

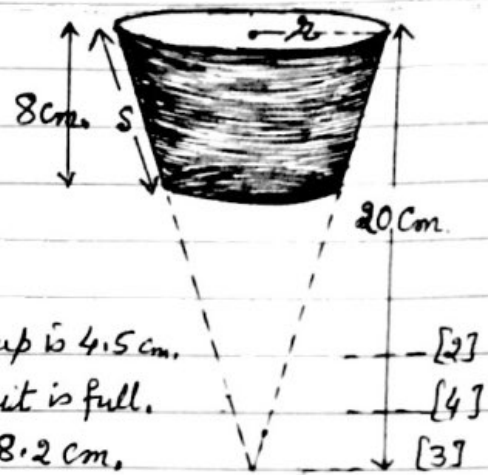
IG - Maths
0580

Mensuration

Exercise.
Paper - 4

(Suresh Goel)

Q1 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. [2]
- (ii) Calculate the volume of water in the cup when it is full. [4]
- (b)(i) Show that the slant height, s , of the cup is 8.2 cm. [3]
- (ii) Calculate the curved surface area of the outside of the cup. [5]

Q2(a) John wants to estimate the value of π . SP-15/04/Q4

He measures the circumference of a circular pizza as 105 cm and its diameter as 34 cm, both correct to the nearest centimetre.

Calculate the lower bound of his estimate of the value of π .
Give your answer correct to 3 decimal places. --- [4]

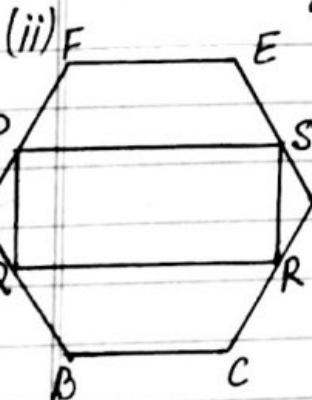
(b) The volume of a cylindrical can is 550 cm^3 , correct to the nearest 10 cm^3 . The height of the can is 12 cm correct to the nearest centimetres.

Calculate the upper bound of the radius of the can.
Give your answer correct to 3 decimal places. [5]

SP-15/04/Q10

Q3 (a) The diagram shows a regular hexagon ABCDEF of side 10 cm.

(i) Show that angle $BAF = 120^\circ$ --- [2]



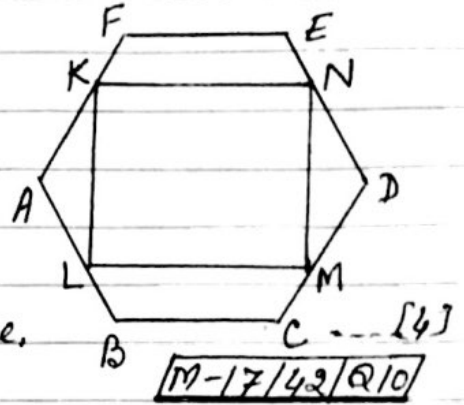
The vertices of a rectangle PQRS touch the sides FA, AB, CD and DE. PS is parallel to EF and $AP = x \text{ cm}$. --- [3]

Use trigonometry to find the length of PQ in terms of x .

(iii) $PF = (10 - x) \text{ cm}$. Show that $PS = (20 - x) \text{ cm}$ (continued) --- [3]

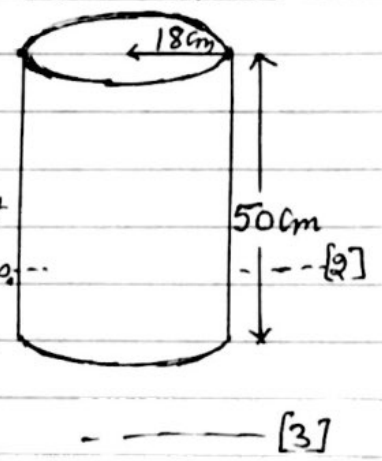
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Q3(b) The diagram shows the vertices of a square $KLMN$ touching the sides of the same hexagon $ABCDEF$, with KN parallel to FE .



Use results from part (a)(ii) and part (a)(iii) to find the length of a side of the square.

Q4 (a) The diagram shows a cylindrical container used to serve coffee in a hotel.

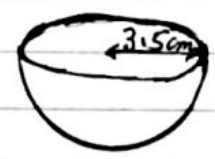


The container has a height of 50 cm and radius of 18 cm.

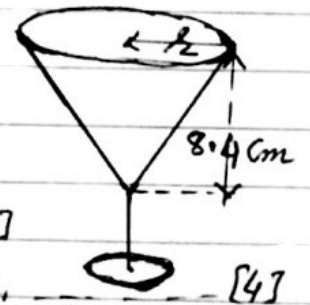
(i) Calculate the volume of the cylinder and show that it rounds to 50900 cm^3 , correct to 3 significant figures.

(ii) 30 litres of coffee are poured into the container. Work out the height, h , of the empty space in the container.

(iii) Cups in the shape of a hemisphere are filled with coffee from the container. The radius of the cup is 3.5 cm. Work out the maximum number of these cups that can be completely filled from the 30 litres of coffee in the container.



(b) The hotel also uses glasses in the shape of a cone. The capacity of each glass is 95 cm^3 .

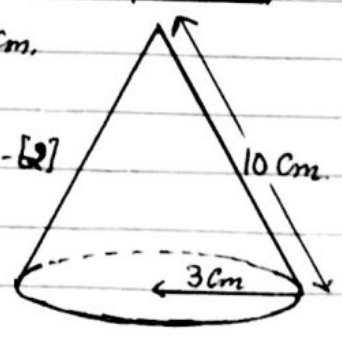


(i) Calculate the radius, r , and show that rounds to 3.3 cm, correct to 1 decimal place.

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

S-17/41/Q5

Q5 The diagram shows a hollow cone with radius 3 cm and slant height 10 cm.



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

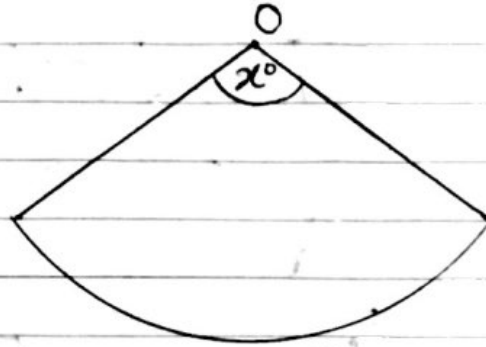
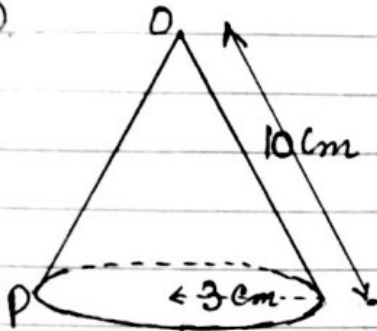
(ii) Calculate the perpendicular height of the cone.

(iii) Calculate the volume of the cone.

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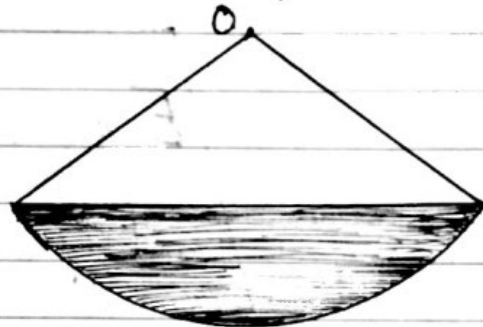
Q5(b)



The cone is cut along the line OP and is opened out into a sector as shown in the diagram. Calculate the sector angle x . --- [4]

(c) The diagram shows the same sector as in part (b)

Calculate the area of the shaded segment. --- [4]



[S-17/42/Q5]

Q6(a) The diagram shows a solid metal prism with cross section ABCDE.

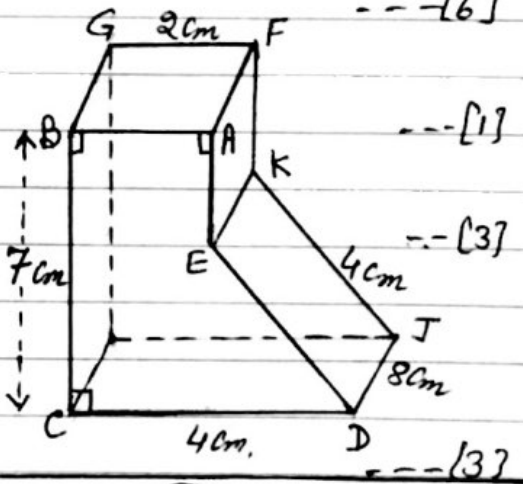
(i) Calculate the area of the cross-section ABCDE. --- [6]

(ii) The prism is of length (DJ) 8 cm. Calculate the volume of the prism. --- [1]

(b) A cylinder of length 13 cm has volume 280cm^3 .

(i) Calculate the radius of the cylinder. --- [3]

(ii) The cylinder is placed in a box that is a cube of side 14 cm. Calculate the percentage of the volume of the box this is occupied by the cylinder. --- [3]

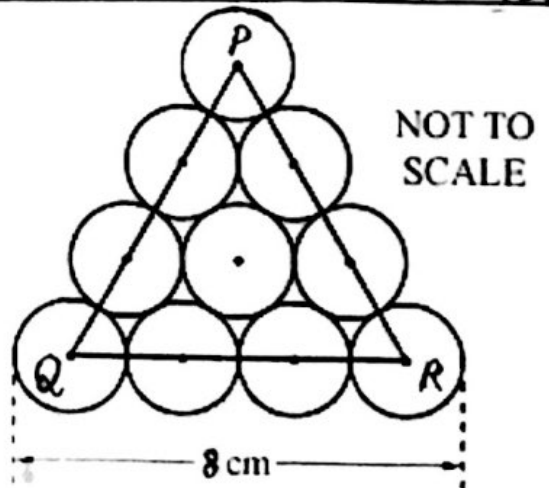


[S-17/43/Q4]

Q7 (a) The ten circles in the diagram each have radius 1 cm. The centre of each circle is marked with a dot. Calculate the height of triangle PQR.

--- [3]

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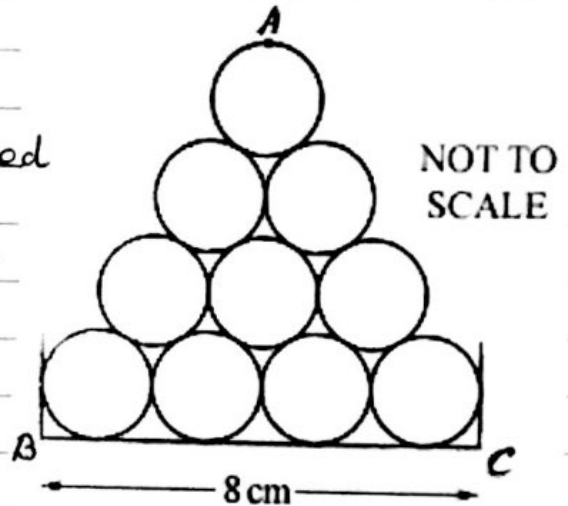


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Q7(b) Mr Patel uses whiteboard pens that are cylinders of radius 1 cm.

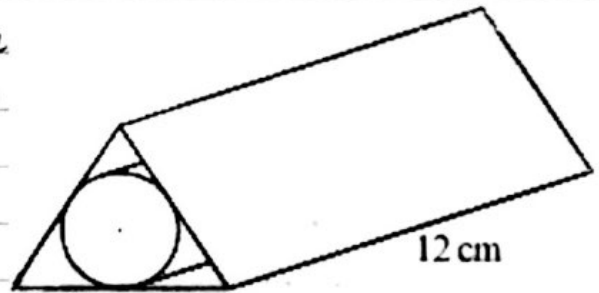
(i) The diagram shows 10 pens stacked in a tray. The tray is 8 cm wide. The point A is the highest point in the stack.

Find the height of A above the base BC, of the tray. --- [1]



(ii) The diagram shows a box that holds one pen. The box is a prism of length 12 cm. The cross section of the prism is an equilateral triangle.

The pen touches each of the three rectangular faces of the box. Calculate the volume of this box, --- [5]



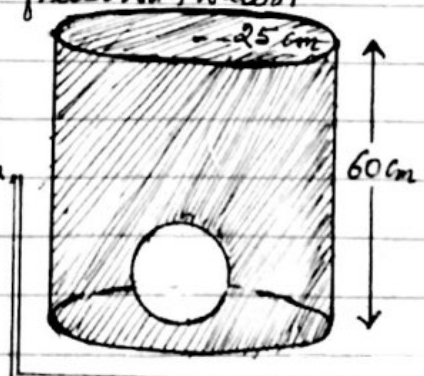
M-16/42/Q10

Q8(a) Calculate the volume of a metal sphere of radius 15 cm and show that it rounds to 14140 cm^3 , correct to 4 significant figures. --- [2]

(b) (i) The sphere is placed inside an empty cylindrical tank of radius 25 cm and height 60 cm. The tank is filled with water.

Calculate the volume of water required to fill the tank. --- [3]

(ii) The sphere is removed from the tank.



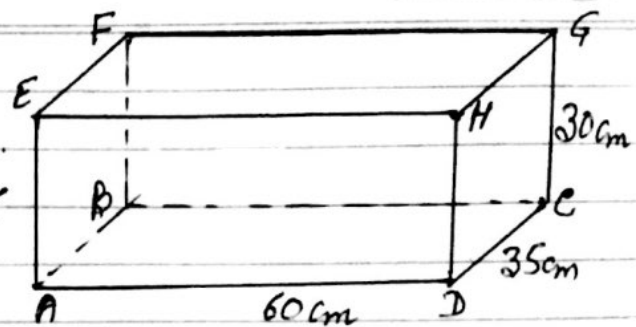
Calculate the depth, d , of the water in the tank. --- [2]

(c) The sphere is melted down and the metal is made into a solid cone of height 54 cm. S-16/41/Q4

(i) Calculate the radius of the cone. --- [3]

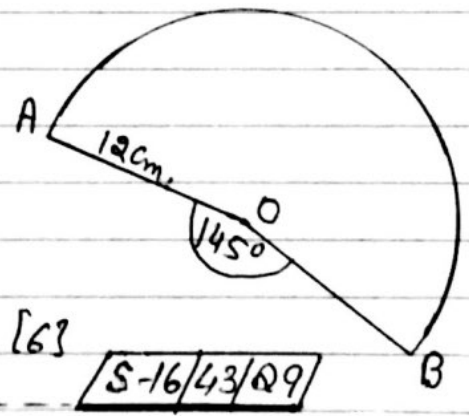
(ii) Calculate the total surface area of the cone. --- [4]

Q9 The diagram shows a cuboid.
 $AD = 60\text{cm}$, $CD = 35\text{cm}$ and $CG = 30\text{cm}$.



- (a) Write down the number of planes of symmetry of this cuboid. --- [1]
- (b) (i) Work out the surface area of the cuboid. --- [3]
- (ii) Write your answer to part (b)(i) in square metres. -- [1]
- (c) Calculate. (i) the length AG. -- [4]
- (ii) the angle between AG and the base ABCD. -- [3]
- (d) (i) Show that the volume of the cuboid is 63000cm^3 . -- [1]
- (ii) A cylinder of height 40cm has the same volume as the cuboid. Calculate the radius of the cylinder. S-16/42/Q6 --- [3]

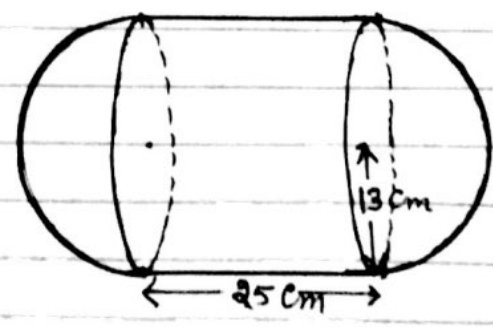
Q10 The diagram shows a sector, centre O, and radius 12cm .



- (a) Calculate the area of the sector. --- [3]
- (b) The sector is made into cone by joining OA and OB. Calculate the volume of the cone. --- [6]

S-16/43/Q9

Q11 (a) The diagram shows a solid made up of a cylinder and two hemispheres. The radius of the cylinder and the hemisphere is 13cm . The length of the cylinder is 25cm .

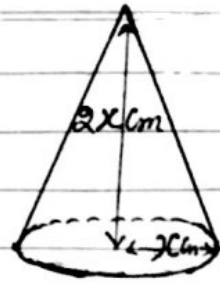


- (i) One cubic centimetre of the solid has a mass of 2.3g . --- [4]
 Calculate the mass of the solid. Give your answer in kilograms.
- (ii) The surface of the solid is painted at a cost of $\$4.70$ per square metre. Calculate the cost of painting the solid. --- [4]

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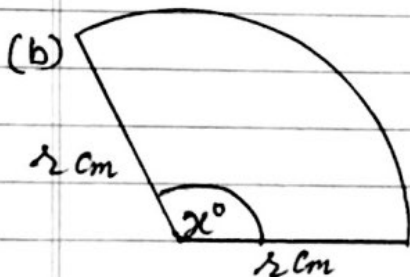
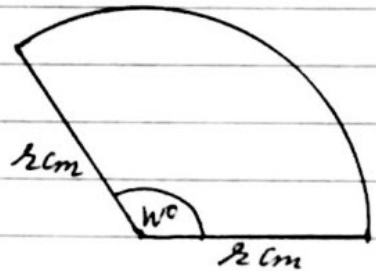
Q11(b) The cone in the diagram has radius x cm, and height $2x$ cm. The volume of the cone is 500cm^3 . Find the value of x . --- [3]



(c) Two mathematically similar solids have volumes 180cm^3 and 360cm^3 . The surface area of the smaller solid is 180cm^2 . Calculate the surface area of the larger solid. [3]

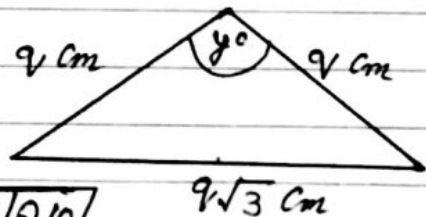
W-16/41/Q3

Q12(a) The area of this sector is $2r^2$ cm. Find the value of N . --- [3]



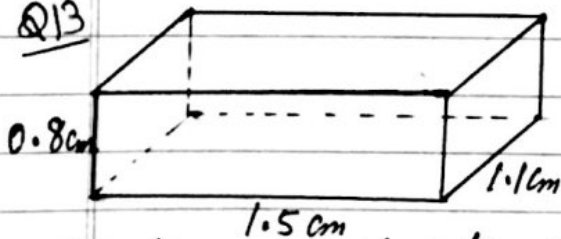
The perimeter of this sector is $2r + \frac{7\pi r}{10}$ cm. Find the value of x . --- [3]

(c) The perimeter of the isosceles triangle is $2q + q\sqrt{3}$ cm. Find the value of y . --- [4]



W-16/41/Q10

Q13

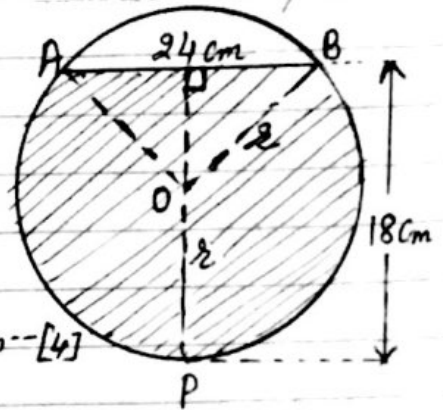


The diagram shows two sweets. The cuboid has length 1.5 cm , width 1.1 cm and height 0.8 cm . The cylinder has height 0.8 cm , and the same volume as the cuboid.

- (i) Calculate the volume of the cuboid. --- [2]
- (ii) Calculate the radius of the cylinder. --- [2]
- (iii) Calculate the difference between the surface areas of the two sweets. --- [5]

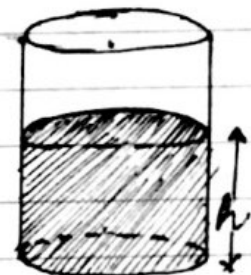
W-16/42/Q6(a)

Q14 The diagram shows the cross section of a cylinder, centre O , radius r , lying on its side. The cylinder contains water to a depth of 18cm . The width, AB , of the surface of the water is 24cm .



- (a) Use an algebraic method to show that $r = 13\text{cm}$. --- [4]
 (b) Show that angle $AOB = 134.8^\circ$, correct to one decimal place. --- [2]
 (c) (i) Calculate the area of the major sector $OAPB$. --- [3]
 (ii) Calculate the area of the shaded segment APB . --- [3]
 (iii) The length of cylinder is 40cm .
 Calculate the volume of water in the cylinder. --- [1]

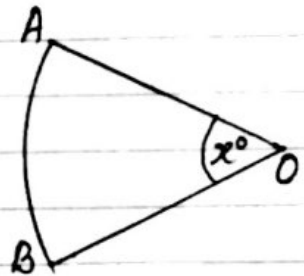
- (d) The cylinder is turned so that it stands on one of its circular ends. In this position, the depth of the water is h . Find h . --- [2]



W-16/43/Q8

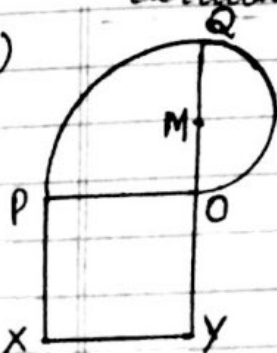
Q15(a) The diagram shows a sector of a circle with centre O and radius 24cm .

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



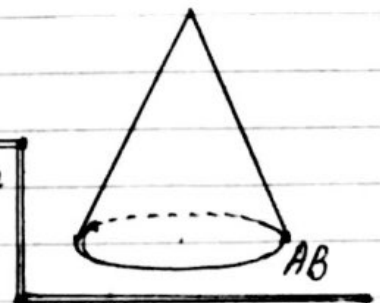
Calculate the volume of the cone. --- [6]

(b)

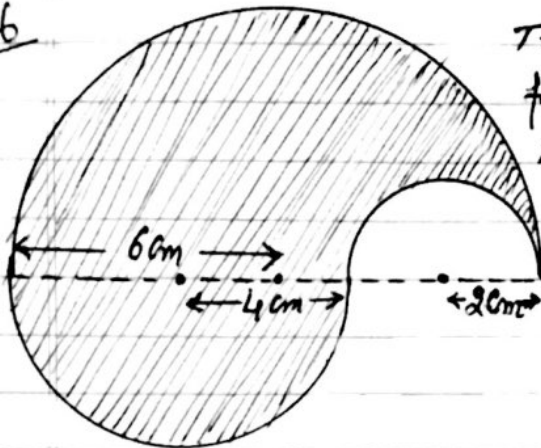


The diagram shows a shape made from a square, a quarter circle and a semi-circle. $OPXY$ is a square of side 8cm . OPQ is quarter circle, centre O .

The line OMQ is a diameter of the semi-circle. --- [5]
 Calculate the area of the shape. M-15/42/Q8



Q16



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

(i) Calculate the perimeter of the shaded shape. --- [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. --- [5]

S-15/41/Q9(b)

Q17 The diagram shows a solid made from a hemisphere and a cone.

(a) The total surface area of the solid is $\frac{115\pi}{4} \text{ mm}^2$.

Show that the slant height, l , is 6.5 mm.

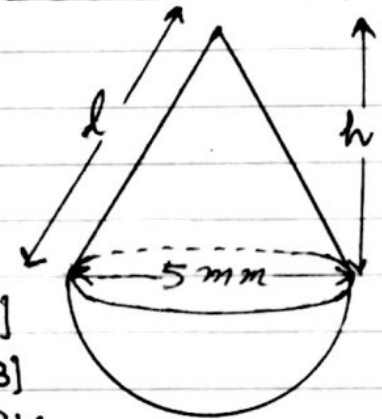
--- [4]

(b) Calculate the height, h , of the cone --- [3]

(c) Calculate the volume of the solid. --- [4]

(d) The solid is made from gold. 1 cubic centimetre of gold has a mass 19.3 grams. The value of 1 gram of gold is \$ 38.62.

Calculate the value of the gold used to make the solid. --- [3]

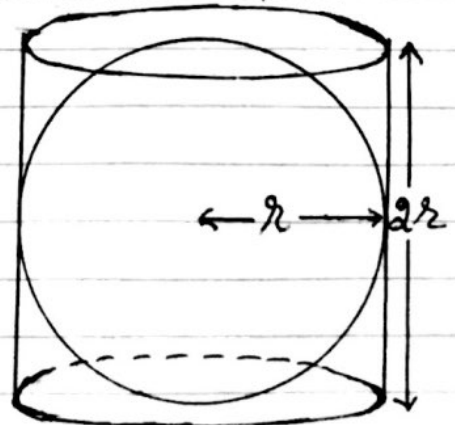


W-17/41/Q8

Q18(a) A sphere of radius ' r ' is inside a closed cylinder of radius ' r ' and height ' $2r$ '.

(i) When $r = 8 \text{ cm}$, calculate the volume inside the cylinder which not occupied by the sphere. --- [3]

(ii) Find ' r ' when the volume inside the cylinder not occupied by the sphere is 36 cm^3 . --- [3]



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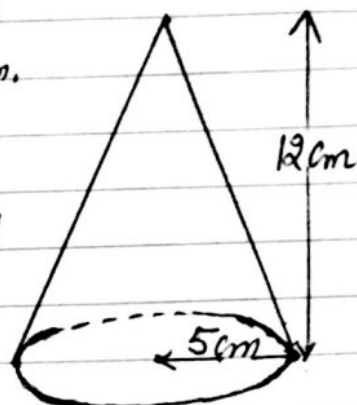
Q18(b) The diagram shows a solid cone with radius 5 cm, and perpendicular height 12 cm.

(i) The total surface area is painted at a cost of \$0.015 per cm^2 .

Calculate the cost of painting the cone. --- [4]

(ii) The cone is made of metal and is melted down and made into smaller solid cones with radius 1.25 cm and perpendicular height 3 cm,

Calculate the number of smaller cones that can be made. --- [3]



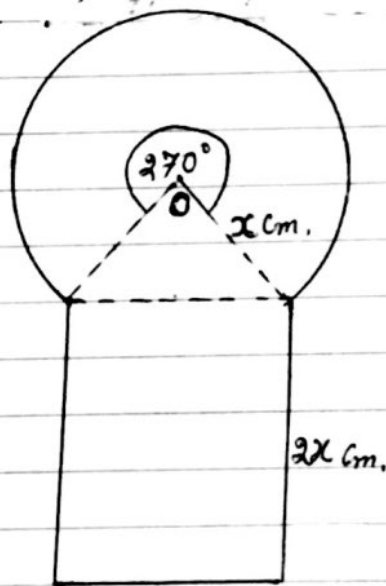
Q19 The diagram shows a sector of a circle, a triangle and a rectangle.

The sector has centre O, radius x cm, and angle 270° . The rectangle has length $2x$ cm.

The total area of the shape is $Kx^2 \text{ cm}^2$.

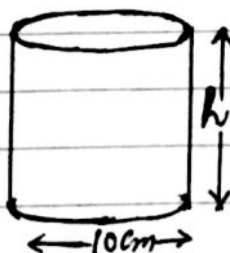
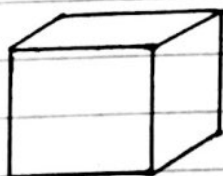
(a) Find the value of K . --- [5]

(b) Find the value of x when the total area is 110 cm^2 . --- [2]



W-17/42/Q10

Q20 (a)



The diagram shows a cube, a cylinder and a hemisphere.

The volume of each of these solids is 2000 cm^3 .

(i) Work out the height, h , of the cylinder. --- [2]

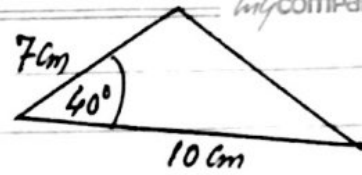
(ii) Work out the radius, r , of the hemisphere. --- [3]

(iii) Work out the surface area of the cube. --- [3]

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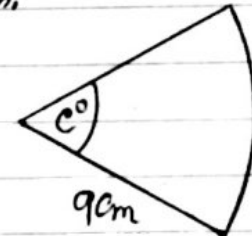
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Q 20 (b) (i) Calculate the area of the triangle, --- [2]



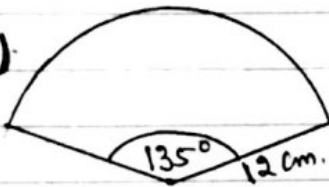
(ii) Calculate the perimeter of the triangle, and show that it is 23.5 cm, correct to 1 decimal place. Show all your working. --- [5]

(c) The perimeter of this sector of a circle is 28.2 cm. Calculate the value of c . --- [3]



W-17/43/A6

Q 21 (a)



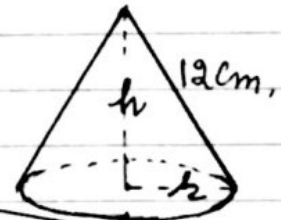
A sector of a circle has radius 12 cm, and an angle of 135° .

(i) Calculate the length of the arc of this sector. Give your answer as a multiple of π . --- [2]

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

(a) Calculate the base radius, r . --- [2]

(b) Calculate the height of the cone, h . --- [3]



(b)



The diagram shows a plant pot.

It is made by removing a small cone from a larger cone and adding a circular base.

This is the cross section of the pot.

(i) Find h . --- [3]

(ii) Calculate the total surface area of the outside of the plant pot. --- [3]

(c) Some cones are mathematically similar.

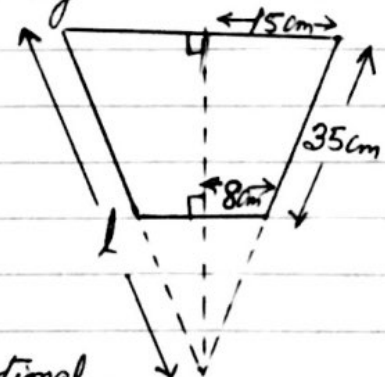
For these cones, the mass, M grams, is proportional to the cube of the base radius, r cm.

One of the cones has mass 1458 grams and base radius 4.5 cm.

(i) Find an expression for M in terms of r . --- [2]

(ii) Two of the cones have radii in the ratio 2:3

Write down the ratio of their masses. --- [1]



S-15/42/A4

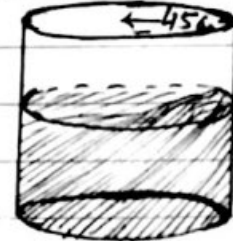
Q22(a) The total surface area of a cone is given by the formula $A = \pi r l + \pi r^2$

(i) Find A when $r = 6.2\text{cm}$ and $l = 10.8\text{cm}$. --- [2]

(ii) Rearrange the formula to make l the subject. --- [2]

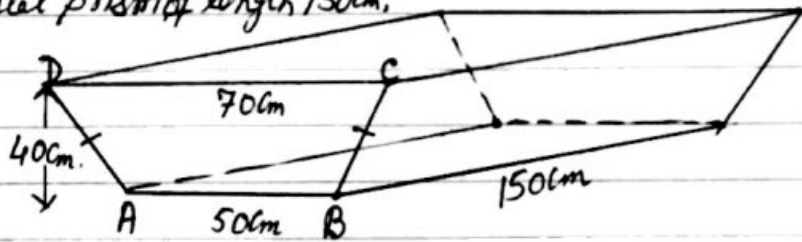
S-15/43/Q27(a)

Q23(a) A cylindrical tank contains $180\,000\text{cm}^3$ of water. The radius of the tank is 45cm . Calculate the height of water in the tank. --- [2]



(b) The diagram shows an empty tank in the shape of a horizontal prism of length 150cm .

The cross section of the prism is an isosceles trapezium $ABCD$.



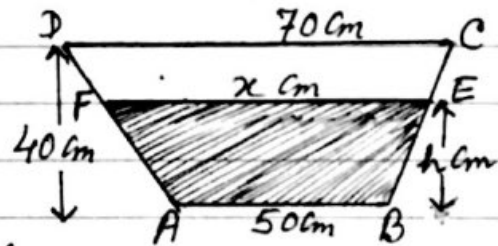
$AB = 50\text{cm}$, $CD = 70\text{cm}$ and the vertical height of the trapezium is 40cm .

(i) Calculate the volume of the tank. --- [3]

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

(c) The $180\,000\text{cm}^3$ of water flows from the tank in part (a) into the tank in part (b) at a rate of $15\text{cm}^3/\text{s}$. Calculate the time this takes. Give your answer in hours and minutes. --- [3]

(d) The $180\,000\text{cm}^3$ of water reaches the level EF as shown in the fig. $EF = x\text{cm}$, and the height of the water is $h\text{cm}$.



(i) Using the properties of similar triangles, show that $h = 2(x - 50)$. --- [2]

(ii) Using $h = 2(x - 50)$, show that the shaded area, in cm^2 , is $x^2 - 2500$. [1]

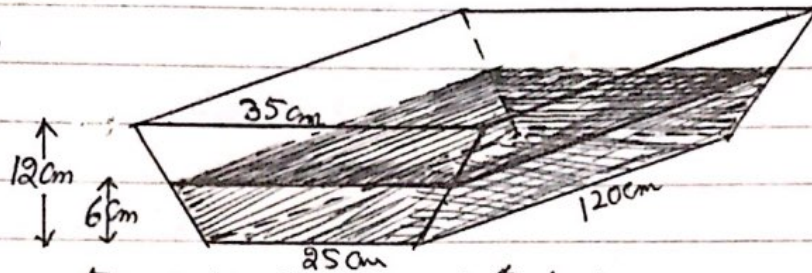
(iii) Find the value of x . --- [2]

(iv) Find the value of h . --- [1]

S-15/43/Q28/

Q24

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



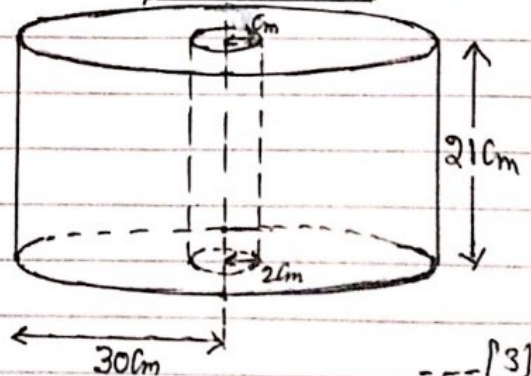
The cross section of this prism is trapezium.

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. --- [3]
- (b) The trough contains water to depth of 6 cm.
- (i) Show that the volume of water is 19800 cm^3 . -- [2]
- (ii) Calculate the percentage of the trough that contains water. --- [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. -- [4]
- (d) The water from the trough first fills a cylinder of radius r cm, and height $3r$ cm. Calculate the value of r . --- [3]
- (e) The cylinder has a mass of 1.2 kg. 1 m^3 of water has a mass of 1000 kg. Calculate the total mass of the cylinder and the water. Give your answer in kilograms. --- [2]

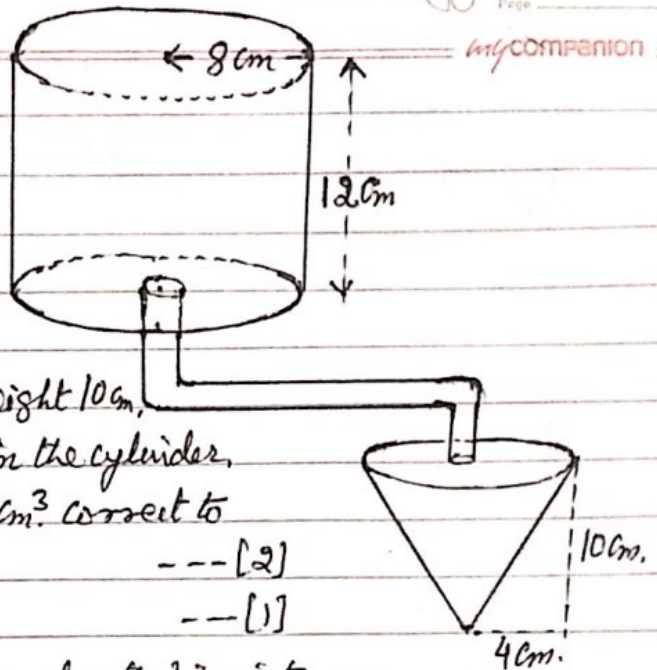
Q25

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 the paper roll is 30 cm.



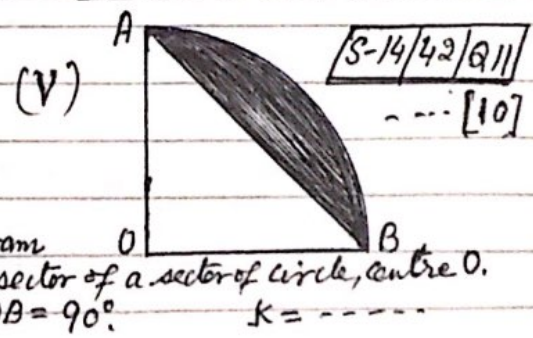
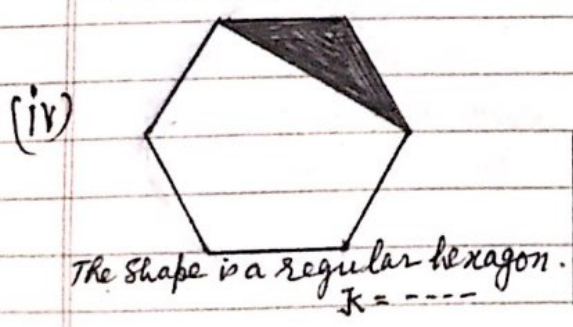
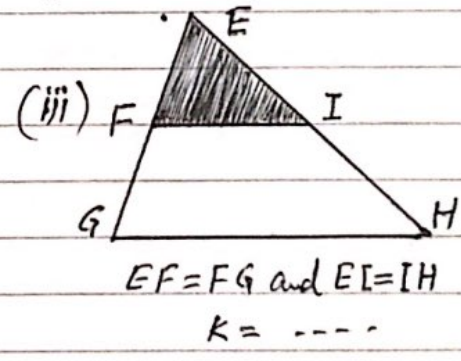
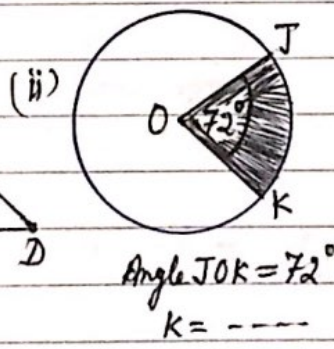
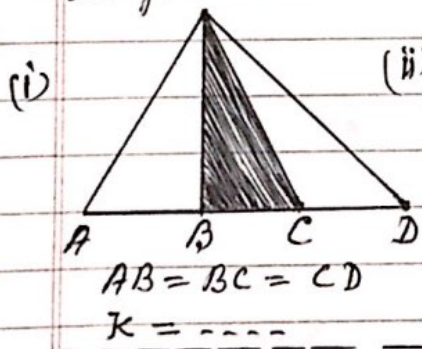
- (i) Calculate the volume of paper in a roll. --- [3]
- (ii) The paper is cut into sheets which measure 21 cm by 29.7 cm. Thickness of each sheet is 0.125 mm.
- (a) Change 0.125 millimetres into centimetres. -- [1]
- (b) Work out how many whole sheets of paper can be cut from a roll. --- [4]

Q26 The diagram shows a cylinder with radius 8cm and height 12cm, which is full of water. A pipe connects the cylinder to a cone.



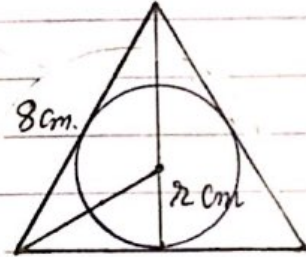
- (a) (i) Calculate the volume of water in the cylinder, show that it rounds to 2410 cm^3 correct to 3 significant figures. --- [2]
 (ii) Change 2410 cm^3 into litres. --- [1]
- (b) Water flows from the cylinder along the pipe into the cone at a rate of 2 cm^3 per second. Calculate the time taken to fill the empty cone. Give your answer in minutes and seconds correct to the nearest second. --- [4]
- (c) Find the number of empty cones which can be filled completely from the full cylinder, 5-14/42/25 --- [3]

Q27 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.



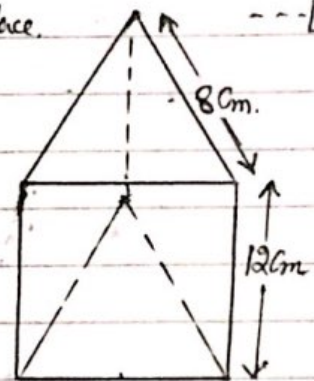
Q28 The total surface area of a cone with radius $2r$ and slant height $3r$ is equal to the area of a circle with radius r .
Show that $r = 2x$ S-14/43/Q28(b) --- [4]

Q29 (a) The three sides of an equilateral triangle are tangents to a circle of radius r cm. The sides of the triangle are 8 cm long. Calculate the value of r .



Show that it rounds to 2.3, correct to 1 decimal place. --- [3]

(b) The diagram shows a box in the shape of a triangular prism of height 12 cm. The cross-section is an equilateral triangle of side 8 cm. Calculate the volume of the box. --- [4]

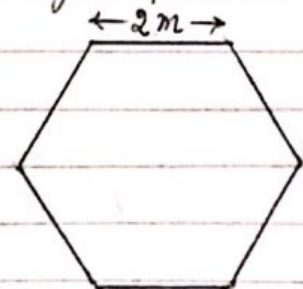
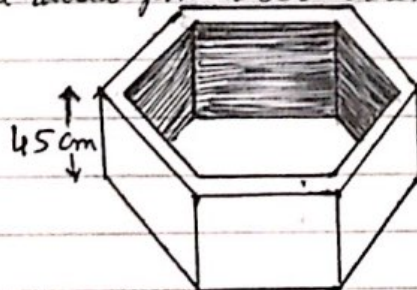


(c) The box contains biscuits. Each biscuit is a cylinder of radius 2.3 cm and height 4 mm. Calculate.

- (i) The largest number of biscuits that can be placed in the box. --- [3]
- (ii) the volume of one biscuit in cubic centimetres --- [2]
- (iii) the percentage of the volume of the box not filled with biscuits. --- [3]

S-14/43/Q10

Q30 Teresa builds a raised garden bed in the shape of a hexagonal prism.



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 cross-section of the inside of the garden bed is 10.4 m^2 , correct to 3 significant figures. --- [3]
- (ii) Calculate the volume of soil needed to fill the garden bed. --- [2]

(continued →)

Continued →

Q 30 (iii) Teresa wants to fill the garden bed with organic top soil. She sees this advertisement in the local garden centre.

Organic top soil is sold in one tonne bags.

Organic Top Soil	Number of tonnes purchased		
	1 to 5	6 to 10	over 10
Cost per tonne	\$47.00	\$45.50	\$44.00

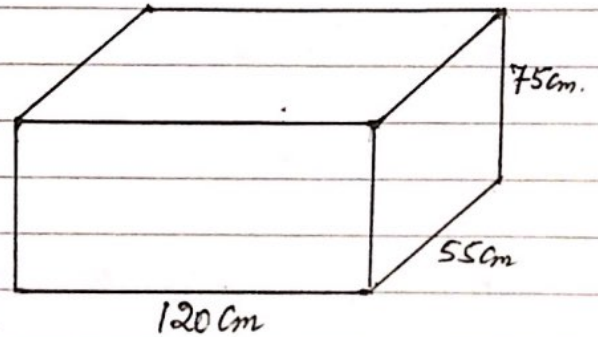
1 m^3 of organic top soil has a mass of 1250 kg.

Calculate the cost of the organic top soil needed to fill the garden bed completely. [1 tonne = 1000 kg] --- [4]

W-14/41/Q1(b)

Q 31 The diagram shows a water tank in the shape of a cuboid measuring 120 cm by 55 cm by 75 cm.

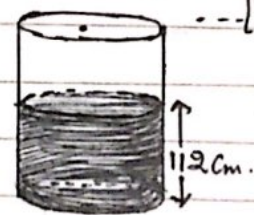
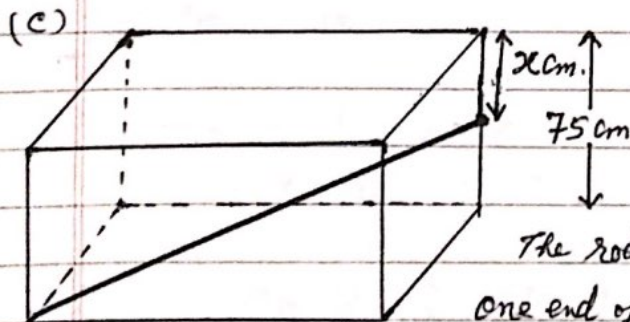
The tank is filled completely with water.



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

(b) (i) The water from the tank flows into an empty cylinder at a uniform rate of 750 millilitres per seconds. Calculate the length of time, in minutes, for the water to be completely emptied from the tank. --- [2]

(ii) When the tank is completely empty, the height of the water in the cylinder is 112 cm. Calculate the radius of the cylinder. --- [3]

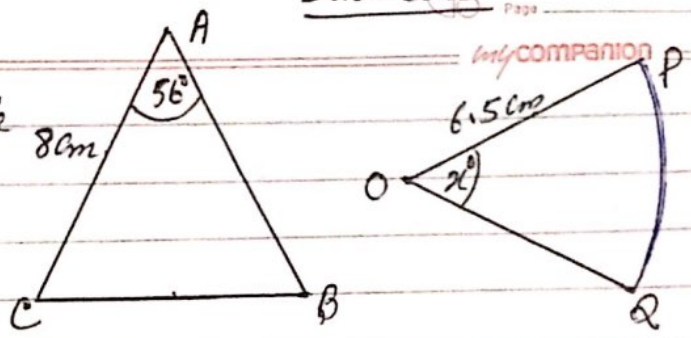


The rod of length 145 cm is placed inside the water tank. One end of the rod is in the bottom corner of the tank as shown. The other end of the rod is x cm below the top corner of the tank as shown. Calculate the value of x . --- [4]

(d) Calculate the angle that the rod makes with the base of the tank. --- [3]

W-14/42/Q7

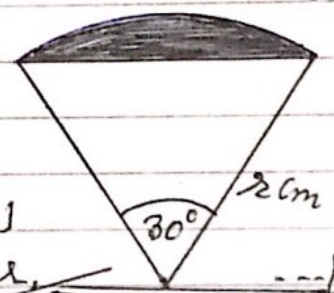
Q32 The diagram show a triangle and a sector of a circle,
In $\triangle ABC$, $AB = AC = 8\text{cm}$,
and angle $BAC = 56^\circ$
Sector OPQ has centre O ,
sector angle x and radius 6.5 .



- (a) Show that the area of triangle ABC is 26.5cm^2 correct to 1 decimal place. ---[3]
 (b) The area of sector OPQ is equal to the area of triangle ABC .
 (i) Calculate the sector angle x . ---[3]
 (ii) Calculate the perimeter of the sector OPQ . ---[3]

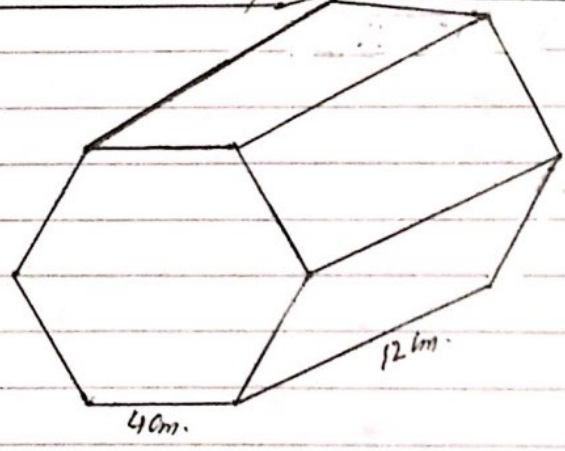
W-14/43/Q7

(c) The diagram shows a sector of a circle,
radius 2cm ,



- (i) Show that the area of the shaded segment is
 $\frac{1}{4}r^2 \left(\frac{1}{3}\pi - 1 \right) \text{cm}^2$ ---[4]
 (ii) The area of segment is 5cm^2 . Find the value of x . ---[3]

Q33 (a) The diagram shows a prism of
length 12cm . The cross-section
is a regular hexagon of side 4cm .
Calculate the total surface area of
the prism. ---[4]

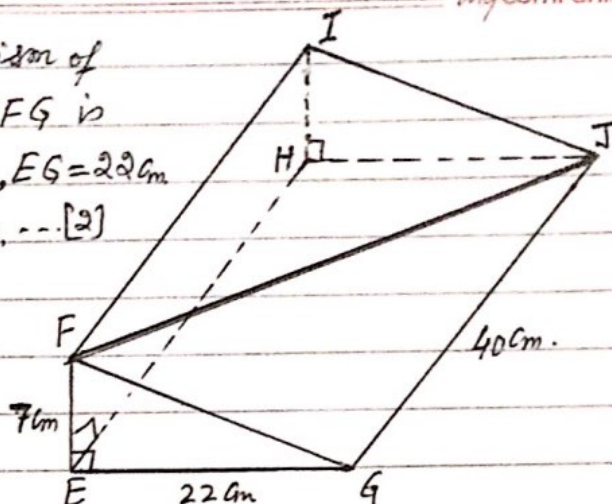


- (b) Water flows through a cylindrical
pipe of radius 0.74cm .
It fills a 12 litre bucket in 4 minutes.
 (i) Calculate the speed of water through the pipe in centimetres per minute. ---[4]
 (ii) When the 12 litre bucket is emptied into a circular pool, the water level ---[5]
 rises by 5 millimetres. Calculate the radius of the pool correct to the nearest cm.

S-13/42/Q9

Q34 EFGHIJ is a solid metal prism of length 40 cm. The cross-section EFG is right-angled triangle. $EF = 7\text{ cm}$, $EG = 22\text{ cm}$

- (a) Calculate the volume of the prism. --- [2]
 (b) Calculate the length FJ. --- [4]
 (c) Calculate the angle between FJ and the base EGJH of the prism. --- [3]

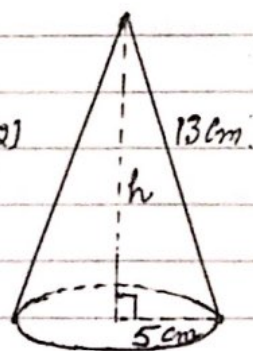


- (d) The prism is melted and made into spheres. Each sphere has a radius 1.5 cm. Work out the greatest number of spheres that can be made. --- [3]
 (e) (i) A right-angled triangle is the cross section of another prism. --- [2]
 This triangle has a height 4.5 cm and base 11.0 cm. Both measurements are correct to 1 decimal place. Calculate the upper bound of this triangle.
 (ii) Write your answer to part (e)(i) correct to four significant figures. [1]

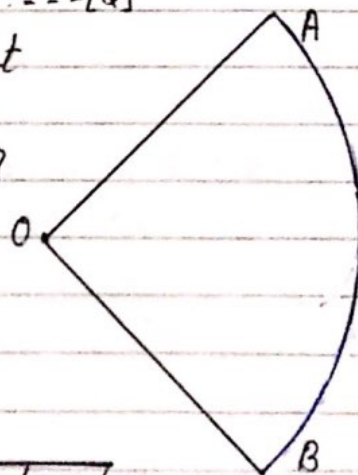
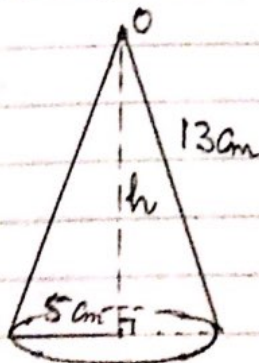
5-13/43/Q4

Q35 (a) The diagram shows a cone of radius 5 cm and slant height 13 cm.

- (i) Calculate the curved surface area of the cone. --- [2]
 (ii) Calculate the perpendicular height, h , of the cone. --- [3]
 (iii) Calculate the volume of the cone. --- [2]
 (iv) Write your answer to part (a)(iii) in cubic metres. Give your answer in standard form. --- [2]

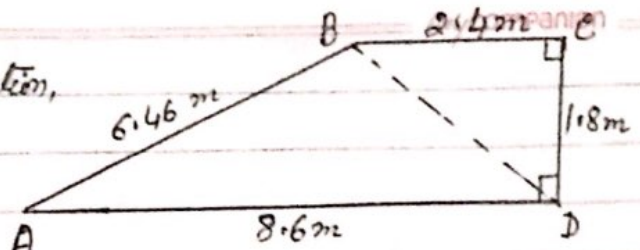


(b) The cone is now cut along a slant height and it opens out to make the sector AOB of a circle. Calculate angle AOB. --- [4]



W-13/41/Q3

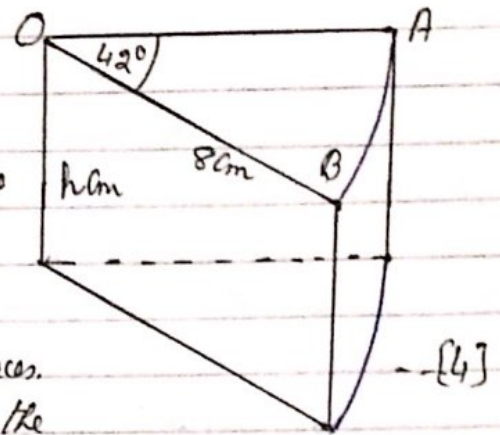
Q36 The diagram shows the cross section, ABCD, of a ramp.



- (a) Calculate angle DBC. --- [2]
- (b) (i) Show that BD is exactly 3m. --- [2]
- (ii) Use the cosine rule to calculate angle ABD.
- (c) The ramp is a prism of width 4m. Calculate the volume of this prism. --- [3]

W-13/42/Q3

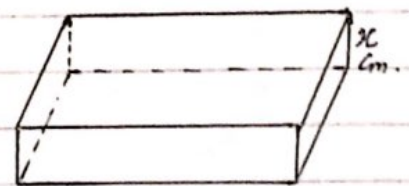
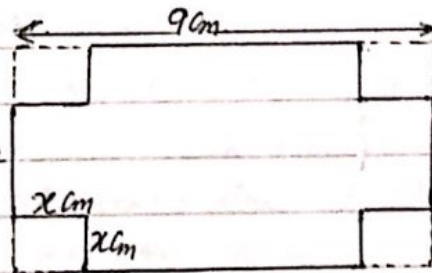
Q37 A wedge of cheese in the shape of a prism is cut from a cylinder of cheese of height h cm. The radius of the cylinder, OA, is 8 cm and angle AOB = 42°



- (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. --- [4]
- (ii) Calculate the total surface area of the wedge of cheese. --- [5]
- (b) A mathematically similar wedge of cheese has a volume of 22.5 cm^3 . Calculate the height of this wedge. --- [3]

W-13/42/Q4

Q38 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 the width of the box. --- [2]
- (b) Show that the volume, V , of the box is $4x^3 - 3x^2 + 63x$. --- [2]
- (c) Complete this table of values for $V = 4x^3 - 3x^2 + 63x$. --- [2]

x	0	0.5	1	1.5	2	2.5	3	3.5
V	0		35	36	30		9	0

(Continued →)

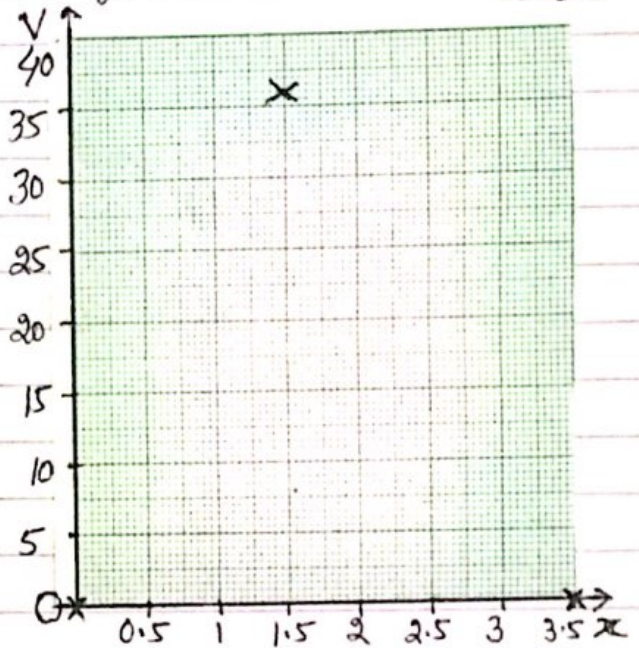
(Continued →)

Q38(d) On the grid opposite, draw the graph of $V = 4x^3 - 32x^2 + 63x$ for $0 \leq x \leq 3.5$. Three of the points have been plotted for you. --- [3]

(e) The volume of the box is at least 30 cm^3 . Write down, as an inequality, the possible values of x . --- [2]

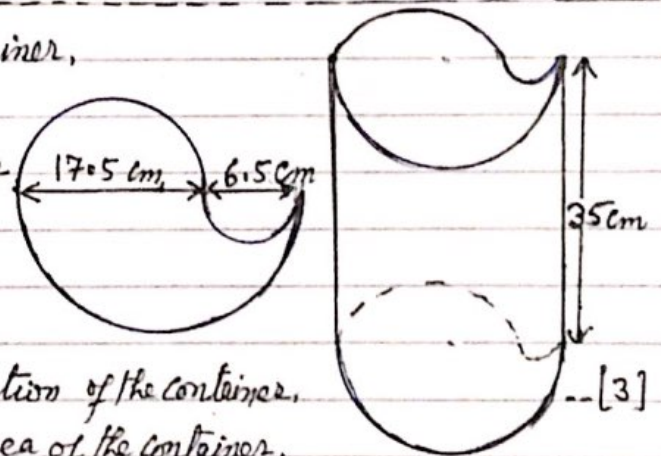
(f)(i) Write down the maximum volume of the box. --- [1]

(ii) Write down the value of x which gives the maximum volume. --- [1]



W-13/43/Q3

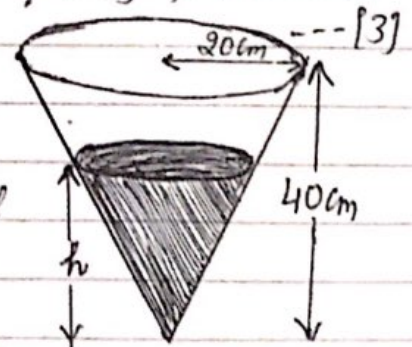
Q39 Sandra has designed this open container, the height of the container is 35 cm , the cross section of the container is designed from three semi-circles with diameters 17.5 cm , 6.5 cm , and 24 cm .



- (a) Calculate the area of the cross section of the container. --- [3]
 (b) Calculate the external surface area of the container, including the base. --- [4]

(c) The container has a height of 35 cm . Calculate the capacity of the container. Give your answer in litres. --- [3]

(d) Sandra's container is completely filled with water. All the water 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 $r = h/2$. --- [1]
 (ii) Find the height, h , of the water in the cone. --- [3]

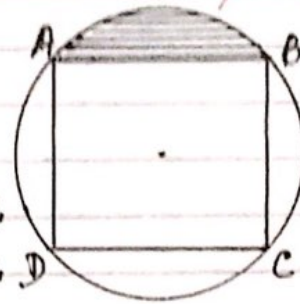
W-13/43/Q6

Q40 The vertices of a square ABCD lie on the circumference of a circle, radius 8cm.

(a) Calculate the area of the square, --- [2]

(b) (i) Calculate the area of the shaded segment, --- [3]

(ii) Calculate the perimeter of the shaded segment, D --- [4]



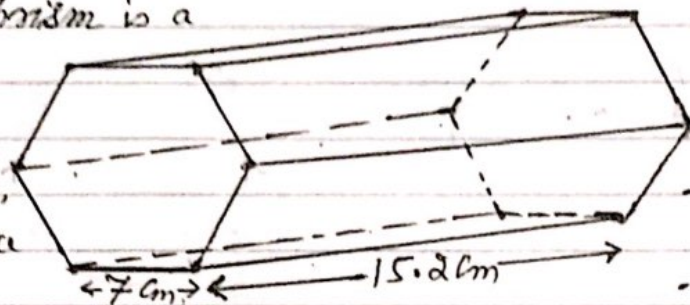
M-18/42/Q2

Q41 (a) The diagram shows a solid prism with length 15.2 cm.

The cross-section of this prism is a regular hexagon with side 7 cm.

(i) Calculate the volume of the prism, --- [5]

(ii) Calculate the total surface area of the prism, --- [3]



(b) Another solid metal prism with volume 500 cm^3 is melted and made into 6 identical spheres. Calculate the radius of each sphere. --- [3]

M-18/42/Q5

Answers

Q1(a)(i) 4.5 cm (ii) 332.3 cm³

(b)(i) $\sqrt{8^2 + (4.5 - 2.7)^2} = 8.2$ (ii) 185

Q2(a) 3.028 or 3.029 (b) 3.919

Q3 (a)(i) $(6-2) \times 180 = 120^\circ$ (ii) $\sqrt{3}x$

(iii) $10 + 2(10-x) \sin 30^\circ$

(b) 12.7

Q4(a) 150890 (ii) 20.5 (iii) 334

(b)(i) 3.28 (ii) 93.1 to 93.6

Q5(a)(i) 94.2 (ii) 9.54 (iii) 89.9

(b) 108° (c) 46.6 to 46.8 cm²

Q6(a)(i) 17.5 cm² (ii) 140 cm³

(b)(i) 2.62 cm (ii) 10.2

Q7(a) 5.2 cm (b)(i) 7.2 cm (ii) 62.4 cm³

Q8 (a) 14137 (b)(i) 104000 (ii) 52.8

(c)(i) 15.8 (ii) 3580

Q9 (a) 3 (b)(i) 9900 cm² (ii) 0.99

(c)(i) 75.7 cm (ii) 23.4

(d)(i) 30 x 35 x 60 = 63000 (ii) 22.4

Q10 (a) 270 cm² (b) 518 cm³

Q11 (a) 51.7 kg (ii) 1.96

(b) 6.2 cm (c) 286 cm²

Q12 (a) 115° (b) 126° (c) 120°

Q13 (i) 1.32 cm³ (ii) 0.725 (iii) 0.513 cm²

Q14 (a) Use Pythagoras theorem. Use (18-x)

$12^2 + (18-x)^2 = x^2$; $x = 13$ cm

(b) $2 \times \sin^{-1} \frac{12}{13} = 134.8^\circ$

(c)(i) 332 (ii) 392 (iii) 15700 (d) 29.5

Q15(a)(i) 47.7° (ii) 25.2 (b) 139 cm²

Q16 (i) 37.7 cm (ii) 12100 mm³

Q17 (a) $\pi \times \frac{5}{2} \times l + \frac{1}{2} \times 4\pi \left(\frac{5}{2}\right)^2 = \frac{115\pi}{4}$

$\Rightarrow l = 6.5$ mm

(b) 6 (c) 72 (d) 53.7

Q18(a)(i) 1070 cm³ (ii) 2.58 cm

(b)(i) 4.24 (ii) 64

Q19 (a) 5.68 (b) 4.4 cm

Q20(a)(i) 25.5 (ii) 9.85 (iii) 952

(b)(i) 22.5 (ii) $\sqrt{10^2 + 7^2} - 2 \times 7 \times 10 \cos 40^\circ + 7^2 + 10$

(c) 64.9

Q21(a)(i) 9π (ii) (a) 4.5 (b) 11.1 cm

(b)(i) 75 (ii) 2730

(c)(i) 16x³ (ii) 8:27

Q22(a)(i) 331 (ii) $\frac{A - \pi r^2}{\pi r}$

Q23(a) 28.3 (b)(i) 360000 (ii) 360

(c) 3h 20min (d)(i) $\frac{R}{40} = \frac{1}{2} \frac{(x-50)}{10}$

(d)(ii) $\frac{1}{2} (x+50)(x-50) \times 2$

(d)(iii) 60.8 (iv) 21.7

Q24(a) 43200 (b)(i) 0.5 x (25+30) x 6 x 120

(b)(ii) 45.8 (c) 1h 39min (d) 12.8 (e) 21

Q25 (i) 59112

(ii)(a) 0.0125 (b) 7580

Q26(a)(i) 2412 (ii) 2.41

(b) 1min 24s (c) 14

Q27 (i) $\frac{1}{3}$ (ii) $\frac{72}{360}$ (iii) $\frac{1}{4}$

(iv) $\frac{1}{6}$ (v) $\frac{\pi-2}{\pi}$ (0.3635)

Q28 $\pi x^2 + \pi \times x \times 3x = \pi x^2$

or $x = 2x$ ✓

Q29 (a) $x = 2.3$ (b) 333 cm³

(c)(i) 30 (ii) 6.65 (iii) 40

Answers

Q30 (i) $6 \times 0.5 \times 2 \times 2 \times \sin 60^\circ$
 $= 10.38$ or 10.4 ✓

(ii) 4.67 (iii) 273

Q31 (a) $(120 \times 55 \times 75) \div 1000 = 495$ lit.

(b) (i) 11 min (ii) 37.5

(c) 15 (d) 24.44 to 24.45

Q32 (a) $\frac{1}{2} \times 8 \times 8 \times \sin 56^\circ = 26.52$

(b) (i) 72° (ii) 21.14 to 21.17

(c) (i) $\frac{30}{360} \times \pi \times r^2 - \frac{1}{2} \times r^2 \times \sin 30^\circ$
 $= \frac{1}{4} r^2 (\frac{1}{3} \pi - 1)$

(ii) 20.6 to 20.7

Q33 (a) 371 (b) (i) 1740 (ii) 87

Q34 (a) 3080 m^3 (b) 46.2

(c) 8.7 (d) 217 (e) (i) 25.13875

(e) (ii) 25.14

Q35 (a) (i) 204 cm^2 (ii) 12 cm (iii) 314 cm^3

(iv) 3.14×10^{-4} (b) 138°

Q36 (a) 36.9° (b) (i) $1.8^2 + 2.4^2 = 3$ ✓

(ii) $\angle ABD = 127^\circ$ (c) 39.6 m^3

Q37 (a) (i) $90 \div (\frac{42}{360} \times \pi \times 8^2) = 3.836$

(ii) 131 (b) 2.42

Q38 (a) $9 - 2x, 7 - 2x$

(b) $x(9 - 2x)(7 - 2x) = 4x^3 - 3x^2 + 63x$

(c) 24, 30 (d) broad curve.

(e) $0.65 \leq x \leq 2$

(f) (i) 36 to 37 (ii) 1.2 to 1.4

Q39 (a) 329.7 to 330 (b) 2970

(c) 11.5 (d) (i) $\frac{r}{R} = \frac{20}{40}$ or $r = \frac{R}{2}$

(d) (ii) 35.3

Q40 (a) 128

(b) (i) 18.3 (ii) 23.9

Q41 (a) (i) 1930 (ii) 893

(b) 2.71

