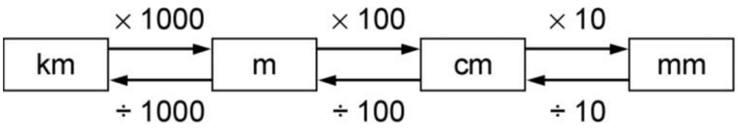
Planning Overview
Year 6 Measures

Solve problems involving the calculation and conversion of units of measure, using decimal notation up to three decimal places where appropriate
Use, read, write and convert between standard units, converting measurements of length, mass, volume and time from a smaller unit of measure to a larger unit, and vice versa, using decimal notation to up to three decimal places
Convert between miles and kilometres
Recognise that shapes with the same areas can have different perimeters and vice versa
Recognise when it is possible to use formulae for area and volume of shapes
Calculate the area of parallelograms and triangles
Calculate, estimate and compare volume of cubes and cuboids using standard units, including cubic centimetres (cm^3) and cubic metres (m^3), and extending to other units [for example, mm^3 and km^3].

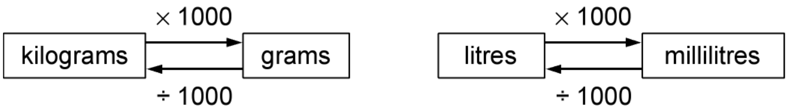
6NPV–1 Understand the relationship between powers of 10 from 1 hundredth to 10 million, and use this to make a given number 10, 100, 1,000, 1 tenth, 1 hundredth or 1 thousandth times the size (multiply and divide by 10, 100 and 1,000).
6NPV–2 Recognise the place value of each digit in numbers up to 10 million, including decimal fractions, and compose and decompose numbers up to 10 million using standard and non-standard partitioning.
6NPV–3 Reason about the location of any number up to 10 million, including decimal fractions, in the linear number system, and round numbers, as appropriate, including in contexts.
6NPV–4 Divide powers of 10, from 1 hundredth to 10 million, into 2, 4, 5 and 10 equal parts, and read scales/number lines with labelled intervals divided into 2, 4, 5 and 10 equal parts.

Consider links to PE/Sports Day, Olympics/Commonwealth Games

	Teaching and Learning
Converting metric measures using decimal notation up to 3dp	Ensure children can recall the common metric conversions from Year 5 and which units are used for each type of measure. Give children cards with words (metre, litre, millilitre etc.) on and abbreviations (ml l kg g m mm cm km). Ask children to sort them in as many ways as they can think of. Explain how they have sorted them. Do they sort by type of measure e.g. mass, capacity or relative sizes e.g. thousandths ? Extend to odd one out discussions. Length has many more common metric units. Why?



What's the same and what's different?



Pupils should confidently recall the conversions below from Year 5 and apply them to whole number conversions, from larger to smaller units and vice versa, for example, 4m = 400cm and 8,000g = 8kg.

5NPV–5 Teaching guidance

Pupils should first memorise the following unit conversions:

1km = 1,000m	1m = 100cm	1cm = 10mm
1 litre = 1,000ml	1kg = 1,000g	£1 = 100p

Move onto converting decimal amounts up to 3dp from one unit to another. Use pattern spotting to help secure this.

1km = 1000m
2km=2000m
1.6km=1600m
2.6km=2600m
2.63km=2630m
2.68km=2680m
2.685km=2685m

Can children generate/recall the rule? Can they generate the rule for an unknown conversion e.g. km to mm?

Reading scales in different units with divisions in 2, 4, 5 or 10 equal parts

Look at models like the one below that incorporate converting from one unit to another and breaking the whole unit into different numbers of parts.

<table>
<tr><td colspan="4">1km</td></tr>
<tr><td colspan="4">1000m</td></tr>
<tr><td colspan="2">0.5km</td><td colspan="2">0.5km</td></tr>
<tr><td colspan="2">½km</td><td colspan="2">½km</td></tr>
<tr><td colspan="2">500m</td><td colspan="2">500m</td></tr>
<tr><td>0.25km</td><td>0.25km</td><td>0.25km</td><td>0.25km</td></tr>
<tr><td>250m</td><td>250m</td><td>250m</td><td>250m</td></tr>
</table>

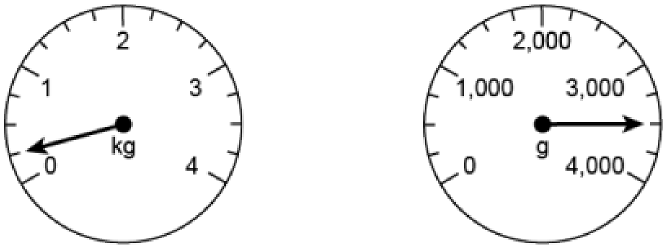
Complete models for different measures. Children need to be fluent in the division of all powers of ten from 10 million to 1 hundredth into 2, 4, 5 and 10 equal parts. They can then apply this into reading scales with labelled intervals divided into 2, 4, 5 and 10 equal parts.

1,000,000g			
?g	?g	?g	?g
?kg	?kg	?kg	?kg

?l				
?l	?l	?l	?l	?l
20ml	20ml	20ml	20ml	20ml

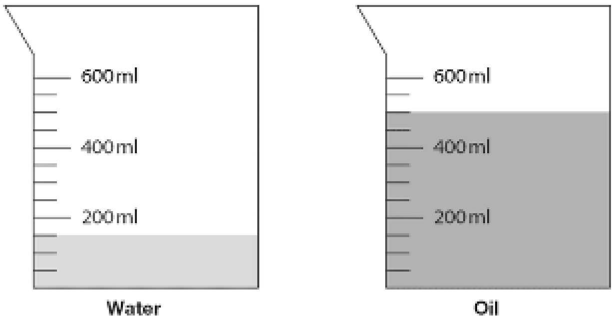
Answer in grams and kilograms

7. What mass does each scale show?

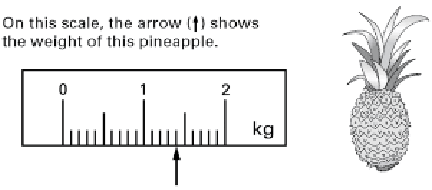


Answer in litres and millilitres

15 One jug contains water and the other jug contains oil.

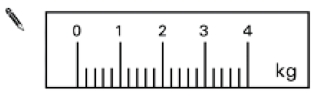


17 On this scale, the arrow (↑) shows the weight of this pineapple.



Here is a **different** scale.

Mark with an arrow (↑) the weight of the **same** pineapple.



<table>
<tr>
<td>Solve problems involving the calculation and conversion of units of measure, using decimal notation up to three decimal places where appropriate</td>
<td>
Solve measures word problems with different units by converting into a common unit. Include problems where children need to compare and order units of measure.

Here are four masses
Write the masses in order from lightest to heaviest

<table>
<tr><td>2 Kg</td><td>1 tonne</td><td>800g</td><td>Half a kg</td></tr>
</table>

Put these lengths in order:
0.45m, 10mm, 208cm, 2 ½m, 80cm, 0.9m

If I use $\frac{1}{5}$ of a 2kg bag of flour, how much is left in grams?

• 'Sean bought 850 kg of sand to build a wall. He used 75,000 g on Monday and 250,000 g on Tuesday. How much sand was left at the end of Tuesday?'

• 'Year 6 have grown some sunflowers. These are the heights of their plants:'
<table>
<tr><th>Plant</th><th>Height</th></tr>
<tr><td>A</td><td>286 cm</td></tr>
<tr><td>B</td><td>3.40 m</td></tr>
<tr><td>C</td><td>3.14 m</td></tr>
<tr><td>D</td><td>260 cm</td></tr>
</table>
• 'Put the plants in order from shortest to tallest.'
• 'What is the difference in height between the tallest and the shortest plant?'
• 'What is the average (mean) height of the sunflowers?'

NCETM PD Materials
</td>
</tr>
</table>

SATS questions that include measures

11 A packet contains 1.5 kg of oats.

Every day Maria uses 50 g of oats to make porridge.

How many days does the packet of oats last?

6 Jacob cuts **4** metres of ribbon into **three** pieces.

The length of the first piece is **1.28** metres.

The length of the second piece is **1.65** metres.

Work out the length of the third piece.

10 toy bricks have a total mass of 1 kg.
A cricket ball weighs $1\frac{1}{2}$ times as much as one brick.

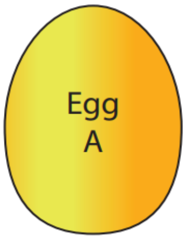
What is the mass of a cricket ball, in grams?

Sarah is 0·2 m taller than Jack.
Ella is 15 cm taller than Sarah.

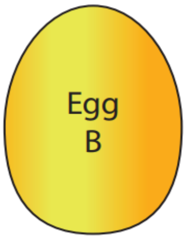
Who is the tallest person?
What is the difference in height between the tallest and the shortest person?

Mastery with Greater Depth

In a story, Jack has to choose between two magic gold eggs to buy.
What would you advise him to do?



Mass when he buys it: 1·2 g
Mass doubles each day



Mass when he buys it: 125 g
Mass increases by 0·01 kg each day

Sarah is 0·2 m taller than Jack.
Ella is 15 cm taller than Sarah.
Their combined height is 3·25 m.

How tall is Ella?

Convert between miles and kilometres

Using the known fact that 8km ≈ 5 miles, what other facts can you generate?

16km = $\square$ miles
4km = $\square$ miles

Can you generate a rule for converting km to miles?

How would we convert the other way around from miles to km? Compare different methods i.e. divide by 5 then multiply by 8 or use 1 mile ≈ 1.6km

Agree or disagree?
It is easier to convert from miles to km than km to miles.
Explain your answer.

Always, sometimes, never
When converting from miles to km it is easier to multiply by 1.5 then add the extra tenths on at the end.

Complete conversion tables for miles to km and vice versa. e.g.

100 miles	100 ÷ 5 = 20 20 x 8 = 160	160km
120 miles		
150 miles		
125 miles		
155 miles		

You could link this to a school trip or event to make it more meaningful.

Use < > or = to compare these distances
50 miles $\square$ 50 km

200 miles $\square$ 350km

160 miles $\square$ 240km

Chester is 46 miles away from Shrewsbury and 72km from Manchester. Which place is closer to Chester?

Toni is training for the Marathon. She runs 45 miles altogether spread over 3 days. On the first day she runs 16 km. On day 2, she runs 10 miles further than she did on day 1. How far does she run on the third day? Give your answer in miles and in kilometres.

If the speed limit in Spain is 120 km per hour and the speed limit in the UK is 70 miles per hour, where can you drive faster?

Convert between other metric units and common imperial units

Recap common imperial units met in Year 5.
Odd one out. Which of these is different to the others?
Explain why

Inch	Pint	Foot	Yard

Play quiz quiz trade to practise the conversions within the imperial system. (1 stone =14lb, 1lb=16oz, 1 gallon = 8 pints, 1 foot=12 inches).
When do we use these imperial measures?

Do they know or are they able to estimate the size of the imperial units in metric units?

- 1 litre is approximately 2 pints (more accurately, 1 ¾ pints)
- 4.5 litres is approximately 1 gallon or 8 pints
- 1 kilogram is approximately 2 lb (more accurately, 2.2 lb)
- 30 grams is approximately 1 oz
- 2.5cm is approximately 1 inch
- 3feet is approximately 1 metre

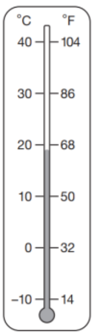
Can they use the approximate conversions to estimate measures in both units e.g. capacity of a mug or the washing up bowl, height of a door frame or their teacher?

Complete fluency questions that involve comparison of metric and imperial measures e.g. adding the < = > symbols to:
1.75kg $\boxed{}$ 4lb

Solve word problems that involve conversions from imperial to metric and vice versa.

If I have 2 pints of milk and I need 100ml for each cup of tea, how many cups of tea can I make?

15 This thermometer shows temperatures in both °C and °F.



Work out what **25°C** is in °F.

Convert between different units of time	Discuss units of time and conversions • Years to months/weeks • Weeks to days • Days to hours • Hours to minutes • Minutes to seconds Children to solve questions around converting units of time using efficient calculation strategies **Mastery** Draw a clock face, then draw the hands showing that the time is 3 p.m. Draw a second clock face, then draw the hands showing the time 12 000 seconds later. **Mastery** A train left London at 09:46 and arrived in Edinburgh later that day. The clock in Edinburgh station showed this time:  How long did the train journey last? **Mastery with Greater Depth** Mehvish and Rima are looking at a clock face. They agree that at midday the hands of the clock lie on top of each other and so the angle between them is 0°. Rima thinks that at 3:15 p.m. the angle between the hands will be 90°. Mehvish thinks that the angle will be less than 90°. **Mastery with Greater Depth** Imagine we talked about time using decimals. Would 2·3 hours be: ■ 2 hours and 3 minutes ■ 2 hours and 20 minutes ■ 2 and a half hours, or ■ 2 hours and 18 minutes? Explain your decision.
Recognise that shapes with the same areas can have different perimeters and vice versa	Ask pupils to draw a shape on squared paper with a defined perimeter. E.g. draw a rectangle with a perimeter of 14. Link back to problems with more than 1 unknown. Choose a value for one of the variables (e.g. width could be 2) then calculate the other variable. How many different rectangles can you draw with a perimeter of 14cm? What is the area for each of your solutions? Similarly draw a shape with a specific area. e.g. draw a pentagon with an area of 10cm². Can you draw another one? What is the perimeter for each solution?

NRICH– Numerically Equal

Age 7 to 11
Challenge Level ★★

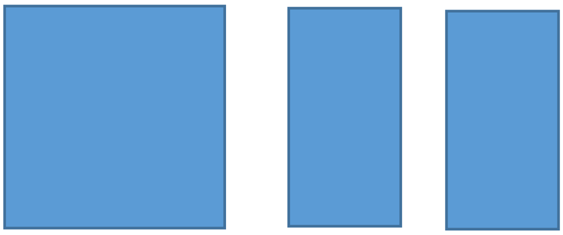
I want to draw a square in which the perimeter is numerically equal to the area.

Of course, the perimeter will be measured in units of length, for example, centimetres (cm) while the area will be measured in square units, for example, square centimetres (cm^2).

What size square will I need to draw?

What about drawing a rectangle that is twice as long as it is wide which still has a perimeter numerically equal to its area?

Here is a square with a perimeter of 72cm. If I cut the square into 2 identical rectangles what will the perimeter of one of the rectangles be?



Complete a range of questions about area and perimeter like the following from the Ready to Progress Maths guidance

Problem: find the perimeter of the large rectangle on the right.

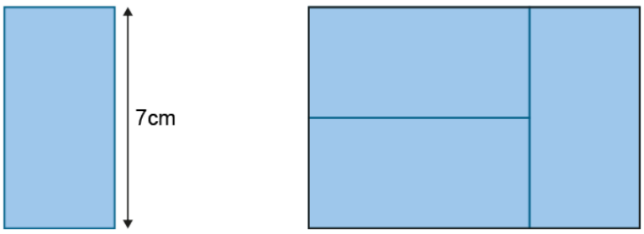
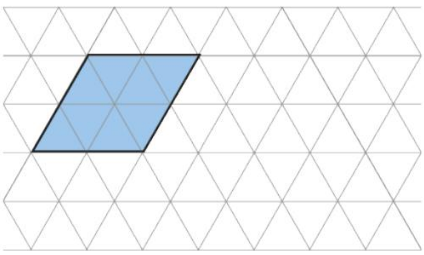
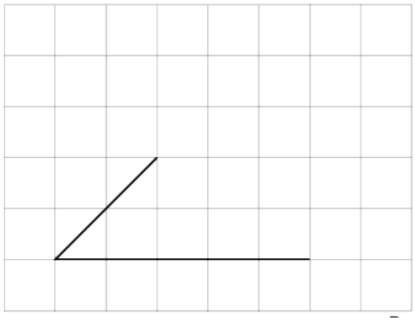
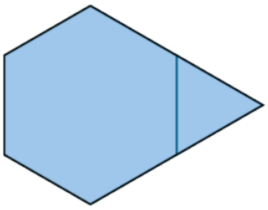
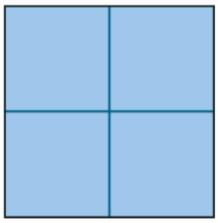
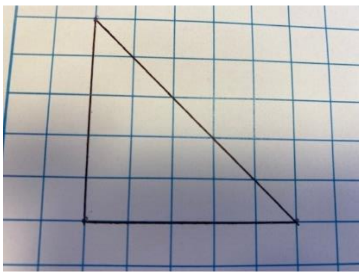
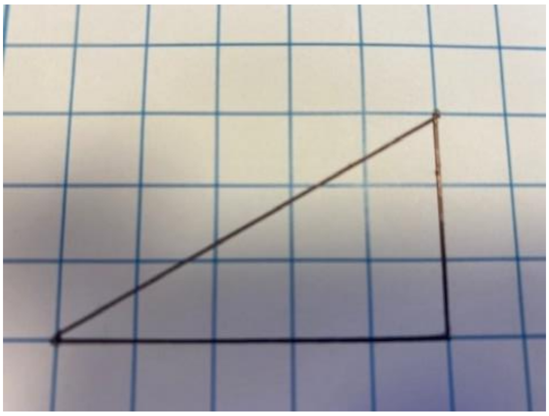


Figure 30: problem involving a compound shape made from 3 identical rectangles

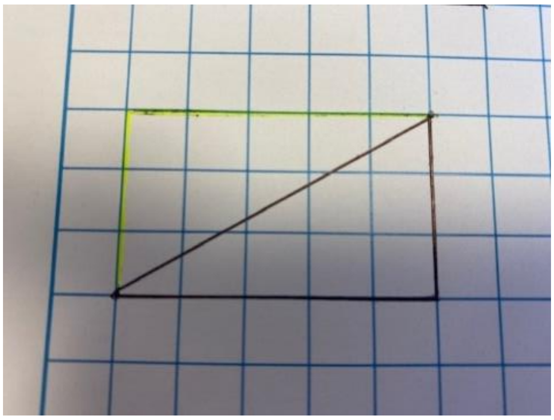
Here is a rhombus on a triangular grid. Draw a different shape with the same area on the grid.



	Lois has started drawing a shape on this squared-centimetre grid. Complete her shape so that it has an area of 14cm^2.  Here is a picture of a pentagon made from a regular hexagon and an equilateral triangle. The perimeter of the triangle is 24cm. What is the perimeter of the pentagon?  *Drawn to scale, not actual size* Here is a square made from 4 smaller squares. The area of the large square is 64cm^2. What is the length of 1 side of each small square? 
Calculate the area of triangles	Start by looking at the area of right-angle triangles on squared paper where children can count the squares to calculate the areas.  For some of the triangles, children will need to estimate the area by combining the part squares.



Move onto comparing the area of a triangle with the area of the rectangle that would be created if you drew in 2 extra lines to create it. What do you notice? Does it always happen? Could you create a formula to represent this?

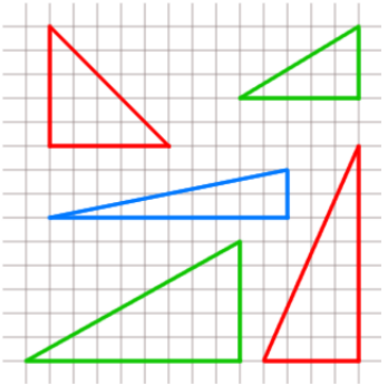


There is a great video that offers some useful visuals to explain this on BBC bitesize

NRICH Uncanny Triangles

Age 7 to 11
Challenge Level ★★★

Thomas, Jane and Anna were drawing right angled triangles on squared paper. Their triangles had two sides which were an exact number of squares long and could not be longer than 15 squares. These are Jane's triangles:



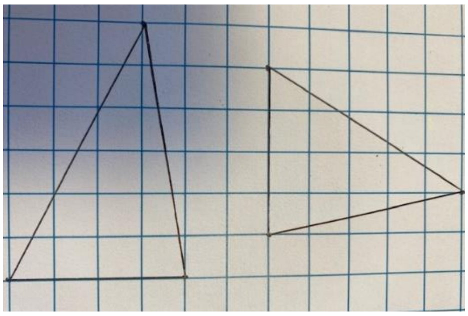
They were calculating the areas of the triangles.

"I've got one triangle where the area and the sum of the lengths of the two shorter sides come to exactly the same number!" exclaimed Anna, "Look, it's that one!"

Thomas looked at his work. "How uncanny - but so have I! But look at it. It's quite a different shape from yours."

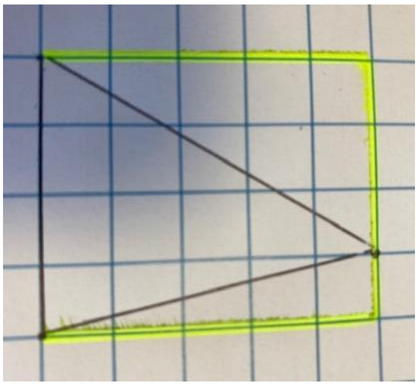
What were the measurements of the triangles they had drawn?

Move onto looking at other types of triangle.



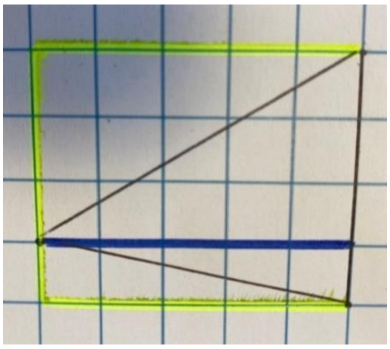
Can we add 2 more lines to turn them into a rectangle?

Explore creating the rectangle that encloses the triangle by drawing 3 lines. What do you notice?



How does the height of the rectangle relate to the triangle? Establish that it is the perpendicular height of the triangle rather than the length of one of the sides that matches the height of the rectangle.

What happens if a triangle is presented in a different orientation? Now the vertical side lines up with the rectangle's height. We need to find the equivalent to the rectangle's length.



Once children are confident about why it works begin to apply the formula
Area = base x perpendicular height ÷ 2
to calculate the area of triangles that are not on squared paper.

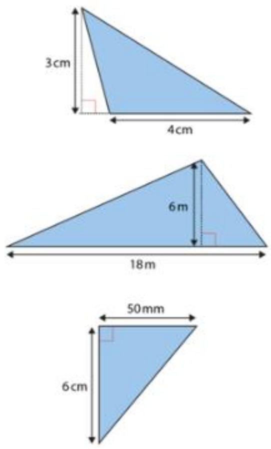
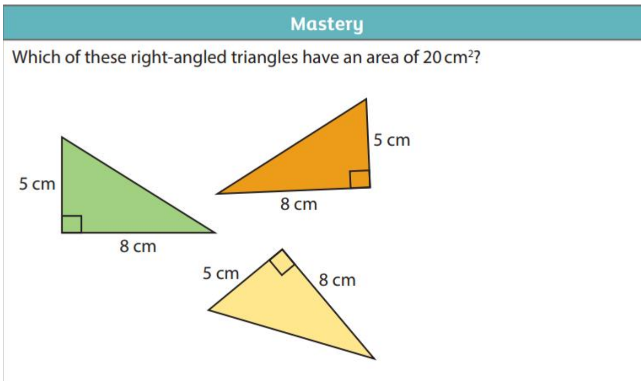
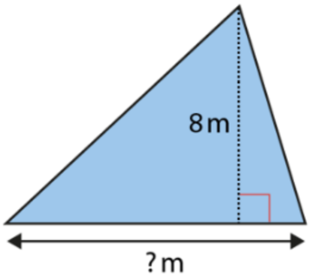
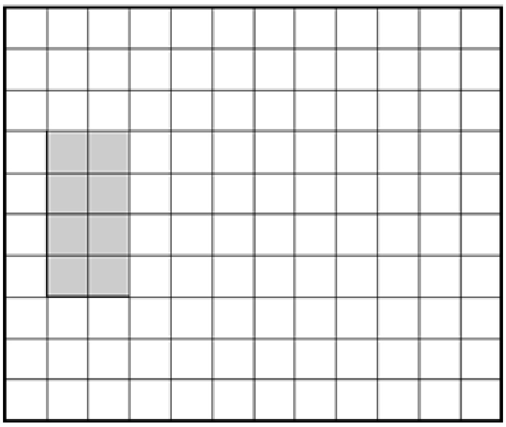
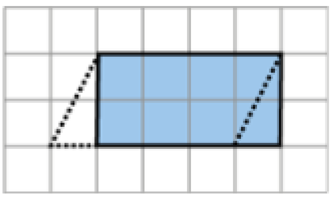


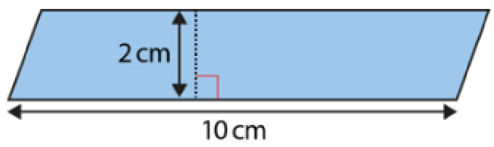
Image taken from NCETM PD Materials

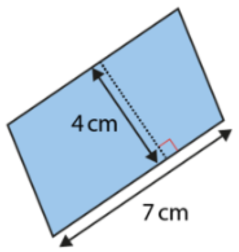


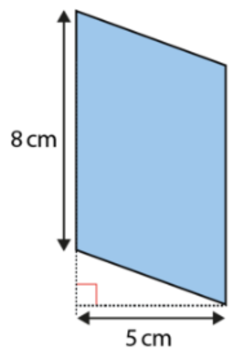
	If we know what the area of a triangle is and one of the measurements of either the base or the height then could we work out the missing measurement by working backwards? *A* = 44 m^2. How long is the base?  NCETM PD Materials We would need to divide 44 by 8 to get 5.5 and then multiply this by 2 to get our missing length of 12m. Children can now draw triangles with a given area. e.g. Can you draw a triangle with an area of 10cm²? On the grid draw a **triangle** with the **same area** as the shaded rectangle. Use a ruler.  1 mark
Calculate the area of parallelograms	Look at parallelograms on squared paper. Using the idea of perpendicular height from work on triangles draw in this line. Children can then cut off the triangle and see how they can move the triangle to the other end to complete a rectangle. Repeat with different parallelograms.  NCETM PD Materials

Can children work out a formula for calculating the area of a parallelogram?
Base x Height (as it is with a rectangle)
Check it works by counting squares.

Move onto fluency questions using the formula to calculate the area of different parallelograms.

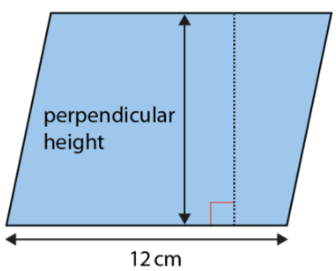






If we know the area of a parallelogram and the length of either the height or the base then we can work out the missing dimension by working backwards

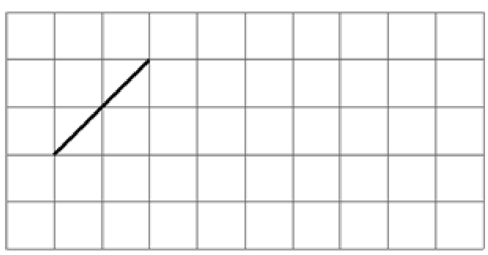
A = 108 cm^2. What is the perpendicular height?



Children can now draw a parallelogram with a given area.

Draw **3 more lines** to make a **parallelogram** with an **area** of **10cm²**

Use a ruler.

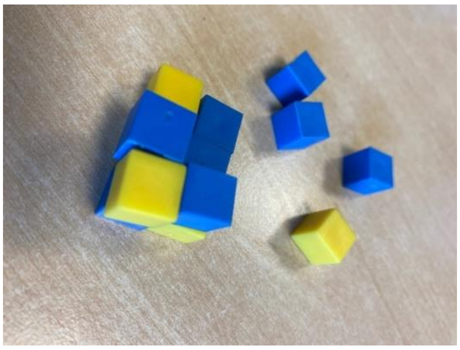


1 mark

Calculate, estimate and compare volume of cubes and cuboids

Volume is the amount of space something takes up. It is measured in cm^3, m^3 etc.

Use $1cm^3$ cubes (for example dienes) to create cuboids. How many different cuboids can you make with a volume of $24cm^3$? What is the width, length, height of each?



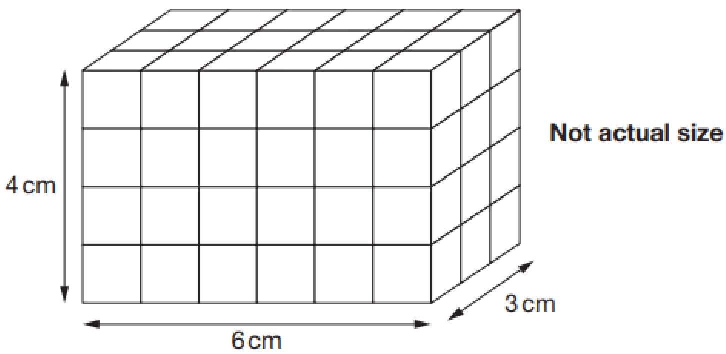
Recap how to record what they have made/measured using multiplication so 4cm x 3cm x 2cm = a volume of $24cm^3$

Fluency questions based on calculating the volume of images of 3D constructions made from 1cm cubes and comparing volumes of two different constructions using < > and = signs.

Move from constructions made from 1cm cubes to cuboids with dimensions recorded in other cubic measures e.g. m^3or mm^3. Calculate volume using width x length x height=volume.

SATs Question

23 Amina made this cuboid using centimetre cubes.



Stefan makes a cuboid that is 5 cm longer, 5 cm taller and 5 cm wider than Amina's cuboid.

What is the **difference** between the number of cubes in Amina's and Stefan's cuboids?

<table>
<tr>
<td></td>
<td>

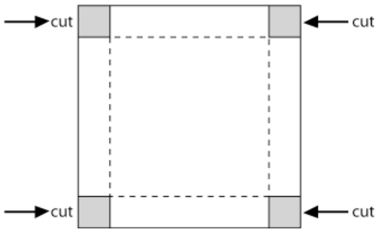
NRICH – Making boxes

Making Boxes

Age 7 to 11
Challenge Level ★★

In this problem you start with some sheets of squared paper measuring 15×15 and use them to make little boxes without lids.

You do this by cutting out squares at the corners and then folding up the sides. (The folds are indicated by the dotted lines in the diagram.)



Begin by cutting one square out of each corner. Fold up the sides. What is the size of the base? How high are the sides? So what is its volume?

Now cut a 2×2 square out of each corner and fold up the sides.
Does it look as if it holds more than the first box, less than the first box or just the same amount?
What is the size of the base now? How high are the sides now? So what is its volume?

Now cut a 3×3 square out of each corner and fold up the sides.
Does it look as if it holds more than the other boxes, less than the other boxes or just the same amount?
What is the size of the base now? How high is it now? So what is its volume?

If you keep on doing this, taking larger and larger squares from the corners, which box will have the largest volume?

</td>
</tr>
<tr>
<td>Make links to topic and real-life situations</td>
<td>It would be great to link work in measures to a school event. What range of measures are needed to run a sports day? Summer fair? End of school production? School trip?</td>
</tr>
</table>