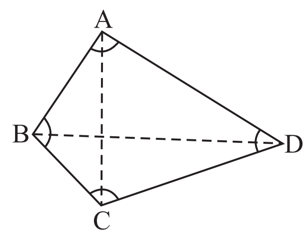
9. Understanding Shapes

Exercise-9.1

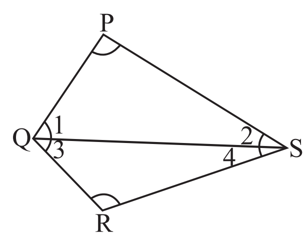
1. The three angles of a quadrilateral are 100°, 50° and 50°.
In a quadrilateral,
Sum of four angles = 360
So, fourth angle = 360 – (Sum of other three angles)
= 360 – (100 + 50 + 50)
= 360 – 200
= 160°

2. (a) Adjoining sides
$= AB, BC; BC, CD; CD, DA; DA, AB$
(b) Opposide side = $AB, CD; BC, AD$
(c) Adjacent angles
$= \angle A, \angle B; \angle B, \angle C; \angle C, \angle D; \angle D, \angle A$
(d) Opposite angles = $\angle A, \angle C; \angle B, \angle D$



3. AC and BD are two diagonals of $ABCD$.

4. Given : A quadrilateral $PQRS$.



Prove that $\angle P + \angle Q + \angle R + \angle S = 360$
Construction : Join Q and S.
Proof : In ΔPQS,
$\angle P + \angle 1 + \angle 2 = 180°$ …(1)
(By angle sum property of triangle)
In ΔQRS,
$\angle R + \angle 3 + \angle 4 = 180°$ …(2)
(By angle sum property of triangle)
Adding eq. (1) and (2), we get
$(\angle P + \angle 1 + \angle 2) + (\angle R + \angle 3 + \angle 4) = 180° + 180°$
$\angle P + (\angle 1 + \angle 3) + \angle R + (\angle 2 + \angle 4) = 360°$
$\angle P + \angle Q + \angle R + \angle S = 360°$
$(\because \angle 1 + \angle 3 = \angle Q$ and $\angle 2 + \angle 4 = \angle S)$. Hence proved.

5. Let the three equal angles of a quadrilateral are x.
The fourth angle = 120°
By angle sum property in a quadrilateral,
$x + x + x + 120° = 360°$
$3x + 120° = 360°$
$3x = 360° - 120°$
$3x = 240°$
$x = 80°$
Thus, each of the equal angles of the quadrilateral is 80°.

6. The two adjacent angles of a quadrilateral are 130° and 30°.
Let other two equal angles = $x°$.
By angle sum property in a quadrilateral
$x + x + 130° + 30° = 360°$
$2x + 160° = 360°$

$2x = 360° - 160°$
$2x = 200°$
$x = 100°$

Thus the measure of each of the equal angles is 100°.

7. Let each of the equal angles be $x°$ and the other two given angles are 75°.

By angle sum property of a quadrilateral

$x + x + x + 75° = 360°$
$2x + 150° = 360°$
$2x = 360° - 150°$
$2x = 210°$
$x = 105°$

Thus the measure of either of these two equal angles is 105°.

8. Let the fourth angle of a quadrilateral be $x°$.

The other three angles are 20°, 90° and 90°.

By angle sum property of a quadrilateral.

$x + 20° + 90° + 90° = 360$
$x + 200° = 360°$
$x = 360° - 200°$
$x = 160°$

Thus the fourth angle o the quadrilateral is 160°.

9. Let the measure of each of equal angles be $x°$.

The two adjacent angles are 85° and 115°.

By angle sum property in a quadrilateral.

$x + x + 85° + 115° = 360°$
$2x + 200° = 360°$
$2x = 360° - 200°$
$2x = 160°$
$x = 80°$

So, the measure of each of the equal angles is 80°.

10. Let the four angles of a quadrilateral be $2x°$, $3x°$, $4x°$ and $x°$.

By angle sum property in a quadrilateral

$2x + 3x + 4x + x = 360°$
$10x = 360°$
$x = 36°$
$2x = 2 \times 36° = 72°$
$3x = 3 \times 36° = 108°$
$4x = 4 \times 36° = 144°$

So, the four angles of the quadrilateral are 72°, 108°, 144° and 36°.

11. Let the four angles of a quadrilateral be x, $2x$, $3x$ and $4x$.

By angle sum property in a quadrilateral $x + 2x + 3x + 4x = 360°$.

$10x = 360°$
$x = 36°$
$x = 36°$
$2x = 2 \times 36° = 72°$
$3x = 3 \times 36° = 108°$
$4x = 4 \times 36° = 144°$

So, the four angles of the quadrilateral are 36°, 72°, 108° and 144°.

12. Suppose the angles of x, $3x$, $7x$ and $9x$.

By angle sum property in a quadrilateral

$$x + 3x + 7x + 9x = 360°$$
$$20x = 360°$$
$$x = 18°$$
$$3x = 3 \times 18° = 54°$$
$$7x = 7 \times 18° = 126°$$
$$9x = 9 \times 18° = 162°$$

So, the four angles of the quadrilateral are 18°, 54° and 162°.

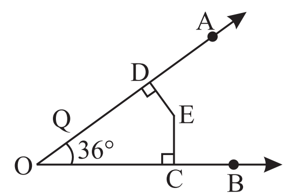
13. Suppose the angles of a quadrilateral are $3x$, $5x$, $7x$and $9x$.

By angle sum property in a quadrilateral $3x + 5x + 7x + 9x = 360°$.

$$24x = 360°$$
$$3x = 3 \times 15° = 45°$$
$$5x = 5 \times 15° = 75°$$
$$7x = 7 \times 15° = 105°$$
$$9x = 9 \times 15° = 135°$$

So, the angles of the quadrilateral are 45°, 75°, 105° and 135°.

14. $\angle AOB = 36°$



$\because \quad EC \perp OB$

$\therefore \quad \angle ECO = 90°$

$\because \quad ED \perp OA$

$\therefore \quad \angle EDO = 90°$

In a quadrilateral $OCED$.

By angle sum property, we have,

$$\angle DOC + \angle ECO + \angle CED + \angle EDO = 360°$$
$$36° + 90° + \angle CED + 90° = 360°$$
$$\angle CED + 216° = 360°$$
$$\angle CED = 360° - 216°$$
$$\angle CED = 144°$$

15. Sum of two angles of a quadrilateral is 150°.

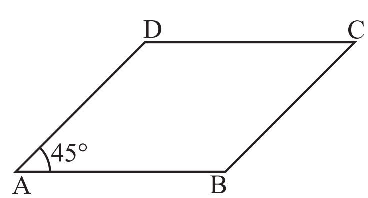
Let other two angles be $2x$ and $3x$. By angle sum property in a quadrilateral

$$150° + 2x + 3x = 360°$$
$$150° + 5x = 360°$$
$$5x = 360° - 150°$$
$$5x = 210°$$
$$x = 42°$$
$$2x = 2 \times 42° = 84°$$
$$3x = 3 \times 42° = 126°$$

So, the other two angles are 84° and 126°.

Exercise-9.2

1. The two adjacent sides of a 11 gm are 3 cm and 4 cm respectively.



We know that

The perimeter of the 11 gm $= 2 \times (\text{sum of sides})$

$= 2 \times (3 + 4)$

$= 2 \times 7 = 14$ cm

2. Longer side of a 11 gm = 8 cm

Shorter side of a 11 gm $= \frac{3}{4} \times$ longer side

$= \frac{3}{4} \times 8$

$= 3 \times 2 = 6$ cm.

We know that

the perimeter of the 11 gm = 2 × (longer side + shorter side)

= 2 × (8 + 6)

= 2 × 14 = 28 cm

3. The longer side of a 11 gm = 8.4 cm

The shorter side of a 11 gm $= \frac{1}{2} \times$ longer side

$= \frac{1}{2} \times 8.4 = 4.2$ cm

We know that

The perimeter of the 11 gm = 2 × (longer side + shorter side)

= 2 × (8.4 + 4.2)

= 2 × (12.6) = 25.2 cm

4. Let the adjacent sides of the 11 gm are $2x$ and $3x$ respectively.

A.T.Q. perimeter = 40 cm

We know that

Perimeter = 2 × sum of adjacnet sides

$$40 = 2 \times (2x + 3x)$$
$$40 = 2 \times 5x$$
$$40 = 10x$$
$$x = \frac{40}{10}$$
$$x = 4$$
$$2x = 2 \times 4 = 8\,\text{cm}$$
$$3x = 3 \times 4 = 12\,\text{cm}$$

Hence the adjacent sides of the 11 gm are 8 cm and 12 cm respectively.

5. Let the adjacent sides of a 11 gm are $2x$ and $3x$ respectively.

A.T.Q. Perimeter = 60 cm.

We know that

Perimeter = 2 × sum of adjacent sides

$$60 = 2 \times (2x + 3x)$$
$$60 = 2 \times 5x$$
$$60 = 10x$$
$$x = \frac{60}{10}$$
$$x = 6$$
$$2x = 2 \times 6 = 12\,\text{cm}$$
$$3x = 3 \times 6 = 18\,\text{cm}$$

Hence the adjacent sides of the 11 gm are 12 cm and 18 cm respectively.

6. Let the other side of the 11 gm = x cm.

and one side of the 11 gm = $(x + 33)$ cm.

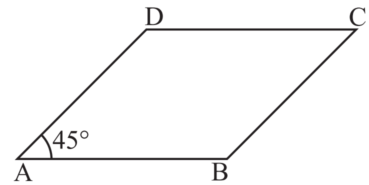
A.T.Q. Perimeter = 150 cm

We know that

$$\text{Perimeter} = 2 \times (\text{Sum of two sides})$$
$$150 = 2 \times (x + x + 33)$$
$$150 = 2 \times (2x + 33)$$
$$150 = 4x + 66$$
$$4x = 150 - 66$$
$$4x = 84$$
$$x = 21$$

Thus the lengths of the sides are 21 cm and 54 cm.

7. In a 11 gm $ABCD$, $\angle A = 45°$



Since the opposite angles of a 11 gm are equal

therefore $\angle A = \angle C$

$\angle C = 45°$

Since, sum of adjacent angles of a 11 gm is 180°.

$\therefore$ $\angle A + \angle B = 180°$

$45° + \angle B = 180°$

$\angle B = 180° - 45°$

$\angle B = 135°$

Now, $\angle B = \angle D$ (opp. angles are equal)

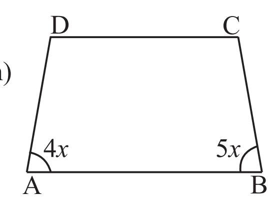
$135° = \angle D$

$\angle D = 135°$

So, the other angles of the 11 gm are 135°, 45° and 135° respectively.

8. Let $ABCD$ is a 11 gm and $\angle A$ & $\angle B$ are two adjacent angles.

Let $\angle A = 4x$ and $\angle B = 5x$



$\angle A + \angle B = 180°$

(sum of adjacent $\angle S$ in a 11 gm)

$4x + 5x = 180°$

$9x = 180°$

$x = 20°$

$\therefore$ $\angle A = 4x = 4 \times 20° = 80°$

and $\angle B = 5x = 5 \times 20° = 100°$

$\because$ $\angle D = \angle B$

and $\angle C = \angle A$ (opp. $\angle S$ of a 11 gm are equal)

$\therefore$ $\angle D = 100$

and $\angle C = 80°$

So, the angles of a 11 gm are 80°, 100°, 80° and 100° respectively.

9. Let $ABCD$ is a 11 gm and $\angle A$ and $\angle B$ are two adjacent angles

Let $\angle A = 7x$

and $\angle B = 2x$

Now, $\angle A + \angle B = 180°$ (sum of adjacent $\angle S$ in a 11 gm is 180°)

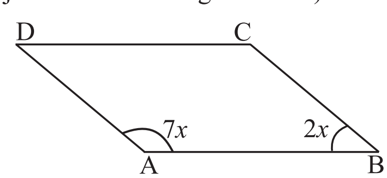
$7x + 2x = 180°$

$9x = 180°$

$x = 20°$

$\therefore$ $\angle A = 7x = 7x \times 20 = 140°$

and $\angle B = 2x = 2 \times 20 = 40°$



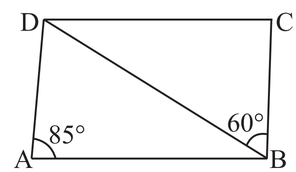
We have,

$\angle D = \angle B$ and $\angle C = \angle A$ (opp. $\angle s$ in a 11 gm are equal)

$\angle D = 400°$ and $\angle C = 140°$

So, the angles of a 11 gm are 140°, 40°, 140° and 40° respectively.

10. In fig. *ABCD* is a 11 gm.



$\angle DAB = 85°$

and $\angle DBC = 60°$

(i) In a 11 m *ABCD*

$AD \parallel BC$ and *BD* is the transversal.

$\angle ADB = \angle DBC$ (alternate interior angles)

$\angle ADB = 60°$

We have,

$\angle ADB + \angle DAB = 180°$ (sum of adj. $\angle s$ in a 11 gm)

$(\angle CDB + \angle ADB) + \angle DAB = 180°$

$\angle CDB + 60° + 85° = 180°$

$\angle CDB + 145° = 180°$

$\angle CDB = 180° - 145°$

$\angle CDB = 35°$

(ii) In 11 gm *ABCD*

$DC \parallel AB$ and *DB* is the trnasversal

$\therefore$ $\angle ADB = \angle CDB$ (alternate interior angles)

$\angle ABD = 35°$

Exercise-9.3

1. (a) T (b) F (c) T (d) F (e) T (f) F (g) T (h) T (i) F (j) F (k) F (l) F (m) F (n) F.

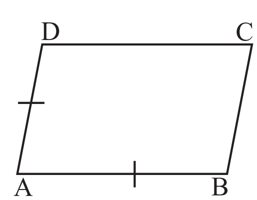
2.

	Rectangle	Square
(i)	F	T
(ii)	T	T
(iii)	T	T
(iv)	F	T
(v)	F	T
(vi)	F	T
(vii)	F	T
(viii)	T	T
(ix)	T	T
(x)	T	T

3. (a) T (b) T (c) F (d) T (e) F (f) T (g) T

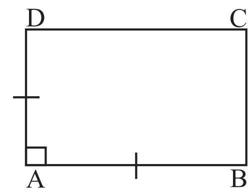
4. (a) $AB = AD$

ABCD is a rhombus.



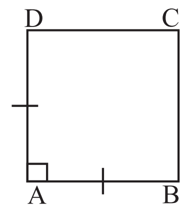
(b) $\angle DAB = 90°$

$ABCD$ is a rectangle.



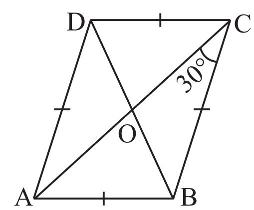
(c) $AB = AD$ and $\angle DAB = 90°$

$ABCD$ is a square.



5. No, it is not a rhombus because diagonals are perpendicular to each other in a rhombus.

6. In fig. $ABCD$ is a rhombus and $\angle ACB = 30°$.



(a) In rhombus, diagonals are perpendicular to each other.

So, $\angle BOC = 90°$

(b) In ΔOBC,

By angle sum property,

We have

$\angle CBO + \angle BOC + \angle OCB = 180°$

$\angle CBO + 90° + 30° = 180°$

$\angle CBO + 120° = 180°$

$\angle CBO = 180° - 120°$

$\angle CBO = 60°$

(c) In rhombus $ABCD$

$AD \parallel BC$ and AC is the transversal

$\therefore$ $\angle OAD = \angle OCB$ (alt. int. $\angle s$)

$\angle OAD = 30°$

(d) In rhombus $ABCD$,

$AB = BC$

$\therefore$ $\angle CAB = \angle BCA$ (opp. $\angle s$ to opp. equal sides)

$\angle CAB = 30°$

In a rhombus, diagonals are perpendicular to each other.

$\therefore$ $\angle AOB = 90°$

In ΔOAB,

By angle sum property,

We have,

$\angle OAB + \angle ABO + \angle BOA = 180°$

$30° + \angle ABO + 90° = 180°$

$\angle ABO + 120° = 180°$

$\angle ABO = 180° - 120°$

$\angle ABO = 60°$

7. Let $ABCD$ is a rhombus.

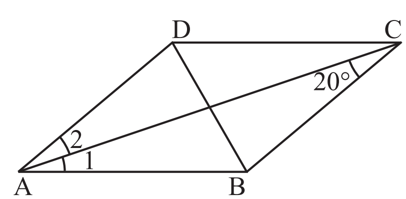
Let $\angle ACB = 20°$

In rhombus, $ABCD$,

$AB = BC$

$\therefore$ $\angle 1 = \angle ACB$

(opp. $\angle s$ are equal to opp. equal sides)



$\angle 1 = 20°$

Since $AD \parallel BC$ and AC is the transvesal therefore $\angle 2 = \angle ACB$

(alt. int. $\angle s$)

$\angle 2 = 20°$

We have, $\angle A = \angle 1 + \angle 2$

$\angle A = 20° + 20°$

$\angle A = 40°$

In rhombus, opp. angles are equal.

So, $\angle C = \angle A$

$\angle C = 40°$

In rhombus, adjacent angles are supplimentary angles.

So, $\angle A + \angle B = 180°$

$40° + \angle B = 180°$

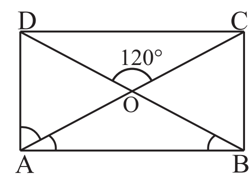
$\angle B = 180° - 40°$

$\angle B = 180° - 120°$

$\angle B = 140°$

So, the four angles of the rhombus are 40°, 140° and 140°.

8. Given that $ABCD$ is a rectangle and $\angle COD = 120°$.



In ΔABD and ΔABC

$AD = BC$ (opp. sides are equal in a rectangle)

$BD = AC$ (diagonals are equal in a rectangle)

$AB = AB$ (common side)

$\therefore$ $\Delta ABD \cong \Delta ABC$ (SSS congruency)

$\therefore$ $\angle ABD = \angle BAC$ (By c.p.c.t.)

$\angle OBA = \angle OAB$

$\angle OBA = \angle OAB = x°$ (say)

Now, $\angle AOB = \angle COD$ (vertically opposite angles)

$\angle AOB = 120°$

In ΔAOB,

$\angle AOB + \angle OBA + \angle OAB = 180°$

$120° + x° + x° = 180°$

$2x = 180° - 120°$

$2x = 60°$

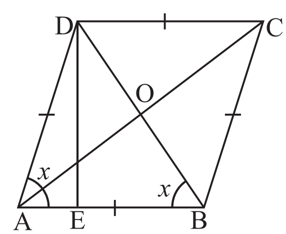
$x = 30°$

So, $\angle OBA = 30°$

9. Let $ABCD$ be a rhombus in which $\angle ADC$ is an obtuse angle.

From the point, draw DE such that

$DE \perp AB$ and it bisects the side AB.



$\therefore$ $AE = EB$

In ΔADE and ΔBDE

$DE = DE$ (common side)

$\angle DEA = \angle DEB$ (each 90°)

$AE = EB$ (given)

$\therefore$ $\Delta ADE \cong \Delta BDE$ (SAS congruency)

$\therefore$ $\angle DAB = \angle DBA$ (By c.p.c.t.)

$\angle DAB = \angle DBA = x$ (say)

We know that each diagonal of a rhombus bisects the angle through which it passes.

So, AC will bisect the $\angle A$.

$\therefore \quad \angle BAO = \frac{x}{2}$

In a rhombus, diagonals are perpendicular to each other.

So, $\quad \angle AOB = 90°$

In ΔAOB

By angle sum property, We have,

$$\angle AOB + \angle OBA + \angle BAO = 180°$$

$$90° + x + \frac{x}{2} = 180°$$

$$90° + \frac{3x}{2} = 180°$$

$$\frac{3x}{2} = 180° - 90°$$

$$\frac{3x}{2} = 90°$$

$$x = 90° \times \frac{2}{3}$$

$$x = 30° \times 2 = 60°$$

$\therefore \quad \angle DAB = x = 60°$

Now, $\quad \angle ABC + \angle DAB + \angle DAB = 180°$

(In a rhombus, adjacent angles are supplimentary)

$\angle ABC + 60° = 180°$

$\angle ABC = 180° - 60°$

$\angle ABC = 120°$

We have, $\quad \angle BCD = \angle DAB \quad$ (In a rhombus, opp. angles are equal)

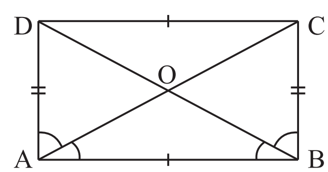
$\angle BC = 60°$

Again, $\quad \angle ADC = \angle ABC \quad$ (In a rhombus opp. angles are equal)

$\angle ADC = 120°$

So, the four angles of the rhombus are 60°, 120°, 60° and 120° respectively.

10. In fig., $ABCD$ is a rectangle.



In ΔABD & ΔABC

$AD = BC \quad$ (opp. sides are equal)

$\angle DAB = \angle ABC \quad$ (each 90°)

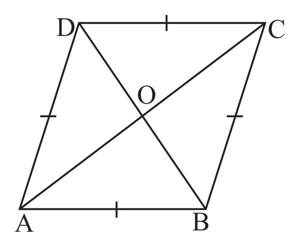
$AB = AB \quad$ (common side)

$\therefore \quad \Delta ABD \cong \Delta ABC \quad$ (SAS congruency)

$\therefore \quad AC = BD \quad$ (By c.p.c.t.)

Hence, the diagonals of a rectangle are equal.

11. In fig. $ABCD$ is a rhombus.



$\therefore \quad AB = BC = CD = DA$

In ΔAOB & ΔCOD

$\angle AOB = \angle COD \quad$ (very. opp. $\angle s$)

$\angle OAB = \angle OCD \quad$ (alt. int. $\angle s$)

$AB = CD \quad$ (Given)

$\therefore \quad \Delta AOB \cong \Delta COD$

$\therefore \quad OA = OC$

and $\quad OB = OD \quad$ (By c.p.c.t.)

So, the digonals bisect each other.

In ΔAOB & ΔBOC

$AB = BC$ (sides of a rhombus)

$OB = OB$ (common side)

$OA = OC$ (proved above)

$\therefore \quad \Delta AOB \cong \Delta BOC$ (SSS congruency)

$\therefore \quad \angle AOB = \angle BOC$ (By c.p.c.t.)

By linear pair axion

$\angle AOB + \angle BOC = 180°$

$\angle AOB + \angle AOB = 180°$

$2\angle AOB = 180°$

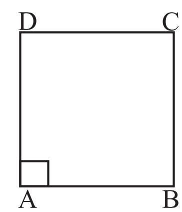
$2\angle AOB = \frac{180°}{2}$

$\angle AOB = 90°$

$\therefore \quad AC \perp BD$

Hence, the diagonals of a rhombus bisect each other at right angles.

12. **Given that :** *ABCD* is a rhombus and let $\angle A = 90°$



Prove that : *ABCD* is a square.

Proof : In a rhombus, sum of adjacent angles is 180°.

$\therefore \quad \angle A + \angle D = 180°$

$90° + \angle D = 180°$

$\angle D = 180° - 90°$

$\angle D = 90°$

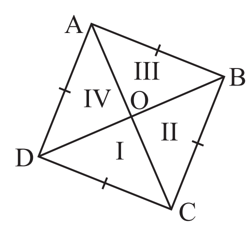
Similarly, $\angle B = \angle C = 90°$

Since, a rhombus, whose all angles are 90° is a square.

Therefore, *ABCD* is a square.

13. **Given that :** *ABCD* is a rhombus in which *AC* and *BD* are diagonals intersecting at *O*.

Prove that : $\Delta OCD \cong \Delta OBC \cong \Delta OBA \cong \Delta OAD$



Proof : In ΔOCD & ΔOBC

$OD = OB$ (diagonals bisect each other)

$OC = OC$ (common side)

$CD = BC$ (sides are equal in a rhombus)

$\therefore \quad \Delta OCD \cong \Delta OBC$ …(1) (SSS congruency)

Similarly, we can prove that

$\Delta OBC \cong \Delta OBA$ …(2)

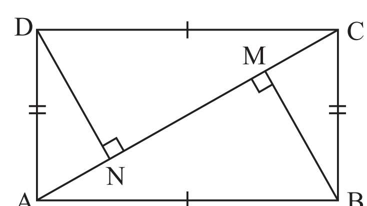
$\Delta OBA \cong \Delta OAD$ …(3)

From eq. (1), (2) & (3), we can say that

$\Delta OCD \cong \Delta OBC \cong \Delta OBA \cong \Delta OAD$ **Hence proved.**

14. **Given that :** *ABCD* is a rectangle.

Prove that : $AN = CM$



Proof : In ΔAND & ΔCMB

$\angle DNA = \angle CMB$

($\because DN \perp AC$ & $BM \perp AC$)

$\angle DAN = \angle BCM$

(alt. int. angles)

$AD = BC$

(opp. sides are equal)

∴ $\Delta AND \cong \Delta CMB$

So, $AN = CM$ **Hence, proved.**

15. (a) F, (b) F, (c) F, (d) T, (e) F, (f) T, (g) T, (h) F, (i) F, (j) T.

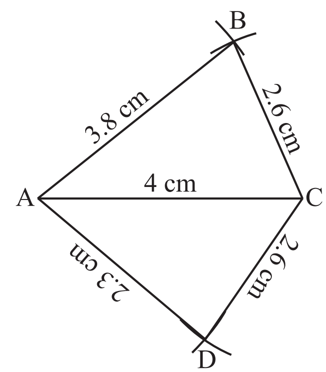
Multiple Choice Questions

1. (c) rhombus	2. (c) 10 cm	3. (b) 32	4. rectangle
5. (c) 70 cm	6. 45°	7. (b) 72	8. (a) rectangle
9. (d) 8	10. (c) 112		

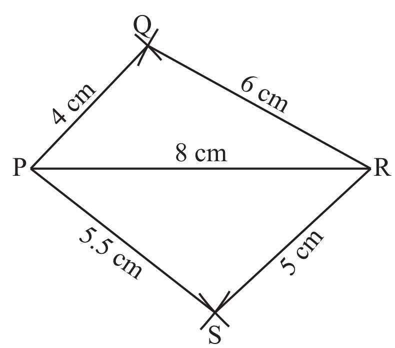
10. Practical Geometry

Exercise 10.1

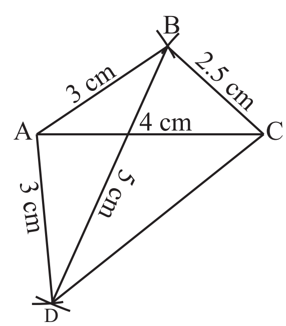
1. **Steps of Construction :**
   (i) Draw $AC = 4$ cm.
   (ii) With A as centre draw an arc of radius 3.8 cm.
   (iii) With C as centre draw an arc of radius 2.6 cm. to intersect the arc of step 2 at B.
   (iv) Join AB and BC.
   (v) With A as centre draw an arc of radius 2.3 cm.
   (vi) With C as centre draw an arc of radius 2.6 cm to intersect the arc of step 4 at D.
   (vii) Join AD and CD.
   Thus $ABCD$ is a required quadrilateral.



2. **Steps of Construction :**
   (i) Draw$PR = 8$ cm.
   (ii) With P as centre draw an arc of radius 4 cm.
   (iii) With R as centre draw an arc of radius 6 cm to intersect the arc of step 2 at Q.
   (iv) Join PQ and QR.
   (v) With P as centre draw an arc of radius 5.5 cm.
   (vi) With R as centre draw an arc of radius 5 cm to intersect the arc of step 5 at S.
   (vii) Join PS and RS.
   Thus $PQRS$ is a required quadrilateral.



3. **Steps of Construction :**
   (i) Draw $AC = 4$ cm.
   (ii) With A as centre draw an arc of radius 3 cm.
   (iii) With C as centre draw an arc of radius 2.5 cm. to intersect the arc of step 2 at B.
   (iv) Join AB and BC.
   (v) With A as centre draw an arc of radius 3 cm.
   (vi) With B as centre draw an arc of radius 5 cm to intersect the arc of step 5 at D.
   (vii) Join CD, BD and DA.
   Thus, $ABCD$ is a required quadrilateral.



4. Steps to Construction :

(i) Draw $AC = 5.5$ cm.

(ii) With A as centre draw an arc of radius 5.5 cm.

(iii) With C as centre draw an arc of radius 5 cm. to intersect the arc of step 2 at D.

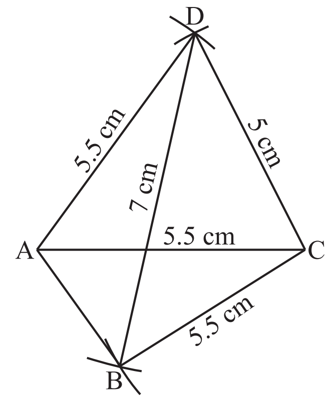
(iv) Join AD and CD.

(v) With C as centre draw an arc of 4.5 cm.

(vi) With D as centre draw an arc of radius 7 cm. to intersect the arc of step 5 at B.

(vii) Join BC, BD and AB.

Thus obtained $ABCD$ is a required quadrilateral.



5. Steps of Construction :

(i) Draw $AC = 6$ cm.

(ii) With A as centre draw an arc of radius 6 cm.

(iii) With C as centre draw an arc of radius 5 cm to intersect the arc of step 2 at D.

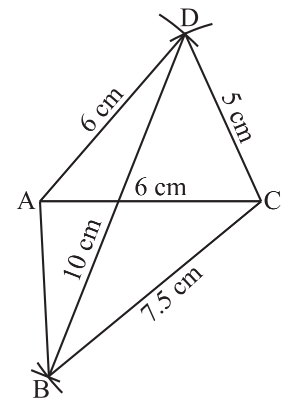
(iv) Join AD and CD.

(v) With C as cntre draw an arc of radius 7.5 cm.

(vi) With D as centre draw an arc of radius 10 cm. to intersect the arc of step 5 at B.

(vii) Join BC, BD and AB.

Thus obtained $ABCD$ is a required quadrilateral.



6. Steps of Construction :

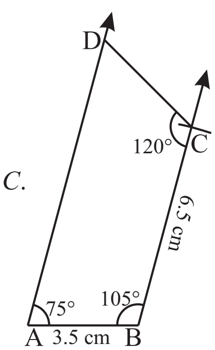
(i) Join $AB = 3.5$ cm.

(ii) Draw $\angle XAB = 75°$ and $\angle ABY = 105°$.

(iii) Draw on arc $BC = 6.5$ cm. with B as centre to intersect BY at C.

(iv) Draw $\angle ZCB = 120°$ to intersect AXD.

Thus obtained $ABCD$ is a required quadrilateral.



7. In a quadrilateral $ABCD$. By angle sum property.

We have,

$\angle A + \angle B + \angle C + \angle D = 360°$

$60° + 75° + \angle C + 90° = 360°$

$\angle C + 255° - 255° \angle C = 105°$

Steps to Construction :

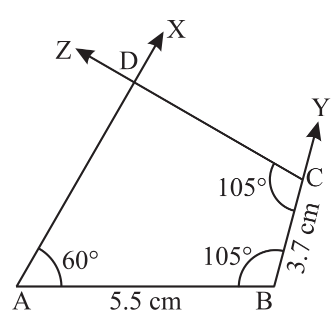
(i) Draw $AB = 5.5$ cm.

(ii) Draw $\angle XAB = 60°$ and $\angle YBA = 105°$.

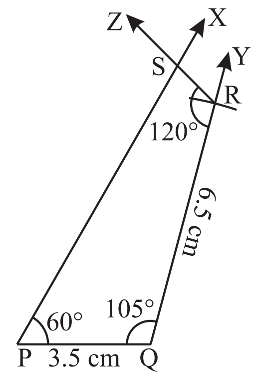
(iii) Draw an arc $BC = 3.7$ cm with B as centre to intersect BY at C.

(iv) Draw $\angle ZCB = 105°$ to intersect AX to D.

Thus obtained $ABCD$ is a required quadrilateral.



8. In a quadrilateral $PQRS$. By angle sum property.



We have,

$\angle P + \angle Q + \angle R + \angle S = 360°$

$60° + 105° + \angle R + 75° = 360°$

$\angle R + 240° = 360° \; \angle R = 120°$

Steps to Construction :

(i) Draw $PQ = 3.5$ cm.

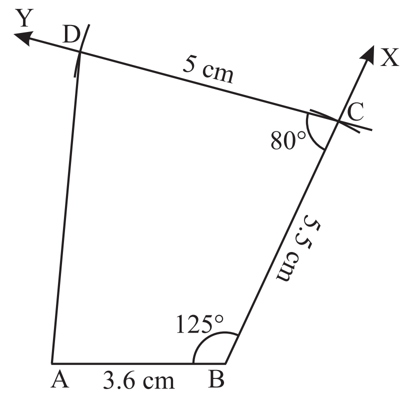
(ii) Draw $\angle XPQ = 60°$ and $\angle YQP = 105°$.

(iii) Draw an arc are $QR = 6.5$ cm. with Q as centre to intersect QY at R.

(iv) Draw $ZRQ = 120°$ to intersect PX at S.

Thus obtained $PQRS$ is a required quadrilateral.

9. **Steps to Construction :**



(i) Draw $AB = 3.6$ cm.

(ii) Draw $\angle XBA = 125°$.

(iii) Draw an arc are $BC = 5.5$ cm with B as centre to intersect BX at C.

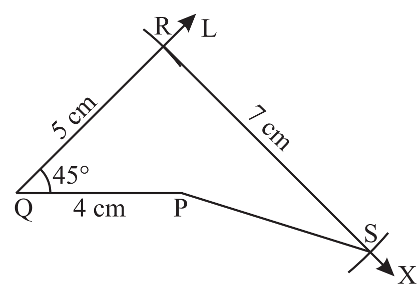
(iv) Draw $\angle YCB = 80°$.

(v) Draw an arc $CD = 5$ cm. with C as centre to intersect CY at D.

(vi) Join AD.

Thus obtained $ABCD$ is a required quadrilateral.

10. **Steps to Construction :**



(i) Draw $QP = 4$ cm.

(ii) At point Q on line QP, draw $\angle PQR = 45°$ using a protractor.

(iii) Taking Q as centre and radius 5 cm, cut an arc on QL intersecting it at R.

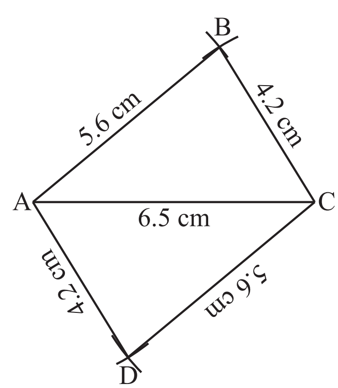
(iv) At point R on line QR, draw $\angle R = 90°$ using a protractor.

(v) Taking R as centre and radius 7 cm, cut an arc on RX intersecting it at S.

(vi) Now, join S and P.

Hence, $PQSR$ is the required quadrilateral.

11. **Given :** $AB = 5.6$ cm, $BC = 4.2$ cm, $AC = 6.5$ cm.



In a parallelogram, opp. sides are equal

$\therefore \quad CD = AB, \quad CD = 5.6$ cm.

and $\quad AD = BC, \quad AD = 4.2$ cm.

Steps of Construction :

(i) Draw $AC = 6.5$ cm.

(ii) With A as centre draw an arc of radius 5.6 cm.

(iii) With C as centre draw an arc of radius 4.2 cm. to intersect the arc of step 2. at B.

(iv) Join AB and BC.

(v) With A as centre draw an arc of radius 4.2 cm.

(vi) With C as centre draw an arc of radius 5.6 cm to intersect the arc of step 5 at D.

(vii) Join AD and CD.

Thus obtained $ABCD$ is a parallelogram.

12. Steps of Construction :

(i) Draw a line $AB = 5.2$ cm.

(ii) With A as centre draw an arc with radius 3 cm.

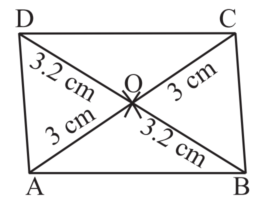
(iii) With B as centre draw another arc of radius 3.2 cm which intersect to last arc at O.

(iv) Join AO and OB.

(v) Extend AO to C such that $AO = OC$ and extend BO to D such that $BO = OD$.

(vi) Join AD, BC and CD.

(vii) Then the quadrilateral is the required parallelogram.



13. Let $ABCD$ is a parallelogram in which

$AC = 5.4$ cm $BD = 6.2$ cm. and $\angle BOC = 70°$

Steps of Construction :

(i) Draw $AC = 5.4$ cm.

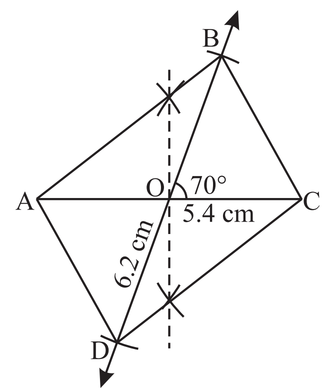
(ii) Bisects AC at O.

(iii) Draw $\angle XOC = 70°$ and produce XO to Y.

(iv) With O as centre draw arcs of radius $= \frac{1}{2} \times 6.2 = 3.1$ cm. to intersect OX at B and OY at D.

(v) Join AB, BC, CD and DA.

Thus obtained $ABCD$ is a required parallelogram.



14. Let $ABCD$ is a rectangle in which

$AB = 8$ cm. and $AC = 10$ cm.

Steps of Construction :

(i) Draw $AB = 8$ cm.

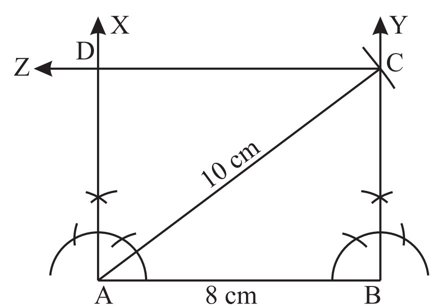
(ii) Draw $\angle XAB = 90°$ and $\angle YBA = 90°$.

(iii) With A as centre draw an arc of radius 10 cm. to intersect BY at C.

(iv) Join AC.

(v) Draw a ray CZ parallel to AB such that it intersects ray AX at D.

Thus obtained $ABCD$ is a rectangle.



15. Let $ABCD$ is a square in which diagonals $AC = BD = 6$ cm.

Steps of Construction :

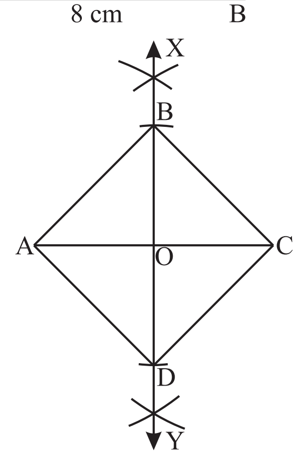
(i) Draw $AC = 6$ cm.

(ii) Draw XY such that it bisects AC at O.

(iii) Withs O as centre draw arcs of radius $\frac{1}{2} \times 6$ cm

$= 3$ cm which intersect OX at B and OY and D.

Thus obtained $ABCD$ is a required square.



16. Let $ABCD$ is a rhombus in which $AB = 4.2$ cm and $\angle A = 75°$.

$\angle A + \angle B = 180°$ (sum of adjacent angles in a rhombus is 180°)

$75° + \angle B = 180°$ $\angle B = 105°$

Steps of Construction :

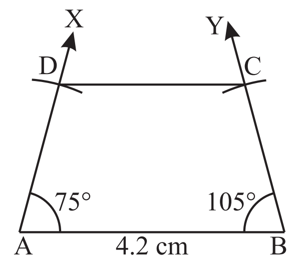
(i) Draw $AB = 4.2$ cm.

(ii) Draw $\angle XAB = 75°$ and $\angle YBA = 105°$.

(iii) Draw A and B as centre draw two arcs which intersect AX at D and BY at C respectively.

(iv) Join CD.

Thus obtained $ABCD$ is a required rhombus.



11. Visualising Solid Shapes

Exercise 11.1

1. (i) Quadrilateral pyramid, (ii) Sphere,
(iii) Cuboid, (iv) Cube, (v) Cone.

2. (i) Yes (ii) Yes (iii) No.

3. (i) In case of all the faces of a polyhedron are congruent, it is called a regular polyhedron.

(ii) Cuboid is not a regular polyhedron.

(iii) Cone is not a regular polyhedron.

4.

4.

S.No.	Solid	V	F	E	$V + F - E = 2$
(i)	Triangular or prism	6	5	9	6 + 5 + 9 = 2
(ii)	Hexagonal prism	12	8	18	12 + 8 – 18 = 2
(iii)	Hexagonal pyramid	7	7	12	14 – 12 = 2
(iv)	Pentagonal pyramid	6	6	10	6 + 6 – 10 = 2
(v)	Cube	8	6	12	8 + 6 – 12 = 2
(vi)	Quadrilateral pyramid	5	5	8	5 + 5 – 8 = 2

5. Number of faces of a polyhedron = 6

Number of vertices of a polyhedron = 8

Let the number of edges be x

With the help of Euler's formula

$$V + F - E = 2$$

The $$8 + 6 - x = 2$$

$$x = 14 - 2$$

$$x = 12$$

Hence, the number of edges = 12.

6. Number of edges $(E) = 30$

Number of vertices $(V) = 20$

Let the number of faces be x

then, $E + F - V = 2$

$20 + x - 30 = 2$

$x = 2 + 30 - 20$

$x = 32 - 20$

$x = 12$

Hence, the number of faces = 12.

7. Number of faces $(F) = 40$

Number of edges $(E) = 60$

Let the number of vertices be x

then $E + F - V = 2$

$60 + 40 - x = 2$

$x = 100 - 2$

$x = 98$

Hence, the number of vertices $(V) = 98$

MCQ's

1. (b) **2.** (c) **3.** (d) **4.** (b) **5.** (a) **6.** (c) **7.** (c).

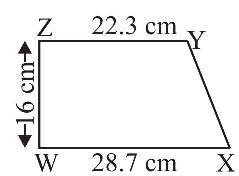
Formative Assessment-3

1. (a) **2.** (d) **3.** (b) **4.** (b) **5.** (c) **6.** (c) **7.** (a) **8.** (d) **9.** (b) **11.** (a) **12.** (d) **13.** (a) **14.** (c) **15.** (b)
16. (d) **17.** (a) **18.** (d) **19.** (b) **20.** (c).

12. Mensuration

Exercise 12.1

1. **Given :** $WXYZ$ is a trapezium whose paralleles sides are $WX = 28.7$ cm. $ZY = 23.3$ cm. height $(h) = WZ = 16$ cm.



Area of trapezium $WXYZ = \frac{1}{2} \times$ (sum of parallel sides) $\times h$

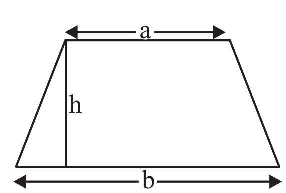
$= \frac{1}{2} \times (ZY + WX) \times h$

$= \frac{1}{2} \times (22.3 + 28.7) \times 16$

$= \frac{1}{2} \times 51 \times 16 = 51 \times 8 = 408 \text{ cm}^2$.

2. **Given :** Area of trapezium = 984 cm^2,

Let $a = 50.5$ cm, $b = 31.5$ cm, $h = ?$



Area of trapezium $= \frac{1}{2} \times$ (sum of parallel sides) $\times h$

$\Rightarrow \quad 984 = \frac{1}{2} \times (a + b) + h$

$\Rightarrow \quad 984 = \frac{1}{2} \times (50.5 + 31.5) \times h$

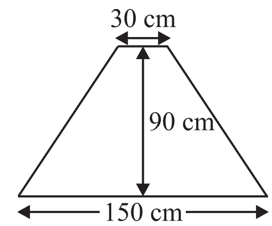
$\Rightarrow \quad 984 = \frac{1}{2} \times 82 \times h$

$\Rightarrow \quad 984 = 41 \times h$

$\Rightarrow \quad h = \dfrac{984}{41} = 24$ cm.

3. **Given :** $a = 150$ cm, $b = 30$ cm, $h = 90$ cm.

$\therefore$ Area of Trapezium $= \dfrac{1}{2} \times$ (sum of parallel sides) $\times h$



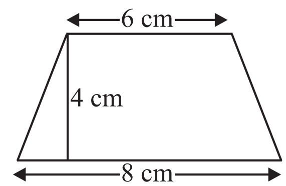
$$\text{Area} = \frac{1}{2} \times (150 + 30) \times 90$$

$$= \frac{1}{2} \times 180 \times 90 = 90 \times 90$$

$$= 8100 \text{ cm}^2.$$

4. **Given :** Let $a = 80 \text{ dm} = \dfrac{80}{10} \text{ m} = 8 \text{ m}$ $\quad \left[\because 1 \text{dm} = \dfrac{1}{10} \text{ m}\right]$

$b = 6$ m, $h = 40 \text{ dm} = \dfrac{40}{10} \text{ m} = 4$ m



$\therefore$ Area of trapezium $= \dfrac{1}{2} \times$ (sides of parallel sides) $\times h$

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

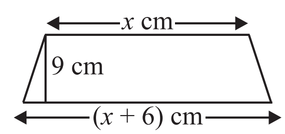
$$= \frac{1}{2} \times 14 \times 4 = 7 \times 4 = 28 \text{ m}^2$$

5. **Given :** Area of trapezium = 270 cm^2 $h = 9$ cm,

Let $b = x$ cm

Then $\quad a = (x + 6)$ cm

Now, by the formula, we have



Area of trapezium $= \dfrac{1}{2} \times$ (sum of parallel sides) $\times h$

$$270 = \frac{1}{2} \times (x + x + 6) \times 9$$

$\Rightarrow \quad 270 \times 2 = (2x + 6) \times 9$

$\Rightarrow \quad 270 \times 9 = 18x + 54$

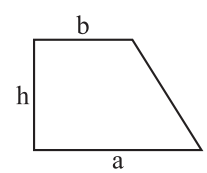
$\Rightarrow \quad 540 - 54 = 18x \quad \Rightarrow \quad 486 = 18x$

$\Rightarrow \quad x = \dfrac{486}{18} = 27$ cm.

$\therefore \; b = x = 27$ cm $a = x + 6 = 27 + 6 = 33$ cm.

6. Given : Area of trapezium = 793 cm^2, $h = 26$ cm,

Let $a = 42$, $b = ?$



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

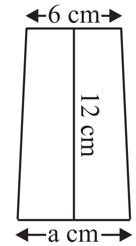
$\Rightarrow \quad 793 = \dfrac{1}{2} \times (42 + b) \times 26$

$\Rightarrow \quad 793 = (42 + b) \times 13 \quad \Rightarrow \quad \dfrac{793}{13} = 42 - b$

$\Rightarrow \quad 61 = 42 + b \quad \Rightarrow \quad 61 - 42 = b$

$\Rightarrow \quad b = 19$ cm.

7. **Given :** Area of trapezium = 78 cm^2, b = cm, n = 12 cm, a = ?



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

$$\Rightarrow \quad 78 = \frac{1}{2} \times (a+b) \times h$$

$$\Rightarrow \quad 78 = \frac{1}{2} \times (a+6) \times 12$$

$$\Rightarrow \quad 78 = (a+6) \times 6$$

$$\Rightarrow \quad 78 = 6a + 36$$

$$\Rightarrow \quad 78 - 36 = 6a \quad \Rightarrow \quad 42 = 6a$$

$$\Rightarrow \quad \frac{42}{6} = a \quad \Rightarrow \quad 7 = a$$

$$\Rightarrow \quad a = 7\,\text{cm}.$$

8. **Given :** Area of trapezium = 38 cm^2

Sum of parallel sides $(a+b) = 9.5$ cm, h = ?

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

$$38 = \frac{1}{2} \times 9.5 \times h \; 38 \times 2 = 9.5 \times h$$

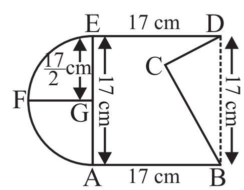
$$h = \frac{38 \times 2}{9.5} = \frac{76 \times 10}{95} = 8$$

Hence, the altitude is 8 cm.

Exercise 12.2

1. (a) We divide given fig. into three parts as semi-circle AEF, square $ABDE$, and a triangle BCD.

In ΔBDC, we have, $a = 17$ cm, $b = 8$ cm, $c = 15$ cm.



$$S = \frac{a+b+c}{2} = \frac{17+8+15}{2} = \frac{40}{2} = 20\,\text{cm}$$

$$\therefore \text{ Area of } \Delta BDC = \sqrt{s(s-a)(s-b)(s-c)}$$

$$= \sqrt{20 \times (20-17)(20-8) \times (20-15)}$$

$$= \sqrt{20 \times 3 \times 12 \times 5}$$

$$= \sqrt{4 \times 4 \times 5 \times 5 \times 3 \times 3} = 60\,\text{cm}^2$$

Area of square $ABDE = (\text{side})^2 = (17)^2 = 289\,\text{cm}^2$

$$\text{Area of semi-circle } AEF = \frac{1}{2}\pi r^2 = \frac{1}{2} \times \frac{22}{7} \times \left(\frac{17}{2}\right)^2$$

$$= \frac{11}{7} \times \frac{289}{4} = \frac{3129}{28} = 113.54$$

$\therefore$ Area of enclosed figure

= Area of semi-circle + Area of square – Area of triangle BDC

$= 113.54 + 289 - 60 = 342.54\,\text{cm}^2$.

(b) Area of square $ABCD = (\text{side})^2$

$= (14)^2 = 196\,\text{cm}^2$

Area of $\Delta CDE = \frac{1}{2} \times \text{base} \times \text{height}$

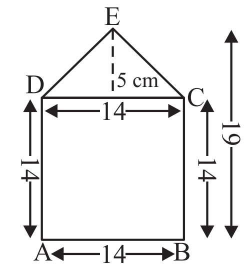
$= \frac{1}{2} \times 14 \times 5 = 35\,\text{cm}^2$

$\therefore$ Area of enclosed figure

= Area of square + Area of triangle

$= 196\,\text{cm}^2 + 35\,\text{cm}^2$

$= 231\,\text{cm}^2$



(c) Let $ABCD$ be a square and $CDEF$ be a trapezium.

Now, Area of square $ABCD = (\text{side})^2$

$= (24\text{ cm})^2$

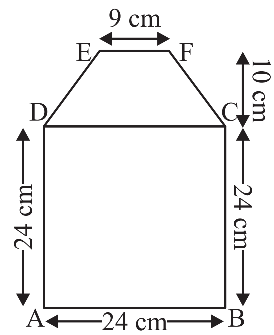
$= 576\text{ cm}^2$

Area of trapezium $CDEF$

$= \frac{1}{2} \times (\text{sum of parallel sides}) \times \text{altitude}$

$= \frac{1}{2} \times (24 + 9) \times 10$

$= 33 \times 5 = 165\,\text{cm}^2$



$\therefore$ Area of closed figure $ABCDEF = 576 + 165 = 714\text{ cm}^2$.

(d) Given Fig. can be divided into two parts, rectangle $ABCD$ and trapezium $BEFG$.

Area of rectangle $ABCD = l \times b = 16 \times 5 = 80\,\text{cm}^2$

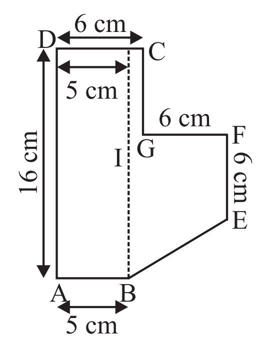
Area of trapezium $BEFG$

$= \frac{1}{2} \times (\text{sum of parllel sides}) \times \text{altitude}$

$= \frac{1}{2} \times (10 + 6) \times 7$

$= \frac{1}{2} \times 16 \times 7$

$= 8 \times 7 = 56\,\text{cm}^2$.



Area of rectangle $CIGH = l \times b = 6 \times 1 = 6\,\text{cm}^2$

$\therefore$ Area of enclosed Fig. $ABEFGHDA$

= Area of rectangle $ABCD$ + Area of rectangle $CIGH$ + Area of trapezium

$= 80 + 56 + 6 = 142\,\text{cm}^2$.

2. Given : In quadrilateral $ABCD$,

Diagonal $AC = 48\,\text{cm}$, $DP = 17.5$ cm, $BQ = 12\,\text{cm}$

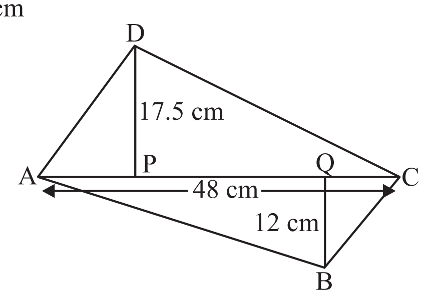
Area of Quadrilateral $ABCD$

$= \frac{1}{2} \times d \times (h_1 + h_2)$

$= \frac{1}{2} \times 48 \times (17.5 + 12)$

$= 24 \times 29.5$

$= 708\,\text{cm}^2$.

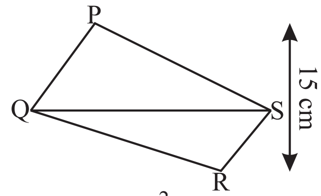


3. Area of quadrilateral $PQRS$

$= \frac{1}{2} \times d \times (h_1 + h_2)$

$= \frac{1}{2} \times \text{diagonal} \times (\text{sum of perpendiculars})$

$= \frac{1}{2} \times 18 \times 15 = 9 \times 15 = 135 \text{ cm}^2.$



4. **Given :** Area of swimming pool in the shape of a trapezium = 112 m^2

$PQ = 16$ m, $SR = 12$ m, $h = ?$

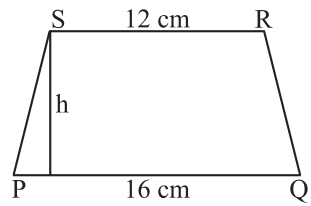
$\therefore$ Area of trapezium $= \frac{1}{2} \times$ (sum of parallel sides) $\times$ height (depth)

$112 = \frac{1}{2} \times (16 + 12) \times h$

$112 = \frac{1}{2} \times 28 \times h$

$\Rightarrow \quad 112 = 14 \times h$

$\therefore \quad h = \frac{112}{14} = 8$ m.



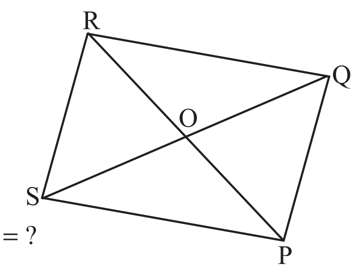
5. **Given :** diagonals $SQ = 30$ cm, $PR = 18$ cm.

$\therefore$ Area of rhombus $= \frac{1}{2} \times d_1 \times d_2$

$= \frac{1}{2} \times 30 \times 18$

$= 15 \times 18$

$= 270 \text{ cm}^2.$



6. **Given :** Area of rhombus = 216 cm^2, $d_1 = 18$ cm, $d_2 = ?$

Area of rhombus $= \frac{1}{2} \times 18 \times d_2$

$216 = 9 \times d_2$

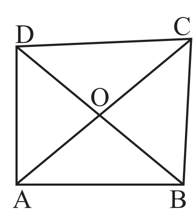
$\Rightarrow \quad d_2 = \frac{216}{9} = 24$ cm.

7. Area of one tile $= \frac{1}{2} \times d_1 \times d_2$

$= \frac{1}{2} \times 20 \times 28$

$= 280 \text{ cm}^2$

$= \frac{280}{100 \times 100} \text{ m}^2 \quad \left[\because 1\text{cm}^2 = \frac{1}{100 \times 100} \text{m}^2\right]$



Area of 2550 tiles $= \frac{280}{100 \times 100} \times 2550$

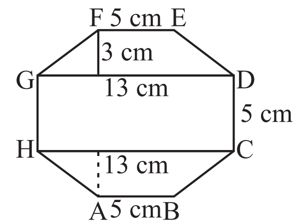
$= \frac{28 \times 255}{100} \text{ m}^2$

Now, cost of polishing the floor of 1 m^2 area = ₹ 25

$\therefore$ Cost of polishing the floor of $\frac{28 \times 255}{100}$ m^2 Area = ₹ $\frac{\overset{7}{\cancel{28}} \times 255 \times \overset{1}{\cancel{25}}}{\underset{\underset{1}{\cancel{4}}}{\cancel{100}}}$

$= 7 \times 255 \times 1 =$ ₹ $1785.$

8. We divide the table into three parts.
trapezium *ABCH*,
rectangle *CDGH*
and another trapezium *DEFG*.
Now, Area of trapezium *ABCD*



$= \frac{1}{2} \times$ (sum of parallel sides) $\times$ height

$= \frac{1}{2} \times (13 + 5) \times 3$

$= \frac{1}{2} \times 18 \times 3$

$= 9 \times 3 = 27$ cm.

Area of trapezium *DEFG* $= \frac{1}{2} \times$ (sum of parallel sides) $\times$ height

$= \frac{1}{2} \times (13 + 5) \times 3 = \frac{1}{2} \times 18 \times 3 = 9 \times 3 = 27 \text{ cm}^2$

Area of rectangle *CDGH* $= l \times b$

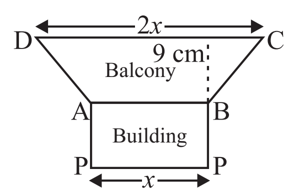
$= 13 \times 5 = 65 \text{ cm}^2$

Area of the regular octagon = Area of *ABCH* + Area of *CDGH* + Area of *DEFG*

$= 27 + 65 + 27 = 119 \text{ cm}^2.$

9. Let *PQAB* be a building and *ABCD* is a balcony attached to the building in the shape of a trapezium.

Area of trapezium $= \frac{1}{2} \times$ (sum of it's parallel sides) $\times$ height



$\Rightarrow \quad 18 = \frac{1}{2} \times (x + 2x) \times 9$

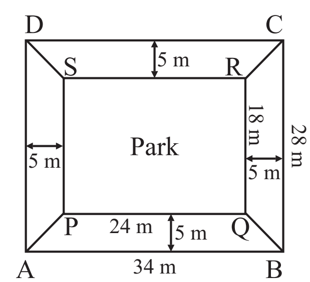
$\Rightarrow \quad 18 \times 2 = 3x \times 9$

$\Rightarrow \quad x = \frac{\overset{2}{\cancel{18}} \times 2}{3 \times \underset{1}{\cancel{9}}} = \frac{4}{3}$

$\therefore$ length of the side of the balcony not attached to the building $= 2x$

$= 2 \times \frac{4}{3} = \frac{8}{3} = 2.666 = 2.67.$

10. Area of trapezium type park *ABQP*



$= \frac{1}{2} \times$ (sum of parallel sides) $\times$ h

$= \frac{1}{2} \times (34 + 24) \times 5$

$= \frac{1}{2} \times 58 \times 5 = 29 \times 5 = 145 \text{ m}^2.$

Area of another trapezium type park $BCRQ = \frac{1}{2} \times$ (sum of parallel sides) $\times h$

$$= \frac{1}{2} \times (28 + 18) \times 5$$

$$= \frac{1}{2} \times 46 \times 5 = 23 \times 5 = 115\, m^2.$$

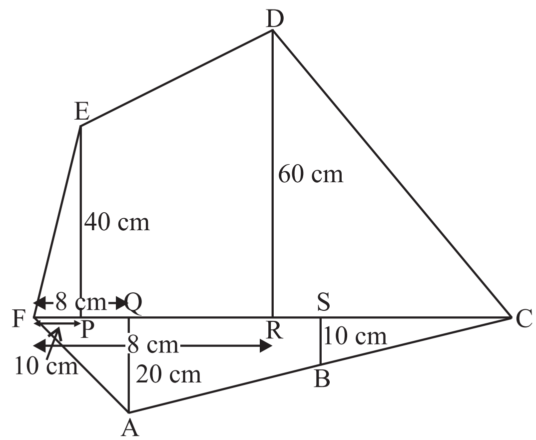
11. **Given :** $FP = 10\,cm$, $FQ = 20\,cm$, $FR = 50\,cm$, $FS = 60\,cm$, $FC = 100\,cm$.

Area of $\Delta\, FQA = \frac{1}{2} \times$ base $\times$ height

$$= \frac{1}{2} \times FQ \times AQ$$

$$= \frac{1}{2} \times 20 \times 20$$

$$= 200\,cm^2$$



Area of trapezium $ABSQ$

$$= \frac{1}{2} \times h \times \text{(sum of parallel sides)}$$

$$= \frac{1}{2} \times SQ \times (AQ + BS)$$

$$= \frac{1}{2} \times 40 \times (20 + 10)$$

$$= 20 \times 30 = 600\,cm^2$$

Area of $\Delta\, BCS = \frac{1}{2} \times$ base height $= \frac{1}{2} \times CS \times BS$

$$= \frac{1}{2} \times 40 \times 10 = 20 \times 10 = 200\,cm^2$$

Area of $\Delta\, CDR = \frac{1}{2} \times$ base $\times$ height $= \frac{1}{2} \times RC \times RD$

$$= \frac{1}{2} \times 50 \times 60 = 25 \times 60 = 1500\,cm^2$$

Area of trapezium $PRDE = \frac{1}{2} \times h \times$ (sum of parallel sides)

$$= \frac{1}{2} \times 40 \times (40 + 60) = \frac{1}{2} \times 40 \times 100$$

$$= 20 \times 100 = 2000\,cm^2$$

Area of $\Delta\, FEP = \frac{1}{2} \times$ base $\times$ height $= \frac{1}{2} \times FP \times EP$

$$= \frac{1}{2} \times 10 \times 40 = 10 \times 20 = 200\,cm^2$$

$\therefore$ Area of the polygon $ABCDEF$

= Area of $\Delta\, FQA$ + Area of trapezium $ABSQ$ − Ara of $\Delta\, BCS$ + Area of $\Delta\, CDR$ + Area of trapezium $PRDE$ + Area of $\Delta\, FEP$

$= 200 + 600 + 200 + 1500 + 2000 + 200$

$= 4700\,cm^2$.

Exercise 12.3

1. Given : $l = 30, b = 25, h = 18\,\text{m}$

Total surface area of the rectangular box $= 2(lb + bh + lh)$

$= 2(30 \times 25 + 25 \times 18 + 30 \times 18)$

$= 2(750 + 450 + 540)$

$= 2 \times 1740 = 3480\,\text{m}^2$

Cost of painting its outer surface of 1 m^2 = ₹ 12

$\therefore$ Cost of painting its outer surface of 3480 m^2 $= 12 \times 3480 =$ ₹ 41760.

2. Since only four walls are to be white washing we heed to find only the lateral surface area of the hall.

Given : $l = 50\,\text{m}, b = 25\,\text{m}, h = 6\,\text{m}$.

Lateral surface area or Area of four wall $= 2 \times h(l + b) = 2 \times 6 \times 150 + 25)$

$= 12 \times 175 = 2100\,\text{m}^2$

Area of roof $= l \times b = 150 \times 25 = 3750\,\text{m}^2$

Total area to be white washing $= 3750 + 2100 = 5850\,\text{m}^2$

$\because$ The cost of while washing its four walls and roof of 1 m^2 = ₹ 20

$\therefore$ The cost of white washing its four walls and roof of 5850 m^2 = ₹ (20×5850)

= ₹ 11,7,000

Area of floor $= l \times b = 150 \times 25 = 3750\,\text{m}^2$

$\because$ Cost of polishing the floor of 1 m^2 Area = ₹ 40

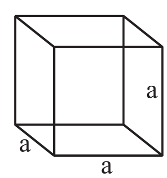
$\therefore$ Cost of polishing the floor of 3750 m^2

Area of = ₹ (40×3750) = ₹ 1,50,000.

3. Let the side of cube be `a' m.

Given : Total surface Area $= 3750\,\text{m}^2$

Total surface area of cube $= 6a^2$



$\Rightarrow \quad 6a^2 = 3750$

$\Rightarrow \quad a^2 = \frac{\overset{625}{3750}}{\underset{1}{6}} = 625$

$\Rightarrow \quad a = \sqrt{625} = 25\,\text{m}.$

$\therefore$ side of cube is 25 m.

4. Since Harshit painted the outer surface of the cuboidal box, we need to find out its total surface area.

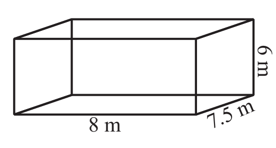
Given : $l = 8\,\text{m}, b = 7.5\,\text{m}, h = 6\,\text{m}$

Total surface area of the cboidal box $= 2(lb + bh + lh)$

$= 2(8 \times 7.5 + 7.5 \times 6 + 8 \times 6)$

$= 2(60 + 45 + 48)$

$= 2 \times 153 = 306\,\text{m}^2$



Again, since Harshit did not paint the bottom of the box

$\therefore$ Area of the bottom $= l \times b = 8 \times 7.5 = 60\,\text{m}^2$.

Now, the required surface area

Painted by him = Total surface Area – Area of the bottom

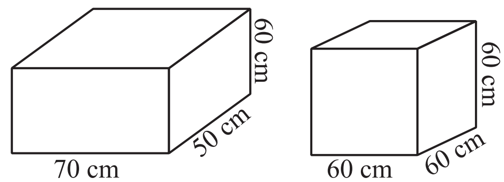
$306-60=246\,\text{m}^2$

5. Total surface Area of first box i.e. cuboidal box = $2(lb+bh+hl)$

$=2(70\times 50+50\times 60+60\times 70)$

$=2\times 10700$

$=21400\,\text{cm}^2$



Total surface of 2nd box

i.e., cubical box = $6a^2$

$=6\times(60)^2=6\times 3600$

$=21600\,\text{cm}^2$

Since $21600\,\text{cm}^2>21400\,\text{cm}^2$

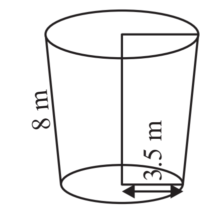
∴ Cubical box requires more material to make.

6. **Given :** $h=8\,\text{m}$, $r=3.5$ m

Total surface area $=2\pi r(h+r)$

$=2\times\frac{22}{7}\times 3.5\times(8+3.5)$

$=\frac{154}{7}\times 11.5=22\times 11.5=253\text{ m}^2$



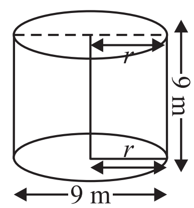
∵ Cost of the metal sheet of 1 m^2 Area = ₹ 130

∴ Cost of the metal sheet of 253 m^2 Area = ₹ (130×253) = ₹ 32890.

7. First is the cylindrical box and the second is cubical box.

$h=9\,\text{cm}$, $D=9\,\text{cm}$

∴ $r=\frac{D}{2}=\frac{9}{2}\,\text{cm}$



Lateral surface Area $=2\pi rh=2\times\frac{22}{7}\times\frac{9}{2}\times 9$

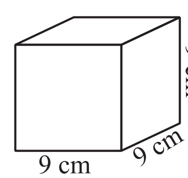
$=\frac{1782}{7}=254.57$

Sides of cube $l=b=h=9\,\text{cm}$ i.e., $a=9\,\text{cm}$

Lateral surface Area $=4a^2$

$=4\times(9)^2$

$=4\times 81=324$



It is clear from the above that lateral surface Area of both figure is not same.

8. **Given :** $l=50\,\text{cm}$, $b=35\,\text{cm}$, $h=10\,\text{cm}$

Total surface Area of chocolate box $=2(lb+bh+hl)$

$=2(50\times 35+35\times 10+10\times 50)$

$=2\times 2600=5200\,\text{cm}^2$

Since 1 box requires the wrapper to be covered equal to the total surface Area of chocolate box.

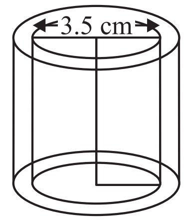
∴ 1 chocolate box requires wrapper = $5200\,\text{cm}^2$

∴ 60 such chocolate box requires wrapper $=60\times 5200\,\text{cm}^2$

$=\frac{60\times 5200}{100\times 100}\text{ m}^2=31.2\text{ m}^2$

9. **Given :** Inner diameter of circular well = 3.5 m

$\therefore$ Inner radius of circular well, $r = \frac{D}{2} = \frac{3.5}{2}$ m



depth i.e., height of the well = 15 m

Inner curved surface Area of well $= 2\pi rh$

$= 2 \times \frac{22}{7} \times \frac{3.5}{2} \times 15 \, m^2$

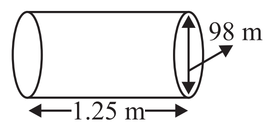
$= \frac{1155}{7} = 165 \, m^2$

$\because$ Cost of plastering the inner curved surface Area of 1 m^2 = ₹ 25

$\therefore$ Cost of plastering the inner curved surface Area of 165 m^2 = ₹ 25 × 165 = ₹ 4125

10. **Given :** $D = 98$ cm

$\therefore \quad r = \frac{D}{2} = \frac{98}{2} = 49$ cm. $h = 1.25$ m



road roller

Area covered in 1 revolution

= curved surface Area of the cylindrical wheel

$= 2\pi rh = 2 \times \frac{22}{7} \times 0.49 \times 1.25 \, m^2$

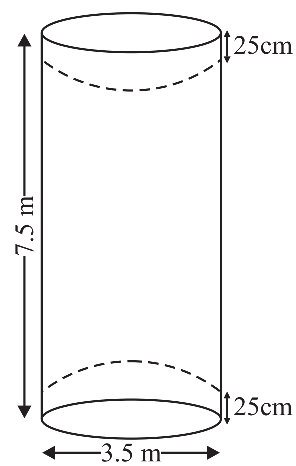
$= 3.85 \, m^2$

$\therefore$ Area covered in 900 revolution $= 900 \times 3.85 = 3465 \, m^2$.

11. Height of cylindrical pillar = 7.5 m

$\because$ diameter of circular surface = 3.5 m

$\therefore$ radius of circular surface $= \frac{3.5}{2} = 1.7$ m



Covered height = 25 cm + 25 cm

= 50 cm = 0.5 m.

Remaining height = 7.5 m – m = 7 m.

Then, the area of the pillar which is to be painted $= 2\pi rh$

$= 2 \times \frac{22}{7} \times 1.75 \times 7$

$= 77 \, m^2$

12. **Given :** $l = 7$ m, $b = 6$ m, $h = 4$ m

Area of the doors + windows = 7 m^2

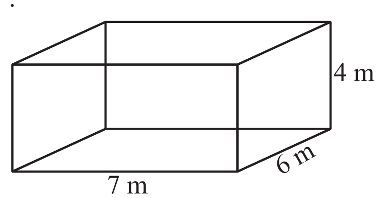
Area of 4 walls of the classroom $= 2(l + b) \times h$

$= 2 \times (7 + 6) \times 4$

$= 2 \times 13 \times 4 = 104 \, m^2$

But, the doors and windows occupy an area of 7 m^2.

$\therefore$ Area of the walls = 104 m^2 – 7 m^2 = 97 m^2



Area of the roof $= l \times b = 7 \times 6 = 42 \, m^2$

Total Area to be whitewashing = 9.7 m^2 + 42 m^2

= 13.9 m^2

Cost of whitewashing 1 m^2 = ₹ 15

$\therefore$ Cost of whitewashing 139 m^2 = ₹ 15 × 139 = ₹ 2085

Exercise 12.4

1. (a) Given : $a = 9\text{cm}$

Volume of cube $= (a)^3 = (9)^3 = 729\,\text{cm}^3$

Surface Area of cube $= 6a^2 = 6\times(9)^2 = 6\times 81 = 486\,\text{cm}^3$.

(b) $a = 1.5\,\text{m}$ Volume of cube $= a^3 = (1.5)^3 = 3.375\,\text{m}^3$.

Surface Area of cube $= 6a^2 = 6\times(1.5)^2 = 6\times 2.25 = 13.5\text{ m}^2$.

2. (a) $l = 20\,\text{cm},\ b = 15\,\text{cm},\ h = 10\,\text{cm}$

Volume of coboid $= l\times b\times h = 20\times 15\times 10 = 3000\,\text{cm}^2$

Lateral surface Area $= 2h(l+b)$

$= 2\times 10\times(20+15) = 20\times 35 = 700\,\text{m}^2$

Total surface Area $= 2(lb + bh + hl)$

$= 2(20\times 15 + 15\times 10 + 10\times 20)$

$= 2(30 + 150 + 200)$

$= 2\times 650 = 1300\,\text{cm}^2$.

(b) $l = 2.5$ m, $b = 75\,\text{cm}$, $h = 50\,\text{cm}$ $l = 2.5\times 100\,\text{cm} = 250$ cm

Volume $= l\times b\times h = 250\times 75\times 50 = 937500\,\text{cm}^3$

$$= \frac{937500}{100\times 100\times 100}\text{ m}^3 = 0.9375\text{ m}^3$$

Lateral surface Area $= 2h(l+b) = 2\times 50\times(250+75)$

$= 100\times 325 = 32500\,\text{cm}^2$

$$= \frac{32500}{100\times 100}\text{ m}^2 \qquad \left[\because 1\text{cm}^2 = \frac{1}{100\times 100}\text{ m}^2\right]$$

$= 3.25\text{ cm}^2$

Total surface Area $= 2(lb + bh + hl)$

$= 2\times(250\times 75 + 75\times 50 + 50\times 250)$

$= 2\times(35000)\,\text{cm}^2$

$$= \frac{70000}{100\times 100}\text{ m}^2 = 7\text{ m}^2$$

3. (a) $r = 7\,\text{cm},\ h = 40\,\text{cm}$

Volume $= \pi r^2 h = \frac{22}{7}\times 7\times 7\times 40 = 6160\text{ cm}^2$

Lateral surface Area $= 2\pi rh = 2\times\frac{22}{7}\times 7\times 40 = 1760\text{ cm}^2$

Total surface Area $= 2\pi r(h+r) = 2\times\frac{22}{7}\times 7\times(40+7)$

$= 44\times 47 = 2068\,\text{cm}^2$.

(b) $r = 2.8$m, h = 1.5 m

Volume $= \pi r^2 h = \frac{22}{7}\times 2.8\times 2.8\times 1.5 = 36.96\,\text{m}^3$

Lateral surface Area $= 2\pi rh = 2\times\frac{22}{7}\times 2.8\times 1.5 = 26.4\,\text{m}^2$

Total surface Area $= 2\pi r(h+r) = 2 \times \frac{22}{7} \times 2.8 \times (1.5 + 2.8)$

$$= \frac{44}{7} \times 2.8 \times 4.3$$

$$= \frac{529.76}{7} = 75.68 \text{ m}^2.$$

4. Volume of Cube I $= (\text{side})^3 = 27$

Volume of Cube II $= (4)^3 = 64$

Volume of Cube III $= (5)^3 = 125$

Volume of new cube = Volume of all the melted cubes

$= 27 + 64 + 125 = 216$

$\Rightarrow \quad a^3 = 216$

$\Rightarrow \quad a = \sqrt[3]{216} = 6 \text{ cm}$

5. Volume of rectangular piece $= 3 \times 100 \times 75 \times 60 = 300 \times 4500 \text{ cm}^3$

Volume of 1 cubical block $= (\text{side})^3 = (301)^3 \text{ cm}^3 = 30 \times 30 \times 30 \text{ cm}^3$

$\therefore$ Number of cubical blocks $= \frac{\text{Volume of rectangular piece}}{\text{Volume of 1 cubical block}}$

$$= \frac{300 \times 4500}{30 \times 30 \times 30} = 50.$$

6. Volume of wooden crate $= 150 \times 75 \times 24$

Volume of wooden box $= 12 \times 10 \times 3$

$\therefore$ number of wooden box $= \frac{\text{Volume of wooden crate}}{\text{Volume of wooden box}}$

$$= \frac{150 \times 75 \times 24}{12 \times 10 \times 3} = 750.$$

7. Volume of cuboid $= 100 \times 80 \times 64 = 512000 \text{ cm}^3$

$\therefore$ Volume of cube = Volume of cuboid

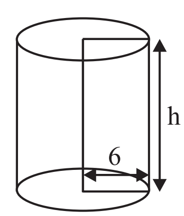
$\Rightarrow \quad a^3 = 51200$

$\Rightarrow \quad a = \sqrt[3]{512000} \quad \Rightarrow \quad a = 80 \text{ cm}$

$\therefore$ edge of new cube is 80 cm.

8. Volume of rectangular vessel $= l \times b \times h$

$= 22 \times 18 \times 14 = 5544 \text{ m}^3$



radius of cylindrical vessel = 6 m, h = ?

Since water from rectangular vessel poured into cylindrical from rectangular volume of water in cylindrical vessel is equal to the volume of water in rectangular vessel.

$\therefore$ We can have,

Volume of cylindrical vessel = Volume of rectangular vessel

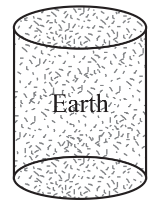
$$\pi r^2 h = 5544$$

$$\frac{22}{7} \times 6 \times 6 \times h = 5544 \; h = \frac{5544 \times 7}{22 \times 6 \times 6} = 49 \text{ m}.$$

$\therefore$ The height of water in the cylindrical vessel is 49 m.

9. **Given :** 5.94 m^3 earth dug out means volume of cylinder i.e. (well)

$\therefore \quad V = 594\ m^3,\ d = 6\,m,\ r = \frac{d}{2} = \frac{6}{2} = 3\,m,\ h = ?$



Volume of dug out = $\pi r^2 h$

$$594 = \frac{22}{7} \times 3 \times 3 \times h$$

$$h = \frac{\overset{27}{594} \times 7}{\underset{1}{22} \times 9} = 21\,m.$$

$\therefore$ the depth of the well is 21 m.

10. **Given :** CSA of cylinder = 4400 cm^2

Circumference of its base = 220 cm^2

Volume of the cylinder = ?

$\because \quad$ CSA = 4400

$\Rightarrow \quad 2\pi rh = 4400$

$\Rightarrow \quad 2 \times \frac{22}{7} \times r \times h = 4400$

$\Rightarrow \quad r \times h = 100 \times 7 = 700 \qquad \ldots(1)$

again, circumference of base $= 220 \Rightarrow 2\pi r = 220$

$\Rightarrow \quad 2 \times \frac{22}{7} \times r = 220$

$\Rightarrow \quad r = \frac{220 \times 7}{2 \times 22} = 35\,cm \qquad \ldots(2)$

From (1) and (2), we get

$$35 \times h = 700$$

$$h = \frac{700}{35} = 20\,cm.$$

$\therefore \quad$ Volume of cylinder $= \pi r^2 h = \frac{22}{7} \times 35 \times 35 \times 20$

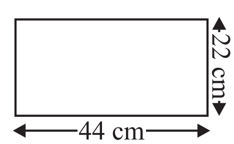
$= 22 \times 5 \times 700 = 77000\,cm^3.$

11. Height of cylinder $(h) = 22\,cm$

Let the radius of cylinder be r cm.

Circumference of base of cylinder = 44 cm.

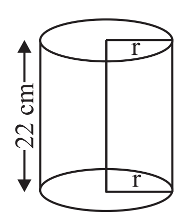
[$\because$ length of rectangle become the circumference of base]



$\Rightarrow \quad 2\pi r = 44$

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

$\Rightarrow \quad r = \frac{7 \times 44}{2 \times 22} = 7\,cm$



$\therefore \quad$ Total surface Area $= 2\pi r(h + r)$

$= 2 \times \frac{22}{7} \times 7 \times (22 + 7)\,cm^2$

$= 44 \times 29\,cm^2 = 1276\ cm^2$

Volume of cylinder $= \pi r^2 h$

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

$= 22 \times 7 \times 22 = 3388\,\text{cm}^3$.

12. **Given :** dimensions of hall are $l = 150\,\text{m}$, $b = 85\,\text{m}$, $h = 12\,\text{m}$

$\therefore$ Volume of the hall $= l \times b \times h$

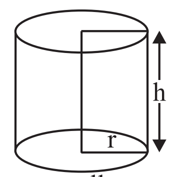
$= 150 \times 85 \times 12\,\text{m}^3$

Volume of air requires by each (i.e. 1) person = 50 m^3

$\therefore$ No. of required persons $= \frac{\text{Volume of the hall}}{\text{Volume of air requires by each person}}$

$= \frac{150 \times 85 \times 12}{50} = 3060.$

13. diameter of well = 7 m is $r = \frac{d}{2} = \frac{7}{2}$ m



height (depth) $h = 20\,\text{m}$

Volume of earth dug out = Volume of rectangular plot

$\Rightarrow \quad \pi r^2 h = l \times b \times h$

$\Rightarrow \quad \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \times 20 = 14 \times 11 \times h$

$\Rightarrow \quad h = \frac{11 \times 10 \times 7}{14 \times 11} = 5\,\text{m}$

Volume of earth dug out $= \pi r^2 h.$

$= \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \times 20 = 770\,\text{m}^3$

14. **Given :** l of brick = 25 cm, b of brick = 10.5 cm, h of brick = 9 cm.
l of wall = 18 m, of wall = 8 m, h of wall = 21 cm

$\therefore$ Number of bricks $= \frac{18 \times 100 \times 8 \times 100 \times 21}{25 \times 10.5\,0 \times 9}$

$= \frac{25 \times 10.5 \times 9}{30240000} = 12800.$

15. Volume of 1 cube = $(\text{side})^3 = (6)^3 = 216\,\text{cm}^3$

$\therefore$ Volume of 6 cubes $= 6 \times 216 = 1296$

$\therefore$ Volume of new solid = Volume of 6 cubes = 1296.

16. Let the number be coins be x.
$r = 0.75\,\text{cm}$, $h = 0.2\,\text{cm}$,
d of cylinder = 6 cm,

r of cylinder $= \frac{d}{2} = 3\,\text{cm}.$

Volume of right circular cylinder $= \pi r^2 h$

$= \frac{22}{7} \times (3)^2 \times 8$

$\therefore$ no. of coins $= \dfrac{\text{Volume of 1 coin}}{\text{Volume of Right circular cylinder}}$

$$= \frac{\frac{22}{7} \times 0.75 \times 0.2 \times 0.75}{\frac{22}{7} \times 3 \times 3 \times 8} = 640.$$

17. dimension of the water taken = 10 m 7.5 m × 4 m

$\therefore$ Volume of the tank $= l \times b \times h$

$= (10 \times 7.5 \times 4)\,\text{m}^3 = 300\text{ m}^3$

Then

$\because$ Capacity of the tank that has 1 cm^3 volume = 1000 l

$\therefore$ Capacity of the tank that has 300 m^3 volume $= 300 \times 1000\,l = 300000\,l$

Now,

$\because$ Time taken by the pump to fill cool water = 1 minutes

$\therefore$ Time taken by the pump to fill 1 l of water $= \dfrac{1}{400}$ mins.

$\therefore$ Time taken by the pump to fill 300000 l of water $= \dfrac{1}{400} \times 300000 = 750$ mins.

Time taken by the pump $= 750$ minutes

$= \dfrac{750}{60}$ hours $= 12\frac{1}{2}$ hour.

Hence, the pump takes $12\frac{1}{2}$ hours to fill the tank.

18. Volume of water which flows out in 1 second from the pipe

= Speed of water × Area of the cross section of the pipe

Given : Area of the cost-section of the tap $n = \pi r^2 = 5\,\text{cm}^2$

$\therefore$ Volume of water $= 30 \times 5 = 150$

$\Rightarrow$ Volume of water which flows out in 1 how (i.e., 60 min) from the pipe

$= 150 \times 60 \times 60$ $[\because 1h = 60\,\text{min} = 60 \times 60\text{sec}]$

$= 540000\,\text{cm}^3$ $[\because 1000\text{cc} = 1000\text{cm}^3 = 1l]$

= 540 L.

19. Let breadth of the room = x m, height of the room = 4 m

then, length of the room = $2x$ m,

$\Rightarrow$ $2(l+b)h = 192$

$\Rightarrow$ $2 \times (2x + x) \times 4 = 192$

$\Rightarrow$ $x = \dfrac{192}{24} = 8.$

$\therefore$ breadth $(b) = x = 8\,\text{m}$

length $(l) = 2x = 16\,\text{m}$

Now, volume of the room $= l \times b \times h = 16 \times 8 \times 4 = 512\,\text{m}^3$.

MCQ's

1. (a) **2.** (b) **3.** (b) **4.** (d) **5.** (d) **6.** (d) **7.** (d) **8.** (b) **9.** (c) **10.** (a) **11.** (c) **12.** (a) **13.** (b).