UNIT 11

MENSURATION

(A) Main Concepts and Results

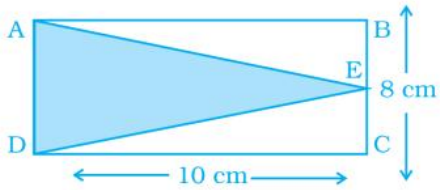
- Length of boundary of a simple closed figure is known as **perimeter**.
- Area is the measure of region enclosed in a simple closed curve.
- Perimeter of a rectangle = 2 (length + breadth).
- Area of a rectangle = length × breadth.
- Perimeter of a square = 4 × side.
- Area of a square = side × side.
- Area of a triangle = $\frac{1}{2}$ × Base × Corresponding Height.
- Area of a parallelogram = Base × Corresponding Height.
- Area of a circle = r^2, where r is the radius.
- Area of a trapezium = $\frac{1}{2}$ × (Sum of parallel sides) × Height.
- Area of a rhombus = $\frac{1}{2}$ × Product of diagonals.
- Lateral surface area of a cube = 4 (side)^2.
- Total surface area of a cube = 6 (side)^2.
- Lateral surface area of a cuboid = 2 × height × (length + breadth).
- Total surface area of a cuboid = $2(lb + bh + hl)$.
- Lateral (curved) surface area of a cylinder = $2\pi rh$.
- Total surface area of a cylinder = $2\pi r\,(r + h)$, where r is the radius and h is the height.

- Amount of space occupied by a solid is called its **volume**.
- Volume of a cube = $(\text{side})^3$.
- Volume of a cuboid = length × breadth × height.
- Volume of a cylinder = $\pi r^2 h$.
- $1\text{cm}^3 = 1\text{ml}$
- $1\text{L} = 1000\ \text{cm}^3$.
- $1\text{m}^3 = 10{,}00{,}000\ \text{cm}^3 = 1{,}000\ \text{L}$.

(B) Solved Examples

In examples 1 and 2, there are four options out of which one is correct. Write the correct answer.

Example 1 : What is the area of the triangle ADE in the following figure?



(a) $45\ \text{cm}^2$ (b) $50\ \text{cm}^2$ (c) $55\ \text{cm}^2$ (d) $40\ \text{cm}^2$

Solution : The correct answer is (d).

Example 2 : What will be the change in the volume of a cube when its side becomes 10 times the original side?

(a) Volume becomes 1000 times.

(b) Volume becomes 10 times.

(c) Volume becomes 100 times.

(d) Volume becomes $\frac{1}{1000}$ times.

Solution : The correct answer is (a).

In examples 3 and 4, fill in the blanks to make the statements true.

Example 3 : Area of a rhombus is equal to _____ of its diagonals.

Solution : Half the product.

Example 4 : If the area of a face of a cube is 10 cm^2, then the total surface area of the cube is _____.

Solution : 60 cm^2.

In examples 5 and 6, state whether the statements are true (T) or false (F).

Example 5 : 1L = 1000 cm^3

Solution : True.

Example 6 : Amount of region occupied by a solid is called its surface area.

Solution : False.

Example 7 : 160 m^3 of water is to be used to irrigate a rectangular field whose area is 800 m^2. What will be the height of the water level in the field?

Solution : Volume of water = 160 m^3

Area of rectangular field = 800 m^2

Let h be the height of water level in the field.

Now, volume of water = volume of cuboid formed on the field by water.

160 = Area of base × height

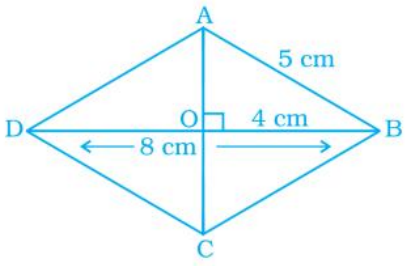
$= 800 \times h$

$$h = \frac{160}{800} = 0.2$$

So, required height = 0.2 m

Example 8 : Find the area of a rhombus whose one side measures 5 cm and one diagonal as 8 cm.

Solution : Let ABCD be the rhombus as shown below.



DO = OB = 4cm, since diagonals of a rhombus are perpendicular bisectors of each other. Therefore, using Pythagoras theorem in ΔAOB,

$AO^2 + OB^2 = AB^2$

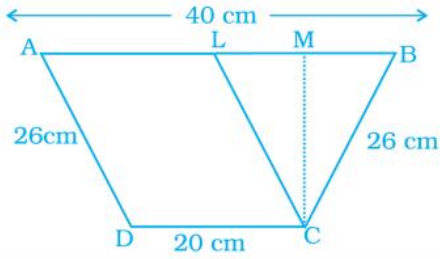
$AO = \sqrt{AB^2 - OB^2} = \sqrt{5^2 - 4^2} = 3$ cm

So, AC = 2 × 3 = 6 cm

Thus, the area of the rhombus = $\frac{1}{2} \times d_1 \times d_2 = \frac{1}{2} \times 8 \times 6$ = 24 cm².

Example 9 : The parallel sides of a trapezium are 40 cm and 20 cm. If its non-parallel sides are both equal, each being 26 cm, find the area of the trapezium.

Solution : Let ABCD be the trapezium such that AB = 40 cm and CD = 20 cm and AD = BC = 26 cm.



Vocabulary Connections

To become familiar with some of the vocabulary terms in the chapter, consider the following:

1. The square root of a number is one of the two equal factors of the number. For example, 3 is a square root because 3 × 3 = 9. How might picturing plant roots help you remember the meaning of square root?
2. The word 'perimeter' comes from the Greek roots *peri*, meaning 'all around,' and *metron*, meaning 'measure.' What do the Greek roots tell you about the perimeter of a geometric figure?
3. To square a number means 'to multiply the number by itself,' as in 2 × 2. Keeping this idea of square in mind, what do you think a perfect square might be?
4. The word 'circumference' comes from the Latin word *circumferre*, meaning to "carry around". How does the Latin meaning help you define the circumference of a circle?

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Now, draw CL ∥ AD

Then ALCD is a parallelogram

So AL = CD = 20 cm and CL = AD = 26 cm.

In ΔCLB, we have

CL = CB = 26 cm

Therefore, Δ CLB is an isosceles triangle.

Draw altitude CM of ΔCLB.

Since Δ CLB is an isosceles triangle. So, CM is also the median.

Then LM = MB = $\frac{1}{2}$BL = $\frac{1}{2}$ × 20 cm = 10 cm

[as BL = AB – AL = (40 – 20) cm = 20 cm].

Applying Pythagoras theorem in ΔCLM, we have

$CL^2 = CM^2 + LM^2$

$26^2 = CM^2 + 10^2$

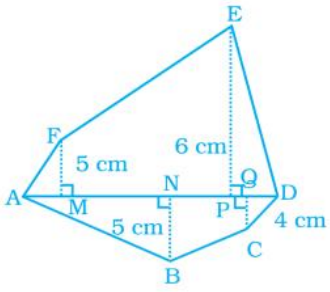
$CM^2 = 26^2 - 10^2 = (26 - 10)(26 + 10) = 16 \times 36 = 576$

CM = $\sqrt{576}$ = 24 cm

Hence, the area of the trapezium = $\frac{1}{2}$ (sum of parallel sides) × Height = $\frac{1}{2}$ (20 + 40) × 24 = 30 × 24 = 720 cm^2.

Example 10 : Find the area of polygon ABCDEF, if AD = 18cm, AQ = 14 cm, AP = 12 cm, AN = 8 cm, AM = 4 cm, and FM, EP, QC and BN are perpendiculars to diagonal AD.

Solution :



In the figure

MP = AP – AM = (12 – 4) cm = 8 cm

PD = AD – AP = (18 – 12) cm = 6 cm

NQ = AQ – AN = (14 – 8) cm = 6 cm

QD = AD – AQ = (18 – 14) cm = 4 cm

Area of the polygon ABCDEF

= area of ΔAFM + area of trapezium FMPE + area of ΔEPD + area of ΔANB + area of trapezium NBCQ + area of ΔQCD.

$= \frac{1}{2} \times AM \times FM + \frac{1}{2}(FM + EP) \times MP + \frac{1}{2} PD \times EP + \frac{1}{2} \times AN \times NB + \frac{1}{2}(NB + CQ) \times NQ + \frac{1}{2} QD \times CQ$

$= \frac{1}{2} \times 4 \times 5 + \frac{1}{2}(5 + 6) \times 8 + \frac{1}{2} \times 6 \times 6 + \frac{1}{2} \times 8 \times 5 + \frac{1}{2}(5 + 4) \times 6 + \frac{1}{2} \times 4 \times 4.$

= 10 + 44 + 18 + 20 + 27 + 8 = 127 cm^2

Application on Problem Solving Strategy



Example 11 :

Horse stable is in the form of a cuboid, whose external dimensions are 70 m × 35 m × 40 m, surrounded by a cylinder halved vertically through diameter 35 m and it is open from one rectangular face 70 m × 40 m. Find the cost of painting the exterior of the stable at the rate of Rs 2/m^2.



Understand and Explore the problem

- What do you know?

  Here you know dimensions of cuboid, L = 70 m, B = 35 m, H = 40 m, diameter of cylinder 35 m and cost of painting Rs. 2 per m^2.
- What fact do you need to solve the question and is not given? Height of cylinder.

Plan a Strategy

- Begin by visualising the shape of the stable and draw it (open from shaded part).
- Think of area to be painted in cuboidal part as well as in cylindrical part.
- Add the two areas calculated in step 2.
- Find cost.

Solve

- Area of cylindrical top be painted

$$= \frac{1}{2} \text{ [T.S.A]}$$

$$= \frac{1}{2} [2\pi R (R + H)]$$

$$= \frac{1}{2}\left[2 \times \frac{22}{7} \times \frac{35}{2}\left(\frac{35}{2} + 70\right)\right]$$

$$= 4812.5 \text{ m}^2$$

- Area of cuboid to be painted = area of three walls

$$= lh + 2bh$$

$$= 70 \times 40 + 2 \times 40 \times 35$$

$$= 2800 + 2800$$

$$= 5600 \text{ m}^2$$

- Total area to be painted

$$= 4812.5 + 5600$$

$$= 10412.5 \text{ m}^2$$

- Cost of painting per m^2 = Rs 2

  Cost of painting 10412.5 m^2 = Rs 10412.5×2

  = Rs 20825

Revise

- Verify your answer by adopting some other plan, i.e. here in this problem instead of taking area in two steps, let's find in one step.

  Area to be painted

  = Area of three walls + Area of cylindrical part.

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$$= 2bh + lh + \frac{1}{2}\,[2\pi RH + 2\pi R^2]$$

$$= h\,[2b + l\,] + [\pi R\,(R + H)]$$

$$= 40\,[2 \times 35 + 70] + \frac{22}{7} \times \frac{35}{2}\left(\frac{35}{2} + 70\right)$$

$$= 40\,[140] + 55 \times 87.5$$

$$= 5600 + 4812.5$$

Final cost (same as in previous method)

Hence verified.

Think and Discuss

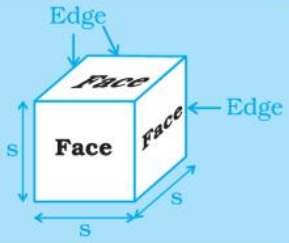
(a) What would be the cost of painting if cylindrical root is not to be painted?

(b) What would be the cost if one face is not included.

Is there any difference in the cost?

A cube is a three-dimensional solid with six square faces.

Its **surface area** is the total area of all Six of its faces. As each face is a square, the formula for surface area of a cube is $\mathbf{A = 6s^2}$



(C) Exercise

In questions 1 to 28, there are four options out of which one is correct. Write the correct answer.

1. A cube of side 5 cm is painted on all its faces. If it is sliced into 1 cubic centimetre cubes, how many 1 cubic centimetre cubes will have exactly one of their faces painted?

(a) 27 (b) 42 (c) 54 (d) 142

2. A cube of side 4 cm is cut into 1 cm cubes. What is the ratio of the surface areas of the original cubes and cut-out cubes?

(a) 1 : 2 (b) 1 : 3 (c) 1 : 4 (d) 1 : 6

3. A circle of maximum possible size is cut from a square sheet of board. Subsequently, a square of maximum possible size is cut from the resultant circle. What will be the area of the final square?

(a) $\frac{3}{4}$ of original square. (b) $\frac{1}{2}$ of original square.

(c) $\frac{1}{4}$ of original square. (d) $\frac{2}{3}$ of original square.

4. What is the area of the largest triangle that can be fitted into a rectangle of length l units and width w units?

(a) $lw/2$ (b) $lw/3$ (c) $lw/6$ (d) $lw/4$

5. If the height of a cylinder becomes $\frac{1}{4}$ of the original height and the radius is doubled, then which of the following will be true?

(a) Volume of the cylinder will be doubled.

(b) Volume of the cylinder will remain unchanged.

(c) Volume of the cylinder will be halved.

(d) Volume of the cylinder will be $\frac{1}{4}$ of the original volume.

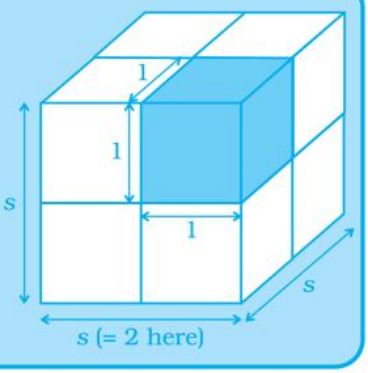
Volume is a measurement of the amount of space inside a three-dimensional object.

It's measured in cubic units and equals the number of unit cubes (cubes whose edges have length 1) that fit inside the object.

In the diagram on the right, each side has a length of 2 units, so two unit cubes fit along each side. (One unit cube is shaded blue.)

You can calculate the volume of cube using the formula.

$V = S \times S \times S$ Or $V = S^3$



6. If the height of a cylinder becomes $\frac{1}{4}$ of the original height and the radius is doubled, then which of the following will be true?

(a) Curved surface area of the cylinder will be doubled.

(b) Curved surface area of the cylinder will remain unchanged.

(c) Curved surface area of the cylinder will be halved.

(d) Curved surface area will be $\frac{1}{4}$ of the original curved surface.

7. If the height of a cylinder becomes $\frac{1}{4}$ of the original height and the radius is doubled, then which of the following will be true?

(a) Total surface area of the cylinder will be doubled.

(b) Total surface area of the cylinder will remain unchanged.

(c) Total surface of the cylinder will be halved.

(d) None of the above.

8. The surface area of the three coterminus faces of a cuboid are 6, 15 and 10 cm^2 respectively. The volume of the cuboid is

(a) 30 cm^3 (b) 40 cm^3 (c) 20 cm^3 (d) 35 cm^3

9. A regular hexagon is inscribed in a circle of radius r. The perimeter of the regular hexagon is

(a) $3r$ (b) $6r$ (c) $9r$ (d) $12r$

10. The dimensions of a godown are 40 m, 25 m and 10 m. If it is filled with cuboidal boxes each of dimensions 2 m × 1.25 m × 1 m, then the number of boxes will be

(a) 1800 (b) 2000 (c) 4000 (d) 8000

Think about your answers to these questions. Discuss your ideas with other students and your teacher. Then write a summary of your findings in your notebook.

1. Explain how to find the total area of all the faces of a rectangular box.
2. Explain how to find the number of identical cubes it will take to fill a rectangular box.
3. Suppose several different nets are made for a given box. What do all of the nets have in common? What might be different?

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11. The volume of a cube is 64 cm^3. Its surface area is

(a) 16 cm^2 (b) 64 cm^2 (c) 96 cm^2 (d) 128 cm^2

12. If the radius of a cylinder is tripled but its curved surface area is unchanged, then its height will be

(a) tripled (b) constant (c) one sixth (d) one third

13. How many small cubes with edge of 20 cm each can be just accommodated in a cubical box of 2 m edge?

(a) 10 (b) 100 (c) 1000 (d) 10000

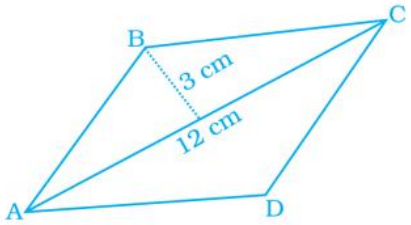
14. The volume of a cylinder whose radius r is equal to its height is

(a) $\frac{1}{4}\pi r^3$ (b) $\frac{\pi r^3}{32}$ (c) πr^3 (d) $\frac{r^3}{8}$

15. The volume of a cube whose edge is $3x$ is

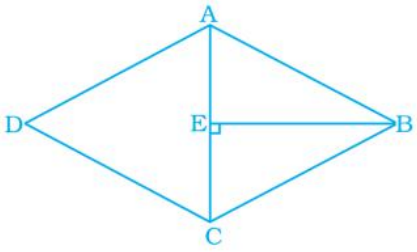
(a) $27x^3$ (b) $9x^3$ (c) $6x^3$ (d) $3x^3$

16. The figure ABCD is a quadrilateral in which AB = CD and BC = AD. Its area is



(a) 72 cm^2 (b) 36 cm^2 (c) 24 cm^2 (d) 18 cm^2

17. What is the area of the rhombus ABCD below if AC = 6 cm, and BE = 4cm?



(a) 36 cm^2 (b) 16 cm^2 (c) 24 cm^2 (d) 13 cm^2

18. The area of a parallelogram is 60 cm^2 and one of its altitude is 5 cm. The length of its corresponding side is

(a) 12 cm (b) 6 cm (c) 4 cm (d) 2 cm

19. The perimeter of a trapezium is 52 cm and its each non-parallel side is equal to 10 cm with its height 8 cm. Its area is

(a) 124 cm^2 (b) 118 cm^2 (c) 128 cm^2 (d) 112 cm^2

20. Area of a quadrilateral ABCD is 20 cm^2 and perpendiculars on BD from opposite vertices are 1 cm and 1.5 cm. The length of BD is

(a) 4 cm (b) 15 cm (c) 16 cm (d) 18 cm

21. A metal sheet 27 cm long, 8 cm broad and 1 cm thick is melted into a cube. The side of the cube is

(a) 6 cm (b) 8 cm (c) 12 cm (d) 24 cm

22. Three cubes of metal whose edges are 6 cm, 8 cm and 10 cm respectively are melted to form a single cube. The edge of the new cube is

(a) 12 cm (b) 24 cm (c) 18 cm (d) 20 cm

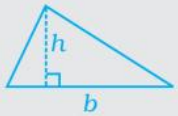
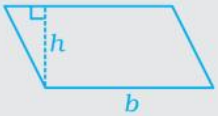
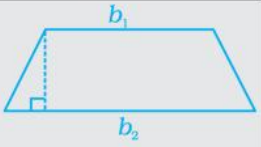
23. A covered wooden box has the inner measures as 115 cm, 75 cm and 35 cm and thickness of wood as 2.5 cm. The volume of the wood is

(a) 85,000 cm^3 (b) 80,000 cm^3 (c) 82,125 cm^3 (d) 84,000 cm^3

24. The ratio of radii of two cylinders is 1: 2 and heights are in the ratio 2:3. The ratio of their volumes is

(a) 1:6 (b) 1:9 (c) 1:3 (d) 2:9

Finding Areas of Plane Figures

Triangle	Parallelogram	Trapezoid	Circle
 $A = \frac{1}{2}bh$	 $A = bh$	 $A = \frac{1}{2}(b_1 + b_2)h$	 $A = \pi r^2$

25. Two cubes have volumes in the ratio 1:64. The ratio of the area of a face of first cube to that of the other is

(a) 1:4 (b) 1:8 (c) 1:16 (d) 1:32

26. The surface areas of the six faces of a rectangular solid are 16, 16, 32, 32, 72 and 72 square centimetres. The volume of the solid, in cubic centimetres, is

(a) 192 (b) 384 (c) 480 (d) 2592

27. Ramesh has three containers.

(a) Cylindrical container A having radius r and height h,

(b) Cylindrical container B having radius $2r$ and height $1/2\ h$, and

(c) Cuboidal container C having dimensions $r \times r \times h$

The arrangement of the containers in the increasing order of their volumes is

(a) A, B, C

(b) B, C, A

(c) C, A, B

(d) cannot be arranged

28. If R is the radius of the base of the hat, then the total outer surface area of the hat is



(a) $\pi r\ (2h + R)$ (b) $2\pi r\ (h + R)$

(c) $2\ \pi rh + \pi R^2$ (d) None of these

In questions 29 to 52, fill in the blanks to make the statements true.

29. A cube of side 4 cm is painted on all its sides. If it is sliced in 1 cubic cm cubes, then number of such cubes that will have exactly two of their faces painted is _____.

30. A cube of side 5 cm is cut into 1 cm cubes. The percentage increase in volume after such cutting is _____.

31. The surface area of a cuboid formed by joining two cubes of side a face to face is _____.

32. If the diagonals of a rhombus get doubled, then the area of the rhombus becomes _____ its original area.

33. If a cube fits exactly in a cylinder with height h, then the volume of the cube is _____ and surface area of the cube is _____.

34. The volume of a cylinder becomes _____ the original volume if its radius becomes half of the original radius.

35. The curved surface area of a cylinder is reduced by _____ per cent if the height is half of the original height.

36. The volume of a cylinder which exactly fits in a cube of side a is _____.

37. The surface area of a cylinder which exactly fits in a cube of side b is _____.

38. If the diagonal d of a quadrilateral is doubled and the heights h_1 and h_2 falling on d are halved, then the area of quadrilateral is _____.

39. The perimeter of a rectangle becomes _____ times its original perimeter, if its length and breadth are doubled.

40. A trapezium with 3 equal sides and one side double the equal side can be divided into _____ equilateral triangles of _____ area.

41. All six faces of a cuboid are _____ in shape and of _____ area.

42. Opposite faces of a cuboid are _____ in area.

43. Curved surface area of a cylinder of radius h and height r is _____.

44. Total surface area of a cylinder of radius h and height r *is* _____

45. Volume of a cylinder with radius h and height r is _____.

Revise

- Is your answer reasonable?

  After you solve a word problem, ask yourself if your answer makes sense. You can round the numbers in the problem and estimate to find a reasonable answer. It may also help to write your answer in sentence form.

46. Area of a rhombus = $\frac{1}{2}$ product of _____.

47. Two cylinders A and B are formed by folding a rectangular sheet of dimensions 20 cm × 10 cm along its length and also along its breadth respectively. Then volume of A is _____ of volume of B.

48. In the above question, curved surface area of A is _____ curved surface area of B.

49. _____ of a solid is the measurement of the space occupied by it.

50. _____ surface area of room = area of 4 walls.

51. Two cylinders of equal volume have heights in the ratio 1:9. The ratio of their radii is _____.

52. Two cylinders of same volume have their radii in the ratio 1:6, then ratio of their heights is _____.

In question 53 to 61, state whether the statements are true (T) or false (F).

53. The areas of any two faces of a cube are equal.

54. The areas of any two faces of a cuboid are equal.

55. The surface area of a cuboid formed by joining face to face 3 cubes of side x is 3 times the surface area of a cube of side x.

56. Two cuboids with equal volumes will always have equal surface areas.

57. The area of a trapezium become 4 times if its height gets doubled.

58. A cube of side 3 cm painted on all its faces, when sliced into 1 cubic centimetre cubes, will have exactly 1 cube with none of its faces painted.

59. Two cylinders with equal volume will always have equal surface areas.

60. The surface area of a cube formed by cutting a cuboid of dimensions 2 × 1 × 1 in 2 equal parts is 2 sq. units.

61. Ratio of area of a circle to the area of a square whose side equals radius of circle is 1 : π.

Solve the following:

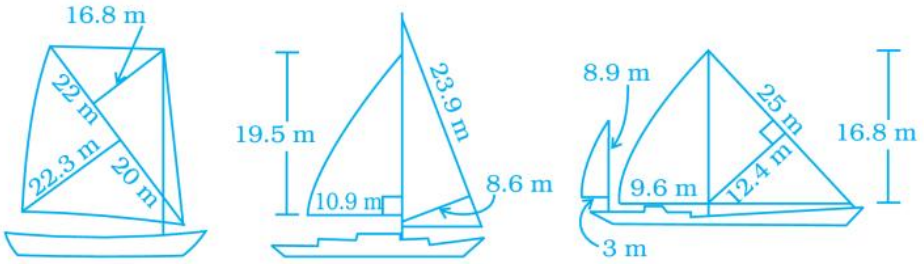
62. The area of a rectangular field is 48 m^2 and one of its sides is 6m. How long will a lady take to cross the field diagonally at the rate of 20 m/minute?

63. The circumference of the front wheel of a cart is 3 m long and that of the back wheel is 4 m long. What is the distance travelled by the cart, when the front wheel makes five more revolutions than the rear wheel?

64. Four horses are tethered with equal ropes at 4 corners of a square field of side 70 metres so that they just can reach one another. Find the area left ungrazed by the horses.

65. The walls and ceiling of a room are to be plastered. The length, breadth and height of the room are 4.5 m, 3 m, and 350 cm respectively. Find the cost of plastering at the rate of Rs 8 per m^2.

66. Most of the sailboats have two sails, the jib and the mainsail. Assume that the sails are triangles. Find the total area of each sail of the sail boats to the nearest tenth.



(i) (ii) (iii)

67. The area of a trapezium with equal non-parallel sides is 168 m^2. If the lengths of the parallel sides are 36 m and 20 m, find the length of the non-parallel sides.

68. Mukesh walks around a circular track of radius 14 m with a speed of 4 km/hr. If he takes 20 rounds of the track, for how long does he walk?

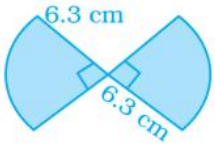
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69. The areas of two circles are in the ratio 49:64. Find the ratio of their circumferences.

70. There is a circular pond and a footpath runs along its boundary. A person walks around it, exactly once keeping close to the edge. If his step is 66 cm long and he takes exactly 400 steps to go around the pond, find the diameter of the pond.

71. A running track has 2 semicircular ends of radius 63 m and two straight lengths. The perimeter of the track is 1000 m. Find each straight length.

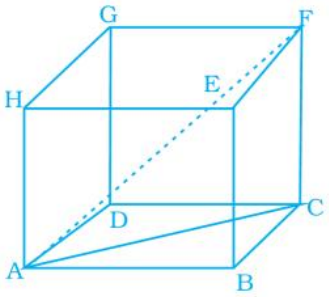
72. Find the perimeter of the given figure.

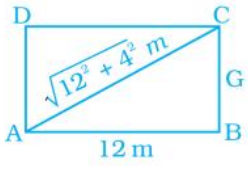


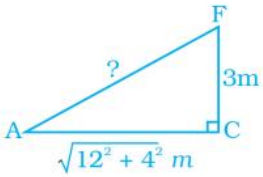
73. A bicycle wheel makes 500 revolutions in moving 1 km. Find the diameter of the wheel.

74. A boy is cycling such that the wheels of the cycle are making 140 revolutions per hour. If the diameter of the wheel is 60 cm, calculate the speed in km/h with which the boy is cycling.

75. Find the length of the largest pole that can be placed in a room of dimensions 12 m × 4 m × 3 m.

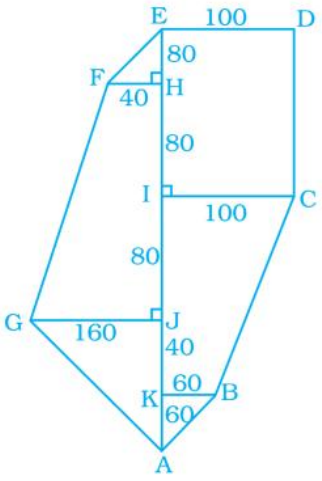




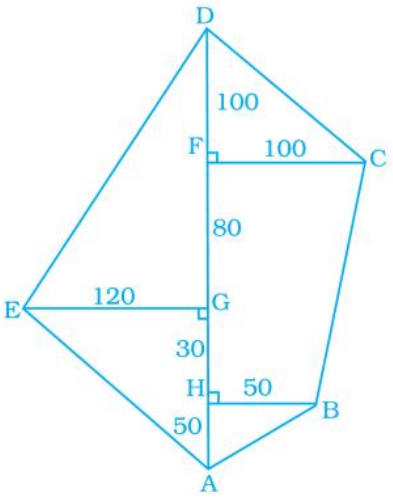


Find the area of the following fields. All dimensions are in metres.

76.

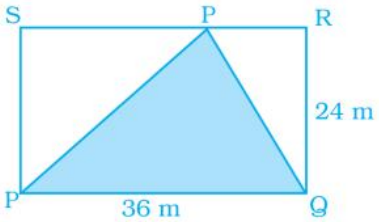


77.

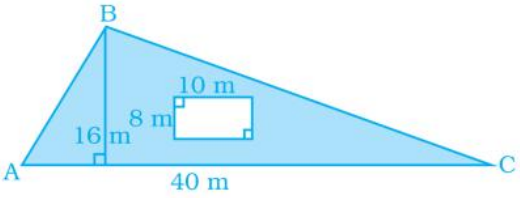


Find the area of the shaded portion in the following figures.

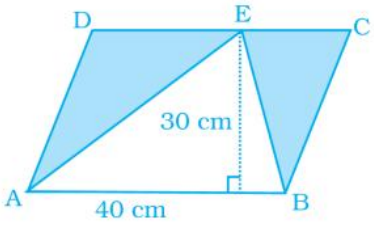
78.



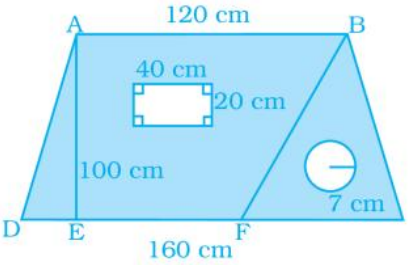
79.



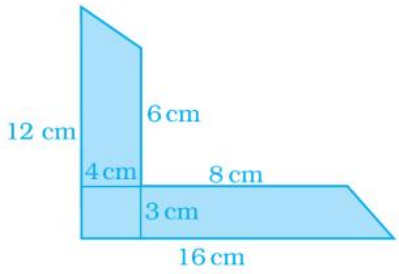
80.



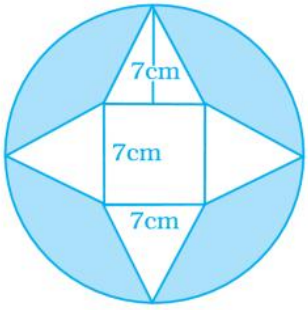
81.



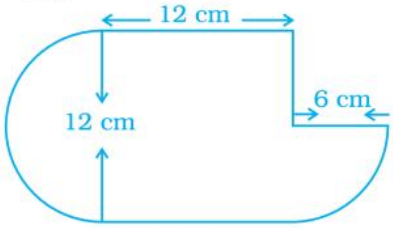
82.



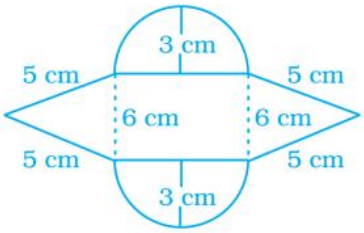
83.



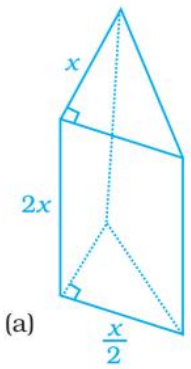
84.



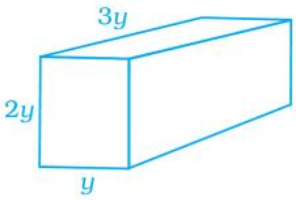
85.



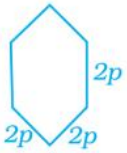
86. Find the volume of each of the given figure if volume = base area × height.



(a)



(b)



(c)

87. A cube of side 5 cm is cut into as many 1 cm cubes as possible. What is the ratio of the surface area of the original cube to that of the sum of the surface areas of the smaller cubes?

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88. A square sheet of paper is converted into a cylinder by rolling it along its side. What is the ratio of the base radius to the side of the square?

89. How many cubic metres of earth must be dug to construct a well 7 m deep and of diameter 2.8 m?

90. The radius and height of a cylinder are in the ratio 3:2 and its volume is 19,404 cm^3. Find its radius and height.

91. The thickness of a hollow metallic cylinder is 2 cm. It is 70 cm long with outer radius of 14 cm. Find the volume of the metal used in making the cylinder, assuming that it is open at both the ends. Also find its weight if the metal weighs 8 g per cm^3.

92. Radius of a cylinder is r and the height is h. Find the change in the volume if the

(a) height is doubled.

(b) height is doubled and the radius is halved.

(c) height remains same and the radius is halved.

93. If the length of each edge of a cube is tripled, what will be the change in its volume?

94. A carpenter makes a box which has a volume of 13,400 cm^3. The base has an area of 670 cm^2. What is the height of the box?

95. A cuboidal tin box opened at the top has dimensions 20 cm × 16 cm × 14 cm. What is the total area of metal sheet required to make 10 such boxes?

96. Find the capacity of water tank, in litres, whose dimensions are 4.2 m, 3 m and 1.8 m?

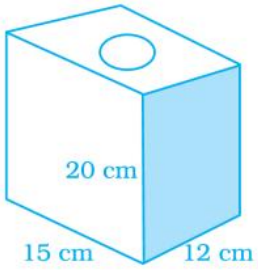
97. How many cubes each of side 0.5 cm are required to build a cube of volume 8 cm^3 ?

98. A wooden box (including the lid) has external dimensions 40 cm by 34 cm by 30 cm. If the wood is 1 cm thick, how many cm^3 of wood is used in it?

99. A river 2 m deep and 45 m wide is flowing at the rate of 3 km per hour. Find the amount of water in cubic metres that runs into the sea per minute.

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100. Find the area to be painted in the following block with a cylindrical hole. Given that length is 15 cm, width 12 cm, height 20 cm and radius of the hole 2.8 cm.

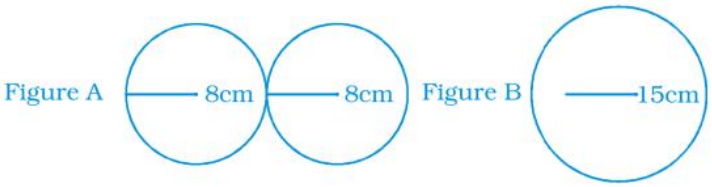


101. A truck carrying 7.8 m^3 concrete arrives at a job site. A platform of width 5 m and height 2 m is being contructed at the site. Find the length of the platform, constructed from the amount of concrete on the truck?

102. A hollow garden roller of 42 cm diameter and length 152 cm is made of cast iron 2 cm thick. Find the volume of iron used in the roller.

103. Three cubes each of side 10 cm are joined end to end. Find the surface area of the resultant figure.

104. Below are the drawings of cross sections of two different pipes used to fill swimming pools. Figure A is a combination of 2 pipes each having a radius of 8 cm. Figure B is a pipe having a radius of 15 cm. If the force of the flow of water coming out of the pipes is the same in both the cases, which will fill the swimming pool faster?



105. A swimming pool is 200 m by 50 m and has an average depth of 2 m. By the end of a summer day, the water level drops by 2 cm. How many cubic metres of water is lost on the day?

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106. A housing society consisting of 5,500 people needs 100 L of water per person per day. The cylindrical supply tank is 7 m high and has a diameter 10 m. For how many days will the water in the tank last for the society?

107. Metallic discs of radius 0.75 cm and thickness 0.2 cm are melted to obtain 508.68 cm^3 of metal. Find the number of discs melted (use $\pi = 3.14$).

108. The ratio of the radius and height of a cylinder is 2:3. If its volume is 12,936 cm^3, find the total surface area of the cylinder.

109. External dimensions of a closed wooden box are in the ratio 5:4:3. If the cost of painting its outer surface at the rate of Rs 5 per dm^2 is Rs 11,750, find the dimensions of the box.

110. The capacity of a closed cylindrical vessel of height 1 m is 15.4 L. How many square metres of metal sheet would be needed to make it?

111. What will happen to the volume of the cube, if its edge is (a) tripled (b) reduced to one-fourth?

112. A rectangular sheet of dimensions 25 cm × 7 cm is rotated about its longer side. Find the volume and the whole surface area of the solid thus generated.

113. From a pipe of inner radius 0.75 cm, water flows at the rate of 7 m per second. Find the volume in litres of water delivered by the pipe in 1 hour.

114. Four times the area of the curved surface of a cylinder is equal to 6 times the sum of the areas of its bases. If its height is 12 cm, find its curved surface area.

115. A cylindrical tank has a radius of 154 cm. It is filled with water to a height of 3 m. If water to a height of 4.5 m is poured into it, what will be the increase in the volume of water in kl?

116. The length, breadth and height of a cuboidal reservoir is 7 m, 6 m and 15 m respectively. 8400 L of water is pumped out from the reservoir. Find the fall in the water level in the reservoir.

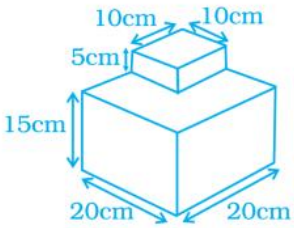
117. How many bricks of size 22 cm × 10 cm × 7 cm are required to construct a wall 11m long, 3.5 m high and 40 cm thick, if the cement and sand used in the construction occupy $(1/10)^{th}$ part of the wall?

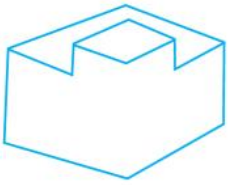
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118. A rectangular examination hall having seats for 500 candidates has to be built so as to allow 4 cubic metres of air and 0.5 square metres of floor area per candidate. If the length of hall be 25 m, find the height and breadth of the hall.

119. The ratio between the curved surface area and the total surface area of a right circular cylinder is 1:2. Find the ratio between the height and radius of the cylinder.

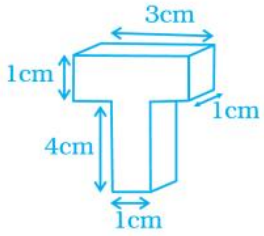
120. A birthday cake has two tiers as shown in the figure below. Find the volume of the cake.



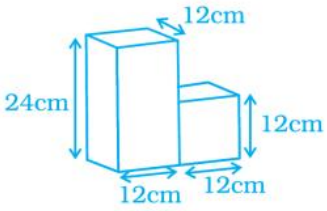


Work out the surface area of following shapes in questions 121 to 124 (use $\pi = 3.14$).

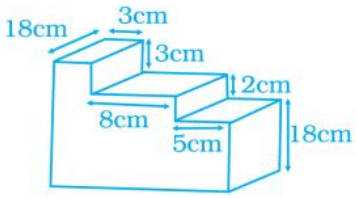
121.



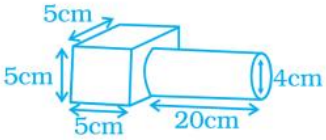
122.



123.



124.

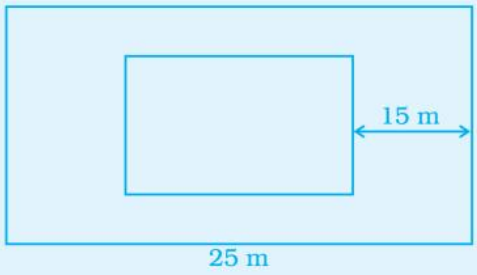


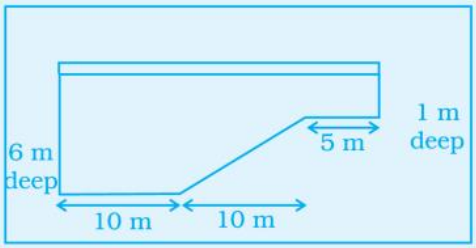
125. Water flows from a tank with a rectangular base measuring 80 cm by 70 cm into another tank with a square base of side 60 cm. If the water in the first tank is 45 cm deep, how deep will it be in the second tank?

126. A rectangular sheet of paper is rolled in two different ways to form two different cylinders. Find the volume of cylinders in each case if the sheet measures 44 cm × 33 cm.

(D) Applications, Games and Puzzles

1. Rashid has decided to build a swimming pool as shown in the figure on an empty plot 25 metres long and 15 metres wide. He is discussing with his son Majid about his plan to build the pool, put tiles on the bottom of the pool and other requirements of the pool. Can you help Majid to answer the following questions which his father has asked in the discussion?





1. What is the surface area of the pool?
2. If Rashid plans to cover the bottom and sides of the pool with square tiles having side 25 cm, how many such tiles will be required?
3. If each tile costs Rs 40, how much will be the total cost?
4. A local digging company charges at the rate of Rs 150/- per cubic metre. How much Rashid has to pay for digging the swimming pool?

   [Hint : Volume = base area × height]

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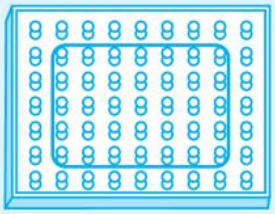
5. How long will it take for the swimming pool to be filled completely, if a pipe is pouring water into the pool at the rate of 40 litres per minute?
6. What is the area of the wall at the shallow end of the swimming pool?
7. What is the area of the wall at the deep end of the swimming pool?
8. How much Rashid has to pay in total for making the swimming pool operational, considering cost of digging the pool and fixing tiles?

2. The following table shows the dimensions of cuboids such that, their volumes remain the same. Extend the table with as many more dimensions such that all the cuboids thus formed have the same volume. Complete the table and write your conclusion on surface area and volume of each cuboid.

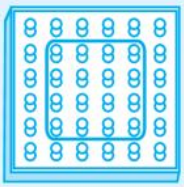
Dimensions of cuboid (in units)	**Surface Area (sq. unit)**	**Volume (cube unit)**
15, 10, 8		1200
6, 10, 20		1200
--	--	--
--	--	--
--	--	--
--	--	--

3. The figure shown is a geoboard in which a rectangle has been outlined using a rubberband.

1. What is the area of the rectangle?
2. Draw a similar figure whose area is 50% larger than this figure.
3. Draw a similar figure whose area is 25% larger than this figure.
4. Suppose that the figure shown is 75% of another figure. What would the other figure look like?

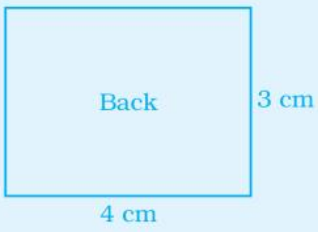


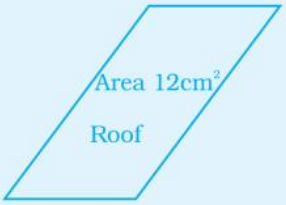
5. The enclosed area represents 75% of another area on the geoboard. Use a geoboard or draw a diagram of a geoboard to represent 100% of the area.

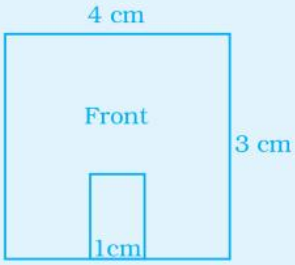


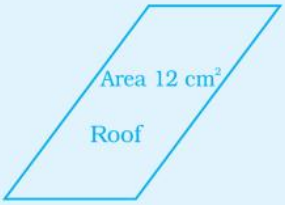
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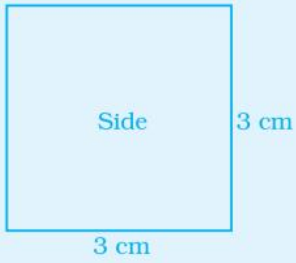
i. Given here are sketches of front, back, sides and roof of a kennel. The drawings are as per the scale. 1 cm = 10 cm.

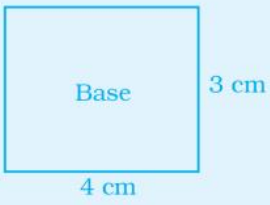


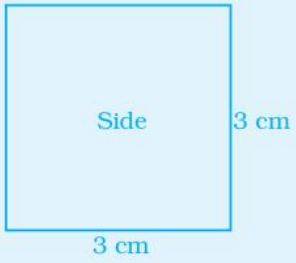


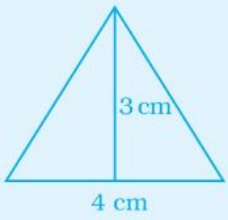




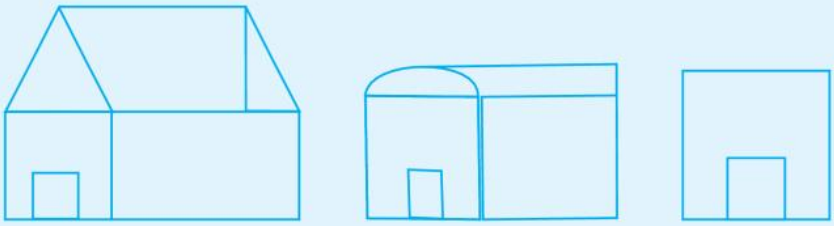








(ii) Sketches given above belong to which kennel?



(a) (b) (c)

(iii) Draw the net of the correct choice on the graph paper.

(iv) Take a waste piece of cardboard. Trace the net you have drawn above on the cardboard and fold it to make the kennel.

(v) If you had to pay Rs 2 for each square cm of surface area, how much would it cost you to paint the kennel?

5.

Word Maze

r	h	r	h	o	m	b	u	s	z
a	t	h	a	m	o	b	s	u	q
b	t	r	a	p	e	z	i	u	m
c	y	l	i	n	d	e	r	b	c
t	z	w	v	a	m	q	r	e	u
i	j	l	t	q	*n*	g	b	a	b
k	b	d	f	v	s	g	t	r	o
s	z	q	c	i	r	c	l	e	i
a	w	h	m	a	n	k	p	e	d

Find the names of the solids from the given word maze whose areas or volumes are given below by colouring the boxes using the given colour code.

	Area/Volume	**Colour Code**
1.	$\frac{1}{2}\ d_1 \times d_2$	red
2.	$l\ b\ h$	blue
3.	$\pi r^2 h$	yellow
4.	πr^2	green
5.	$\frac{1}{2} bh$	orange
6.	$\frac{1}{2}\ (a + b) \times h$	pink

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