Shape, space and measures 3

contents

There are four lessons in this unit, **Shape, space and measures 3**.

objectives

The objectives covered in this unit are:

- Visualise and describe 2-D and 3-D shapes.
- Use a ruler and protractor to:
  - measure and draw lines to the nearest millimetre and angles to the nearest degree;
  - construct a triangle given two sides and the included angle or two angles and the included side.
- Use the labelling conventions for lines, angles and shapes.
- Identify parallel and perpendicular lines.
- Recognise properties of rectangles.
- Begin to identify and use angle, side and symmetry properties of triangles and quadrilaterals.
- Identify nets of an open cube.
- Use standard units of mass and capacity.
- Suggest suitable units and equipment to estimate and measure mass and capacity.
- Read and interpret scales on a range of measuring instruments.
- Solve problems and investigate in shape, space and measures.
- Explain reasoning with diagrams and text.

Using the lesson plans in this unit

These lesson plans supplement the *Springboard 7* materials for Key Stage 3 pupils working toward level 4 in mathematics. All the lessons are examples only. There is no requirement to use them. If you decide to use the lessons, you will need to prepare overhead projector transparencies (OHTs) and occasional resource sheets for pupils to use.

The lessons consolidate work at level 3 and extend into level 4. They are suitable for a group of pupils or a whole class. Whatever the size of the group, the pupils are referred to as 'the class'.

Each lesson will support about 30 to 40 minutes of direct teaching. To help match the time to your timetable, each plan refers to 'other tasks' for pupils, based on *Springboard 7* resources. Select from these, textbook exercises or your own materials to provide practice and consolidation in the main part of a lesson and to set homework. Aim to choose tasks that vary in their level of demand, to suit pupils' knowledge, confidence and rate of progress.

Although the 'other tasks' are listed for convenience at the end of the main part of the lesson, they can be offered at any point, especially between the 'episodes' that form the main activity.

The lesson starters are of two kinds: practice starters and teaching starters. The former are opportunities to rehearse skills that will be needed later in the lesson. Teaching starters introduce an idea that is then developed in the main activity.

You will need to tell pupils what they will learn in the lesson, either in the starter or at the beginning of the main activity. Use the plenary to check pupils' learning against the lesson's objectives and to draw attention to the key points that pupils should remember.

Interactive teaching programs (ITPs)

Interactive teaching programs are interactive animated visual aids that can be used with a laptop and data projector or with an interactive whiteboard. As extra support for this unit, you may find it useful to download and use these ITPs from the website www.standards.dfes.gov.uk/numeracy:

for lesson S3.2: *Polygon*

for lesson S3.4: *Weighing scales*
Measuring cylinder

S3.1 Constructing triangles

objectives

- Use the labelling conventions for lines, angles and shapes.
- Use a ruler and protractor to:
  - measure and draw lines to the nearest millimetre and angles to the nearest degree;
  - construct a triangle given two sides and the included angle or two angles and the included side.
- Solve problems and investigate in shape, space and measures.

starter

Vocabulary
triangle
isosceles
pentagon
regular
vertex
vertices

Resources
OHT S3.1a
Resource S3.1b

Show **OHT S3.1a**. Trace round the perimeter of the pentagon and ask:

Q **What is the name of this shape?**

Tell the class that the shape is a *regular pentagon*, and that 'regular' means that all the sides are the same length, and all the angles are equal. Write *regular pentagon* on the board. Say that an equilateral triangle is regular, and so is a square.

Explain that each corner or vertex of the pentagon is labelled by a letter, and that the pentagon is the shape ABCDE. Trace round one of the triangles in the pentagon, such as triangle ABG.

Q **What would we call this triangle using the letters?**

Explain that ABG, BGA or GAB represent the same triangle.

Q **How many different triangles can you see in the pentagon?**

Give each pupil a copy of **Resource S3.1b**. Get pupils to work in pairs and to record different triangles by drawing them and labelling the vertices of the triangle on the diagram. Stress that the triangles can be different sizes and shapes. Allow the pairs several minutes to discover as many as possible of the 11 different triangles, then bring the class together. Refer to triangle ABE on **OHT S3.1a**.

Q **What kind of triangle is triangle ABE?** (isosceles) **Can you explain why?**

Establish that triangle ABE must be isosceles because two of its sides are equal, since they are also sides of the regular pentagon.

Q **Which two angles must be equal?** (angle ABE and angle BEA)
Q **Are any other triangles that you found isosceles?**

Ask pupils to respond using the letter labels. Ask them to justify their conclusions by identifying which sides and which angles are equal.

main activity

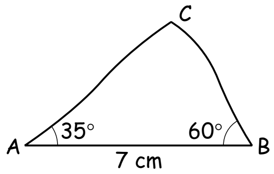
Vocabulary
construct

Resources
blank OHTs
transparent ruler and protractor
rulers and protractors for pupils
Resources S3.1c, S3.1d

Show the class how to construct a triangle, given two angles and the included side.
Write on the board:

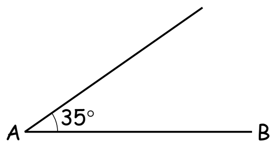
Construct triangle ABC.
AB = 7 cm   angle A = 35°   angle B = 60°

Start by sketching the triangle on a blank OHT.

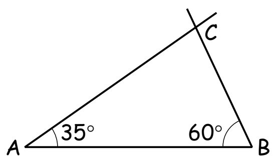


Use a ruler to draw a line AB 7 cm long.

Use a protractor to draw an angle of 35° at A.



Use a protractor to draw an angle of 60° at B. Label point C.

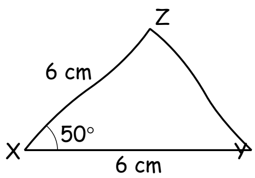


Give pupils **Resource S3.1c**. Ask them to use their rulers and protractors to construct the two triangles.

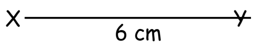
Write on the board:

Construct triangle XYZ.
XY = 6 cm   XZ = 6 cm   angle X = 50°

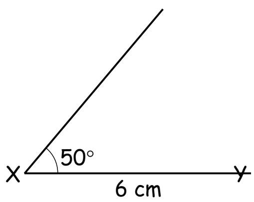
Start by sketching the triangle on a blank OHT.



Use a ruler to draw a line XY 6 cm long.



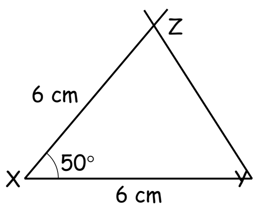
Use a protractor to draw an angle of 50° at X.



Measure from X a distance of 6 cm and mark it on the line.

Label this point Z.

Join ZY.



Give pupils **Resource S3.1d**. Ask them to use their rulers and protractors to construct the two triangles.

other tasks

Springboard 7
Unit 14

Unit 14 section 4: Drawing angles

1 Constructing accurate triangles page 460
Star challenge 7: More triangles page 462

You may wish to provide some further examples of constructing triangles.

plenary

Vocabulary
perimeter

Resources
seven sticks or straws of equal length to place on the OHP

Place six of the seven sticks on the projector. Invite a pupil to the projector to make a triangle using all six sticks (with sides 2, 2, 2).

Q What type of triangle has been made? (equilateral)

Q What is its perimeter? (6 units or sticks)

Q Is it possible to make a triangle from the six sticks with one side 3 units long?

Allow the pupil to experiment and to discover that it is impossible: the sum of the two shorter sides of a triangle must always be greater than the longest side, otherwise the two shorter sides would not meet.

Add one more stick. Invite a different pupil to make a triangle using all seven sticks (e.g. with sides 3, 3, 1). Ask another pupil to make a different triangle (e.g. 3, 2, 2). Point out that the perimeter of each triangle is 7 units long.

Q Can you use the seven sticks to make a triangle with one side 4 units long?

If pupils do not realise immediately that it would be impossible, allow a pupil to experiment. Stress again that the sum of the two shorter sides must be greater than the longest side.

Tell the class to work in pairs. Ask them to investigate the different triangles that they could make with a perimeter of 11 units. After a few minutes, gather the results, writing a list of the lengths of the sides on the board:

5, 5, 1
5, 4, 2
5, 3, 3
4, 4, 3

Check with the class that in each case the sum of the two shorter sides is greater than the longest side.

Remember

- The vertices of a polygon can be labelled with letters. You can use the letters to refer to sides and angles of the polygon.
- You can use a ruler and protractor to construct a triangle, given two sides and the included angle, or two angles and the included side.
- The sum of the two shorter sides of a triangle must be greater than the longest side.

S3.2 Exploring 2-D shapes

objectives

- Visualise and describe 2-D shapes.
- Recognise properties of rectangles.
- Begin to identify and use angle, side and symmetry properties of triangles and quadrilaterals.
- Solve problems and investigate in shape, space and measures.
- Explain reasoning with diagrams and text.

starter

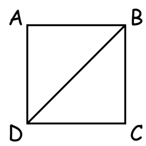
Vocabulary
diagonal
line of symmetry
vertex
vertices

Resources
OHT S3.2a

Show **OHT S3.2a**. Point out square ABCD (diagram 1) and that each corner is a right angle. Tell the class that if you find the sum of the angles at the vertices or corners of a square you get $90° \times 4 = 360°$.

Q **What do you get if you find the sum of the angles at the corners of a triangle?** (180°)

Point to the second diagram. Explain that a square can be folded in half along a diagonal to get two identical triangles.



Q **How do we know that the triangles are identical?**

Establish that each triangle has two sides equal to the side of the square, and a third side, which is common to the two triangles. One triangle can be folded on to the top of the other triangle, because the diagonal BD is a line of symmetry.

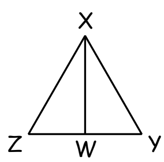
Tell pupils to look at triangle ABD. Mark the sizes of angles on the diagram as pupils answer questions.

Q **What is the size of angle ABD?** (45°, or half a right angle, because the diagonal is a line of symmetry and cuts the angle in half)

Q **What are the three angles at the corners of triangle ABD?** (90°, 45°, 45°)

Q **What is the sum of these three angles?** (180°)

Point to the third diagram. Tell pupils that triangle XYZ is an equilateral triangle.



Q **What is special about an equilateral triangle?** (it has three equal sides and three equal angles)

Say that an equilateral triangle can be folded in half to produce two identical triangles. Mark the sizes of angles on the diagram as pupils answer questions.

Q **What is the size of angle WXY?** (30°, or half of 60°, because the line XW is a line of symmetry and cuts angle ZXY in half)

Q **What is the size of angle XWY?** (90°, or half a straight line, because the line XW is a line of symmetry)

Q What are the three angles at the corners of triangle XYW? (30°, 60°, 90°)
Q What is the sum of these three angles? (180°)

Point out the fourth and fifth diagrams. Explain that each of the triangles PQR and LMN has been formed from two triangles from the second or the third diagram.

Q What are the angles at the corners of triangle PQR?

Invite a pupil to the projector to mark in each of the angles, explaining their reasoning as they do so.

Q What is the sum of the three angles of triangle PQR? (180°)

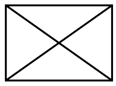
Repeat with triangle LMN.

main activity

Vocabulary
isosceles
equilateral
scalene

Resources
plain A4 paper
scissors for each pupil
Resource S3.2b

Ask pupils to fold a piece of A4 paper along each diagonal.



Q How many small triangles do you have? (four)

Q Are any of the small triangles the same? (there are two identical pairs)

Q Do any of your small triangles have two equal sides? (all of them)
How do you know that the sides are equal?

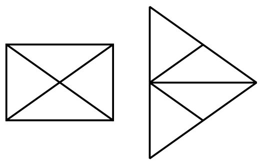
Remind pupils that the diagonals of a rectangle are equal and cut each other in half. The small triangles have two sides each equal to half of a diagonal of the rectangle.

Q What type of triangle is a triangle with two equal sides? (isosceles)

Ask pupils to cut along the folds of the paper to make the four small triangles. Hold up one of each pair of triangles.

Q What is different about these isosceles triangles? (one has a longer base and one obtuse angle; one has a shorter base and all its angles are acute)

Ask pupils to reassemble the four triangles to form one large isosceles triangle.



Allow time for them to experiment and to assemble the triangle, then ask:

Q What do we know about the area of the large isosceles triangle? (it is the same as the original rectangle because it consists of the same parts)

Q How do we know for certain that we have made a large isosceles triangle with two sides of the same length?

Establish with the class that two sides of the large isosceles triangle are the same length as a diagonal of the original rectangle.

Give pupils copies of **Resource S3.2b**. Ask pupils to work in pairs and to discuss the solution to each problem before recording it on the sheet.

Discuss with the class the different ways that the right-angled triangles can fit into the shapes.

other tasks

Springboard 7
Unit 8

Unit 8 section 2: Triangles and coordinates
Star challenge 3: Equilateral triangle puzzles page 277

You may wish to provide some further examples of exploring 2-D shapes.

plenary

Vocabulary
acute
obtuse
reflex
parallel
perpendicular
quadrilateral
square
rectangle
parallelogram
rhombus
kite
trapezium

Resources
OHT S3.2c
mini-whiteboards
ITP *Polygon* (optional)

Use **OHT S3.2c** to remind pupils of the names and shapes of different types of quadrilaterals.

Q What is a quadrilateral? (a flat shape with four straight sides)

Point to one of the quadrilaterals.

Q Does this shape have any right angles? Any acute angles? Any obtuse angles? Any equal angles?

Q Does this shape have any equal sides? Any pairs of parallel sides? Any sides that are perpendicular to one another?

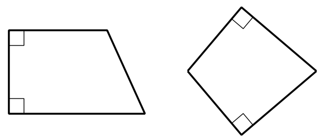
Repeat with the other quadrilaterals.

Remove **OHT S3.2c**. Tell pupils to visualise the quadrilaterals and to discuss the answers to the next questions with a partner.

Q A square has four right angles. Does any other quadrilateral have four right angles? If so, draw it on your whiteboard and write its name. (rectangle)

Q Can a quadrilateral have exactly two right angles? If so, draw it on your whiteboard and write its name.

Establish that a quadrilateral can have two adjacent right angles (a trapezium), or two opposite right angles (a kite).



Say that any quadrilateral can be cut into two triangles.

Q What is the sum of the angles in a quadrilateral? (360°)

Establish with the class that the sum of the four angles of the quadrilateral is the same as the sum of the angles in both the triangles.

You could if you wish use the ITP *Polygon,* downloaded from the website www.standards.dfes.gov.uk/numeracy, to support the plenary.

Remember

- The angle sum of a triangle is 180°.
- A triangle has three straight sides. Some triangles with special properties are an equilateral triangle, an isosceles triangle and a right-angled triangle. A triangle in which all three sides are different lengths is called a scalene triangle.
- The angle sum of a quadrilateral is 360°.
- A quadrilateral has four straight sides. Some quadrilaterals with special properties are a square, rectangle, rhombus, kite, parallelogram and trapezium.

S3.3 Exploring 3-D shapes

objectives

- Visualise and describe 3-D shapes.
- Identify parallel and perpendicular lines.
- Identify nets of an open cube.

starter

Vocabulary
names of 3-D shapes (see below)
solid
faces
edges
vertices
parallel
perpendicular

Resources
a set of 3-D shapes, including cube, cuboid, cone, cylinder, pyramids and prisms
cloth bag to hold the shapes
mini-whiteboards

Hold up one of the 3-D shapes, for example, the triangular prism. Ask:

Q **What is the name of this solid shape?** (a prism)

Q **How many faces does it have?**

Establish that there are five faces; two triangles and three rectangles. Count the vertices (6) and the edges (9). Explain that because the two ends are triangular that it is called a *triangular prism*. Write *triangular prism* on the board. Repeat for other shapes, producing a list on the board.

Put all the shapes in the bag. Choose a pupil to pick out and hold up a shape, and to tick its name on the board. Repeat several times.

Remind the class that *parallel* lines are straight lines that never meet, even when extended, and *perpendicular* lines meet at right angles. Hold up a cuboid. Point out a pair of parallel faces, explaining that the faces will never meet. Point out a pair of perpendicular faces, explaining that they meet at right angles. Hold up the triangular prism, and ask pupils to identify pairs of parallel faces, and pairs of parallel edges. Repeat with the cube.

Secretly put one of the shapes in the cloth bag, for example, a tetrahedron. Invite a pupil to come to the front of the class, to feel the shape through the cloth, and to describe the shape to the class without saying its name. If necessary, prompt the pupil by saying:

Q **How many faces does the shape have? What shape are the faces?**
Q **How many vertices does the shape have?**
Q **Are any of the edges curved?**
Q **Are any of the faces parallel? What shape are any parallel faces?**

Ask the rest of the class to visualise the shape and to write its name on their whiteboards. Repeat with some of the other shapes.

main activity

Vocabulary
net
hollow

Resources
OHTs S3.3a, 3.3d
Resources S3.3b, S3.3c
scissors

Show **OHT S3.3a**. Explain that a *net* is a pattern of shapes which, if drawn on paper or card and cut out, can be folded to make a hollow shape. Talk through each net explaining how the sides can be folded to make the shape.

Give each pupil a copy of **Resource S3.3b** and a pair of scissors. Ask pupils to cut out each shape and to fold it to see whether it is a net that would make a cuboid.

Discuss pupils' explanations of why shapes A and D cannot be folded to make a cuboid.

Working with the whole class, give each pupil a copy of **Resource S3.3c**. Taking each net in turn, ask pupils to visualise whether it would fold up to make the required shape, and to put a tick or cross on their whiteboards. Ask a pupil who gives a correct answer to justify their conclusion to those who answered incorrectly. If pupils are still in doubt, ask them to confirm by cutting out and folding up the net.

Show **OHT 3.3d**. Discuss the problem with the class.

Q Describe in your own words the construction of the box.

Draw out that two flaps fold in from opposite sides to make the first part of the lid. They do not meet each other in the middle. Then two more flaps fold from opposite sides to meet in the middle. These second two flaps form the top lid of the box.

other tasks

Springboard 7
Unit 3

Unit 3 section 5: 3D shapes

plenary

Vocabulary
volume

Resources
interlocking cubes
mini-whiteboards
OHT S3.3e

Join 12 interlocking cubes to make a 3 × 4 block. Hold it up and ask:

Q What shape is this? (a cuboid) **How many cubes are there?** (12)

Explain that the *volume* of a solid is a measure of the amount of space that it takes up. Write on the board:

volume = 3 × 4 cubes = 12 cubes

Add another layer of 12 cubes to the cuboid, and hold it up. Explain that there are now two layers, with 12 cubes in each layer. Write on the board:

volume = 3 × 4 × 2 cubes = 24 cubes

Repeat the process, adding a third layer and a fourth.

Now hold up a cuboid made from 2 × 3 × 2 interlocking cubes, and ask:

Q What is the volume of this cuboid? How many cubes are there in it? (12)

Draw out that there are two layers of 3 × 2 cubes, so that the volume or total number of cubes is 3 × 2 × 2 cubes.

Say that the volume of a solid made from cubes can be found by counting the cubes. Sometimes there is a quick way to work out the number of cubes. For example, for a cuboid, the total number of cubes can be found by multiplying the number of cubes in one layer by the number of layers.

Q What other cuboids could we make with a volume of exactly 12 cubes?

Ask pupils to discuss the question in pairs. Take feedback, drawing out the possibilities of 3 × 4 × 1 cubes, or 6 × 2 × 1, or 12 × 1 × 1 cubes. Reinforce pupils' understanding by making each cuboid from the interlocking cubes.

Q What cuboids could we make with a volume of exactly 30 cubes?

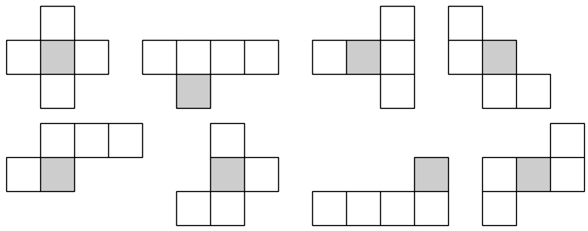
Ask the pairs to discuss this question. Draw out the possibilities of 30 × 1 × 1, 15 × 2 × 1, 10 × 3 × 1, 5 × 6 × 1 and 5 × 3 × 2 cubes.

Repeat with 36 cubes (36 × 1 × 1, 18 × 2 × 1, 12 × 3 × 1, 9 × 4 × 1, 6 × 6 × 1, 9 × 2 × 2, 6 × 3 × 2, 4 × 3 × 3 cubes).

Show **OHT S3.3e.** Work through the questions one by one, giving pupils time to think about the question. Ask them to answer using their whiteboards. If necessary, help pupils to visualise the shapes by constructing them from cubes.

Remember

- Parallel faces never meet.
- Perpendicular faces meet at a right angle.
- A net is a pattern of shapes which, if drawn on paper or card and cut out, can be folded to make a hollow shape. There are eight different nets for an open cube. In each case, the shaded square is the base.



- The volume of a solid is a measure of the amount of space it occupies. The volume of a solid shape made from cubes can be measured by counting the cubes.
- The volume of a cuboid can be calculated by multiplying the number of 'cubes' in one layer by the number of layers.

S3.4 Working with measures

objectives

- Use standard units of mass and capacity.
- Suggest suitable units and equipment to estimate and measure mass and capacity.
- Read and interpret scales on a range of measuring instruments.
- Solve problems involving measures.

starter

Vocabulary
units of measurement
metric
imperial
capacity

Resources
OHT S3.4a
one pint milk bottle full of water
one empty litre measuring jug or cylinder
some kilogram and half kilogram weights
one or more 1 lb weights (or 1 lb of dried beans in a polythene bag)
mini-whiteboards

Show **OHT S3.4a**. Explain that these are all units of measurement.

Q **Which of the units are used to measure liquid?**

Say that when we measure the space taken up by liquid or air in a container we are measuring the *capacity* of the container. Establish that litres, millilitres, pints and gallons are all units of capacity. Litres and millilitres are part of the *metric* system. Pints and gallons are part of the *imperial* system. Imperial measures are still used in some circumstances: for example, milk is sold in pints as well as litres and half litres. Hold up the litre jug and the pint bottle.

Q **Which is more, a litre or a pint?**

Pour the water from the pint bottle into the litre jug to show the class that a pint is a more than half a litre but less than one litre. One litre is about one pint plus three quarters of a pint, or $1\frac{3}{4}$ pints.

Tell the class that an ordinary kitchen bucket holds about 2 gallons. Hold up the litre jug and ask:

Q **Roughly how many jugs full of water would fill a kitchen bucket?**

Establish that an ordinary kitchen bucket would hold about 9 to 10 litres.

Q **How many millilitres are there in one litre?** (1000) **In half a litre?** (500) **In one tenth of a litre?** (100) **In one quarter of a litre?** (250)

Write on the board: 1 litre = 1000 millilitres. Remind the class of the abbreviations for litres and millilitres (l and ml). Ask pupils to write estimates on their whiteboards.

Q **Roughly, what is the capacity in millilitres of a coffee mug?** (250 to 300 ml) **Of an egg cup?** (50 ml) **Of a teaspoon?** (5 ml)

Repeat the above with units of mass, referring again to **OHT S3.4a**.

Q **Which of these units are used to measure weight?** (metric: kilogram, gram; imperial: pound, ounce)

Pass a kilogram weight around the class so that pupils can feel how heavy it is.

Q **How many grams are there in one kilogram?** (1000) **In half a kilogram?** (500) **In one tenth of a kilogram?** (100)

Write on the board: 1 kilogram = 1000 grams, pointing out that the abbreviation for kilograms is kg, and for grams is g.

Q Which weighs more, half a kilogram or a pound?

Invite one or two pupils to compare the 1 lb weight with the 500 g weight. Tell the class that a pound is just less than half a kilogram (so that a kilogram is just over 2 pounds), and an ounce is about 30 grams.

Ask pupils to write some estimates on their whiteboards.

Q Roughly, what is the average weight of newborn baby? (3 to 4 kg) **Of a large loaf of bread?** (800 g) **Of an apple?** (150 to 200 g)

End the starter by asking:

Q What metric units of length do you know? (kilometres, metres, centimetres, millimetres) **Imperial units?** (miles, possibly feet and inches)

Q Which is longer, one kilometre or one mile? (a kilometre lies between half a mile and one mile, but is closer to half a mile)

Q How many metres in a kilometre? (1000) **How many millimetres in a centimetre?** (10) **In a metre?** (1000)

Write on the board: 1 metre = 100 centimetres = 1000 millimetres and 1 kilometre = 1000 metres.

Q Roughly, what is the height of the classroom door? (2 m) **The length of a piece of A4 paper?** (30 cm) **The width of the palm of your hand?** (10 cm)

main activity

Vocabulary
weighing scale
interval
convert

Resources
OHTs S3.4b, S3.4c
ITPs *Weighing scales* and *Measuring cylinder* (optional)

If you wish, introduce the main activity by using the ITP *Weighing scales*, downloaded from www.standards.dfes.gov.uk/numeracy. Choose a target to reach on the scales. Invite pupils to add the weights to the pan. Observe how the pointer moves on the scale and the decimal reading.

Prepare **OHT S3.4b** and cut out the pointer so that you can position it on the scale. Show this OHT, saying that it represents a weighing scale. Write 0 at the '12 o'clock' position and 140 kg in the box. Place the pointer on the scale pointing at 0. Explain that the pointer points to 0 when there is nothing on the scale and rotates clockwise. Rotate the pointer so that it points to the first division on the scale.

Q What does this mark represent?

Take responses (e.g. 30 kg). Move round the scale, counting in 30s, until you reach the box. If the count results in anything other than 140 kg, it is obviously incorrect. Establish that each interval represents 20 kg, since there are seven intervals, and $7 \times 20 = 140$. Repeat the count from zero, this time counting in 20s.

Rotate the pointer to different positions on the scale, such as 46 kg. Ask pupils to estimate the weight by first stating the interval that contains the weight (for example: 'The weight lies between 40 and 60 kg, but is nearer to 40 kg than to 60 kg. My estimate is 45 kg.')

Repeat the above by writing 35 kg, then 700 g, in the box.

Show **OHT S3.4c**, and work through the two problems with the class. Remind pupils of the relationship 1 litre = 1000 millilitres, referring to it on the board.

In the first problem, stress that the empty container is marked in litres. There are two ways of tackling the problem. They can either convert each of the first two readings in millilitres to litres, then add them together, or they can add the readings in millilitres to find the total, then convert the total in millilitres to litres.

In the second problem, ask:

Q What do the labels of 500 really mean? (500 ml and 1500 ml)
Q What does each interval represent? (100 millilitres or $\frac{1}{10}$ of a litre)

Stress that the answer needs to be given in millilitres.

You could if you wish supplement the main activity by using the ITP *Measuring cylinder*.

other tasks

Springboard 7
Unit 11

Unit 11 section 1: Mass
2 Grams and kilograms page 366
Star challenge 2: The metal button appeal page 367
Star challenge 3: In order of weight page 368

Unit 11 section 2: Units of mass
Star challenge 5: Metric and imperial equivalent weights page 372
Star challenge 6: Meet the heavyweights page 373

Unit 11 section 3: Capacity
1 Metric units of capacity page 375
3 Capacity problems page 376
Star challenge 7: What would you use to measure …? page 377

plenary

Resources
OHT S3.4d

Remind the class of the relationships written on the board:

1 litre = 1000 millilitres
1 kilogram = 1000 grams
1 kilometre = 1000 metres
1 metre = 1000 millimetres

Q What is one quarter of a litre in millilitres? Half a kilogram in grams? Three quarters of a metre in millimetres?

Q What is 500 metres in kilometres? 1250 grams in kilograms? 4750 millilitres in litres?

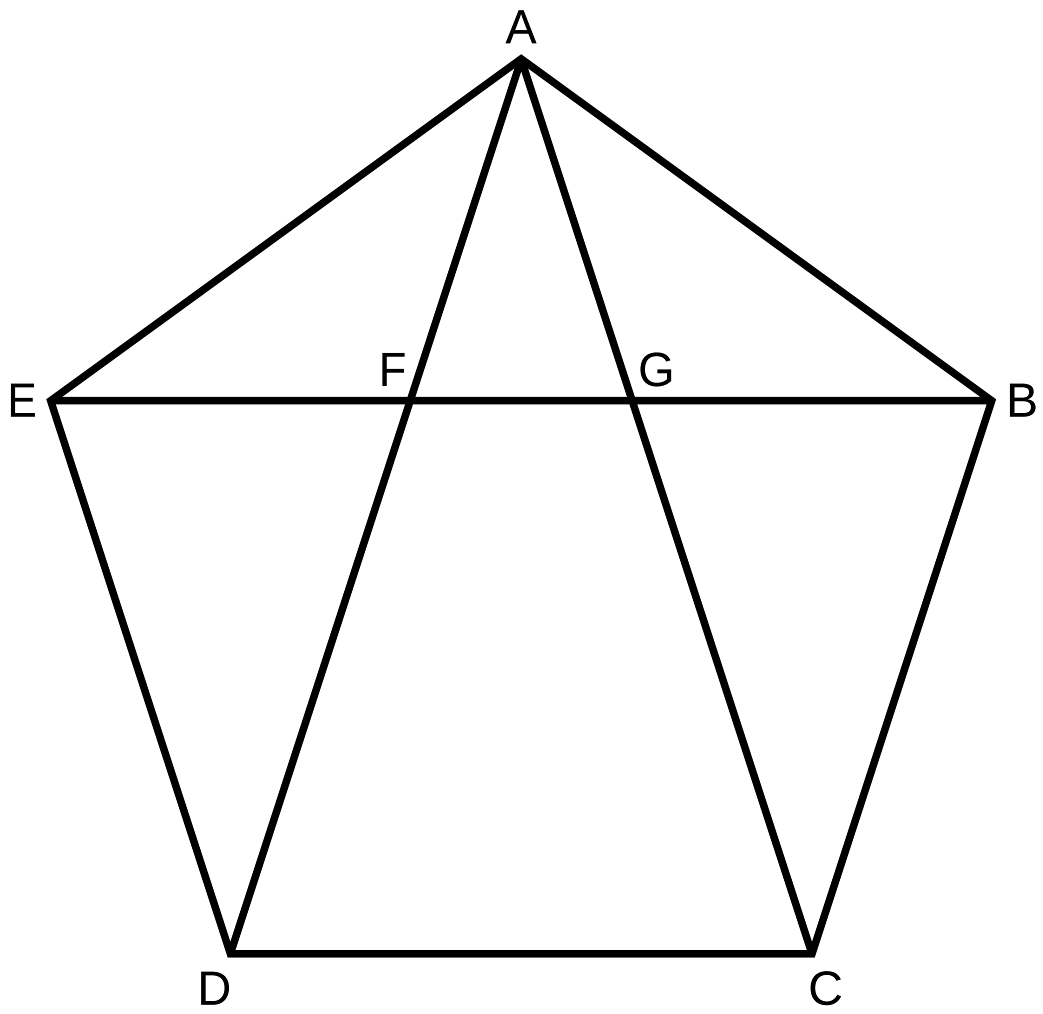
Display **OHT S3.4d**. Explain that the first panel shows a recipe to make one fruit cake. Ask:

Q What do we have to do to solve the problem? (multiply each quantity by 10)

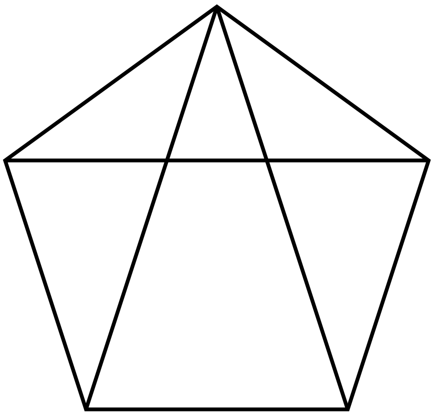
Invite different pupils to complete the lines of the table, stressing that each quantity has to be expressed in grams and in kilograms.

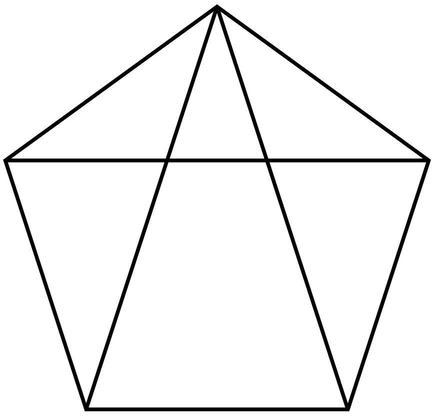
Remember

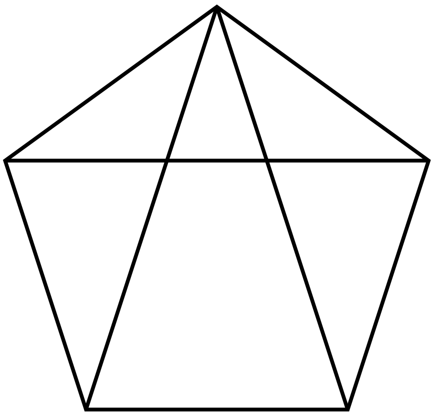
- The metric system uses multiples of 10, 100 and 1000.
- *Kilo* means 1000, *centi* means one hundredth, and *milli* means one thousandth.
- One kilogram is just over 2 pounds (2 lb). One litre is about $1\frac{3}{4}$ pints. One kilometre is just over half a mile ($\frac{5}{8}$ of a mile).

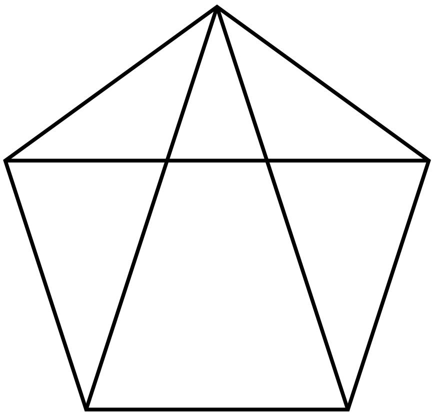

A
E
F
G
B
D
C

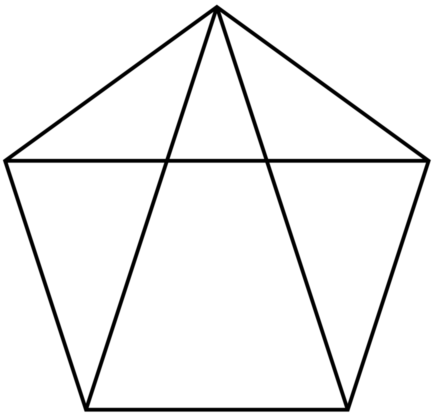
Resource S3.1b

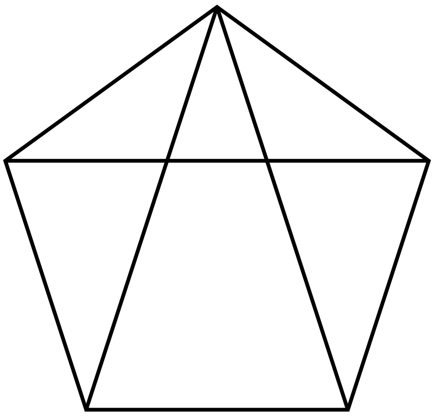












In the space below, construct triangle LMN.

LM = 8 cm angle L = 45° angle M = 30°

Measure side MN. What is its length? .... cm

In the space below, construct triangle PQR.

PQ = 7.5 cm angle P = 25° angle Q = 105°

Measure side PR. What is its length? .... cm

Resource S3.1d

In the space below, construct triangle DEF.

DE = 6.5 cm DF = 6.5 cm angle D = 70°

Measure angle E. What is its size? .... °

In the space below, construct triangle ABC.

AB = 6 cm BC = 5 cm angle B = 120°

Measure angle A. What is its size? .... °

Diagram 1

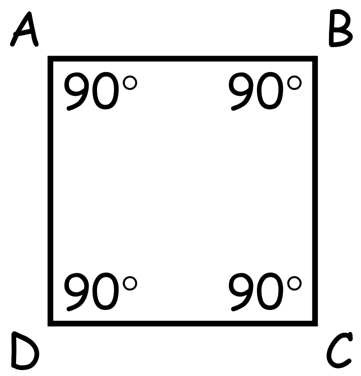


Diagram 2

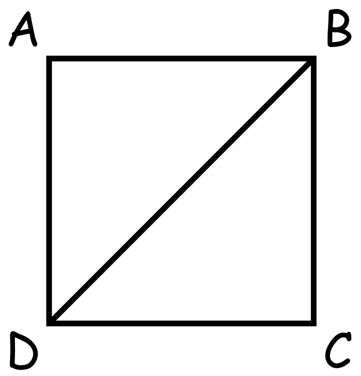


Diagram 3

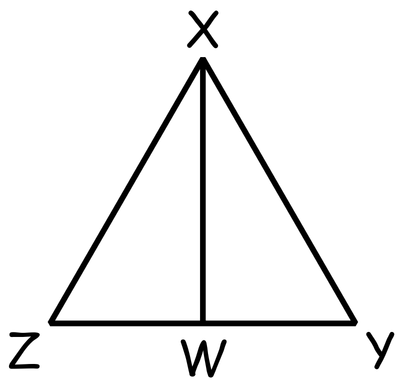


Diagram 4

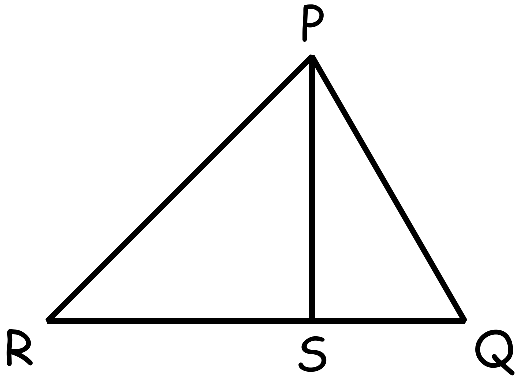
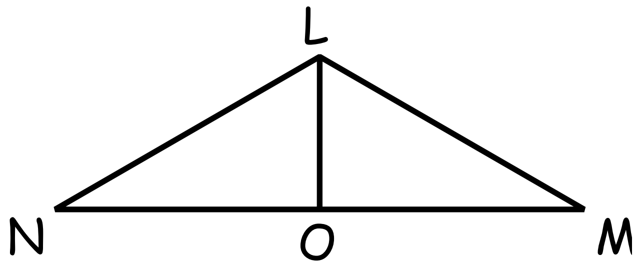
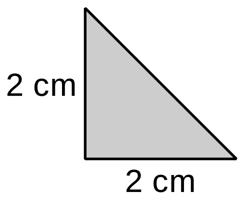


Diagram 5

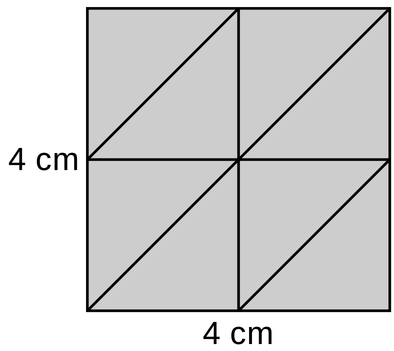


Resource S3.2b

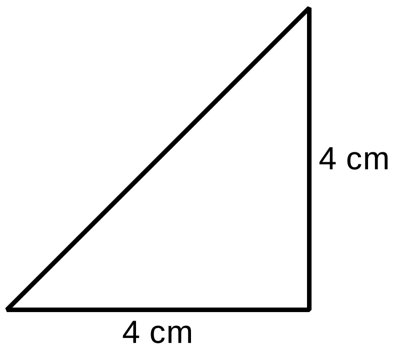
This is a right-angled triangular tile.



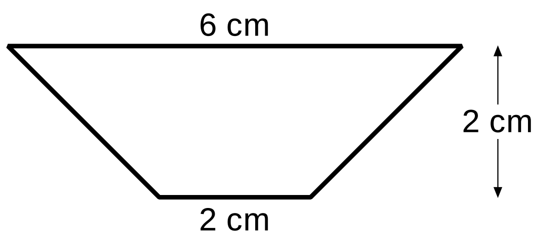
You can fit 8 of the tiles into a 4 cm by 4 cm square like this.



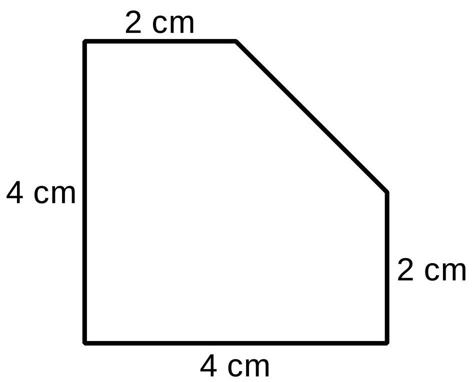
Write how many of the tiles you can fit into each of these shapes.



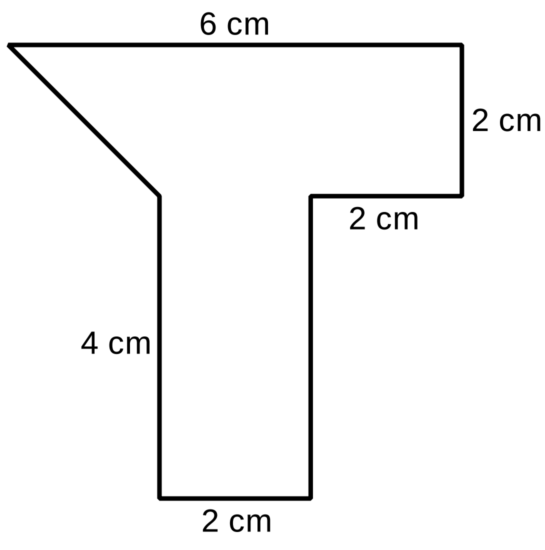
Number of tiles: …………….



Number of tiles: …………….

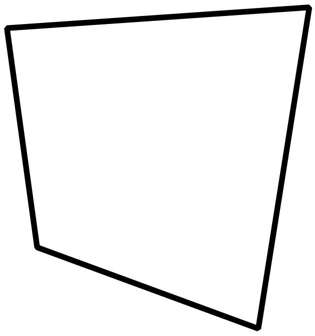


Number of tiles: …………….

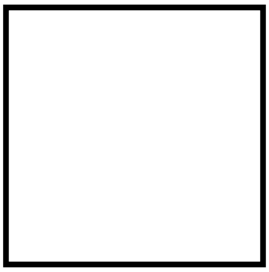


Number of tiles: …………….......

quadrilateral



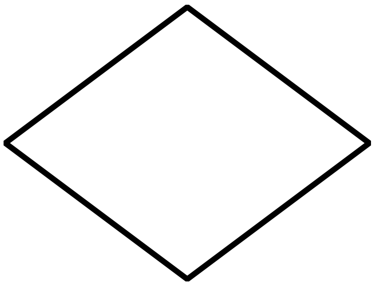
Quadrilaterals with special properties



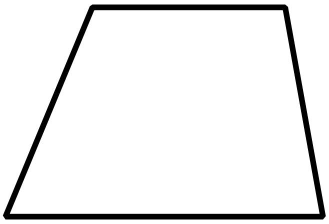
square

rectangle

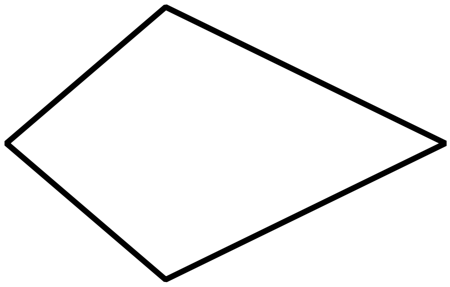
parallelogram



rhombus

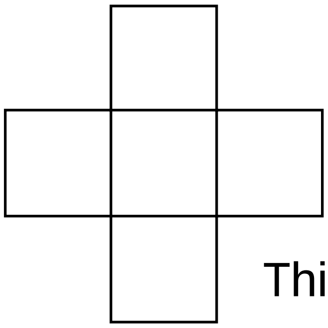
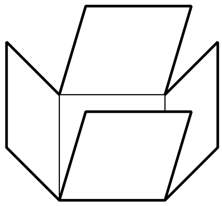
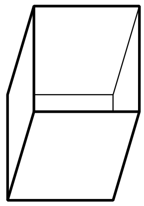


trapezium

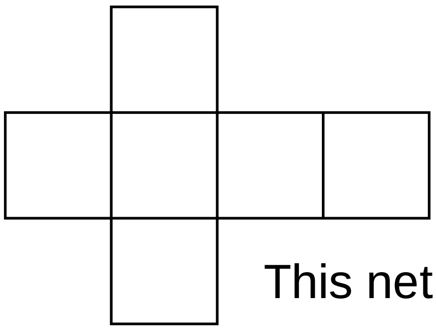
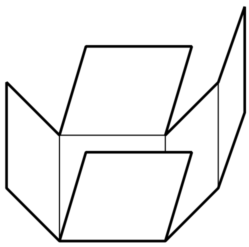
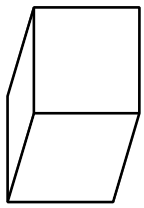


kite

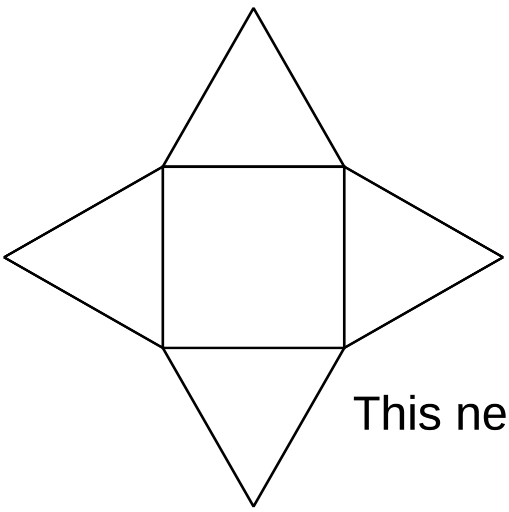
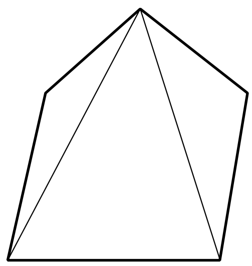
OHT S3.3a

This net would make this open box

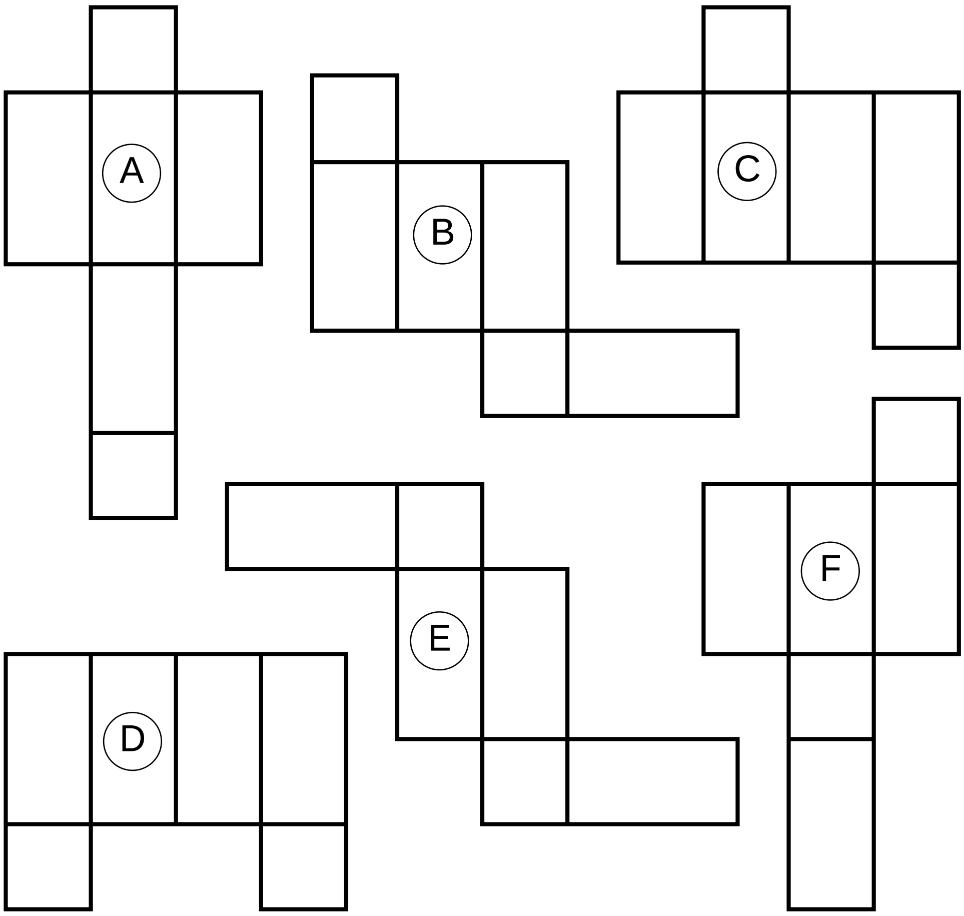
This net would make this box with a lid

This net would make this pyramid

Resource S3.3b

Some of these shapes are nets that can be folded to make cuboids.



Which shapes are nets that can be folded to make cuboids?

....

Choose a shape which cannot be folded to make a cuboid.
Say which shape you have chosen. ....

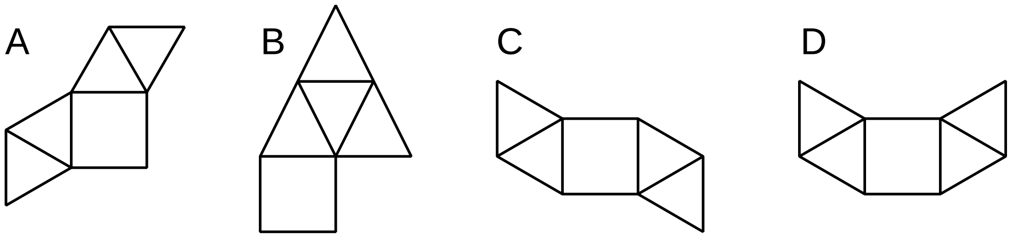
Explain why the shape you have chosen cannot be folded to make a cuboid. Write your explanation, or show it on a diagram.

....

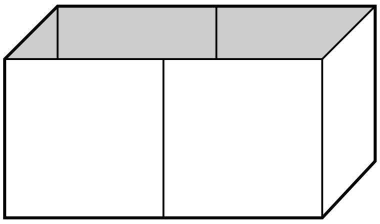
....

....

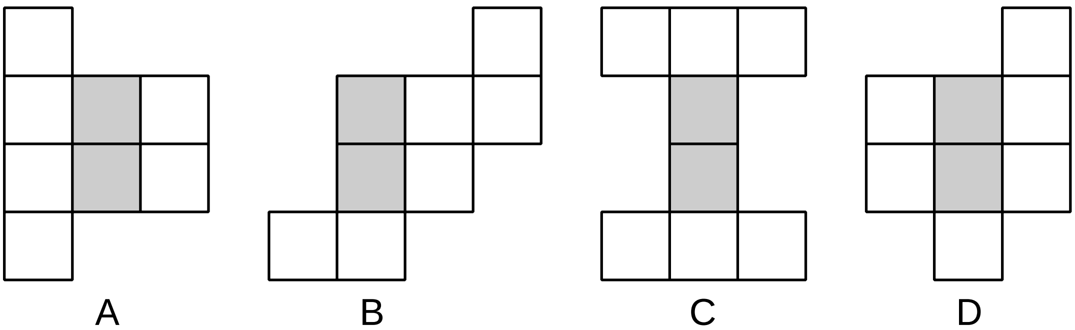
Look at each diagram.
Put a tick (✓) if it is the net of a square-based pyramid.
Put a cross (✗) if it is not.



This is an open top box.

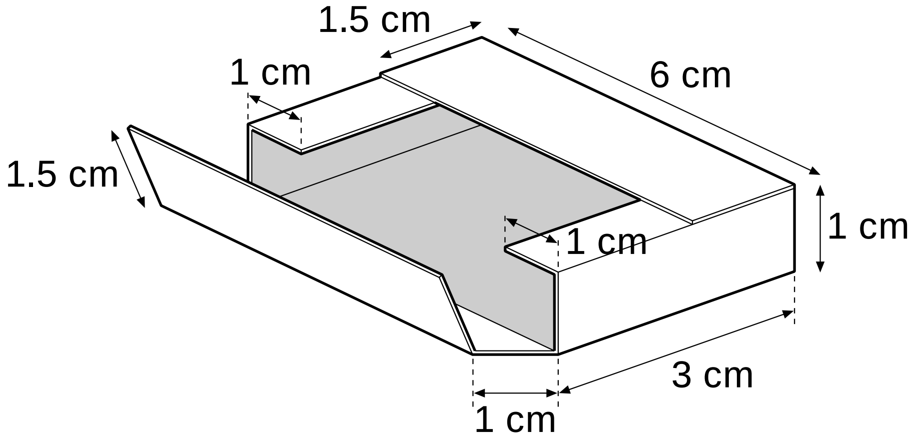


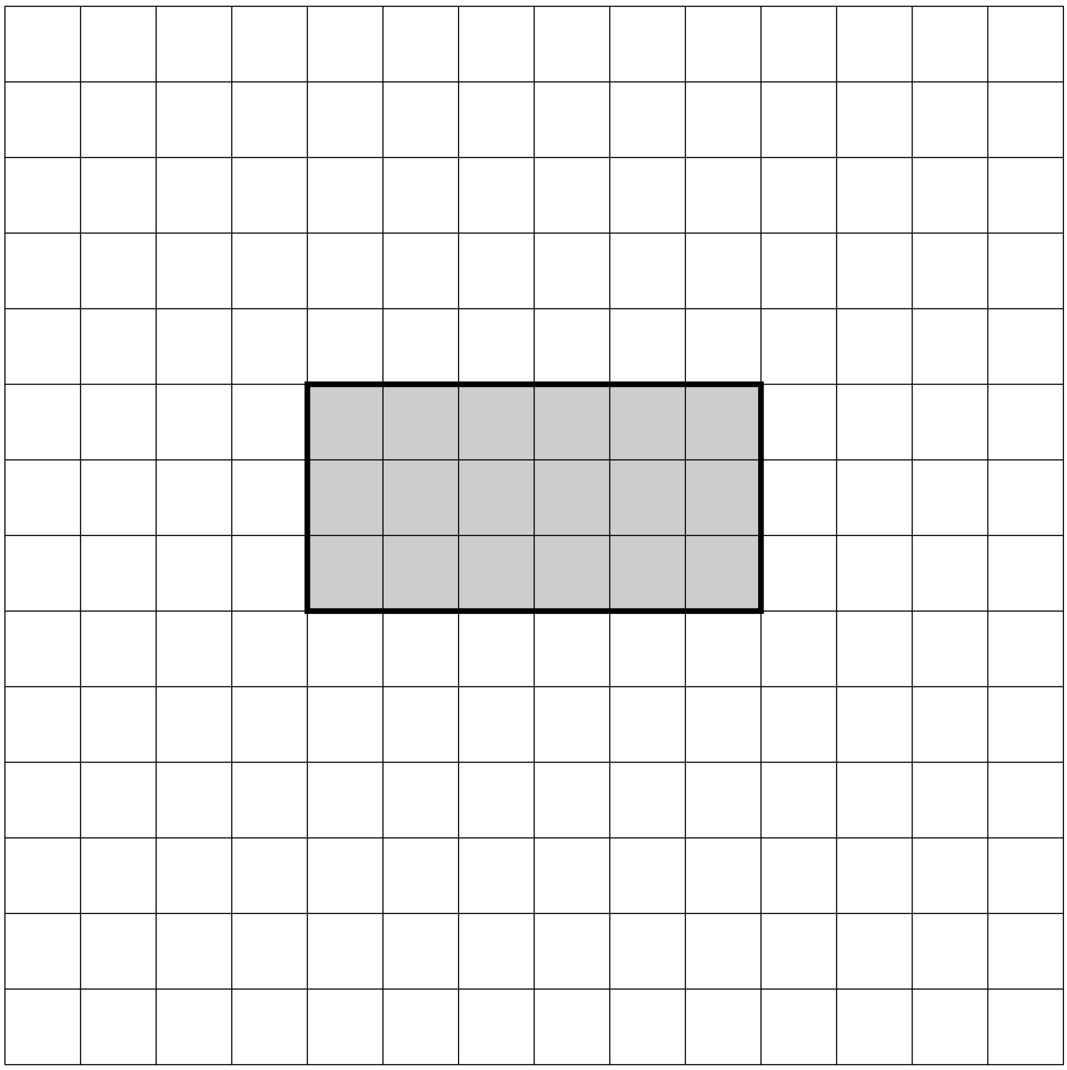
Put a tick (✓) for a diagram if it is a net for the box.
Put a cross (✗) if it is not.
The base is shaded in each one.



OHT S3.3d

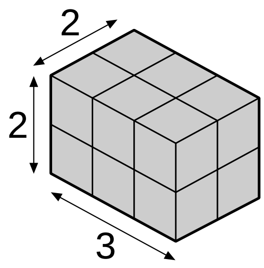
The diagram shows a box.
Complete the net for the box.



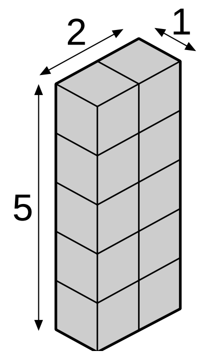


OHT S3.3e

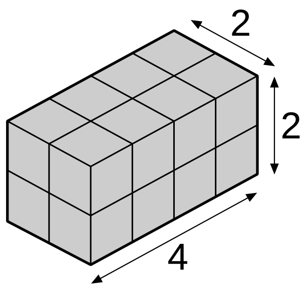
How many small cubes are there in these shapes?



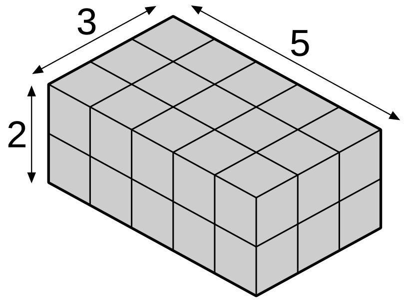
Number of cubes: ....



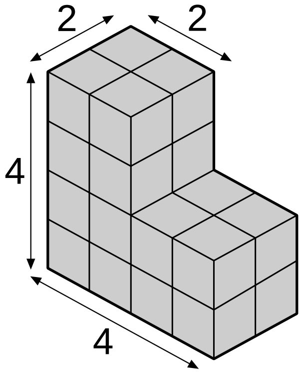
Number of cubes: ....



Number of cubes: ....



Number of cubes: ....



Number of cubes: ....

OHT S3.4a

litre

kilogram

pint

millilitre

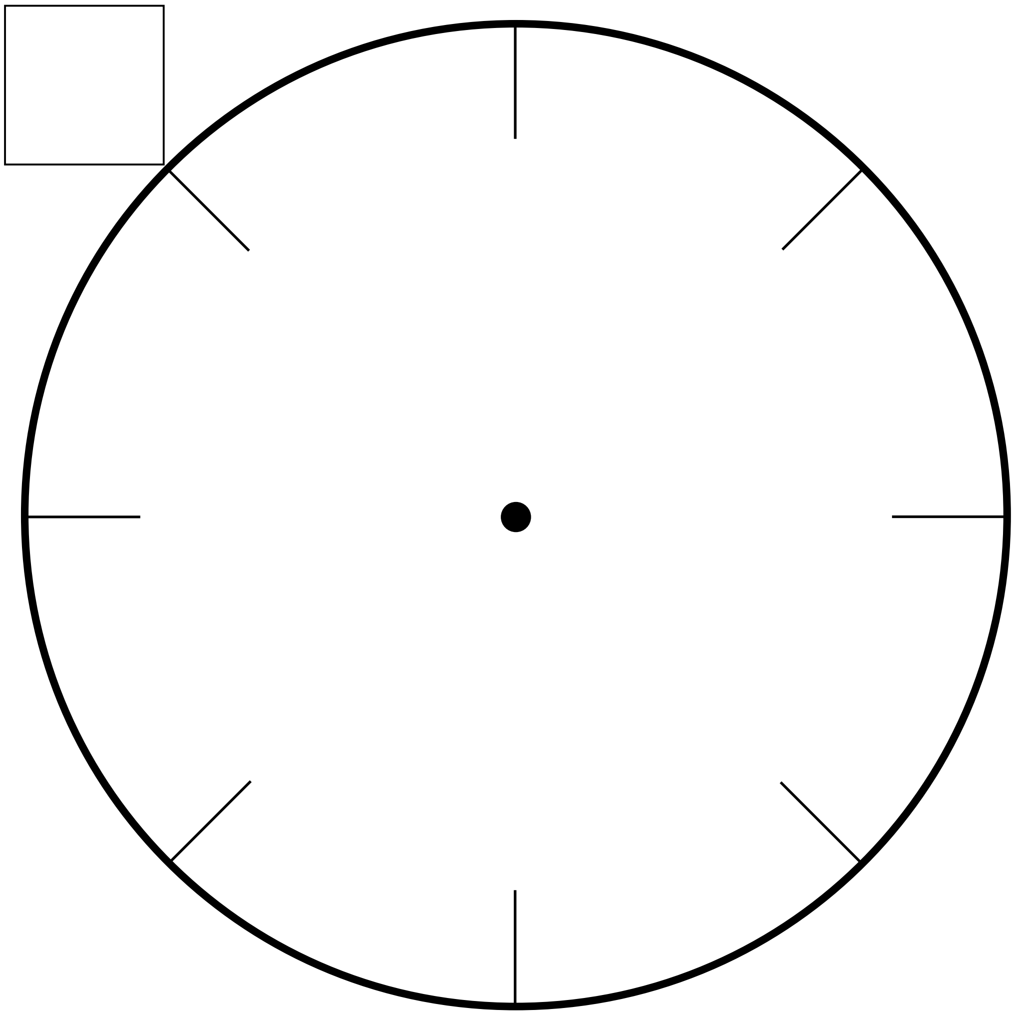
pound (lb)

gallon

gram

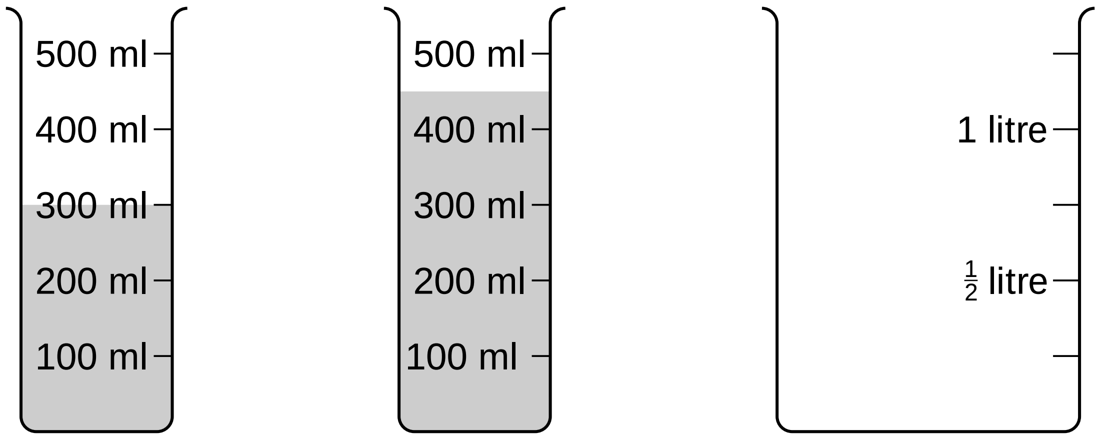
ounce (oz)

OHT S3.4b

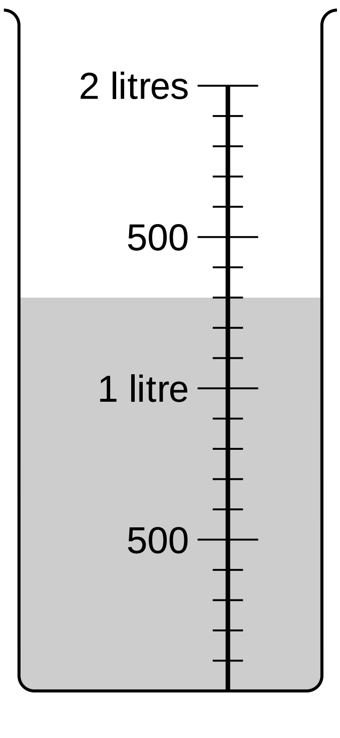


OHT S3.4c

All the water in the two jars is poured into the empty jar. Draw the water level in the empty jar.



There is some water in the measuring jar. How much more water is needed to make 2 litres? .... ml



Here are the ingredients for one fruit cake.

1 fruit cake

200 g	self-raising flour
100 g	caster sugar
150 g	margarine
125 g	mixed fruit
3	eggs

Complete the table to show how much you need in grams and in kilograms to make 10 fruit cakes.

10 fruit cakes

...2000...	g	=	....	kg	self-raising flour
....	g	=	....	kg	caster sugar
....	g	=	....	kg	margarine
....	g	=	....	kg	mixed fruit
30	eggs				