Birmingham City Council

Birmingham
Resources for
Understanding
Mathematics

C if U can

Shape, space and measures

Birmingham City Council

Area and volume			
I can calculate the area and volume of shapes			
I can calculate the surface area of prisms			
I can solve problems involving area and volume			

Pythagoras			
I can work out the length of a missing side in a right angled triangle			
I can apply Pythagoras theorem in a range of contexts			
I can use Pythagoras Theorem to solve problems			

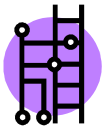
Angles	I am **confident** I can do this	I am **close** to being able to do this	I am **clueless** and need more help
I know angle facts involving triangles, parallel lines, quadrilaterals etc			
I can use angle facts to solve problems			
I can solve problems with angles in polygons			

Transformations			
I can transform shapes using reflection, rotation and enlargement			
I can describe a transformation fully			
I can use scale factors of enlargements to find missing lengths.			

Circles			
I know and can use the formula for the circumference of a circle			
I know and can use the formula for the area of a circle			
I can use circle formulae to solve problems			

How will this booklet help you to get a grade C in maths?

- This booklet is one of four covering number, algebra, shape, space and measures and handling data.
- Each booklet contains work on the topics you need to understand to get a grade C
- Each topic starts off with a 'warm up' with some easier grade E questions followed by a harder D grade questions where you get a bit of help
- There are then some (harder still) C grade questions, where you are given clues if you need them (try on your own first) and finally a C grade question for you to try on your own.

Look for  to indicate grade E/D questions,

to indicate harder D grade questions

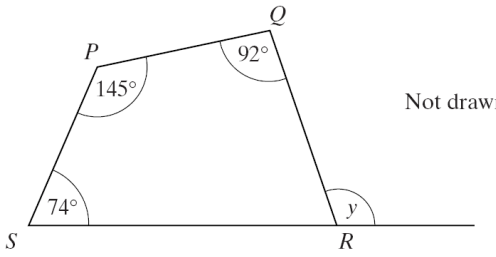
and  to indicate C grade work

At the end of each topic, go to the back of the booklet and keep a record of your progress

Angles

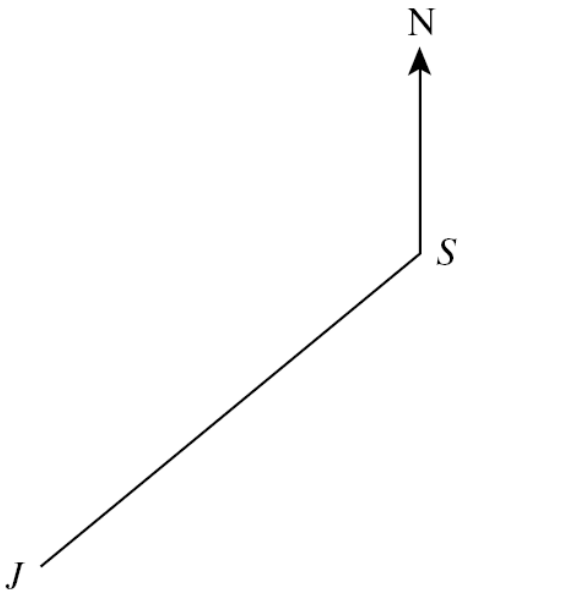
Easy E/D grade questions

1. The diagram shows a quadrilateral PQRS
   Angle P = 145°, angle Q = 92° and angle S = 74°
   Calculate the value of the exterior angle marked y



Not drawn accurately

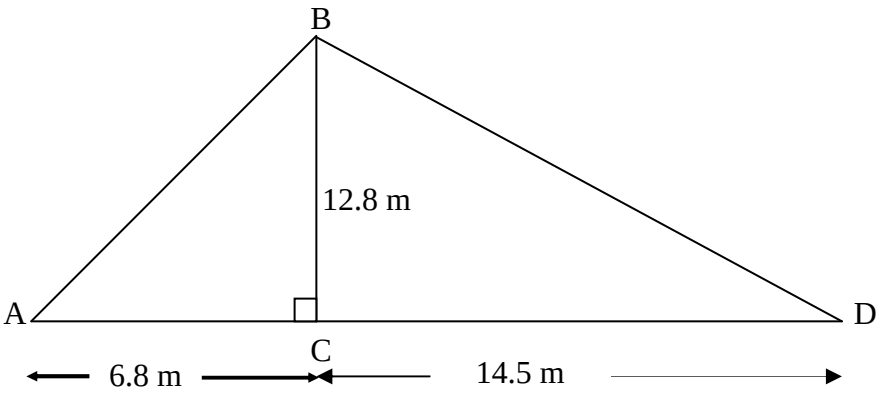
2. The diagram shows the position of Jane's house (J) and the local shop (S).
   Measure and write down the three figure bearing of Jane's house from the shop



Are you feeling more **C**onfident?

C if you can ..... cope on your own!

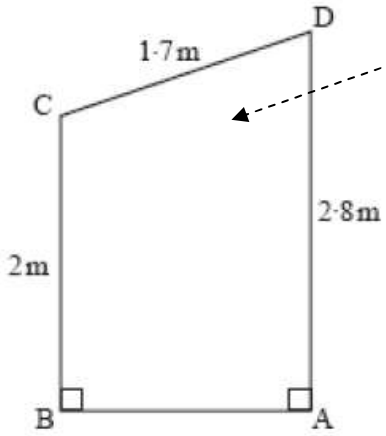
The diagram represents a vertical flagpole, AB.
The flagpole is supported by two ropes, BC and BD fixed to the horizontal ground at C and D.
BC = 12·8m, AC = 6·8m and CD = 14·5m
Calculate the total length of the ropes



The diagram shows the end, ABCD, of a shed.
The shed is standing on horizontal ground.

Calculate the area of the end of the shed

This is an area question but in order to solve it you will need to use Pythagoras Theorem. It is common for questions to have 'hidden' parts like this

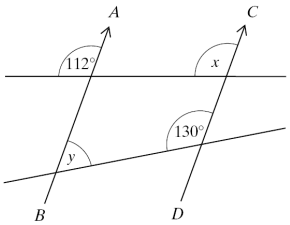


Draw a line here to make the shape a rectangle and a triangle.
Write in any lengths that you know

Don't forget to give the answer in square units and remember that it should be to a sensible degree of accuracy (rounded)

Definitely D grade questions

In the diagram, AB is parallel to CD



You need to think about angle facts with parallel lines

(a) state the value of x and give a reason for your answer

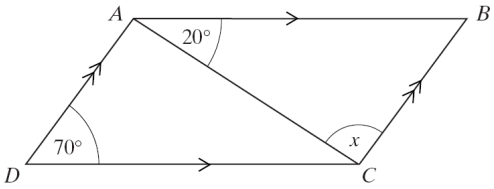
Here you need to use some of the other angle facts you know – like angles on a straight line, vertically opposite angles, angles in a quadrilateral?????

(b) find the value of y

C if U can……. answer the rest! (With a few **C**lues)

The diagram shows a parallelogram ABCD.
Angle BAC = 20°, angle ADC = 70°
Show that angle x is a right angle

Here again you need to think about angle facts with parallel lines.
If you are stuck, write in any angles you do know – this may give you a clue.



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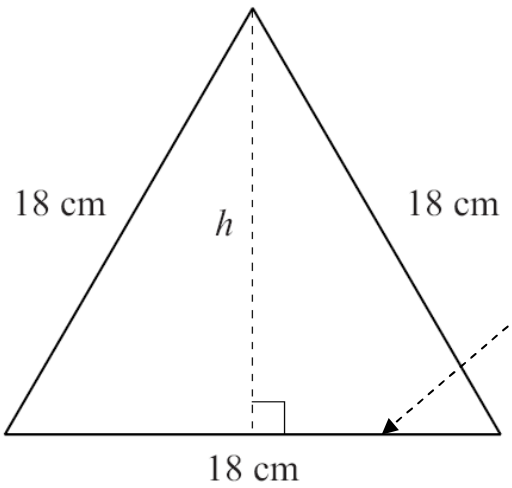
The diagram shows an equilateral triangle of side length 18cm
Calculate the height of the triangle (marked h in the diagram)



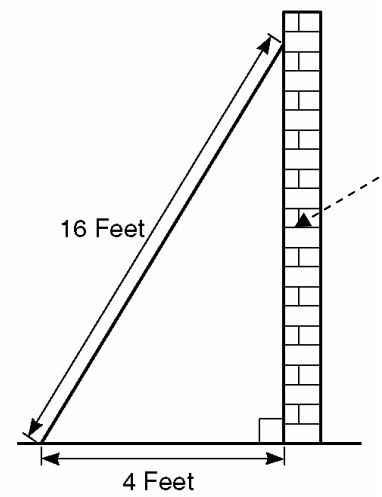
The right angle gives you a hint that this could be a Pythagoras question.
Remember that the line h will split the base of the triangle into 2 equal parts, so you should know this length

You are finding one of the shorter sides again, so go back to the previous question if you need help with this

C if U can……. answer the rest! (With a few **C**lues)

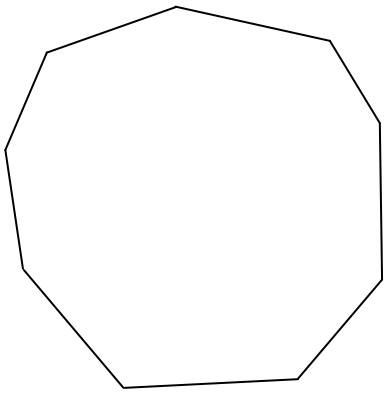
George places the foot of his ladder on horizontal ground and the top against a vertical wall.
The ladder is 16 feet long.
The foot of the ladder is 4 feet away from the base of the wall
Work out how high up the wall the ladder reaches
Give your answer to 3 significant figures

Here you will need to find one of the shorter sides of the right angled triangle Use Pythagoras and remember, if you are finding a shorter side, you need to SUBTRACT



Don't forget to give your answer to three significant figures (that means most important, or those with the greatest value)

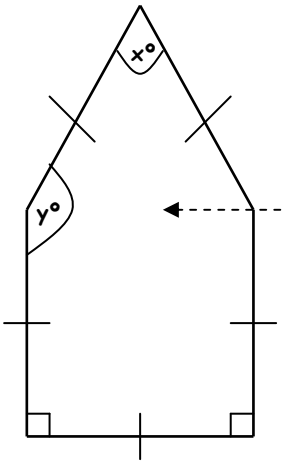
This is a regular polygon with 9 sides
The diagram is not drawn accurately



Here, make sure you read the question – it is the *exterior* angle size you need to find. Remember, you already know what all of the exterior angles add up to in total.

Work out the size of an exterior angle

The diagram shows a five sided shape
All the sides of the shape are equal in length



Not accurately drawn

You could try making the diagram into two shapes, with a line drawn in to make a triangle and a square

What is special about the triangle? This should give you a hint about finding angle x

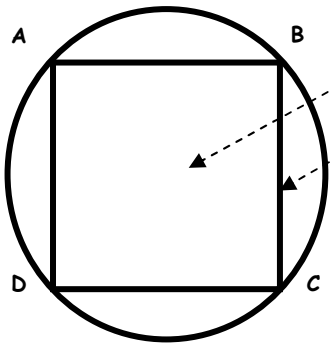
(a) Find the value of x. Give a reason for your answer.

You might think about finding angle y in two parts – the part inside the triangle and the part inside the square

(b) Work out the value of y

Definitely D grade questions

A, B, C and D are four points on the circumference of a circle.
ABCD is a square with sides 20cm long.
Work out the diameter of the circle
Give your answer correct to 3 significant figures



The diameter of the circle is the diagonal of the square

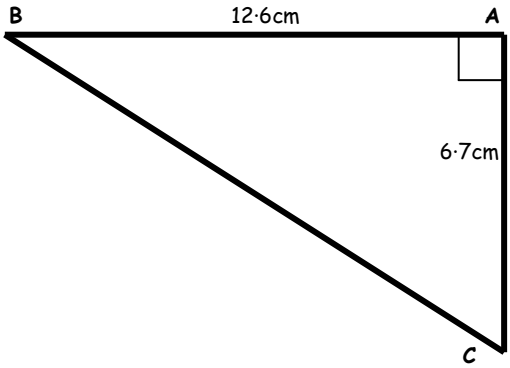
You know the lengths of the sides of the square. Use Pythagoras to work out the diagonal/diameter.

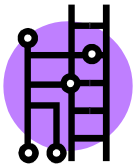
Don't forget to give your answer to three significant figures (that means most important, or those with the greatest value)

Pythagoras

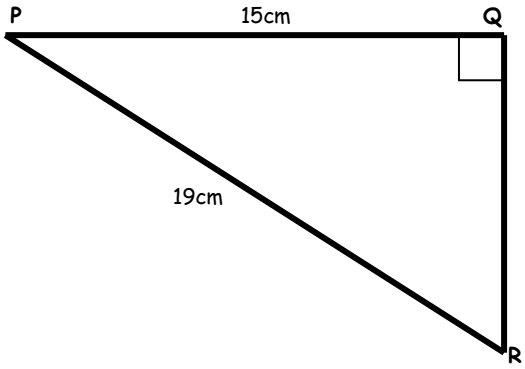
Easy E/D grade questions

1. Angle BAC = 90°
   AB = 12·6cm
   AC = 6·7cm
   Work out the length of AB





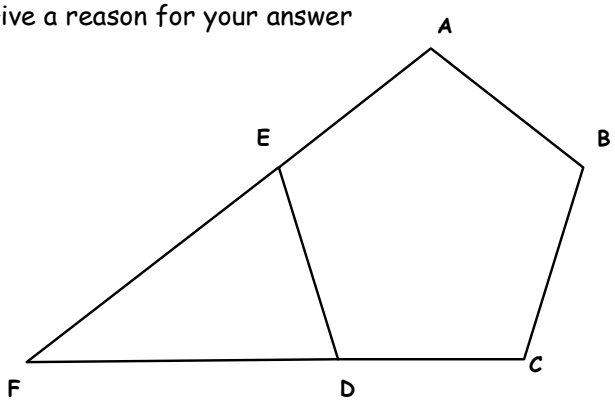
2. PQR is a right angled triangle
Angle PQR = 90°
PQ = 15cm
PR = 19cm
Work out the length of QR



Are you feeling more **C**onfident?

C if you can ….. cope on your own!

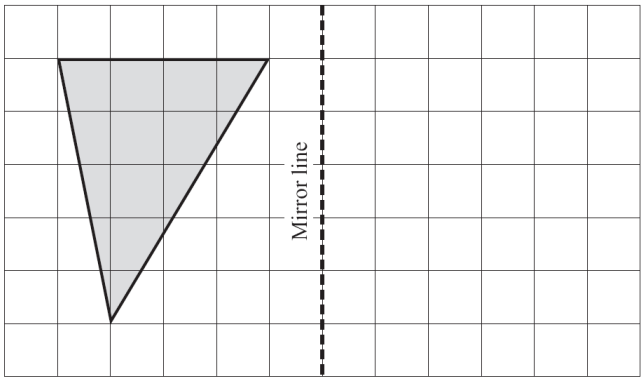
ABCDE is a regular pentagon.
AEF and CDF are straight lines.
Work out the size of angle DFE
Give a reason for your answer



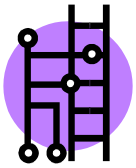
Transformations

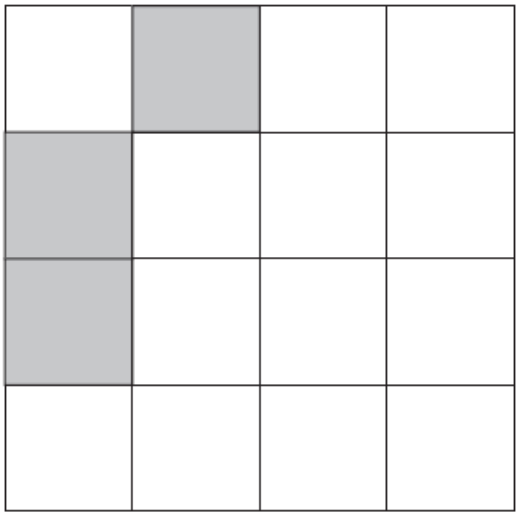
Easy E/D grade questions

1. Draw the reflection of the triangle in the mirror line



2. Three small squares are shaded in the diagram. Shade in three more small squares to make a pattern with rotational symmetry of order 2

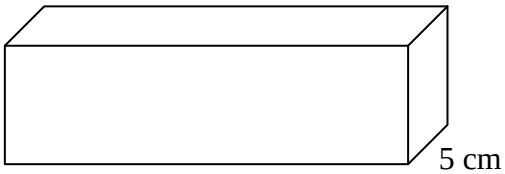




Confident?

C if you can ..... cope on your own!

The volume of a solid cuboid is 140cm^3
The length of the cuboid is 8cm. The width of the cuboid is 5cm



(a) work out the height of the cuboid

The cuboid is made from wood. The wood has a density of 1·2 grams per cm^3

(b) work out the mass of the cuboid

A skip is in the shape of a prism with a cross section ABCD.
AD = 2·3m, DC = 1·3m and BC = 1·7m
The width of the skip is 1·5m

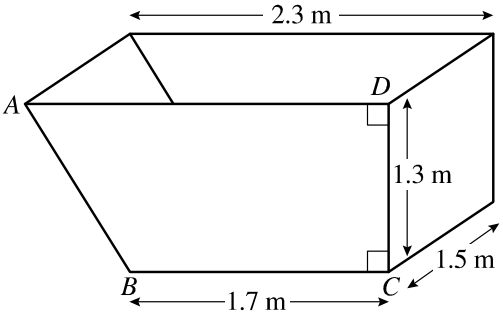
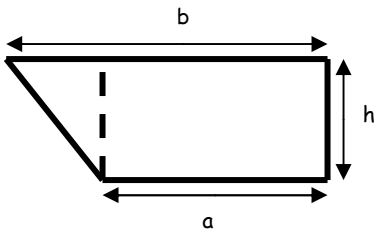


Diagram **NOT** accurately drawn

(a) Calculate the area of the shape ABCD

This shape is a trapezium and looks like this



You might know that the formula for the area of a trapezium is
$\frac{1}{2}$ (a + b) × h
If you can't remember that, you could split the shape into a triangle and a rectangle, find the 2 areas and add them together

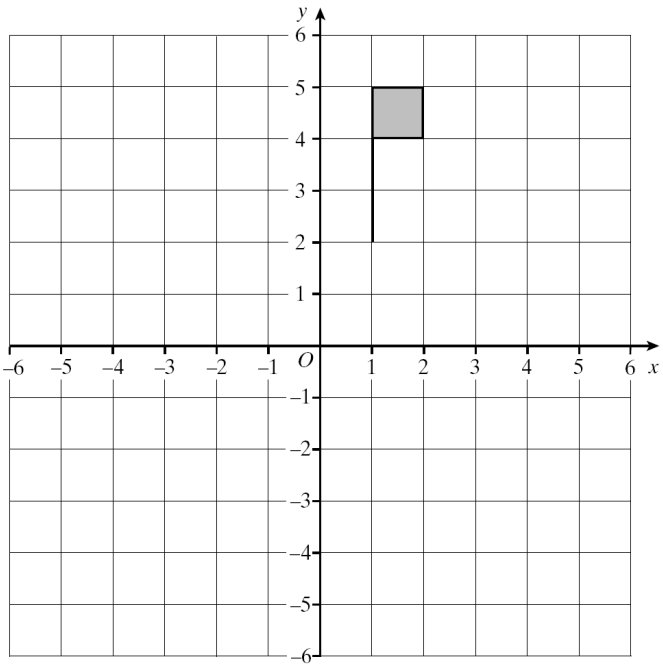
(b) Calculate the volume of the skip

The weight of an empty skip is 650kg. The skip is full to the top with sand. 1m^3 of sand weighs 4300kg

(c) Calculate the total weight of the skip and the sand

The weight will be the volume (in m^3) x weight per 1 m^3
Remember to add on the weight of the skip itself

Definitely D grade questions



(a) Rotate the shaded flag 90° anticlockwise about the origin. Label this new flag with the letter A

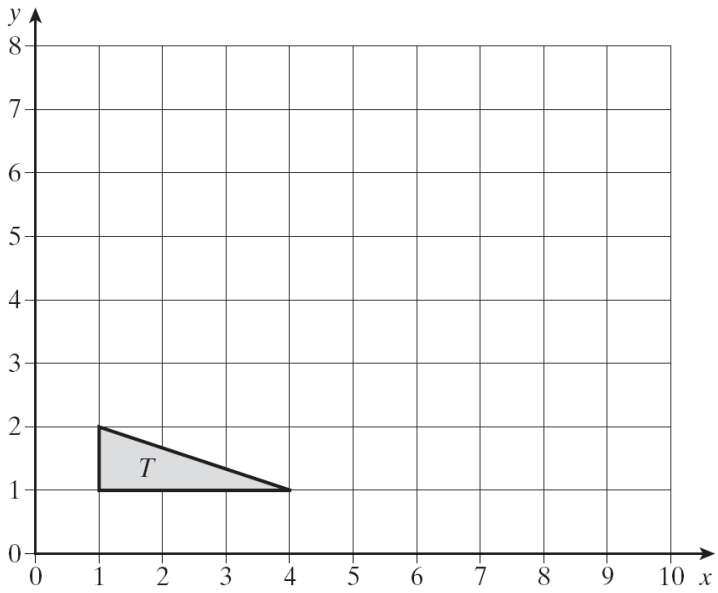
The origin is the point where the axes cross (0,0)

(b) Reflect the original shaded flag in the line y = 1. label this new flag with the letter B

Remember it is the ORIGINAL flag you must reflect. The line y = 1 is the HORIZONTAL line on which all the y coordinates are 1 (1, 1), (2, 1), (3, 1) and so on

C if U can……. answer the rest! (With a few **C**lues)

Enlarge triangle T by scale factor 2, with (0,0) as the centre of enlargement

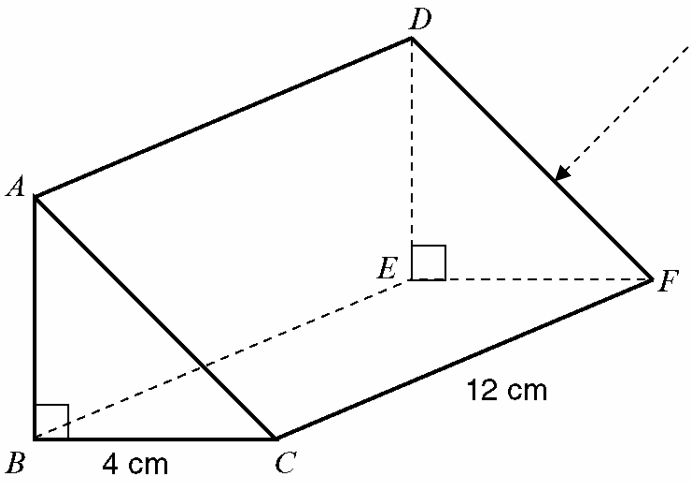


Scale factor 2 will mean every line is twice as long.
You might find it helpful to draw in the 'rays' from the centre of enlargement through all of the vertices (corners) of the triangle
Make sure each vertex of the enlarged triangle is twice as far from (0,0) as it is in the original triangle

BC = 4cm, CF = 12cm and angle ABC = 90°
The volume of the triangular prism is 84cm^3
Work out the length of the side AB of the prism

You need to remember that the volume of a prism is the area of the end (in this case the triangle) multiplied by the length (12)

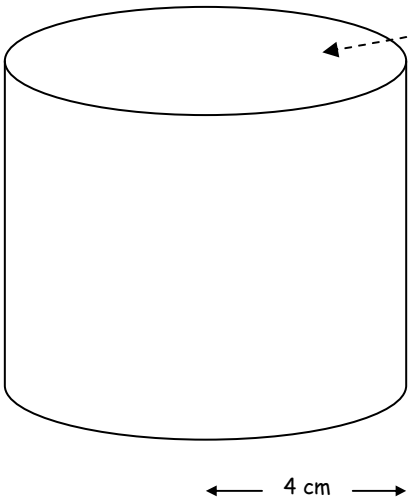
Diagram **NOT** accurately drawn



Then use the formula for the area of a triangle ½ (base x height) to find the height
You need to learn this formula too.

C if U can……. answer the rest! (With a few **C**lues)

This cylinder has a radius of 4cm and a height of 15cm
Calculate the volume of the cylinder
Give your answer correct to 3 significant figures



First, you need to work out the area of the circular end of the cylinder. Use the formula $A = \pi r^2$ and LEARN IT!!

The volume is the area of the end multiplied by the height

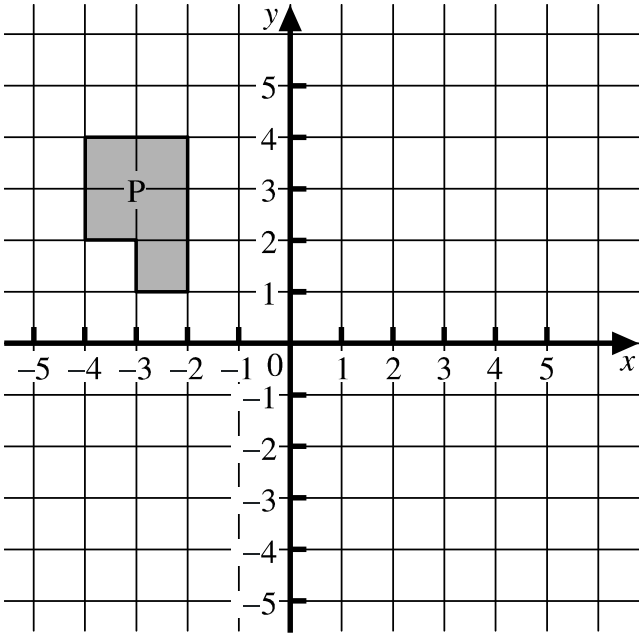
Don't forget to give your answer to three significant figures (that means most important, or those with the greatest value)

The shape P has been drawn on the grid.

(a) Reflect the shape P in the y axis and label the image Q

(b) Rotate the shape Q through 180° about (0,0) Label this image R

(c) Describe fully the single transformation which maps shape P onto shape R



You might find it helpful to use tracing paper to help with the rotation. Trace shape Q and turn the tracing paper through 180° about (0,0)
Part (c) means how do you get from P to R with only one move

The big trapezium is an enlargement of the small trapezium with a scale factor of 4
Find the value of

(a) w

(b) y

(c) x

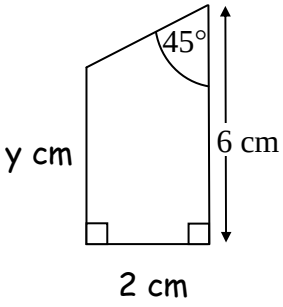
(d) Work out the area of the big trapezium

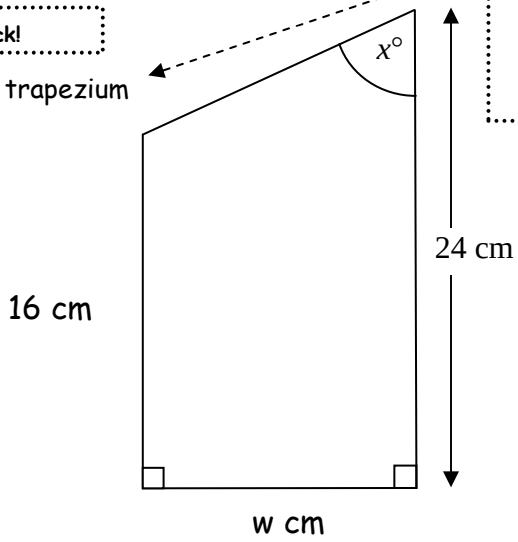
With a scale factor of 4, each line will be 4 times as long

Here you need to work backwards. 16 is 4 times as long as y

This is a trick!

If you know the formula for the area of a trapezium, you could use it – if you don't, you could split the shape into a rectangle and a triangle, find the area of each and add them together

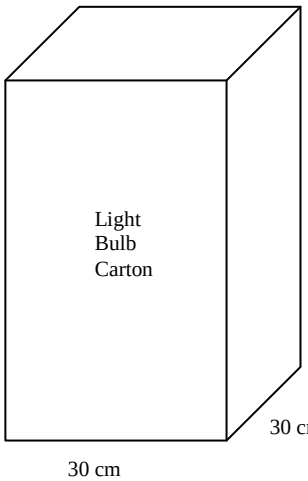


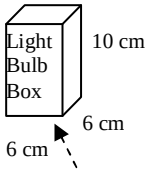


Definitely D grade questions

A light bulb box measures 6cm by 6cm by 10cm
Light bulb boxes are packed into cartons
A carton measures 30cm by 30cm by 80cm
Work out the number of light bulb boxes that can completely fill one carton

You could start by working out how many light bulb boxes fit on the bottom layer first, then work out how many layers there will be





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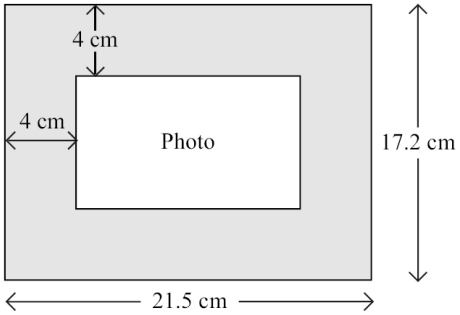
An alternative method might be to work out the volume of the carton, work out the volume of a light bulb box, then work out how many times the light bulb box volume goes into the carton volume

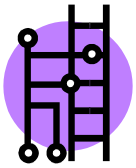
Area and volume

Easy E/D grade questions

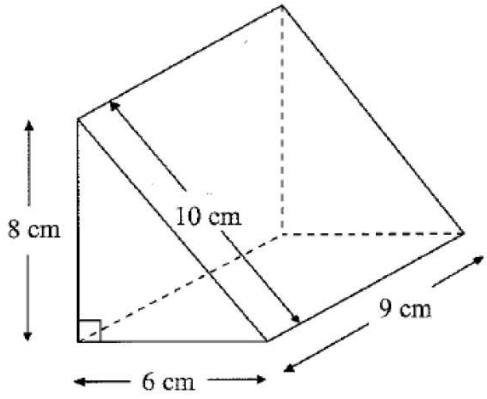
1. A rectangular photo is surrounded by a frame which is 4cm wide.
   The outer measurements of the frame are 21·5cm by 17·2cm



Calculate the area of the frame.
This area is shaded in the diagram



2. Work out the surface area of this triangular prism.
   State the units with your answer

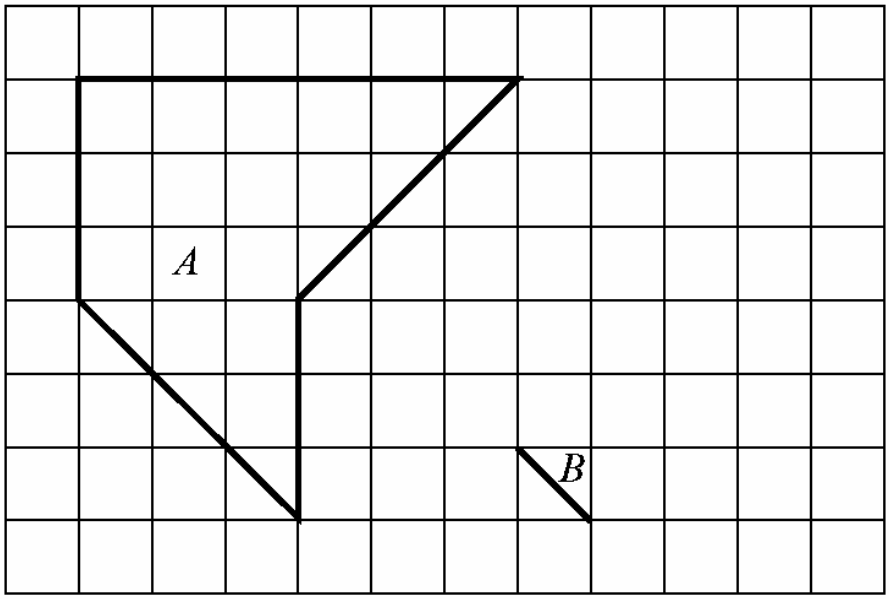


Are you feeling more **C**onfident?
C if you can ….. cope on your own!

Shape A is enlarged to obtain the shape B

(a) Write down the scale factor of the enlargement

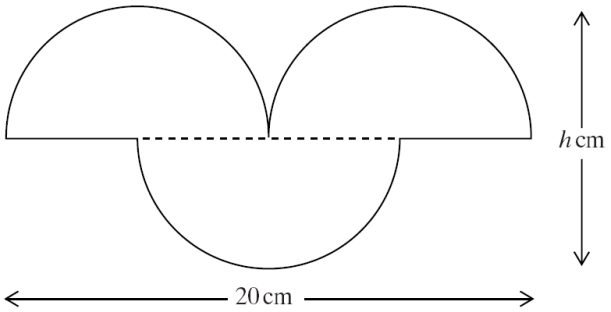
(b) Complete the drawing of shape B on the diagram



The circle

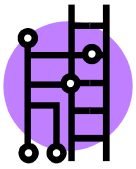
Easy E/D grade questions

1. The diagram shows a shape made from three identical semicircles. The width of the shape is 20cm

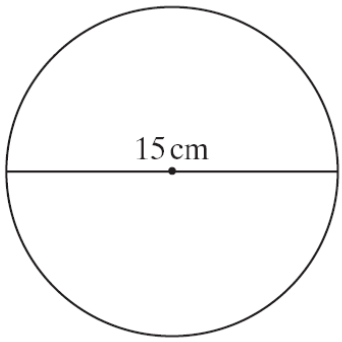


(a) Work out the radius of one of the semicircles

(b) Work out the height of the shape marked *h* on the diagram



2. The diameter of a circle is 15cm

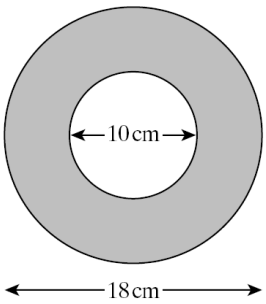


Calculate the circumference of the circle

Are you feeling more **C**onfident?

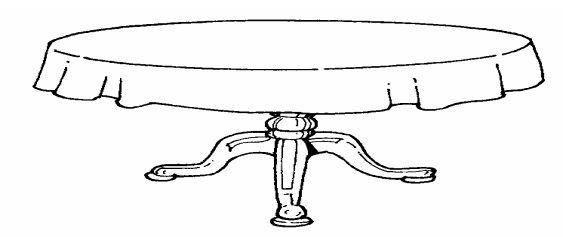
C if you can ..... cope on your own!

A circular photo frame is shown below.
The diameter of the photo is 10cm and the outer diameter of the frame is 18cm



Calculate the area of the frame

Mary has a circular dining table with a radius of 0·65m



Here you will need to use the formula for the area of a circle. If you can't remember, look back to the D grade question – and LEARN IT!!!

(a) Work out the area of the top of the table. Give your answer correct to three significant figures

If you can't remember what 'significant figures' means look back to the garden roller question – LEARN THAT TOO!!

The perimeter of the circular table cloth is 5m

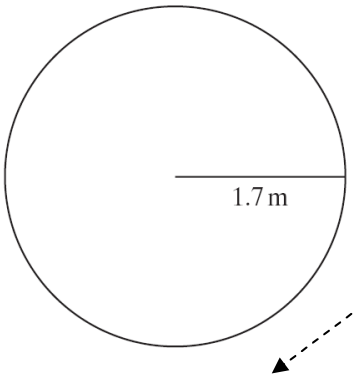
(b) Work out the diameter of the table cloth

Perimeter means the same as circumference.
The challenge here is to use the formula for circumference a bit differently.

If $C = \pi \times D$, then $D = \frac{C}{\pi}$

Definitely D grade questions

A circular flowerbed has a radius of 1·7m

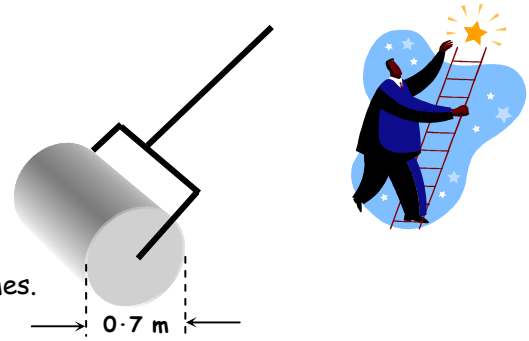


You need to remember the formula to find the area of a circle is …….
πr^2

Calculate the area of the flowerbed.
State the units of your answer.

Remember to do this part

C if U can……. answer the rest! (With a few **C**lues)



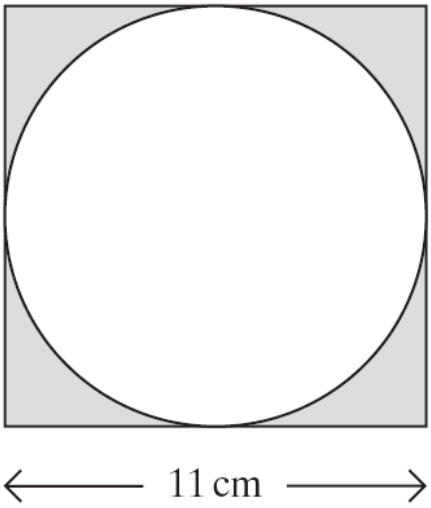
Jerry has a new garden roller
Part of the roller is a cylinder.
The diameter of the cylinder is 0·7 m
Jerry pushes the roller along and the cylinder goes round exactly 16 times.

Work out how far the roller moves.
Give your answer correct to 3 significant figures

First, you need to work out how far the roller moves when the cylinder turns once. That would be the distance all the way around – so that's the CIRCUMFERENCE. You will need to use the diameter in this calculation.
So for 16 turns…….?????.

Don't forget to give your answer to three significant figures (that means most important, or those with the greatest value)

The diagram shows a circle which touches all four sides of a square.
The diameter of the circle is 11cm



Do this by finding the area of the square, then find the area of the circle and take it away.

Calculate the total area of the shaded parts of the square
Give your answer to a suitable degree of accuracy

A suitable degree of accuracy only means a sensible answer – not too many figures after the decimal point