

## Exercise 8.1

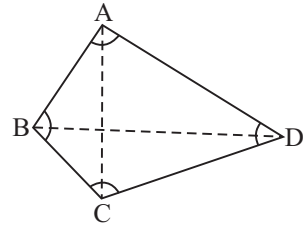
1. The three angles of a quadrilateral are  $100^\circ$ ,  $50^\circ$  and  $50^\circ$ .

In a quadrilateral,

Sum of four angles =  $360^\circ$

$$\begin{aligned} \text{So, fourth angle} &= 360^\circ - (\text{Sum of other three angles}) \\ &= 360 - (100^\circ + 50^\circ + 50^\circ) \\ &= 360^\circ - 200^\circ \\ &= 160^\circ \end{aligned}$$

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



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

4. Given : A quadrilateral  $PQRS$ .

Prove that  $\angle P + \angle Q + \angle R + \angle S = 360^\circ$

Construction : Join  $Q$  and  $S$ .

**Proof :** In  $PQS$ ,

$$\angle P + \angle 1 + \angle 2 = 180^\circ \quad \dots(1)$$

(By angle sum property of triangle)

In  $QRS$ ,

$$\angle R + \angle 3 + \angle 4 = 180^\circ \quad \dots(2)$$

(By angle sum property of triangle)

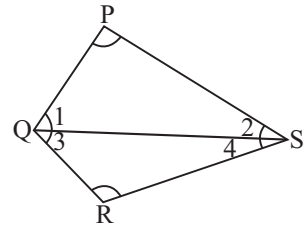
Adding eq. (1) and (2), we get

$$(\angle P + \angle 1 + \angle 2) + (\angle R + \angle 3 + \angle 4) = 180 + 180$$

$$\angle P + (\angle 1 + \angle 3) + \angle R + (\angle 2 + \angle 4) = 360$$

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

( $\because \angle 1 + \angle 3 = \angle Q$  and  $\angle 2 + \angle 4 = \angle S$ ). Hence proved.



5. Let the three equal angles of a quadrilateral be  $x$ .

The fourth angle =  $120^\circ$

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  $80^\circ$ .

6. The two adjacent angles of a quadrilateral are  $130^\circ$  and  $30^\circ$ .

Let other two equal angles =  $x$ .

By angle sum property in a quadrilateral

$$x + x + 130 + 30 = 360$$

$$\begin{array}{r}
 2x \quad 160 \quad 360 \\
 \quad 2x \quad 360 - 160 \\
 \quad 2x \quad 200 \\
 \quad \quad x \quad 100
 \end{array}$$

Thus the measure of each of the equal angles is  $100^\circ$ .

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

By angle sum property of a quadrilateral

$$\begin{array}{r}
 x \quad x \quad 15 \quad 75 \quad 360 \\
 \quad 2x \quad 150 \quad 360 \\
 \quad \quad 2x \quad 360 - 150 \\
 \quad \quad 2x \quad 210 \\
 \quad \quad \quad x \quad 105
 \end{array}$$

Thus the measure of either of these two equal angles is  $105^\circ$ .

8. Let the fourth angle of a quadrilateral be  $x$ .  
The other three angles are  $20^\circ$ ,  $90^\circ$  and  $90^\circ$ .

By angle sum property of a quadrilateral.

$$\begin{array}{r}
 x \quad 20 \quad 90 \quad 90 \quad 360 \\
 \quad x \quad 200 \quad 360 \\
 \quad \quad x \quad 360 - 200 \\
 \quad \quad \quad x \quad 160
 \end{array}$$

Thus the fourth angle of the quadrilateral is  $160^\circ$ .

9. Let the measure of each of equal angles be  $x$ .  
The two adjacent angles are  $85^\circ$  and  $115^\circ$ .

By angle sum property in a quadrilateral.

$$\begin{array}{r}
 x \quad x \quad 85 \quad 115 \quad 360 \\
 \quad 2x \quad 200 \quad 360 \\
 \quad \quad 2x \quad 360 - 200 \\
 \quad \quad 2x \quad 160 \\
 \quad \quad \quad x \quad 80
 \end{array}$$

So, the measure of each of the equal angles is  $80^\circ$ .

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

By angle sum property in a quadrilateral

$$\begin{array}{r}
 2x \quad 3x \quad 4x \quad x \quad 360 \\
 \quad 10x \quad 360^\circ \\
 \quad \quad x \quad 36 \\
 \quad \quad 2x \quad 2 \quad 36 \quad 72 \\
 \quad \quad 3x \quad 3 \quad 36 \quad 108 \\
 \quad \quad 4x \quad 4 \quad 36 \quad 144
 \end{array}$$

So, the four angles of the quadrilateral are  $72^\circ$ ,  $108^\circ$ ,  $144^\circ$  and  $36^\circ$ .

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

By angle sum property in a quadrilateral  $x \quad 2x \quad 3x \quad 4x \quad 360$ .

$$\begin{array}{r}
 10x \quad 360 \\
 \quad 2x \quad 2 \quad 36 \quad 72 \\
 \quad \quad 3x \quad 3 \quad 36 \quad 108 \\
 \quad \quad 4x \quad 4 \quad 36 \quad 144
 \end{array}$$

So, the four angles of the quadrilateral are  $36^\circ$ ,  $72^\circ$ ,  $108^\circ$  and  $144^\circ$ .

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

By angle sum property in a quadrilateral

$$\begin{array}{r} x \quad 3x \quad 7x \quad 9x \quad 360 \\ 20x \quad 360 \\ x \quad 18 \\ 3x \quad 3 \quad 18 \quad 54 \\ 7x \quad 7 \quad 18 \quad 126 \\ 9x \quad 9 \quad 18 \quad 162 \end{array}$$

So, the four angles of the quadrilateral are  $18^\circ$ ,  $54^\circ$ ,  $126^\circ$  and  $162^\circ$ .

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

By angle sum property in a quadrilateral be  $3x \quad 5x \quad 7x \quad 9x \quad 360$ .

$$\begin{array}{r} 24x \quad 360 \\ x \quad 15 \\ 3x \quad 3 \quad 15 \quad 45 \\ 5x \quad 5 \quad 15 \quad 75 \\ 7x \quad 7 \quad 15 \quad 105 \\ 9x \quad 9 \quad 15 \quad 135 \end{array}$$

So, the angles of the quadrilateral are  $45^\circ$ ,  $75^\circ$ ,  $105^\circ$  and  $135^\circ$ .

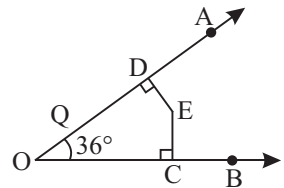
14.  $AOB \quad 36$

$$\begin{array}{l} \because \quad EC \quad OB \\ \quad \quad \quad ECO \quad 90 \\ \because \quad ED \quad OA \\ \quad \quad \quad EDO \quad 90 \end{array}$$

In a quadrilateral  $OCED$ .

By angle sum property, we have,

$$\begin{array}{r} DOC \quad ECO \quad CED \quad EDO \quad 360 \\ 36 \quad 90 \quad CED \quad 90 \quad 360 \\ \quad \quad \quad CED \quad 216 \quad 360 \\ \quad \quad \quad CED \quad 360 - 216 \quad CED \quad 144 \end{array}$$



15. Sum of two angles of a quadrilateral is  $150^\circ$ .

Let other two angles be  $2x$  and  $3x$ .

By angle sum property in a quadrilateral

$$\begin{array}{r} 150 \quad 2x \quad 3x \quad 360 \\ 150 \quad 5x \quad 360 \\ 5x \quad 360 - 150 \\ 5x \quad 210 \\ x \quad 42 \\ 2x \quad 2 \quad 42 \quad 84 \\ 3x \quad 3 \quad 42 \quad 126 \end{array}$$

So, the other two angles are  $84^\circ$  and  $126^\circ$ .

### Exercise 8.2

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.

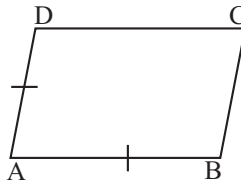
	Rectangle	Square
(i)	F	T

(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

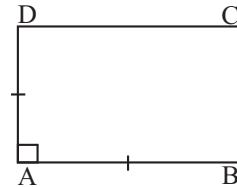
4. (a)  $AB = AD$

$ABCD$  is a rhombus.



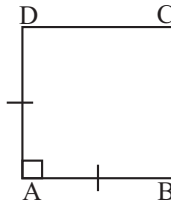
(b)  $\angle DAB = 90^\circ$

$ABCD$  is a rectangle.



(c)  $AB = AD$  and  $\angle DAB = 90^\circ$

$ABCD$  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  $\angle ACB = 30^\circ$ .

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

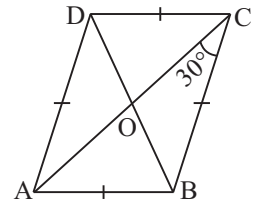
So,  $\angle BOC = 90^\circ$

(b) In  $\triangle OBC$ ,

By angle sum property,

We have

$$\begin{array}{rclcl}
 \angle CBO + \angle BOC + \angle OCB & = & 180 & \\
 \angle CBO + 90 + 30 & = & 180 & \\
 \angle CBO + 120 & = & 180 & \\
 \angle CBO & = & 180 - 120 & \\
 \angle CBO & = & 60 & 
 \end{array}$$



(c) In rhombus  $ABCD$

$AD \parallel BC$  and  $AC$  is the transversal

$$\angle OAD = \angle OCB \text{ (alt. int. } \angle\text{s)}$$

$$\angle OAD = 30^\circ$$

(d) In rhombus  $ABCD$ ,

$$AB = BC$$

$$\angle CAB = \angle BCA \text{ (opp. } \angle\text{s to opp. equal sides)}$$

$$\angle CAB = 30^\circ$$

In a rhombus, diagonals are perpendicular to each other.

$$\angle AOB = 90^\circ$$

In  $\triangle OAB$ ,

By angle sum property,

We have,

$$\angle OAB + \angle ABO + \angle BOA = 180^\circ$$

$$30^\circ + \angle ABO + 90^\circ = 180^\circ$$

$$\angle ABO = 120^\circ$$

$$\angle ABO = 180^\circ - 120^\circ$$

$$\angle ABO = 60^\circ$$

7. Let  $ABCD$  is a rhombus.

$$\text{Let } \angle ACB = 20^\circ$$

In rhombus,  $ABCD$ ,

$$AB = BC$$

$$\angle 1 = \angle ACB$$

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

$$\angle 1 = 20^\circ$$

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

(alt. int.  $\angle$ s)

$$\angle 2 = 20^\circ$$

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

$$\angle A = 20^\circ + 20^\circ$$

$$\angle A = 40^\circ$$

In rhombus, opp. angles are equal.

$$\text{So, } \angle C = \angle A$$

$$\angle C = 40^\circ$$

In rhombus, adjacent angles are supplementary angles.

$$\text{So, } \angle A + \angle B = 180^\circ$$

$$40^\circ + \angle B = 180^\circ$$

$$\angle B = 180^\circ - 40^\circ$$

$$\angle B = 180^\circ - 120^\circ \quad \angle B = 140^\circ$$

In rhombus, opp. angles are equal.

$$\text{So, } \angle D = \angle B \quad \angle D = 140^\circ$$

So, the four angles of the rhombus are  $40^\circ$ ,  $140^\circ$ ,  $40^\circ$  and  $140^\circ$ .

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

In  $\triangle ABD$  and  $\triangle ABC$

$$AD = BC \text{ (opp. sides are equal in a rectangle)}$$

$$BD = AC \text{ (diagonals are equal in a rectangle)}$$

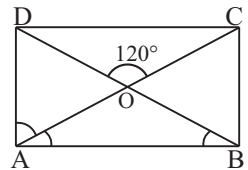
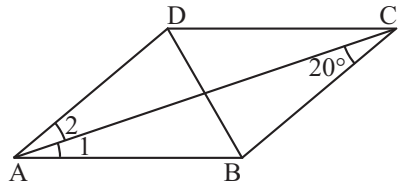
$$AB = AB \text{ (common side)}$$

$$\triangle ABD \cong \triangle ABC \text{ (SSS congruency)}$$

$$\triangle ABD \cong \triangle BAC \text{ (By c.p.c.t.)}$$

$$\angle OBA = \angle OAB$$

$$\angle OBA = \angle OAB = x \text{ (say)}$$



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

$$\angle AOB = 120$$

In  $\triangle AOB$ ,

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

$$120 + x + x = 180$$

$$2x = 180 - 120$$

$$2x = 60$$

$$x = 30$$

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  $AB$ .

$$AE = EB$$

In  $\triangle ADE$  and  $\triangle BDE$

$$DE = DE \quad (\text{common side})$$

$$\angle DEA = \angle DEB \quad (\text{each } 90^\circ)$$

$$AE = EB \quad (\text{given})$$

$$\triangle ADE \cong \triangle BDE \quad (\text{SAS congruency})$$

$$\angle DAB = \angle DBA \quad (\text{By c.p.c.t.})$$

$$\angle DAB = \angle DBA = x \text{ (say)}$$

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

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

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

In a rhombus, diagonals are perpendicular to each other.

So,  $\angle AOB = 90$

In  $\triangle AOB$

By angle sum property, We have,

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

$$90 + x + \frac{x}{2} = 180$$

$$90 + \frac{3x}{2} = 180$$

$$\frac{3x}{2} = 180 - 90$$

$$\frac{3x}{2} = 90$$

$$x = 90 \cdot \frac{2}{3}$$

$$x = 30 \cdot 2 = 60$$

$$\angle DAB = x = 60$$

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

(In a rhombus, adjacent angles are supplementary)

$$\angle ABC + 60 = 180$$

$$\angle ABC = 180 - 60$$

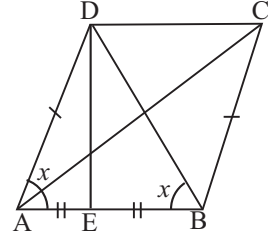
$$\angle ABC = 120$$

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

$$\angle BCD = 60$$

Again,  $\angle ADC + \angle ABC = 180$  (In a rhombus opp. angles are equal)

$$\angle ADC = 120$$

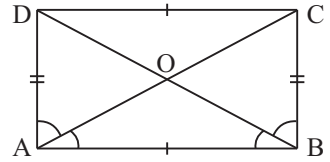


So, the four angles of the rhombus are  $60^\circ$ ,  $120^\circ$ ,  $60^\circ$  and  $120^\circ$  respectively.

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

In  $\triangle ABD$  &  $\triangle ABC$

$$\begin{aligned} AD &= BC && \text{(opp. sides are equal)} \\ \angle DAB &= \angle ABC && \text{(each } 90^\circ) \\ AB &= AB && \text{(common side)} \\ \triangle ABD &\cong \triangle ABC && \text{(SAS congruency)} \\ AC &= BD && \text{(By c.p.c.t.)} \end{aligned}$$



Hence, the diagonals of a rectangle are equal.

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

$$AB = BC = CD = DA$$

In  $\triangle AOB$  &  $\triangle COD$

$$\begin{aligned} \angle AOB &= \angle COD && \text{(very opp. } \angle\text{s)} \\ \angle OAB &= \angle OCD && \text{(alt. int. } \angle\text{s)} \\ AB &= CD && \text{(Given)} \\ \triangle AOB &\cong \triangle COD && \text{(AAS Congruency)} \\ OA &= OC && \text{(By c.p.c.t.)} \end{aligned}$$

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

So, the diagonals bisect each other.

In  $\triangle AOB$  &  $\triangle BOC$

$$\begin{aligned} AB &= BC && \text{(sides of a rhombus)} \\ OB &= OB && \text{(common side)} \\ OA &= OC && \text{(proved above)} \\ \triangle AOB &\cong \triangle BOC && \text{(SSS congruency)} \\ \angle AOB &= \angle BOC && \text{(By c.p.c.t.)} \end{aligned}$$

By linear pair axiom

$$\begin{aligned} \angle AOB + \angle BOC &= 180 \\ \angle AOB + \angle AOB &= 180 \\ 2 \angle AOB &= 180 \\ \angle AOB &= \frac{180}{2} \\ \angle AOB &= 90 \\ \angle AOC &= \angle BOD \end{aligned}$$

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

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

**Prove that :**  $ABCD$  is a square.

**Proof :** In a rhombus, sum of adjacent angles is  $180^\circ$ .

$$\begin{aligned} \angle A + \angle D &= 180 \\ 90 + \angle D &= 180 \\ \angle D &= 180 - 90 \\ \angle D &= 90 \end{aligned}$$

Similarly,  $\angle B = \angle C = 90^\circ$

Since, a rhombus, whose all angles are  $90^\circ$ , is a square.

Therefore,  $ABCD$  is a square.

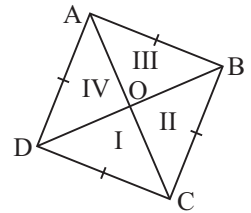
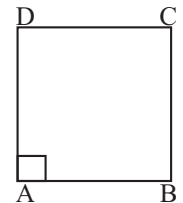
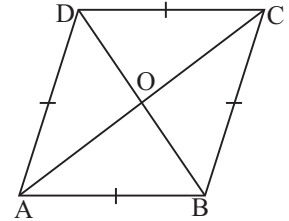
**Hence proved.**

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

**Prove that :**  $\angle OCD = \angle OBC = \angle OBA = \angle OAD$

**Proof :** In  $\triangle OCD$  &  $\triangle OBC$

$$\begin{aligned} OD &= OB && \text{(diagonals bisect each other)} \\ OC &= OC && \text{(common side)} \end{aligned}$$



$CD = BC$  (sides are equal in a rhombus)  
 $\triangle OCD \cong \triangle OBC$  ... (1) (SSS congruency)

Similarly, we can prove that

$\triangle OBC \cong \triangle OBA$  ... (2)

$\triangle OBA \cong \triangle OAD$  ... (3)

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

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

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

**Prove that :**  $AN = CM$

**Proof :** In  $\triangle AND$  &  $\triangle CMB$

$\angle DNA = \angle CMB$

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

$\angle DAN = \angle BCM$

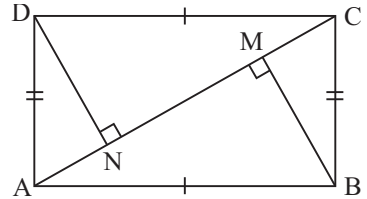
(alt. int. angles)

$AD = BC$

(opp. sides are equal)

$\triangle AND \cong \triangle CMB$

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



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

### MCQ's

1. (a)

2. (a)

3. (c)

4. (d)

5. (a)

6. (b)

7. (c)

## 9

### (Construction of Quadrilaterals)

#### Exercise 9.1

1. Steps of construction :

(i) Draw  $AB = 5$  cm.

(ii) Draw  $BA$   $80^\circ$ .

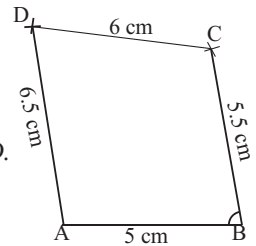
(iii) With centre  $B$  cut an arc  $C$  on  $BX$  of radius  $5.5$  cm.

(iv) With  $C$  as centre and radius  $6$  cm.

(v) With  $A$  as centre and radius  $6.5$  cm cut the previous arc at  $D$ .

Join  $CD$  and  $BC$ .

$ABCD$  is a required quadrilateral.



2. Step of construction :

(i) With  $PQ = 5$  cm.

(ii) With  $Q$  as center and radius  $7.5$  cm cut as arc.

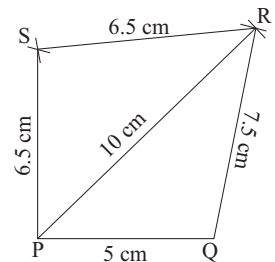
(iii) With  $P$  as center and radius  $10$  cm cut the previous arc at  $R$ .

(iv) With  $R$  as center and radius  $6.5$  cm cut an arc.

(v) With  $P$  as center and radius  $6.5$  cm cut the previous arc at  $S$ .

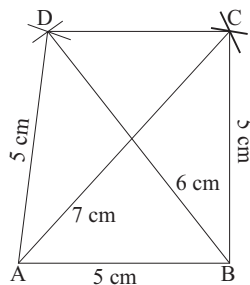
Join  $PS, PR, SR, QR$ .

$AQRS$  is a required quadrilateral.



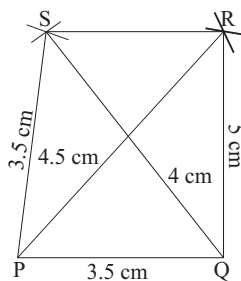
3. Step of constructions :

- (i) Draw  $AB$  5 cm
- (ii) With  $B$  as centre and radius 5 cm cut an arc.
- (iii) With  $A$  as centre and radius 7 cm cut the previous arc at  $C$ .  
With  $A$  as centre and radius 5 cm cut an arc.  
With  $B$  as center and radius 6 cm cut an the previous arc at  $D$ .  
Join  $CD, AD, CB, AC, BD$ .  
 $ABCD$  is a required quadrilateral.



4. Step of construction :

- (i) Draw  $PQ$  3.5 cm
- (ii) With  $P$  as centers and radius 3.5 cm cut an arc.
- (iii) With  $Q$  as centre and radius 5 cm cut the previous arc at  $S$ .
- (iv) With  $Q$  as center and radius 4 cm cut an arc.
- (v) With  $P$  as center and radius 4.5 cm cut an the previous arc at  $R$ .  
Join  $PS, SR, QR, PR, QS$ .  
 $PQRS$  is a required quadrilateral.



5. Step of construction :

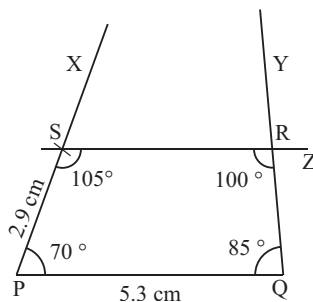
- (i) Draw  $KL$  3.7 cm
- (ii)  $LXKL$  90
- (iii) With  $L$  as centre and radius 4 cm cut an arc  $M$  on  $KX$ .
- (iv) With  $M$  as centre and radius 4.5 cm cut can arc.
- (v) With  $K$  as centre and radius 5 cm cut previous arc at  $N$ .
- (vi) join  $KM, KN, KN, CM, NL$   
 $KLMN$  is required parallelogram.

6. Step of construction :

- Draw  $AB$  6.5 cm  
with  $B$  as centre and radius 4 cm cut arc  
with  $A$  as centre and radius 7 cm cut pervious arc at  $C$ .  
with  $C$  as centre and radius 4.5 cm cut arc.  
with  $A$  as centre and radius 4 cm at pervious arc at  $D$ .  
Join  $AD, CD, BC, AC$ .  
 $ABCD$  is a required parallelogram.

7. Steps of construction

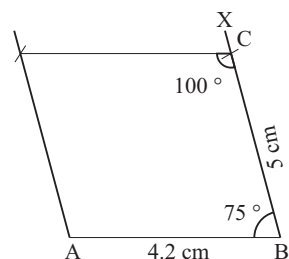
- (i) Draw  $PQ$  5.3 cm
- (ii) Draw  $PQ$  70
- (iii) Draw  $YQP$  85
- (iv) With  $P$  as centre and radius 2.9 cm cut 8 at  $S$ .
- (v) Draw  $ZSP$  105 .
- (vi)  $SZ$  at on  $QY$  at  $R$ .  
 $PQRS$  is required quadrilateral.



## Exercise 9.2

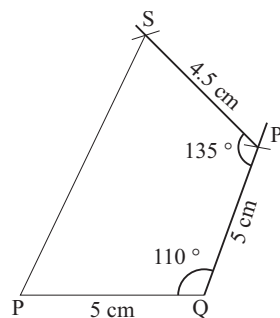
1. Steps of construction :

- (i) Draw  $AB$  4.2 cm
- (ii) Draw  $\angle XBA$   $75^\circ$
- (iii) With  $B$  as centre and radius 5 cm cut an arc  $C$  on  $BX$ .
- (iv) draw  $\angle YCB$   $100^\circ$ .
- (v) With  $C$  as centre and radius 4.5 cm cut an arc  $D$  on  $CY$ .  
Join  $AD$  and  $CD$   
 $ABCD$  is required quadrilateral.



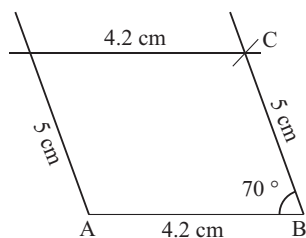
2. Steps of construction :

- (i) Draw  $PQ$  5 cm
- (ii) Draw  $\angle XQP$   $110^\circ$
- (iii) With  $Q$  as centre and radius 5 cm cut an arc  $R$  on  $XQ$ .
- (iv) Draw  $\angle YRQ$   $135^\circ$
- (v) With  $R$  as centre and radius 4.5 cm cut an arc  $S$  on  $YR$ .  
Join  $PS$ .  
 $PQRS$  is required quadrilateral.



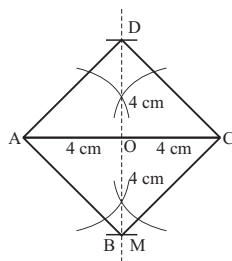
3. Steps of construction :

- (i) Draw  $AB$  4.2 cm  
Draw  $\angle XBA$   $70^\circ$
- (ii) With  $B$  as centre and radius 5 cm cut an arc  $C$  on  $BX$ .
- (iii) With  $C$  as centre and radius 4.2 cm cut an arc.
- (iv) With  $A$  as centre radius 5 cm at the previous arc at  $D$ .
- (v) Join  $AD$  and  $CD$   
 $ABCD$  is required parallelogram.



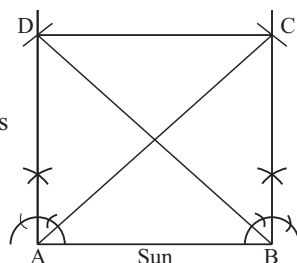
4. Steps of construction :

- (i) Draw  $AC$  8cm
- (ii) Draw  $CM$  the perpendicular bisector of  $AC$ , intersecting  $AC$  at  $O$ .
- (iii) With  $O$  as centre and radius 3 cm (*i.e.*, half of 8 cm) draw two arcs on either side of  $AC$  intersecting  $CM$  at  $B$  and  $D$  respectively.
- (iv) Join  $AB, CB, CD$  and  $DA$ .



5. Step of construction :

- (i) Draw  $AB$  5cm
- (ii) With  $A$  and  $B$  as centres draw angles of  $90^\circ$  at each point.
- (iii) With  $A$  and  $B$  as centres and radius 7 cm, draw two arcs intersecting  $BY$  and  $AX$  at  $C$  respectively.
- (iv) Join  $D$  and  $S$ .  
The figure  $ABCD$  thus drawn is the required rectangle.

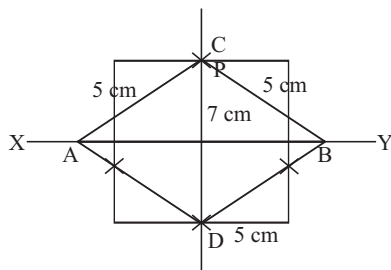
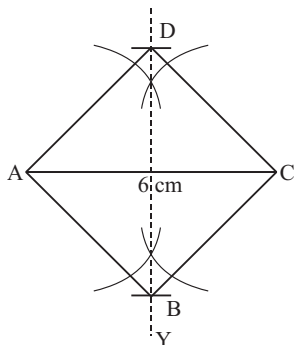


6. Steps of construction :

Draw diagonal  $AC$  6 cm

Draw perpendicular bisector of  $AC$  meeting  $AC$  at  $O$ .

with  $O$  as centre and radius  $\frac{BD}{2}$  4 cm cut arcs  $B$  and  $D$



Join  $AD, DC, BC$  and  $AB$   
 $ABCD$  is required rhombs.

7. Steps of constructions :

(i) Draw  $AB$  5 cm

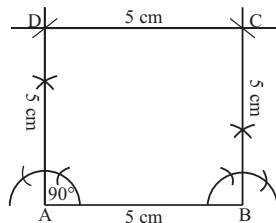
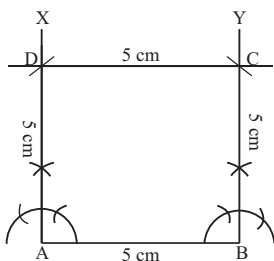
(ii) Draw  $\angle XAB$  90

(iii) Draw  $\angle YBA$  90

(iv) With  $A$  as centre and radius 5 cm cut an arc  $Y$  on  $BX$ .

Join  $CD$

$ABCD$  is required square.



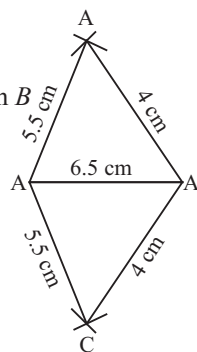
### Exercise 9.3

1. Step of construction

(i) Draw  $BD$  6.5 cm

(ii) With  $B$  and  $D$  as centres and radii 5.5 cm and 4 cm respectively draw two arcs on one side of  $BD$  intersecting each other at  $A$ . Join  $B$  to  $A$  and  $D$  to  $A$ .

(iii) Again, with  $B$  and  $D$  as centres and radii 5.5 cm and 4 cm respectively, draw two arc on the other side of  $BD$  intersecting each other etc. Join  $B$  to  $C$  and  $D$  to  $C$ .



2. Steps of construction :

(i) Draw  $AB$  4.6 cm

(ii) Draw  $\angle XAB$  90

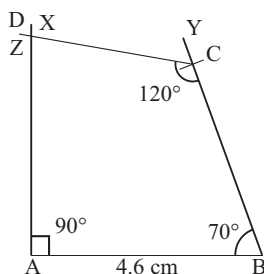
(iii) Draw  $\angle YBA$  70

(iv) With  $B$  as centre and radius 4 cm cut an arc  $C$  on  $YB$ .

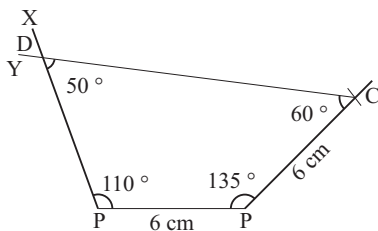
(v) Draw  $\angle ZCB$  120 cut  $AX$  at  $D$ .

(vi) Join  $CD$ .

$ABCD$  is required quadrilateral.



3. Steps of construction :
- Draw  $\angle A = 110^\circ$  (360 35 60 55 )
  - Draw  $\angle YBA = 135^\circ$
  - With  $B$  as centre and radius 6 cm cut an arc  $C$  or  $YB$   
Draw  $\angle ZCB = 60^\circ$  cut  $CZ$  at  $D$ .



# 10

## Visualising Solid Shapes

### Exercise 10.1

- Quadrilateral pyramid, (ii) Sphere, (iii) Cuboid, (iv) Cube, (v) Cone.
- Yes (ii) Yes (iii) No.
- In case of all the faces of a polyhedron are congruent, it is called a regular polyhedron.
  - Cuboid is not a regular polyhedron.
  - Cone is not a regular polyhedron.

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

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

$$V - F + E = 2$$

$$8 - 6 + x = 2$$

$$x = 14 - 2$$

$$x = 12$$

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,

$$V - F + E = 2$$

$$20 - x + 30 = 2$$

$$x = 10 + 2$$

$$x = 12$$

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

$$V + F + E = 2$$

$$x + 40 + 60 = 2$$

$$x + 20 = 2$$

$$x = 20 - 2$$

$$x = 22$$

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

### MCQ's

1. (a)

2. (c)

3. (b)

4. (d)

5. (c)

6. (b)

7. (c)

8. (c)

# 11

## Area of Plane Figures

### Exercise 11.1

1.  $PQ = 30$  cm ;  $QR = 21$

$$\begin{aligned} \text{Area of rectangle } PQRS &= PQ \times QR \\ &= 30 \times 21 \text{ cm}^2 \\ &= 630 \text{ cm}^2 \end{aligned}$$

$$\begin{aligned} \text{Area of Semicircles} &= \frac{1}{2} r^2 \quad r = \frac{21}{2} \text{ cm} \\ &= \frac{1}{2} \times \frac{22}{7} \times \frac{21}{2} \times \frac{21}{2} \text{ cm}^2 \\ &= 173.25 \text{ cm}^2 \end{aligned}$$

$$\text{Area of the remaining part} = (630 - 173.25) \text{ cm}^2 = 456.75 \text{ cm}^2$$

2. Side of the square  $PAST = 14$  cm

$AS = 14$  cm ;  $PT = 14$  cm

$$\text{ALS ; Semicircles} \quad \frac{1}{2} r^2 \quad r = \frac{14}{2} = 7 \text{ cm}$$

$$\frac{1}{2} \times \frac{22}{7} \times 7 \times 7 \text{ cm}^2 = 77 \text{ cm}^2$$

$$\text{PLT ; Semicircles} \quad \frac{1}{2} r^2 \quad r = \frac{14}{2} = 7 \text{ cm}$$

$$\frac{1}{2} \times \frac{22}{7} \times 7 \times 7 \text{ cm}^2 = 77 \text{ cm}^2$$

$$\text{Area of square } PAST = \text{square of side} = (14)^2 \text{ cm}^2 = 196 \text{ cm}^2$$

$$\text{Area of the shaded part} = (196 - 77 - 77) \text{ cm}^2 = 196 - 154 \text{ cm}^2 = 42 \text{ cm}^2$$

3. Diameter of circular 4 m

$$\text{Radius of caroler } r = \frac{4}{2} \text{ m} = 2 \text{ m}$$

$$\text{length of the rectangle } (l) = (10 - 2 - 2) \text{ m} = 6 \text{ m}$$

$$\text{Breadth of the rectangle } (b) = 4 \text{ m}$$

$$\text{Area of rectangular part} = l \times b$$

$$\begin{array}{l}
 \text{Area of semicircular ends} \quad \frac{1}{2} \pi r^2 \\
 \frac{1}{2} \times \frac{22}{7} \times 2 \times 2 = 6.29 \text{ m}^2 \\
 \text{Area of semicircular ends} \quad \frac{1}{2} \pi r^2 \\
 \frac{1}{2} \times \frac{22}{7} \times 2 \times 2 = 6.29 \text{ m}^2 \\
 \text{Area of the play ground} \quad (24 + 6.29 + 6.29) \text{ m}^2 \\
 36.58 \text{ m}^2
 \end{array}$$

4. Let, length of rectangular field =  $x$   
 After increase 50% length of rectangular

$$x \quad 50\% \text{ of } x \quad x \quad \frac{x}{2} \quad \frac{3x}{2}$$

decrease 50% breadth of rectangular  $x \quad 50\%$

$$x \quad \frac{x}{2} \quad \frac{1x}{2} \quad \frac{x}{2}$$

$$\text{Area of length and breadth} \quad x \times x \text{ cm} = x^2 \text{ cm}^2$$

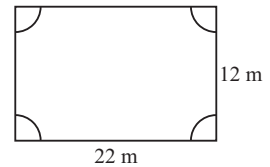
$$\text{Area of after change length and breadth} \quad \frac{3x}{2} \times \frac{x}{2} = \frac{3x^2}{4} \text{ cm}^2$$

$$\text{change area} \quad x^2 - \frac{3x^2}{4} = \frac{x^2}{4}$$

$$\% \text{ of change area} \quad \frac{x^2/4}{x^2} \times 100 = 25\%$$

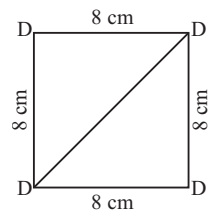
Decrease 25% area.

5. Length of rectangle = 22 m  
 Width of rectangle = 12 m  
 Area of rectangle = length  $\times$  width  
 $(22 \times 12) \text{ m}^2$   
 $264 \text{ m}^2$   
 Area of circle =  $\frac{1}{4} \pi r^2$   
 $\frac{1}{4} \times \frac{22}{7} \times 2.5 \times 2.5 \text{ m}^2$   
 $19.64 \text{ m}^2$   
 Area of the remaining part =  $(264 - 19.64) \text{ m}^2$   
 $244.36 \text{ m}^2$



6. Square of ABCD

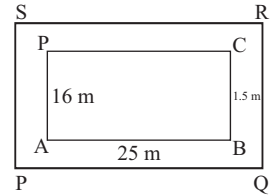
$$\begin{array}{l}
 \text{AB} = 8 \text{ cm}, \text{CB} = 8 \text{ cm} \\
 (AC)^2 = (BA)^2 + (CB)^2 \\
 (AC)^2 = (8)^2 + (8)^2 \\
 64 + 64 = 128
 \end{array}$$



length of diagonal  $AC = \sqrt{128} = 8\sqrt{2}$  cm

7. Let sides of one square  $4x$   
 Side of second square  $5x$   
 Area of one square  $4x \times 4x = 16x^2$  cm<sup>2</sup>  
 second square  $5x \times 5x = 25x^2$  cm<sup>2</sup>  
 Ratio of both square  $\frac{16x^2}{25x^2} = \frac{16}{25} = 16:25$

8. Area of  $ABCD = 25 \times 16 = 400$  m<sup>2</sup>  
 Area of  $PQRS = (25 + 1.5 \times 2) \times (16 + 1.5 \times 2) = 28 \times 29 = 532$  m<sup>2</sup>



9. Area of footpath  $PQRS - ABCD = (532 - 400)$  m<sup>2</sup> = 132 m<sup>2</sup>  
 Area of footpath  $132 \times 100$  cm<sup>2</sup> = 13200 cm<sup>2</sup>  
 Tile measuring  $20$  cm  $\times$   $20$  cm  
 Area of Tile  $400$  cm<sup>2</sup>

No of tile covered in footpath  $\frac{13200 \text{ cm}^2}{400 \text{ cm}^2} = 33$

10. Suppose, distance the shorter sides  $x$   
 Then, Area of parallelogram  $AE \times CD = 4 \times 10 = 40$  m<sup>2</sup>  
 Area of parallelogram  $40$  m<sup>2</sup>  
 $\therefore$  Area  $AE \times DC = AF \times BC$   
 So,  $AF \times BC = 40$  m<sup>2</sup>  
 $x \times 8 = 40$  m<sup>2</sup>  
 $x = \frac{40 \text{ m}^2}{8 \text{ m}} = 5$

Hence, the distance between shorter sides is 5 m.

### Exercise 11.2

1. (a) Base – 15 cm and 20 cm and altitude 8 cm  
 Area  $\frac{1}{2}(15 + 20) \times 8$  cm<sup>2</sup> = 140 cm<sup>2</sup>  
 (b) Base 10 cm and 12 cm and altitude 5 cm  
 Area  $\frac{1}{2}(10 + 12) \times 5$  cm<sup>2</sup> = 16 cm<sup>2</sup>
2. Draw  $CE \parallel CB$   
 $ABCE$  is a parallelogram  
 $EC = AD = 25$  cm

For  $\triangle CEB$

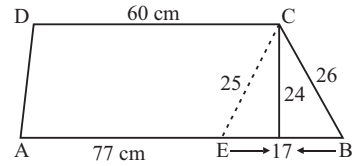
$$BE = 77 - 60 = 17 \text{ cm}$$

$$S = \frac{25 + 26 + 17}{2} = \frac{68}{2} = 34 \text{ cm}$$

$$\begin{aligned} \text{Area of } \triangle BCE &= \sqrt{S(S-a)(S-b)(S-c)} \\ &= \sqrt{34(34-17)(34-26)(34-25)} \\ &= \sqrt{34 \times 17 \times 8 \times 9} \\ &= \sqrt{41616} = 204 \text{ cm}^2 \end{aligned}$$

$$\begin{aligned} \text{Area} &= \frac{1}{2} BE \cdot h \\ &= \frac{1}{2} \cdot 17 \cdot h = 204 \\ h &= \frac{204 \cdot 2}{17} = 24 \text{ cm} \end{aligned}$$

$$\begin{aligned} \text{Area of } ABCD &= \frac{1}{2}(a+b)h \\ &= \frac{1}{2}(60+77) \cdot 24 \text{ cm}^2 \\ &= \frac{1}{2} \cdot 137 \cdot 24 \text{ cm}^2 = 1644 \text{ cm}^2 \end{aligned}$$



3. Area of a trapezium =  $105 \text{ cm}^2$

Let other side of the parallel sides is  $x$

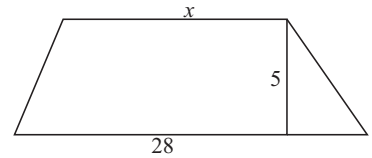
One side of the parallel side =  $28 \text{ cm}$

$$\begin{aligned} \text{Area of a trapezium} &= \frac{1}{2}(a+b)h \\ 105 &= \frac{1}{2}(28+x) \cdot 5 \end{aligned}$$

$$\begin{aligned} 105 \cdot 2 &= (28+x) \cdot 5 \\ 210 &= 140 + 5x \\ \frac{210 - 140}{5} &= x \end{aligned}$$

$$14 = x$$

other side of trapezium =  $14 \text{ cm}$



4. Suppose depth =  $h$   
parallel sides =  $8 \text{ m}$  and  $12 \text{ m}$

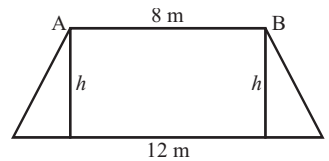
Area of trapezium =  $84 \text{ m}^2$

Then area of trapezium =  $\frac{1}{2}$

(sum of length of parallel sides)  $\cdot$  depth.

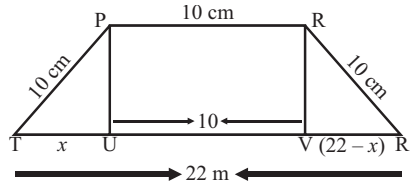
$$84 \text{ m}^2 = \frac{1}{2} (8 + 12) \text{ m} \cdot h$$

$$h = \frac{84 \cdot 2 \text{ m}^2}{20 \text{ m}} = 8.4 \text{ m}$$



Hence, depth of the cross section of a canal is  $8.4 \text{ m}$ .

5. Let  $PART$  be the given trapezium  
 $PA = 10\text{cm}, TR = 22\text{cm}$   
 $PA = UV = 10\text{cm}$   
 Let  $PU$  be  $h$  cm and  $UT$  be  $x$  cm  
 $RV = (12 - x)\text{cm}$



In  $PTU$ ;

$$PU^2 = PT^2 - TU^2$$

$$h^2 = (10)^2 - x^2 = 100 - x^2$$

In  $AVR$ ;

$$RV^2 = AR^2 - VR^2 = (10)^2 - (12 - x)^2$$

$$h^2 = 100 - 144 + 24x - 4x^2 = 44x - 4x^2$$

From equation (1) and (2) we get

$$100 - x^2 = 44x - 4x^2$$

$$100 - 44x + 3x^2 = 24x$$

$$\frac{144}{24} = x$$

$$6 = x$$

height = 6 cm

$$PUT; TU = 6\text{cm}^2$$

$$PU^2 = PT^2 - TU^2$$

$$(10)^2 - (6)^2 = 100 - 36 = 64$$

$$PU = \sqrt{64} = 8\text{cm}$$

$$\text{height of } RV = 8\text{cm}$$

$$\text{Area of } PART = \frac{1}{2}(PA + TR) \times \text{height}$$

$$= \frac{1}{2}(10 + 22) \times 8\text{cm}^2$$

$$= \frac{1}{2} \times 32 \times 8\text{cm}^2$$

$$= 128\text{cm}^2$$

6. Area of the table as trapezium shape  $\frac{1}{2}(a + b)h$

$$= \frac{1}{2}(1.5 + 2) \times 1.2\text{m}^2$$

$$= \frac{1}{2} \times 3.5 \times 1.2\text{m}^2$$

$$= 2.1\text{m}^2$$

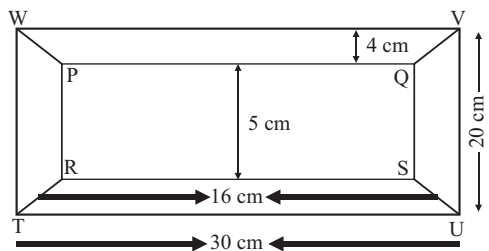
Area of table = 2.1m<sup>2</sup>

7.  $PQWW$  and  $RSTU$  trapezium

In  $PQWW$ ,  $PQ = 16\text{cm}, WW = 30\text{cm}$

$$\text{Area of } PQWW = \frac{1}{2}(PQ + WW) \times h$$

$$= \frac{1}{2}(16 + 30) \times 4\text{cm}^2$$



$$\frac{1}{2} (46 + 4) \text{ cm}^2 = 92 \text{ cm}^2$$

Area of  $RSTU = \frac{1}{2} (RS + TU) \cdot h$

$$\frac{1}{2} (16 + 30) \cdot 4 \text{ cm}^2 = 92 \text{ cm}^2$$

$PRTW$  and  $QSVU$  trapezium

In  $PRTW$ ,

$PR = 5 \text{ cm}$ ,  $WT = 20 \text{ cm}$ , height  $= \frac{30 + 16}{2} = 7 \text{ cm}$

Area of  $PRTW = \frac{1}{2} (PR + WT) \cdot h$

$$\frac{1}{2} (5 + 20) \cdot 7 \text{ cm}^2 = 87.5 \text{ cm}^2$$

$PQRS$  rectangular.

$PQ = 16 \text{ cm}$ ;  $PR = 5 \text{ cm}$

Area of  $PQRS = PQ \cdot PR$

$$16 \cdot 5 \text{ cm}^2 = 80 \text{ cm}^2$$

Area of given figure.

$$\text{Area of } PQWV + RSTU + PRTW + QSVU + PQRS \\ (92 + 92 + 87.5 + 87.5 + 80) \text{ cm}^2$$

8. Area of  $PQRS$  ;

$PQ = 100 \text{ cm}$

$RS = 150 \text{ cm}$

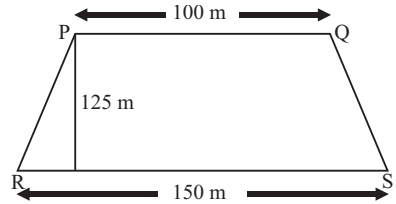
$PT = 125 \text{ cm}$

Area of  $PQRS = \frac{1}{2} (PQ + RS) \cdot PT$

$$\frac{1}{2} (100 + 150) \cdot 125 \text{ cm}^2$$

$$125 \cdot 125 \text{ cm}^2$$

$$15625 \text{ cm}^2$$



9. Area of trapezium  $720 \text{ cm}^2$

Area of  $PQRS = \frac{1}{2} (PQ + SR) \cdot ST$

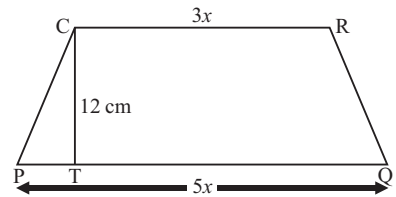
$$720 = \frac{1}{2} (5x + 3x) \cdot 12$$

$$720 = \frac{8x}{2} \cdot 12 \Rightarrow 720 = 48x$$

$$x = 15 \text{ cm}$$

length of  $SR = 3 + 15 = 45 \text{ cm}$

length of  $PQ = 5 + 15 = 20 \text{ cm}$

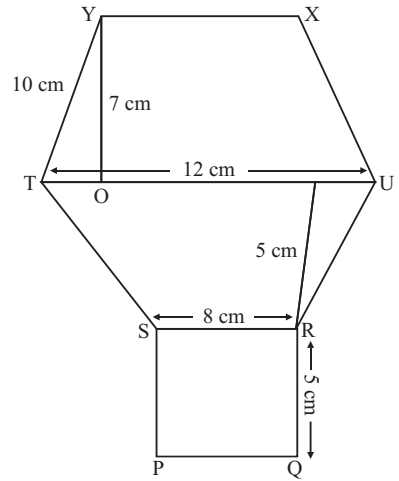


10.  $UTXY$  Trapeziums

Area of  $\frac{1}{2} (XY + TU) \cdot XYO$

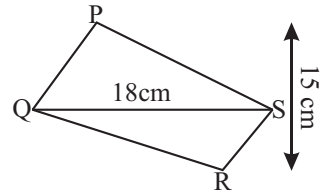
$$UTX = \frac{1}{2} (10 + 12) \cdot 7 \text{ cm}^2$$

$77\text{cm}^2$   
*TURS* Trapezium  
 Area of *TURS*  $\frac{1}{2}(TU + SR)UV$   
 $\frac{1}{2}(12 + 8) \times 5\text{cm}^2$   
 $50\text{cm}^2$   
*SRPQ* Rectangular.  
 Area of *SRPQ*  $SR \times RQ$   
 $8 \times 5\text{cm}^2$   
 $40\text{cm}^2$   
 Area of this figure = Area of trapezium *TURS*  
 and *VTXY* Rectangular.  
 $7 \times 50 + 40\text{cm}^2$   
 $167\text{cm}^2$

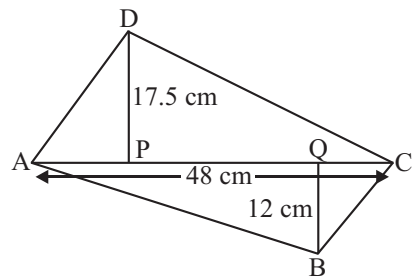


### Exercise 11.3

1. (a)



- (b)  
(c)  
(d)

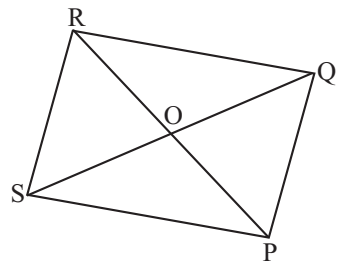


2. Area of quadrilateral *PQRS*

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

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

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



3. Given : In quadrilateral *ABCD*,

Diagonal *AC* = 48 cm, *DP* = 17.5 cm, *BQ* = 12 cm

Area of Quadrilateral *ABCD*

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