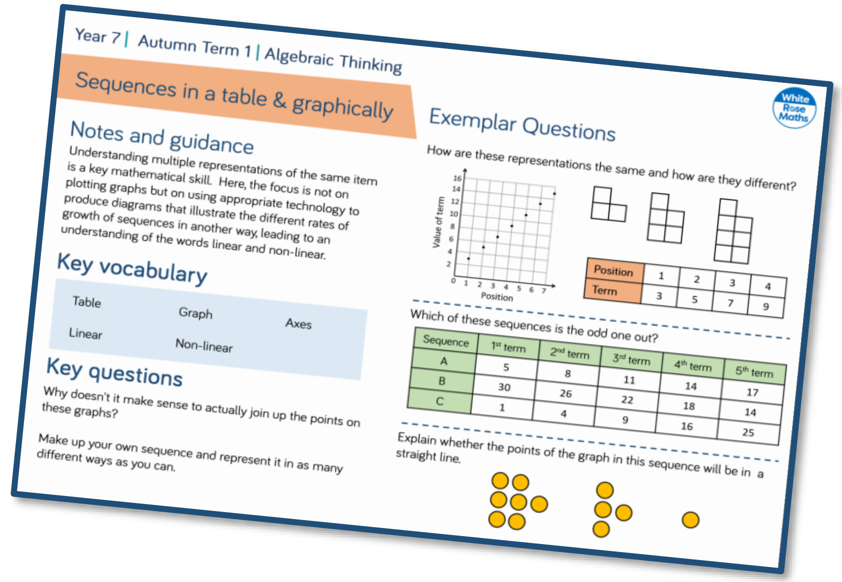
Why Small Steps?

We know that breaking the curriculum down into small manageable steps should help students to understand concepts better. Too often, we have noticed that teachers will try and cover too many concepts at once and this can lead to cognitive overload. We believe it is better to follow a "small steps" approach.

As a result, for each block of content in the scheme of learning we will provide a "small step" breakdown. ***It is not the intention that each small step should last a lesson – some will be a short step within a lesson, some will take longer than a lesson.*** We would encourage teachers to spend the appropriate amount of time on each step for their group, and to teach some of the steps alongside each other if necessary.

What We Provide

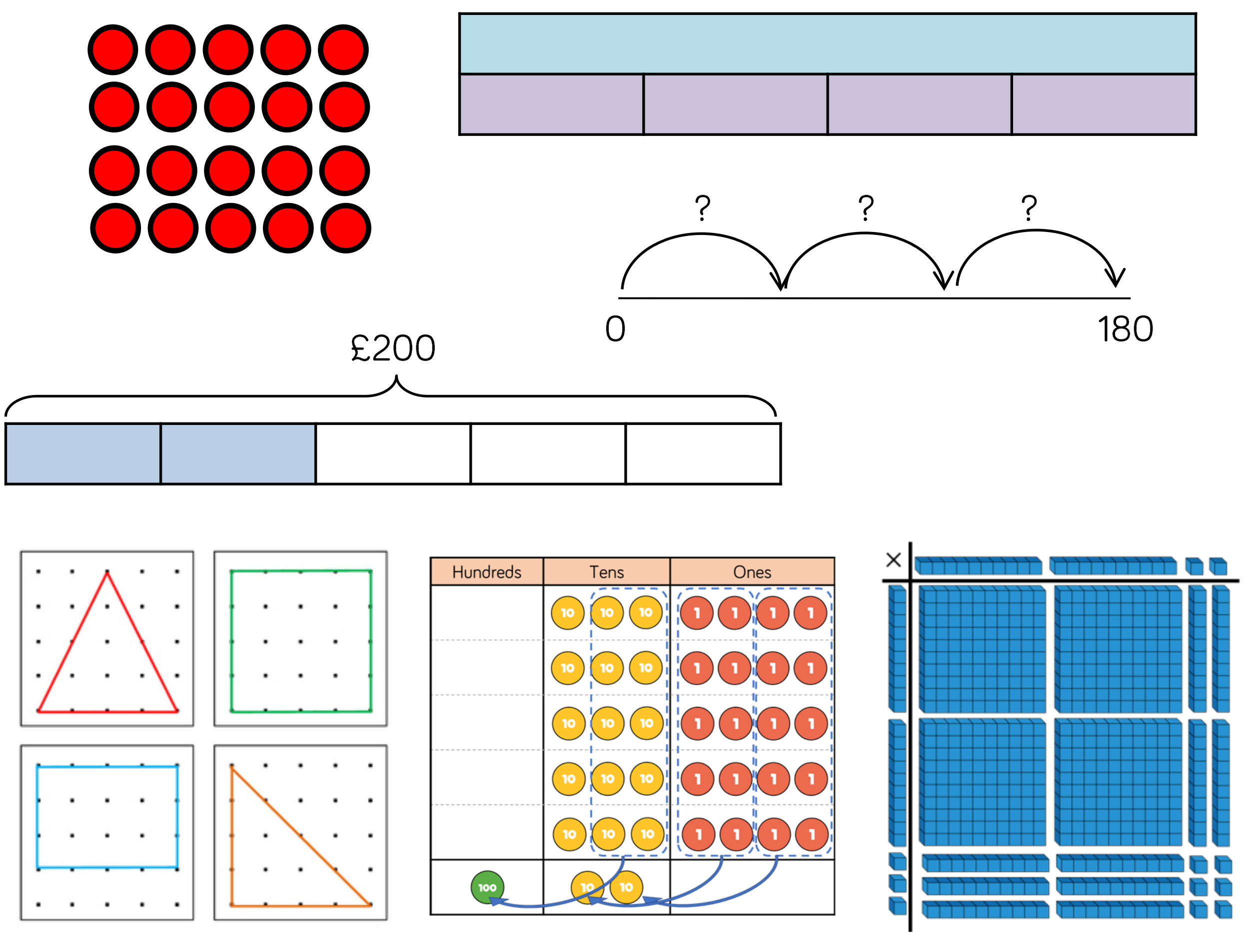
- Some ***brief guidance*** notes to help identify key teaching and learning points
- A list of ***key vocabulary*** that we would expect teachers to draw to students' attention when teaching the small step,
- A series of ***key questions*** to incorporate in lessons to aid mathematical thinking.
- A set of questions to help ***exemplify*** the small step concept that needs to be focussed on.



- These include reasoning and problem-solving questions that are fully integrated into the scheme of learning. Depending on the attainment of your students, you many wish to use some or all of these exemplars, which are in approximate order of difficulty. Particularly challenging questions are indicated with the symbol .
- For each block, we also provide ideas for key representations that will be useful for all students.

In many of the blocks of material, some of the small steps are in **bold**. These are content aimed at higher attaining students, but we would encourage teachers to use these with as many students as possible – if you feel your class can access any particular small step, then please include it in your planning.

Key Representations



Arrays of counters are very useful to illustrate both multiplication and division, as well as demonstrating the commutativity of multiplication.
Number lines are particularly useful to illustrate the links between multiplication and repeated addition, and division and repeated subtraction.

The column methods are sometimes not understood by students and are therefore prone to error. Linking these formal methods to the use of place value counters and/or base 10 blocks illustrating the result of increasing by factors of 10 are very useful.

Bar models are particularly useful for linking multiplication and division and for calculations involving fractions of amounts.

Multiplication and Division

Small Steps

- Properties of multiplication and division
- Understand and use factors
- Understand and use multiples
- Multiply and divide integers and decimals by powers of 10
- **Multiply by 0.1 and 0.01** H
- Convert metric units
- Use formal methods to multiply integers
- Use formal methods to multiply decimals
- Use formal methods to divide integers
- Use formal methods to divide decimals

Multiplication and Division

Small Steps

- Understand and use order of operations
- Solve problems using the area of rectangles and parallelograms
- Solve problems using the area of triangles
- **Solve problems using the area of trapezia** H
- Solve problems using the mean
- **Explore multiplication and division in algebraic expressions** H

H denotes higher strand and not necessarily content for Higher Tier GCSE

Properties of multiplication & division

Notes and guidance

Students should be reminded of various forms of representing multiplication including those shown and number lines. Discussing scaling models as well as repeated addition would be useful. The inverse nature of multiplication and division should be emphasised, as should the commutativity and associativity of multiplication.

Key vocabulary

Product	Multiply	Divide	Inverse
Quotient	Commutative		

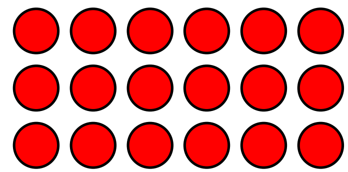
Key questions

If $a = b \times c$ what other multiplication and division facts do we know?

Why is doubling and doubling again the same as multiplying by 4?

Is $\times\ 10$ and then $\div\ 2$ a quick way of multiplying by 5? Find a similar way to divide by 50.

Exemplar Questions



What two multiplications does the array show?
What two divisions does the array show?
Explain how the array shows that multiplication is commutative.
Is division commutative? Why or why not?

36			
9	9	9	9

Write the fact family for this bar model

Draw a bar models to illustrate these:

$$c \div 3 = d$$

$$5p = g$$

What other facts do your models show?

Write true or false next to each statement.
Explain your reasons for each decision.

- 32 × 4 gives the same answer as 4 × 32
- Lucy says that 125 ÷ 5 is the same as 5 ÷ 125
- 62 = 248 ÷ 4 is another way of writing 248 ÷ 4 = 62

Are these statements always, sometimes or never true?
Give examples to illustrate your decisions.

- Multiplication makes numbers bigger
- $1 \times y = y$
- $a \times b = b \times a$
- You cannot multiply or divide by 0
- $a \times (b \times c) = (a \times b) \times c$
- $a \div b = b \div a$

Understand and use factors

Notes and guidance

This small step is a good opportunity to revisit the concept or check understanding through the use of arrays and area models. It is important to emphasise the need for a systematic approach when recording factors, such as recording factor pairs in ascending order. Explore why a number is not a factor as well as why a number is a factor - again arrays will be helpful here.

Key vocabulary

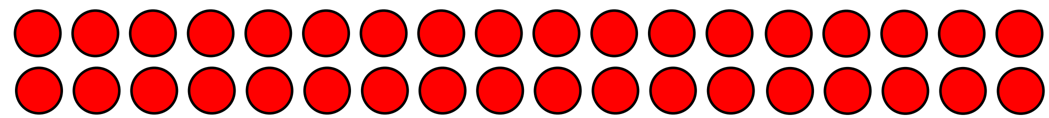
Factor	Array	Venn diagram
Odd	Even	Integer

Key questions

How do you work out the factors of a number?
Which numbers have an odd number of factors? Explain why.
The larger the number the more factors it has. True or false?
Why are factors always integers?

Exemplar Questions

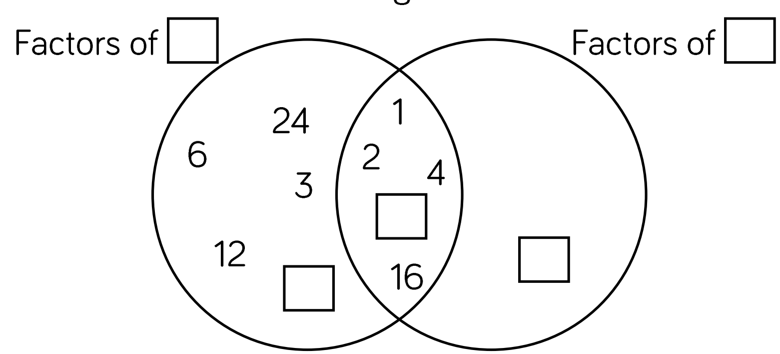
How many different arrays can you make with 36 counters?
For example:



What does this tell you about the factors of 36?
How do you know when you have them all?
Repeat for 24, 17 and 25
What do you notice?

Work out the factors of 30
Explain your method.
What are the factors of 45?
What are the common factors of 30 and 45?
What is their highest common factor?

Here is a part completed Venn diagram containing the factors of two numbers. Work out the missing information.



Understand and use multiples

Notes and guidance

Students need to understand that a multiple of a number is the result of multiplying a number by an integer. Use a bar model to help children see what a multiple looks like. Students may list out the multiples of numbers by multiplying the number by 1, 2, 3 etc… Students need to also be able to work out common multiples of numbers, and also understand the term "lowest common multiple".

Key vocabulary

Multiple   Common   Lowest Common Multiple

Key questions

How do multiples relate to times-table facts?
Is 0 a multiple of every number?
Can multiples be negative?
Do multiples have to be a whole number?
Explain how 18 can be both a factor and a multiple of a number.

Exemplar Questions

Use the diagram to explain why 48 is a multiple of 12

12	12	12	12

Write down 5 other multiples of 12
Write down a multiple of 12 that is greater than 1000.
Explain why 40 is not a multiple of 12

Here is a 50 grid.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50

Circle all the multiples of 4
Now put a square around all the multiples of 6
What are the common multiples of 4 and 6 less than 50?
What is the lowest common multiple of 4 and 6?
How do you know?

Is this always, sometimes or never true?

To work out the lowest common multiple of two numbers, you multiply the numbers together.

What is the lowest common multiple of 3, 6 and 9?
What is the next common multiple of 3, 6 and 9?

Multiply & divide by powers of 10

Notes and guidance

Students are first introduced to multiplying and dividing by powers of 10 in KS2. It is important that within this small step teachers check there is conceptual understanding and not just that students rely on a rule or procedure. Using counters and place value grids will help explain that you don't just "add a zero". Particular attention needs to paid to working with decimals.

Key vocabulary

Place value	Ones	Tenths
Hundredths	Multiply	Divide

Key questions

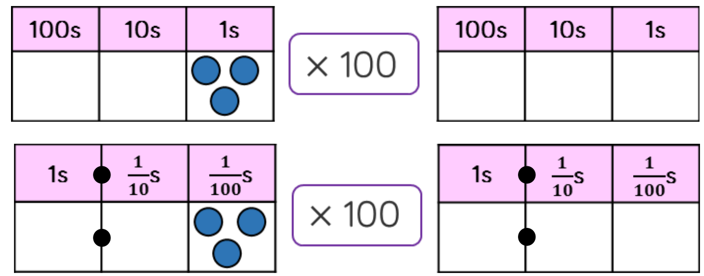
What's the same and what's different about dividing 30 by 10 and 3 by 10?

Why is dividing a number by 10 and then dividing by 10 again the same as dividing the original number by 100?

What's different about multiplying an integer by 10, 100 or 1000 and multiplying a non-integer by 10, 100 or 1000?

Exemplar Questions

Draw counters on each place value grid to show the new number and complete the calculations.



___ × ___ = ___

___ × ___ = ___

What's the same, what's different?

Solve the equations.

$\frac{x}{10} = 5.8$ $\quad$ $100y = 4$ $\quad$ $1.18 \times z = 1180$

Put these calculation cards in order starting with the card that gives the smallest result.

100 × 3.2 | 320 ÷ 10 | 3.2 × 1000 | 3200 ÷ 1000

What is the range of the value of the cards?
What is the median of the value of the cards?

A B C

- B is 10 times bigger than A
- C is 1000 times bigger than A
- What is the value of C ÷ B?

Multiply by 0.1 and 0.01

H

Notes and guidance

Students are already familiar with converting tenths and hundredths between decimal and fractional form, but this next step in understanding can prove challenging. Emphasising the links between fractional and decimal forms is essential. For students following the core strand, it may be best to stick to considering just multiplying by 0.1 To avoid confusion, division by decimals is studied in Year 8

Key vocabulary

Place value	Ones	Tenths
Hundredths	Multiply	Divide

Key questions

What decimal is the same as $\frac{1}{10}$?

How do you find one-tenth of a number?

Explain why $\times\ 0.1$ is the same as $\div\ 10$

Give an example of when multiplication makes a number bigger, and one where it makes a number smaller.

Exemplar Questions

Complete the calculations

$$63 \times 0.1 = 63 \times \frac{1}{10} = 63 \div 10 = \square$$

$$603 \times 0.1 = 603 \times \frac{1}{10} = 603 \div 10 = \square$$

$$603 \times 0.01 = 603 \times \frac{\square}{\square} = 603 \div \square = \square$$

$\times\ 1$	$\div\ 10$
$\times\ 0.1$	$\div\ 100$
$\times\ 0.01$	$\div\ 1$

Match the cards on the left to the equivalent cards on the right.

What card would match with this card? $\div\ 0.1$

Put the results of these calculations in order, starting with the smallest.

82×0.1	$802 \div 10$	$80.2 \div 100$
8.2×10	$82 \div 100$	80.2×0.01

Convert metric units

Notes and guidance

When students convert metric units they need to understand the different types of metric units - length, mass and capacity. Students need to understand the relative size of these different measures to help them understand the connection between them. This will help them see whether they need to multiply or divide., rather than relying on just remembering; for example 1 m is 100 times as big as 1 cm

Key vocabulary

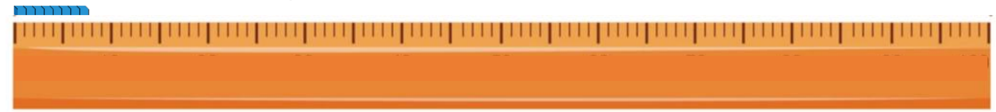
Metric	Milli-	Centi-	Kilo-
Convert	Litre	Gram	Metre

Key questions

What do the words milli-, centi- and kilo- mean?
How do you convert km to m and kg to g? What's the same, what's different?
What do you think a centilitre is? What about a kilolitre? Do these measurements exist?
Why can you not convert metres to milligrams?

Exemplar Questions

How many ones can you place along a metre stick?
What does this tell you?



Complete each bar model and conversion.

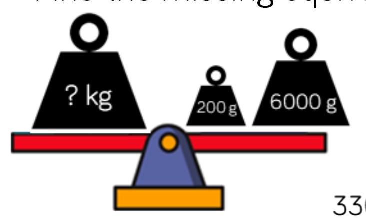
1 km	1 km	1 km	1 km
1,000 m	1,000 m		

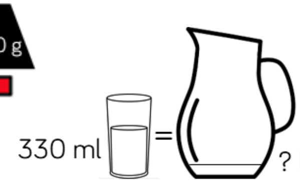
4 km = ________ m

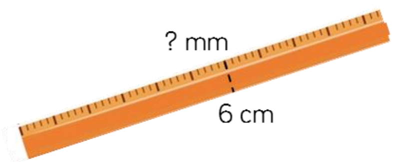
1 kg	1 kg	1 kg	1 kg	1 kg	1 kg	$\frac{1}{2}$ kg	
1000 g	1000 g	1000 g					

$6\frac{1}{2}$ kg = ________ g

Find the missing equivalent measures:







Which is the greatest in each pair? How do you know?

20 m or 20 000 cm

3 kg or 30 000 g

0.7 m or 7 cm

0.4 kg or 40 000 mg

60 cl or 6000 ml

Formal methods: multiply integers

Notes and guidance

Students have been exposed to formal methods of multiplication throughout KS1 and KS2, but may not have discussed the conceptual understanding behind each individual method or which method is a more efficient method to use especially when we are using increasingly larger numbers. Revisiting of estimating using rounding to one significant figure is vital here.

Key vocabulary

Multiply	Integer	Product
Efficient	Estimate	

Key questions

Why would it not be sensible to show 27 × 39 using place value counters?
Is a formal method always the best way to solve a multiplication?
How would you work out 63 × 99?
Why is 36 × 24 ≠ 30 × 20 + 6 × 4?

Exemplar Questions

Hundreds	Tens	Ones
100 100	10 10 10 10 10 10	1 1 1 1
100 100	10 10 10 10 10 10	1 1 1 1
100 100	10 10 10 10 10 10	1 1 1 1
100 100	10 10 10 10 10 10	1 1 1 1

What multiplication is illustrated here?
What exchanges could you make?
How does this link to the formal column method?

Complete these calculations.

	H	T	O
	1	8	7
×			9

×	100	80	7
9			

	1	8	7
	1	8	7
	1	8	7
	1	8	7
	1	8	7
	1	8	7
	1	8	7
	1	8	7
+	1	8	7

Which is the most efficient method?
Which method is not appropriate for 187 × 56?

By rounding the numbers to one significant figure, estimate the answers to these calculations.
Then use the column method to find the actual answers.

25 times as big as 61

What is the product of 84 and 12?

9 tens and 3 ones multiplied by 235

Formal methods: multiply decimals

Notes and guidance

Students should learn to multiply decimals through using what they have learned about multiplying and dividing by powers of 10. For example when multiplying 0.2 by 0.3 they should think of it as 2×3 first then adjust their answer to match the original question. A common mistake here is to think the answer is 0.6. Students should recognise that the calculation has been multiplied by 100 not 10 and therefore the answer should be divided by 100 not 10, hence giving them 0.06

Key vocabulary

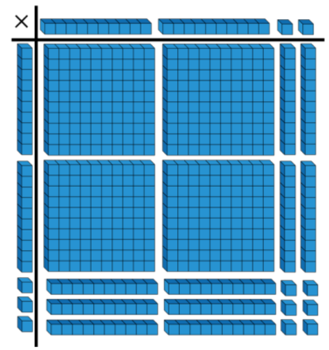
Place value	Adjust	Estimate

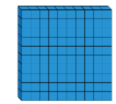
Key questions

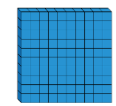
How do you estimate the answer to a decimal multiplication?

Explain why $6.4 \times 24 = 2.4 \times 64$. Tell me three more multiplications using these digits that have the same answer.

Exemplar Questions



What does the diagram represent if  is equal to 100?

What does the diagram represent if  is equal to 1?

Work out 17×8. Use your answer to write down the answers to

- 1.7×8
- 0.17×8
- 0.8×17
- 0.8×0.17

Compare these ways of calculating 43×9.9

- Work out 43×99 and divide the answer by 10
- Work out 43×10 and 43×0.1 and subtract the answers

Find the missing number in the calculations using the fact that

$$58 \times 113 = 6554$$

$5.8 \times 113 = \square$ $\quad$ $5.8 \times \square = 65.54$ $\quad$ $\square \times 1.13 = 0.6554$

Here is a rule for generating a sequence.

Multiply the previous number by 1.6 then add 5

The second term of the sequence is 15

What is the difference between the third and fourth terms of the sequence?

Formal methods: divide integers

Notes and guidance

Students have studied both short and long division at KS2. In this small step they will revisit the formal method of short division, and also consider strategies to simplify complex divisions e.g. $8808 \div 24$ as $8808 \div 6$ and then divide the answer by 4. Problems should be chosen so that answers with remainders and with decimals are appropriate.

Key vocabulary

Place value	Divisor	Dividend
Quotient	Remainder	

Key questions

The quotient is 7. Make up some questions.
The quotient is 23. Make up some questions.
How do you do about estimating the answer to a division calculation?
Is it possible to divide an integer by a larger integer? Why or why not?

Exemplar Questions

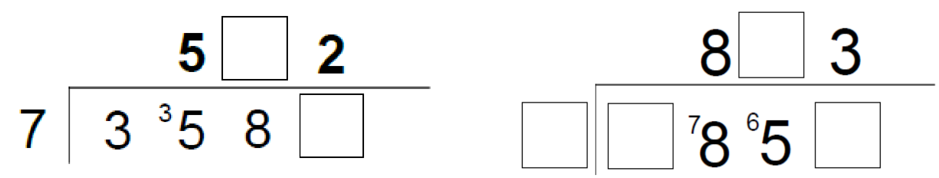
Complete the calculations.

- 135 ÷ 3
- 136 ÷ 3
- 137 ÷ 3
- 138 ÷ 3
- 139 ÷ 3
- 140 ÷ 3

What's stayed the same?
What's changed?
What generalisations can you make?

Predict what would happen when you divide six consecutive numbers by 4 then test if you are correct by completing your calculations.

Find the missing numbers in these calculations.



To divide a number by 18 you can use the rule:

Divide the number by 6 then divide that answer by 3

Use the rule to work out the answer to 387 ÷ 18
Why do you think the rule works? Which other one digit numbers could you have used instead of 6 and 3?

Formal methods: divide decimals

Notes and guidance

The previous step looked at dividing integers by integers. This step builds on this by extending to dividing decimals by integers. Dividing decimals by decimals is covered in Year 8. Students should use the formal method for division used earlier to divide a decimal by an integer. Remind students that a division may be written as a fraction too.

Key vocabulary

Place value	Divisor	Dividend
Quotient	Decimal	

Key questions

How do you know $341 \div 2$ will not have an integer answer?

Explain why 341 is the same as 341.0 or 341.00

What type of equations are solved using division? Tell me three examples.

Exemplar Questions

Use formal methods to solve the equations.

$3a = 411$ $3a = 41.1$ $3a = 4.11$ $3a = 0.411$

$6b = 72.6$ $4c = 0.9$ $12d = 96.9$ $e = \frac{36.8}{8}$

Garnel is thinking of a number.

When Garnel multiplies his number by 8 he gets 12.48

What number did Garnel start with?

Complete the missing numbers.

Make up a similar problem of your own.

$$\begin{array}{r} 0\ \square\ 4\ .\ \square \\ 8\overline{)\ \square\ {}^{1}9\ {}^{3}\square\ .\ {}^{4}0} \end{array}$$

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16 text books cost £61.60 in total. Compare these methods of finding the cost of one text book.

£61.60 ÷ 8 ÷ 2 £61.60 ÷ 4 ÷ 4 £61.60 ÷ 2 ÷ 2 ÷ 2 ÷ 2

The books weigh 9.28 kg in total.

Find the weight of three of the books.

Explain your different approaches to perform these calculations.

$34.7 \div 8$ 34.7×8 34.7×0.8

Order of operations

Notes and guidance

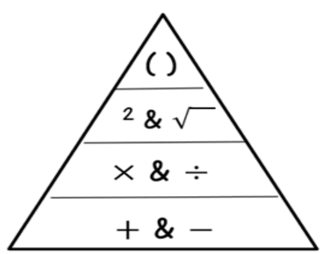
Students have met the order of operations at KS2 but some may be reliant on rules such as BIDMAS and may have misconceptions about when it is correct to work from left to right e.g. $10 - 3 + 5$ should be $7 - 5 = 2$ but is often incorrectly performed as $10 - 8$ “because you have to do addition before subtraction”.

Key vocabulary

Order	Operation	Priority

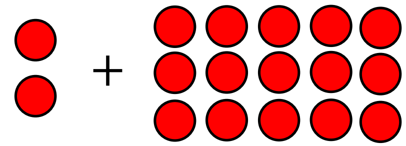
Key questions

Why is multiplication done before addition?
Why do multiplication and division have equal priority?
Explain how this diagram helps you remember which operations come before others.



Exemplar Questions

Explain how these counters show $2 + 3 \times 5$



What is the answer?
Which part of the calculation did you do first?

Underline the first part of the calculation you will do.
Then work out each calculation.

$3 + 5 \times 8$	$3 \times 5 - 8$	$3 - (5 - 8)$
$72 + 5 \times 2$	$5 \times 2 + 72$	$72 + (5 \times 2)$

What mistake has been made in each of the calculations?

$18 - 10 \div 2 = 4$ $10 - 2 + 4 = 4$

What should the correct answer be?

Find the missing numbers

_____ $\times 3 + 8 = 22$ $19.8 - 5 +$ ____ $= 11.3$

$126^2 -$ _____ $= 74$ ____ $\times 4 + 10 \div$ ____ $= 17$

Explain two ways you could work out the answer to this calculation.

$39 \times 2 + 2 \times 17$

Is one method more efficient that the other(s)?

Area of rectangles & parallelograms

Notes and guidance

Students should explore the connection between the area of a rectangle and parallelogram. They should see how the area formulae for both shapes are related. You might want to use squared or dotty paper with students so that they can understand why the area of a 6×4 rectangle is 24 cm^2 and it will help them see that the area of a parallelogram is base $\times$ perpendicular height.

Key vocabulary

Base	Perpendicular height
Parallelogram	Parallel

Key questions

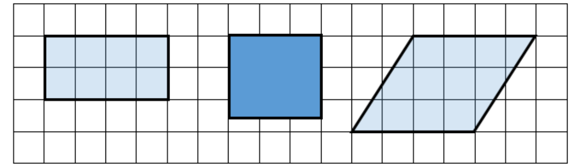
What is the same? What's different about finding the area of a rectangle and parallelogram?

Draw a rectangle with an area of 20 cm^2. Draw a parallelogram with an area of 20 cm^2. Now draw more. What do you notice?

"If the area of the two rectangles are equal, then the perimeters are equal." Always, never or sometimes true?

Exemplar Questions

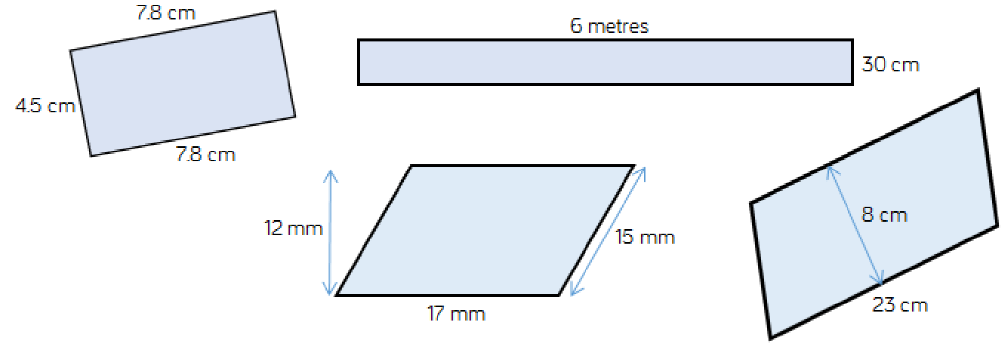
Find the area of each of these shapes.



A rectangle has area 34 cm^2. Find its width if its length is:

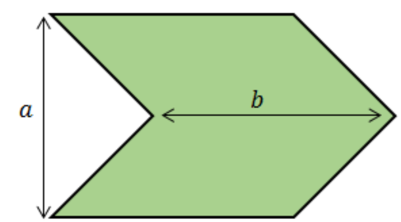
- 17 cm
- 8 cm
- 4 cm

Calculate the area of these shapes.



How many rectangles can you find with an area of 60 cm^2 if the length and width are both integers?
Which rectangle has the greatest perimeter?

Explain why the area of this shape is ab.



Area of triangles

Notes and guidance

The focus of this small step is more on solving problems as they have met the area of a triangle previously. Remind students that the area of a triangle can be found by multiplying the base and perpendicular height and then dividing the answer by 2. Help them understand why they divide by 2 by showing a squares, rectangles and parallelograms divided into two equal sized triangles.

Key vocabulary

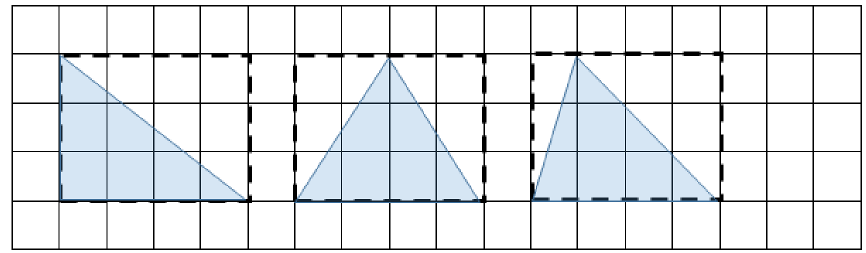
Base	Perpendicular height
Parallelogram	Parallel

Key questions

Explain/show why you need to divide by 2 to find the area of triangle.
What is meant by the perpendicular height?
How do you work out the area of a triangle when the units are different?
How can you show any triangle is half of a parallelogram?

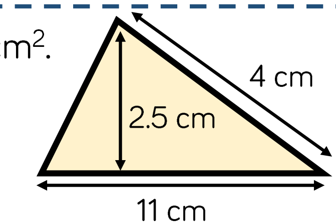
Exemplar Questions

Find the area of these triangles.



What do you notice? Why is this the case?

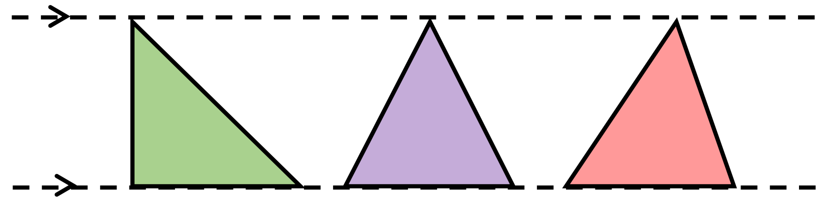
Max says the area of this shape is 22 cm^2.
Explain why Max is wrong.
How can he work out the area of the triangle?



The area of a triangle is 50 cm^2.
What is the height of the triangle if the base and height are equal?
Work out the height of the triangle if the length of the base is

- 10 cm
- 20 cm
- 50 cm
- 1 cm

The base of each of these triangles is equal.
Explain why the area of the triangles is equal.



Area of trapezia

H

Notes and guidance

Ask students to find the area of a right trapezium. Students will probably divide the shape into a rectangle and a triangle and then add up the answers. Consider then replacing the sides with letters to be able to find a formula for the general area of the trapezium. Explore other trapezia including isosceles, acute and obtuse examples. Students should always be encouraged to find the area of the a trapezium using the formula.

Key vocabulary

Trapezium	Perpendicular height	Parallel

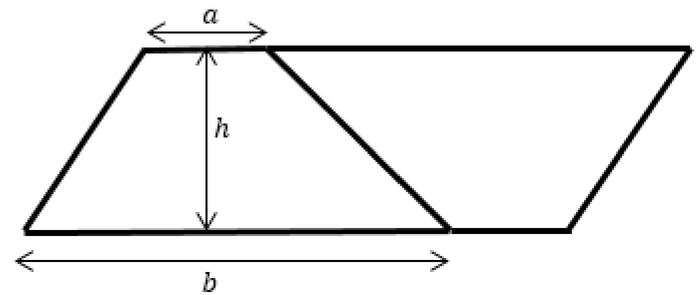
Key questions

What is a trapezium? What are the properties? How many different types of trapezia can you draw/make?

How could you find the area of this trapezium? Can you prove that the area of a trapezium is always $\frac{1}{2}(a+b)h$?

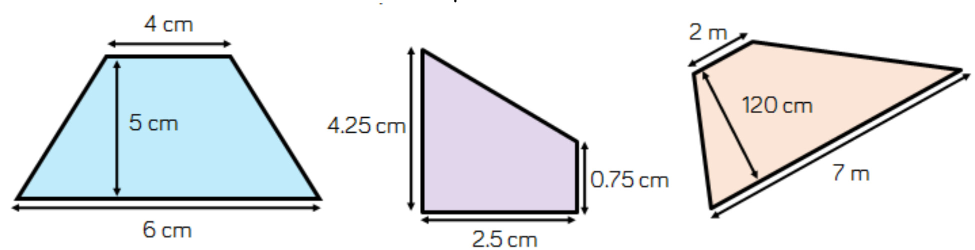
Why is it more efficient to use the formula for find the area rather than dividing it into other shapes?

Exemplar Questions

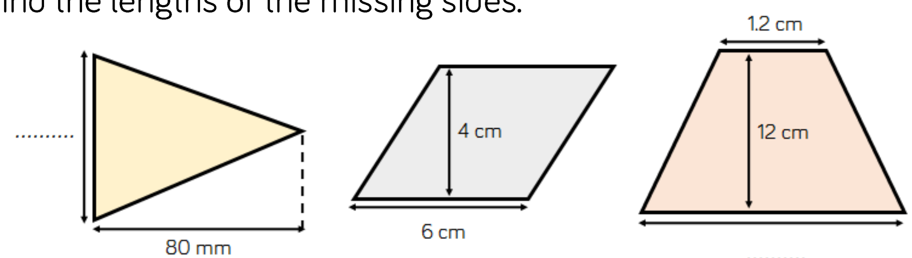


The diagram shows two identical trapezia. Explain why the area of the trapezium is given by $\frac{1}{2} \times (a+b) \times h$

Calculate the area of each shape.



All these shapes have the same area.
Find the lengths of the missing sides.



Solve problems involving the mean

Notes and guidance

Students should understand that the mean of a set of number is an example of an average. The mean gives an idea of the central value. It is important for students to understand visually what happens when you find the mean and how the set of numbers "average out". This will help students when they have to find missing numbers.
Consider also with some students extending finding the mean of a set of numbers that have been summarised in a table.

Key vocabulary

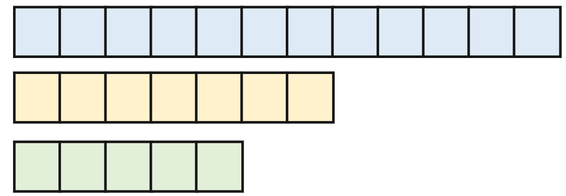
Mean Average Median Range

Key questions

Can you show visually what happens when you find the mean of a set of numbers?
Do you know any other measures of average?
When might you use the mean over the median? When might it be better to use the median rather than the mean?
If you know the mean of a set of numbers, how do you find their total?

Exemplar Questions

Alex has 12 cubes, Bilal has 7 cubes and Carlos has 5 cubes.



What is the mean number of cubes?
Use cubes to help you.
How would you move the cubes to show that the mean is 7?

Find the mean of these sets of numbers.

5, 7, 11, 29, 29 12.8 kg, 32.5 kg, 19.7 kg, 84.6 kg

What do you notice about the mean of all these sets of numbers?

- 10 10 10 10 10
- 10 10 10 5 15
- 50 0 0 0 0
- 26 20 2 1 1

Write down more sets of 5 numbers that have the same mean.

The mean of these numbers cards is 12
What is the missing number?

19 18 7 ?

The mean of a different 4 cards is 6
The median of the cards is 7
What could the cards be?

Multiplication & division with algebra H

Notes and guidance

Students will already be familiar with substitution into expressions from their study of algebra in the Autumn term. This step builds on this, and gives them the opportunity to look at more complex expressions involving repeated letters and more than one letter. Division of algebraic terms is often neglected, but should be taught alongside multiplication emphasising the inverse nature of the operations.

Key vocabulary

Coefficient	Quotient	Expression
Simplify	Term	

Key questions

Why is it possible to simplify $2a \times 3b$ but not $2a + 3b$?

The area of a rectangle is $6xy$. What might the lengths of the sides be?

Why do we write $a \times 2$ as $2a$ instead of $a2$?

Exemplar Questions

If $x = 7$ and $z = 3$, calculate the value of the following expressions:

$\frac{4x}{z}$ $z(3x + 4z)$ $\frac{3}{4}x$ x^z

Put these expressions in ascending order of size.
Could you change the values of x and z to change the order of the value of the expressions?

Simplify the following sets of expressions. What's the same and what's different?

2×6	$15a^2 \div 3$	$20cd \div 4$
$2a \times 6$	$15a^2 \div a$	$20cd \div 4d$
$2 \times 6b$	$15a^2 \div 3a$	$20cd \div 4c$
$2a \times 6b$	$15a^2 \div 3a^2$	$20cd \div 4cd$

Make up some more sets of related calculations.

Jim says all three of these expressions are the same as they're just the same numbers and letters in a different order. Do you agree?

$4ab$ $ab4$ $a4b$ $2a2b$ $4ba$

Match the sets of cards that show equivalent expressions

$\frac{24de}{2e}$ $12d^3$ $6d^2 + 6d^2$ $48d \div 4$ $\frac{36d^2}{3}$

$2d \times 6d$ $d \times 3 \times 4d$ $4d^2 \times 3d$ $3d \times 4$