This guide is for parents/carers and any adult working with the child.

The Year 5 homework book is aimed to support children's in-class learning. There are ten pieces of homework, each linked to the units of work in the Year 5 programme of study. The tasks provided complement the work done in class and aim to provide opportunities for children to practise and consolidate their understanding of key concepts relevant to the Year 5 curriculum. Each piece of homework should take no more than 30 minutes to complete.

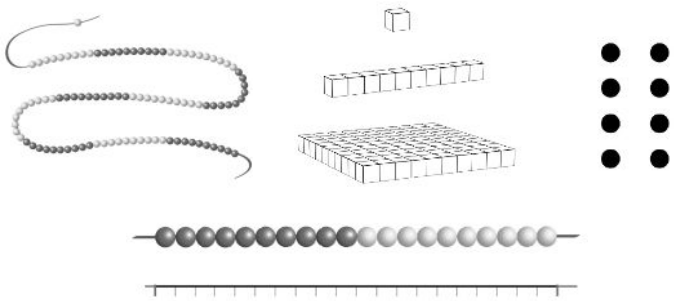
In order to support your child with the tasks, each piece of homework is accompanied by parental guidance. The guidance also aims to provide an opportunity for you to understand the methods your child is being taught, which may differ from methods you are familiar with. The methods used correspond to the expectations of the National Curriculum 2014 and are the expected methods that children are required to demonstrate understanding of. For additional support, there is also a glossary of key words at the end of the book.

What is 'Mastery'?

The 'mastery approach' to teaching mathematics is the underlying principle of Mathematics Mastery. Instead of learning mathematical procedures by rote, we want your child to build a deep understanding of concepts which will enable them to apply their learning in different situations. We do this by using three key principles:

Conceptual understanding

Your child will use multiple concrete and pictorial representations and make connections between them. A key part of a 'deep understanding' in maths is being able to represent ideas in lots of different ways.



34 864 - 25 423 = 9441

This is an ***equation***

We don't round a number 'up' or 'down', we round it to the ***nearest multiple*** of 10, 100, 1000 etc.

Mathematical language

When asked to explain, justify and prove their ideas, your child is deepening their understanding of a concept. The correct mathematical vocabulary is taught from the outset and communication and discussions are encouraged.

Mathematical thinking

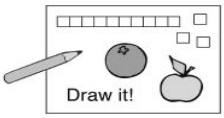
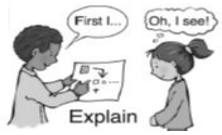
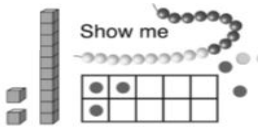
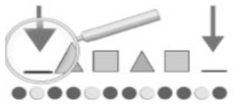
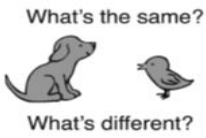
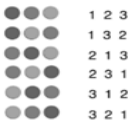
Lots of opportunities are planned for your child to investigate open questions that require them to sort and compare, seek patterns and look for rules. Good questioning, both for and from your child, build a deeper understanding of maths.

What is the same? What is different?

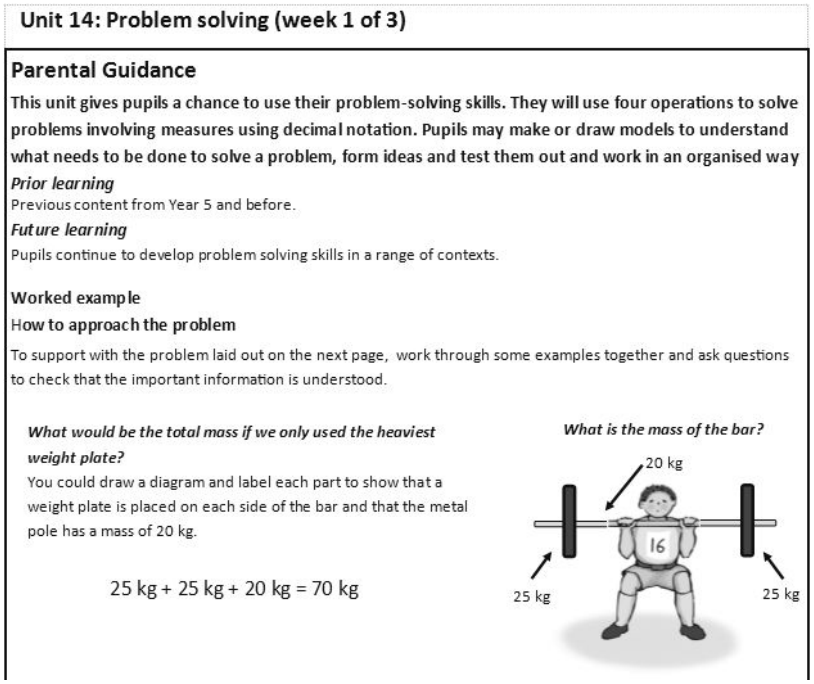
Is there a rule? Is it always, sometimes or never true?

Ideas for Depth

At the end of each homework piece there is an 'Idea for Depth' question or activity for your child to engage with which will provide further challenge to deepen their understanding of a concept. Children could use the pages at the back of the book to record their answers. These challenges may be open-ended, involve discussion and/or application to real life situations and you should encourage your child to apply their learning to each task. All challenges support the development of at least one of the principles of mastery. The ideas can also be used outside of maths homework tasks in day to day discussions to allow opportunities for your child to see maths in everyday situations. The table below explains the Ideas for Depth.

	'**What's the question**?' If this is the answer, what could the question have been? This could be an equation or a word problem.
	'**What's wrong with this**?' Can you explain what is wrong with this and correct the error?
	'**Draw it'** Draw a picture to explain or demonstrate what you have worked out.
	'**Reason it'** Explain how you know.
	'**Show me!**' Convince me that you are right.
	**'Find a pattern'** Can you see a pattern (in the numbers)? Can you see a pattern in the answers? Continuing this pattern, what would happen if...? What came before? What comes next? Explain how you know.
	'**What's the same? What's different?**' Can you find anything that is the same about these two numbers/shapes/calculations? Now can you find something that is different?
	**'Have you found all possibilities**?' Is there more than one way of completing this? Is there more than one answer? Have you found them all?
	**'Maths story'** Make up a real-life story using your equation/numbers or shapes.
	'**Odd one out'** Find an odd one out and explain why it doesn't fit. Could another one be the odd one out? Why?

Parental guidance



Unit 14: Problem solving (week 1 of 3)

Parental Guidance

This unit gives pupils a chance to use their problem-solving skills. They will use four operations to solve problems involving measures using decimal notation. Pupils may make or draw models to understand what needs to be done to solve a problem, form ideas and test them out and work in an organised way

Prior learning

Previous content from Year 5 and before.

Future learning

Pupils continue to develop problem solving skills in a range of contexts.

Worked example

How to approach the problem

To support with the problem laid out on the next page, work through some examples together and ask questions to check that the important information is understood.

What would be the total mass if we only used the heaviest weight plate?

You could draw a diagram and label each part to show that a weight plate is placed on each side of the bar and that the metal pole has a mass of 20 kg.

25 kg + 25 kg + 20 kg = 70 kg

What is the mass of the bar?

Unit number and unit title

Key learning

Prior and future learning: where this objective fits into the sequence of learning over time.

A worked example followed by key points to support your child.

On every parental guidance page the unit title is located at the top, followed by an overview of the key learning. In addition, you will see where the key learning fits in with what your child has previously learnt, along with where the learning will be taken in subsequent units and years of study. It is important to understand that the principle of mastery does not encourage acceleration and remember that depth of understanding is key to your child becoming a confident mathematician who can think flexibly.

Additional information

Language use

For some homework tasks there is guidance on specific vocabulary or phrases that you and your child should use. E.g.

> The word 'sum' should only be used for calculations involving addition, e.g. the sum of 23 plus 24 is equal to 47. 45 - 32 = , 12 x 4 = , 240 ÷ 4 = are NOT 'sums' they are '**equations**' or '**calculations**'.

The way that pupils speak and write about mathematics has been shown to have an impact on their success in mathematics (Morgan, 1995; Gergen, 1995). Therefore, there is a carefully sequenced, structured approach to introducing and reinforcing mathematical vocabulary throughout maths tasks. You may find some terminology different to that which you are used to.

Use of commas versus spaces in numbers

In Mathematics Mastery numbers with 5 digits or more are represented using a space after the 'thousands' number, e.g. 32 500 (thirty-two thousand, five hundred). However, such numbers can also be represented using a comma instead of a space e.g. 32,500.

You can find further information about the Mathematics Mastery programme online at **www.mathematicsmastery.org.** If you have any questions regarding this homework book please speak with your child's class teacher.

Unit 10: Converting units of measure (Week 1 of 2)

Parental Guidance

Pupils will convert between different units of measure, such as kilometre and metre, gram and kilogram, litre and millilitre as well as converting between units of time. They will begin to understand and use approximate equivalences between metric and common imperial units such as inches and pints.

Prior learning

In previous years, pupils have learned to use a range of measuring equipment with increasing accuracy. In Year 4 pupils were introduced to converting units of length from larger to smaller units and recorded measures as decimal numbers. In Years 3 and 4 pupils measured the perimeter of rectangles and this is extended to measuring the perimeter of shapes that are composite rectangles.

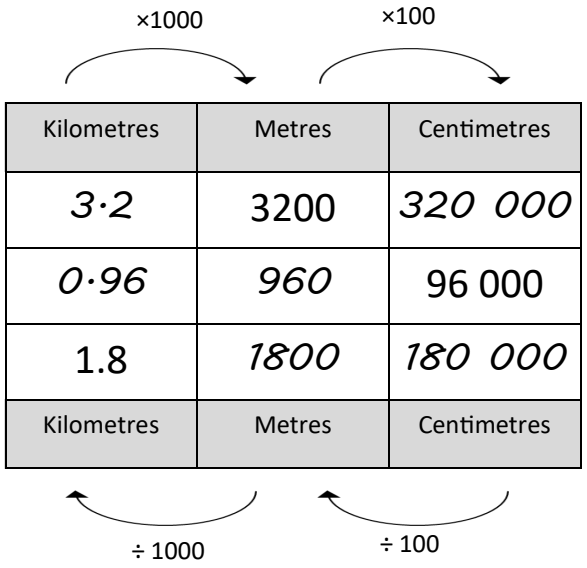
Future learning

Pupils will continue to solve problems involving measures and converting units. They will extend their understanding of the number system to work with numbers with up to three decimal places.

Worked example

Children will know that there are a variety of different units of measurement and they need to be given the opportunity in every day life to identify when and how different measures are appropriately used. Through practical experiences, such as talking about distances when on journeys, weighing ingredients when cooking and talking about how long it might take to complete a certain task will help them become confident in understanding measurement in the real world.

1. 1 km is equal to 1000 m and 1 m is equal to 100 cm. Use this information to complete the table below.



Kilometres	Metres	Centimetres
3·2	3200	320 000
0·96	960	96 000
1.8	1800	180 000
Kilometres	Metres	Centimetres

Being able to convert measures from one unit to another requires children to utilise their knowledge of place value and multiplying and dividing by 10, 100 and 1000.

2. Megan weighs 34 kg. Her brother, Lewis, weighs 260 g more than her. Find the weight of Lewis in kg.

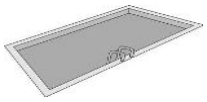
34 kg in g: 34 x 1000 = 34 000 g
Lewis weighs 34 000 g + 260 g = 34 260 g
34 260 g = 34·26 kg
Lewis weighs 34·26 kg.

To calculate accurately measurements should be in the same unit. Here, one of them needs converting. In this example, kilograms have been converted into grams, although the grams could have been converted into kilograms. 260 g in kg: 260 ÷ 1000 = 0.26 so Lewis weighs 34 kg + 0.26 kg = 34.26 kg

Pupil tasks

1. Match each image with the appropriate measurement (*images not to scale or in proportion to each other)

68 metres	4 metres	346 kilometres	330 millilitres	19 grams	150 kilograms

					
The height of a double decker bus	The capacity of a can of drink	The weight of a mouse	The length of the River Thames	The perimeter of a swimming pool	The weight of a motorcycle

_____ _____ _____ _____ _____ _____

2.

A) 1kg is equal to 1000 g. Use this information to complete the below table.

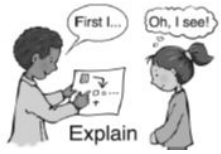
Kilograms	Grams
1.7	
	8400
250	

B) A garden lawn is rectangular in shape. The length of the lawn is 12 m. The width of the lawn is 87 cm shorter. Find the width of the lawn in metres.

3. Caleb leaves his home to travel to the Olympic stadium to watch the athletics. He leaves the house at 7.45 am and is on the train exactly 30 minutes later. His train journey takes 1 hour and 33 minutes. He then has a 42 minute bus journey to reach the stadium. How long is his journey in total? What time does he arrive at the stadium?

Idea for Depth

Explain the meaning of 'kilo', 'centi' and 'milli'.



How do these definitions support your understanding of how to convert kilometres to centimetres and centimetres to millimetres?

Unit 10: Converting units of measure (Week 2 of 2)

Parental Guidance

Pupils will convert between different units of measure, such as kilometre and metre, gram and kilogram, litre and millilitre as well as converting between units of time. They will begin to understand and use approximate equivalences between metric and common imperial units such as inches and pints.

Prior and future learning

See week 1

Metric and imperial units of measure

In previous years, pupils will have had experiences of measure using non-standard units such as measuring length in paperclips or using their finger or hands. These experience led to a realisation of the need for units of measure that are the same and these are called standard units of measure. There are different systems of units of measure that have been and are used in different places around the world.

The most common system used today is the metric system (metres, kilograms, litres). In the past, in England and across the British Empire, the imperial system was used. The focus of this week is on imperial units of measure that might be encountered in real life. Children will develop an understanding of approximate equivalences between these and metric units. Some of the units of measure from this system, that are still in use, are listed on the table in question one of the pupil tasks. For children to make sense of imperial measures, try to give as many opportunities for them to experience them in their own lives and surroundings and apply them in a variety of situations.

Worked example

In class pupils have converted between kilometres and miles and between pounds and kilograms. The pupil tasks on the next page focus on measuring in inches and centimetres and converting between pints and litres.

Using measuring tools accurately

Pupils will need to measure in inches and centimetres using a ruler or a tape measure. Encourage them to think about how to ensure they are as accurate as possible:

- line the zero mark with the start of the item measured,
- hold the tool carefully along the item and
- place their eye in line with the end of the item to read the scale.

Comparing metric and imperial units of measure

Choose the correct symbol to make the statement correct $<$ or $\approx$ or $>$

1 inch $\approx$ 2.5 cm

10 inch $>$ 20 cm

8 inch $<$ 25 cm

16 inch $\approx$ 40 cm

10 inches is equivalent to 25 cm so 10 inches is greater than 20 cm.

2 inches is about 5 cm so 4 inches is about 10 cm and 8 inches is approximately 20 cm.

8 inches is less than 25 cm

From the question before we worked out that 8 inches is approximately 20 cm so 16 inches is approximately equal to 40 cm

The approximately equal symbol $\approx$ is used. This is not an exact conversion between the two, it is an approximation.

Pupil tasks

1) Are imperial units of measure still used? Explore your surroundings to see and hear examples of these units. Ask your family and friends if they can think of examples where these units are used. Record your findings in the table below or in the notes pages at the back of the book.

Length inches, feet, miles	
Mass ounce, pound (lb), stone	
Volume fluid ounce (fl oz), pint, gallon	
Other	

2) Measure the length of different items in centimetres and then again in inches. If you do not have a ruler at home, there is a small one printed at the back of the book.

Item measured	Inches	Centimetres

3) Some liquids are sold in pints, have a look at milk containers. A pint is a bit more than half a litre.

1 pint ≈ 570 ml Which symbol will make the statements below correct. $<$ or $\approx$ or $>$

1 litre ◯ 3 pints

2 litres ◯ 2 pints

10 pints ◯ 5.7 litres

6 pints ◯ 3 litres

Idea for Depth

? ← Answer

If these are the measurements, what could have been measured?

14 inches	3 feet	5 miles
1 pint	2 lbs	12 fl oz

Unit 11: Calculating with whole numbers and decimals (week 1 of 3)

Parental Guidance

Pupils become fluent multiplying and dividing by 10, 100 and 1000 with numbers involving decimals. In this unit time is dedicated to exploring, clarifying and applying previously met content. They will use all four operations to solve problems involving measure using decimal notation.

Prior learning

This unit consolidates learning from previous units on place value, calculating with all four operations and measures.

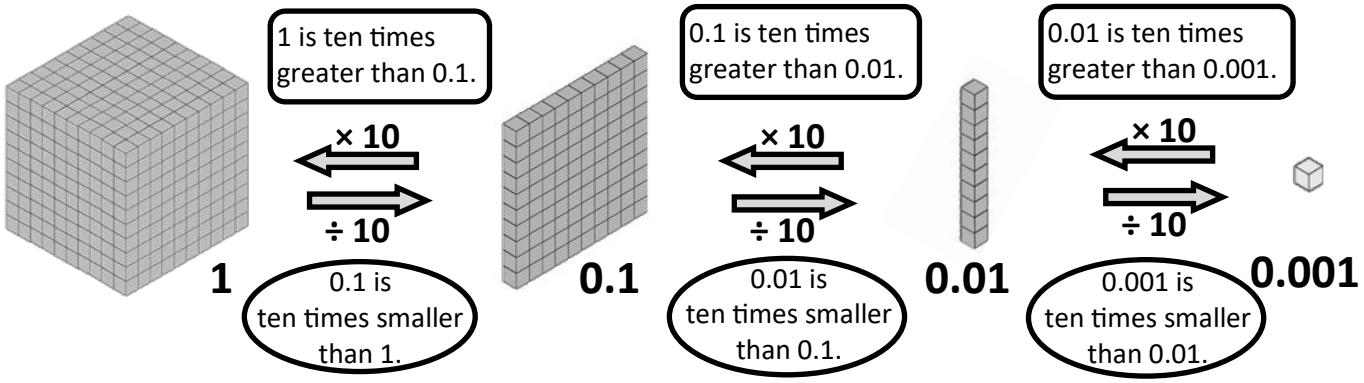
Future learning

Pupils will continue to consolidate learning.

REMEMBER: The digits after the decimal place are said as separate digits. For example, 0.25 is said "zero point two five" and not "zero point twenty five" as this can cause place value confusion, thinking that 0.25 is greater than 0.3 because 25 is greater than 3.

Worked examples

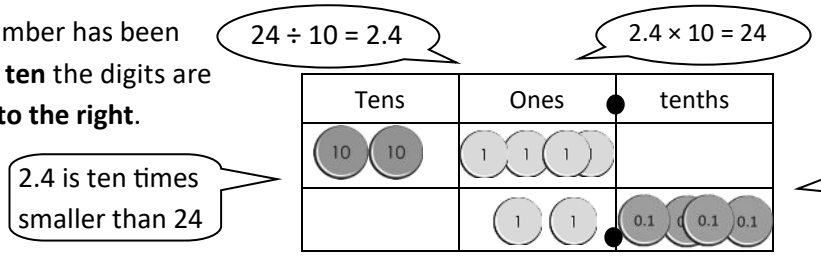
Dienes blocks are used to build an understanding of the relationship between ones, tenths, hundredths and thousandths. The large cube now represents one and pupils can line up the blocks to see that ten of these are the same as one of these for each value.



Place value counters on a place value chart are useful for visualising and explaining the relationships in our number system that make it quite simple to multiply and divide by 10, 100 and 1000.

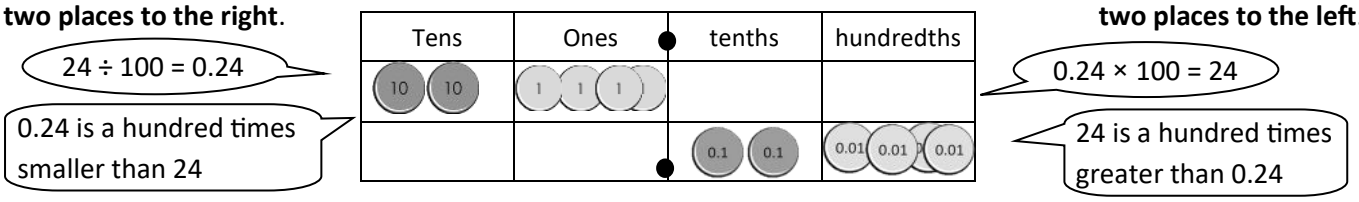
When a number has been **divided by ten** the digits are **one place to the right**.

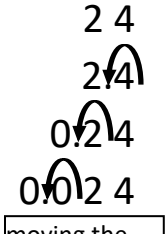
When a number has been **multiplied by ten** the digits are **one place to the left**.



When a number has been **divided by 100** it is the same as dividing by ten and then dividing by ten again and so the digits are **two places to the right**.

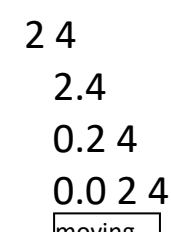
When a number has been **multiplied by 100** it is the same as multiplying by ten and then multiplying by ten again and so the digits are **two places to the left**.





Should you just move the decimal point?

You may have been taught to multiply and divide by 10, 100 and 1000 by moving the decimal point. On the charts above the digits appear to move rather than the decimal point. Once pupils have built an understanding of place value relationships and are confident explaining, then this "trick" of moving the decimal point or moving the digits can be highlighted and used.



Pupil tasks

1a) Complete the table to represent the answer to each calculation:

Make 1.6 ten times greater.

Make 1.6 ten times smaller.

Make 1.6 one hundred times smaller.

Tens	Ones	tenths	hundredths	thousandths
	1	0.1 0.1 0.1 0.1 0.1 0.1		

1.6

1.6 × 10 = ☐

1.6 ÷ 10 = ☐

1.6 ÷ ☐ = ☐

1b) Complete the table to represent the answer to each calculation:

Make 0.34 ten times smaller.

Make 0.34 ten times greater.

Make 0.34 one hundred times greater.

Tens	Ones	tenths	hundredths	thousandths
		0.1 0.1 0.1	0.01 0.01 0.01 0.01	

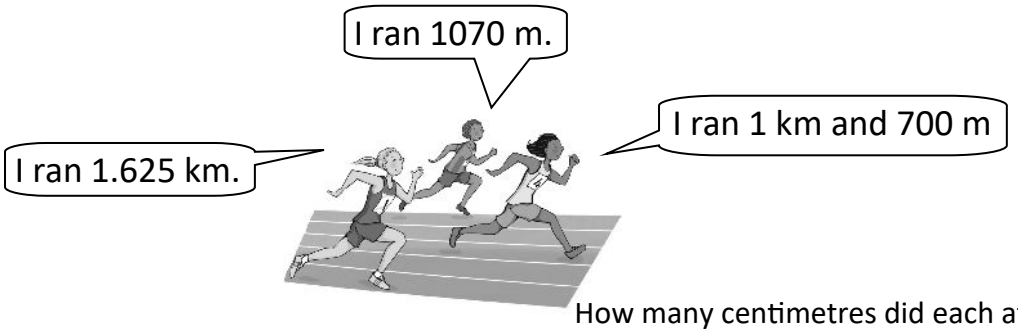
0.34

0.34 ÷ 10 = ☐

0.34 × ☐ = ☐

0.34 × 100 = ☐

2) Write down each distance in kilometres, then in metres. Which athletes ran the greatest distance?



How many centimetres did each athlete run?

3) 

Across a day, Mike drank 2.4 litres of water.

How many millilitres did Mike drink?

Mike drank ☐ ml.

Dom drank 3.8 litres of water. How many millilitres did Dom drink?

Dom drank ☐ ml.

How many millilitres did they drink altogether?

In total they drank ☐ ml.

How many litres did they drink altogether?

In total they drank ☐ litres.

Idea for Depth

Spot the errors and use space at the back of the book to explain the mistakes.

10.5 ÷ 10 = 1.5

2.06 ÷ 10 = 0.26

407 ÷ 10 = 47

140 ÷ 100 = 0.14

2360 ÷ 1000 = 0.236

Unit 11: Calculating with whole numbers and decimals (week 2 of 3)

Parental Guidance

Pupils extend addition and subtraction calculation strategies for whole numbers to decimal numbers. There is a focus on devising and explaining efficient strategies for different calculations. Pupils realise how powerful known facts can be when deriving unknown facts and time is dedicated to exploring, clarifying and applying previously met content. They will use all four operations to solve problems involving measure using decimal notation.

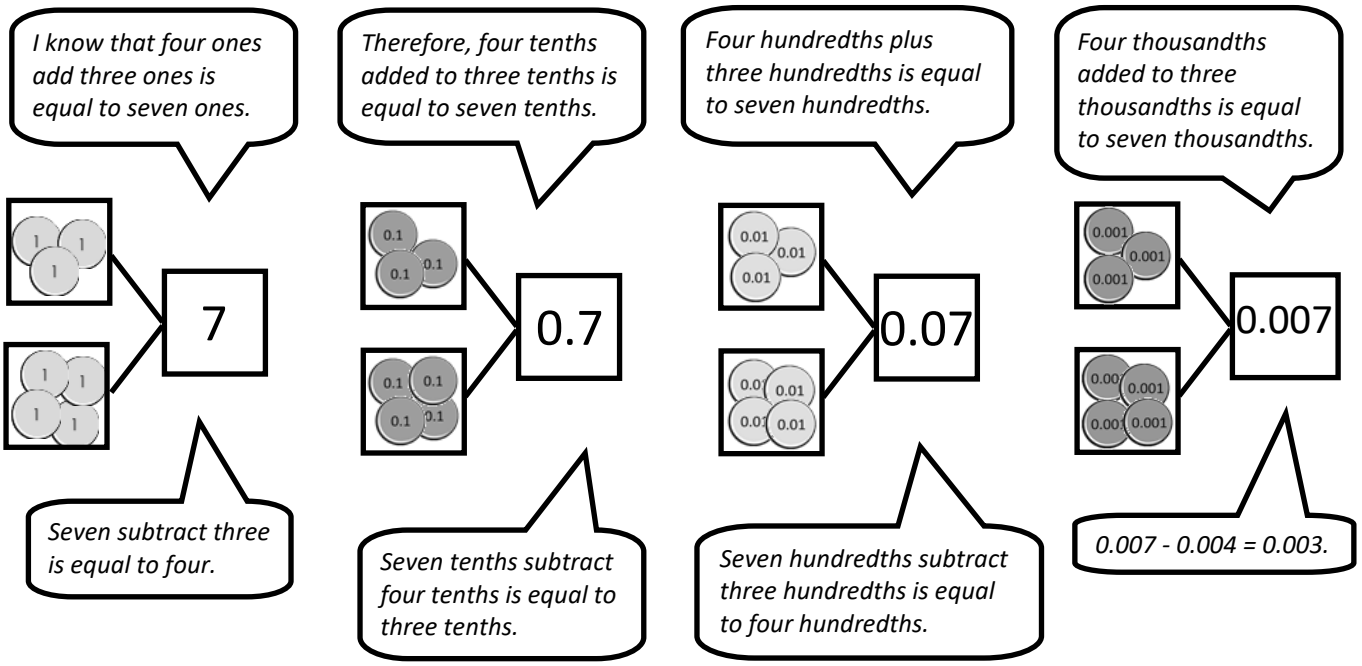
Prior & future learning

See week 1.

Say the words 'tenths', 'hundredths' and 'thousandths' carefully to avoid confusion with tens, hundreds and thousands.

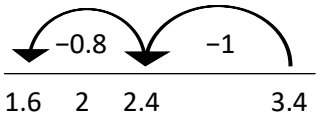
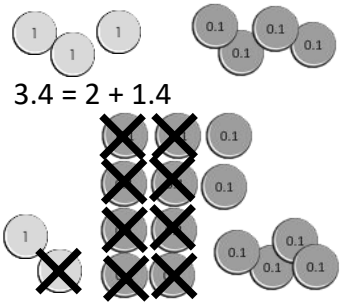
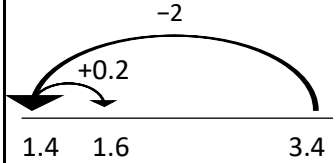
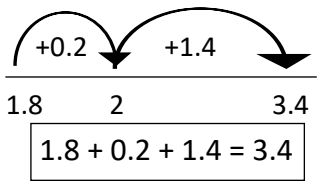
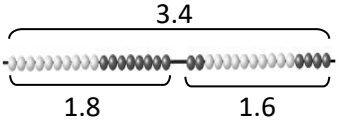
Worked examples

The strategies for calculating with decimal numbers are essentially the same as those for whole numbers however, a secure understanding of decimal place value is needed.



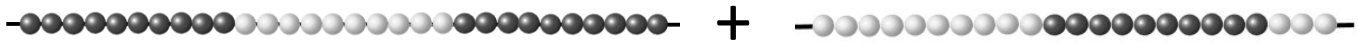
These examples show a range of addition and subtraction facts that can be derived from a known fact. This can be applied to all of the whole number addition and subtraction facts that pupils know.

The calculation strategies that pupils are familiar with from whole number calculations can be used with decimal numbers. Below are examples of a range of strategies that can be used to calculate $3.4 - 1.8$:

Partition one number	***Partition both numbers***	***Round and adjust***	***Find the difference***
 3.4 − 1 = 2.4 2.4 − 0.8 = 1.6	 2 − 1 = 1 1.4 − 0.8 = 0.6	 3.4− 2 = 1.4 1.4 + 0.2 = 1.6	 1.8 + 0.2 + 1.4 = 3.4  1.8 + 1.6 = 3.4

Pupil tasks

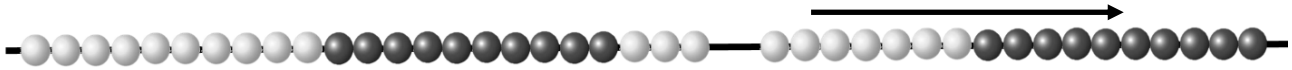
1) The beads below represent an addition calculation:



Which of these calculation could it represent?

3 + 0.23	0.3 + 0.23
3000 + 2300	30 + 230
300 + 23	3 + 2.3

2) The beads below represent a subtraction calculation:

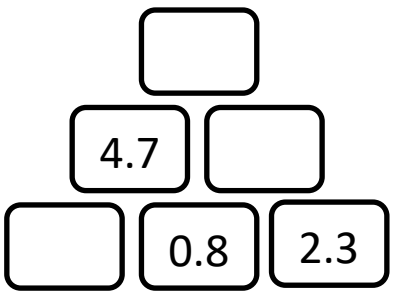


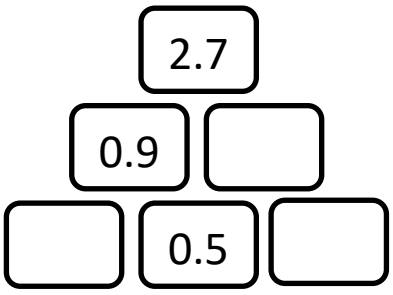
Complete the table by recording the calculation represented if each bead had a different value.

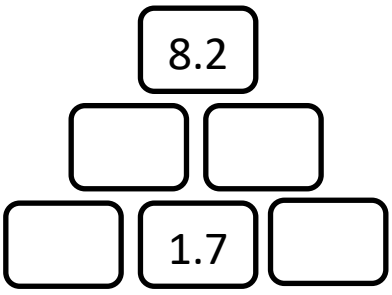
If each bead represents ...	...the calculation is...	The difference is...
1	40 − 17	
0.1		
10		
0.01		

For the last row, choose your own value for each bead.

3) Complete the pyramids. Each block is the sum of the two blocks below.

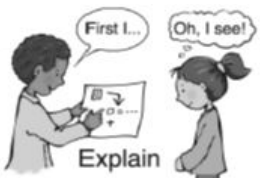






There is more than one possibility. Use the spare pyramids at the back of the book to investigate.

Idea for Depth



Look at question one:

Choose a calculation that the bead string **does not** represent and explain why.

Unit 11: Calculating with whole numbers and decimals (week 3 of 3)

Parental Guidance

Formal column methods for addition and subtraction are reviewed and used for calculating with decimal numbers. A variety of other addition and subtraction strategies are extended to use with decimal numbers with a focus on being flexible, accurate and efficient when calculating.

Prior & future learning

See week 1.

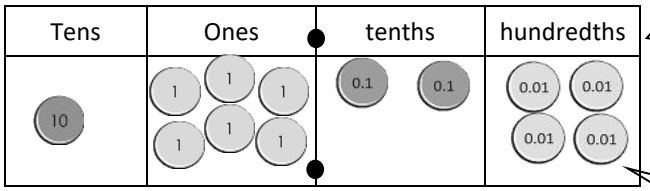
Worked examples

The formal written methods of column addition and subtraction for decimal number follow the same process as for whole numbers because of the base ten relationship in our number system. Below is an example of how counters on a place value chart can be used to explain the process of the formal written method of subtraction.

16.24 − 3.9

$$\begin{array}{r} 1\ 6.2\ 4 \\ -\quad 3.9\ 0 \\ \hline \quad\quad . \end{array}$$

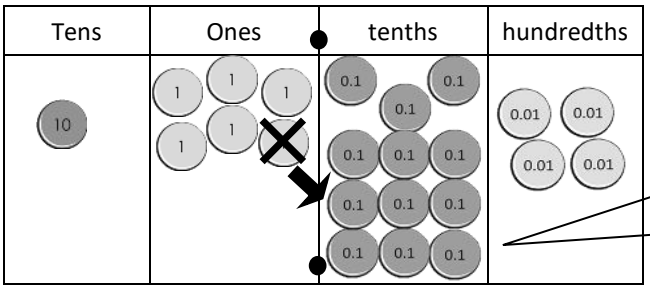
You can put a zero here to avoid lining up the digits incorrectly.



Start subtracting with the digit of least value because if regrouping needs to happen then this will affect digits of greater value.

I do not need to subtract any hundredths. 4 − 0 = 4.

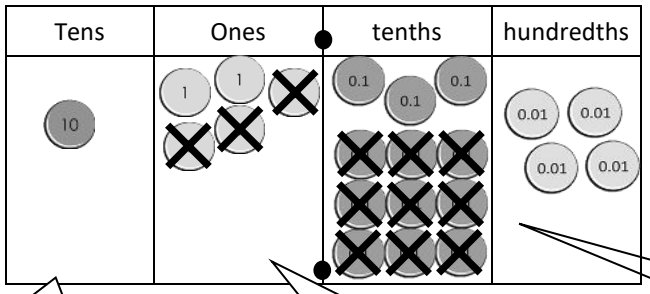
$$\begin{array}{r} 1\ {}^{5}\not{6}.{}^{1}2\ 4 \\ -\quad 3.9\ 0 \\ \hline \quad\quad .\ 4 \end{array}$$



I only have two tenths and I need to subtract nine of them so I must regroup. I can regroup one one for ten tenths and I now have 12 tenths.

The word regrouping is what some people might refer to as 'borrowing'. Regrouping is a clear way of describing that you are choosing to use, for example, **one** tenth as a group of **ten** hundredths.

$$\begin{array}{r} 1\ {}^{5}\not{6}.{}^{1}2\ 4 \\ -\quad 3.9\ 0 \\ \hline \quad 1\ 2.3\ 4 \end{array}$$



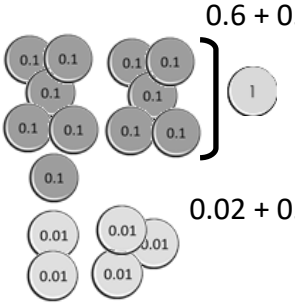
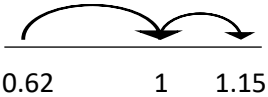
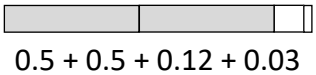
The difference between 16.24 and 3.9 is 12.34.

I do not need to subtract any ones. 1 − 0 = 1.

Five ones subtract three ones is equal to two ones.

12 tenths subtract nine tenths is equal to three tenths.

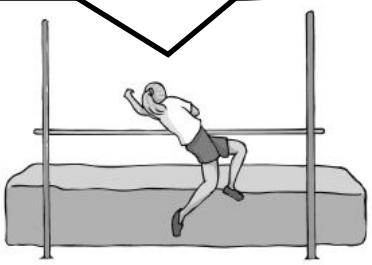
A range of calculation strategies should be explored and below are some examples of ways to calculate 0.62 + 0.53:

Partition both numbers	***Partition one number***	***'Make one' strategy***	***Near doubles***
0.6 + 0.5  0.02 + 0.03	I know six tenths add five tenths is equal to 11 tenths. 0.62 + 0.5 = 1.12 1.12 + 0.03 =	 0.62 1 1.15 0.62 + 0.38 = 1 1 + 0.15 =	0.62 0.53 0.5 + 0.12 0.5 + 0.03  0.5 + 0.5 + 0.12 + 0.03 1 + 0.15

Pupil tasks

1) How high did the Olympic athlete jump?
Work it out using more than one strategy.

I can jump a height of 1.35 m. I watched an athlete at the Olympics jump 0.93 m higher.



2) Marcus has made an error when he calculated

$$4.57 - 2.74 = 2.23$$

What did he do wrong? How can you correct it?

I partitioned the number into place value parts and found the difference between the parts.

The difference between four ones and two ones is two ones. Between five tenths and seven tenths is two tenths. Between seven hundredths and four hundredths is three hundredths.

The answer is **2.23**

3) Use any of the digits 1 to 9 once to create each target. There are spare grids at the back of the book.

TARGET: a total less than 0.8.

$$\begin{array}{rr} & 0.\square\square \\ & 0.\square\square \\ + & 0.\square\square \\ \hline & \\ \hline \end{array}$$

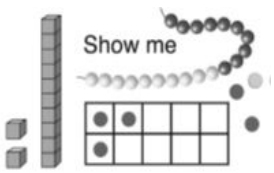
TARGET: the largest possible sum.

$$\begin{array}{rr} & 0.\square\square \\ & 0.\square\square \\ + & 0.\square\square \\ \hline & \\ \hline \end{array}$$

TARGET: a sum as close to 1 as possible.

$$\begin{array}{rr} & 0.\square\square \\ & 0.\square\square \\ + & 0.\square\square \\ \hline & \\ \hline \end{array}$$

Idea for Depth



For the second calculation in question three, how do you know that you have the largest possible sum? Is there more than one calculation that gives the same total?

Clearly show that there cannot be a larger sum using the digit 1 to 9 once.

Unit 12: 2-D and 3-D shape (week 1 of 2)

Parental Guidance

Pupils reason about the properties of 2-D and 3-D shapes, including classify different triangles and quadrilaterals and using knowledge of properties to find missing length, coordinates and angles.

Prior learning

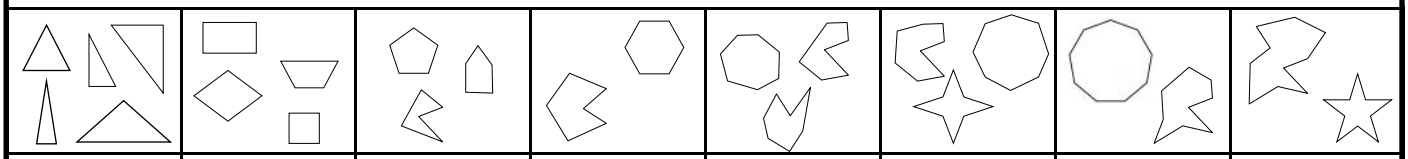
In previous years pupils have compared and classified a range of geometric shapes, including different triangles and quadrilaterals, identifying properties such as pairs of parallel and perpendicular lines.

Future learning

Pupils learn about the properties of circles and explore the internal angles of triangles, quadrilaterals and other regular polygons. They accurately draw shapes and make the nets of shapes such as cubes and cuboids.

Worked example

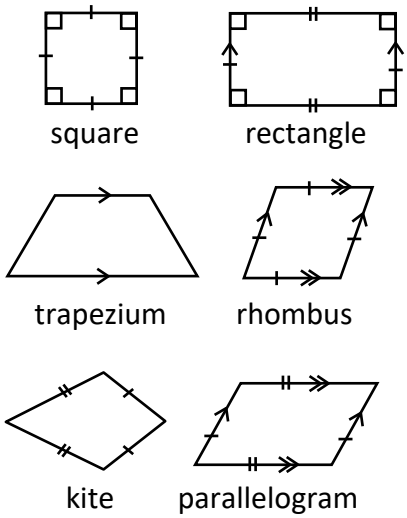
In geometry, a lot of technical language is used to classify shapes into categories. A two dimensional shape with three or more **straight** sides is called a **polygon**.

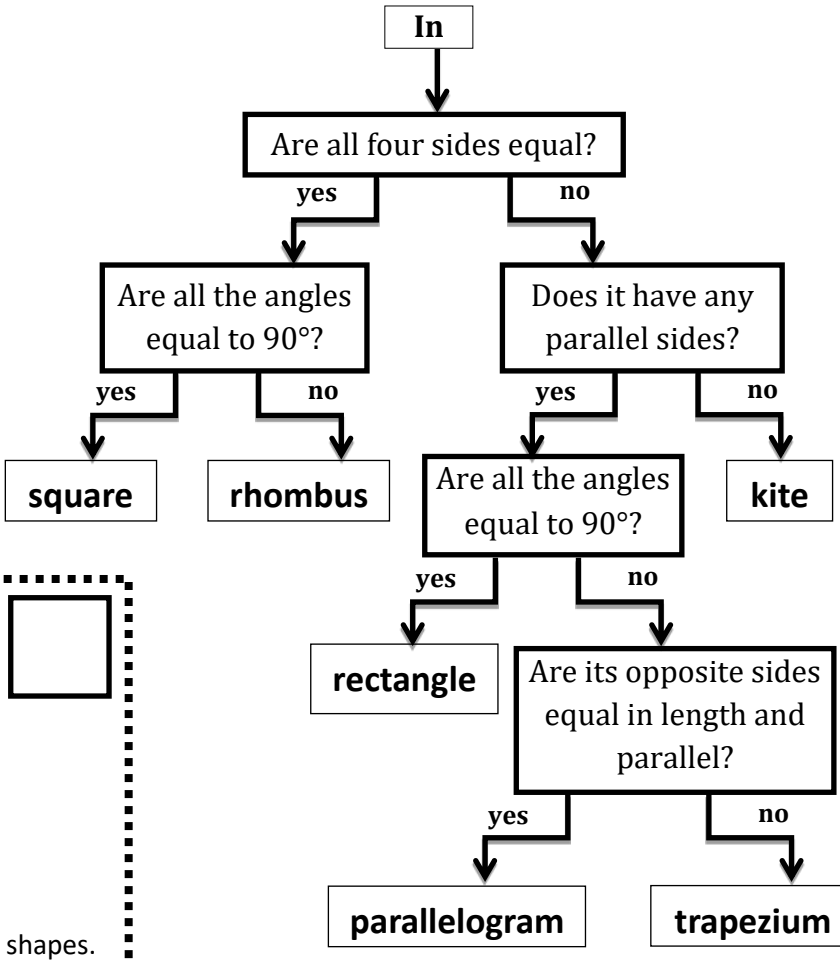


triangles	*quadrilaterals*	*pentagons*	*hexagons*	*heptagons*	*octagons*	*nonagons*	*decagons*
3 sides	4 sides	5 sides	6 sides	7 sides	8 sides	9 sides	10 sides

2-D shapes are classified by properties such as number sides, number of vertices (corners), size of angles, or pairs of parallel lines (see glossary for definitions of these terms).

This is a completed version of a sorting machine that has sorted these shapes.





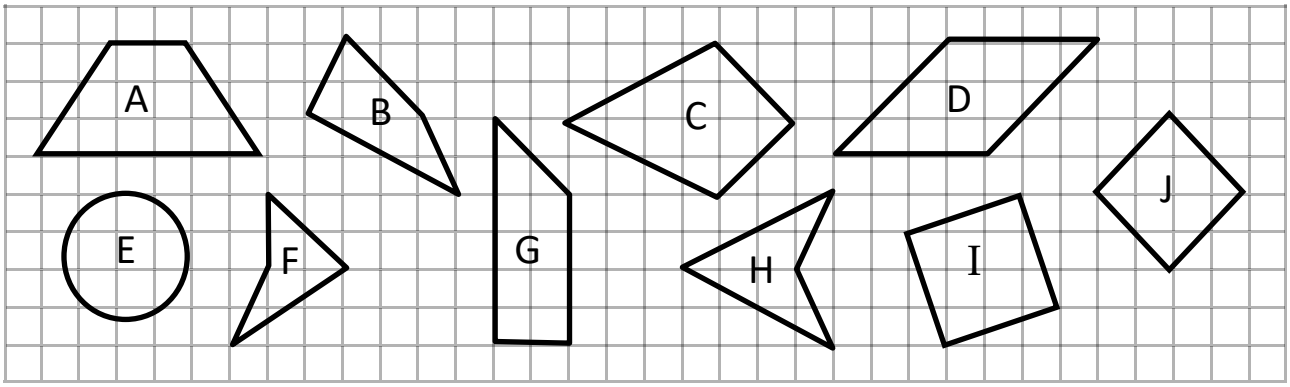
A square is a rectangle. It is a regular rectangle. **Regular** shapes have sides of equal length and all angles of equal size.

Examples of other regular shapes:

equilateral triangle regular pentagon

Shapes that are not regular are **irregular** shapes.

Pupil tasks



1) List the letters of the shapes for which each statement is true:

i) It has at least two sides which are equal in length _____

ii) It has **only** one pair of parallel lines _____

iii) It is a regular shape _____

iv) It is not a polygon _____

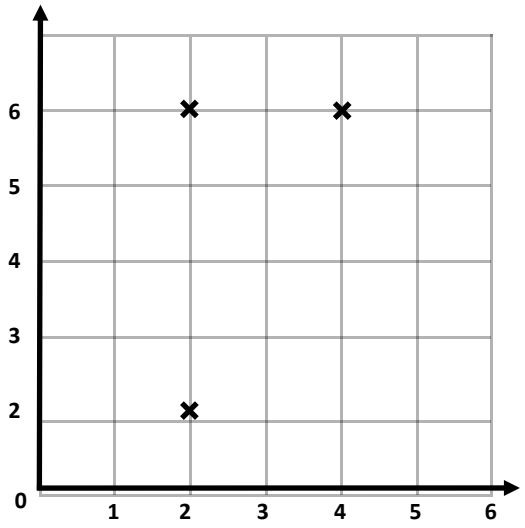
v) It has at least one acute angle _____

vi) It has a pair of perpendicular lines _____

vii) There is a right angle at every vertex _____

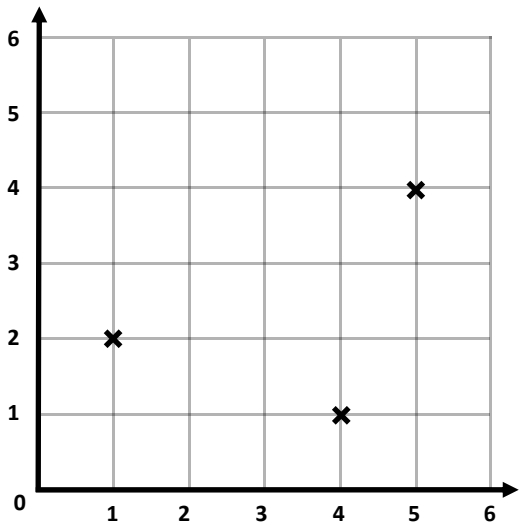
2a) Complete the missing coordinate to plot the vertices of a rectangle:

(2, 6) (2, 2) (4, 6) (__ , __)

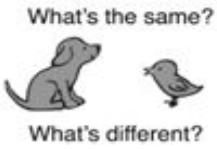


2b) Complete the missing coordinate to make a regular rectangle (a square):

(1, 2) (4, 1) (5, 4) (__ , __)



Idea for Depth



Look at the shapes in question one. Choose pairs of shapes and describe as many similarities and differences as you can think of.

Unit 12: 2-D and 3-D shape (week 2 of 2)

Parental Guidance

The focus this week is on the properties of three dimensional shapes, such as the number of edges, faces and vertices. Pupils identify and name a range of 3-D shapes from 2-D representations such as the images shown on these pages.

Prior & future learning

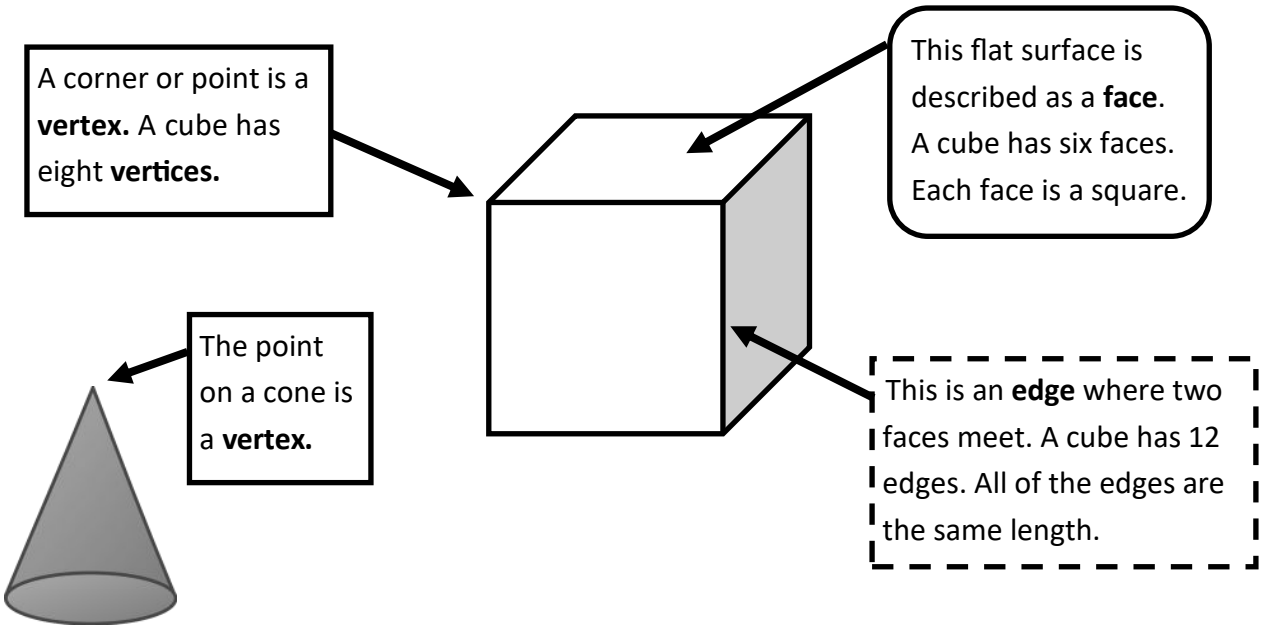
See week 1.

Worked example

Properties of 3-D shapes

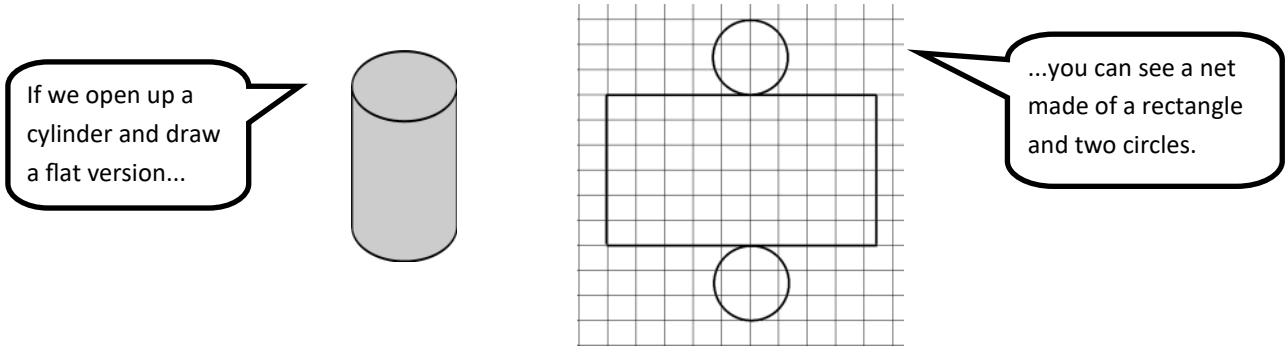
We live in a three dimensional world where all the objects within it have length, width and depth. Have discussions about the geometric shapes you see and use everyday, for example, a cereal box is a cuboid, a tin of beans is a cylinder and a ball is a sphere. Encourage pupils to draw 3-D shapes and explore the difficulties with trying to make a 2-D image of a 3-D object. A two dimensional shape cannot be picked up. It only has length and width and no depth. Even a piece of paper, which you might describe as a rectangle, is actually a very thin 3-D shape.

Below are examples of the properties of a cube with a range of sentences that can be said about cubes.



Nets of shapes

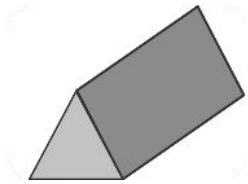
A net is a pattern that you can cut and fold to make a 3-D shape. You can explore nets of shapes at home by opening up packaging and looking at the unfolded shape and how it returns to the original shape. Look out for interesting boxes and encourage pupils to try to guess what the net might look like.

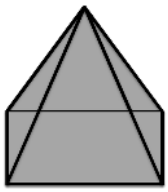


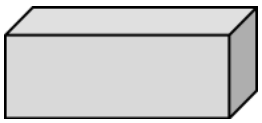
Pupil tasks

1) I have two of these 3-D shapes. In total there are 11 faces, 14 vertices and 21 edges.

Fill out the information and put ticks to show the two shapes that I have.







Triangular prism

☐ faces

☐ vertices

☐ edges

Square based pyramid

☐ faces

☐ vertices

☐ edges

Cuboid

☐ faces

☐ vertices

☐ edges

2) What shape is each person describing? Write the name of the shape, sketch a diagram of the shape and answer their questions.

I'm thinking of a shape. When I try to draw my shape I start with a triangle.

My shape has four vertices and four faces.

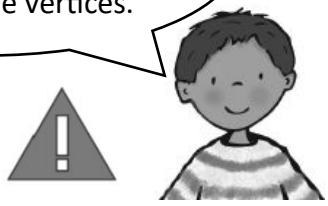
How many edges does it have?

When I draw my shape it looks like a triangle but with a curved side.

It has only one vertex. *What food might I eat out of a shape like this?*

3) Can you explain why this person must be incorrect?

My shape has six flat faces.
It only has two edges.
It has only three vertices.



Idea for Depth

Look at the shapes in question one.

Which shape is the odd one out. How many different answers can you think of?

Unit 13: Volume

Parental Guidance

Pupils are introduced to volume of solids using 1 cm^3 blocks to build cuboids and other shapes. Pupils will estimate and measure the volume of liquids and the capacity of containers as well as convert between litres and millilitres.

Prior learning

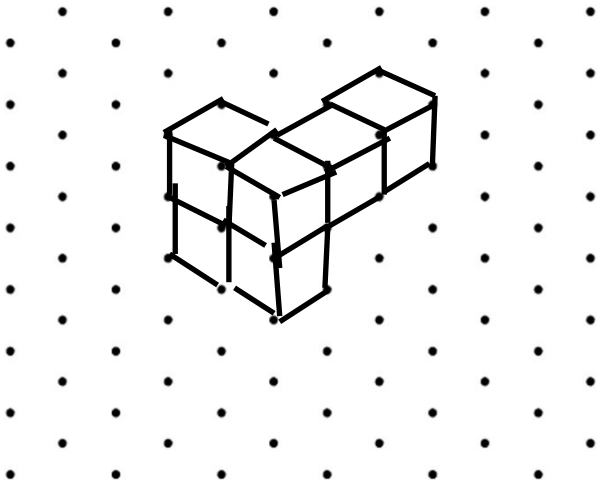
Pupils have experience from previous years of measuring capacity in millilitres and litres as well as converting between these metric units of measure.

Future learning

In Year 6 pupils will continue to explore the volume of solids , liquids and gases and will be introduced to using mm^3, m^3, and km^3 in calculating, estimating and comparing volume.

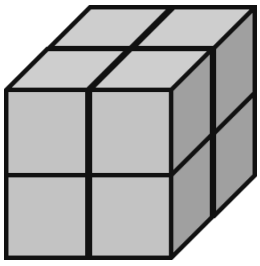
Worked example

1. Sketch a solid with a volume of 6cm^3.



Isometric grids are used to draw representations of 3-d (solid) shapes. It is not expected that children master this skill, however it is important they have a go at practising it to help understand and conceptualise volume problems. Encourage children to first build or visualise their solid shape. It may take a few goes before a sensible representation is created. Children do not need to use a ruler to sketch the shapes.

2. What is the volume of this cuboid? Each block represents 1cm^3.



The cube has a volume of 8cm^3

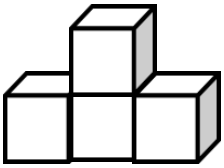
Through practical experiences children will understand that hidden cubes still count towards the total volume of a solid shape. Here, only 7 cubes are visible but as the question states that the solid is a cuboid, they should assume there is an eighth cube.

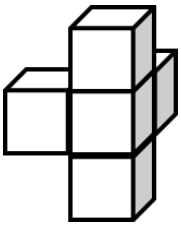
<u>The difference between volume and capacity</u>

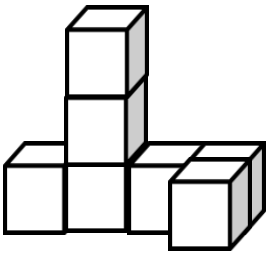
Volume is the actual amount of space an object takes up, where as capacity is the measure of the potential amount an object can hold. Solid objects have volume only, whereas hollow objects have volume and capacity. Volume is measured in cubic units (e.g. cm^3, m^3) and capacity is measured in units such as millilitres, litres (metric) and pint, gallon (imperial).

Pupil tasks

1) Find the volume of the following solids if each block represents 1 cm^3.

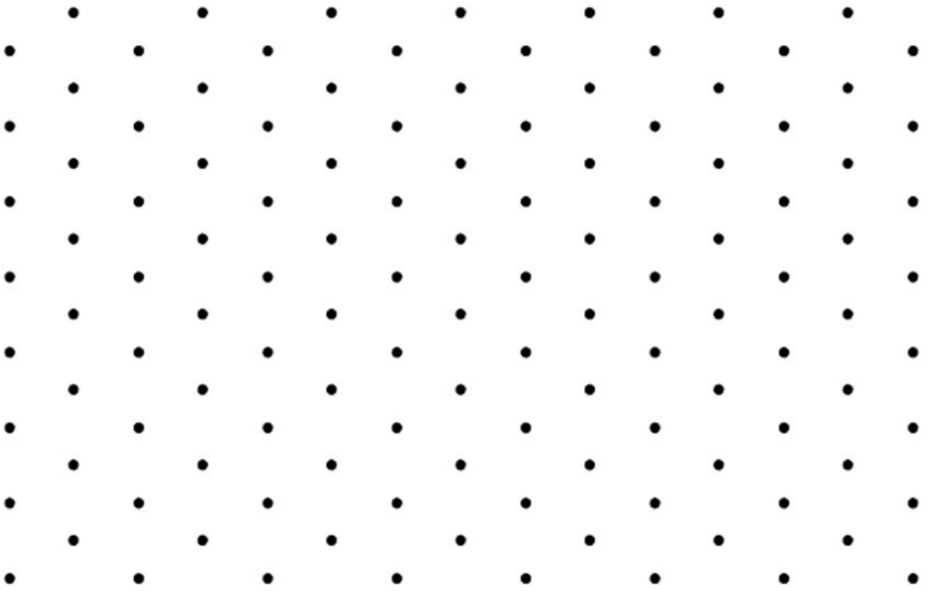




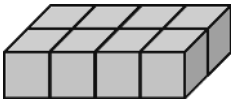


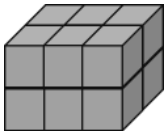
A) _____ B) _____ C) _____

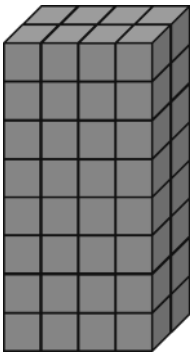
2) Sketch two different solids with a volume of $5cm^3$



3) What is the volume of these cuboids? Each block represents $1cm^3$



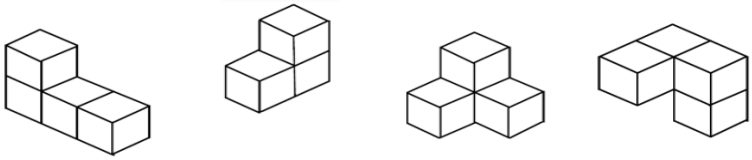




A) _____ B) _____ C) _____

Idea for Depth

Which solid is the odd one out? Why?



Unit 14: Problem solving (week 1 of 2)

Parental Guidance

This unit gives pupils a chance to use their problem-solving skills. They will use all four operations (+, −, ×, ÷) to solve problems involving measures using decimal notation. Pupils make or draw models to understand what needs to be done to solve a problem, form ideas and test them out and work in an organised way.

Prior learning

Previous content from Year 5 and before.

Future learning

Pupils continue to develop problem solving skills in a range of contexts.

Worked example

How to approach the problem

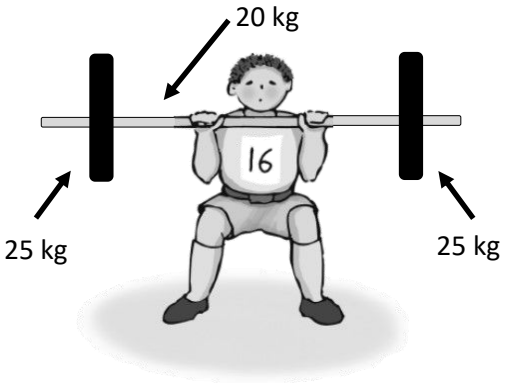
To support with the problem laid out on the next page, work through some examples together and ask questions to check that the important information is understood.

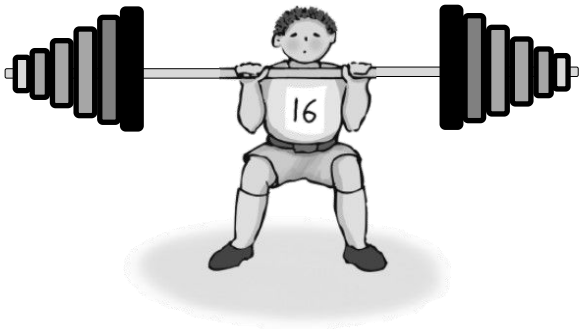
What would be the total mass if we only used the heaviest weight plate?

You could draw a diagram and label each part to show that a weight plate is placed on each side of the bar and that the metal pole has a mass of 20 kg.

25 kg + 25 kg + 20 kg = 70 kg

What is the mass of the bar?





Ask open questions that encourage exploration of the different values in the problem.

What is the lightest total mass?

What is the total mass if we use each type of weight plate?

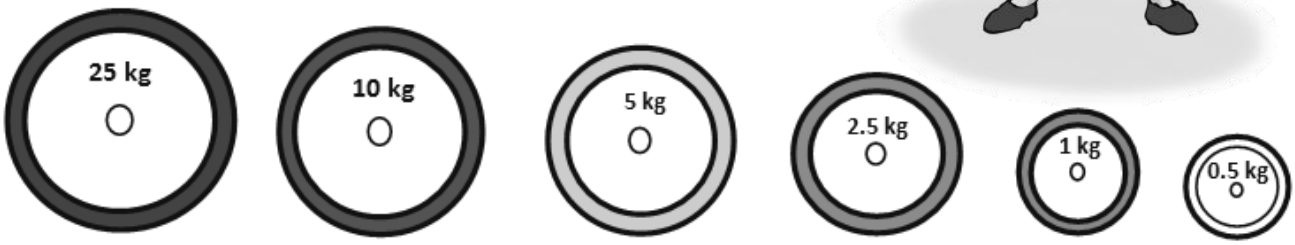
What other totals can we make? Are there any amounts that we can't make?

Useful information to have is double the value of each weight plate. In fact, because the weight plates are added in pairs, it would be useful when investigating to know the mass of two, four, six or even eight weight plates. The table in the pupil task gathers this information to support exploration of the problem.

At Mathematics Mastery we always suggest the use of concrete resources that can be picked up and moved around to promote discussion and exploration. Pupils will be familiar with creating bar models to represent a problem and this problem could be represented by making **barbell models**.
Use small pieces of paper labelled with the values of the weight plates and a pencil or a straw to make a small version of a barbell and play with the problem.

Pupil tasks

In Olympic weight lifting, athletes attempt to lift a barbell loaded with weight plates.
The weight plates are large metal discs that slide onto each end of the metal pole. The mass of the plates available are shown below:



IMPORTANT INFORMATION

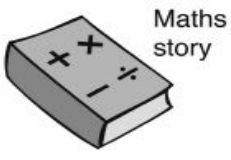
- The barbell (the metal pole) has a mass of 20 kg
- A weight plate is added to each side of the pole to keep it balanced.

Complete the table and use the information to solve the problem below:

One weight plate	25 kg	10 kg	5 kg	2.5 kg	1 kg	0.5 kg
Two weight plates	50 kg					
Four weight plates			20 kg			2 kg
Six weight plates		60 kg		15 kg		

Adrian lifts a total mass of 120 kg. How many different ways can you find of making this?

Idea for Depth



An athlete started at **round one** lifting a mass of **100 kg**. He wins by lifting a mass of **137 kg** in **round four**. A different weight plate was added each round.

Tell the story of the four round competition and the mass lifted each round.

Unit 14: Problem solving (week 2 of 2)

Parental Guidance

Pupils continue to use problem-solving skills and all four operations to solve problems involving measures using decimal notation. They form ideas and test them out, work systematically and use a trial and improvement method.

Prior & future learning

See previous week.

Worked example

Understanding the problem

Here are some questions that will make sure that the key information in the problem laid out on the next page has been understood:

? ***If he buys a flag for his mum, what does he buy for his dad?***

A flag because he bought the same thing for his mum and dad.

? ***If he buys two water bottles and a t-shirt, what options does he have for the fourth item?***

A flag or a key ring because he bought two different things for his sisters.

Trial and improvement

The problem could be tackled using a strategy of trial and improvement, where you try out a possible solution and then improve the choices based on the result.

This problem has to have a solution that is more than £10 and less than £15. A combination of presents can be tried and then the choices improved to fit within those amounts.

Below is a possible combination of souvenirs. The most expensive items have been chosen and so this should make the greatest possible total.

This combination has a total of **£16.50** which is too much and needs to be improved. Encourage the calculations to be done in a variety of ways to make sure they are completed accurately. When different combinations are tried, calculation short cuts might be found by comparing the price of items. For example:

? ***If we swap the key chain for the flag will it still be too much?***

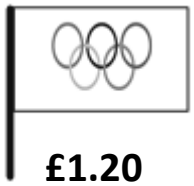
Yes because the difference between the flag is only £1.20 and we need at least £1.50 less.

There are six possible combinations as long as you think carefully about the phrase "**less than** £15" and working in an organised way will help make sure all of them are found.

Pupil tasks

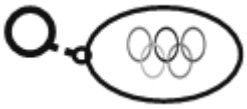
A market stall at the Olympic park sells these items:

£4.80



£1.20

£2.40



£4.50

I bought four souvenirs for my family. I bought the same thing for my mum and dad, but two different things for my sisters. I spent **more than £10** but **less than £15.** What did I buy?

How many solutions can you find? Use the table to record your investigation.

						
						
						
						
TOTAL COST:						

What could he have bought for his family?

_____

_____

_____

Idea for Depth

Have you found every possible solution? How can you organise your results to convince your teacher that you have found them all?

CLUE: There are six.

1 2 3
1 3 2
2 1 3
2 3 1
3 1 2
3 2 1

BONUS TASK

Parental Guidance

Pupils continue to use problem-solving skills and all four operations to solve problems involving measures using decimal notation.

Worked example

Understanding the problem

Here are some questions that will make sure that the key information in the problem laid out on the next page has been understood:

? ***Which swimmer has the longest length/width? What about the shortest?***

Person A has the longest length of 25 metres and person D has the shortest with 12.5 metres.

? ***How much longer is the length of the small pool than the width of the big pool?***

The difference between 17.5 and 20 is 2.5. The small pool is 2.5 metres longer than the big pool is wide.

? ***If Person D swims two widths, how far has he gone?***

I know that half of 25 is 12.5 so double 12.5 must be 25.He swam 25 metres.

Gather information

The problem will be easier to tackle if you have the numbers available to play around with. A table is useful for organising the distance each person swam for between one and ten lengths/widths.

	Person A	Person B	Person C	Person D
Lap 1	25	17.5	20	12.5
Lap 2	50	35	40	25
Lap 3				
Lap 4				
Lap 5				
Lap 6				
Lap 7				
Lap 8				
Lap 9				
Lap 10				

Once the information has been gathered it can be used to find a different value for each swimmer that gives a total of 425 metres. The numbers have been selected so that there is more than one solution for this problem.

Pupil tasks

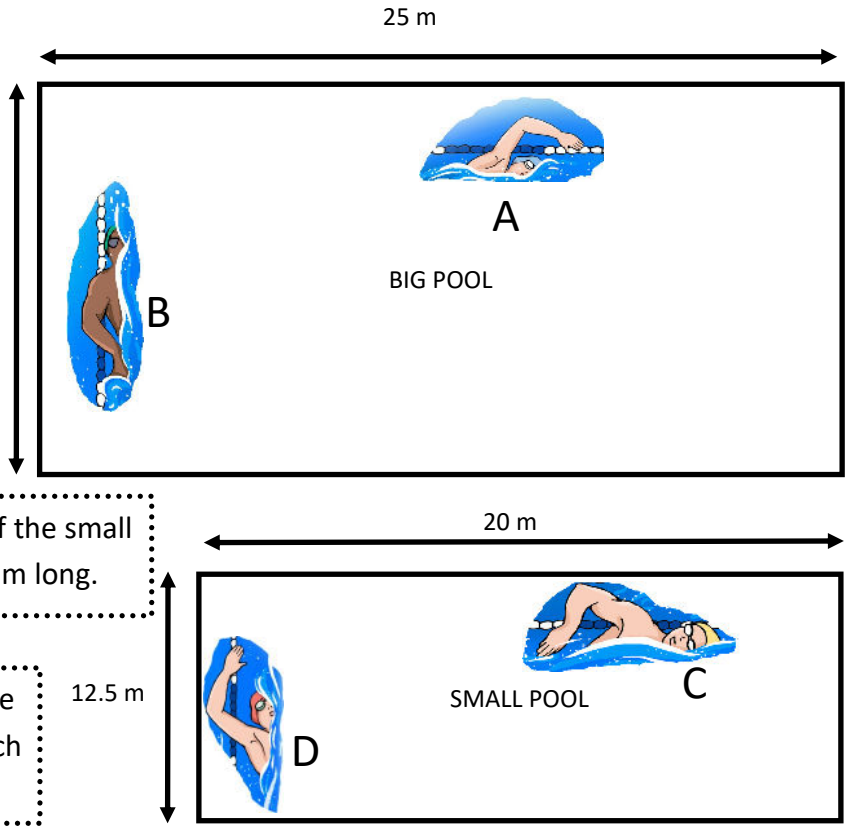
Four people take part in a swimathon. They took it in turns to swim different lengths in two different pools, the big pool and the small pool.

Person A swam lengths of the big pool. Each length was 25 m long.

Person B swam the width of the big pool. Each width was 17.5 m long.

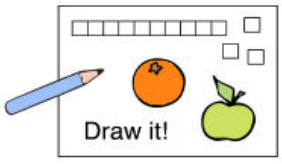
Person C swam lengths of the small pool. Each length was 20 m long.

Person D swam across the width of the big pool. Each width was 12.5 m long.



In total they swam a distance of 425 metres. No one swam more than ten lengths. How far did each person swim? Is there more than one solution?

Idea for Depth



For your solution (or choose a solution if you have more than one) draw a line showing the total distance swum and the different number of lengths each person did. It should resemble a number line.

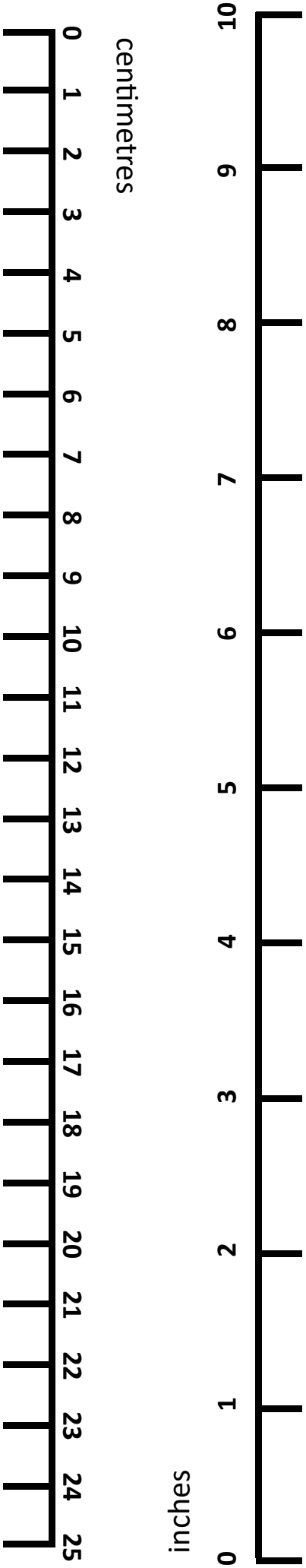
Notes pages

Notes pages

Notes pages

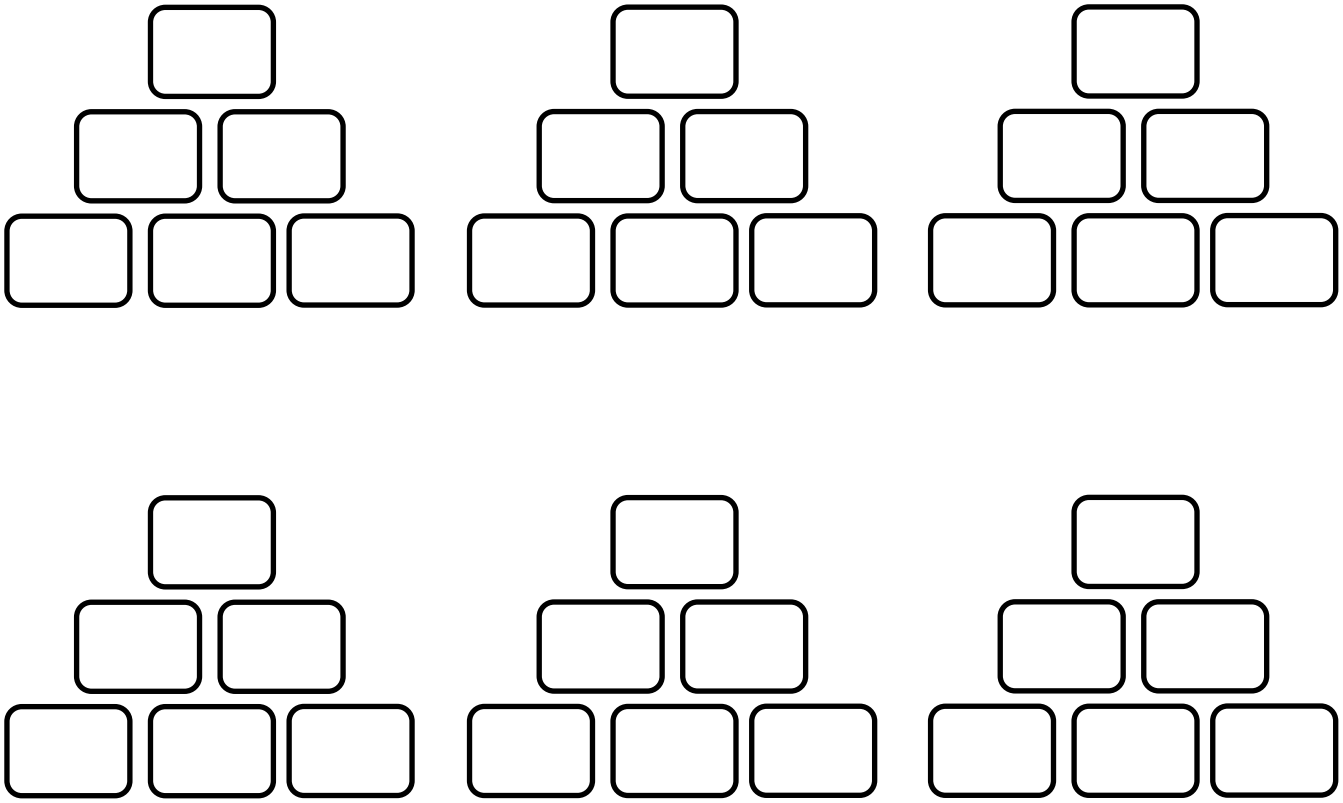
Ruler to measure items for Unit 10 week 2.

Based on printing options these may not be exactly to scale



Notes pages

Further investigation



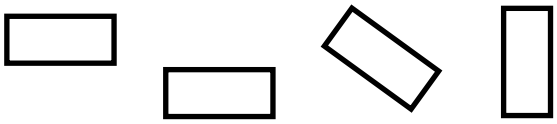
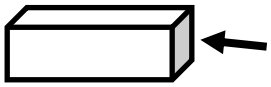
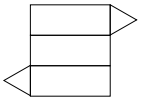
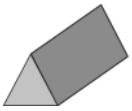
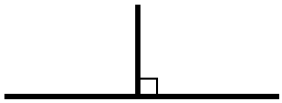
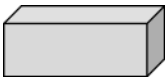
$$0.\square\square + 0.\square\square + 0.\square\square = \underline{\quad}$$

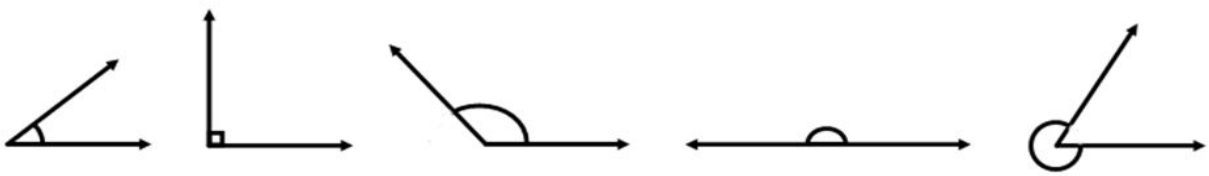
$$0.\square\square + 0.\square\square + 0.\square\square = \underline{\quad}$$

$$0.\square\square + 0.\square\square + 0.\square\square = \underline{\quad}$$

Glossary

Hundred Thousand	Ten Thousand	Thousand	Hundred	Ten	One	tenth	hundredth	thousandth

Word	Definition	*Example*
congruent	Congruent shapes are identical in shape and size. These four rectangles are all congruent.	
edge	An edge is where two faces of a 3-D shape meet.	 *A cuboid has 12 edges.*
face	The surface of a solid object.	*A tetrahedron has four faces.* 
irregular polygon	A polygon that is not regular (see below).	*This is an irregular hexagon* 
net	A pattern that can be cut and folded to make a 3-D shape.	*This is a net for a triangular prism.* 
polygon	A 2-D shape with three or more straight sides.	*A hexagon is a polygon.*  *This shape is not a polygon because there is a curve.* 
polyhedron	A solid shape with flat faces. Each face is a polygon.	 *This triangular prism is a polyhedron.*
regular polygon	A regular polygon has all sides of equal length and all angles equal.	*A square is a regular rectangle.* *A regular triangle is an equilateral triangle.*
parallel	Parallel lines are two lines that are always the same distance apart and never touch.	
perpendicular	Perpendicular lines are at right angles (90°) to each other.	
side	The sides of a 2-D shape are the line segments that connect its vertices	*A pentagon has five sides* 
vertex **vertices**	A corner or a point. This word is used for both 2-D and 3-D shapes.	 *This triangle has 3 vertices.* *This cuboid has six vertices.* 



Acute
Less than 90°

Right
90°

Obtuse
Greater than 90°

Straight
180°

Reflex
Greater than 180°