Congruence of Triangles

Exercise 11.1

1. $\overline{XY} = 4.2$ cm,

∵ $\overline{MN} \cong \overline{XY}$

∴ $\overline{MN} = \overline{XY} = 4.2$

2. ∵ R is the mid point of $\overline{PQ}$.

∴ $\overline{PR} = \overline{RQ}$

If two line segments are equal in length, they are called identical.

∵ Identical line segments are said to be congruent.

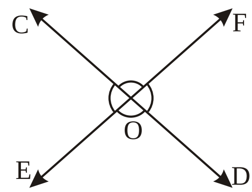
∴ $\overline{PR} \cong \overline{RQ}$

3. Figure (a), (b), (c), (g), (h), (i), (j), (k), (l) are congruent.

4. Here, $\angle COF = \angle EOD$ (Vertical opposite angle.)

and $\angle COE = \angle FOD$ (Vertical opposite angle.)

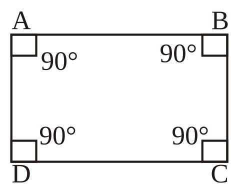
So, $\angle COF \cong \angle EOD$ and $\angle COE \cong \angle FOD$



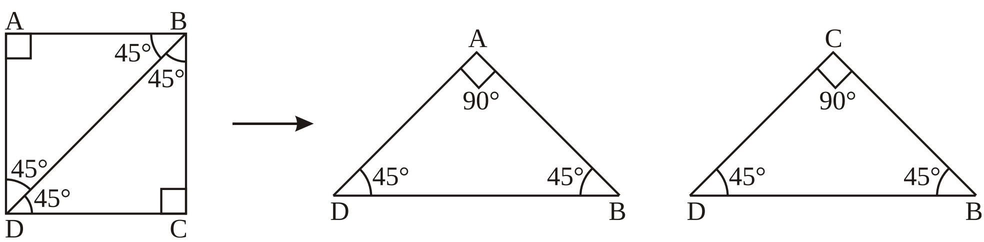
5. Yes, since each of the angle of a rectangle measures 90°.

∴ $\angle A = \angle B = \angle C = \angle D = 90°$

then any two angles of a rectangle are congruent.



6. A diagonal divides a square into two isosceles triangles.



In ΔABD and ΔDCB,

$AD = DC$ (Edges of square)

$AB = CB$ (Edges of square)

$\angle DAB = \angle DCB = 90°$ (Angle of square) DB common line segment.

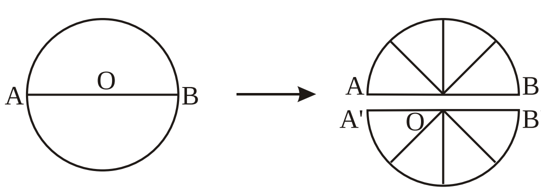
∵ $AB \parallel DC$

∴ $\angle ABD = \angle BDC$ (Alternate angle)

∴ $\angle CBD = \angle ADB$ (Alternate angle)

Hence, $\angle ABD \cong \angle DCB$

7.



Yes, diameter divide the circle into two equal (congruent) parts called semicircle.

8. **Fill in the blanks :**

(a) Two circles are congruent, if they have the same **radius.**

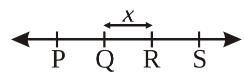
(b) Two angles are congruent, if they are equal in **degree** measure.

(c) If two figures have the same **shape** and **dimension**, they are congruent.

(d) Two rectangles will be **congruent**, if their respective lengths and breadths are equal.

(e) If ΔABC is superimposed over ΔDEF and ΔDEF is covered completely, then the two triangles are **congruent.**

9. $\because \quad \overline{PQ} \cong \overline{RS}$



$PQ = PS - QS$

and $\quad RS = PS - PR$

$\because \quad PQ = \overline{RS}$

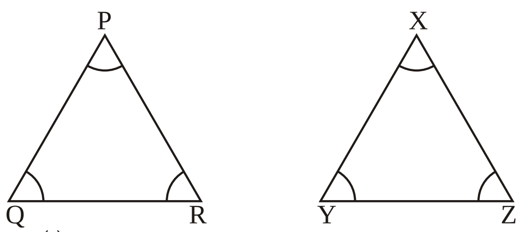
then $\quad PS - QS = PS - PR$

$\therefore \quad QS = PR$

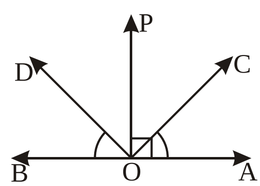
Hence $\quad \overline{PR} \cong QS \qquad (\because QS = PR)$

10. No, because their angles will be used but sides may or may not be equal.

11. $\because \Delta PQR \cong \Delta XYZ \therefore \overline{PQ} = \overline{XY}$



12. In the figure, $\overrightarrow{OP} \perp \overleftrightarrow{BOA}$, $\angle AOC = \angle BOD$



$\because \angle POB = \angle POA = 90^\circ \qquad (\because \overrightarrow{OP} \perp \overleftrightarrow{BOA})$

$(\because \quad \angle POB = \angle POD + \angle BOD$

And $\quad \angle POA = \angle POC + \angle COA)$

Then $\angle POD + \angle DOB = \angle POC + \angle DOB$

$(\because \angle COA = \angle DOB$ Given)

$\angle POD + \angle POC + \angle DOB - \angle DOB$

$\angle POD = \angle POC$

Hence, $\quad \angle POD \cong \angle POC.$

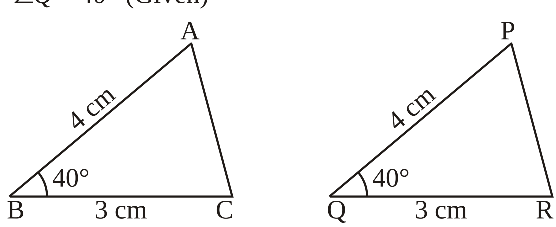
Exercise 11.2

1. (a) Considering ΔABC and ΔPQR, we have

$AB = PQ = 4$ cm (Given)

$BC = QR = 3$ cm

$\angle B = \angle Q = 40^\circ$ (Given)



$\therefore \Delta ABC \cong \Delta PQR$ (By SAS rule of congruence.)

(b) Considering ΔABC and ΔDEF

We have, $AB = DE = 6$ (Given)

$\angle B = \angle E = 50°$ (Given)

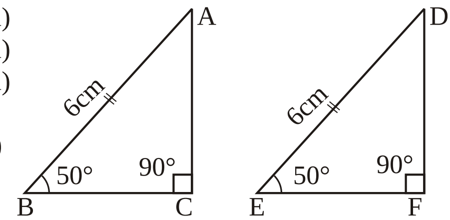
$\angle C = \angle F = 90°$ (Given)

$\angle A = \angle D$

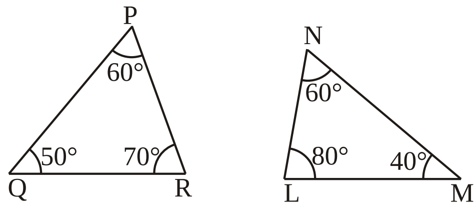
($\because$ two angles of triangles are equal.)

$\therefore \quad \Delta ABC \cong \Delta DEF$

(By Angle side Angle rule of congruence.)



(c) Considering ΔPQR and $\angle LMN$



$\angle P = \angle N = 60°$ (Given)

$\angle Q \neq \angle L$

$\angle R \neq \angle M$

$\therefore$ triangles cannot be congruence.

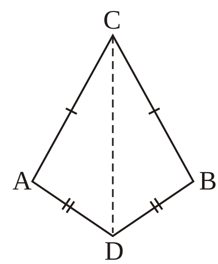
2. Considering ΔACD and ΔCDB, we have

$AC = CB$ (Given)

$AD = DB$ (Given)

$CD = CD$ (Common side)

$\therefore \quad \Delta ACD \cong \Delta CDB$ (By SAS rule of congruence.)



3. Here, $BC = PR$

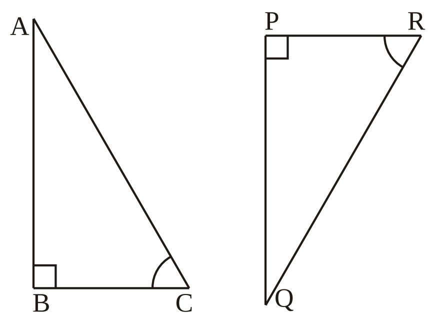
$AC = QR$

$\angle C = \angle R$

(Included angles)

$\therefore \quad \Delta ABC \cong \Delta PQR$

(By SAS rule of congruence.)



4. $CO = OD$ (Given)

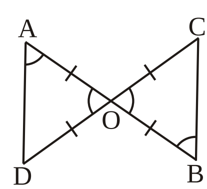
$AD \,||\, CB$ (Given)

$\angle AOD = \angle BOC$ (Vertical opposite angles.)

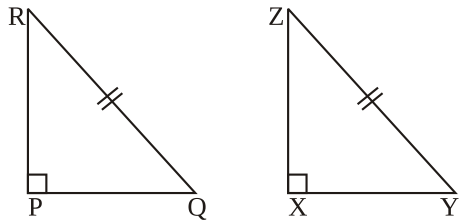
$\angle CBO = \angle OAD$ ($\because AD \,||\, CB$ alternate angles.)

Then $\Delta AOD \cong \Delta COB$ (By ASA rule of congruence.)

Hence, $AO = OB$ ($\because \Delta AOD \cong \Delta COB$)



5. Two right triangles congruent, if the hypotenuse and one side of the first triangle are respectively equal to the hypotenuse and one side of the second.



Here $\angle P = \angle X = 90°$

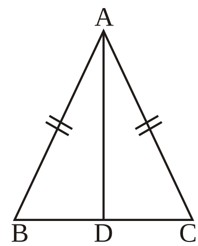
and $QR = YZ$ (Given)

So, the triangle are congruent under RHS congruent condition.

If either $PR = XZ$

or $PQ = XY$

6. Considering ΔABD and ΔADC



We have, $AB = AC$

$\angle BAD = \angle DAC$

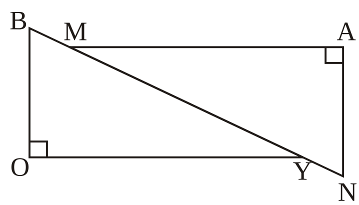
$AD = AD$

(Common side)

$\therefore$ $\Delta ABD \cong \Delta ADC$

(By SAS rule of congruent)

7. Considering ΔBOY and ΔMAN



We have, $\angle BOY = \angle MAN = 90°$ (Given)

$OY = AM$ (Given)

$BM = YN$ (Given)

$BY = BN - YN$ ...(i)

and $MN = BN - BM$

$BN = MN + BM$

Put the value of BN is the equation (i)

Then $BY = BN - YN$

$= MN + BM - YN$

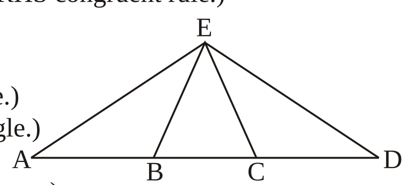
($\because BN = MN + BM$)

$BY = MN + YN - YN$ ($\because BM = YN$)

$\therefore$ $BY = MN$

So, $\Delta BYO \cong \Delta NMA$ (By RHS congruent rule.)

8. Consider ΔABE and ΔCDE, we have



$CD = AB$ (Given)

$ED = EA$ (Given isosceles triangle.)

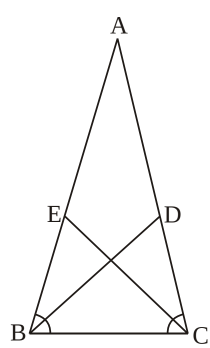
$\angle EAB = \angle EDC$ (angle of isosceles triangle.)

$\therefore$ $\Delta ABE \cong \Delta CED$

(By SAS rule of congruence.)

$\therefore$ $BE = EC$ Hence, ΔBEC is also a isosceles triangle.

9. Considering ΔBDC and ΔCEB



We have, $BC = BC$ (Common side.)

$\angle EBC = \angle BCD$ (Isosceles triangle.)

$\angle BCE = \angle DBC$ (Bisect angle are equal.)

So, $\Delta BDC \cong \Delta CEB$ (By ASA rule of congruence.)

10. (a) Consider ΔADB and ΔCDE

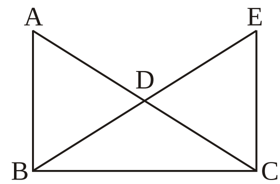
We have, $BD = DE$ (Given)

$AD = DC$ (Given)

$\angle ADB = \angle CDE$ (Vertical opposite angle.)

$\therefore$ $\Delta ADB \cong \Delta CDE$

(By SAS rule of congruence.)



(b) Consider ΔABC and ΔECB $BC = BC$ (common side)

$\angle A = \angle E$ $(\because \Delta ABD \cong \Delta CDE)$

$AB = CE$ $(\because \Delta ABD \cong \Delta CDE)$

$\therefore$ $\Delta ABC \cong \Delta FCB$ (By SAS rule of congruence.)

(c) $\because$ $\Delta BCA \cong \Delta BCE$

Hence, $\angle BCE = \angle ABC = 90°$

11. Considering ΔOAB and ΔOAC we have,

$BO = OC$ (Given)

$AB = AC$ (Given)

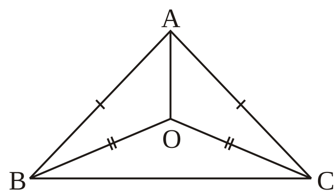
$AO = OA$ (Common side)

So, $\Delta OAB \cong \Delta OAC$

(By SSS rule of congruence.)

Then, $\Delta ABO = \angle ACO$

$(\because \Delta AOB \cong \Delta AOC)$



MCQ's

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

12 Practical Geometry

Exercise 12.1

1. Steps to construct :

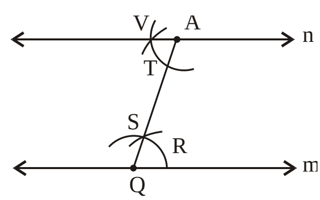
(a) Draw a line m using a ruler and mark a point A outside m.

(i) Take any point Q on m. Join AQ.

(ii) With Q as centre and a suitable radius drawn an arc using compas to cut m at R and QA at S.

(iii) With A as centre and the same radius drawn an arc, cutting AQ at T.

(iv) Now, place the pointed tip of the compass at R and adjust the opening, so that the pencil tip is at S.



(v) With T as centre and the same radius RS, draw an arc cutting the previous arc at V.

(vi) Join AV and produce it on both sides to get the required line n parallel to m.

(b) Infinite number of lines can be drawn from the point A.

(c) One and only one line would be parallel to the line m, which is line n.

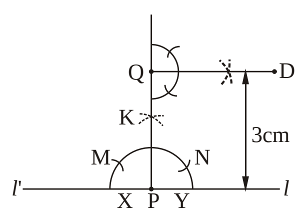
2. Steps to construct :

(a) Draw a line (i.e., $l' l$ using a ruler).

(b) Mark a point P on l and with P as centre, draw an arc intersecting l at X and Y.

(c) Again taking X as centre and with the same radius, draw an arc intersecting the previous arc XY at M.

(d) Taking M as the centre and with the same radius, draw another arc intersecting arc XY at N.



(e) With M and N as centres and with the same radius, draw arcs such that they intersect each other at point K. Join P and K such that $\angle KPl' = 90° = \angle KPl$.

(f) Now, mark a point Q on perpendicular PK such that $QP = 3$ cm.

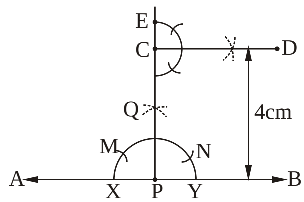
(g) Again construct a right angle at Q by following the steps a to e.
Since $\angle EQD = \angle QPl = 90°$ (Corresponding angles)
So, QD is parallel to l or $l'l$.

(h) Line QD. thus constructed, is at a distance of 3 cm away from $l'l$ and is parallel to line l i.e., $QD \parallel l$.

3. Steps to construct :

(a) Draw a line AB using a ruler.

(b) Mark a point P on AB and with P as centre, draw an arc intersecting AB at X and Y.



(c) Again taking X as centre and with the same radius, draw an arc intersecting the previous arc XY at M.

(d) Taking M as the centre and with the same radius, draw another arc intersecting arc XY at N.

(e) With M and N as centres and with the same radius, draw arcs such that they intersect each other at point Q. Join P and Q such that $\angle QPA = 90° = \angle QPB$.

(f) Now, mark a point C on perpendicular as PQ such that $PC = 4$ cm.

(g) Again construct a right angle at C by following the steps a to e.
Since $\angle ECD = \angle CPB = 90°$ (Corresponding angles)
So, CD is parallel to AB.

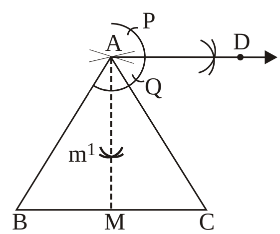
(h) Line CD, thus constructed, is at a distance of 4 cm from AB and is parallel to line AB, i.e., $CD \parallel AB$.

4. Do it yourself.

5. Steps to construct :

(a) Draw a line segment BC using a ruler.

(b) With B as centre and radius more than half of BC, draw an arc on any side of BC.



(c) Similarly, with C as centre and radius more than half of CB, draw an arc intersecting the first arc at A.

(d) Join B to A and C to A.

(e) Draw perpendicular AM on side BC.

(f) Now, with A as centre draw two arcs on produced perpendicular AM intersecting AM at X and Y.

(g) Construct a right angle at A by drawing necessary arcs which intersect at point D.

(h) Join AD. Thus, AD is parallel to BC.

Exercise 12.2

1. (a) Let $a = 8$ cm, $b = 4$ cm, $c = 3$ cm $a + b = 8 + 4 = 13$ cm > 3

$\Rightarrow \quad b + c < a$

$b + c = 4 + 3 = 7 < 8$

$\Rightarrow \quad b + c < a$

$c + a = 3 + 8 = 11 > 4$

$c + a > b$

Since, the sum of two side of the three sides < the third triangle.
Hence, with these sides this triangle can't be constructed.

(b) $7 + 15 > 5 \qquad 15 + 5 > 7 \qquad 5 + 7 < 15$

$\therefore$ with these sides triangle can't be constructed.

(c) $14+6>9$ $\quad 6+9>14$ $\quad 9+14>6$

$\therefore$ with these sides triangle can be constructed.

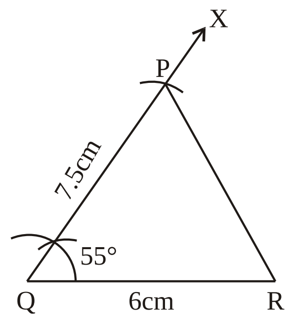
(e) $10+10=20$ (third side)

$20+10>10$ (first side)

$10+20>10$ (second side)

$\therefore$ with these sides triangle can't be constructed.

2. First, we draw a rough sketch of ΔPQR.



Steps to construct :

(a) Draw a line segment $QR = 6$ cm.

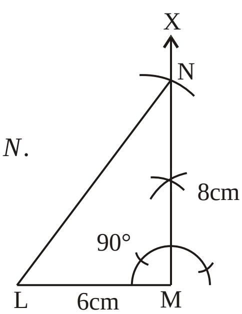
(b) At Q, construct $\angle XQR = 55°$.

(c) With Q as centre and radius 7.5 cm, draw an arc cutting QX at P.

(d) Join PR.

Then, ΔPQR is the required triangle.

3. First draw a rough sketch of ΔLMN as given below.



Steps to construct :

(a) Draw a line segment $LM = 6$ cm.

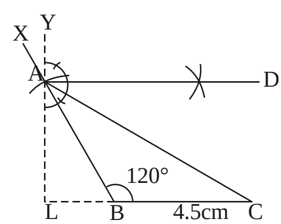
(b) At M, construct $\angle XML = 90°$.

(c) With M as centre and radius 8 cm, draw an arc cutting MX at N.

(d) Join NL.

Then, ΔLMN is the required triangle.

4. First draw a rough sketch of ΔABC as given below.



Steps to construct :

(a) Draw a line segment $BC = 4.5$ cm.

(b) At B, construct $\angle XBC = 120°$.

(c) With B as centre and radius 5 cm, draw an arc cutting BX at A.

(d) Join AC.

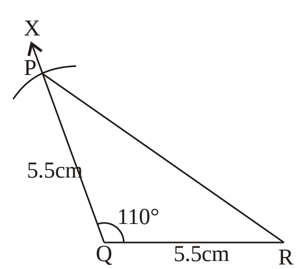
(e) Produce BC to L and draw a line LY passing through point A.

(f) Now, make angle of 90° at A by necessary arcs.

(g) Produce A to D to get the required line AD parallel to BC.

5. First, draw a rough sketch of ΔPQR.

Let $QR = PQ = 5.5$, $LQ = 110°$.



Steps to construct :

(a) Draw a line segment $QR = 5.5$ cm.

(b) At Q, construct $\angle RQX = 110°$.

(c) With Q as centre and radius 5.5 cm. draw an arc cutting QX at P.

(d) Join PR.

Then, ΔPQR is the required triangle.

6. **Steps to construct :** given $PQ = QR = RP = 6.5$ cm.

(a) Draw a line segment $PQ = 6.5$ cm.

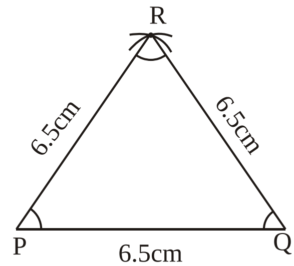
(b) With P as centre and radius 6.5 cm, draw an arc using a compass.

(c) With Q as centre and radius 6.5 cm, draw another arc. Cutting the previous arc at R.

(d) Join RP and RQ. Then ΔPQR is the required triangle.

(e) Measuring $\angle P, \angle Q$ and $\angle R = 60°$.

Thus, we can conclude that in equilateral triangle all the three sides are same and all the three angles are of equal measurement.



7. Given an isosceles Δ in which $AB = AC = 4.5$ cm, $BC = 5.5$ cm.

First draw a rough sketch of ΔABC.

Steps to construct :

(a) Draw a line segment $BC = 5.5$ cm.

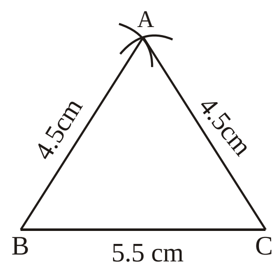
(b) With B as centre and radius 4.5 cm, draw an arc using a compass.

(c) With C as centre and same radius 4.5 cm, draw another arc, cutting the previous arc at A.

(d) Join AB and AC.

Then ΔABC is the required triangle.

(e) Measuring $\angle B$ and $\angle C$ with the help of protractor.



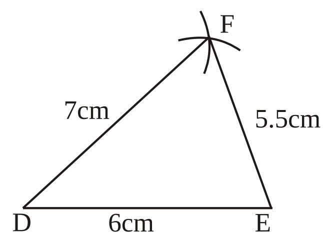
8. **Steps to construct :**

(a) Draw a line segment DE of length 6 cm.

(b) With D as centre and radius 7 cm, draw an arc using a compass.

(c) With E as centre and radius 5.5 cm, draw another arc, cutting the previous arc at F.

(d) Join FD and FE. Then ΔDEF is the required triangle.



9. Given ΔXYZ with $XY = 6$ cm, $YZ = 7$ cm, $ZX = 5.5$ cm.

Steps to construct :

(a) Draw a line segment $YZ = 7$ cm.

(b) With Y as centre and radius 6 cm, draw an arc using a compass.

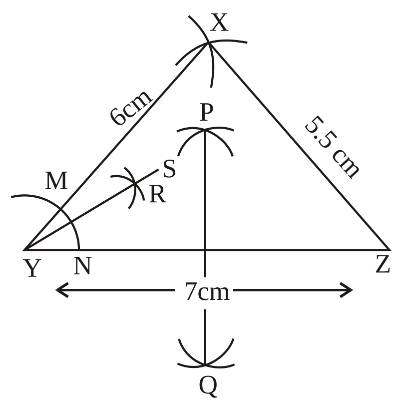
(c) With Z as centre and radius 5.5 cm draw another arc, cutting the previous arc a X.

(d) Join XY and XZ.

then ΔXYZ is the required triangle.

(e) Now, Y and Z as centre respectively and radius more than half of radius YZ (i.e., length of YZ) draw two arc cutting each other on both sides as given.

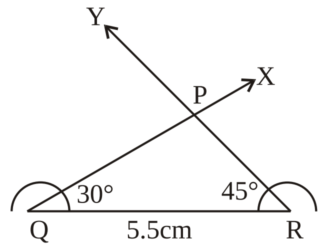
(f) With Y as centre draw an arc of any radius which intersect the side XY and side YZ at point. M, N respectively.



(g) Now, taking M and N as centre, draw two arcs of same radius or radius more than half of MN, which intersect each other at point R.

(h) Finally, produce YR to S. This line segment YS. Bisect $\angle XYZ$.

Exercise 12.3



1. **Given :** ΔPQR in which $QR = 5.5$ cm,

   $\angle P = 45°, \angle Q = 30°.$

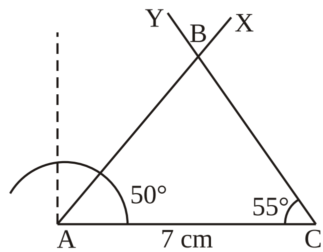
   Steps to construct :

   (a) Draw a line segment $QR = 5.5$ cm.

   (b) At Q & R,
   draw $\angle XQR = 30°$ and $\angle YRQ = 45°$ respectively by using protractor or by using arcs.

   (c) Let QX and RY intersect at P.

   Then ΔPQR is the required triangle.



2. Given : ΔABC in which $AC = 7$ cm, $\angle A = 50°, \angle C = 55°.$

   Steps to construct :

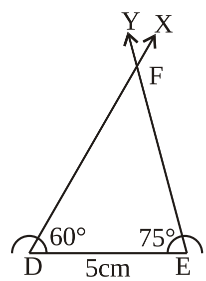
   (a) Draw AC of length 7 cm.

   (b) At A construct $\angle XAC = 50°$ by using protractor.

   (c) At C draw $\angle YCA = 55°$ by using protractor.

   (d) Let AX and CY intersect at B.

   Then ΔABC as the required triangle.



3. Given : ΔDEF in which $DE = 5$ cm, $\angle D = 60°$, $\angle E = 75°.$

   Steps to construct :

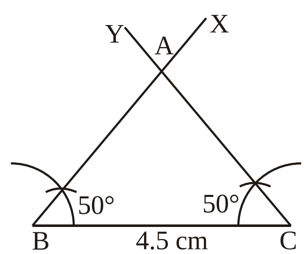
   (a) Draw DE of length 5 cm.

   (b) At D construct $\angle XDE = 60°.$

   (c) At E draw $\angle YED = 75°$ by using protractor or by using arcs.

   (d) Let DX and EY intersect at F.

   Then ΔDEF is the required triangle.



4. **Given :** ΔABC in which $BC = 4.5$ cm,

   $\angle B = \angle C = 50°$

   $\angle A = 180° - (\angle B + \angle C) = 180° - (50° + 50°)$

   $= 180° - 100° = 80°$

   $\angle A = 80°$

   Measured by scale, $AB = 3.1$ cm $= AC$

   Steps to construct :

   (a) Draw a line sement BC of length 4.5 cm.

   (b) At B, construct $XBC = 50°.$

   (c) At C, construct $\angle YCB = 50°.$

   (d) Let BX and CY intersect at A. Then ΔABC is the required triangle.

5. **Given :** $\angle X = 105°, \angle X = 75°, XY = 5.8$ cm.

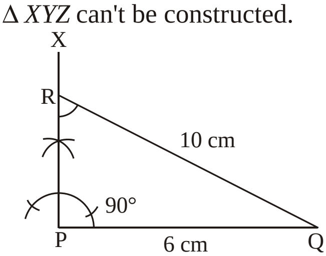
   $\angle X + \angle Y + \angle Z = 180°$ (Angle sum property of triangles)

   $105° + 75° + \angle Z = 180°$

   $\angle Z = 180° - 180° = 0°$

   $\angle Z = 0°$

   But it is not possible that any angle of a triangle be 0°. So, ΔXYZ can't be constructed.



6. **Steps to construct :**

   (a) Draw a line segment $PQ = 6$ cm.

   (b) At P, construct $\angle QPX = 90°.$

   (c) With Q as centre and radius 10 cm, draw an arc cutting PX at R.

   (d) Join RQ.

   Then, ΔPQR is the required triangle.

7. **Steps to construct :**

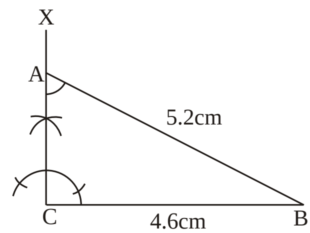
(a) Draw a line segment $BC = 4.6$ cm.

(b) At C, construct $\angle BCX = 90°$.

(c) With B as centre and radius 5.2 cm, draw an arc cutting CX at A.

(d) Join AB.

Then, ΔABC is the required triangle.



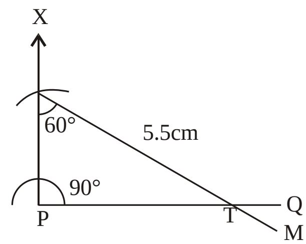
8. **Steps to constructs :**

(a) Draw a line segment PQ of any length.

(b) At P, construct $\angle QPX = 90°$.

(c) With R as centre, construct $\angle MRP = 60°$ and radius 5.5 cm draw an arc cutting PQ at T.

(d) Thus, ΔPRT is the required triangle.



9. **Steps to construct :**

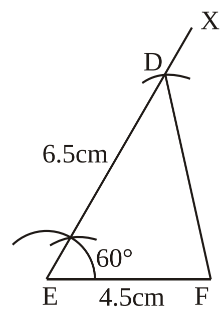
(a) Draw a line segment $EF = 4.5$ cm.

(b) At E, construct $\angle XEF = 60°$.

(c) With E as centre and radius 6.5 cm, draw an arc cutting EX at D.

(d) Join DF.

Then, ΔDEF is the required triangle..



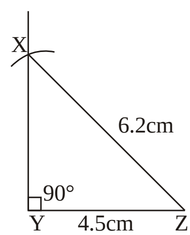
10. **Steps to construct :**

(a) Draw a line segment of length $YZ = 4.5$ cm.

(b) At Y construct $\angle XYZ = 90°$.

(c) With Z as centre and radius 6.2, draw an arc cutting ZX at X.

(d) Join XZ. Then, ΔXYZ is the required triangle.



11. **Steps to construct :**

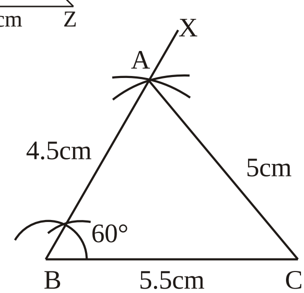
(a) Draw a line segment $BC = 5.5$ cm.

(b) At B, construct an angle of any degree, here, we construct $\angle CBX = 60°$ for convenience.

(c) With B as centre and radius 4.5 cm, draw an arc cutting BX at A.

(d) Similarly, with C as centre and radius 5 cm, draw an another arc cutting BX at A.

(e) Join AC then, ΔABC is the required triangle.



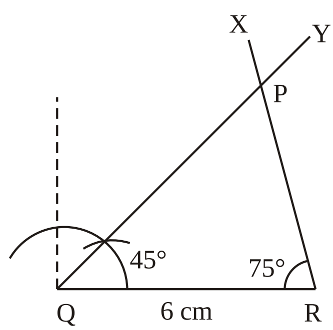
12. **Steps to construct :**

(a) Draw $QP = 6$ cm.

(b) At Q, construct $\angle XQP = 45°$.

(c) At P, draw $\angle YPQ = 75°$.

(d) Let QX and PY intersect at R then ΔPQR is the required triangle.



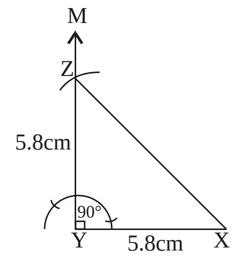
13. Steps to construct :

(a) Draw a line segment $XY = 5.8$ cm.

(b) At Y, construct $\angle XYM = 90°$.

(c) With Y as centre and radius 5.8 cm, draw an arc cutting YM at Z.

(d) Join ZX, then, ΔXYZ is the required isosceles right angle triangle.



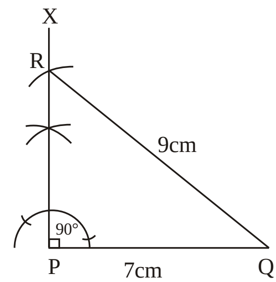
14. Steps to construct :

(a) Draw a line segment $PQ = 7$ cm.

(b) At P, construct $\angle QPX = 90°$.

(c) With Q as centre and radius 9 cm, draw an arc cutting PX at R.

(d) Join RQ. Then, ΔPQR is the required triangle.



13 Perimeter and Area

Exercise 13.1

1.

	Figure	Length	Breadth	Area	Perimeter
(a)	Square	**13 cm**	**13 cm**	169 cm^2	**52 cm**
(b)	Rectangle	80 cm	**3m, 20 cm**	**25.6 m^2**	8 m
(c)	Square	**1.21 m**	**1.21 m**	**1.4641 m^2**	4.84 m

2. The given side of a square $= 16\,m$

Area $= side^2$

$= side \times side$

$= 16\ m \times 16\,m$

$= 256\,m^2$

Now, length $= 32\,m$

Area $= l \times b$

$256 = 32 \times b$

$b = \dfrac{256}{32} = 8$

$b = 8\,m$

So, perimeter of rectangle $= 2[l + b]$

$= 2[32 + 8]$

$= 2 \times [40]$

$= 80\,m$

3. (a) length $= 12$ cm, breadth $= 8$ cm

Perimeter of rectangle $= 2[l + b]$
$= 2[12 + 8]$
$= 2 \times 20$ cm
$= 40$ cm

Area of rectangle $= l \times b$
$= 12 \times 8$
$= 96 \text{ cm}^2$

(b) length $= 20$ m, breadth $= 15$ m

Perimeter of rectangle $= 2[l + b]$
$= 2[20 + 15]$
$= 2 \times 35$
$= 70$ m

Area of rectangle $= l \times b$
$= 20 \text{ m} \times 15 \text{ m}$
$= 300 \text{ m}^2$

4. (a) Side $= 8$ cm

Area of square $= (\text{side})^2$
$= \text{side} \times \text{side}$
$= 8 \text{ cm} \times 8 \text{ cm}$
$= 64 \text{ cm}^2$

(b) diagonal $= 5.2$ cm

Area of square $= \frac{1}{2} \times d_1 \times d_2$
$= \frac{1}{2} \times 5.2 \times 5.2$
$= 13.52 \text{ cm}^2$

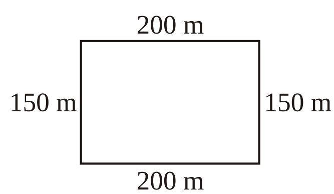
5. (a) Perimeter of given figure
$= 8 \text{ cm} + 10 \text{ cm} + 7 \text{ cm} + 6 \text{ cm} + 11 \text{ cm} + 12 \text{ cm} + 4 \text{ cm} + 4 \text{ cm} = 62 \text{ cm}$

Area $= 11 \times 6 + 4 \times 10 + 4 \times 4$
$66 \text{ cm}^2 + 40 \text{ cm}^2 + 16 \text{ cm}^2 = 122 \text{ cm}^2$

(b) Perimeter of given figure $= 3 \text{ cm} + 4.5 \text{ cm} + 4 \text{ cm} + 4.5 \text{ cm} + 2 \text{ cm} + 12 \text{ cm}$
$+ 2 \text{ cm} + 4.5 \text{ cm} + 4 \text{ cm} + 4.5 \text{ cm} + 3 \text{ cm} + 12 \text{ cm}$
$= 60$ cm

Area $= 12 \times 3 + 12 \times 2 + 3 \times 4$
$= 38 + 24 + 12$
$= 72 \text{ cm}^2$

6. Length of a playground = 200 m
Breadth of a playground = 150 m
Athlete want to run 7 km around this field.
Now, distance covered by the athlete in 1 round
= Perimeter of the playground
$= 2(l + b)$
$= 2(200 + 150)$ m
$= 2 \times 350 = 700$ m



$\therefore$ Total distance covered by the athlete $= 7$ km $\quad (\because 1 \text{ km} = 1000 \text{ m})$
$= 7 \times 1000$ m
$= 7000$ m

$\therefore$ required no. of times to go around this field $= \frac{7000}{700}$
$= 10$ times

Hence, the athlete should go 10 times around this field.

7. Length of the floor = 16 m,
Breadth of the floor = 12 m

$\therefore$ Area of the rectangular floor $= l \times b = 16 \text{ m} \times 12 \text{ m} = 192 \text{ m}^2$

$\because$ The cost of carpetting the rectangular floor of 1 m^2 = ` 225

$\therefore$ The cost of carpetting the rectangular floor of 192 m^2 = ` (225 × 192)
= ` 43200

8. Area of greeting cards $= l \times b = 10 \text{ cm} \times 6 \text{ cm} = 60 \text{ cm}^2$

Area of a sheet of paper $= l \times b = 1 \times 0.96 = 0.96 \text{ m}^2$

$= 0.96 \times 100 \times 100 \text{ cm}^2$ $\quad [\because 1\text{m}^2 = 100 \times 100\text{cm}^2]$

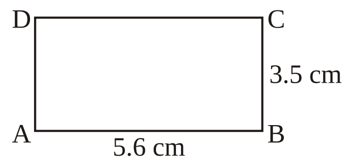
$= \frac{96}{100} \times 100 \times 100 \text{ cm}^2 = 9600 \text{ cm}^2$

No. of greeting cards $= \frac{\text{Area of a sheet of paper}}{\text{Area of 1greeting cards}}$

$= \frac{9600\text{cm}^2}{60\text{cm}^2} = 160$

9. Length of room = 5.6 m

Breadth of room = 3.6 m



$\therefore$ Area of room $= l \times b = 5.6 \times 3.6 \text{ m}^2 = 20.16 \text{ m}^2$

Area of one square marble tile = side × side

$= 10 \times 10 = 100 \text{ cm}^2$

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

$[\because 1\text{m} = 100\text{cm}]$

$= \frac{1}{100} \text{ m}^2$

$= 0.01 \text{ m}^2$ $\quad \left[1\text{cm}^2 = \frac{1}{100 \times 100} \text{m}^2\right]$

$\therefore$ required number of tiles to be laid in the room

$= \frac{\text{Area of the room}}{\text{Area of one square marble tile}}$

$= \frac{20.16\text{m}^2}{0.01\text{m}^2} = \frac{20.16}{0.01}$

$= \frac{2016}{1} = 2016$

$\because$ Cost of laying 2 tiles = ` 5

$\therefore$ Cost of laying 1 tile = ` $\frac{5}{2}$

And cost of laying 2016 tiles = ` $\frac{5}{2} \times 2016$

= ` 5 × 1008 = ` 5040

10. Length $(l) = 2.6$ m,

Breadth $(b) = 1.1$ m

Area of the door $= l \times b = 2.6 \text{ m} \times 1.1 \text{ m} = 2.86 \text{ m}^2$

$\because$ cost of painting 1 m^2 the area of door = ` 20

$\therefore$ cost of painting 2.86 m^2 area of the door on both sides = ` 20 × (2 × 2.86)

= ` 114.40

11. Length $(l) = 400$ m, Breadth $(b) = 225$ m

Area of farmer's rectangular plot $= l \times b$

$= 400 \text{ m} \times 225 \text{ m} = 90{,}000 \text{ m}^2$

We know that, $1 \text{ hectare} = 10{,}000 \text{ m}^2$

Let he should buy $x \text{ m}^2$ more area of the land.

then, we have $x + 90{,}000 = 10 \text{ hectare}$

$$x + 90{,}000 = 10 \times 10{,}000 \text{ m}^2$$
$$x + 90{,}000 = 100000$$
$$x = 100000 - 90000$$
$$x = 10{,}000 \text{ m}^2$$

Hence, he should buy $10{,}000 \text{ m}^2$ more area of land to make the area of his field equal to be hectare.

12. Length $(l) = 9.5$ m, Breadth $(b) = 7.5$ m, Height = 2.5 m

$\therefore$ area of 4 walls of the room $= 2(l + b) \times h$

$$= 2 \times (9.5 + 7.5) \times 2.5$$
$$= 85 \text{ m}^2 \quad \ldots(1)$$

Area of 1 door $= 2 \text{ m} \times 3 \text{ m}$

$$= 6 \text{ m}^2 \quad \ldots(2)$$

Area of 2 windows $= 2 \times (l \times b) = 2 \times (3.5 \times 2)$

$$= 14 \text{ m}^2 \quad \ldots(3)$$

Total area of 1 door and 2 windows $= 6 + 14 = 20 \text{ m}^2 \quad \ldots(4)$

$\therefore$ area to be painting $= 85 - 20 = 65 \text{ m}^2$

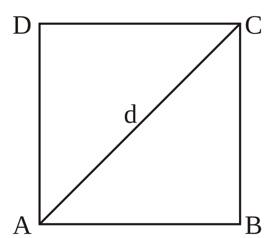
$\because$ cost of painting 1 m^2 area = ` 5.60

$\therefore$ cost of painting 65 m^2 area = ` $(65 \times 5.60)$ = ` 364

Hence, the total cost of painting the 4 walls = ` 364

13. Given, area of the square = 18050 m^2

We know that,



$$\text{the area of square} = \frac{1}{2} \text{diagonal}^2$$

$$\therefore \quad 18050 = \frac{1}{2} \text{diagonal}^2$$

$$\text{diagonal} = \sqrt{2 \times 18050}$$
$$\text{diagonal} = \sqrt{31600}$$
$$\text{diagonal} = 190$$

Hence, the length of diagonal is 190 m.

14. The area of four walls of a room $= 144 \text{ m}^2$

Let breadth of the room x m.

Then length of the room $= (3x)$,

and height of the room = 3 m

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

$$\Rightarrow \quad 2 \times (3x + x) \times 3 = 144$$
$$\Rightarrow \quad 6 \times 4x = 144$$
$$\Rightarrow \quad x = \frac{144}{24} = 6$$

$\therefore$ Breadth $(b) = x = 6 \text{ m}$

Length $(l) = 3 \times x = 3 \times 6 = 18 \text{ m}$

Now, Area of the floor $= l \times b = 18 \times 6 = 108 \text{ m}^2$

15. Area of the square plot = 400 m × 400 m = 160000 m^2

He keeps the area of the square plot with him $= 9 \text{ hectares}$

$= 9 \times 10,000 \text{ m}^2$ [$\because$ 1 hectare $= 10,000 \text{ m}^2$]

$= 90,000 \text{ m}^2$

$\therefore$ remaining sold plot $= (160000 - 90000) \text{ m}^2 = 70,000 \text{ m}^2$

Now, since cost of selling the remaining plot of 1 m^2 = ` 900

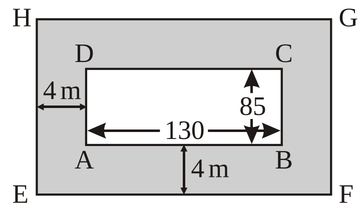
$\therefore$ cost of selling the remaining plot of 70,000 m^2 = ` 900 × 70,000

= ` 63,000,000

= ` 6 crore 30 lakh.

Exercise 13.2

1. Let *ABCD* is the field and shaded portion is the path.



Then, $EF = 130 + 4 + 4 = 138 \text{ m}$

$FG = 85 + 4 + 4 = 93 \text{ m}$

Area of the field $= (l \times b) \text{ m}^2$

$ABCD = (130 \times 85) \text{ m}^2 = 11050 \text{ m}^2$

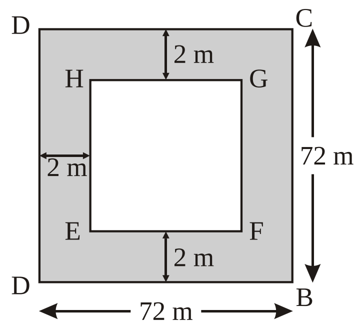
Area of $EFGH = (l \times b) \text{ m}^2$

$= 138 \times 93 = 12834 \text{ m}^2$

$\therefore$ area of the path = Area of *EFGH* – Area of *ABCD*

$= 12834 - 11050 = 1784 \text{ m}^2$

2. Let *ABCD* be a square field.



Whose sides $AB = BC = CD = DA = 72 \text{ cm}$

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

$= (72)^2$

$= 72 \times 72 = 5184 \text{ m}^2$

Length of the square $EFGH = 72 - 2 = 2 = 68 \text{ m}$

Breadth of the square $EFGH = 72 - 2 - 2 = 68 \text{ m}$

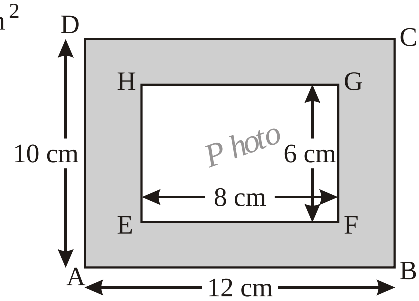
$\therefore$ Area of square $EFGH = (\text{side})^2 = (68)^2$

$= 68 \times 68 = 624 \text{ m}^2$

$\therefore$ Area of the path = Area of square field *ABCD* – Area of square field *EFGH*

$= (5184 - 4624) \text{ m}^2 = 560 \text{ m}^2$

3. Let *ABCD* be a cardboard



Area of the cardboard $= l \times b$

= 12 cm × 10 cm

= 120 cm^2

Again, let *EFGH* be the photo which is placed in the middle of the cardboard.

$\therefore$ length of the photo = 8 cm

breadth of the photo = 6 cm

$\therefore$ Area of the mounted photo on a cardboard

$= l \times b$

$= 8 \times 6$

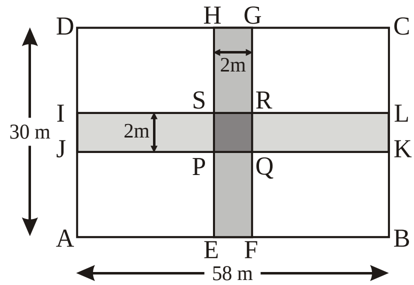
$= 48 \text{ cm}^2$

Now, area of cardboard that is visible outside the photo

= Area of the cardboard *ABCD* – Area of the mounted photo on a cardboard

$= (120 - 48) \text{ cm}^2 = 72 \text{ cm}^2$

4. Let *ABCD* represent the field and *EFGH* and *IJKL* represent the two cross roads.



Area of the road *IJKL* $= l \times b$

$= 58 \times 2 = 116\ m^2$

Area of the road *EFGH* $= l \times b = 30 \times 2 = 60\,m^2$

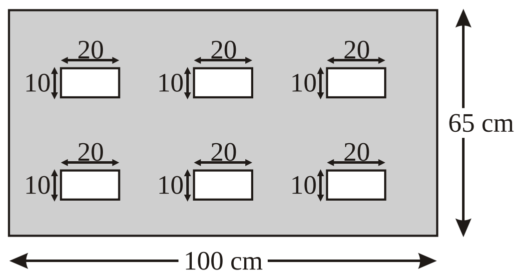
Area of the square *PQRS* = $(\text{side})^2$

$= (2)^2 = 4\ m^2$

Area of square *PQRS* occurs in both these roads. In order to get the area of the roads, we subtract the area of *PQRS* once from their sum, i.e.,

$\therefore$ Area of the roads $= 116 + 60 - 4 = 172\,m^2$

5. Let *ABCD* be a retangular park in while length $(l) = 100\,m$, breathe $(b) = 65\,m$



Area of the rectangular park *ABCD*

$= l \times b = 100 \times 65 = 6500\,m^2$

$\because$ Area of 1 flower bed

$= l \times b = 20 \times 10 = 200\,m^2$

$\therefore$ Area of such 6 flower beds

$= 6 \times 200 = 1200\,m^2$

$\therefore$ Area of the path remaining portion of the park

= Area of *ABCD* – Area of 6 flower beds

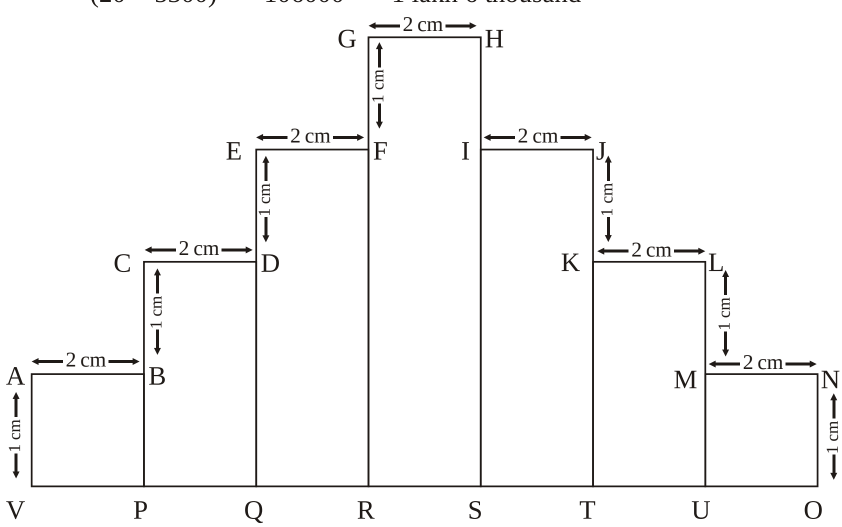
$= (6500 - 1200)\,m^2 = 5300\ m^2$

$\because$ Cost of laying the path in the remaining portion of the park 1 m^2 area = ` 20

$\therefore$ cost of laying the path in the remaining portion of the park of 5300 m^2 area

= ` (20 × 5300) = ` 106000 = ` 1 lakh 6 thousand

6. (a)



Area of *ABVP* $= 2cm \times 1cm = 2\ cm^2$

Area of *CDPQ* $= 2cm \times 2cm = 4\ cm^2$

Area of *FFQR* $= 2cm \times 3cm = 6\ cm^2$

Area of *GHRS* $= 2cm \times 4\,cm = 8\ cm^2$

Area of $IJST = 2\text{cm} \times 3\text{cm} = 6 \text{ cm}^2$

Area of KLTU $= 2\text{ cm} \times 2\text{ cm} = 4 \text{ cm}^2$

Area of $MNUO = 2\text{cm} \times 1\text{cm} = 2 \text{ cm}^2$

So, Area of whole fig $= 2 + 4 + 6 + 8 + 6 + 4 + 2 == 32 \text{ cm}^2$

(b) Area of $DEMN = l \times b = 17 \times 4$

$= 68 \text{ m}^2$ ...(1)

Area of $MFGH = l \times b = 11 \times 4$

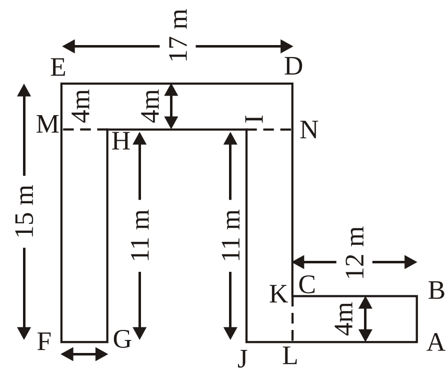
$= 44 \text{ m}^2$ ...(2)

Area of $IJLN = l \times b = 11 \times 4$

$= 44 \text{ m}^2$ ...(3)

Area of $ABKL = l \times b = 12 \times 4$

$= 48 \text{ m}^2$ ...(4)



Adding all the equations (1) to (4), we get

Area of the required figure

= Area of $DEMN$ + Area of $MFGH$

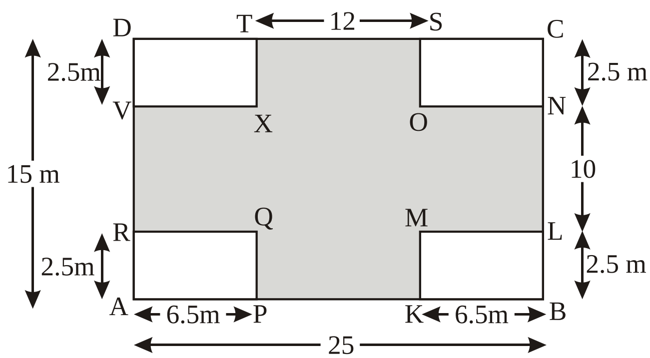
+ Area of $IJLN$ + Area of $ABKL$

$= (68 + 44 + 44 + 48) \text{ m}^2 = 204 \text{ m}^2$

7. (a) Let $AB = DC = 25 \text{ m}$, $AD = BC = 15 \text{ m}$

Area of $ABCD = l \times b = 25 \times 15 = 375 \text{ m}^2$

From the fig. it is clear that $AP = RQ = 6.5$ m, $KB = ML = 6.5$ m



Similarly, $ON = SC = 6.5$ and $VX = DT = 6.5$ m

$AR = PQ = 2.5$ m, $KM = BL = 2.5$ m

and $NC = OK = 2.5$ m, $DV = TX = 2.5$ m

Now, area of one corner $= l \times b = 6.5 \times 2.5 = 16.25 \text{ m}^2$

Area of 4 corner $= 4 \times (l \times b) = 4 \times 16.25 = 65 \text{ m}^2$

$\therefore$ Area of the shaded portion = Area of $ABCD$ − Area of 4 corners

$= 375 - 65 = 310 \text{ m}^2$

(b) Given $AB = DC = 25 \text{ m}$, $AD = BC = 15 \text{ m}$, $AN = AB - (NM + MB) = 25 - (13 + 6)$

$\therefore$ $AN = 25 - 19 = 6 \text{ m}$

$\Rightarrow$ $AN = FG = EH = DI = 6 \text{ m}$

$CP = JK = IH = DE = 3.5$ m

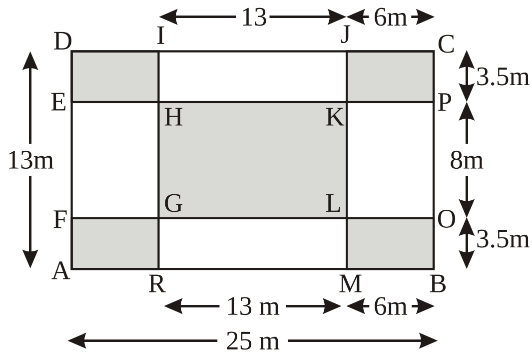
$FA = AD - (DE + EF) = 15 - (3.5 + 8) = 15 - 11.5 = 3.5 \text{ m}$

Area of whole $ABCD$ part $= l \times b = 25 \times 15 = 375 \text{ m}^2$ …(1)

Area of 1 corner part $= l \times b = 6 \times 3.5 = 21.0 \text{ m}^2$

$\therefore$ Area of 4 corner part $= 4 \times 21 = 84 \text{ m}^2$ …(2)

Area of inner part $GLKH = l \times b = 13 \times 8 = 104$ …(3)

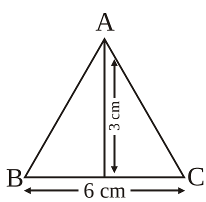


Now, area of shaded parts = Area of 4 corners + Area of inner part $GLKH$

$(84 + 104) \text{ m}^2 = 188 \text{ m}^2$

Exercise 13.3

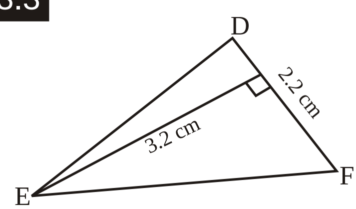
1. (a)



Area of $\Delta ABC = \frac{1}{2}$ Base $\times$ Altitude

Area of $\Delta ABC = \frac{1}{2} \times 6 \text{ cm} \times 3 \text{ cm} = 9 \text{ cm}^2$

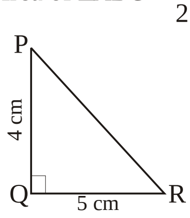
(b)



Area of $\Delta DEF = \frac{1}{2} \times 2.2 \times 3.2$

$= 3.52 \text{ cm}^2$

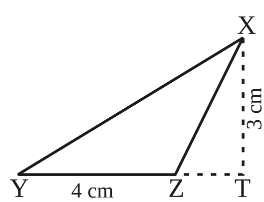
(c)



Area of $\Delta PQR = \frac{1}{2} \times 4 \text{ cm} \times 5 \text{ cm}$

$= 10 \text{ cm}^2$

(d)



Area of $\Delta XYZ = \frac{1}{2} \times 4 \text{ cm} \times 3 \text{ cm}$

$= 6 \text{ cm}^2$

2. (a) Given, Area = 4.83 cm^2, altitude = 2.3 cm, base = ?

Area $= \frac{1}{2} \times$ base $\times$ altitude

$\Rightarrow \quad 4.83 = \frac{1}{2} \times \text{base} \times 2.3$

$\Rightarrow \quad \text{base} = \frac{4.83 \times 2}{2.3}$

$$\Rightarrow \quad \text{base} = \frac{9.66}{2.3}$$
$$= 4.2 \text{ cm.}$$

(b) Area = 9.38 m^2, altitude = 2.8 m, base = ?

$$\text{Area} = \frac{1}{2} \times \text{base} \times \text{altitude}$$
$$\Rightarrow \quad 9.38 = \frac{1}{2} \times \text{base} \times 2.8$$
$$\Rightarrow \quad \text{base} = \frac{2 \times 9.38}{2.8}$$
$$= 2 \times 3.35$$
$$= 6.7 \text{ m.}$$

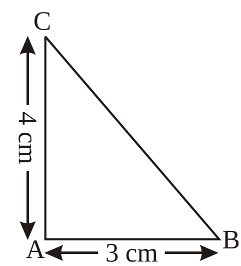
(c) Area = 11.4 cm^2, altitude = 4 cm, base = ?

$$\text{Area} = \frac{1}{2} \times \text{base} \times \text{altitude}$$
$$\Rightarrow \quad 11.4 = \frac{1}{2} \times \text{base} \times 4$$
$$\Rightarrow \quad 11.4 = \text{base} \times 2$$
$$\Rightarrow \quad \text{base} = \frac{11.4}{2}$$
$$= 5.7 \text{ cm.}$$

3. Area of right triangle = 6 cm^2, base = 3 cm

but, $\text{Area} = \frac{1}{2} \times \text{base} \times \text{height}$

$$6 = \frac{1}{2} \times 3 \times h$$
$$\Rightarrow \quad h = \frac{6 \times 2}{3}$$
$$= 4 \text{ cm.}$$



Let *ABC* is the right triangle.

Then by Pythagoras theorem, we have.

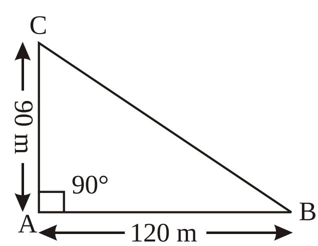
$$BC^2 = AC^2 + AB^2$$
$$= 4^2 + 3^2 = 16 + 9 = 25$$
$$BC = \sqrt{25} = 5 \text{ cm.}$$

Hence, the other two sides are 4 cm and 5 cm.

4. Let *ABC* be field in the form of a right triangle whose sides are $AB = 120 \text{ m}$, $AC = 90 \text{ m}$

$\therefore$ Area of triangular field $= \frac{1}{2} \times \text{base} \times \text{height}$

$$= \frac{1}{2} \times 120 \times 90$$
$$= 60 \times 90$$
$$= 5400 \text{ m}^2$$



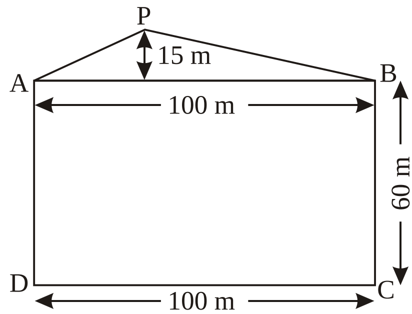
$\therefore$ cost of levelling the 1m^2 field = ` 12

$\therefore$ cost of levelling the 5400 m^2 = ` 12×5400

= ` 64800.

5. Let *PADCBP* is the wall.

$\therefore$ Area of the wall = Area of rectangle *ABCD* + Area of triangle *ABP*



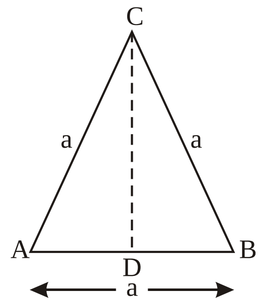
$$= (l \times b) + \frac{1}{2} \times b \times h$$

$$= (100 \times 60) + \frac{1}{2} \times (100 \times 15)$$

$$= 6000 + 50 \times 15$$

$$= 6750 \text{ m}^2$$

6. Area of equilateral $\Delta = \frac{\sqrt{3}}{4} a^2$



$$\Rightarrow \quad \frac{\sqrt{3}}{4} a^2 = 9\sqrt{3}$$

$$\Rightarrow \quad a^2 = 9 \times 4 = 36$$

$$a = \sqrt{36} = 6 \text{ cm}$$

$$\text{altitude} = \frac{\sqrt{3}}{2} a = \frac{\sqrt{3}}{2} \times 6$$

$$\therefore \quad \text{altitude} = 3\sqrt{3} \text{ cm.}$$

7. Let $a = 17$ cm, $b = 10$ cm, $c = 9$ cm

$$2S = a + b + c = 17 + 10 + 9 = 36$$

$$S = \frac{36}{2} = 18 \text{ cm}$$

By Heron's formula, we know that

$$\text{Area of the triangle} = \sqrt{S.(S-a)(S-b)(S-c)}$$

$$= \sqrt{18 \times (18-17)(18-10)(18-9)}$$

$$= \sqrt{18 \times 1 \times 8 \times 9} = \sqrt{2 \times 9 \times 8 \times 9}$$

$$= \sqrt{16 \times 81} = \sqrt{4 \times 4 \times 9 \times 9}$$

$$= 4 \times 9 = 36 \text{ cm}^2$$

8. Let $a = 40$ m, $b = 37$ m, $c = 13$ m

$$S = \frac{a+b+c}{2} = \frac{40+37+13}{2} = \frac{90}{2} = 45 \text{ m}$$

$\therefore$ By Heron's formula, we know that

$$\text{Area of the triangle} = \sqrt{S(S-a)(S-b)(S-c)}$$

$$= \sqrt{45 \times (45-40) \times (45-37) \times (45-13)}$$

$$= \sqrt{45 \times 5 \times 8 \times 32} = \sqrt{225 \times 256}$$

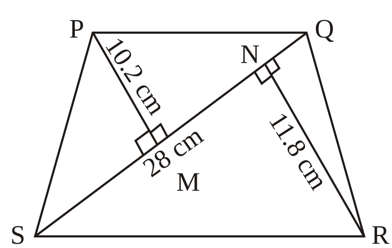
$$= \sqrt{15 \times 15 \times 16 \times 16} = 15 \times 16 = 240 \text{ m}^2$$

9. Let *PQRS* be the given quadrilateral.

QS is the given diagonal and $PM \perp QS$, $RN \perp SQ$.

$SQ = 28$ cm, $PM = 10.2$ cm, $RN = 11.8$ cm.

Area of quadrilateral *PQRS*



$$= \text{Area of } \Delta PSQ + \text{Area of } \Delta RSQ$$

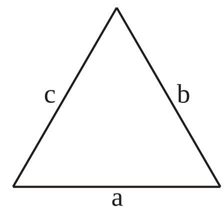
$$= \frac{1}{2} \times SQ \times PM + \frac{1}{2} \times SQ \times RN$$

$= \frac{1}{2} \times SQ \times (PM + RN)$

$= \frac{1}{2} \times 28 \times (10.2 + 11.8) = 14 \times 22 = 308 \text{ cm}^2$

Hence, the area of the quadrilateral *PQRS* is 308 cm^2.

10. Given, perimeter of triangle = 24 cm



Sides = 3 : 4 : 5,

Let $a = 3x, b = 4x, c = 5x$

then $P =$ sum of all the sides $= a + b + c$

$\Rightarrow \quad 24 = 3x + 4x + 5x$

$\Rightarrow \quad 24 = 12x$

$\Rightarrow \quad \frac{24}{12} = x \quad \Rightarrow \quad x = 2$

Hence, $a = 3x = 3 \times 2 = 6$ cm,

$b = 4x = 4 \times 2 = 8$ cm,

$c = 5x = 5 \times 2 = 10$ cm.

Now, $2S = a + b + c = 6 + 8 + 10 = 24$

$S = \frac{24}{2} = 12$

By Heron's formula, we know that

Area of $\Delta = \sqrt{S(S-a)(S-b)(S-c)}$

$= \sqrt{12 \times (12-6) \times (12-8) \times (12-10)}$

$= \sqrt{12 \times 6 \times 4 \times 2} = \sqrt{12 \times 12 \times 4} = 12 \times 2 = 24 \text{ cm}^2$.

Exercise 13.4

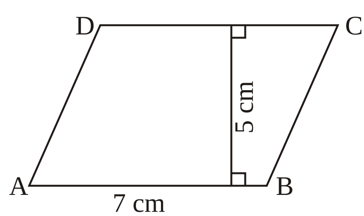
1. (a) Area of the parallelogram

$= \text{Base} \times \text{Altitude}$

$= AB \times h_1$

$= 7 \text{ cm} \times 5 \text{ cm}$

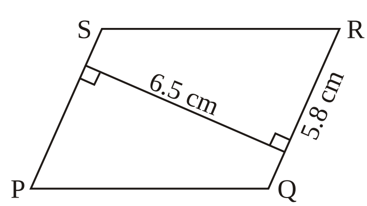
$= 35 \text{ cm}^2$



(b) Area of the parallelogram $= b \times h$

$= 5.8 \times 6.5$

$= 37.7 \text{ cm}^2$

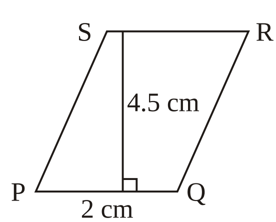


(c) Area of the parallelogram

$= \text{Base} \times \text{Altitude}$

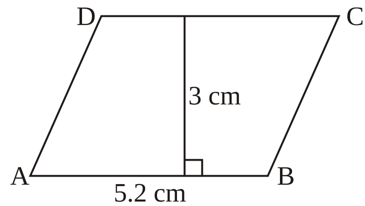
$= 2 \times 4.5$

$= 9 \text{ cm}^2$



(d) Area of the parallelogram

$= \text{Base} \times \text{Altitude}$
$= 5.2 \times 3$
$= 15.6\,\text{cm}^2$



2. (a) Given, base = 5.6 cm, height = 4.2 cm

$\therefore$ Area $= \text{Base} \times \text{Height}$
$= 5.6 \times 4.2 = 23.52\ \text{cm}^2$

(b) Given, base = 6.4 cm, height = 3.6 cm

Area $= \text{Base} \times \text{Height}$
$= 6.4 \times 3.6 = 23.04\ \text{cm}^2$

3. Given, Area of paralelogram = 6.25 m^2

altitude (height) = 5.0 m

base = ?

Area = Base × Altitude

6.25 = Base × 5.0

$\therefore$ $\text{Base} = \frac{6.25}{5.0} = 1.25\,\text{m}$

4. Let $PQRS$ be the parallelogram

whose side are $PQ = 4$ cm, $QR = 3$ cm

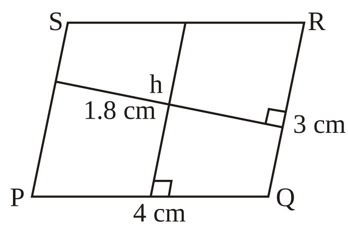
Area of parallelogram = Base × Altitude

$\therefore$ $4 \times 1.8 = 3 \times h$

$\Rightarrow$ $7.2 = 3 \times h$

or $3h = 7.2$

$\Rightarrow$ $h = \frac{7.2}{3} = 2.4$ cm



5. Side of parallelogram = 8.2 cm

Altitude = 6.2 cm

Area of parallelogram = base × altitude
= 8.2 × 6.2
= 50.84 sq. cm.

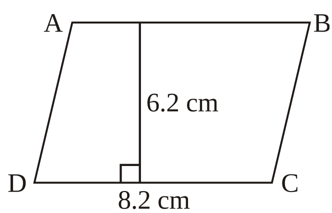
It is divided in 3 equal parts.

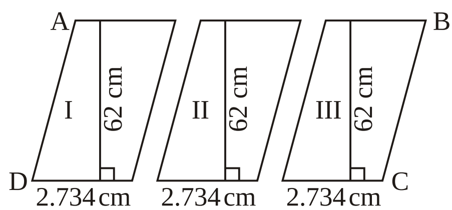
Then, Length of base = 8.2 ÷ 3
= 2.734 cm (aprox)

Altitude = 6.2 cm

So, area of each parallelogram

= base × altitude
$= (2.734 \times 6.2)$ sq. cm.
= 16.950 sq. cm.





6. Let *ABCD* is the rhombus whose diagonals are $d_1 = 8$ cm 8 mm and $d_2 = 6$ cm 5 mm

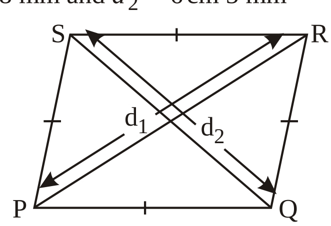
Now, $d_1 = 8$ cm 8 mm = 8 cm + 8 mm

$= 8\ \text{cm} + \frac{8}{10}\ \text{mm}$

= 8 cm + 0.8 cm [$\because 1\text{cm} = 10\,\text{mm}$]

= 8.8 cm

and $d_2 = 6$ cm 5 mm = 6 cm + 5 mm



$= 6 \text{ cm} + \frac{5}{10} \text{ cm}$

$= 6 \text{ cm} + 0.5 \text{ cm} = 6.5 \text{ cm}$

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

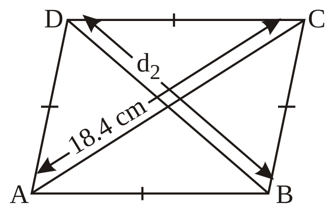
$= \frac{1}{2} \times 8.8 \times 6.5 = 4.4 \times 6.5 = 28.6 \text{ cm}^2$

$= 28.6 \times 100 \text{ mm}^2 = 2860 \text{ mm}^2 \qquad (\because \quad 1 \text{ cm} = 100 \text{ mm}^2)$

7. Area of rhombus = 202.4 cm^2

One diagonal $(d_1) = 18.4$ cm

Other diagonal $(d_2) = ?$



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

$\Rightarrow \quad 202.4 = \frac{1}{2} \times 18.4 \times d_2$

$\Rightarrow \quad 202.4 = 9.2 \times d_2$

$\Rightarrow \quad d_2 = \frac{202.4}{9.2} = 22 \text{ cm}$

Hence, other diagonal $(d_2) = 22$ cm.

Exercise 13.5

1. (a) $d = 35$ cm

So, $r = \frac{35}{2}$ cm

Now, circumference $= 2\pi r$

$= 2 \times \frac{22}{7} \times \frac{35}{2}$

$= 110$ cm

(b) $d = 4.2$ cm

So, $r = \frac{4.2}{2} = 2.1$ cm

Now, circumference $= 2\pi r$

$= 2 \times \frac{22}{7} \times \frac{2}{10}$

$= \frac{132}{10} = 13.2$ cm

(c) $d = 2.8$ cm

So, $r = \frac{2.8}{2} = 1.4$ m

Now, circumference $= 2\pi r$

$= 2 \times \frac{22}{7} \times \frac{1.4}{10} = \frac{88}{10} = 8.8$ cm

2. Given, $C = 26.4$ m, but

$C = 2\pi r$

$\Rightarrow \quad 2\pi r = 26.4$

$\Rightarrow \quad r = \frac{26.4 \times 7}{2 \times 22} = 4.2$ m

$\therefore \quad d = 2r = 2 \times 4.2 = 8.4$ m.

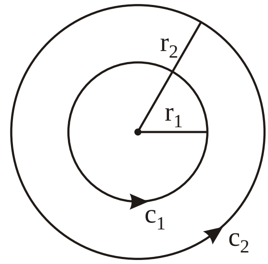
3. Given, $d = 5.6$ m, $r = \frac{d}{2} = \frac{5.6}{2} = 2.8$ m

$C = 2\pi r$

$= 2 \times \frac{22}{7} \times 2.8$

$= 17.6 \text{ m}^2$

4. Given, $r_1 = 77\text{ cm}, r_2 = 91\text{cm}$

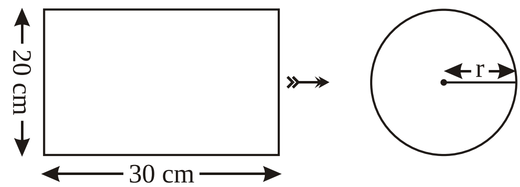


$$C_1 = 2\pi r_1 = 2\times\frac{22}{7}\times 77$$
$$= 44\times 11 = 484 \text{ cm}$$
$$C_2 = 2\pi r_2 = 2\times\frac{22}{7}\times 91$$
$$= 44\times 13 = 572\text{ cm.}$$

$\therefore$ Difference $= C_2 - C_1 = 572 - 484 = 88\text{ cm}$

$\therefore$ The circumference of second circle is 88 cm longer than the first.

5. Perimeter of rectangle $= 2(l+b)$



$$= 2(35+20)$$
$$= 2\times 55$$
$$= 110\text{ cm}$$

Circumference of circular ring

= Perimeter of rectangle

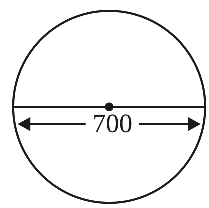
$\Rightarrow$ $2\pi r = 110$

$\Rightarrow$ $2\times\frac{22}{7}\times r = 110$

$\Rightarrow$ $r = \frac{7\times 110}{44} = 17.5 \text{ cm}$

$\therefore$ $d = 2r = 2\times 17.5 = 35\text{ cm.}$

6. Given, $d = 700\text{ m}$



$\therefore$ $r = \frac{d}{2} = \frac{700}{2} = 350\text{ m}$

Since distance travelled in a round by a man

= circumference of the circular park

$= 2\pi r$

$= 2\times\frac{22}{7}\times 350 = 2200\text{ m.}$

$\therefore$ distance travelled in 5 rounds (i.e. times) daily by a man ($\because$ 1000 m = 1 km)

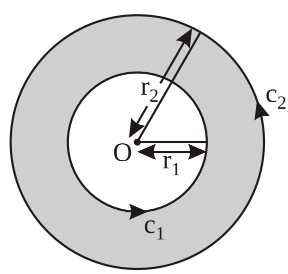
$= 5\times(2200\text{ m})$ = 11000 m = 11 km.

7. Given, $r_1 : r_2 = 4:5$

$\therefore$ $C_1 : C_2 = 2\pi r_1 : 2\pi r_2$

$$= \frac{2\pi r_1}{2\pi r_2} = \frac{r_1}{r_2} = \frac{4}{5} = 4:5$$

8. Given, $C_1 = 200\text{ m}$



$\Rightarrow$ $2\pi r_1 = 200$

$\Rightarrow$ $2\times\frac{22}{7}\times r_1 = 200$

$r_1 = \frac{200\times 7}{2\times 22} = \frac{700}{22}\text{ m}$ ...(1)

again, $C_2 = 220\text{ m}$

$\Rightarrow$ $2\times\frac{22}{7}\times r_2 = 220$

$\Rightarrow$ $r_2 = \frac{220\times 7}{2\times 22} = 35\text{ m}$ ...(2)

$\therefore$ width of the track $= r_2 - r_1$

$$= 35 - \frac{700}{22} = \frac{770-700}{22} = \frac{70}{22}$$

$$= 3.18 \text{ m or } 3\frac{4}{22} \text{ m.}$$

9. $C_1 = 2\pi r_1$,

$\Rightarrow \quad 2\pi r_1 = 154 \quad \Rightarrow \quad 2 \times \frac{22}{7} \times r_1 = 154$

$\Rightarrow \quad r_1 = \frac{154 \times 7}{2 \times 22} = \frac{49}{2} = 24.5$ cm.

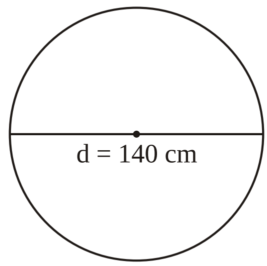
$C_2 = 2\pi r_2$

$\Rightarrow \quad 2 \times \frac{22}{7} \times r_2 = 121 \quad \Rightarrow \quad r_2 = \frac{121 \times 7}{2 \times 22} = \frac{847}{44} = 19.25$ cm

$\therefore$ required difference $= C_1 - C_2 = 24.5 - 19.25 = 5.25$ cm.

10. Given, diameter of the wheel of a cart = 140 cm

$\therefore \quad r = \frac{d}{2} = \frac{140}{2} = 70$ cm.



Distance covered by the cart in 1complete revolution

$= $ circumference of the wheel

$= 2\pi r$

$= 2 \times \frac{22}{7} \times 70 = 44 \times 10$ cm

$= 440$ cm

$\therefore$ distance covered by the cart in 40 complete revolutions

$= 40 \times 440$ cm

$= 17600 = 176$ m.

Exercise 13.6

1. (a) $r = 21$ mm

$C = 2\pi r$

$= 2 \times \frac{22}{7} \times 21$

$= 132$ mm

(b) $d = 14$ cm

or $r = \frac{14}{2} = 7$ cm

$c = 2\pi r$

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

$= 44$ cm

2. (a) $r = 20$ cm

$A = \pi r^2$

$= \frac{22}{7} \times 20 \times 20 \text{ cm}^2$

$= \frac{8800}{7} \text{ cm}^2$

$= 1257.14 \text{ cm}^2$

(b) $d = 42$ cm

$r = \frac{42}{2} = 21$ cm

$A = \pi r^2$

$= \frac{22}{7} \times 21 \times 21 \text{ cm}^2$

$= 1386 \text{ cm}^2$

3. The given, $C = 39.6$ cm

$C = 2\pi r$

$$39.6 = 2 \times \frac{22}{7} \times r$$

$$r = \frac{39.6 \times 7}{2 \times 22 \times 10}$$

$$r = \frac{63}{10} = 6.3 \text{ cm}$$

4. Let the two radii be $r_1 = 4x$ and $r_2 = 5x$ respectively.

$C_1 = 2\pi r_1$ $\quad$ $C_2 = 2\pi r_2$

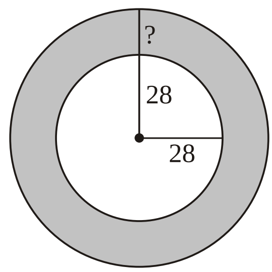
$C_1 = 2\pi \times 4x$ $\quad$ $C_2 = 2\pi \times 5x$

$$\frac{C_1}{C_2} = \frac{2\pi \times 4x}{2\pi \times 5x}$$

So, $\quad C_1 : C_2 = 4 : 5$

Hence, the ratio of circumferences of two circles are 4 : 5.

5. (a)



$$C = 176 \text{ m},$$

$$C = 2\pi r$$

$$176 = 2 \times \frac{22}{7} \times r$$

$$r = \frac{176 \times 7}{2 \times 22}$$

$$r = 28 \text{ m}$$

$$\text{Area of track} = \pi r_1^2 - \pi r_2^2$$

$$= \pi (r_1^2 - r_2^2)$$

$$= \frac{22}{7} [(35)^2 - (28)^2]$$

$$= \frac{22}{7} \times 63 \times 7$$

$$= 1386 \text{ m}^2$$

Hence, the area of track is 1386 m^2

(b)

$$r_1 = 35 \text{ m}$$

$$C = 2\pi r_1$$

$$= 2 \times \frac{22}{7} \times 35 \text{ m}$$

$$= 220 \text{ m}$$

Cost of fencing = ` 220 × 12 = ` 2640

Hence, the cost of fencing along the outer circle is ` 2640.

6.

$$C = r + 37$$

$$2\pi r - r = 37$$

$$r(2\pi - 1) = 37$$

$$r\left[\frac{22 \times 2}{7} - 1\right] = 37$$

$$r\left[\frac{44}{7} - 1\right] = 37$$

$$r\left[\frac{44 - 1}{7}\right] = 37$$

$$r\left[\frac{37}{7}\right] = 37$$

$$r = \frac{37 \times 7}{37} \text{ cm}$$

$$r = 7 \text{ cm}$$

So, $d = 7 \times 2$

$$d = 14 \text{ cm}$$

7. The side of square $= 11 \text{cm}$

$\therefore$ Perimeter $= 4 \times \text{side}$

$$= 4 \times 11 \text{cm}$$

$$= 44 \text{ cm}$$

$$C = \text{Perimeter of square}$$

$$C = 44 \text{ cm}$$

$$2\pi r = 44 \text{ cm}$$

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

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

$$r = 7 \text{ cm}$$

The area of cirlce $= \pi r^2$

$$= \frac{22}{7} \times 7 \times 7 \text{ cm}^2 = 54 \text{ cm}^2$$

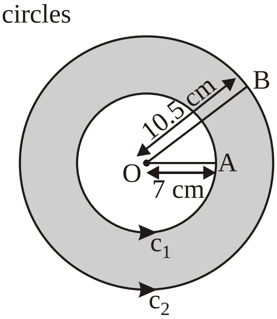
8. Let C_1 and C_2 be two concentric circles whose radii are :

$r_1 = 7 \text{ cm}$, $r_2 = 10.5 \text{ cm}$

Area of inner circle $= \pi r_1^2$

Area of outer circle $= \pi r_2^2$

$\therefore$ area of ring lying between the circumference of both the circles



$$= \pi r_2^2 - \pi r_1^2$$

$$= \pi[r_2^2 - r_1^2]$$

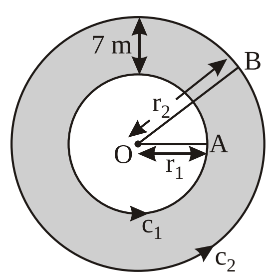
$$= \frac{22}{7} \times [(10.5)^2 - (7)^2]$$

$$= \frac{22}{7} \times (110.25 - 49)$$

$$= \frac{22}{7} \times 61.25 = 192.5 \text{ cm}^2$$

Hence, the area of a ring lying between the circumferences of two concentric circles is 192.5 cm^2.

9. Inner circumference of circular track $= 242 \text{ m}$



$\Rightarrow$ $2\pi r_1 = 242$

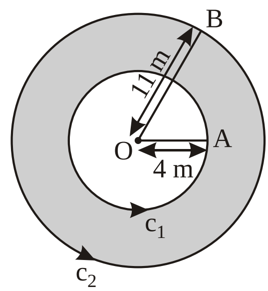
$\Rightarrow$ $2 \times \frac{22}{7} \times r_1 = 242$

$$r_1 = \frac{242 \times 7}{2 \times 22} = \frac{77}{2} = 38.5 \text{ m}$$

$\therefore$ $r_2 = r_1 + 7 = 38.5 + 7 = 45.5 \text{ m}$

$$\text{Area of the track } = \pi(r_2^2 - r_1^2)$$
$$= \frac{22}{7}[(45.5)^2 - (38.5)^2]$$
$$= \frac{22}{7}[2070.25 - 1482.25]$$
$$= \frac{22}{7} \times 588 = 22 \times 84 = 1848 \text{ m}^2$$

10. Let C_1 and C_2 be two concentric circle with centre O and radii are $r_1 = 4$ m, $r_2 = 11$ m



$\therefore$ area of inner circle $= \pi r_1^2$

area of outer circle $= \pi r_2^2$

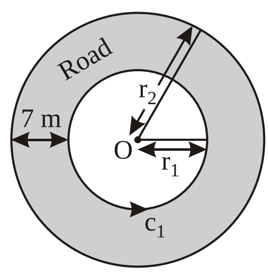
$\therefore$ area of circular ring formed by
The circumference of two concentric circles

$$= \pi r_2^2 - \pi r_1^2 = \pi[r_2^2 - r_1^2]$$
$$= \frac{22}{7} \times [(11)^2 - (4)^2]$$
$$= \frac{22}{7} \times [121 - 16]$$
$$= \frac{22}{7} \times 105 \text{ m}^2$$
$$= 22 \times 15 = 330 \text{ m}^2$$

$\because$ cost of painting this ring of 1 m^2 area = ` 21

$\therefore$ cost of painting this ring of 330 m^2 area = ` 21 × 330 = ` 6930

11. Circumference of the park = 352 m



$$\Rightarrow \quad 2\pi r_1 = 352$$
$$\Rightarrow \quad 2 \times \frac{22}{7} \times r_1 = 352$$
$$\Rightarrow \quad r_1 = \frac{352 \times 7}{2 \times 22} = 8 \times 7$$
$$\Rightarrow \quad r_1 = 56 \text{ m}$$
$$r_2 = r_1 + 7 = 56 + 7 = 63 \text{ m}$$

The Area of the road $= \pi r_2^2 - \pi r_1^2 = \pi[r_2^2 - r_1^2]$

$$= \frac{22}{7} \times [(63)^2 - (56)^2] = \frac{22}{7} \times [3969 - 3136]$$
$$= \frac{22}{7} \times 833 = 22 \times 119 = 2618 \text{ m}^2$$

12. Given, $C - r = 37$ cm, or $2\pi r - r = 37$, $r(2\pi - 1) = 37$

$$r\left(2 \times \frac{22}{7} - 1\right) = 37$$
$$r\left(\frac{44 - 7}{7}\right) = 37, \qquad r\left(\frac{37}{7}\right) = 37$$
$$\Rightarrow \quad r = \frac{7 \times 37}{37} = 7 \text{ cm}$$

Area of the circle $= \pi r^2$

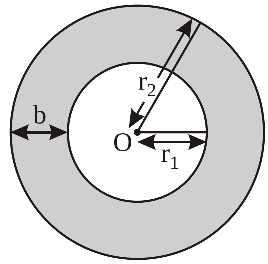
$= \frac{22}{7} \times (7)^2 = \frac{22}{7} \times 7 \times 7$

$= 154 \text{ cm}^2$

13. Given, $A_1 = 1386 \text{ cm}^2$ $A_2 = 1886.5 \text{ cm}^2$

$\Rightarrow \quad \pi r_1^2 = 1386 \text{ cm}^2$

$\Rightarrow \quad \frac{22}{7} \times r_1^2 = 1386 \text{ cm}^2$



$r_1^2 = \frac{1386 \times 7}{22} = 63 \times 7 = 441 \text{cm}^2$

$\Rightarrow \quad r_1 = \sqrt{441} = 21 \text{ cm}$

Again, $A_2 = 1886.5 \text{cm}^2$

$\Rightarrow \quad \pi r_2^2 = 1886.5 \text{ cm}^2$

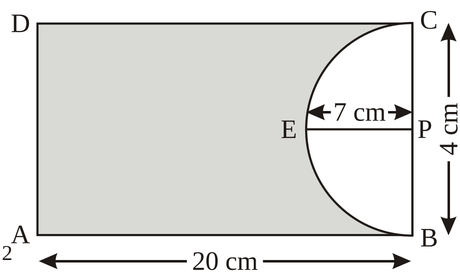
$\Rightarrow \quad \frac{22}{7} \times r_2^2 = 1886.5 \text{ cm}^2$

$r_2^2 = \frac{1886.5 \times 7}{22} = \frac{13205.5}{22} = 600.25 \text{cm}^2$

$\Rightarrow \quad r_2 = \sqrt{600.25} = 24.5 \text{ cm}$

width of the ring $= r_2 - r_1 = 24.5 - 21 = 3.5$ cm

14. Area of paper $ABCD = l \times b$



$= 20 \times 14 \text{ cm}^2$

$= 280 \text{ cm}^2$

Area of semi circle portion $= \frac{1}{2} \pi r^2$

$= \frac{1}{2} \times \frac{22}{7} \times 7 \times 7$

$= 11 \times 7 = 77 \text{ cm}^2$

$\therefore$ area of the remaining part $=$ Area of rectangle $ABCD$ – Area of semi circle

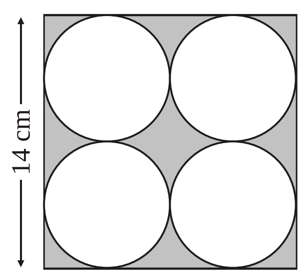
$= 280 - 77 = 203 \text{ cm}^2$

16. Area of square $= 14 \text{ cm} \times 14 \text{ cm} = 196 \text{ cm}^2$

$d = 7 \text{ cm}$

$r = \frac{7}{2} \text{ cm}$

Area of a circle $= \pi r^2$



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

$= \frac{77}{2}$

$= 38.5 \text{ cm}^2$

Area of 4 circle $= 4 \times 38.5$

$= 154 \text{ cm}^2$

So, area of shaded portion $= 196 - 154 = 42 \text{ cm}^2$

MCQ's

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