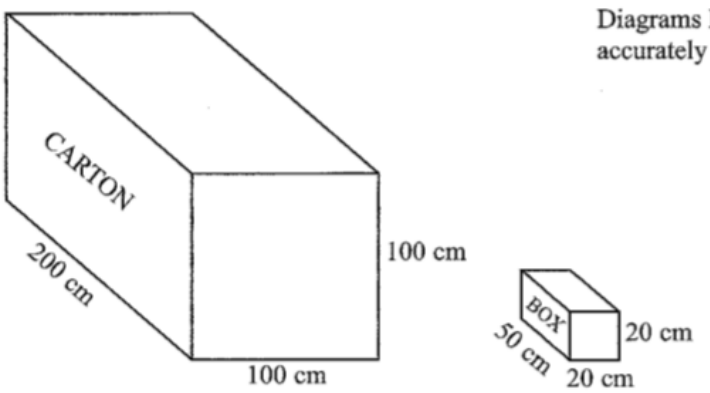
"Full Coverage": Volumes & Surface Area

This worksheet is designed to cover one question of each type seen in past papers, for each GCSE Higher Tier topic. This worksheet was automatically generated by the DrFrostMaths Homework Platform: students can practice this set of questions interactively by going to www.drfrostmaths.com/homework, logging on, *Practise* → *Past Papers/Worksheets* (or *Library* → *Past/Past Papers* for teachers), and using the 'Revision' tab.

Question 1

Categorisation: Determine the volume of a cuboid, and find how many times one cuboid will go into another.

[Edexcel GCSE Nov2005-3I Q2b]



A carton measures 200 cm by 100 cm by 100 cm.
The carton is to be completely filled with boxes.
Each box measures 50 cm by 20 cm by 20 cm.
Work out the number of boxes which can completely fill the carton.

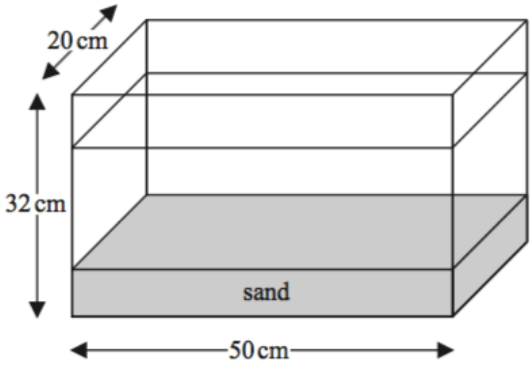
..... boxes

Question 2

Categorisation: Solve cuboid problems involving ratio and fractions of amounts.
Know the conversion 1 litre = 1000 cm³

[Edexcel GCSE(9-1) Mock Set 3 Autumn 2017 1F Q21, 1H Q2 Edited]

The diagram shows a fish tank in the shape of a cuboid.



The dimensions of the tank are 50 cm by 32 cm by 20 cm.

The tank is $\frac{3}{4}$ full of water and sand.

The ratio of the volume of water to the volume of sand is 5 : 1

Work out the number of litres of water in the tank.

..... litres

Question 3

Categorisation: Form an equation based on cuboids with algebraic sides.

[Edexcel GCSE Nov2012-2H Q11a Edited]

The diagram shows a cube and a cuboid.

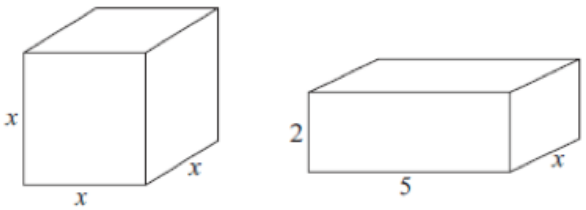


Diagram **NOT** accurately drawn

All the measurements are in cm.

The volume of the cube is 100 cm³ more than the volume of the cuboid.

Show that $x^3 + ax = b$ where a and b are integers to be found.

.....

Question 4

Categorisation: Determine an unknown length using two cuboids of the same volume.

[Edexcel GCSE June2012-1H Q12]

Jane has a carton of orange juice.

The carton is in the shape of a cuboid.

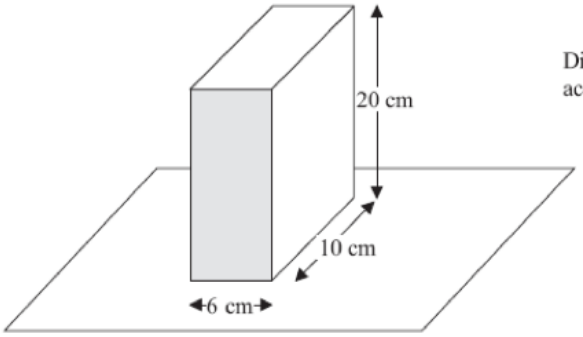


Diagram **NOT** accurately drawn

The depth of the orange juice in the carton is 8 cm. Jane closes the carton.

Then she turns the carton over so that it stands on the shaded face.

Work out the depth, in cm, of the orange juice now.

..... cm

Question 5

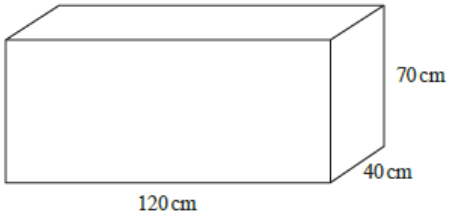
Categorisation: Use volume in the context of bounds.

[Edexcel GCSE(9-1) Mock Set 2 Spring 2017 2H Q17 Edited]

The diagram shows Helen's fish tank.

The fish tank is in the shape of a cuboid.

All the dimensions are correct to the nearest centimetre.



Helen is going to use a bucket to fill the fish tank completely with water.

There are 14 litres, correct to the nearest litre, of water in a full bucket.

What's the maximum number of buckets required to fill the tank?

Give your answer correct to 1 decimal place.

..... buckets (1dp)

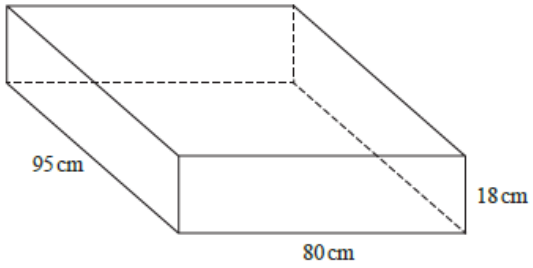
Question 6

Categorisation: Determine the surface area of a cuboid.

[Edexcel GCSE(9-1) Mock Set 2 Spring 2017 3F Q19a, 3H Q3a]

A sofa has 6 identical cushions.

Each cushion is a cuboid 18 cm by 80 cm by 95 cm.



The cushions are covered with a protective spray.

The protective spray is in cans.

The label on each can has this information.

Spray in this can covers 4 m²

(a) Work out how many cans are needed to cover the 6 cushions with protective spray.

..... cans

Question 7

Categorisation: Determine the volume of a cylinder.

[Edexcel IGCSE Jan2012-3H Q3]

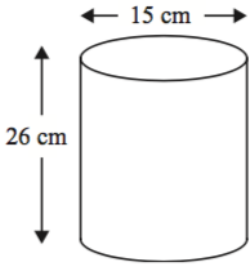


Diagram **NOT** accurately drawn

A cylinder has a diameter of 15 cm and a height of 26 cm.

Work out the volume of the cylinder. Give your answer correct to 3 significant figures.

..... cm^3

Question 8

Categorisation: Use the volume of a cylinder to determine either its radius or height.

[Edexcel GCSE Nov2013-2H Q24]

The diagram shows a large tin of pet food in the shape of a cylinder.

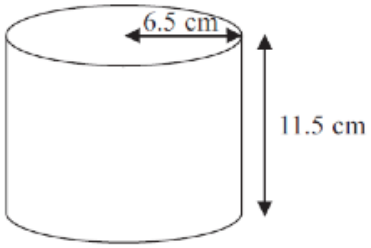


Diagram **NOT** accurately drawn

The large tin has a radius of 6.5 cm and a height of 11.5 cm.

A pet food company wants to make a new size of tin.

The new tin will have a radius of 5.8 cm. It will have the same volume as the large tin.

Calculate the height of the new tin. Give your answer correct to one decimal place.

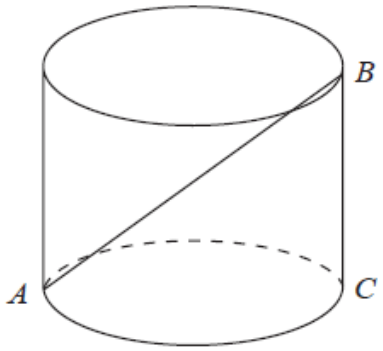
..... cm

Question 9

Categorisation: Use trigonometry in the context of volumes of solids.

[Edexcel GCSE(9-1) Mock Set 3 Autumn 2017 3H Q12]

The diagram shows a metal rod, *AB*, resting inside a cylindrical tin.



The tin is on a horizontal table.

AC is a diameter of the base of the tin.

B is on the top edge of the tin.

BC is vertical.

The radius of the base of the tin is 5 cm.

The volume of the tin is 1178 cm^3.

Find the angle between the rod and the base of the tin.

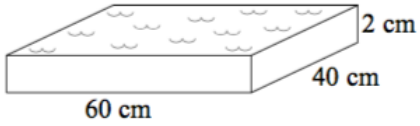
Give your answer correct to the nearest degree.

..... °

Question 10

Categorisation: Compare volumes of cylinders and cuboids.

[Edexcel GCSE Nov2006-6H Q14]



Diagrams **NOT** accurately drawn

A rectangular tray has length 60 cm, width 40 cm and depth 2 cm.
It is full of water. The water is poured into an empty cylinder of diameter 8 cm.

Calculate the depth, in cm, of water in the cylinder.
Give your answer correct to 3 significant figures.

..... cm

Question 11

Categorisation: Determine the surface area of a cylinder.

[Edexcel IGCSE Jan2015(R)-3H Q10a]

The diagram shows a solid cylinder.

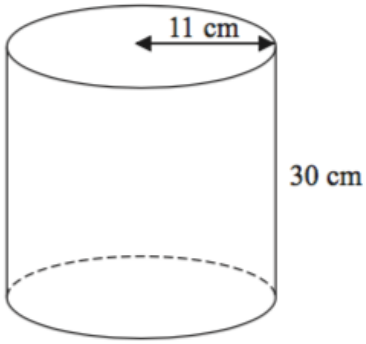


Diagram **NOT** accurately drawn

The cylinder has a height of 30 cm and a radius of 11 cm. Work out the total surface area of the cylinder. Give your answer correct to 2 significant figures.

..... cm^2

Question 12

Categorisation: Determine the surface area of composite solids.

[Edexcel IGCSE Jan2014(R)-3H Q14]

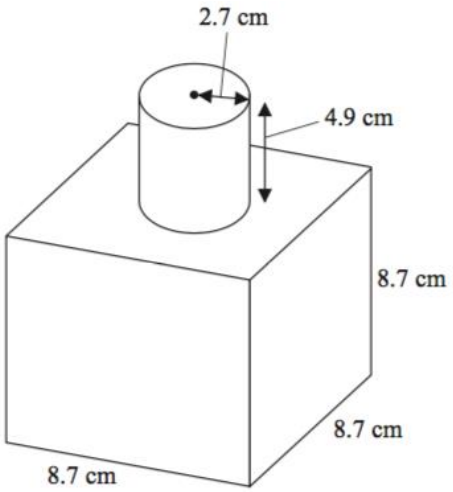


Diagram **NOT** accurately drawn

The diagram shows a shape made from a solid cube and a solid cylinder.
The cube has sides of length 8.7 cm. The cylinder has a radius of 2.7 cm and a height of 4.9 cm.

Calculate the total surface area of the solid shape.
Give your answer correct to 3 significant figures.

..... cm^2

Question 13

Categorisation: Determine the surface area of volume of a solid when surd lengths are involved.

[Edexcel IGCSE Jan2016-4H Q23]

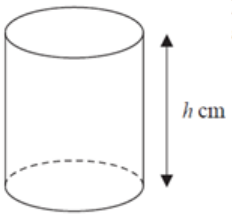


Diagram **NOT** accurately drawn

The diagram shows a solid cylinder.

The cylinder has radius $4\sqrt{3}$ cm and height h cm.
The total surface area of the cylinder is $56\pi\sqrt{6}cm^2$.

Find the exact value of h .
Give your answer in the form $a\sqrt{2} + b\sqrt{3}$ where a and b are integers.

Show your working clearly.

.....

Question 14

Categorisation: Determine the volume of a prism.

[Edexcel GCSE Nov2013-1H Q3]

Here is a triangular prism.

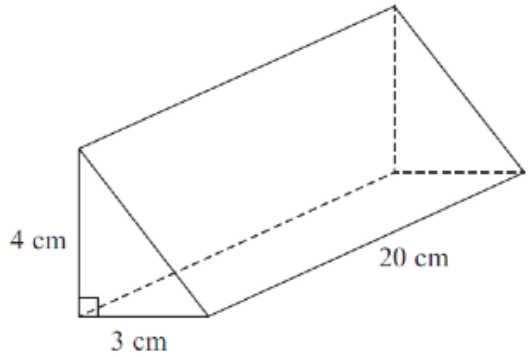


Diagram **NOT** accurately drawn

Work out the volume of this triangular prism.

..... cm^3

Question 15

Categorisation: As above, but where the cross-section is a composite shape.

[Edexcel IGCSE May2015-1F Q23, May2015-3H Q11]

Here is a prism.

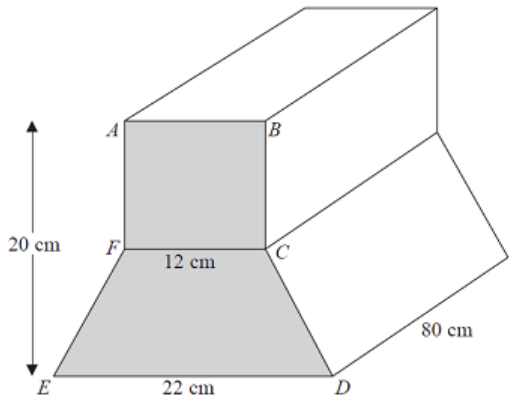


Diagram **NOT** accurately drawn

$ABCDEF$ is a cross section of the prism. $ABCF$ is a square of side 12 cm.

$FCDE$ is a trapezium. $ED = 22$ cm. The height of the prism is 20 cm.

The length of the prism is 80 cm.

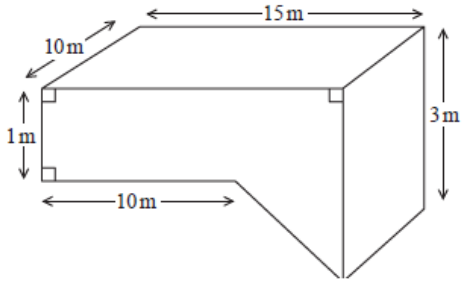
Work out the total volume of the prism.

..... cm ^{3}

Question 16

Categorisation: Solve rates of flow questions involving prisms.

[Edexcel GCSE(9-1) Mock Set 2 Spring 2017 1F Q21, 1H Q4]



The diagram shows a swimming pool. The swimming pool is in the shape of a prism.
The swimming pool is filled with water at a rate of 5 litres per second.

Jeremy has 10 hours to fill the swimming pool. 1 m^3 = 1000 litres.

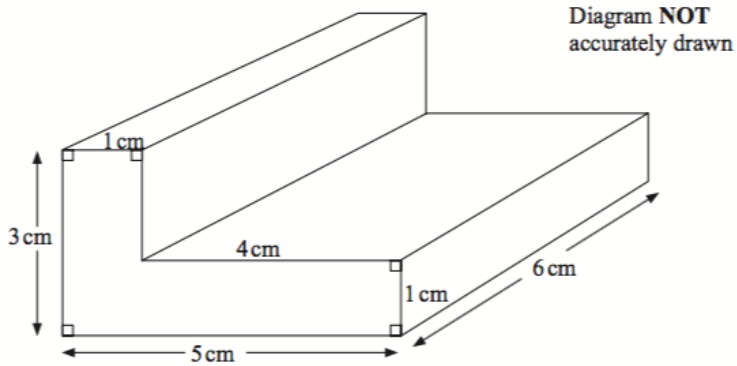
Will he completely fill the swimming pool in 10 hours?
You must show all your working.

[ ] Yes [ ] No

Question 17

Categorisation: Determine the surface area of a prism.

[Edexcel GCSE June2007-5H Q4 Edited]



Work out the total surface area of the L-shaped prism.

..... cm^2

Question 18

Categorisation: Determine the volume of a cone.

[Edexcel GCSE June2007-6H Q25a]

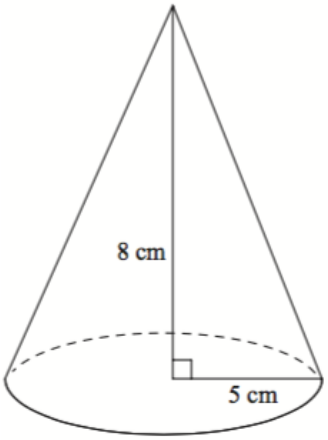


Diagram **NOT** accurately drawn

A cone has a base radius of 5 cm and a vertical height of 8 cm.

(a) Calculate the volume of the cone.
Give your answer correct to 3 significant figures.

..... cm^3

Question 19

Categorisation: Determine the volume of a sphere or hemisphere.

[Edexcel IGCSE Jan2015(R)-3H Q18]

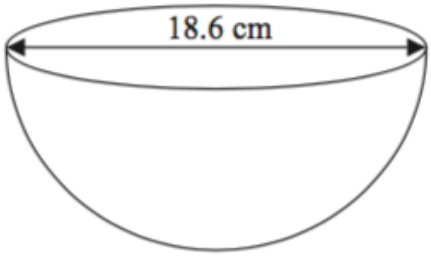


Diagram **NOT** accurately drawn

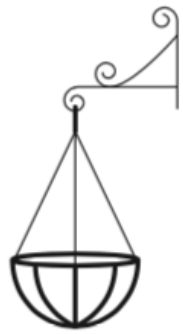
The diagram shows a hemisphere with a diameter of 18.6 cm. Work out the volume of the hemisphere. Give your answer correct to 3 significant figures.

..... cm^3

Question 20

Categorisation: Solve applied problems involving volumes of spheres/hemispheres.

[Edexcel GCSE Nov2016-2H Q21 Edited]



hanging basket

Anne wants to fill 12 hanging baskets with compost.
Each hanging basket is a hemisphere of diameter 40 cm.

Anne has 4 bags of compost.
There are 50 litres of compost in each bag.

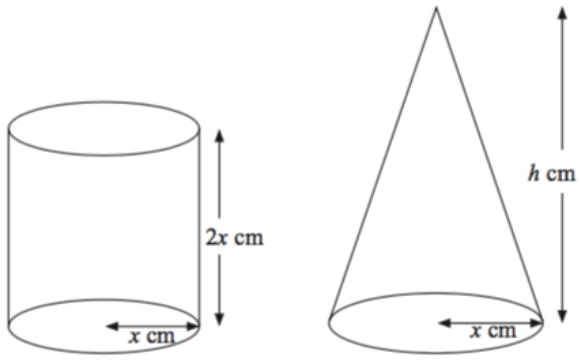
Has Anne got enough compost to fill the 12 hanging baskets?

[ ] Yes [ ] No

Question 21

Categorisation: Solve problems when the volumes of a cylinder and cone, involving algebraic sides, are equated.

[Edexcel GCSE June2008-3H Q26]



Diagrams **NOT** accurately drawn

A cylinder has base radius x cm and height $2x$ cm. A cone has base radius x cm and height h cm. The volume of the cylinder and the volume of the cone are equal.

Find h in terms of x. Give your answer in its simplest form.

$h =$ .....

Question 22

Categorisation: As above, but with a cylinder and sphere.

[Edexcel GCSE June2012-1H Q25 Edited]

Provided formula: the volume of a sphere is $\frac{4}{3}\pi r^3$.

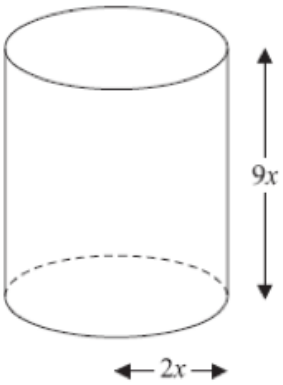


Diagram **NOT** accurately drawn

The diagram shows a solid metal cylinder.

The cylinder has base radius $2x$ and height $9x$. The cylinder is melted down and made into a sphere of radius r. Find an expression for r in terms of x .

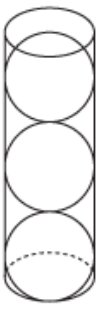
.....

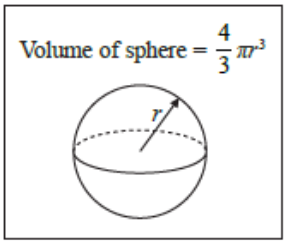
Question 23

Categorisation: Determine the volume of space not occupied.

[Edexcel GCSE(9-1) Mock Set 2 Spring 2017 3H Q8a]

A hollow cylinder has radius r cm and height $6r$ cm. 3 spheres, also of radius r cm, are put into the cylinder.





(a) Work out the proportion of the cylinder that is **not** filled by the spheres.

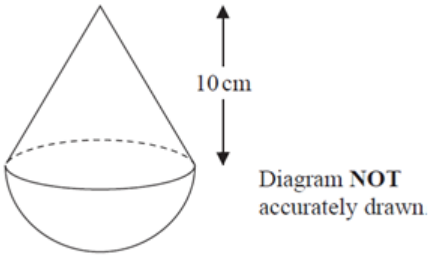
.....

Question 24

Categorisation: Solve problems involving composite solids and unknown lengths/volumes.

[Edexcel GCSE Nov2015-1H Q19]

The diagram shows a solid shape.



The solid shape is made from a hemisphere and a cone. The radius of the hemisphere is equal to the radius of the base of the cone. The cone has a height of 10 cm.
The volume of the cone is 270π cm^3.

Work out the total volume of the solid shape in cm^3 . Give your answer in terms of π .

.....

Question 25

Categorisation: Determine the volume of a frustum.

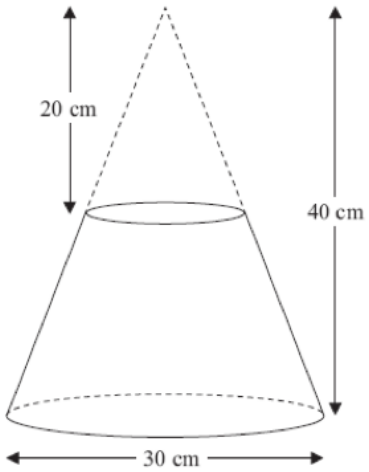


Diagram **NOT** accurately drawn

[Edexcel GCSE March2013-2H Q22]

A frustum is made by removing a small cone from a similar large cone.

The height of the small cone is 20 cm.
The height of the large cone is 40 cm.
The diameter of the base of the large cone is 30 cm.

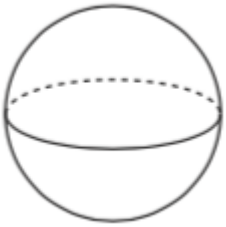
Work out the volume of the frustum. Give your answer correct to 3 significant figures.

..... cm^3

Question 26

Categorisation: Determine the surface area of a sphere.

[Edexcel IGCSE May2014-4H Q21]



A sphere has a surface area of 81π cm^2. Work out the volume of the sphere. Give your answer correct to 3 significant figures.

.....

Question 27

Categorisation: Compare surface areas of solids, involving algebraic sides.

[Edexcel GCSE June2011-3H Q25]

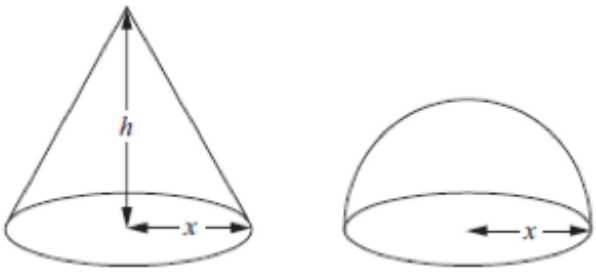


Diagram **NOT** accurately drawn

The diagram shows a solid cone and a solid hemisphere. The cone has a base of radius x cm and a height of h cm. The hemisphere has a base of radius x cm. The surface area of the cone is equal to the surface area of the hemisphere.

Find an expression for h in terms of x.

$h =$ .....

Question 28

Categorisation: Use Pythagoras to find the vertical or slant height in a cone.

[Edexcel IGCSE June2010-4H Q19]

A cone has slant height 4 cm and base radius r cm.

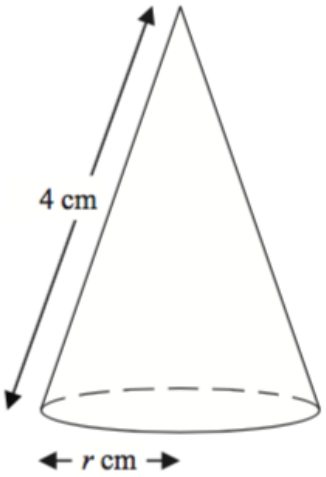


Diagram **NOT** accurately drawn

The **total** surface area of the cone is $\frac{33}{4}\pi$ cm^2.

Calculate the value of r .

$r =$ ..... cm

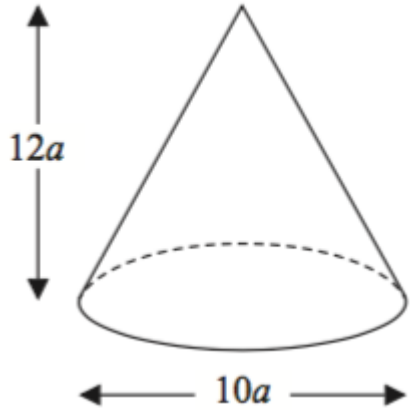
Question 29

Categorisation: As above.

[Edexcel IGCSE May2014(R)-4H Q20]

The diagram shows a solid cone.

Diagram **NOT** accurately drawn



The diameter of the base of the cone is $10a$ cm.

The height of the cone is $12a$ cm.

The total surface area of the cone is 360π cm^2.

The volume of the cone is $k\pi$ cm^3, where k is an integer.

Find the value of k .

.....

Question 30

Categorisation: Determine the surface area of a cone given its volume.

[Edexcel IGCSE Jan2015-3H Q21]

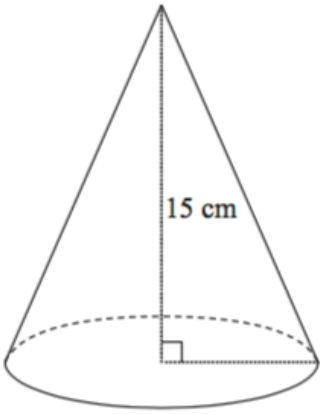


Diagram **NOT** accurately drawn

A solid cone has a height of 15 cm.
The volume of the cone is 320π cm^3.

Work out the curved surface area of the cone.
Give your answer correct to 3 significant figures.

..... cm^2

Question 31

Categorisation: Determine the volume of pyramid, possibly using Pythagoras to determine the vertical height.

[Edexcel GCSE Nov2012-2H Q23a]

The diagram shows a pyramid.

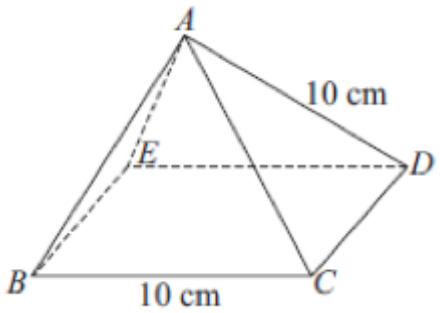


Diagram **NOT** accurately drawn

BCDE is a square with sides of length 10 cm.

The other faces of the pyramid are equilateral triangles with sides of length 10 cm.

Calculate the volume of the pyramid.

Give your answer correct to 3 significant figures.

..... cm^3

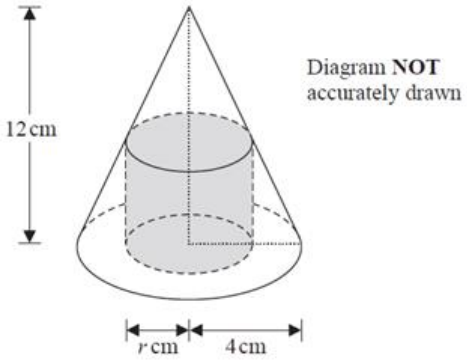
Question 32

Categorisation: Use similar triangles in the context of 3D solids.

[Edexcel IGCSE Jan2016(R)-3H Q15a]

Key Formula: The curved surface area of a cone with radius r and slant height l is rl .

The diagram shows a cylinder inside a cone on a horizontal base.
The cone and the cylinder have the same vertical axis.
The base of the cylinder lies on the base of the cone.
The circumference of the top face of the cylinder touches the curved surface of the cone.



The height of the cone is 12 cm and the radius of the base of the cone is 4 cm.

Work out the curved surface area of the cone.
Give your answer correct to 3 significant figures.

..... cm^2

Question 33

Categorisation: Determine a surface area involving a composite solid, making use of Pythagoras.

[Edexcel IGCSE May2016-4H Q20 Edited]

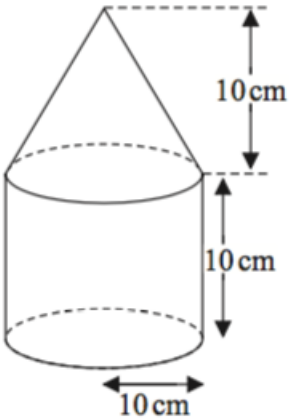


Diagram **NOT** accurately drawn

The diagram shows a solid shape made from a cone on top of a cylinder.

The cone has a radius of 10 cm and a height of 10 cm.
The cylinder has a radius of 10 cm and a height of 10 cm.
The centre of the base of the cone coincides with the centre of the top face of the cylinder.

The total surface area of the solid is Acm^2

Show that $A = \left(a + b\sqrt{2}\right)\pi$ where a and b are integers to be found.

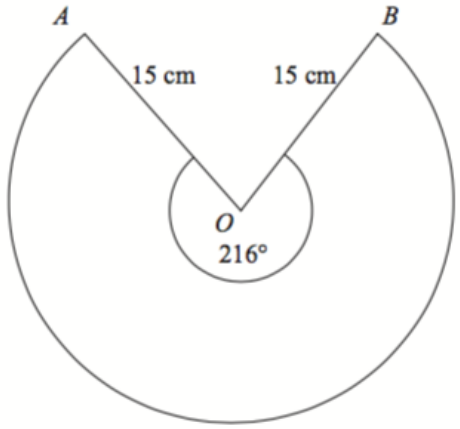
.....

Question 34

Categorisation: Determine the volume of a cone using its net.

[Edexcel GCSE June2007-6H Q25b Edited]

Here is the net of a cone.



The net is a sector of a circle, centre O, and radius 15 cm.

Reflex angle AOB = 216°

The net makes a cone of slant height 15 cm.

(b) Work out the vertical height of the cone

..... cm

Question 35

Categorisation: Solve rates of change problems involving composite curved shapes.

[Edexcel GCSE Jun2015-1H Q23]

The diagram shows a container for grain.

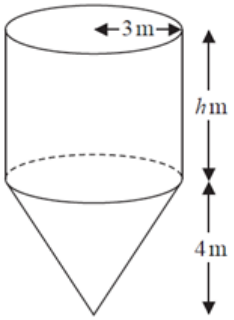


Diagram **NOT** accurately drawn

The container is a cylinder on top of a cone.
The cylinder has a radius of 3 m and a height of h m.
The cone has a base radius of 3 m and a vertical height of 4 m.

The container is empty.
The container is then filled with grain at a constant rate.

After 5 hours the depth of the grain is 6 metres above the vertex of the cone.
After 9 hours the container is full of grain.

Work out the value of h .
Give your answer as a fraction in its simplest form.
You must show all your working.

.....

Answers

Question 1

100 boxes

Question 2

20 litres

Question 3

$a = -10$, $b = 100$

Question 4

4 cm

Question 5

25.5 buckets (1dp)

Question 6

4 cans

Question 7

4590 cm^3

Question 8

14.4 cm to 14.5 cm

Question 9

56 $^\circ$

Question 10

95.5 cm

Question 11

2800 cm^2

Question 12

537 cm^2

Question 13

$7\sqrt{2} - 4\sqrt{3}$

Question 14

120 cm^3

Question 15

22400 cm ^{3}

Question 16

No

Question 17

110 cm^2

Question 18

209 cm^3 to 210 cm^3

Question 19

1680 cm^3

Question 20

No

Question 21

$h = 6x$

Question 22

$3x$

Question 23

$\frac{1}{3}$

Question 24

756π

Question 25

8250 cm^3

Question 26

382

Question 27

$h = \sqrt{3}x$

Question 28

$r =$ 1.5 cm

Question 29

$k = 800$

Question 30

427 cm^2

Question 31

236 cm^3

Question 32

158 cm ^{2} to 159 cm ^{2}

Question 33

$a = 300$, $b = 100$

Question 34

12 cm

Question 35

$\frac{14}{3}$