Chhetri Academy

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GCSE MATHS

Geometry and measures

Edexcel 1MA1 | Subtopic collection Topic 46

Similar shapes (length, area, volume)

Higher tier

Past paper question booklet

59	2003-2025	Higher
question groups	available papers	tier

Before you begin

1. Show working and use units where appropriate.
2. Use extra paper if you need more space.
3. Print at actual size (100%) for measurement questions.

Name _____ **Date** _____

Whole questions are retained for context; some parts cover other points. Legacy sources are labelled.

8.

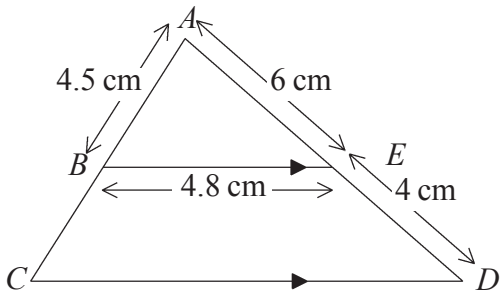


Diagram **NOT** accurately drawn

Leave blank

BE is parallel to *CD*.
AE = 6 cm, *ED* = 4 cm, *AB* = 4.5 cm, *BE* = 4.8 cm.

(a) Calculate the length of *CD*.

.....cm
(2)

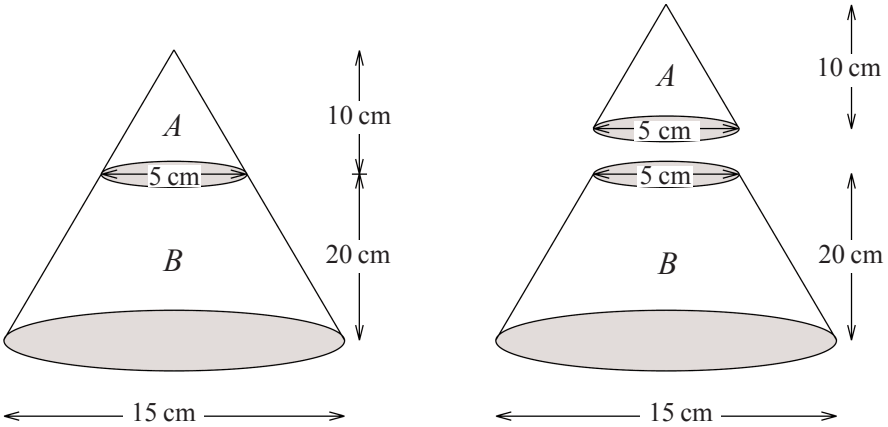
(b) Calculate the perimeter of the trapezium *EBCD*.

.....cm
(2)

12.

Leave blank

Diagram **NOT** accurately drawn



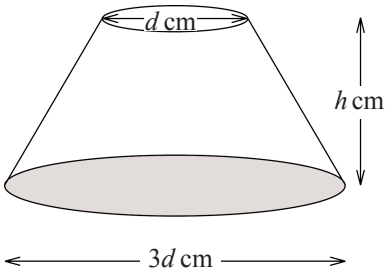
The diagram represents a large cone of height 30 cm and base diameter 15 cm.

The large cone is made by placing a small cone A of height 10 cm and base diameter 5 cm on top of a frustum B.

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

.....cm^3
(3)

Diagram **NOT** accurately drawn



The diagram shows a frustum.
The diameter of the base is $3d$ cm and the diameter of the top is d cm.
The height of the frustum is h cm.

The formula for the curved surface area, S cm^2, of the frustum is

$$S = 2\pi d\sqrt{h^2 + d^2}$$

Leave blank

(b) Rearrange the formula to make h the subject.

$h =$ .....

(3)

Two mathematically similar frustums have heights of 20 cm and 30 cm.

The surface area of the smaller frustum is 450 cm^2.

(c) Calculate the surface area of the larger frustum.

.....cm^2

(2)

Page Total

16.

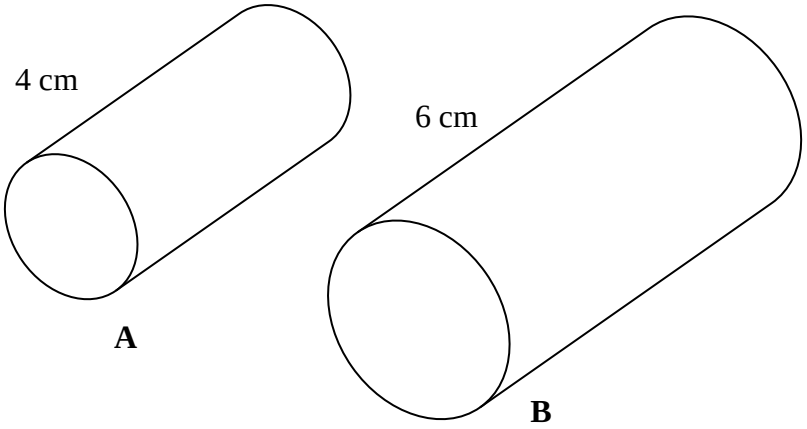


Diagram **NOT** accurately drawn

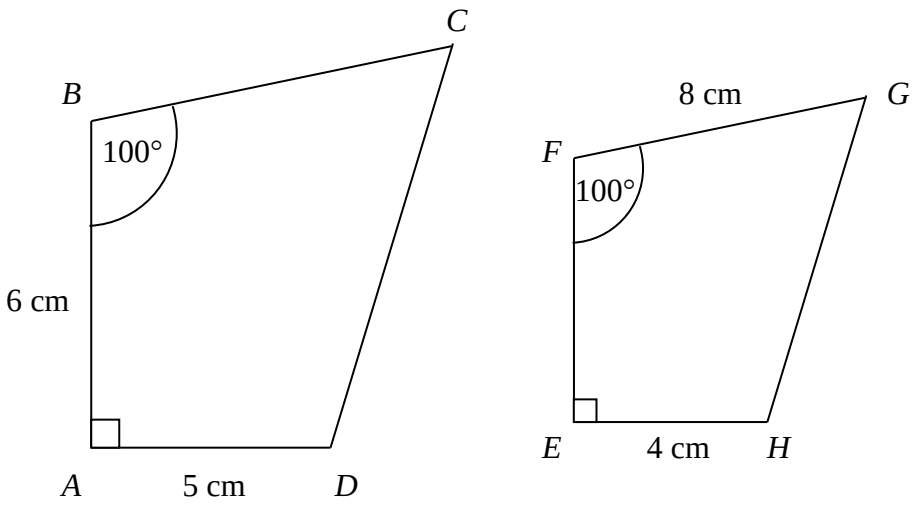
Cylinder **A** and cylinder **B** are mathematically similar.
The length of cylinder **A** is 4 cm and the length of cylinder **B** is 6 cm.
The volume of cylinder **A** is 80 cm^3.

Calculate the volume of cylinder **B**.

..... cm^3
(3)

10.

Diagrams **NOT** accurately drawn



Shapes *ABCD* and *EFGH* are mathematically similar.

(i) Calculate the length of *BC*.

BC = ... cm

(ii) Calculate the length of *EF*.

EF = ... cm

(5)

11.

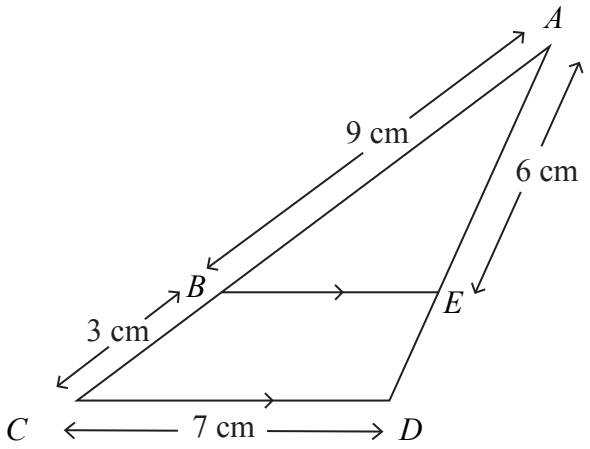


Diagram **NOT** accurately drawn

BE is parallel to *CD*.
AB = 9 cm, *BC* = 3 cm, *CD* = 7 cm, *AE* = 6 cm.

(a) Calculate the length of *ED*.

..... cm
(2)

(b) Calculate the length of *BE*.

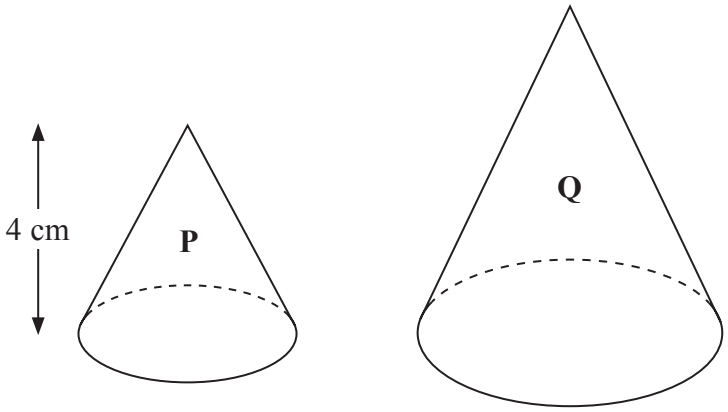
..... cm
(2)

(Total 4 marks)

Q11

20.

Diagrams **NOT** accurately drawn



Two cones, **P** and **Q**, are mathematically similar.
The total surface area of cone **P** is 24 cm^2.
The total surface area of cone **Q** is 96 cm^2.
The height of cone **P** is 4 cm.

(a) Work out the height of cone **Q**.

..... cm
(3)

The volume of cone **P** is 12 cm^3.

(b) Work out the volume of cone **Q**.

..... cm^3
(2)

Q20

(Total 5 marks)

12.

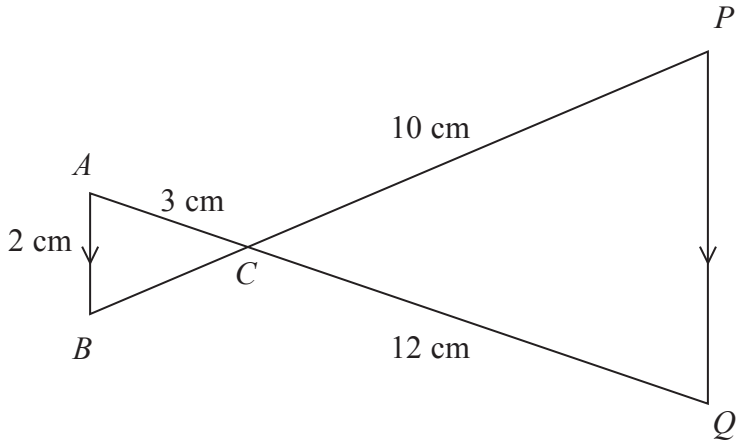


Diagram **NOT** accurately drawn

ACQ and *BCP* are straight lines.
AB is parallel to *PQ*.
AB = 2 cm.
AC = 3 cm.
CQ = 12 cm.
CP = 10 cm.

(a) Work out the length of *PQ*.

..... cm
(2)

(b) Work out the length of *BP*.

..... cm
(3)

Q12

(Total 5 marks)

21. The volumes of two mathematically similar solids are in the ratio 27 : 125

The surface area of the smaller solid is 36 cm^2.

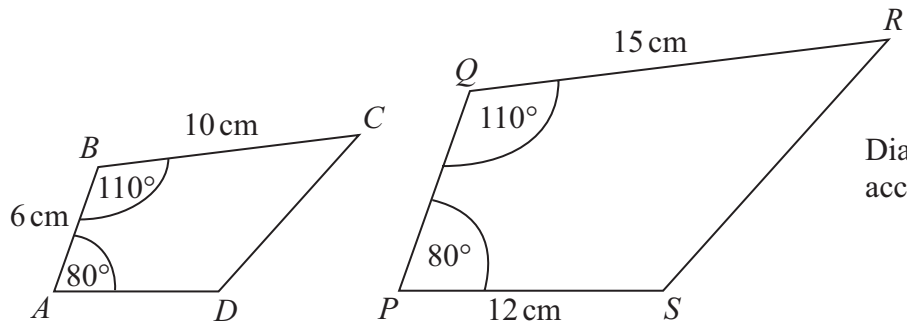
Work out the surface area of the larger solid.

..... cm^2

(Total 3 marks)

Q21

22.



Diagrams **NOT** accurately drawn

ABCD and *PQRS* are mathematically similar.

(a) Find the length of *PQ*.

..... cm
(2)

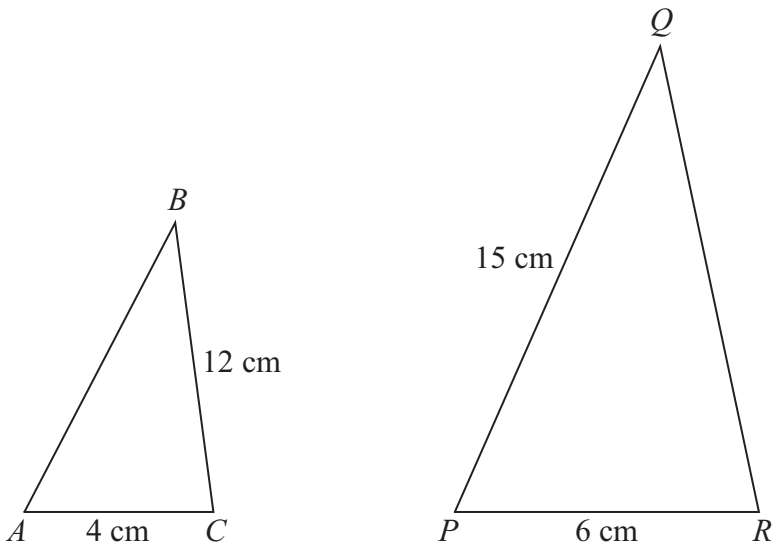
(b) Find the length of *AD*.

..... cm
(2)

Q22

(Total 4 marks)

18.



Diagrams **NOT** accurately drawn

Triangles ABC and PQR are mathematically similar.

Angle A = angle P.
Angle B = angle Q.
Angle C = angle R.
AC = 4 cm.
BC = 12 cm.
PR = 6 cm.
PQ = 15 cm.

(a) Work out the length of QR.

..... cm
(2)

(b) Work out the length of AB.

..... cm
(2)

(Total 4 marks)

Q18

23. **A** and **B** are two solid shapes which are mathematically similar.
The shapes are made from the same material.

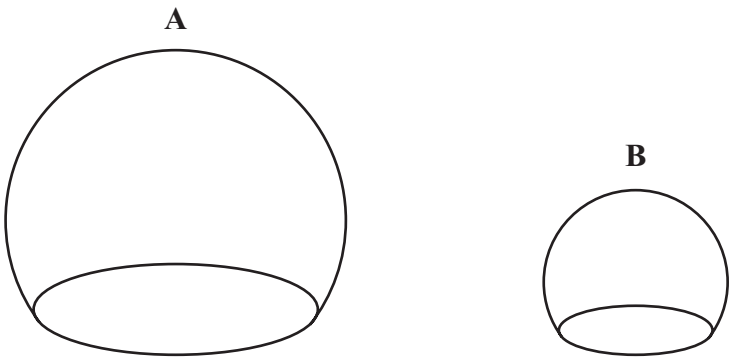


Diagram **NOT** accurately drawn

The surface area of **A** is 50 cm^2.
The surface area of **B** is 18 cm^2.

The mass of **A** is 500 grams.

Calculate the mass of **B**.

..... grams

(Total 4 marks)

Q23

19.

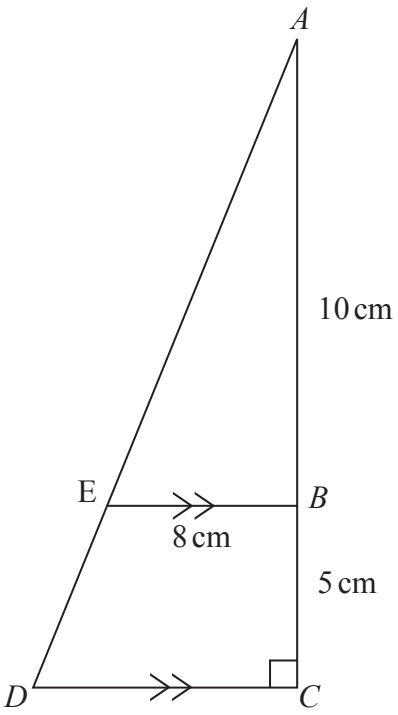


Diagram **NOT** accurately drawn

ABC and *AED* are straight lines.
EB is parallel to *DC*.
Angle *ACD* = 90°.

AB = 10 cm.
BC = 5 cm.
EB = 8 cm.

(a) Work out the length of *DC*.

..... cm
(2)

(b) Work out the area of the trapezium *EBCD*.

..... cm^2
(2)

(Total 4 marks)

Q19

17.

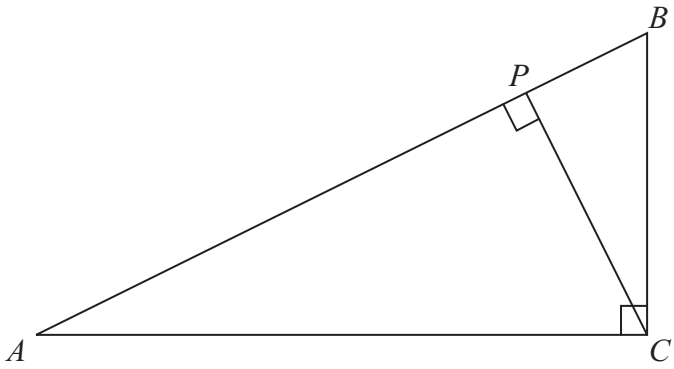


Diagram **NOT** accurately drawn

In the diagram,

ABC is a triangle,
angle *ACB* = 90°,
P lies on the line *AB*,
CP is perpendicular to *AB*.

Prove that the angles of triangle *APC* are the same as the angles of triangle *CPB*.

Q17

(Total 3 marks)

17. The diagram shows two similar triangles.

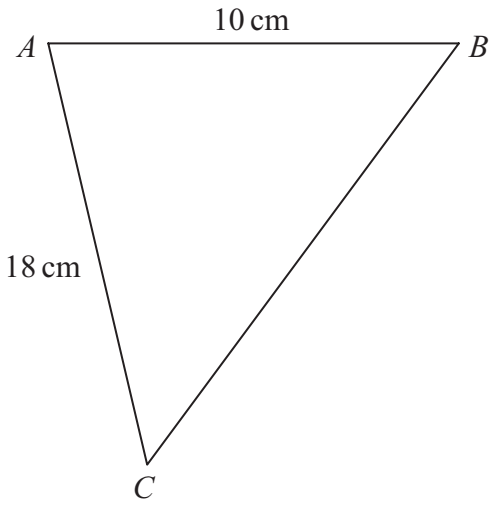
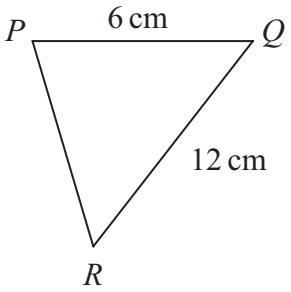


Diagram **NOT** accurately drawn



In triangle ABC, $AB = 10$ cm and $AC = 18$ cm.
In triangle PQR, $PQ = 6$ cm and $QR = 12$ cm.

Angle ABC = angle PQR.
Angle CAB = angle RPQ.

(a) Calculate the length of BC.

..... cm
(2)

(b) Calculate the length of PR.

..... cm
(2)

Q17

(Total 4 marks)

17.

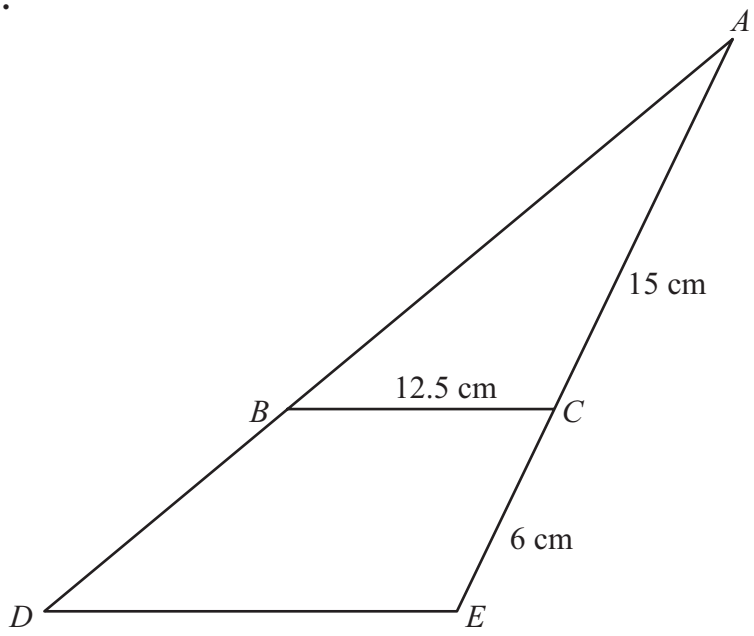


Diagram **NOT** accurately drawn

Triangle ABC is similar to triangle ADE.
$AC = 15$ cm.
$CE = 6$ cm.
$BC = 12.5$ cm.

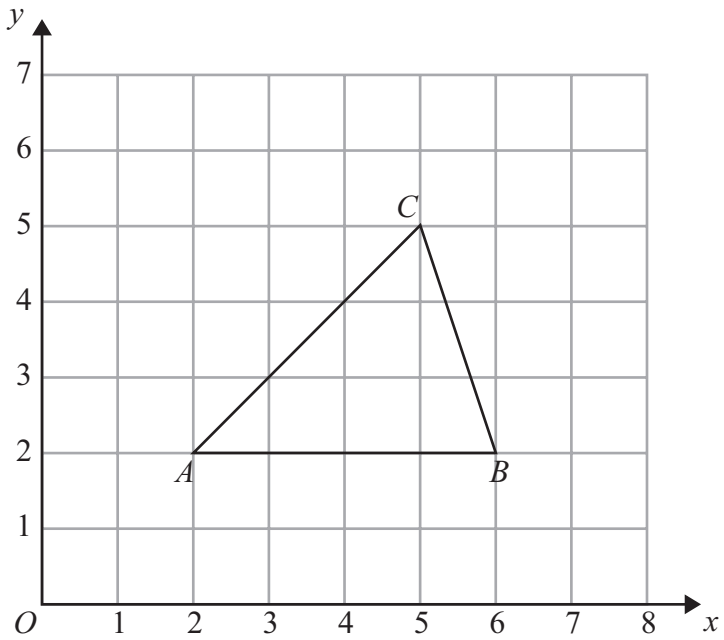
Work out the length of DE.

..... cm

Q17

(Total 3 marks)

18



Triangle ABC is drawn on a centimetre grid.
A is the point (2, 2).
B is the point (6, 2).
C is the point (5, 5).

Triangle PQR is an enlargement of triangle ABC with scale factor $\frac{1}{2}$ and centre (0, 0).

Work out the area of triangle PQR.

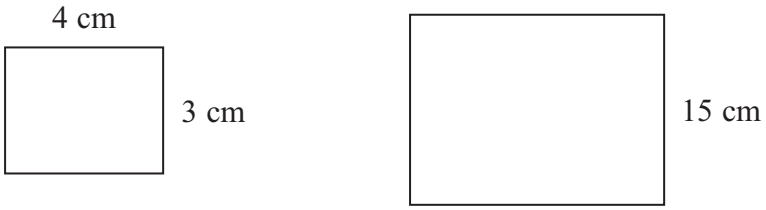
..... cm^2

(Total for Question 18 is 3 marks)

1 A small photograph has a length of 4 cm and a width of 3 cm.
Shez enlarges the small photograph to make a large photograph.

The large photograph has a width of 15 cm.

Diagram **NOT** accurately drawn



Small photograph Large photograph

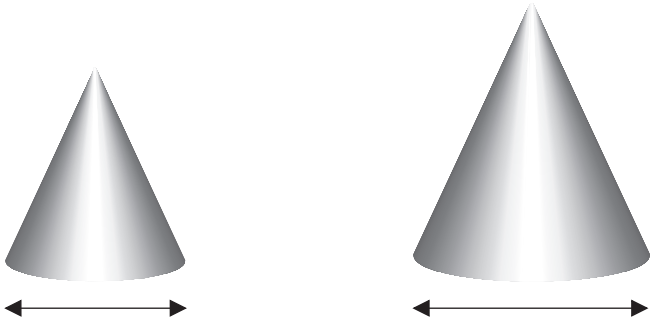
The two photographs are similar rectangles.

Work out the length of the large photograph.

.....

(Total for Question 1 is 3 marks)

17 Ali has two solid cones made from the same type of metal.



A **B**

Diagram **NOT** accurately drawn

The two solid cones are mathematically similar.
The base of cone **A** is a circle with diameter 80 cm.
The base of cone **B** is a circle with diameter 160 cm.

Ali uses 80 m*l* of paint to paint cone **A**.
Ali is going to paint cone **B**.

(a) Work out how much paint, in m*l*, he will need.

..... m*l*
(2)

The volume of cone **A** is 171 700 cm^3.

(b) Work out the volume of cone **B**.

..... cm^3
(3)

(Total for Question 17 is 5 marks)

25 The diagram shows two similar solids, A and B.

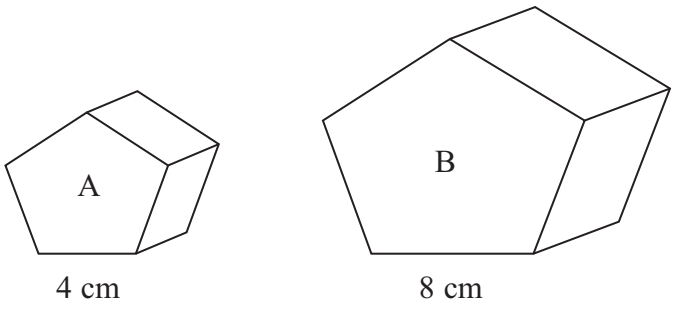


Diagram **NOT** accurately drawn

Solid A has a volume of 80 cm^3.

(a) Work out the volume of solid B.

..... cm^3

(2)

Solid B has a total surface area of 160 cm^2.

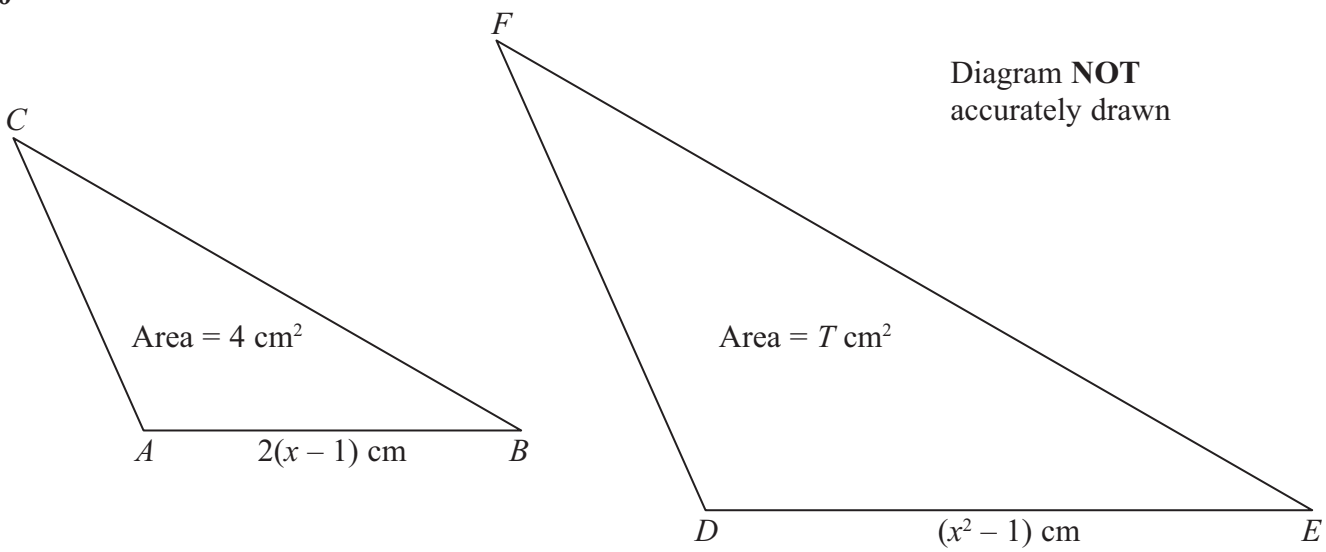
(b) Work out the total surface area of solid A.

..... cm^2

(2)

(Total for Question 25 is 4 marks)

20



Triangles ABC and DEF are mathematically similar.

The base, AB, of triangle ABC has length $2(x - 1)$ cm
The base, DE, of triangle DEF has length $(x^2 - 1)$ cm

The area of triangle ABC is 4 cm^2
The area of triangle DEF is T cm^2

Prove that

$$T = x^2 + 2x + 1$$

(Total for Question 20 is 4 marks)

15

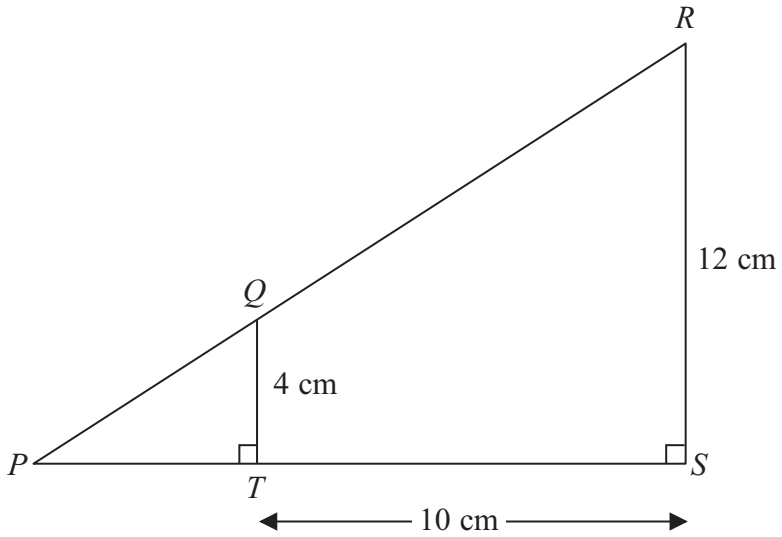


Diagram **NOT** accurately drawn

PQR and *PTS* are straight lines.
Angle *PTQ* = Angle *PSR* = 90°
QT = 4 cm
RS = 12 cm
TS = 10 cm

(a) Work out the area of the trapezium *QRST*.

..... cm^2
(2)

(b) Work out the length of *PT*.

..... cm
(3)

(Total for Question 15 is 5 marks)

22

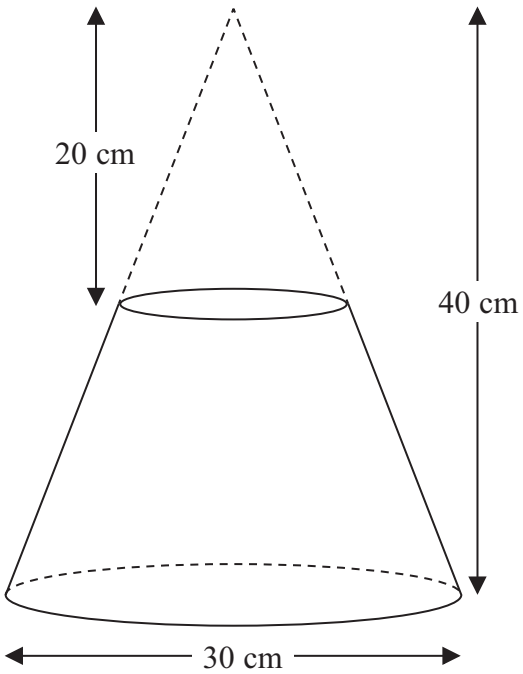


Diagram **NOT** accurately drawn

A frustrum 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 frustrum.
Give your answer correct to 3 significant figures.

..... cm^3

(Total for Question 22 is 4 marks)

22 **P** and **Q** are two triangular prisms that are mathematically similar.

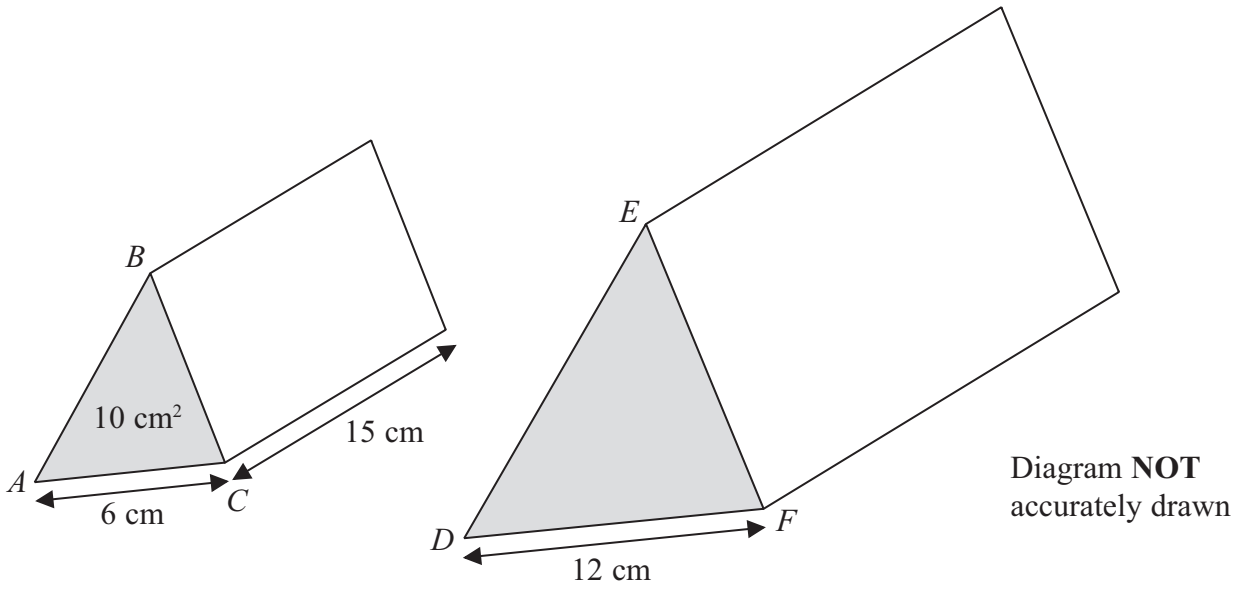


Diagram **NOT** accurately drawn

Prism P **Prism Q**

Prism **P** has triangle *ABC* as its cross section.
Prism **Q** has triangle *DEF* as its cross section.

AC = 6 cm
DF = 12 cm

The area of the cross section of prism **P** is 10 cm².
The length of prism **P** is 15 cm.

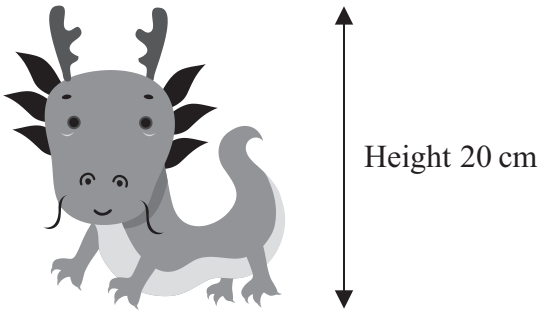
Work out the volume of prism **Q**.

.....

(Total for Question 22 is 4 marks)

16 A company makes monsters.

The company makes small monsters with a height of 20 cm.



A small monster has a surface area of 300 cm^2.

The company also makes large monsters with a height of 120 cm.

A small monster and a large monster are mathematically similar.

Work out the surface area of a large monster.

..... cm^2

(Total for Question 16 is 3 marks)

13 ABC is a triangle.

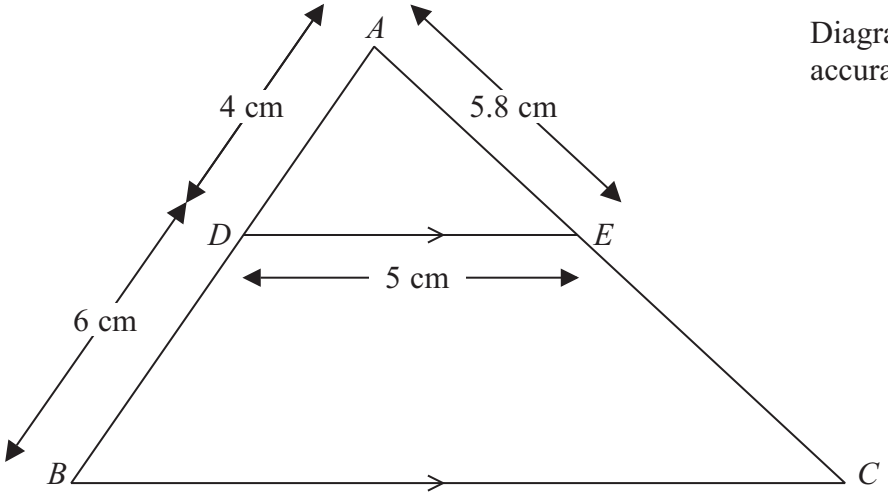


Diagram **NOT** accurately drawn

D is a point on AB and E is a point on AC.
DE is parallel to BC.
$AD = 4$ cm, $DB = 6$ cm, $DE = 5$ cm, $AE = 5.8$ cm.

Calculate the perimeter of the trapezium $DBCE$.

.....cm

(Total for Question 13 is 4 marks)

13 ABC is a triangle.

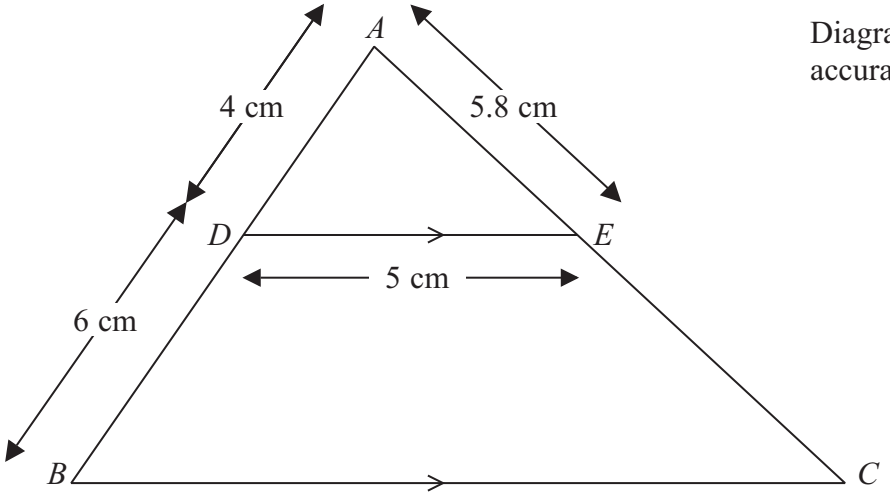


Diagram **NOT** accurately drawn

D is a point on AB and E is a point on AC.
DE is parallel to BC.
$AD = 4$ cm, $DB = 6$ cm, $DE = 5$ cm, $AE = 5.8$ cm.

Calculate the perimeter of the trapezium $DBCE$.

.....cm

(Total for Question 13 is 4 marks)

20 Steve has a photo and a rectangular piece of card.

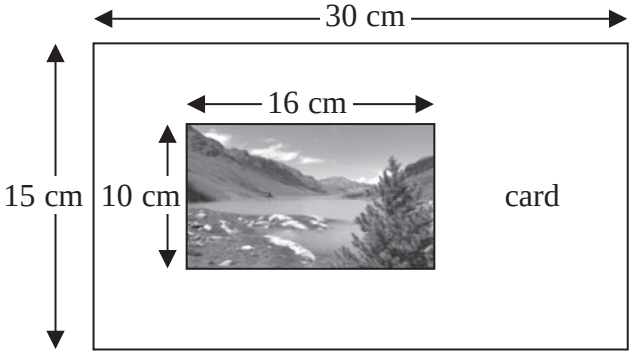
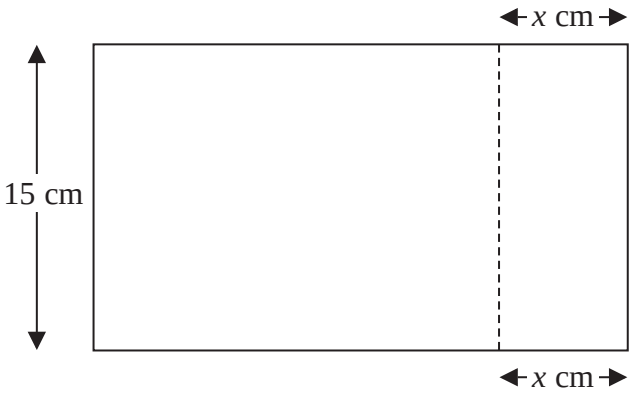


Diagram **NOT** accurately drawn

The photo is 16 cm by 10 cm.
The card is 30 cm by 15 cm.

Steve cuts the card along the dotted line shown in the diagram below.



Steve throws away the piece of card that is 15 cm by x cm.
The piece of card he has left is mathematically similar to the photo.

Work out the value of x.

.....

(Total for Question 20 is 3 marks)

17

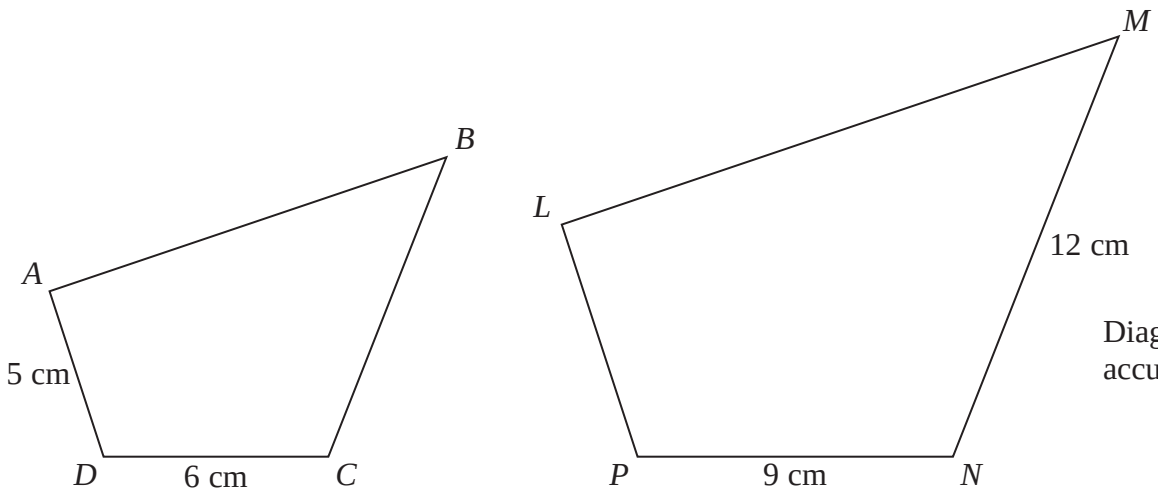


Diagram **NOT** accurately drawn

Quadrilaterals *ABCD* and *LMNP* are mathematically similar.

Angle *A* = angle *L*
Angle *B* = angle *M*
Angle *C* = angle *N*
Angle *D* = angle *P*

(a) Work out the length of *LP*.

..... cm
(2)

(b) Work out the length of *BC*.

..... cm
(2)

(Total for Question 17 is 4 marks)

18

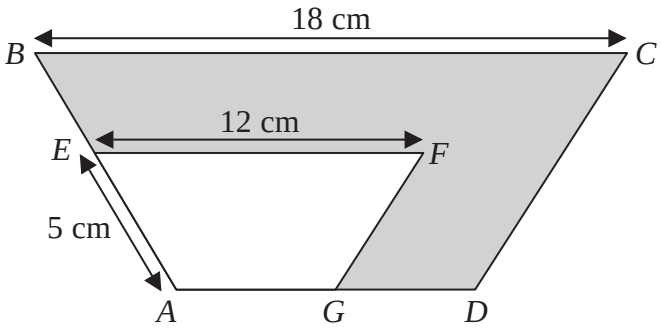


Diagram **NOT** accurately drawn

ABCD and *AEFG* are mathematically similar trapeziums.
AE = 5 cm
EF = 12 cm
BC = 18 cm

(a) Work out the length of *AB*.

..... cm
(2)

Trapezium *AEFG* has an area of 36 cm^2.

(b) Work out the area of the shaded region.

..... cm^2
(3)

(Total for Question 18 is 5 marks)

3 The diagram shows two rectangles.

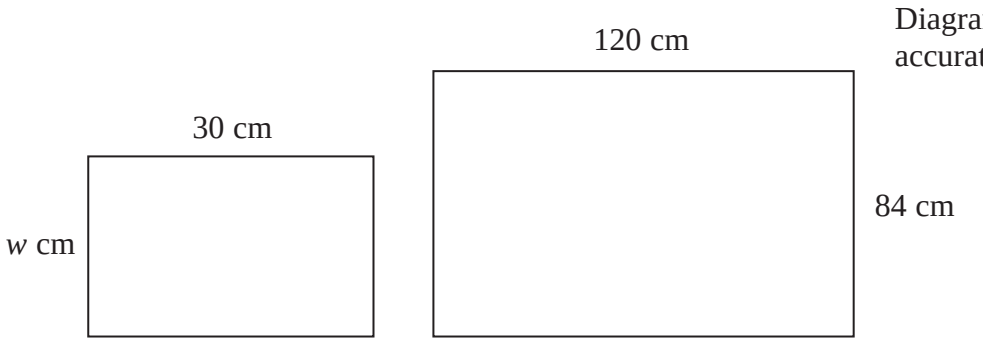


Diagram **NOT** accurately drawn

The rectangles are similar.

Work out the value of w.

.....

(Total for Question 3 is 2 marks)

21 Fred is making two rectangular flower beds.
The dimensions of the larger rectangle will be three times the dimensions of the smaller rectangle.

There is going to be the same depth of soil in each flower bed.
Fred needs 180 kg of soil for the smaller flower bed.

Work out how much soil Fred needs for the larger flower bed.

..... kg

(Total for Question 21 is 2 marks)

***9** *ABCD* and *PQRS* are two rectangles.

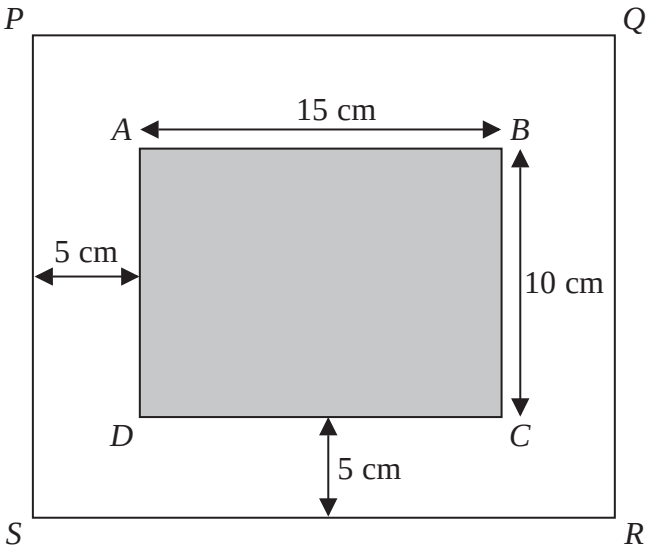


Diagram **NOT** accurately drawn

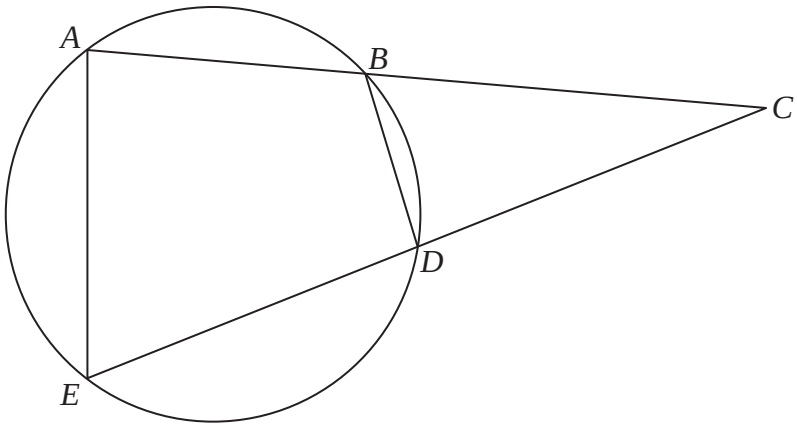
Rectangle *ABCD* is 15 cm by 10 cm.
There is a space 5 cm wide between rectangle *ABCD* and rectangle *PQRS*.

Are rectangle *ABCD* and rectangle *PQRS* mathematically similar?
You must show how you got your answer.

(Total for Question 9 is 3 marks)

***22**

Diagram **NOT** accurately drawn



A, *B*, *D* and *E* are points on a circle.
ABC and *EDC* are straight lines.

Prove that triangle *BCD* is similar to triangle *ECA*.
You must give reasons for your working.

(Total for Question 22 is 5 marks)

21

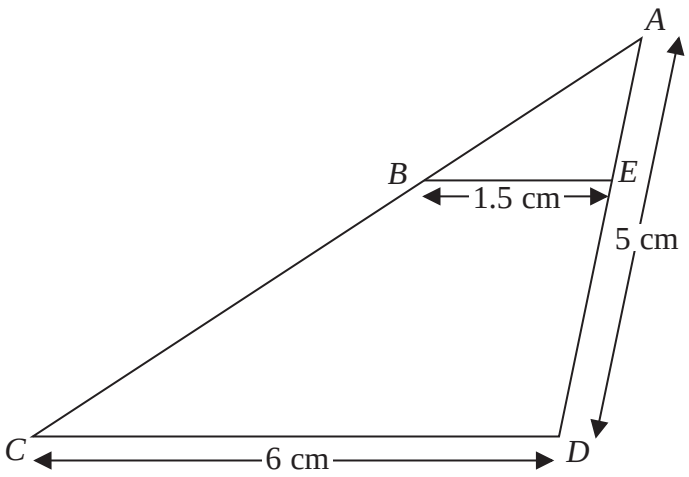


Diagram **NOT** accurately drawn

ABC and *AED* are straight lines.
BE and *CD* are parallel.
BE = 1.5 cm.
CD = 6 cm.
AD = 5 cm.

Calculate the length of *ED*.

..... cm

(Total for Question 21 is 3 marks)

17

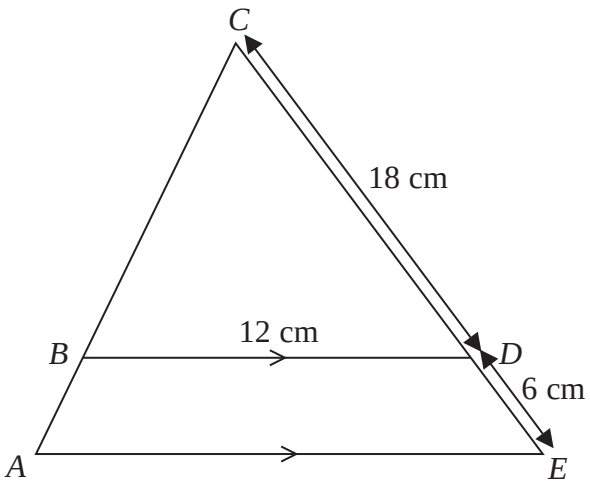


Diagram **NOT** accurately drawn

ABC and *CDE* are straight lines.
BD and *AE* are parallel.
BD = 12 cm, *CD* = 18 cm, *DE* = 6 cm.

Work out the length of *AE*.

..... cm

(Total for Question 17 is 2 marks)

15

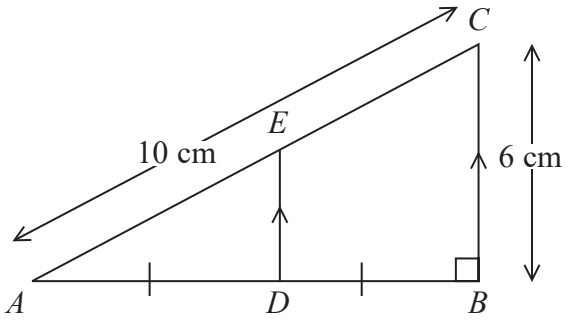


Diagram **NOT** accurately drawn

ADB and *AEC* are straight lines.
DE is parallel to *BC*.

Angle *ABC* = 90°
AC = 10 cm.
BC = 6 cm.

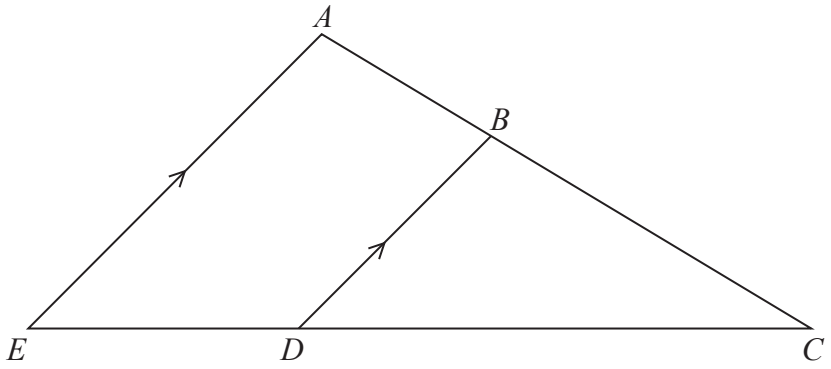
D is the midpoint of *AB*.

Work out the area of trapezium *BCED*.

.....cm^2

(Total for Question 15 is 4 marks)

5



ABC and *EDC* are straight lines.
EA is parallel to *DB*.

EC = 8.1 cm.
DC = 5.4 cm.
DB = 2.6 cm.

(a) Work out the length of *AE*.

..... cm
(2)

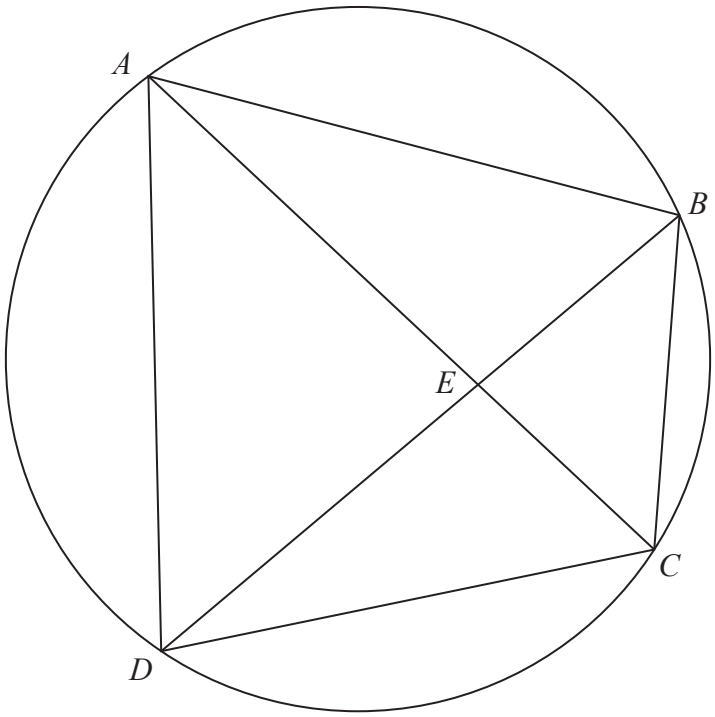
AC = 6.15 cm.

(b) Work out the length of *AB*.

..... cm
(2)

(Total for Question 5 is 4 marks)

15 A, B, C and D are four points on the circumference of a circle.

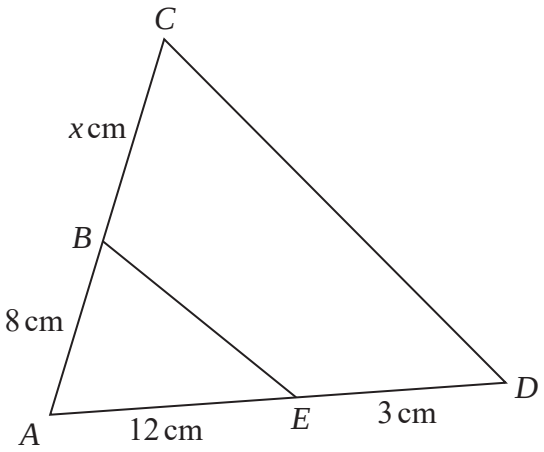


AEC and BED are straight lines.

Prove that triangle ABE and triangle DCE are similar.
You must give reasons for each stage of your working.

(Total for Question 15 is 3 marks)

22 The two triangles in the diagram are similar.



There are two possible values of x.

Work out each of these values.
State any assumptions you make in your working.

(Total for Question 22 is 5 marks)

14 Cone **A** and cone **B** are mathematically similar.
The ratio of the volume of cone **A** to the volume of cone **B** is 27 : 8

The surface area of cone **A** is 297 cm^2

Show that the surface area of cone **B** is 132 cm^2

(Total for Question 14 is 3 marks)

13 Here are two similar solid shapes.

A



B



surface area of shape **A** : surface area of shape **B** = 3 : 4

The volume of shape **B** is 10 cm^3

Work out the volume of shape **A**.
Give your answer correct to 3 significant figures.

..... cm^3

(Total for Question 13 is 3 marks)

Question 42

November 2018 | 1MA1/1H | Original Q15

15 Three solid shapes **A**, **B** and **C** are similar.

The surface area of shape **A** is $4\,cm^2$
The surface area of shape **B** is $25\,cm^2$

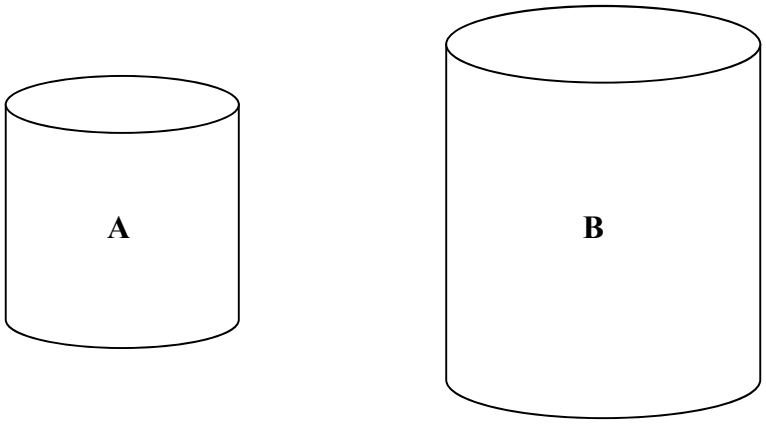
The ratio of the volume of shape **B** to the volume of shape **C** is $27 : 64$

Work out the ratio of the height of shape **A** to the height of shape **C**.
Give your answer in its simplest form.

.....

(Total for Question 15 is 4 marks)

17 **A** and **B** are two similar cylindrical containers.



the surface area of container **A** : the surface area of container **B** = 4 : 9

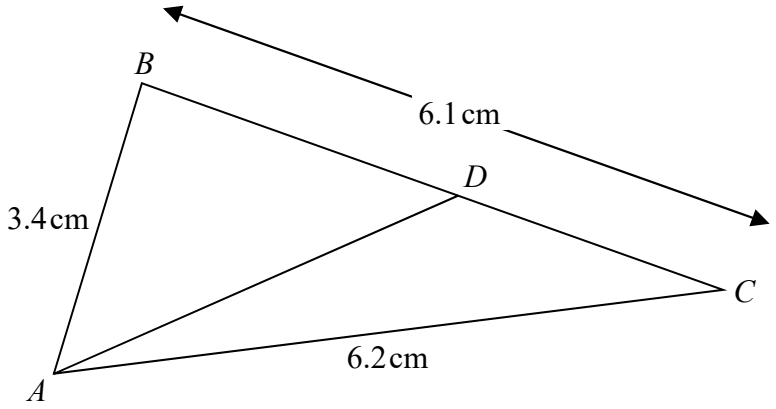
Tyler fills container **A** with water.
She then pours all the water into container **B**.
Tyler repeats this and stops when container **B** is full of water.

Work out the number of times that Tyler fills container **A** with water.
You must show all your working.

.....

(Total for Question 17 is 4 marks)

18 The diagram shows triangle ABC.



$AB = 3.4\,\text{cm}$ $AC = 6.2\,\text{cm}$ $BC = 6.1\,\text{cm}$

D is the point on BC such that

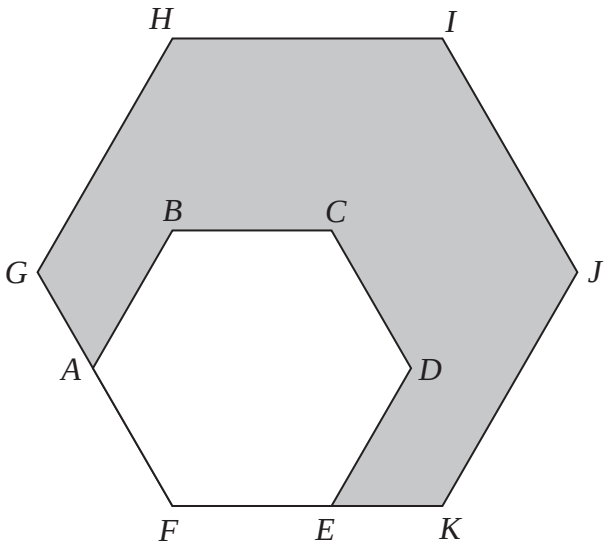
$$\text{size of angle } DAC = \frac{2}{5} \times \text{ size of angle } BCA$$

Calculate the length DC.
Give your answer correct to 3 significant figures.
You must show all your working.

..... cm

(Total for Question 18 is 5 marks)

19

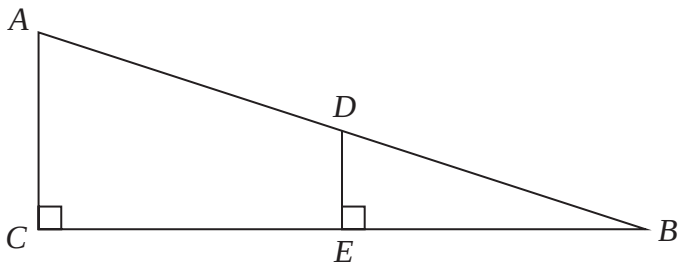


ABCDEF is a regular hexagon with sides of length x.
This hexagon is enlarged, centre F, by scale factor p to give hexagon *FGHIJK*.

Show that the area of the shaded region in the diagram is given by $\frac{3\sqrt{3}}{2}(p^2 - 1)x^2$

(Total for Question 19 is 4 marks)

10 The diagram shows two right-angled triangles *ACB* and *DEB*.



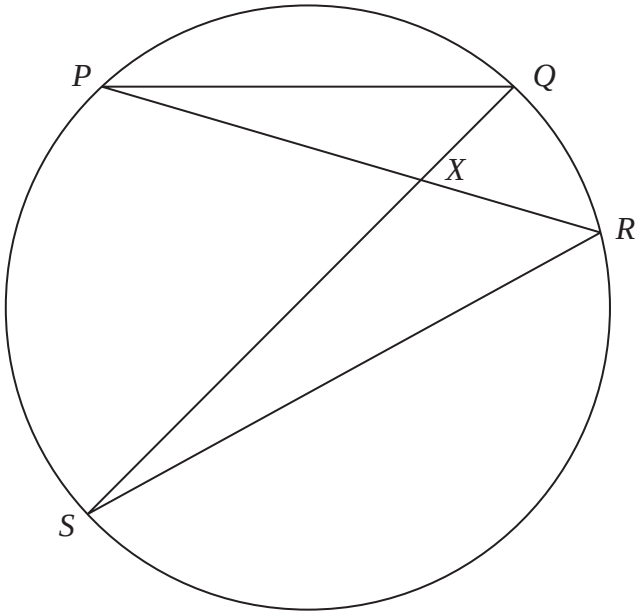
AD = 9 cm
DE = 2 cm
DB = 6 cm

Calculate the length of *CB*.
Give your answer correct to 2 decimal places.

..... cm

(Total for Question 10 is 4 marks)

15 P, Q, R and S are four points on a circle.

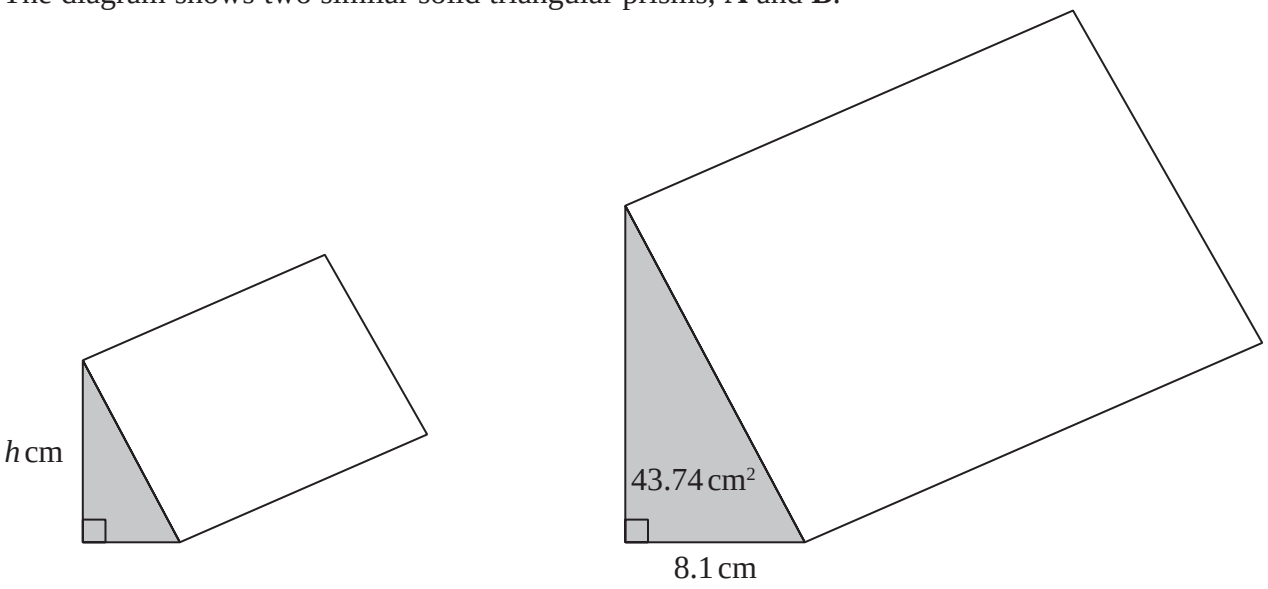


PXR and SXQ are straight lines.

Prove that triangle PQX and triangle SRX are similar.

(Total for Question 15 is 3 marks)

17 The diagram shows two similar solid triangular prisms, **A** and **B**.



Prism **A** Prism **B**

The volume of prism **A** is 58.806 cm^3
The volume of prism **B** is 1587.762 cm^3

The cross section of each prism is a right-angled triangle.

For prism **B**
the length of the base of the triangle is 8.1 cm
the area of the triangle is 43.74 cm^2

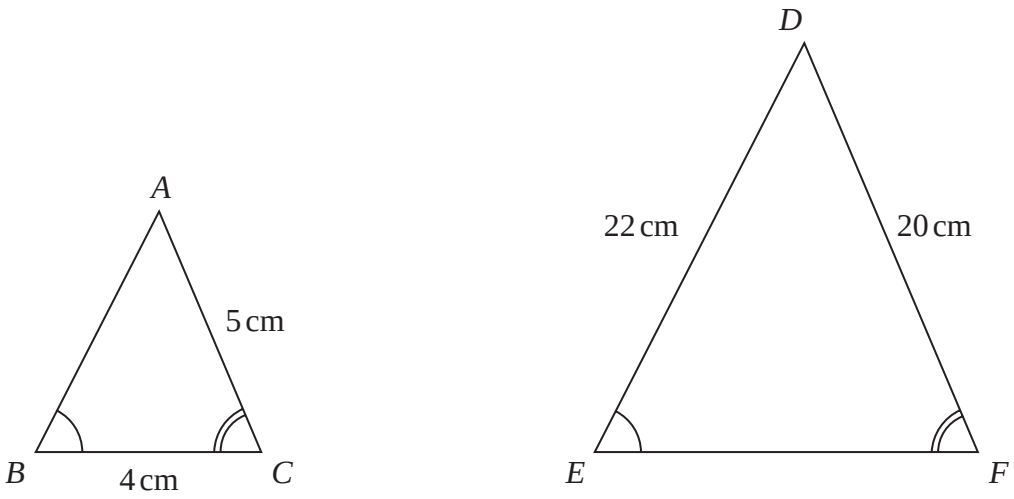
The height of the triangle for prism **A** is h cm.

Work out the value of h.

h = ...

(Total for Question 17 is 4 marks)

5 Triangle *ABC* and triangle *DEF* are similar.



(a) Work out the length of *EF*.

..... cm

(2)

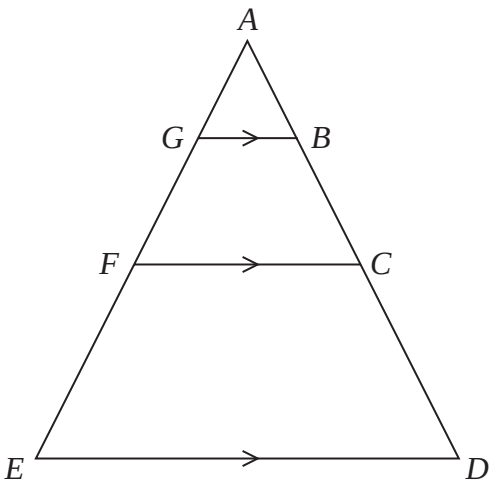
(b) Work out the length of *AB*.

..... cm

(2)

(Total for Question 5 is 4 marks)

23 Here are three similar triangles, *ABG*, *ACF* and *ADE*.



ABCD and *AGFE* are straight lines.

$AB : BC : CD = 1 : 2 : 3$

Show that

area of ABG : area of $BCFG$: area of $CDEF = 1 : 8 : 27$

(Total for Question 23 is 3 marks)

13 Solid **A** and solid **B** are similar.

The ratio of the height of solid **A** to the height of solid **B** is $2:5$

The volume of solid **A** is $12\,cm^3$

Work out the volume of solid **B**.

..... cm^3

(Total for Question 13 is 3 marks)

Question 52

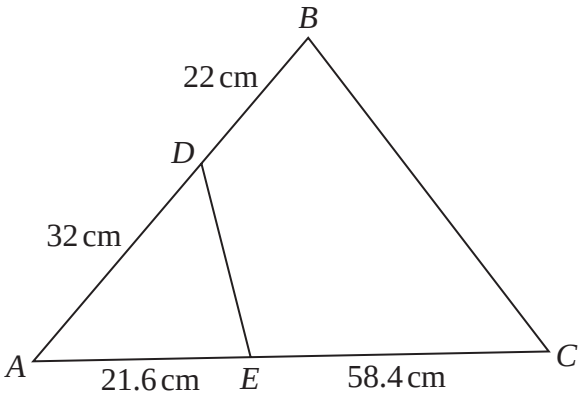
11 The floor plan of a house is drawn using a scale of 1 : 50
On the plan, a room in the house has a floor area of 48 cm^2

Work out the real area of the floor of this room.
Give your answer in m^2

..... m^2

(Total for Question 11 is 3 marks)

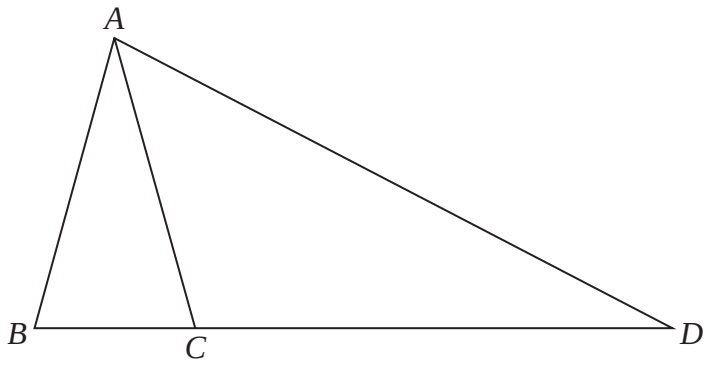
15 The diagram shows triangle *ABC* and triangle *AED*.



Show that triangle *ABC* and triangle *AED* are similar.

(Total for Question 15 is 2 marks)

19



ABC and *DAB* are similar isosceles triangles.

$AB = AC$
$AD = BD$

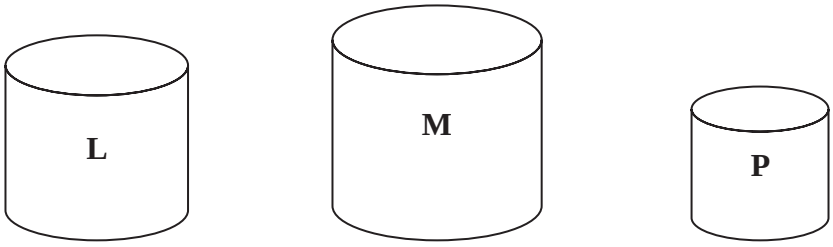
$BC : CD = 4 : 21$

Find the ratio $AB : AD$

.....

(Total for Question 19 is 3 marks)

17 **L**, **M** and **P** are three similar solid cylinders made from the same material.



L has a mass of 64 g
M has a mass of 125 g

M has a total surface area of 144 cm^2
P has a total surface area of 16 cm^2

Work out

height of cylinder **L** : height of cylinder **M** : height of cylinder **P**

.....

(Total for Question 17 is 4 marks)

12 **A**, **B** and **C** are three solid spheres.

Sphere **A** has a volume of $64\,cm^3$
Sphere **B** has a volume of $125\,cm^3$

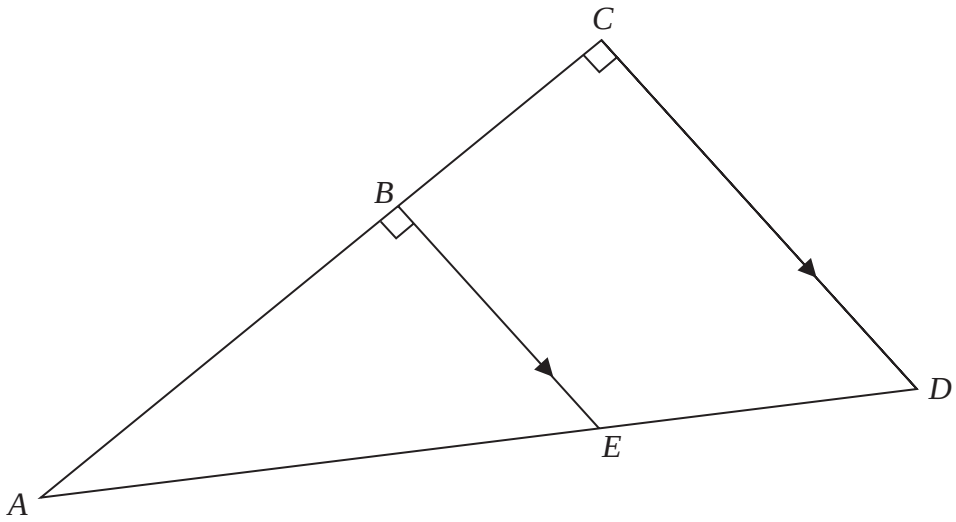
The radius of sphere **C** is 50% of the radius of sphere **B**.

Work out the ratio of the surface area of sphere **A** to the surface area of sphere **C**.
Give your answer in the form $a:b$ where a and b are integers.

.....

(Total for Question 12 is 4 marks)

13 *ABC* and *AED* are straight lines.
BE and *CD* are parallel.



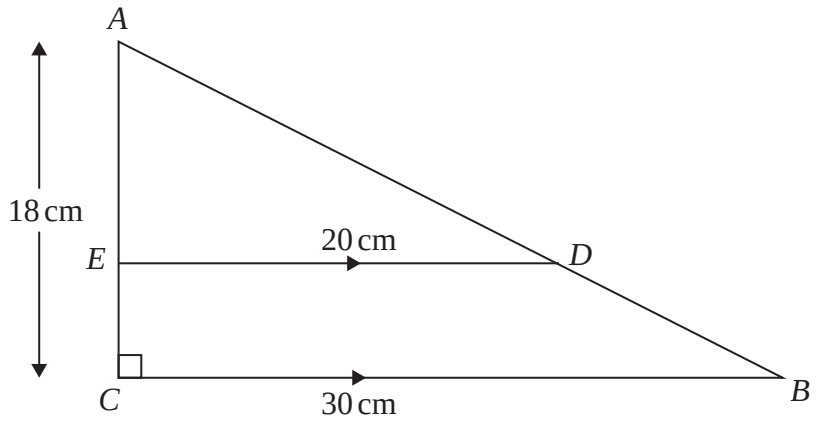
BE = 4.2 cm
CD = 6.3 cm
AC = 10.8 cm

Work out the area of trapezium *BCDE*.

..... cm^2

(Total for Question 13 is 3 marks)

8 *ABC* is a right-angled triangle.



AEC and *ADB* are straight lines.
ED is parallel to *CB*.

(a) Prove that triangle *ABC* is similar to triangle *ADE*.

(2)

ED = 20 cm *CB* = 30 cm *AC* = 18 cm

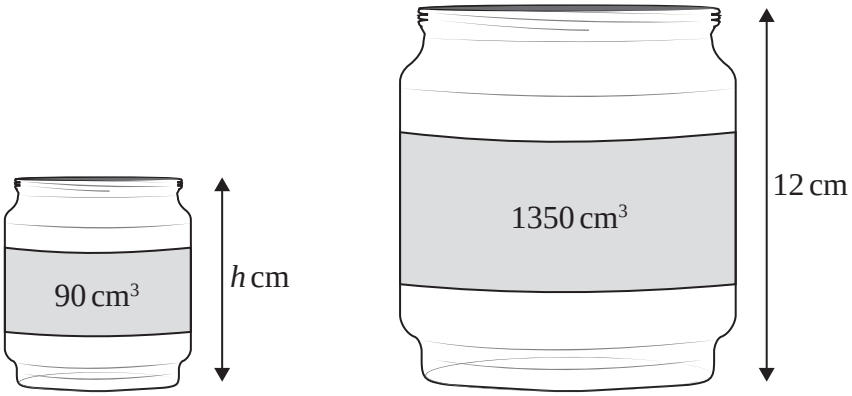
(b) Work out the length of *EC*.

..... cm

(3)

(Total for Question 8 is 5 marks)

16 Two jars are mathematically similar.



(a) Work out the height, h cm, of the smaller jar.
Give your answer correct to 1 decimal place.

..... cm

(4)

The surface area of the smaller jar is A cm^2
The surface area of the larger jar is pA cm^2

(b) Find the exact value of p.

p = ...

(1)

(Total for Question 16 is 5 marks)