Mensuration
(Past Year Topical Questions 2010-2015)

May/June 2010 (41)
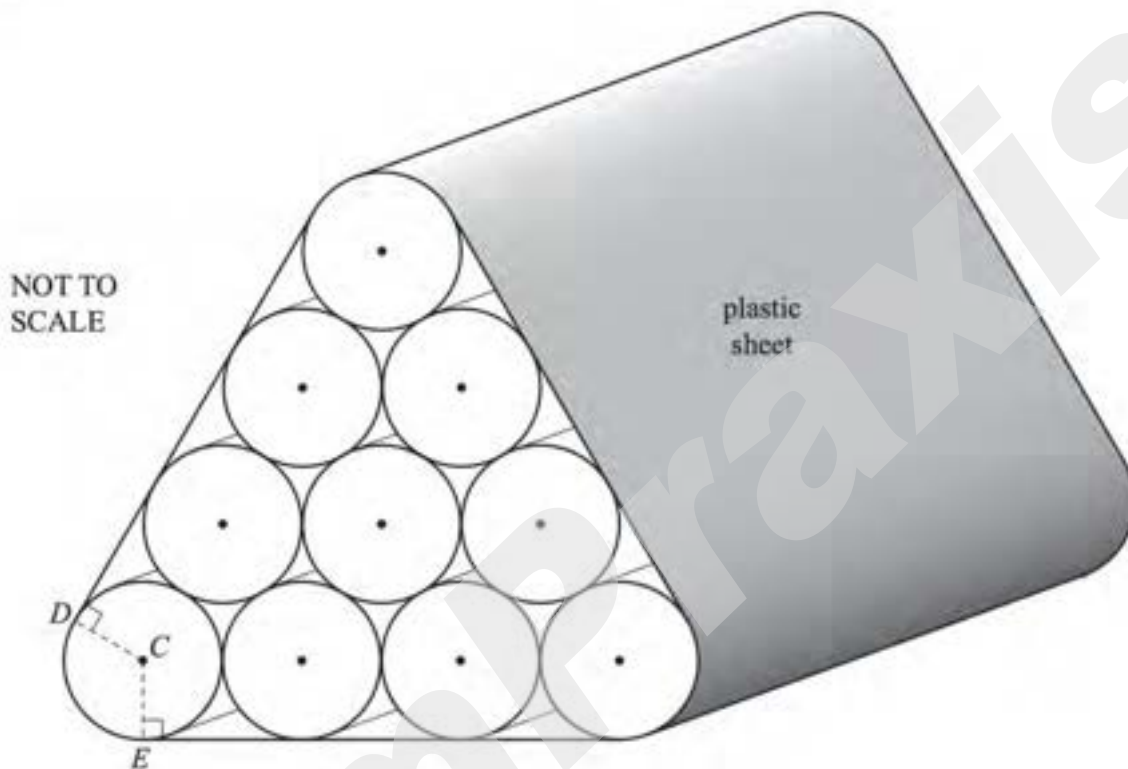
7 **(a)** Calculate the volume of a cylinder of radius 31 **centimetres** and length 15 **metres**.
Give your answer in cubic metres.

Answer(a) .... m³ [3]

(b) A tree trunk has a circular cross-section of radius 31 cm and length 15 m.
One cubic metre of the wood has a mass of 800 kg.
Calculate the mass of the tree trunk, giving your answer in tonnes.

Answer(b) .... tonnes [2]

(c)

NOT TO
SCALE

plastic
sheet

The diagram shows a pile of 10 tree trunks.
Each tree trunk has a circular cross-section of radius 31 cm and length 15 m.
A plastic sheet is wrapped around the pile.

C is the centre of one of the circles.
CE and CD are perpendicular to the straight edges, as shown.

(i)   Show that angle $ECD = 120°$.

Answer(c)(i)

[2]

(ii) Calculate the length of the arc *DE*, giving your answer in metres.

Answer(c)(ii) .... m [2]

(iii) The edge of the plastic sheet forms the perimeter of the cross-section of the pile.
The perimeter consists of three straight lines and three arcs.
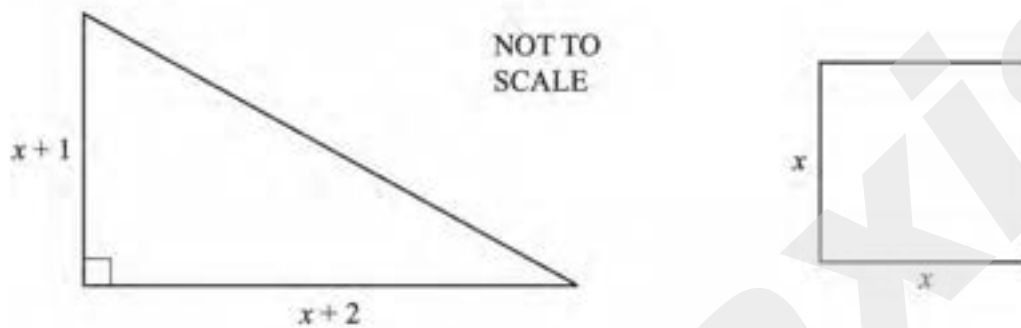Calculate this perimeter, giving your answer in metres.

Answer(c)(iii) .... m [3]

(iv) The plastic sheet does not cover the two ends of the pile.
Calculate the area of the plastic sheet.

Answer(c)(iv) .... m² [1]

Question 9c

(c)

NOT TO SCALE

The area of the triangle is equal to the area of the square.
All lengths are in centimetres.

(i) Show that $x^2 - 3x - 2 = 0$.

Answer(c)(i)

[3]

4

(ii) Solve the equation $x^2 - 3x - 2 = 0$, giving your answers correct to 2 decimal places. Show all your working.

Answer(c)(ii) $x =$ .... or $x =$ .... [4]

(iii) Calculate the area of one of the shapes.

Answer(c)(iii) .... cm^2 [1]

6 A spherical ball has a radius of 2.4 cm.
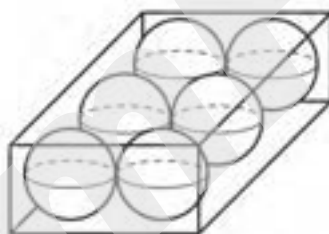
    (a) Show that the volume of the ball is 57.9 cm^3, correct to 3 significant figures.

    [The volume V of a sphere of radius r is $V = \frac{4}{3}\pi r^3$.]

    Answer(a)

                                 [2]

    (b)

NOT TO SCALE

    Six spherical balls of radius 2.4 cm fit exactly into a **closed** box.
    The box is a cuboid.

    Find

    (i) the length, width and height of the box,

               Answer(b)(i) .... cm, ... cm, ... cm [3]

    (ii) the volume of the box,

               Answer(b)(ii) .... cm^3 [1]

(iii) the volume of the box **not** occupied by the balls,

Answer(b)(iii) .... cm^3 [1]

(iv) the surface area of the box.

Answer(b)(iv) .... cm^2 [2]

(c)

NOT TO
SCALE

The six balls can also fit exactly into a **closed** cylindrical container, as shown in the diagram.

Find

(i) the volume of the cylindrical container,

Answer(c)(i) .... cm^3 [3]

(ii) the volume of the cylindrical container **not** occupied by the balls,

Answer(c)(ii) .... cm^3 [1]

(iii) the surface area of the cylindrical container.

Answer(c)(iii) .... cm^2 [3]

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8
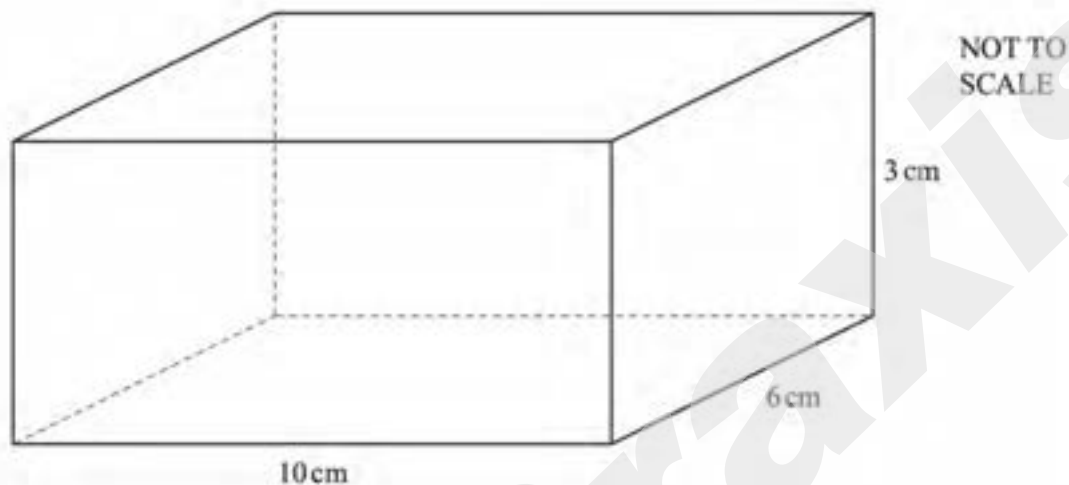
A solid metal cuboid measures 10 cm by 6 cm by 3 cm.

(a) Show that 16 of these solid metal cuboids will fit exactly into a box which has internal measurements 40 cm by 12 cm by 6 cm.

Answer(a)

[2]

(b) Calculate the volume of **one** metal cuboid.

Answer(b) .... cm^3 [1]

(c) One cubic centimetre of the metal has a mass of 8 grams.
The box has a mass of 600 grams.

Calculate the **total** mass of the 16 cuboids **and** the box in

(i) grams,

Answer(c)(i) .... g [2]

(ii) kilograms.

Answer(c)(ii) .... kg [1]

(d) (i) Calculate the surface area of one of the solid metal cuboids.

Answer(d)(i) .... cm² [2]

(ii) The surface of each cuboid is painted. The cost of the paint is $25 per **square metre**.

Calculate the cost of painting all **16** cuboids.

Answer(d)(ii) $ .... [3]

(e) **One** of the solid metal cuboids is melted down.
Some of the metal is used to make 200 identical solid spheres of radius 0.5 cm.

Calculate the volume of metal from this cuboid which is **not** used.

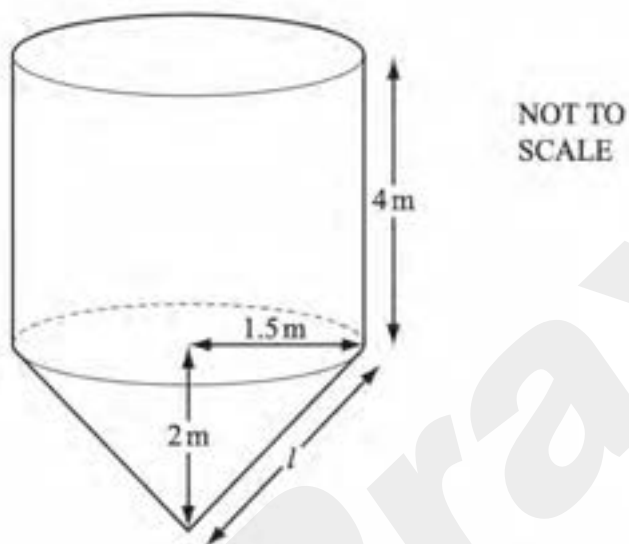[The volume, V, of a sphere of radius r is $V = \dfrac{4}{3} \pi r^3$.]

Answer(e) .... cm³ [3]

(f) 50 cm³ of metal is used to make 20 identical solid spheres of radius r.

Calculate the radius r.

Answer(f) $r =$ .... cm [3]

October/November 2010 (41)

4

An **open** water storage tank is in the shape of a cylinder on top of a cone.
The radius of both the cylinder and the cone is 1.5 m.
The height of the cylinder is 4 m and the height of the cone is 2 m.

(a) Calculate the **total** surface area of the **outside** of the tank.
[The curved surface area, A, of a cone with radius r and slant height l is $A = \pi r l$.]

Answer(a) .... m² [6]

(b) The tank is completely full of water.

    (i) Calculate the volume of water in the tank and show that it rounds to 33 m^3, correct to the nearest whole number.

        [The volume, V, of a cone with radius r and height h is $V = \dfrac{1}{3}\pi r^2 h$.]

        Answer(b)(i)

        [4]

(ii)
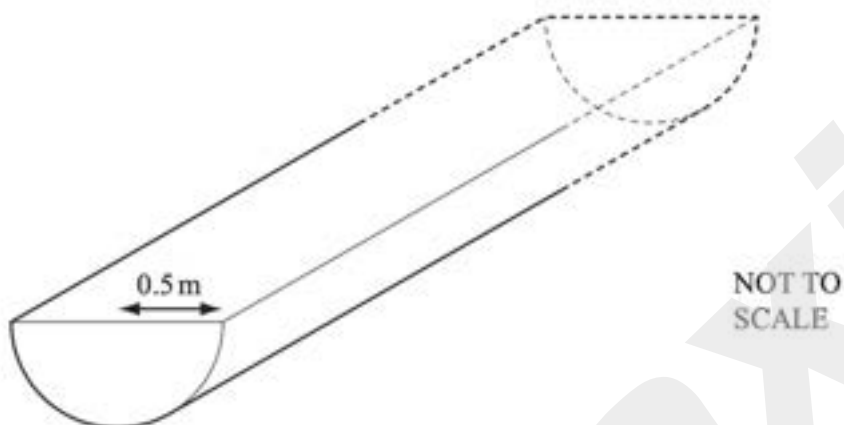
The cross-section of an irrigation channel is a semi-circle of radius 0.5 m.
The 33 m³ of water from the tank completely fills the irrigation channel.

Calculate the length of the channel.

Answer(b)(ii) .... m   [3]

(c) (i) Calculate the number of litres in a full tank of 33 m³.

Answer(c)(i) .... litres   [1]

(ii) The water drains from the tank at a rate of 1800 litres per minute.

Calculate the time, in minutes and seconds, taken to empty the tank.

Answer(c)(ii) .... min .... s   [2]

October/November 2010 (42)

4   **(a)**

4 cm

NOT TO
SCALE
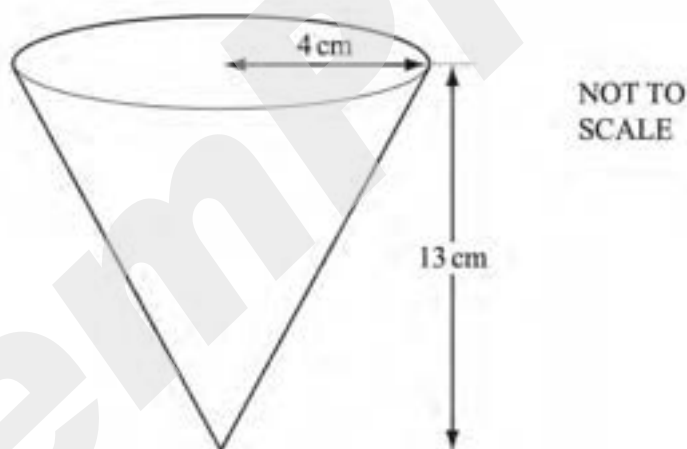
13 cm

The diagram shows a cone of radius 4 cm and height 13 cm.
It is filled with soil to grow small plants.
Each cubic centimetre of soil has a mass of 2.3g.

(i)   Calculate the volume of the soil inside the cone.

[The volume, V, of a cone with radius r and height h is $V = \frac{1}{3}\pi r^2 h$.]

Answer(a)(i) .... cm^3 [2]

(ii) Calculate the mass of the soil.

Answer(a)(ii) .... g [1]

(iii) Calculate the greatest number of these cones which can be filled **completely** using 50 kg of soil.

Answer(a)(iii) .... [2]

(b) A **similar** cone of height 32.5 cm is used for growing larger plants.

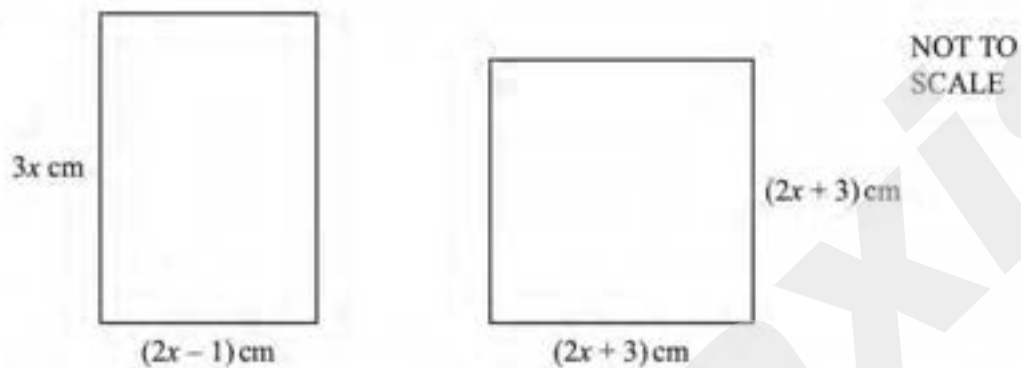Calculate the volume of soil used to fill this cone.

Answer(b) .... cm^3 [3]

(c)
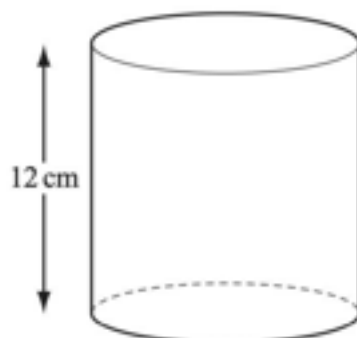
NOT TO SCALE

12 cm

Some plants are put into a cylindrical container with height 12 cm and volume 550 cm^3.

Calculate the radius of the cylinder.

Answer(c) .... cm   [3]

Question 5b

(b)

The rectangle and the square shown in the diagram above have the same area.

(i) Show that $2x^2 - 15x - 9 = 0$.

Answer(b)(i)

[3]

(ii) Solve the equation $2x^2 - 15x - 9 = 0$.
Show all your working and give your answers correct to 2 decimal places.

Answer(b)(ii) $x =$ .... or $x =$ .... [4]

(iii) Calculate the perimeter of the square.

Answer(b)(iii) .... cm [1]

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Question 7b, 7c and 7d

(b)
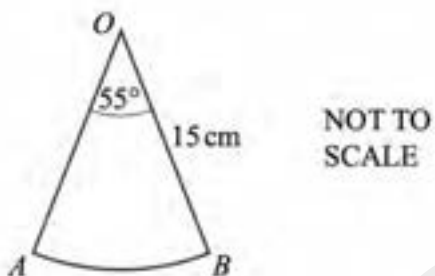
A sector OAB has an angle of $55°$ and a radius of $15\,cm$.

Calculate the area of the sector and show that it rounds to $108\,cm^2$, correct to 3 significant figures.

Answer (b)

[3]

(c)

15 cm   NOT TO SCALE
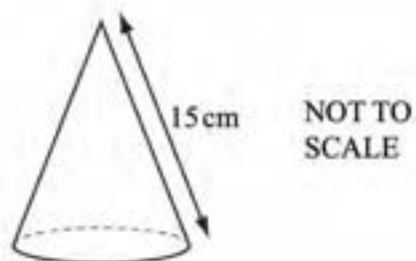
The sector radii OA and OB in **part (b)** are joined to form a cone.

(i) Calculate the base radius of the cone.
[The curved surface area, A, of a cone with radius r and slant height l is $A = \pi r l$.]

Answer(c)(i) .... cm [2]

(ii) Calculate the perpendicular height of the cone.

Answer(c)(ii) .... cm [3]

(d)
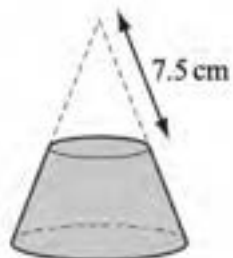
7.5 cm

NOT TO
SCALE

A solid cone has the same dimensions as the cone in **part (c)**.
A small cone with slant height 7.5 cm is removed by cutting parallel to the base.

Calculate the volume of the remaining solid.

[The volume, V, of a cone with radius r and height h is $V = \frac{1}{3}\pi r^2 h$.]

Answer(d) .... cm³ [3]

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3
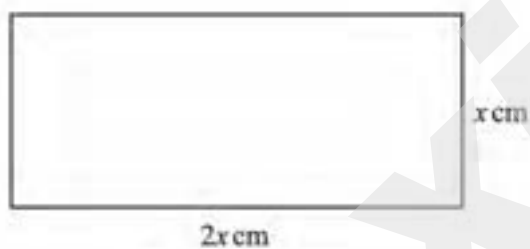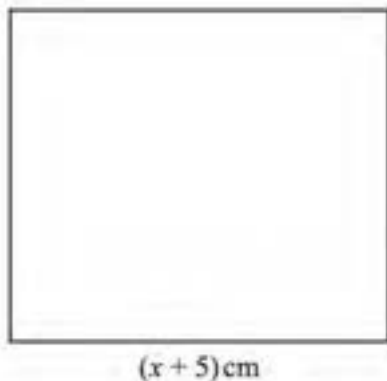
The diagram shows a square of side $(x + 5)$ cm and a rectangle which measures $2x$ cm by x cm.

The area of the square is 1 cm^2 more than the area of the rectangle.

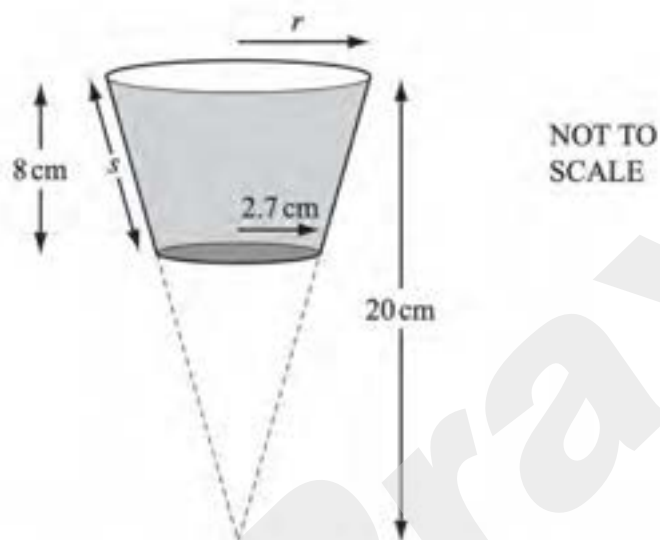**(a)** Show that $x^2 - 10x - 24 = 0$.

Answer(a)

[3]

(b) Find the value of x.

Answer(b) $x =$ .... **[3]**

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4

NOT TO SCALE

The diagram shows a plastic cup in the shape of a cone with the end removed.
The vertical height of the cone in the diagram is 20 cm.
The height of the cup is 8 cm.
The base of the cup has radius 2.7 cm.

(a) **(i)** Show that the radius, r, of the circular top of the cup is 4.5 cm.

Answer(a)(i)

[2]

(ii) Calculate the volume of water in the cup when it is full.

[The volume, V, of a cone with radius r and height h is $V = \dfrac{1}{3} \pi r^2 h$.]

Answer(a)(ii) .... cm^3 [4]

(b) (i) Show that the slant height, s, of the cup is 8.2 cm.

Answer(b)(i)

[3]

(ii) Calculate the curved surface area of the outside of the cup.
[The curved surface area, A, of a cone with radius r and slant height l is $A = \pi r l.$]

Answer(b)(ii) .... cm^2 [5]

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4 Boris has a recipe which makes 16 biscuits.

The ingredients are

160 g flour,

160 g sugar,

240 g butter,

200 g oatmeal.

(b) The ingredients are mixed together to make dough.

This dough is made into a sphere of volume 1080 cm^3.

Calculate the radius of this sphere.

[The volume, V, of a sphere of radius r is $V = \dfrac{4}{3}\pi r^3$.]

Answer(b) .... cm [3]

(c)
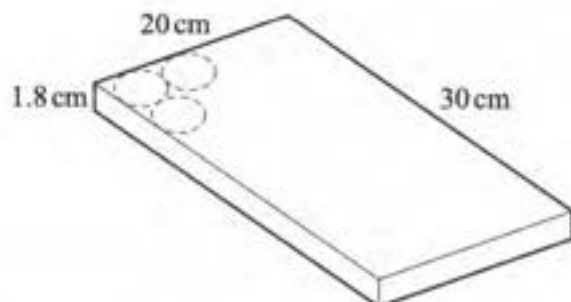
The 1080 cm³ of dough is then rolled out to form a cuboid 20 cm × 30 cm × 1.8 cm.

Boris cuts out circular biscuits of diameter 5 cm.

(i) How many whole biscuits can he cut from this cuboid?

Answer(c)(i) .... [1]

(ii) Calculate the volume of dough left over.

Answer(c)(ii) .... cm³ [3]

6

NOT TO SCALE

10 cm

h cm

9 cm
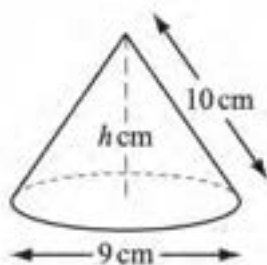
A solid cone has diameter 9 cm, slant height 10 cm and vertical height h cm.

(a) **(i)** Calculate the curved surface area of the cone.

[The curved surface area, A, of a cone, radius r and slant height l is $A = \pi r l$.]

Answer(a)(i) .... cm^2 [2]

(ii) Calculate the value of h, the vertical height of the cone.

Answer(a)(ii) $h =$ .... [3]

(b)

NOT TO SCALE
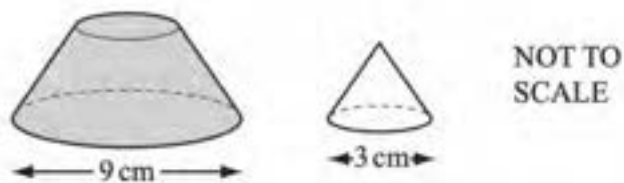
Sasha cuts off the top of the cone, making a smaller cone with diameter 3 cm.
This cone is **similar** to the original cone.

(i) Calculate the **vertical** height of this small cone.

Answer(b)(i) .... cm [2]

(ii) Calculate the curved surface area of this small cone.

Answer(b)(ii) .... cm^2 [2]

(c)

NOT TO
SCALE

12 cm

9 cm
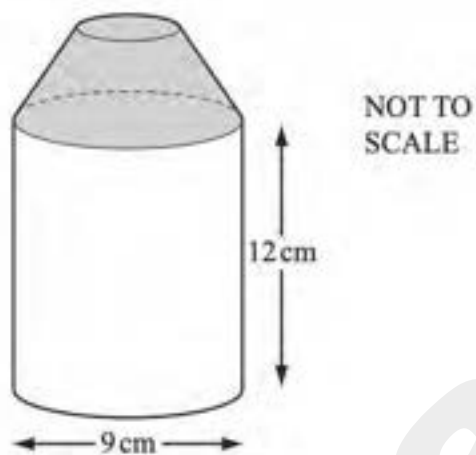
The shaded solid from **part (b)** is joined to a solid cylinder with diameter 9 cm
and height 12 cm.
Calculate the **total** surface area of the whole solid.

Answer(c) .... cm^2 [5]

1
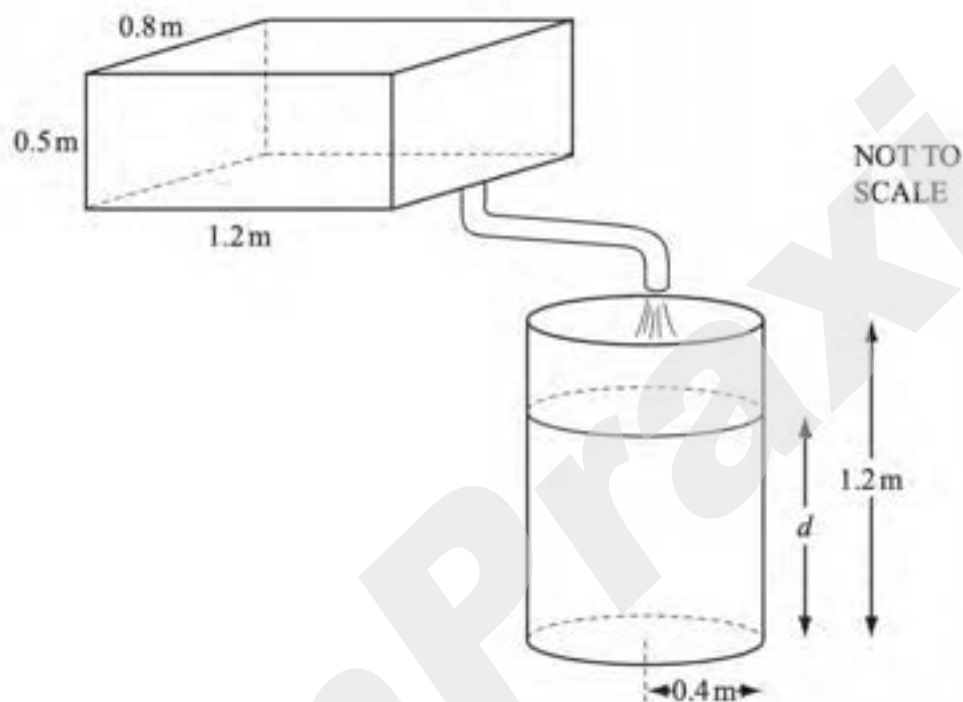
A rectangular tank measures 1.2 m by 0.8 m by 0.5 m.

(a) Water flows from the full tank into a cylinder at a rate of 0.3 m³/min.

Calculate the time it takes for the full tank to empty.
Give your answer in minutes and seconds.

Answer(a) .... min .... s [3]

(b) The radius of the cylinder is 0.4 m.

Calculate the depth of water, d, when all the water from the rectangular tank is in the cylinder.
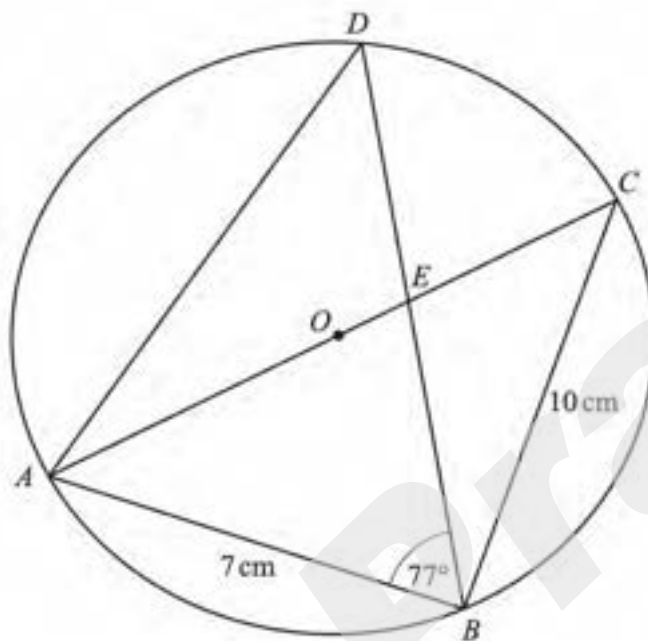
Answer(b) d = ... m [3]

(c) The cylinder has a height of 1.2 m and is open at the top.
The inside surface is painted at a cost of \$2.30 per m^2.

Calculate the cost of painting the inside surface.

Answer(c) \$ .... [4]

May/June 2012 (41)

4

A, B, C and D lie on a circle, centre O.
AB = 7 cm, BC = 10 cm and angle ABD = 77°.
AOC is a diameter of the circle.

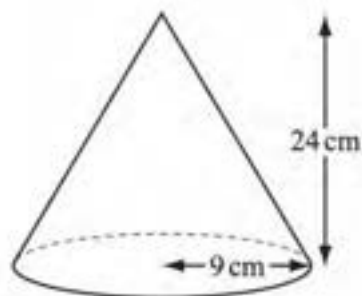**(a)** Find angle ABC.

Answer(a) Angle ABC = ... [1]

(c) Explain why angle ADB = angle ACB.

Answer(c) .... [1]

10

24 cm

NOT TO SCALE

←9 cm→

A solid metal cone has base radius 9 cm and vertical height 24 cm.

(a) Calculate the volume of the cone.

[The volume, V, of a cone with radius r and height h is $V = \frac{1}{3}\pi r^2 h$.]

Answer(a) .... cm^3 [2]

(b)

16 cm

NOT TO SCALE

←9 cm→
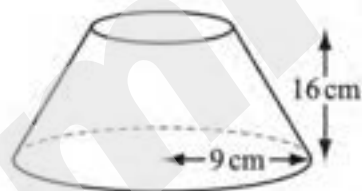
A cone of height 8 cm is removed by cutting parallel to the base, leaving the solid shown above. Show that the volume of this solid rounds to 1960 cm^3, correct to 3 significant figures.

Answer (b)

[4]

(c) The 1960 cm^3 of metal in the solid in **part (b)** is melted and made into 5 identical cylinders, each of length 15 cm.
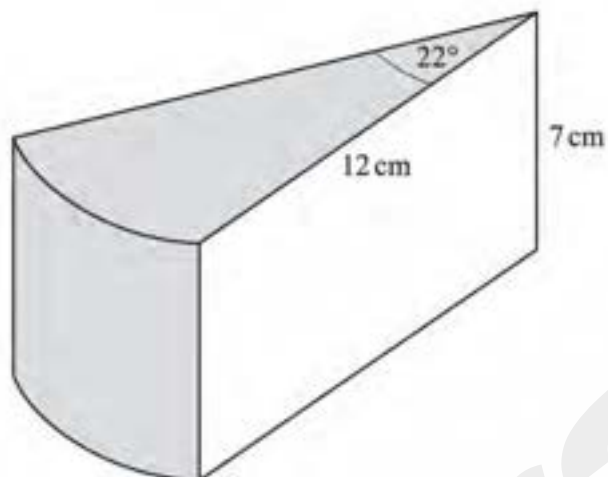Show that the radius of each cylinder rounds to 2.9 cm, correct to 1 decimal place.

Answer (c)

[4]

May/June 2012 (42)

11 (a) Calculate the area of a circle with radius 12 cm.

Answer(a) .... cm^2 [2]

(b)

A circular cake has radius 12 cm and height 7 cm.
The uniform cross-section of a slice of the cake is a sector with angle 22°.
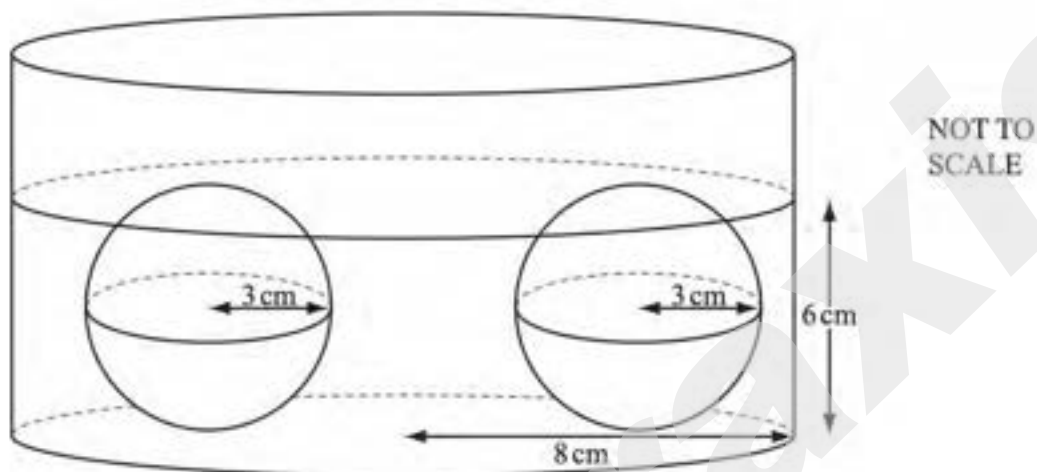The top and the curved surface of the slice, shaded in the diagram, are covered with chocolate.

Calculate the area of the slice which is covered with chocolate.

Answer(b) .... cm² [5]

May/June 2012 (43)

5

The diagram shows two solid spheres of radius 3 cm lying on the base of a cylinder of radius 8 cm.

Liquid is poured into the cylinder until the spheres are just covered.

[The volume, V, of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

(a) Calculate the volume of liquid in the cylinder in

   (i) cm³,

Answer(a)(i) .... cm³ [4]

(ii) litres.

<p style="text-align:right">Answer(a)(ii) .... litres [1]</p>

(b) One cubic centimetre of the liquid has a mass of 1.22 grams.

Calculate the mass of the liquid in the cylinder.

Give your answer in kilograms.

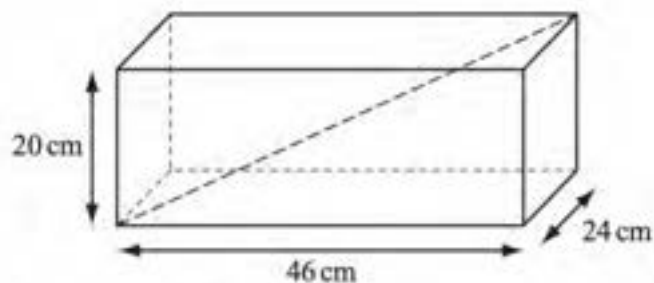<p style="text-align:right">Answer(b) .... kg [2]</p>

(c) The spheres are removed from the cylinder.

Calculate the new height of the liquid in the cylinder.

<p style="text-align:right">Answer(c) .... cm [2]</p>

October/November 2012 (41)

5 (a)

NOT TO SCALE

20 cm

24 cm

46 cm

Jose has a fish tank in the shape of a cuboid measuring 46 cm by 24 cm by 20 cm.

(b) Maria has a fish tank with a volume of 20 000 cm³.

Write the volume of Maria's fish tank as a percentage of the volume of Jose's fish tank.
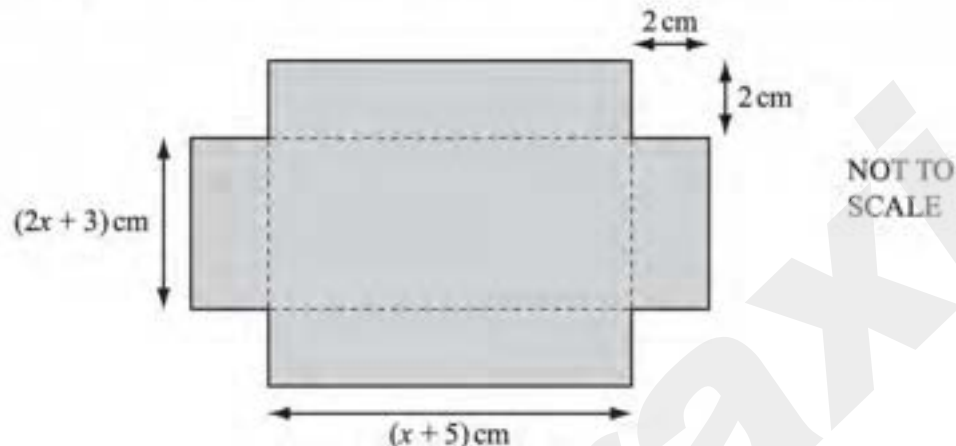
Answer(b) .... % [3]

(d) A sphere has a volume of 20 000 cm³. Calculate its radius.

[The volume, V, of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

Answer(d) .... cm [3]

8 A rectangular piece of card has a square of side 2 cm removed from each corner.

NOT TO SCALE

2 cm

2 cm

$(2x + 3)$ cm

$(x + 5)$ cm

(a) Write expressions, in terms of x, for the dimensions of the rectangular card before the squares are removed from the corners.

Answer(a) .... cm by .... cm [2]

(b) The diagram shows a net for an open box.
Show that the volume, V cm^3, of the open box is given by the formula $V = 4x^2 + 26x + 30$.

Answer(b)

[3]

(c) (i) Calculate the values of x when $V = 75$.
Show all your working and give your answers correct to two decimal places.

Answer(c)(i) $x =$ .... or $x =$ .... [5]

(ii) Write down the length of the longest edge of the box.

Answer(c)(ii) .... cm [1]

Question 4b

(b)
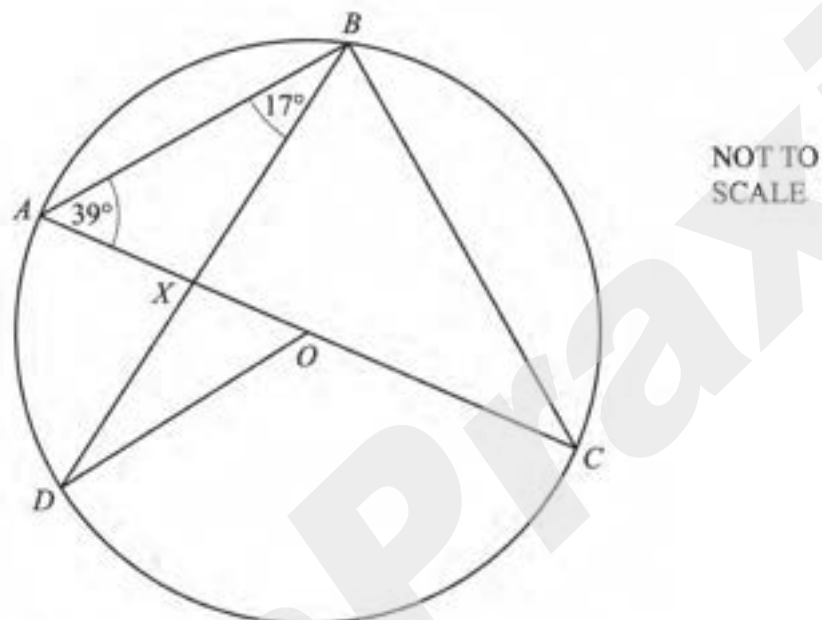
A, B, C and D are on the circumference of the circle centre O.
AC is a diameter.
Angle CAB = 39° and angle ABD = 17°.

(v) The radius of the circle is 12 cm. Calculate the length of major arc ABCD.

Answer(b)(v) Arc ABCD = ... cm [3]

October/November 2012 (43)

3 A metal cuboid has a volume of $1080 \, cm^3$ and a mass of $8 \, kg$.

(a) Calculate the mass of one cubic centimetre of the metal.
     Give your answer in grams.

Answer(a) .... g [1]

(b) The base of the cuboid measures $12 \, cm$ by $10 \, cm$.

     Calculate the height of the cuboid.

Answer(b) .... cm [2]

(c) The cuboid is melted down and made into a sphere with radius $r \, cm$.

     (i) Calculate the value of r.

          [The volume, V, of a sphere with radius r is $V = \dfrac{4}{3}\pi r^3$.]

Answer(c)(i) r = ... [3]

(ii) Calculate the surface area of the sphere.

[The surface area, A, of a sphere with radius r is $A = 4\pi r^2$.]

Answer(c)(ii) .... cm^2 [2]

(d) A larger sphere has a radius R cm.
The surface area of this sphere is double the surface area of the sphere with radius r cm in **part (c)**.

Find the value of $\dfrac{R}{r}$.

Answer(d) .... [2]

May/June 2013 (42)

4
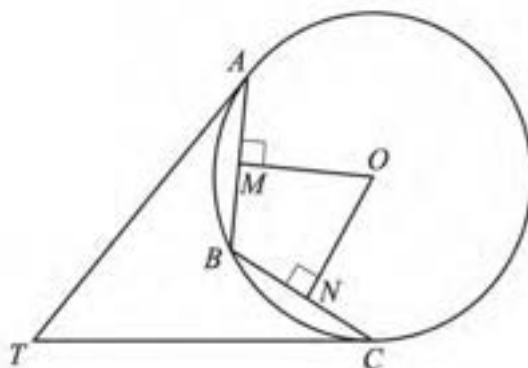
NOT TO SCALE

A, B and C lie on the circle centre O, radius 8.5 cm.
$AB = BC = 10.7$ cm.
OM is perpendicular to AB and ON is perpendicular to BC.

(a) Calculate the area of the circle.

Answer(a) .... cm² [2]

(b) Write down the length of MB.

Answer(b) .... cm [1]

(d) Using angle $MOB = 39°$, calculate the length of the **major** arc AC.

Answer(d) .... cm [3]

9 (a)

NOT TO
SCALE

12 cm

4 cm
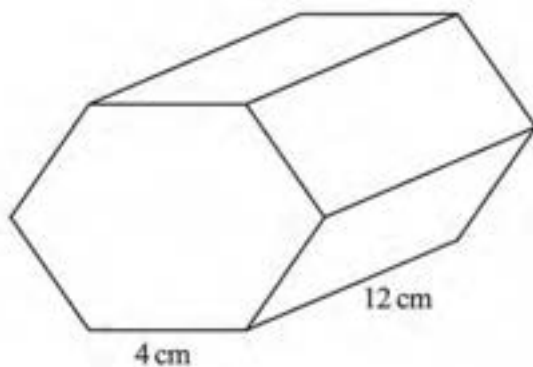
The diagram shows a prism of length 12 cm.
The cross section is a regular hexagon of side 4 cm.

Calculate the total surface area of the prism.

Answer(a) .... cm^2 [4]

(b) Water flows through a cylindrical pipe of radius 0.74 cm.
It fills a 12 litre bucket in 4 minutes.

(i) Calculate the speed of the water through the pipe in centimetres per minute.

Answer(b)(i) .... cm/min [4]

(ii) When the 12 litre bucket is emptied into a circular pool, the water level rises by 5 **millimetres**.

Calculate the radius of the pool correct to the nearest centimetre.

Answer(b)(ii) .... cm [5]

Question 2b

(b) A circular lake in the nature reserve has a radius of 45 m.

    (i) Calculate the area of the lake.

Answer(b)(i) .... m² [2]

    (ii)
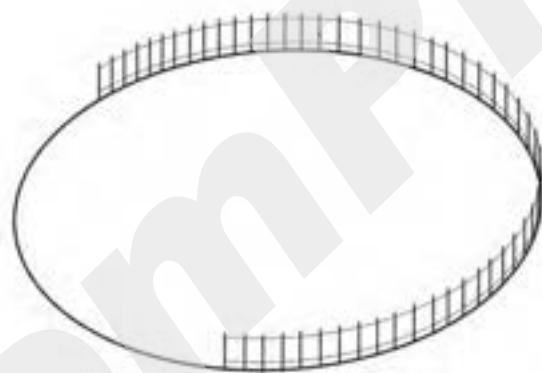
NOT TO SCALE

A fence is placed along part of the circumference of the lake.
This arc subtends an angle of 210° at the centre of the circle.

Calculate the length of the fence.

Answer(b)(ii) .... m [2]

4
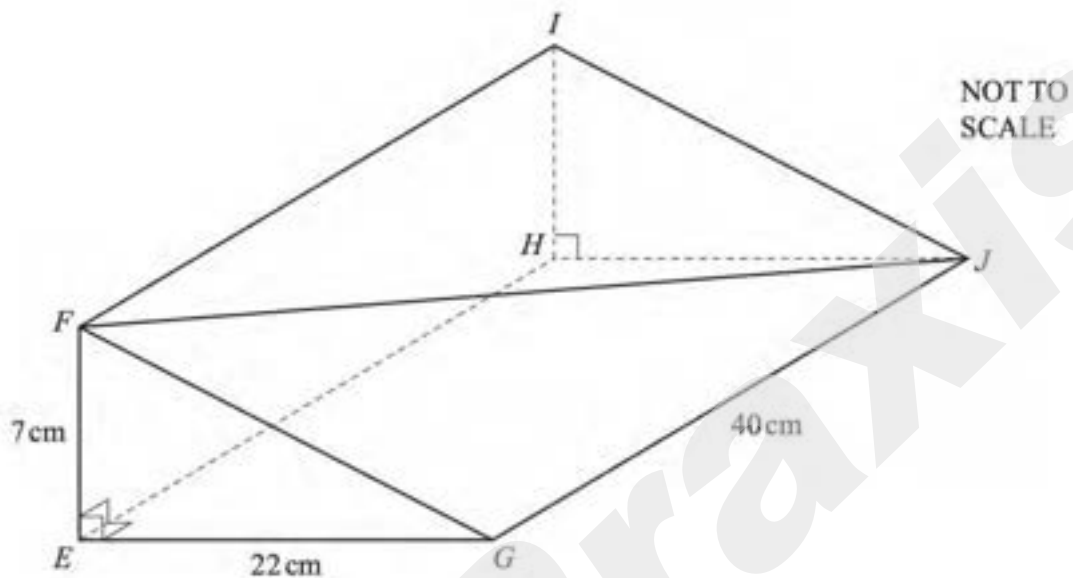
EFGHIJ is a solid metal prism of length 40 cm.
The cross section *EFG* is a right-angled triangle.
EF = 7 cm and *EG* = 22 cm.

(a) Calculate the volume of the prism.

Answer(a) .... cm³ [2]

(d) The prism is melted and made into spheres.
Each sphere has a radius 1.5 cm.

Work out the greatest number of spheres that can be made.

[The volume, V, of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

Answer(d) .... [3]

October/November 2013 (41)

3

NOT TO SCALE

13 cm

h

5 cm
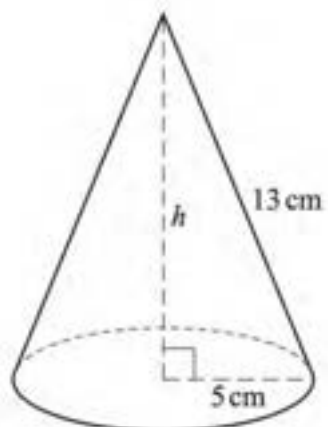
(a) The diagram shows a cone of radius 5 cm and slant height 13 cm.

   (i) Calculate the curved surface area of the cone.
     [The curved surface area, A, of a cone with radius r and slant height l is $A = \pi r l$.]

                                 Answer(a)(i) .... cm^2 [2]

   (ii) Calculate the perpendicular height, h, of the cone.

                                 Answer(a)(ii) h = ... cm [3]

   (iii) Calculate the volume of the cone.
      [The volume, V, of a cone with radius r and height h is $V = \frac{1}{3}\pi r^2 h$.]

                                 Answer(a)(iii) .... cm^3 [2]

(b)
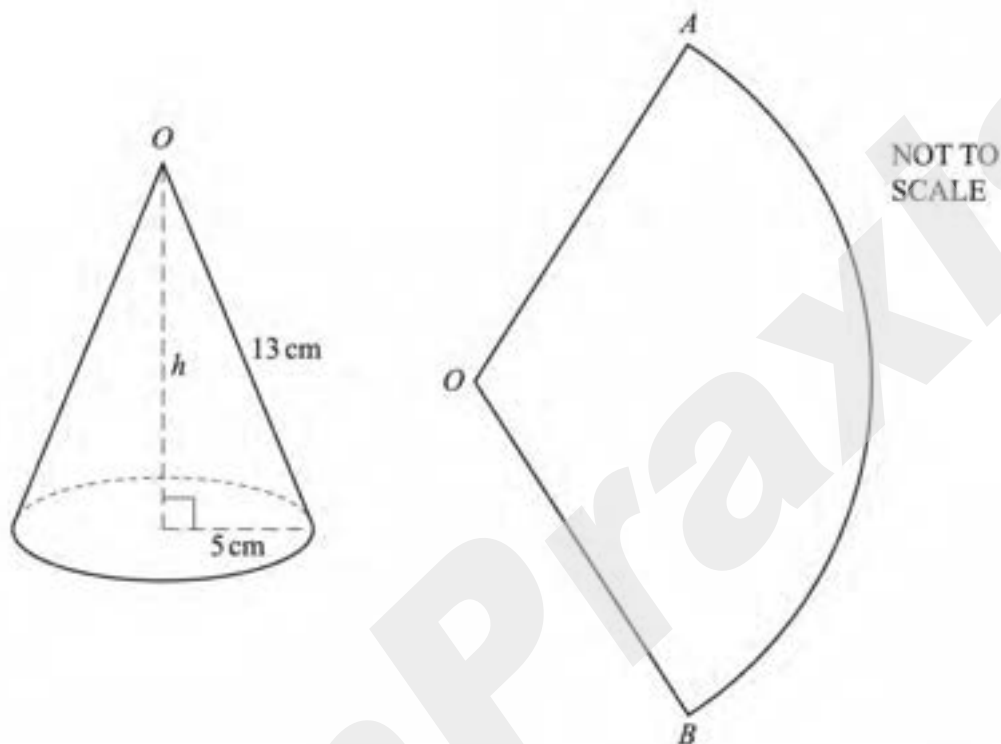
The cone is now cut along a slant height and it opens out to make the sector AOB of a circle.

Calculate angle AOB.

Answer(b) Angle $AOB =$ .... [4]

October/November 2013 (42)

2
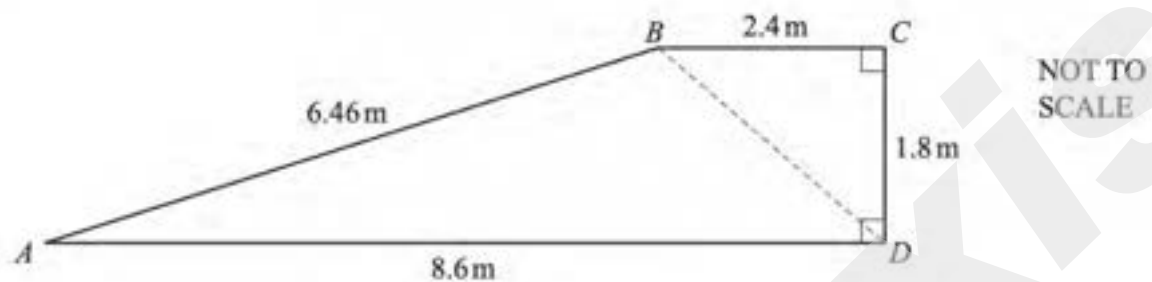
The diagram shows the cross section, *ABCD*, of a ramp.

(c) The ramp is a prism of width 4 m.

Calculate the volume of this prism.

Answer(c) .... m³ [3]

4
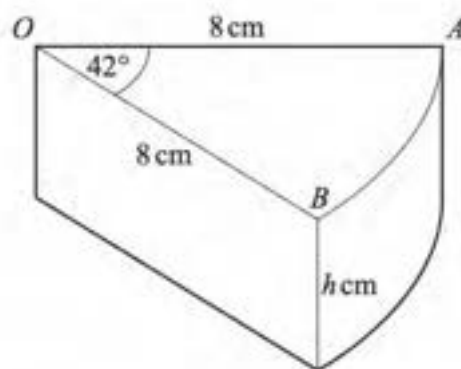
A wedge of cheese in the shape of a prism is cut from a cylinder of cheese of height h cm. The radius of the cylinder, OA, is 8 cm and the angle $AOB = 42°$.

(a) (i) The volume of the wedge of cheese is 90 cm^3.

Show that the value of h is 3.84 cm correct to 2 decimal places.

Answer(a)(i)

[4]

(ii) Calculate the **total** surface area of the wedge of cheese.

Answer(a)(ii) .... cm^2 [5]

October/November 2013 (43)

3   A rectangular metal sheet measures 9 cm by 7 cm.
    A square, of side x cm, is cut from each corner.
    The metal is then folded to make an open box of height x cm.
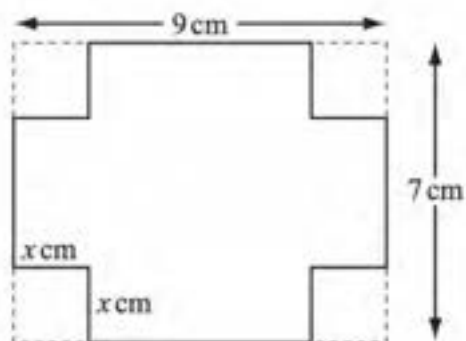
(a) Write down, in terms of x, the length and width of the box.

Answer(a) Length = ...

Width = ... [2]

(b) Show that the volume, V, of the box is $4x^3 - 32x^2 + 63x$.

Answer(b)

[2]

6 Sandra has designed this open container.
The height of the container is 35 cm.

NOT TO
SCALE

35 cm
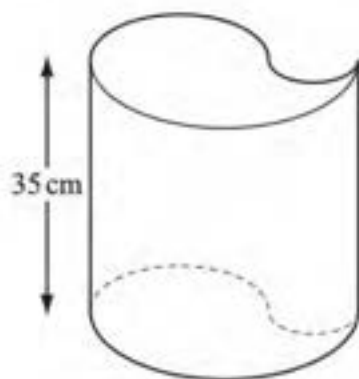
The cross section of the container is designed from three semi-circles with diameters 17.5 cm, 6.5 cm and 24 cm.

17.5 cm   6.5 cm
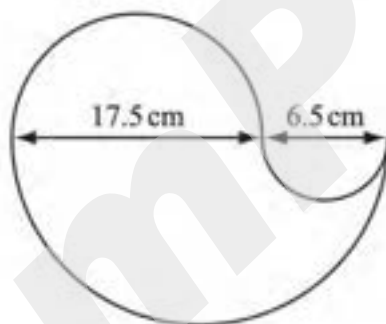
NOT TO
SCALE

(a) Calculate the area of the cross section of the container.

Answer(a) .... cm^2 [3]

(b) Calculate the external surface area of the container, including the base.

Answer(b) .... cm^2 [4]

(c) The container has a height of 35 cm.

Calculate the capacity of the container.
Give your answer in litres.

Answer(c) .... litres [3]

(d) Sandra's container is completely filled with water.
All the water is then poured into another container in the shape of a cone.
The cone has radius 20 cm and height 40 cm.
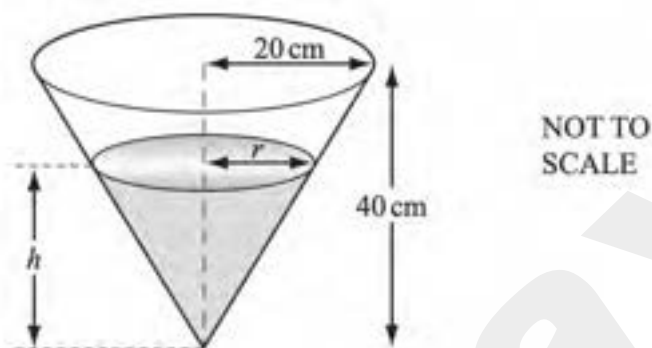
(i) The diagram shows the water in the cone.

Show that $r = \dfrac{h}{2}$.

Answer(d)(i)

[1]

(ii) Find the height, h, of the water in the cone.
[The volume, V, of a cone with radius r and height h is $V = \frac{1}{3}\pi r^2 h$.]

Answer(d)(ii) $h =$ .... cm **[3]**

Question 3d

(d)
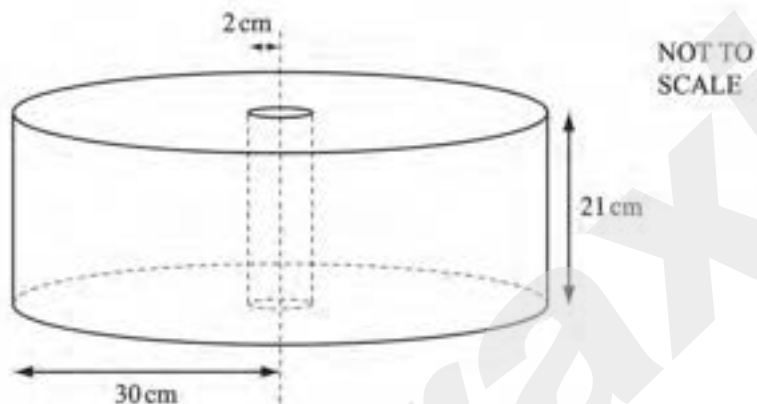
Paper is sold in cylindrical rolls.
There is a wooden cylinder of radius 2 cm and height 21 cm in the centre of each roll.
The outer radius of a roll of paper is 30 cm.

(i) Calculate the volume of paper in a roll.

Answer(d)(i) .... cm³ [3]

(ii) The paper is cut into sheets which measure 21 cm by 29.7 cm.
The thickness of each sheet is 0.125 mm.

(a) Change 0.125 millimetres into centimetres.

Answer(d)(ii)(a) .... cm [1]

(b) Work out how many whole sheets of paper can be cut from a roll.

Answer(d)(ii)**(b)** .... [4]

May/June 2014 (42)

5
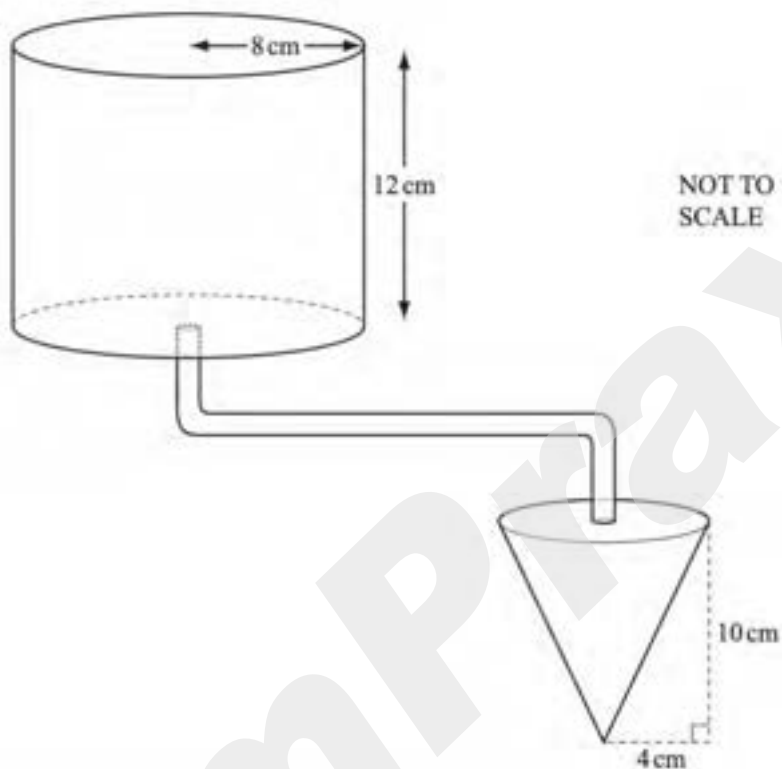
The diagram shows a cylinder with radius 8 cm and height 12 cm which is full of water.
A pipe connects the cylinder to a cone.
The cone has radius 4 cm and height 10 cm.

(a) (i) Calculate the volume of water in the cylinder.
Show that it rounds to 2410 cm³ correct to 3 significant figures.

Answer(a)(i)

[2]

(ii) Change 2410 cm^3 into litres.

Answer(a)(ii) .... litres [1]

(b) Water flows from the cylinder along the pipe into the cone at a rate of 2 cm^3 per second.

Calculate the time taken to fill the empty cone.
Give your answer in minutes and seconds correct to the nearest second.

[The volume, V, of a cone with radius r and height h is $V = \frac{1}{3}\pi r^2 h$.]

Answer(b) .... min .... s [4]

(c) Find the number of empty cones which can be filled completely from the full cylinder.

Answer(c) .... [3]

11 The total area of each of the following shapes is X.
The area of the shaded part of each shape is kX.

For each shape, find the value of k and write your answer below each diagram.

NOT TO
SCALE

NOT TO
SCALE

NOT TO
SCALE

$AB = BC = CD$

Angle $JOK = 72°$

$EF = FG$ and $EI = IH$

$k = $ ....

$k = $ ....

$k = $ ....

NOT TO
SCALE

NOT TO
SCALE
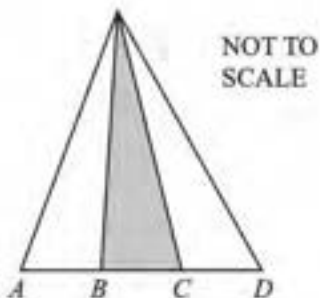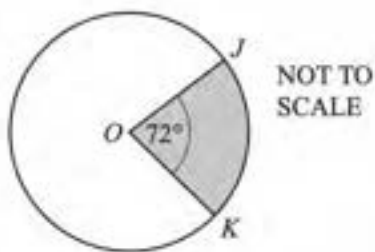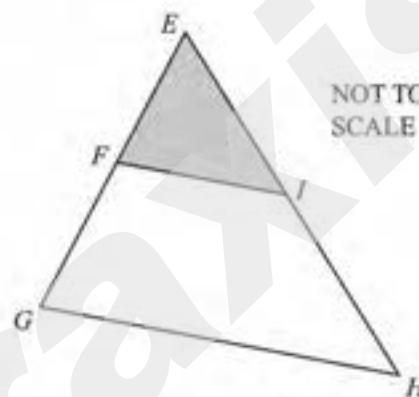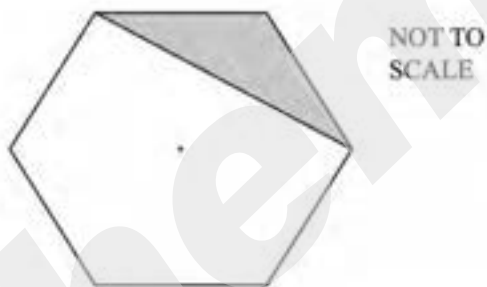
The shape is a regular hexagon.
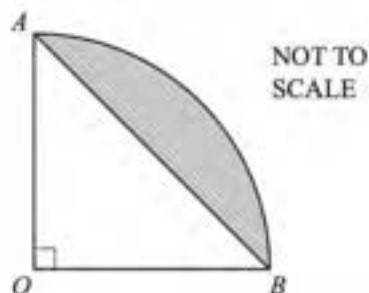
The diagram shows a sector of a circle centre O.
Angle $AOB = 90°$

$k = $ ....

$k = $ ....

[10]

Question 1b

(b) Teresa builds a raised garden bed in the shape of a hexagonal prism.
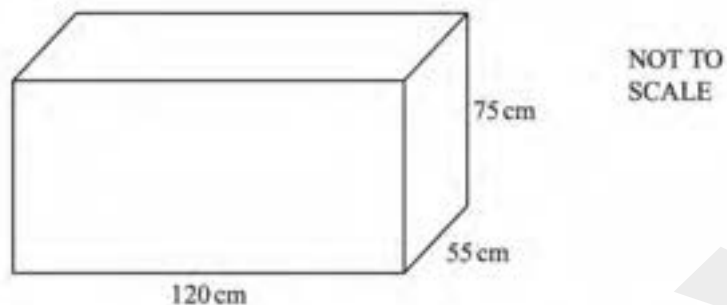

NOT TO SCALE
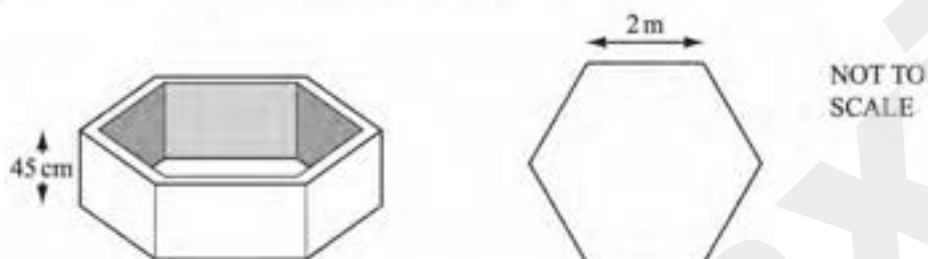
The garden bed has a height of 45 cm.
The cross section of the inside of the garden bed is a regular hexagon of side 2 m.

(i) Show that the area of the cross section of the inside of the garden bed is $10.4 \, m^2$, correct to 3 significant figures.

(ii) Calculate the volume of soil needed to fill the garden bed.

Answer(b)(ii) .... m^3 [2]

October/November 2014 (42)

7

The diagram shows a water tank in the shape of a cuboid measuring 120 cm by 55 cm by 75 cm.
The tank is filled completely with water.

**(a)** Show that the capacity of the water tank is 495 litres.

Answer(a)

[2]

(b) (i) The water from the tank flows into an empty cylinder at a uniform rate of 750 millilitres per second.

Calculate the length of time, in minutes, for the water to be completely emptied from the tank.

Answer(b)(i) .... min [2]

(ii) When the tank is completely empty, the height of the water in the cylinder is 112 cm.

NOT TO
SCALE

112 cm
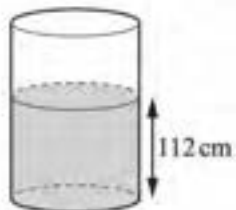
Calculate the radius of the cylinder.

Answer(b)(ii) .... cm [3]

October/November 2014 (43)

7
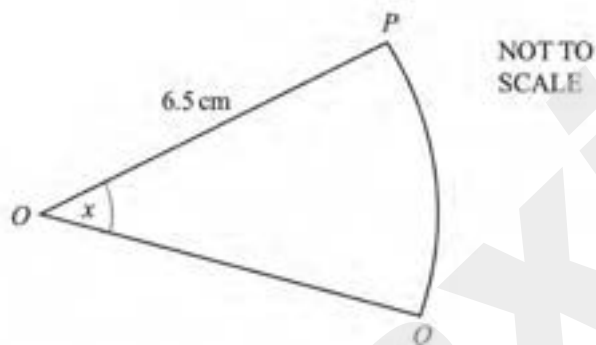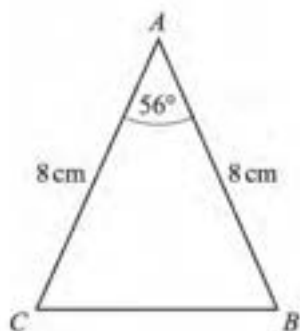
The diagram shows a triangle and a sector of a circle.
In triangle ABC, $AB = AC = 8\,$cm and angle $BAC = 56°$.
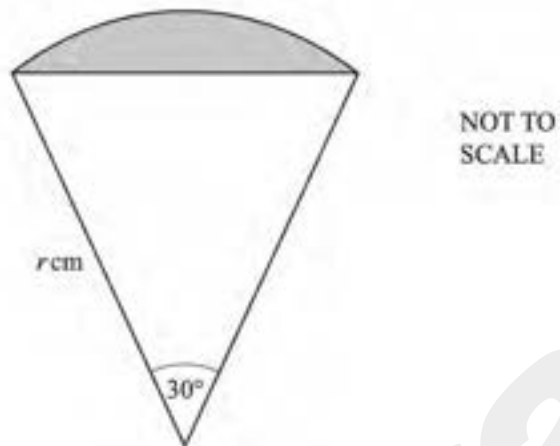Sector OPQ has centre O, sector angle x and radius $6.5\,$cm.

(a) Show that the area of triangle ABC is $26.5\,$cm^2 correct to 1 decimal place.

(b) The area of sector OPQ is equal to the area of triangle ABC.

   (i) Calculate the sector angle x.

Answer(b)(i) .... [3]

   (ii) Calculate the perimeter of the sector OPQ.

Answer(b)(ii) .... cm [3]

(c) The diagram shows a sector of a circle, radius r cm.

NOT TO
SCALE

(i) Show that the area of the shaded segment is $\frac{1}{4}r^2\left(\frac{1}{3}\pi - 1\right)$ cm².

Answer(c)(i)

[4]

(ii) The area of the segment is 5 cm².

Find the value of r.

Answer(c)(ii) r = ... [3]

<u>February/March 2015 (42)</u>

Question 1d and 1e

(d) On a plan of the house, the area of the kitchen is $5.6\,cm^2$.
The scale of the plan is $1:200$.

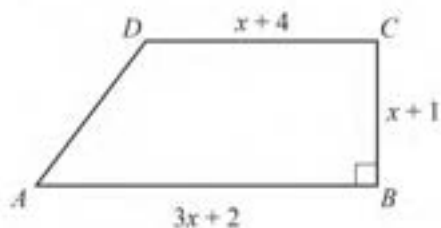Calculate the actual area of the kitchen in square metres.

Answer(d) .... m^2 [2]

(e) The house was built using cuboid blocks each measuring $12\,cm$ by $16\,cm$ by $27\,cm$.

Calculate the volume of one block.

Answer(e) .... cm^3 [2]

Question 4d

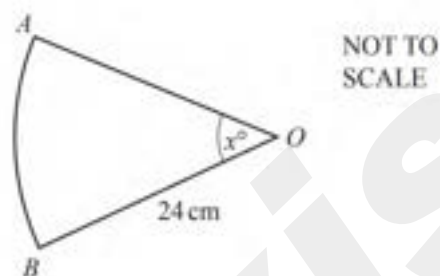(d) In this part, all lengths are in centimetres.

$ABCD$ is a trapezium with area $15\,\text{cm}^2$.

(i) Show that $2x^2 + 5x - 12 = 0$.

Answer(d)(i)

[3]

8   (a)   The diagram shows a sector of a circle
          with centre O and radius 24 cm.
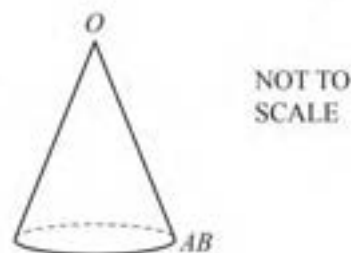
NOT TO
SCALE

$x°$ O

24 cm

A

B

(i)   The total perimeter of the sector is 68 cm.

      Calculate the value of x.

Answer(a)(i) $x =$ .... [3]

(ii) The points A and B of the sector are joined together to
      make a hollow cone.
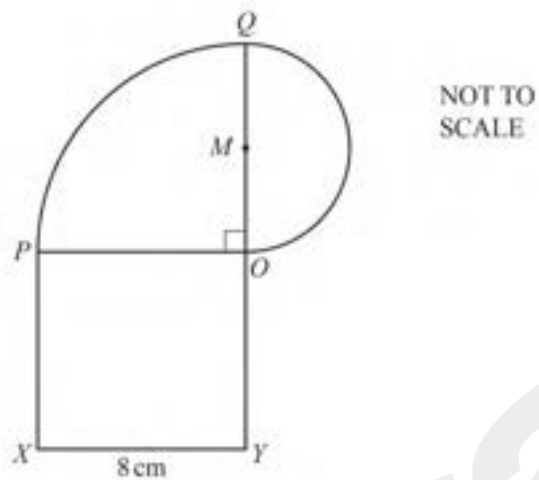   The arc AB becomes the circumference of the base of the cone.

O

NOT TO
SCALE

AB

      Calculate the volume of the cone.

      [The volume, V, of a cone with radius r and height h is $V = \frac{1}{3}\pi r^2 h$.]

Answer(a)(ii) .... cm^3 [6]

(b)

NOT TO SCALE

The diagram shows a shape made from a square, a quarter circle and a semi-circle.
OPXY is a square of side 8 cm.
OPQ is a quarter circle, centre *O*.
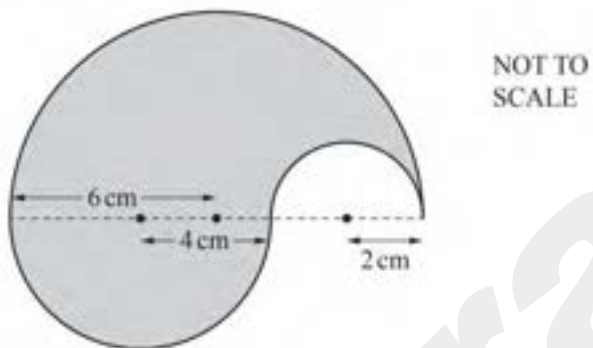The line *OMQ* is the diameter of the semi-circle.

Calculate the area of the shape.

Answer(b) .... cm² [5]

May/June 2015 (41)

Question 9b

(b) The diagram shows a shaded shape formed by three semi-circular arcs.
The radius of each semi-circle is shown in the diagram.

NOT TO
SCALE

6 cm

4 cm

2 cm

(i) Calculate the perimeter of the shaded shape.

Answer(b)(i) .... cm [2]

(ii)   The shaded shape is made from metal 1.6 mm thick.

Calculate the volume of metal used to make this shape.
Give your answer in cubic millimetres.

Answer(b)(ii) .... mm^3 [5]

4   (a)   A sector of a circle has radius 12 cm and an angle of 135°.

(i)   Calculate the length of the arc of this sector.
Give your answer as a multiple of π.

NOT TO SCALE

135°   12 cm
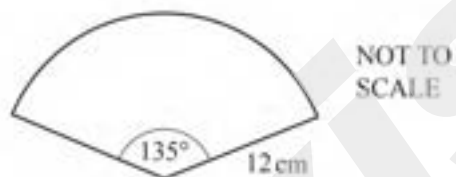
Answer(a)(i) .... cm [2]

(ii)   The sector is used to make a cone.

(a)   Calculate the base radius, r.

NOT TO SCALE

h 12 cm

r
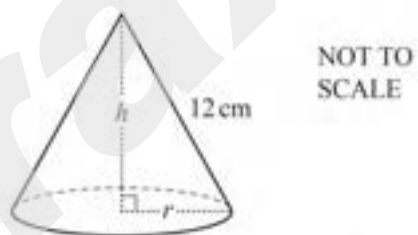
Answer(a)(ii)(a) $r =$ .... cm [2]

(b)   Calculate the height of the cone, h.

Answer(a)(ii)(b) $h =$ .... cm [3]
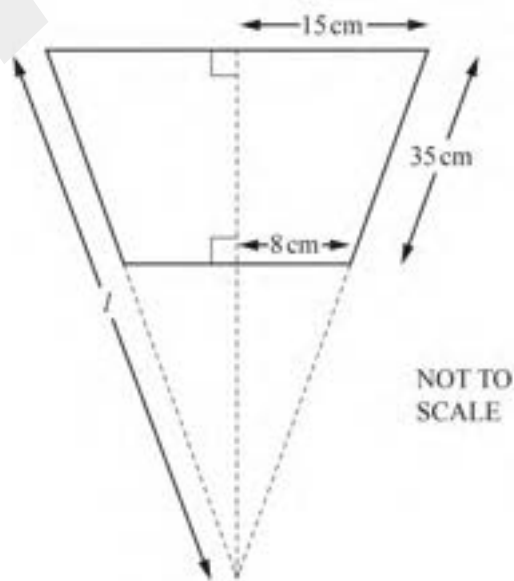
78

(b) The diagram shows a plant pot.
It is made by removing a small cone from a larger cone and adding a circular base.

NOT TO
SCALE
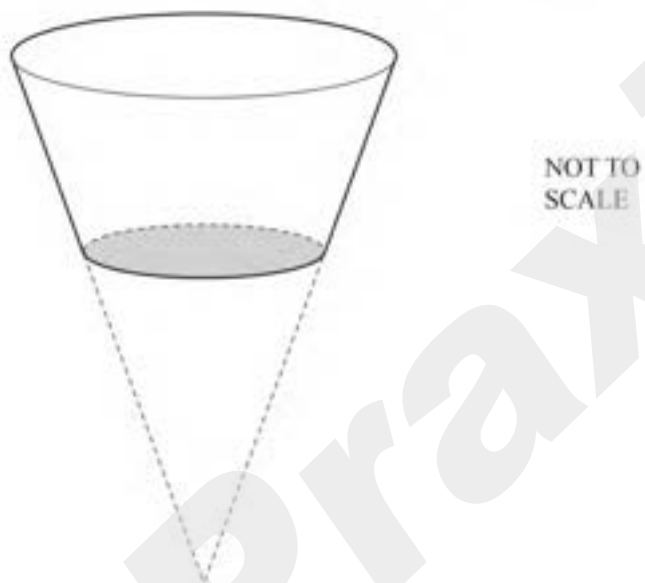
This is the cross section of the plant pot.

$l = 75$ cm.

←—15 cm—→

35 cm

←8 cm→

l

NOT TO
SCALE

79

(ii) Calculate the total surface area of the outside of the plant pot.
[The curved surface area, A, of a cone with radius r and slant height l is $A = \pi r l$.]

Answer(b)(ii) .... cm² [3]

May/June 2015 (43)

7 (a) The total surface area of a cone is given by the formula $A = \pi r l + \pi r^2$.

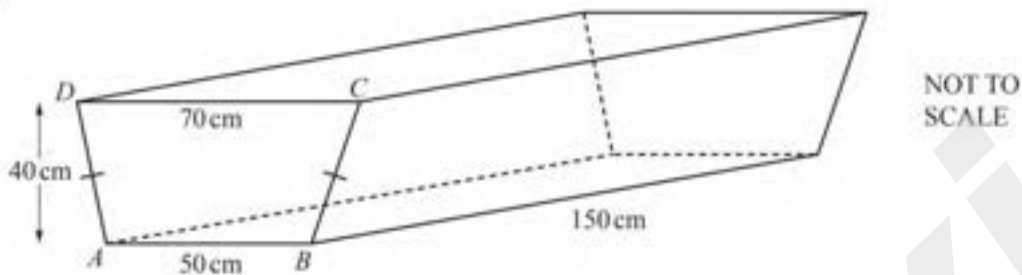(i) Find A when $r = 6.2$ cm and $l = 10.8$ cm.

Answer(a)(i) .... cm² [2]

8 (a) A cylindrical tank contains 180 000 cm³ of water.
The radius of the tank is 45 cm.

Calculate the height of water in the tank.

45 cm

NOT TO
SCALE

Answer(a) .... cm [2]

(b)

The diagram shows an empty tank in the shape of a horizontal prism of length 150 cm.
The cross section of the prism is an isosceles trapezium *ABCD*.
AB = 50 cm, *CD* = 70 cm and the vertical height of the trapezium is 40 cm.

(i) Calculate the volume of the tank.

Answer(b)(i) .... cm^3 [3]

(ii) Write your answer to part (b)(i) in litres.
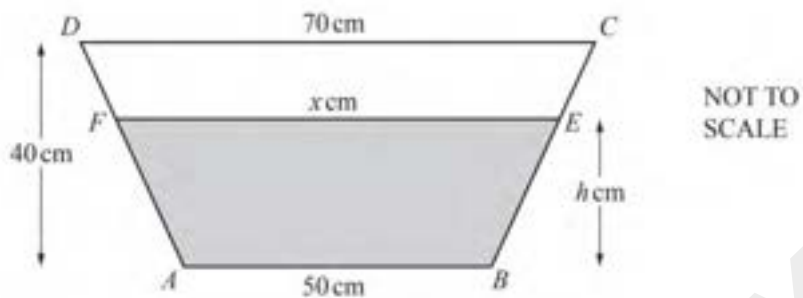
Answer(b)(ii) .... litres [1]

(c) The 180 000 cm^3 of water flows from the tank in **part (a)** into the tank in **part (b)** at a rate of 15 cm^3/s.

Calculate the time this takes.
Give your answer in hours and minutes.

Answer(c) .... h .... min [3]

(d)

The $180\,000\,cm^3$ of water reaches the level EF as shown above.
$EF = x$ cm and the height of the water is h cm.

(ii) Using $h = 2(x - 50)$, show that the shaded area, in cm^2, is $x^2 - 2500$.

Answer(d)(ii)

[1]

October/November 2015 (41)

Question 1e

(e) Paint is sold in cylindrical tins of height 11 cm.
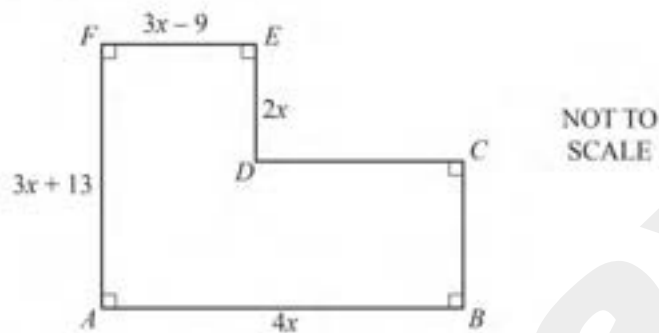Each tin holds 750 ml of paint.

(i) Write 750 ml in cm³.

Answer(e)(i) .... cm³ [1]

(ii) Calculate the radius of the tin.
Give your answer correct to 1 decimal place.

Answer(e)(ii) .... cm [3]

October/November 2015 (42)

5 (a) The area of shape $ABCDEF$ is $24\,cm^2$.
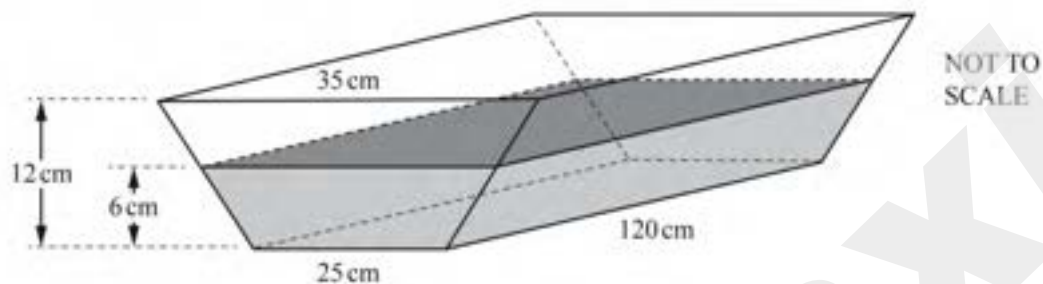All lengths are in centimetres.

(i) Show that $5x^2 + 17x - 12 = 0$.

Answer(a)(i)

[3]

October/November 2015 (43)

3   The diagram shows a horizontal water trough in the shape of a prism.

NOT TO SCALE

The cross section of this prism is a trapezium.
The trapezium has parallel sides of lengths 35 cm and 25 cm and a perpendicular height of 12 cm.
The length of the prism is 120 cm.

(a) Calculate the volume of the trough.

Answer(a) .... cm³ [3]

(b) The trough contains water to a depth of 6 cm.

    (i) Show that the volume of water is $19\,800\,cm^3$.

    Answer (b)(i)

[2]

    (ii) Calculate the percentage of the trough that contains water.

Answer(b)(ii) .... % [1]

(c) The water is drained from the trough at a rate of 12 litres per hour.

Calculate the time it takes to empty the trough.
Give your answer in hours and minutes.

Answer(c) .... h .... min [4]

(d) The water from the trough just fills a cylinder of radius r cm and height $3r$ cm.

Calculate the value of r.

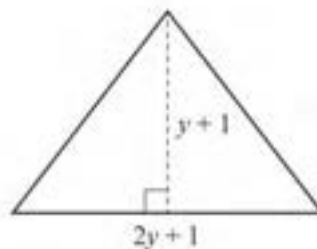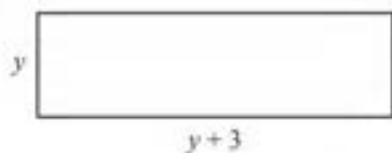*Answer(d) r* = ... [3]

(e) The cylinder has a mass of 1.2 kg.
1 cm^3 of water has a mass of 1 g.

Calculate the total mass of the cylinder and the water.
Give your answer in kilograms.

Answer(e) .... kg [2]

Question 7b

(b)

NOT TO
SCALE

The area of the rectangle and the area of the triangle are equal.

Find the value of y.

Answer(b) y = ... [4]