Date 10.10.2019

IG_Maths
0580

Mensuration

Exercise : Paper_4

SP-20 ; M-19, M-18,
S-19, S-18,
W-18

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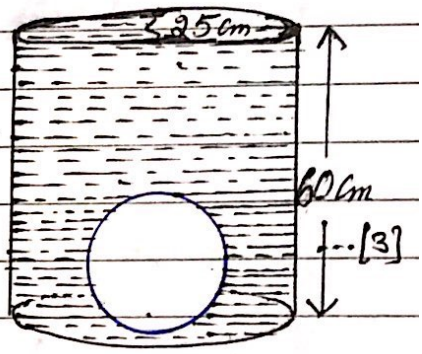
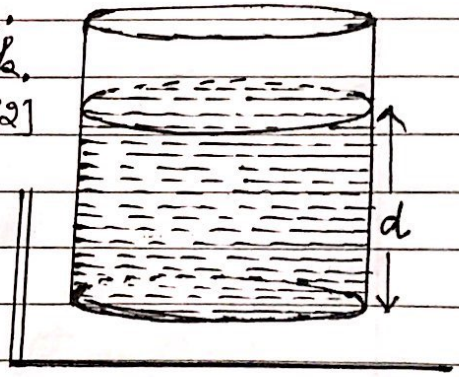
1.(a) Show that the volume of a metal sphere of radius 15cm is 14140 cm^3, correct to 4 significant figures. ---[2]

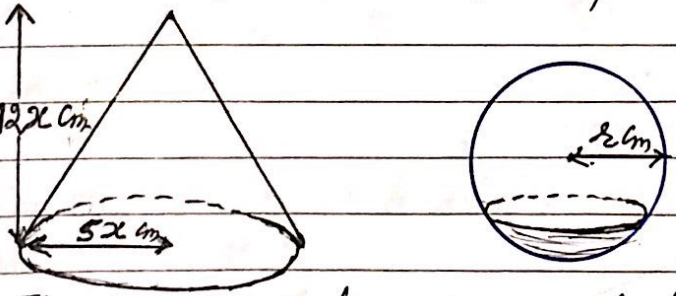
(b) (i) The sphere is placed inside an empty cylindrical tank of radius 25cm. and height 60cm. The tank is filled with water. Calculate the volume of the water needed to fill the tank. ---[3]



(ii) The sphere is removed from the tank. Calculate the depth, d, of water in the tank. ----[2]

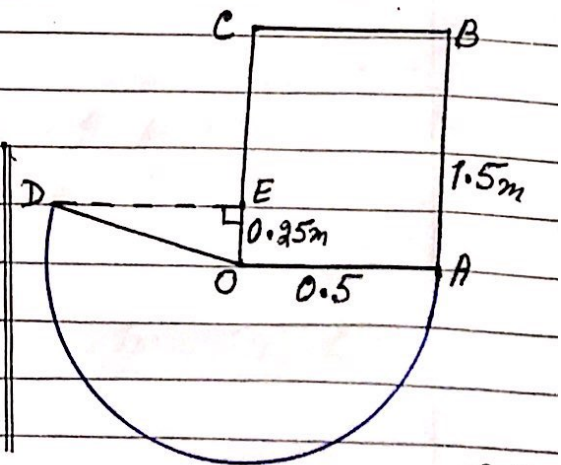


(c) The diagram below shows a solid circular cone and a solid sphere.



The cone has radius 5x cm. and height 12x cm.
The sphere has radius r cm.
The cone has the same total surface area as the sphere.
Show that $r^2 = \frac{45}{2}x^2$ [SP-20/04/Q10] ---[5]

2. The diagram shows a company logo made from a rectangle and a major sector of a circle.
The circle has centre O and radius OA.
OA = OD = 0.5 cm and AB = 1.5 cm.
E is a point on OC such that OE = 0.25 and angle OED = 90°



(a) Calculate the perimeter of the logo. ---[5]
(b) Calculate the area of the logo. ---[3]

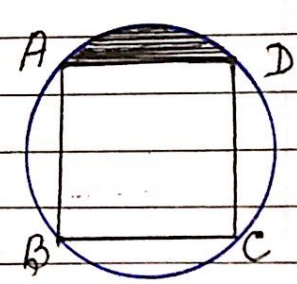
(Continued →)

(continued →)

2 (C) A mathematical similar logo is drawn.
The area of the logo is $77.44\ cm^2$.
(i) Calculate the radius of the major sector in this logo. --[3]
(ii) A gold model is made.
This model is a prism with a cross-section of area $77.44\ cm^2$.
This gold model is 15 mm thick.
One cubic centimetre of gold has a mass of 19 grams.
Calculate the mass of the gold model in kilogram. --[3]

M-19|42|Q6

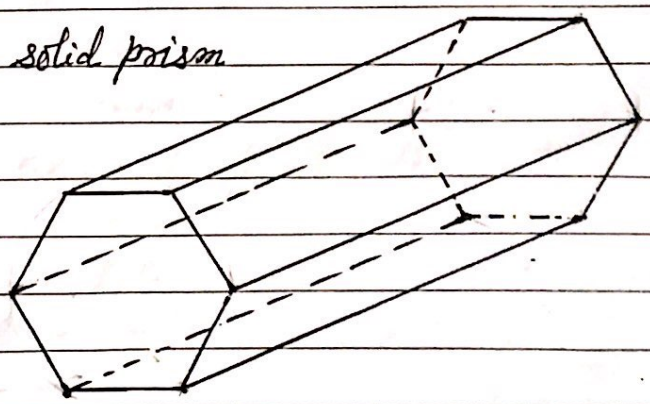
3. The vertices of a square ABCD lie on the circumference of a circle, radius 8 cm.



(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. --[4]

M-18|42|Q2

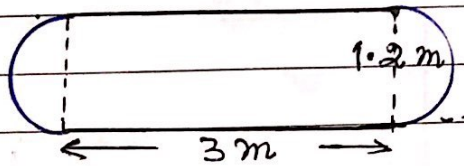
4. The diagram shows a solid prism with length 15.2 cm.
The cross-section of this prism is a regular hexagon with side 7 cm.



(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

5 The diagram shows the surface of a garden pond, made from a rectangle and two semicircles.
The rectangle measures 3m by 1·2m.



(a) Calculate the area of this surface. ---[3]

(b) The pond is a prism and the water in the pond has a depth of 20m.
Calculate the number of litres of water in the pond. ---[3]

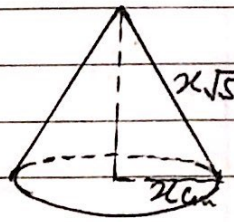
(c) After a rainfall, the number of litres of water in the pond is 100%.
Calculate the increase in depth of water in the pond.
Give your answer in centimetres. S-19|41|Q5 --[3]

6. The volume of each of the following solids is 1000 cm^3.
Calculate the value of x for each solid.

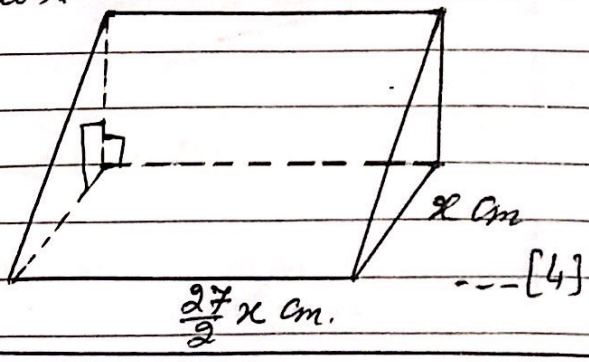
(a) A cube of side length x cm. ---[1]

(b) A sphere with radius x cm. --[3]

(c) A cone with radius x cm and slant height $x\sqrt{5}$ cm.



(d) A prism with a right-angle triangle as its cross-section.



---[4]

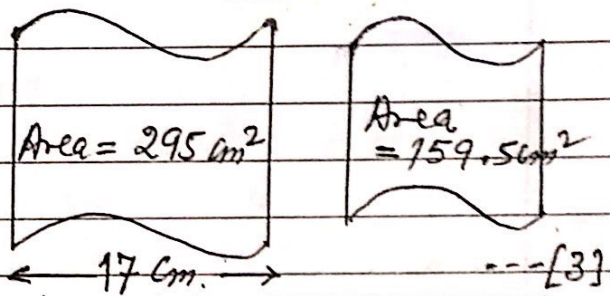
S-19|41|Q10

7(a) The volume of a solid metal solid sphere is 24430 cm^3.
(i) Calculate the radius of the sphere. ---[3]
(ii) The metal sphere is placed in an empty tank.
The tank is a cylinder with radius 50 cm, standing on its circular base.
Water is poured into the tank to a depth of 60 cm. ---[3]
Calculate the number of litres of water needed.

(Continued→)

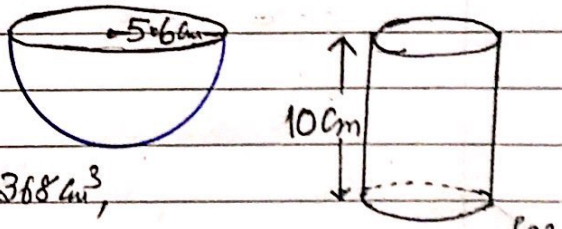
7(b) A different tank is a cuboid measuring 1·8m by 1·5m by 1·2m. Water flows from a pipe into this empty tank at a rate of 200 cm^3 per seconds.
Find the time it takes to fill the tank.
Give your answer in hours and minutes. --[4]

(c) The diagram shows two mathematically similar shapes with areas 295 cm^2 and 159·5 cm^2, the width of the larger shape is 17 cm.



Calculate the width of the smaller shape. ---[3]
[S-19|42|Q10]

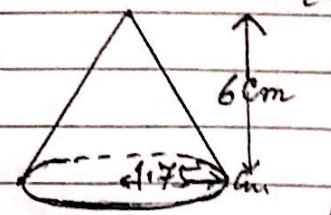
8 (a) The diagram shows a hemispherical bowl of radius 5·6cm, and a cylindrical tin of height 10cm,



(i) Show that the volume of the bowl is 368 cm^3, correct to the nearest cm^3. ---[2]

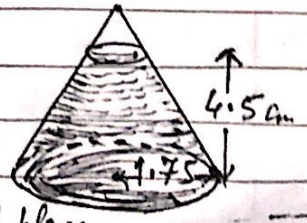
(ii) The tin is completely full of soup.
When all the soup is poured into the empty bowl, 80% of the volume of the bowl is filled.
Calculate the radius of the tin. --[4]

(b) The diagram shows a cone with radius 1·75 cm and height 6 cm.



(i) Calculate the total surface area of the cone. --[5]
[S-19|43|Q4]

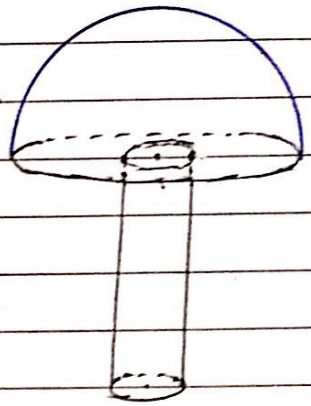
(ii) The cone contains salt to a depth of 4·5 cm.
The top layer of the salt forms a circle that is parallel to the base of the cone.



(a) Show that the volume of the salt inside the cone is 18·9 cm^3, nearest to 1 decimal place. --[4]

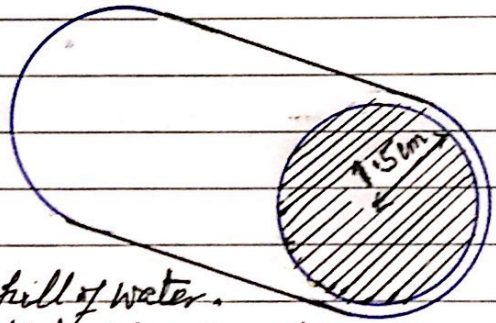
(b) The salt is removed from the cone at constant rate of 200 mm^3 per second.
Calculate the time taken for the cone to be completely emptied.
Give your answer in seconds, correct to nearest second. --[3]

9. A solid hemisphere has volume 230 cm^3.
(a) Calculate the radius of the hemisphere. ---[3]
(b) A solid cylinder with radius 1·6 cm, is attached to the hemisphere to make a toy.
The total volume of the toy is 300 cm^3.
(i) Calculate the height of the cylinder. --[3]
(ii) A mathematically similar toy has volume 19200 cm^3.
Calculate the radius of the cylinder for this toy. ---[3]

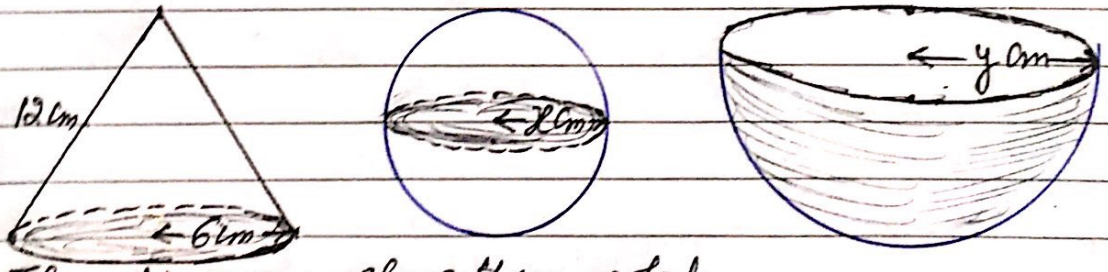


S-18/41/Q6

10. (a) Water flows through a cylindrical pipe at a speed of 8 cm/s.
The radius of the circular cross-section is 1·5 cm, and the pipe is always completely full of water.
Calculate the amount of water that flows through the pipe in 1 hour.
Give your answer in litres. ---[4]



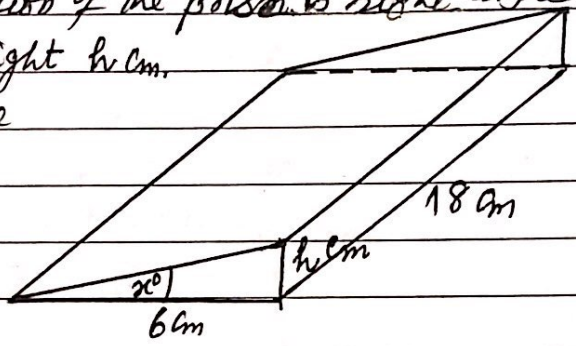
(b)



The diagram shows three solids.
The base radius of the cone is 6 cm and the slant height is 12 cm.
The radius of the sphere is x cm and the radius of the hemisphere is y cm.
The total surface area of each solid is same.
(i) Show that the total surface area of the cone is 108π cm^2. ---[2]
(ii) Find the value of x and the value of y. ---[4]

S-18/43/Q7

11. The diagram shows a prism with length 18 cm and volume 253.8 cm^3. The cross-section of the prism is right angled triangle with base 6 cm and height h cm.



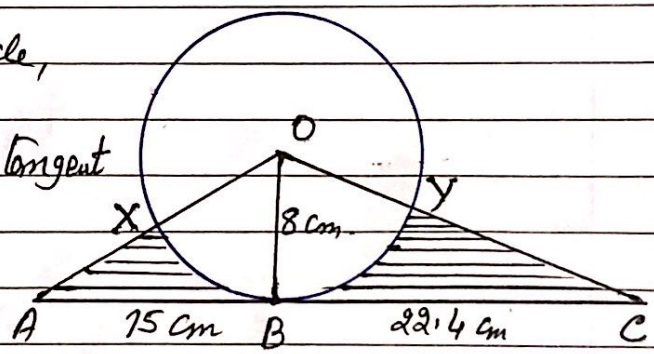
(a) (i) Show that the value of h is 4.7. --[3]

(ii) Calculate the value of x. --[2]

(b) Calculate the total surface area of the prism. --[6]

[W-18|41|Q5]

12. The diagram shows a circle, centre O. The straight line ABC is a tangent to the circle at B. OB = 8 cm, AB = 15 cm and BC = 22.4 cm. AO crosses the circle at X and OC crosses the circle at Y.



(a) Calculate angle XOY. ---[5]

(b) Calculate the length of the arc XBY. --[2]

(c) Calculate the total area of the two shadged regions. --[4]

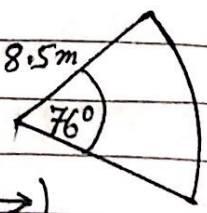
[W-18|41|Q10]

13(a) The lake behind a dam has an area of 55 hectares. When the gates in the dam were open, water flows out at a rate of 75 000 litres per seconds.

(i) Show that 90 million of water flow out in 20 minutes. --[1]

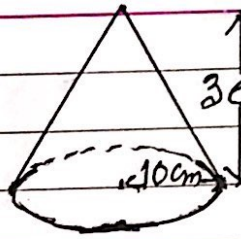
(ii) Beneath the surface, the lake has vetical sides. Calculate the drop in water level of the lake when the gates are open for 20 minutes. Give your answer in centimetres. --[3]

(iii) The cross-section of a gate is a sector of a circle with radius 8.5 m and angle 76°. Calculate the perimeter of the sector. --[3]



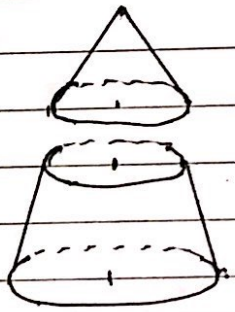
(Continued →)

13(b) A solid metal cone has radius 10cm. and height 36cm.



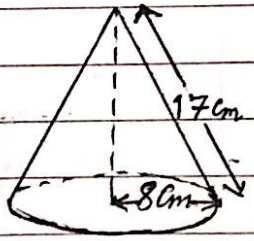
(i) Calculate the volume of this cone. ---[2]

(ii) The cone is cut parallel to its base, to give a smaller cone. The smaller cone is melted down to make two different spheres. The ratio of the radii of these two spheres is 1:2. Calculate the radius of the smaller sphere. ---[4]



W-18/42/10

14(a) The diagram shows a solid cone. The radius is 8cm and the slant height is 17cm.



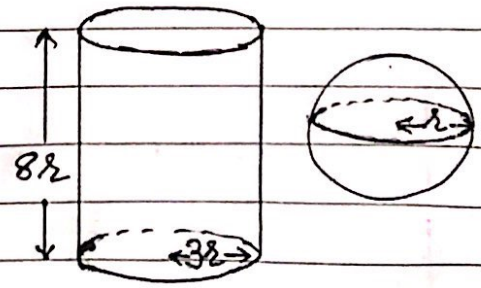
(i) Calculate the curved surface area of the cone. ---[2]

(ii) Calculate the volume of the cone. ---[4]

(iii) The cone is made of wood and $1cm^3$ of the wood has a mass of 0.8g. Calculate the mass of the cone. ---[1]

(iv) The cone is placed in a box. The total mass of the cone and the box is 1.2 kg. Calculate the mass of the box. Give your answer in grams. ---[1]

(b) The diagram shows a solid cylinder and a solid sphere. The cylinder has radius 3r and height 8r. The sphere has radius r.



(i) Find the volume of the sphere as a fraction of the volume of the cylinder. ---[4]

(ii) The surface area of the sphere is $81\pi cm^2$. Find the curved surface area of the cylinder. Give your answer in terms of π. ---[4]

W-18/43/Q3

Answers

1. (a) $\frac{4}{3} \times \pi \times 15^2 = 1413.7$ ✓

(b) (i) 104000 (ii) 52.8

(c) slant height $= \sqrt{(5x)^2 + (12x)^2} = 13x$

$\pi \times (5x)^2 + \pi (5x)(13x) = 4\pi x^2$

$\rightarrow s^2 = \frac{90}{4\pi} x^2 = \frac{45}{2} x^2$ ✓

2. (a) 5.83

(b) 1.21

(c) (i) 4 (ii) 2.20704

3. (a) 128

(b) (i) 18.3 (ii) 23.9

4. (a) (i) 1930 (or 1940) (ii) 893

(b) 2.71.

5. (a) 4.73 (b) 946 (c) 1.28

6. (a) 10 (b) 6.2 (c) 7.82 (d) 6.67

7. (a) (i) 18 (ii) 447.

(b) 4 h 30 mins

(c) 12.5

8. (a) (i) $\frac{1}{2} \times \frac{4}{3} \pi \times 5.6^3 = 367.8$ ✓

(ii) 3.06

(b) (i) 44

(ii) (a) $SF = \frac{1}{4}$

$\frac{1}{3} \pi \times 1.75^2 \times 6 - \frac{1}{3} \pi \times 0.4375^2 \times 1.5$

$= 18.94$ ✓

(b) 95 ✓

9. (a) 4.79

(b) (i) 8.7 (ii) 6.4

10. (a) 204

(b) (i) $\pi \times 6 \times 12 + \pi \times 6^2 = 108\pi$ ✓

(ii) $x = 5.2$; $y = 6$

11. (a) (i) $h = \frac{253.8}{18 \times 6/2} = 4.7$ ✓

(ii) 38.1.

(b) 3.58.

12. (a) 132.26

(b) 18.4

(c) 75.7

13. (a) (i) $75000 \times 60 \times 20$

(ii) 16.4

(iii) 28.3

(b) (i) 3770

(ii) 3.68

14. (a) (i) 427 (ii) 1010

(iii) 804 (iv) 396

(b) (i) $\frac{1}{54}$ (ii) 972π

← X — X →