MATHEMATICS

Chapter 11: Mensuration

Important Questions

Multiple Choice Questions-

Question 1. The diagram has the shape of a

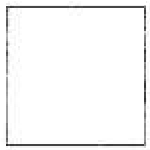
(a) square

(b) rectangle

(c) triangle

(d) trapezium.

Question 2. The diagram has the shape of a



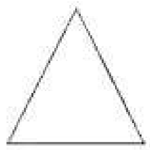
(a) rectangle

(b) square

(c) circle

(d) parallelogram.

Question 3. The diagram has the shape of a



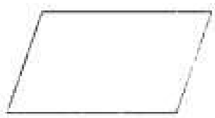
(a) circle

(b) rectangle

(c) square

(d) triangle.

Question 4. The diagram has the shape of a



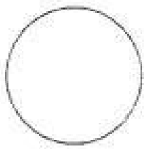
(a) rectangle

(b) square

(c) parallelogram

(d) circle.

Question 5. The diagram has the shape of a



(a) circle

(b) square

(c) rectangle

(d) parallelogram.

Question 6. The diagram has the shape of a

(a) circle

(b) parallelogram

(c) rectangle

(d) trapezium.

Question 7. The area of a rectangle of length a and breadth b is

(a) a + b

(b) ab

(c) $a^2 + b^2$

(d) 2ab.

Question 8. The area of a square of side a is

(a)a

(b) a^2

(c) 2a

(d) 4a.

Question 9. The area of a triangle with base b and altitude h is

(a) $\frac{1}{2}$bh

(b) bh

(c) $\frac{1}{3}$bh

(d) $\frac{1}{4}$bh.

Question 10. The area of a parallelogram of base b and altitude h is

(a) $\frac{1}{2}$bh

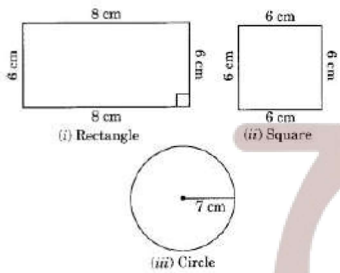
(b) bh

(c) $\frac{1}{3}$bh

(d) $\frac{1}{4}$bh.

Very Short Questions:

1. Find the perimeter of the following figures:



2. The length and breadth of a rectangle are 10 cm and 8 cm respectively. Find its perimeter if the length and breadth are (i) doubled (ii) halved.

3. A copper wire of length 44 cm is to be bent into a square and a circle. Which will have a larger area?

4. The length and breadth of a rectangle are in the ratio 4 : 3. If its perimeter is 154 cm, find its length and breadth.

5. The area of a rectangle is 544 cm^2. If its length is 32 cm, find its breadth.

6. If the side of a square is doubled then how much time its area becomes?

7. The areas of a rectangle and a square are equal. If the length of the rectangle is 16 cm and breadth is 9 cm, find the side of the square.

8. If the lengths of the diagonals of a rhombus are 16 cm and 12 cm, find its area.

9. The area of a rhombus is 16 cm^2. If the length of one diagonal is 4 cm, find the length of the other diagonal.

10. If the diagonals of a rhombus are 12 cm and 5 cm, find the perimeter of the rhombus.

Short Questions :

1. The volume of a box is 13400 cm^3. The area of its base is 670 cm^2. Find the height of the box.

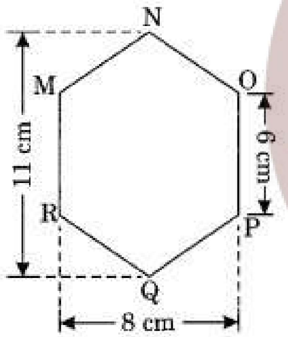
2. Complete the following table; measurement in centimetres.

	(a)	(b)	(c)	(d)	(e)	(f)
Length	4	12	7	16	60	40
Breadth	5	8	6	—	—	24
Height	6	6	—	8	5	—
Volume	—	—	84	1536	5400	2400

3. Two cubes are joined end to end. Find the volume of the resulting cuboid, if each side of the cubes is 6 cm.

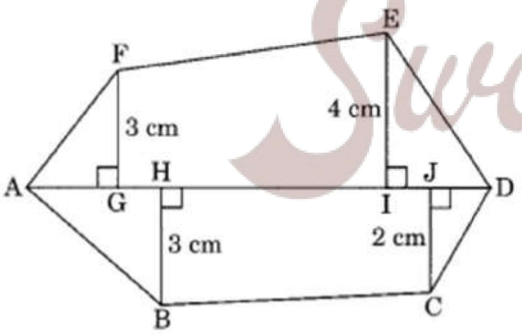
4. How many bricks each 25 cm by 15 cm by 8 cm, are required for a wall 32 m long, 3 m high and 40 cm thick?

5. MNOPQR is a hexagon of side 6 cm each. Find the area of the given hexagon in two different methods.



6. The area of a trapezium is 400 cm^2, the distance between the parallel sides is 16 cm. If one of the parallel sides is 20 cm, find the length of the other side.

7. Find the area of the hexagon ABCDEF given below. Given that: AD = 8 cm, AJ = 6 cm, AI – 5 cm, AH = 3 cm, AG = 2.5 cm and FG, BH, EI and CJ are perpendiculars on diagonal AD from the vertices F, B, E and C respectively.



8. Three metal cubes of sides 6 cm, 8 cm and 10 cm are melted and recast into a big cube. Find its total surface area.

Long Questions :

1. The diameter of a roller is 84 cm and its length is 120 cm. It takes 500 complete revolutions to move once over to level a playground. Find the area of the playground in m2.

2. A rectangular metal sheet of length 44 cm and breadth 11 cm is folded along its length to form a cylinder. Find its volume.

3. 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?

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

5. 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.

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

Answer Key-

Multiple Choice questions-

1. (b) rectangle
2. (b) square
3. (d) triangle
4. (c) parallelogram
5. (a) circle
6. (d) trapezium
7. (b) ab
8. (b) a^2
9. (a) $\frac{1}{2}$bh
10. (b) bh

Very Short Answer :

1. (i) Perimeter of the rectangle = 2(l + b) = 2(8 + 6) = 2 × 14 = 28 cm

   (ii) Perimeter of the square = 4 × side = 4 × 6 = 24 cm

   (iii) Perimeter of the circle $= 2\pi r = 2 \times \frac{22}{7} \times 7 = 44$ cm.

2. Length of the rectangle = 10 cm

   Breadth of the rectangle = 8 cm

   (i) When they are doubled,

   l = 10 × 2 = 20 cm

   and b = 8 × 2 = 16 cm

   Perimeter = 2(l + b) = 2(20 + 16) = 2 × 36 = 72 cm

   (ii) When they are halved,

$$l = \frac{10}{2} = 5 \text{ cm}$$

$$b = \frac{8}{2} = 4 \text{ cm}$$

Perimeter = 2(l + b) = 2(5 + 4) = 2 × 9 = 18 cm

3. (i) When the wire is bent into a square.

Side $= \frac{44}{4} = 11\ cm$

Area of the square = $(\text{side})^2 = (11)^2 = 121 \text{ cm}^2$

(ii) When the wire is bent into a circle.

Circumference = 2πr

44 = 2πr

$$44 = 2 \times \frac{22}{7} \times r$$

$$\therefore \quad r = \frac{44 \times 7}{2 \times 22} = 7 \text{ cm}$$

$$\therefore \text{ Area of the circle} = \pi r^2$$

$$= \frac{22}{7} \times 7 \times 7$$

$$= 154 \text{ cm}^2$$

So, the circle will have a larger area.

4. Let the length of the rectangle be 4x cm and that of breadth = 3x cm

Perimeter = 2(l + b) = 2(4x + 3x) = 2 × 7x = 14x cm

14x = 154

x = 11

Length = 4 × 11 = 44 cm

and breadth = 3 × 11 = 33 cm

5. Area = 544 cm^2

Length = 32 cm

Breadth of the rectangle $= \frac{Area}{Length}$

$$= \frac{544}{32}$$

= 17 cm

6. Hence, the required breadth = 17 cm

Let the side of the square be x cm.

Area = $(\text{side})^2 = x^2$ sq. cm

If its side becomes 2x cm then area = $(2x)^2 = 4x^2$ sq. cm

Ratio is $x^2 : 4x^2 = 1 : 4$

Hence, the area would become four times.

7. Area of the square = Area of the rectangle = $16 \times 9 = 144$ cm^2

Side of the square = √Area of the square = √144 = 12 cm

Hence, the side of square = 12 cm.

8. Given:

First diagonal d_1 = 16 cm

Second diagonal d_2 = 12 cm

$$\text{Area of the rhombus} = \frac{1}{2} \times d_1 \times d_2$$
$$= \frac{1}{2} \times 16^{8} \times 12$$
$$= 96 \text{ cm}^2$$

Hence, the required area = 96 cm^2.

9. Given: Area of the rhombus = 16 cm^2

Length of one diagonal = 4 cm

$$\therefore \quad \text{Area} = \frac{1}{2} \times d_1 \times d_2$$
$$16 = \frac{1}{2} \times 4 \times d_2$$
$$\Rightarrow \quad 16 \times 2 = 4 \times d_2$$
$$\Rightarrow \quad 32 = 4 \times d_2$$
$$\therefore \quad d_2 = \frac{32^{8}}{4} = 8 \text{ cm}$$

Hence, the required length = 8 cm.

10. Given: d_1 = 12 cm, d_2 = 5 cm

$$= \frac{1}{2}\sqrt{(12)^2 + (5)^2}$$
$$= \frac{1}{2}\sqrt{144 + 25}$$
$$= \frac{1}{2}\sqrt{169}$$
$$= \frac{1}{2} \times 13$$
$$= \frac{13}{2} \text{ cm} = 6.5 \text{ cm}$$

The perimeter = 4 × side = 4 × 6.5 = 26 cm

Hence, the perimeter = 26 cm.

Short Answer :

1.

Volume of the box = 13400 cm^3

Area of the box = 670 cm^2

$$\text{Height} = \frac{\text{Volume}}{\text{Base area}}$$
$$= \frac{13400}{670} = 20 \text{ cm}$$

Hence, the required height = 20 cm.

2.

(a) $V = l \times b \times h$
$= 4 \times 5 \times 6 = 120 \text{ cm}^3$

(b) $V = l \times b \times h$
$= 12 \times 8 \times 6 = 576 \text{ cm}^3$

(c) $V = l \times b \times h$
$84 = 7 \times 6 \times h$
$\therefore \ h = \frac{84}{7 \times 6} = 2 \text{ cm}$

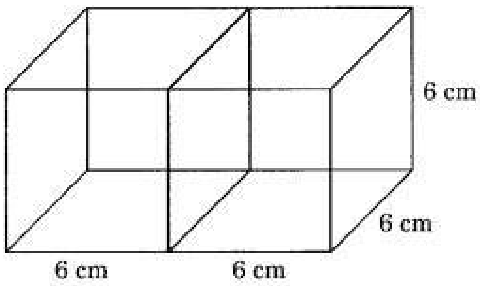
(d) $V = l \times b \times h$
$1536 = 16 \times b \times 8$
$\therefore \ b = \frac{1536}{16 \times 8} = 12 \text{ cm}$

(e) $V = l \times b \times h$
$5400 = 60 \times b \times 5$
$\Rightarrow b = \frac{5400}{60 \times 5} = 18 \text{ cm}$

(f) $V = l \times b \times h$
$2400 = 40 \times 24 \times h$
$\therefore \ h = \frac{2400}{40 \times 24} = 2.5 \text{ cm}$

Hence $(a) \leftrightarrow 120 \text{ cm}^3$, $(b) \leftrightarrow 576 \text{ cm}^3$, $(c) \leftrightarrow 2$ cm, $(d) \leftrightarrow 12$ cm, $(e) \leftrightarrow 18$ cm, $(f) \leftrightarrow 2.5$ cm

3.



Length of the resulting cuboid = 6 + 6 = 12 cm

Breadth = 6 cm

Height = 6 cm

Volume of the cuboid = l × b × h = 12 × 6 × 6 = 432 cm^3

4. Converting into same units, we have,

Length of the wall = 32 m = 32 × 100 = 3200 cm

Breadth of the wall = 3 m = 3 × 100 = 300 cm

and the height = 40 cm

v, length of the brick = 25 cm

breadth = 15 cm

and height = 8 cm

Number of bricks required

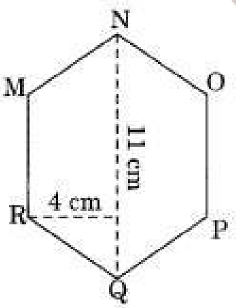
$$= \frac{\text{Volume of the wall}}{\text{Volume of one brick}}$$

$$= \frac{3200 \times 300 \times 40}{25 \times 15 \times 8}$$

$$= 128 \times 20 \times 5 = 12800$$

Hence, the required number of bricks = 12800.

5. Method I: Divide the given hexagon into two similar trapezia by joining QN.



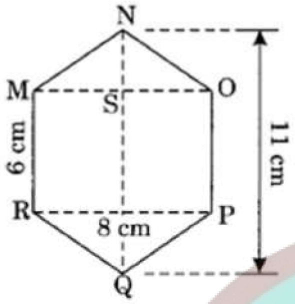
Area of the hexagon MNOPQR = 2 × area of trapezium MNQR

$$= 2 \times \frac{1}{2} (6 + 11) \times 4$$

= 17 × 4

= 68 cm^2

Method II: The hexagon MNOPQR is divided into three parts, 2 similar triangles and 1 rectangle by joining MO, RP.



$$NS = \frac{11\text{ cm} - 6\text{ cm}}{2}$$

$$= \frac{5}{2}\text{ cm} = 2.5\text{ cm}$$

∴ Area of hexagon MNOPQR

$= 2 \times$ area of ΔMNO + area of rectangle MRPO

$$= 2 \times \left(\frac{1}{2} \times MO \times NS\right) + (RP \times MR)$$

$= MO \times NS + RP \times MR$

$= 8 \times 2.5 + 8 \times 6$

$= 20 + 48$

$= 68\text{ cm}^2$.

6. Given: Area of trapezium = 400 cm^2

Height = 16 cm

$$\text{Area of trapezium} = \frac{1}{2}(a+b) \times h$$

$$400 = \frac{1}{2}(20+b) \times 16$$

$$\Rightarrow \quad \frac{400 \times 2}{16} = 20 + b$$

$$\Rightarrow \quad 50 = 20 + b$$

$$\therefore \quad b = 50 - 20 = 30\text{ cm}$$

Hence, the required length = 30 cm.

7. Given:

AD = 8 cm

FG = 3 cm

AJ = 6 cm

EI = 4 cm

AI = 5 cm

BH = 3 cm

AH = 3 cm

CJ = 2 cm

AG = 2.5 cm

$$\text{Area of } \Delta AGF = \frac{1}{2} \times AG \times FG$$

$$= \frac{1}{2} \times 2.5 \times 3$$

$$= 2.5 \times 1.5$$

$$= 3.75 \text{ cm}^2$$

Area of trapezium FGIE

$$= \frac{1}{2} \times (GF + IE) \times GI$$

$$= \frac{1}{2} \times (3 + 4) \times 2.5 \quad [\because GI = AI - AG]$$

$$[\because GI = 5 - 2.5 = 2.5 \text{ cm}]$$

$$= \frac{1}{2} \times 7 \times 2.5$$

$$= 3.5 \times 2.5 = 8.75 \text{ cm}^2$$

$$\text{Area of } \Delta EID = \frac{1}{2} \times ID \times EI$$

$$= \frac{1}{2} \times (AD - AI) \times EI$$

$$= \frac{1}{2} \times (8 - 5) \times 4$$

$$= \frac{1}{2} \times 3 \times 4 = 6 \text{ cm}^2$$

$$\text{Area of } \Delta CJD = \frac{1}{2} \times JD \times JC$$

$$= \frac{1}{2} \times (AD - AJ) \times JC$$

$$= \frac{1}{2} \times (8 - 6) \times 2$$

$$= \frac{1}{2} \times 2 \times 2 = 2 \text{ cm}^2$$

Area of trapezium HBCJ

$$= \frac{1}{2} \times (HB + JC) \times HJ$$

$$= \frac{1}{2} \times (3 + 2) \times (AJ - AH)$$

$$= \frac{1}{2} \times 5 \times (6 - 3)$$

$$= \frac{1}{2} \times 5 \times 3 = 7.5 \text{ cm}^2$$

Area of $\Delta AHB = \frac{1}{2} \times AH \times HB$

$$= \frac{1}{2} \times 3 \times 3$$

$$= \frac{9}{2} = 4.5 \text{ cm}^2$$

Area of hexagon ABCDEF = Area of ΔAGF + Area of trapezium FGIE + Area of ΔEID + Area of ΔCJD + Area of trapezium HBCJ + Area of ΔAHB

= 3.75 cm^2 + 8.75 cm^2 + 6 cm^2 + 2 cm^2 + 7.5 cm^2 + 4.5 cm^2

= 32.50 cm^2.

8. Volume of the cube with side 6 cm = $(side)^3 = (6)^3$ = 216 cm^3

Volume of the cube with side 8 cm = $(side)^3 = (8)^3$ = 512 cm^3

Volume of the cube with side 10 cm = $(side)^3 = (10)^3$ = 1000 cm^3

Volume of the big cube = 216 cm^3 + 512 cm^3 + 1000 cm^3 = 1728 cm^3

Side of the resulting cube $= \sqrt[3]{1728}\ 12$ cm

Total surface area = 6 $(side)^2 = 6(12)^2$ = 6 × 144 cm^2 = 864 cm^2.

Long Answer :

1. Given: Diameter of the roller = 84 cm

Radius $= \frac{84}{2} = 42\ cm$

Height = 120 cm

Curved surface area of the roller = 2πrh

$= 2 \times \frac{22}{7} \times 42 \times 120$

$= 22 \times 1440$

$= 31680 \text{ cm}^2$

$= \frac{31680}{100 \times 100} \text{ m}^2 \qquad [1 \text{ m}^2 = 1000 \text{ cm}^2]$

$= 3.168 \text{ m}^2$

Area covered by the roller in one complete revolution = 3.168 m^2

Area covered in 500 complete revolutions = 500 × 3.168 = 1584 m^2

Hence, the required area = 1584 m^2.

2. Volume of water = 160 m^3

Area of rectangular field = 800 m^2

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

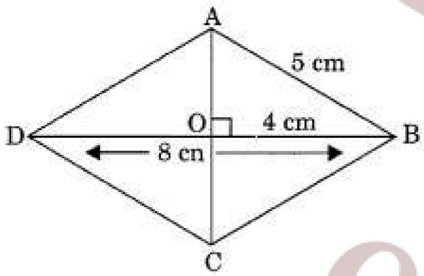
Now, the volume of water = volume of cuboid formed on the field by water.

160 = Area of base × height = 800 × h

⇒ h = 0.2

So, required height = 0.2 m

3. Let ABCD be the rhombus as shown below.



DO = OB = 4 cm, since diagonals of a rhombus are perpendicular bisectors of each other.

Therefore, using Pythagoras theorem in ΔAOB, AO^2 + OB2 = AB^2

$$AO = \sqrt{AB^2 - OB^2} = \sqrt{52 - 42} = 3 \text{ cm}$$

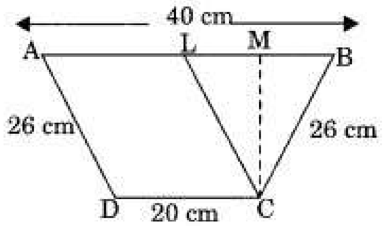
So, $AC = 2 \times 3 = 6$ cm

Thus, the area of the rhombus $= \frac{1}{2} \times d_1 \times d_2$

$$= \frac{1}{2} \times 8 \times 6 = 24 \text{ cm}^2.$$

4. Let ABCD be the trapezium such that

AB = 40 cm and CD 20 cm and AD = BC = 26 cm.



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, ΔCLB is an isosceles triangle.

Draw altitude CM of ΔCLB.

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

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

[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 = √576 = 24 cm

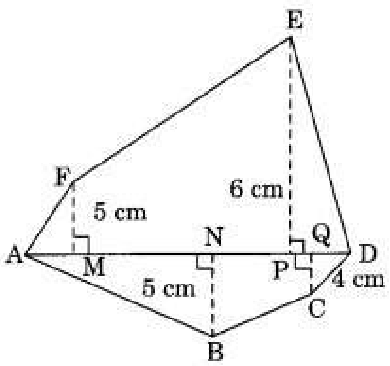
Hence, the area of the trapezium $= \frac{1}{2}$ (sum of parallel sides) $\times$ height

$= \frac{1}{2}(20 + 40) \times 24$

= 30 × 24

= 720 cm^2.

5.



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.

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

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

$$= 10 + 44 + 18 + 20 + 27 + 8 = 127 \text{ cm}^2$$