Chapter # 11

PRACTICAL GEOMETRY

EXERCISE 11.1

Q.1 ***The following table contains certain sets of elements of ΔABC. Tell each case whether the construction of a triangle is possible and, if so, how many triangles you will get. (If necessary you may draw a figure in any case to find out the correct answer).***

Solution:

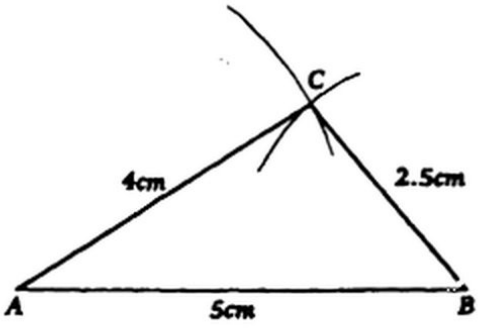
	AB	BC	CA	m∠A	m∠C	m∠C	No. of possible different triangle
I	5cm	2.5cm	4cm	—	—	—	Only one
II	—	—	—	30°	50°	100°	Counstless
III	—	—	—	30°	50°	100°	Only one
IV	5	2.5	4	60°	—	—	Nil
V	—	2.5	4	—	—	100°	Only one
VI	5	—	—	30°	50°	—	Only one
VII	5	—	—	—	50°	100°	Only one
VIII	5	2.5	—	—	145°	—	Only one
IX	5	2.5	—	60°	—	—	Nil
X	5	2.5	—	—	—	25°	Only one
XI	7	2.5	4	—	—	—	Nil
XII	7	6.5	4	—	—	—	Nil

Q.2 ***Plan of a hosue which is to be build on a triangular place of land has to be prepared. Measure of at lest how many and of which angle and side should be for this purpose.***

Solution:

(i) Three sides, or
(ii) Two sides and their included angle, or
(iii) One side and any two angles.

Q.3 ***Verify your answer to Q.1 part I to XII by corresponding the triangle with the help of ruler and protector. State the steps of construction also.***



Solution:

I. Given: $AB = 5cm$

$BC = 2.5cm$

$AC = 4cm$

Steps of Construction:

(1) Draw $BC = 2.5cm$

(2) Draw an arc with centre B of radius $5cm$. and another are with centre C of $4cm$ radius.

(3) Both the arcs cut each other at A. Join AB and AC. ABC is the triangle for satisfying the given conditions.

II. Given: $m\angle A = 30^o$

$m\angle B = 50^o$

$m\angle C = 100^o$

Steps of Construction:

(1) Draw $BC = 2$ inchs.

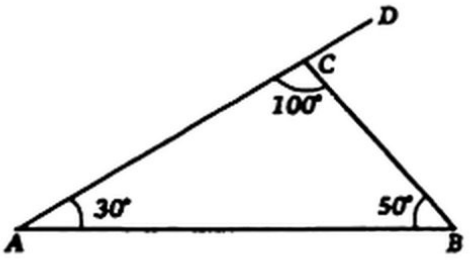
(2) At point B make an angles of 50^o.

(3) At point C make an angle of 100^o.

(4) Let the two arms meet at A.

(5) Angle A will be $180 (50 + 100) = 30°$. AB is the triangle for satisfying the conditions.

But as the measurement of sides has not been given so numerous triangles can be drawn for satisfying the above conditions.



III. Given: $AB = 6cm$

$m\angle A = 30°$

$m\angle B = 50°$

$m\angle A = 100°$

Steps of Construction:

(1) Draw $AB = 6cm$

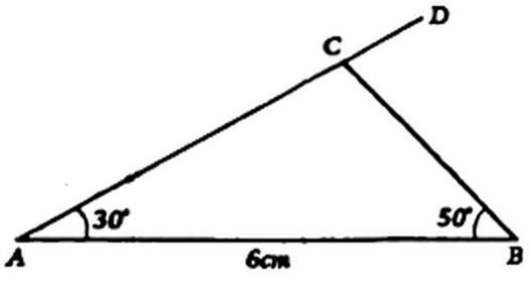
(2) At point A draw $\overrightarrow{AX}$ to meet an angle of $30°$.

(3) At point B draw $\overrightarrow{BY}$ to make an angle of $50°$.

(4) Let $\overrightarrow{AX}$ and $\overrightarrow{BY}$ meet at C.

$\because$ $m\angle C = 180° (30 + 50) = 100°$

$\because$ ABC is the required triangles.



IV. Given: $\overline{AB} = 5cm$

$\overline{BC} = 2.5cm$

$\overline{CA} = 4cm$

$m\angle A = 60^\circ$

Steps of Construction:

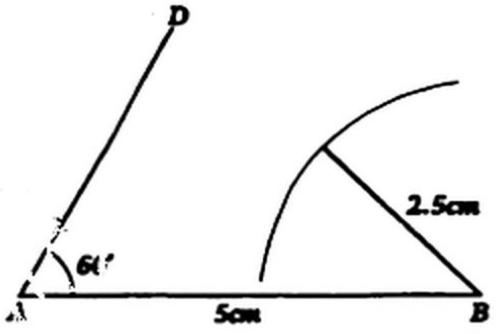
(1) Draw $AB = 5cm$.

(2) At point A draw $\overrightarrow{AX}$ making an angle on 60°.

(3) From $\overrightarrow{AX}$ cut $AC = 4cm$.

(4) With centre B and radius $7.5cm$ draw an arc wich does not meet AC at any point.

Hence the construction of triangle to satisfy the given.



V. Given: $\overline{BC} = 2.5cm$

$CA = 4cm$

$m\angle C = 100^\circ$

Steps of construction:

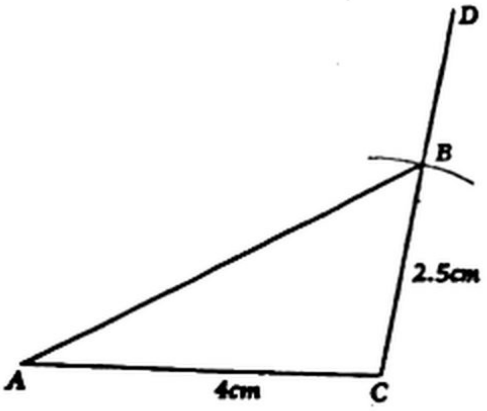
(1) Draw $BC = 2.5cm$.

(2) At point C draw $\overrightarrow{BD}$ making an angle of 100°.

(3) With centre B draw an arc of $4cm$, radius to cut $\overrightarrow{CD}$ at A.

(4) Join $\overline{AB}$.

ABC is the triangle to satisfy the given condition.



VI. Given: $AB = 5cm$
$m\angle A = 30^\circ$
$m\angle B = 50^\circ$

Steps of Construction:

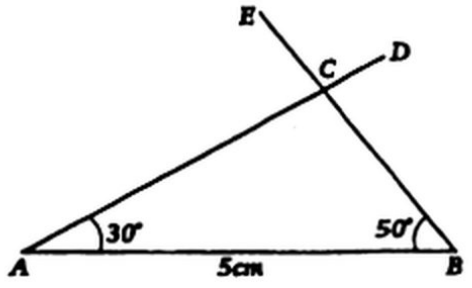
(1) Draw $\overline{AB} = 5cm$.

(2) At point *A* draw $\overrightarrow{AE}$ to make an angle of 30°.

(3) At point *B* draw $\overrightarrow{BD}$ to make an angle of 50°.

(4) $\overrightarrow{AE}$ and $\overrightarrow{BD}$ intersect at C.

ABC is the required triangle.



VII. Given: $\overline{AB} = 5cm$.

$m\angle B = 50^\circ$

$m\angle C = 100^\circ$

Now $m\angle A = 180^\circ - (m\angle B + m\angle C)$

$\because$ $m\angle A = 180^\circ - (50^\circ + 100^\circ)$

or $m\angle A = 180^\circ - 150^\circ$

or $m\angle A = 30^\circ$

Steps of Constrution:

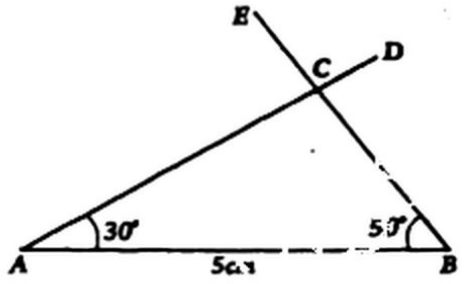
(1) Draw $\overline{AB} = 5cm$.

(2) At point A draw $\overline{AE}$ making an angle of 30°.

(3) At point B draw $\overrightarrow{BD}$ to make an angle of 30°.

(4) $\overrightarrow{BD}$ and $\overrightarrow{AE}$ intersect each other at C.

Hence ABC is the required triangle.



VIII. Given: $\overline{AB} = 5cm$.

$\overline{EC} = 2.5cm$

$m\angle E = 145^\circ$

Steps of Construction:

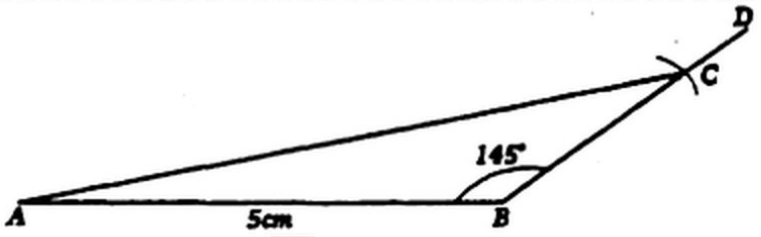
(1) Draw $\overline{BC}$ $2.5cm$

(2) At point B draw $\overrightarrow{BD}$ to make an angle of 145°.

(3) With centre C and radius $5cm$, draw an arc to cut $\overline{BD}$ at A.

(4) Join $\overline{AC}$.

ABC is the required triangle.



IX. Given: $\overline{AB} = 5cm$

$\overline{BC} = 2.5cm$

$m\angle A = 60°$

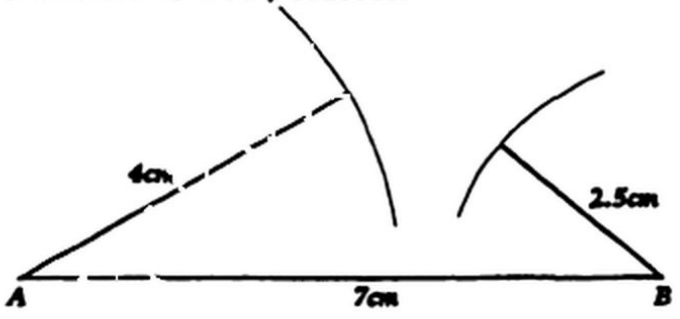
Steps of Construction:

(1) Draw $\overline{AB} = 5cm$.

(2) At point A draw $\overrightarrow{AE} = 5cm$ making an angle of $60°$.

(3) With centre B and radius $2.5cm$, draw an arc which does not meet $\overrightarrow{AE}$ at any point.

Hence construction of triangle according to given conditions is not possible.



X. Given: $\overline{AB} = 5cm$

$\overline{BC} = 2.5cm$

$m\angle C = 25°$

Steps of Construction:

(1) Draw $\overline{BC} = 2.5cm$

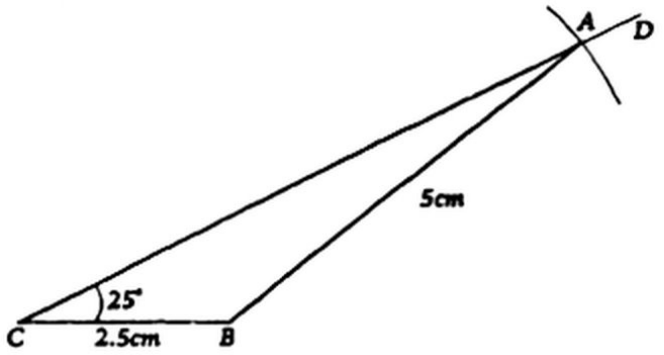
(2) At point C draw $\overrightarrow{DC}$ to make an angle of $25°$.

(3) With centre B and radius $5cm$ draw an arc to cut

$\overrightarrow{CD}$ at A.

(4) Joint AB.

ABC is the required triangle.



XI. Given: $\overline{AB} = 7cm$

$\overline{BC} = 2.5cm$

$\overline{AC} = 4cm$

Steps of Construction:

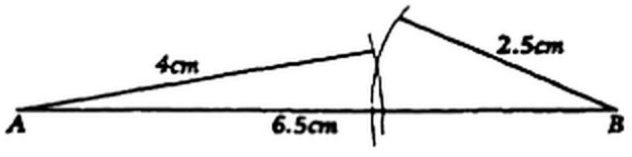
(1) Draw $\overline{BC} = 2.5cm$.

(2) With centre C and radius $4cm$, draw an arc.

(3) With centre B and radius $7cm$, draw another arc.

As these arcs do not intersect each other.

So the construction of Δ with given condition is impossible.



XII. Given: $\overline{AB} = 6.5cm$

$\overline{BC} = 2.5cm$

$\overline{AC} = 4cm$

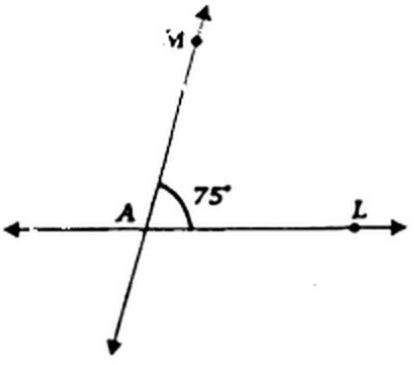
Steps of Construction:

(1) Draw $\overline{AB} = 6.5cm$.

(2) With centre B and radius $2.5cm$, draw an arc.

(3) With centre A and radius $4cm$ draw another arc Both the arcs meet at a point A and A lines at $\overline{AB}$. As points A, B and C are co-linear. So construction of triangle is not possible.

Q.4 ***Two straight roads $\overline{AL}$ and $\overline{AM}$ meet at an angle of 75° at a point A. The school is situated near one of the roads at a distance of 600 meters from A and a bus stop is situated on the other road at a distance of 450 meters from A. A katcha road joins the school and the bus stop. Draw to scale a sketh of the three places and find out how much distance is school from bus stop.***



Solution:

Suppose $100 = 1cm$

(1) Draw $\overline{AL}$ and cut $\overline{AS} = 6cm$.

(Suppose S stands for school)

(2) At point A draw $\overline{AM}$ making an angle of $75°$ and cut $\overline{AB} = 4.5cm$.

(3) Join $\overline{MS}$.

$\overline{MS}$ represents the katcha road joining the

school and the bus stop.

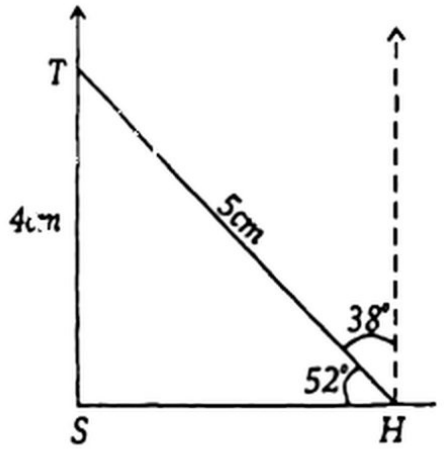
On measuring $\overline{MS}$ comes to $6.5cm$.

Now according to scale $1cm = 100$ meters.

$\because$ $6.5cm = 650$ meters.

$\therefore$ Distance between school and bus stop is 650 meters.

Q.5 ***The TV station is at a distance of 10 kilometers from Abid's house and 8 kilometers from school towards north of it. Abid's house is towards east of school. Draw to scale a sketch of the three places and find out at which angle Abid stands adjust the antema of his T.V.***



Let S stand for school

T stands for TV station

H for Abid's house

Scale: 2 kilometer = $1cm$

Solution:

Let $\overrightarrow{SA}$ represent the horizontal line S is the school.

Draw $\overrightarrow{BS}$ perpendicular to $\overrightarrow{SA}$.

Cut $ST = 4cm$.

Point T shows the position of TV station.

With centre T and radius of 5cm, draw an arc to cut $\overrightarrow{SA}$ at H.

H shows the position of Abid's house.

Since $m\angle 31 + T$ comes to 52^o.

$\therefore$ Antinna should be erected at an angle of $90^o - 52^o = 38^o$.

To north 38^o. ***Ans***

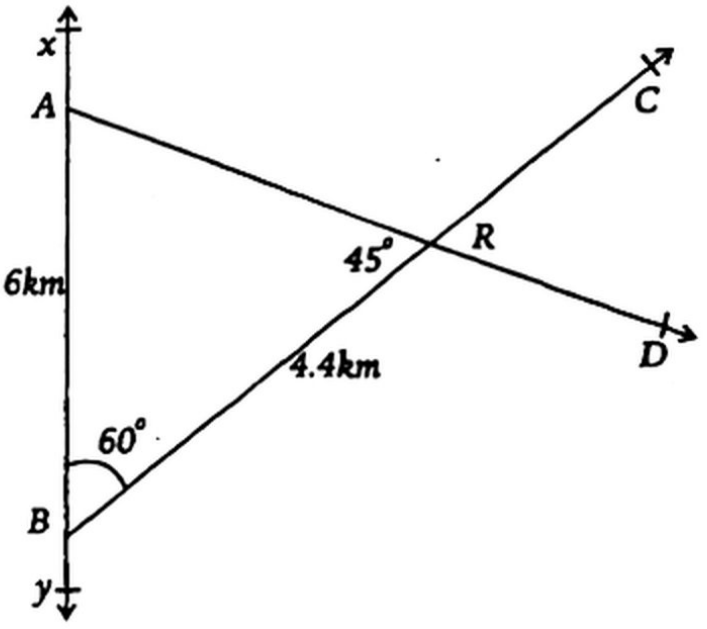
Q.6 Two villages A, B are situated beside a long straight raod and are 6 km apart. The road goes from north to south. Two short roads join the villagers to a railway station which is towards the west of the main road. The short roads make angles of 45° and 60° with the main road. Find the distance of villages from the railway station.

Let A stands for one village.

B stands for another village.

R stands for railway station.

Scale: 1 kilometer = 1cm



Solution:

Let XY represent the road from north to south. Take A and B two points at a distance of 6cm, from each other.

At A draw $\overrightarrow{AC}$ making an angle of 45^o.

At B draw $\overrightarrow{BD}$ making an angle of 60^o.

$\overrightarrow{AC}$ and $\overrightarrow{BD}$ intersect each other at R.

R is the position of railway station.

Measure RA and RB

Since $RA = 53$

$RB = 4.4$

$\therefore$ Village A = 5.3 kilometer from railway station.

Village B = 4.4 kilometer from railway station.

Ans

EXERCISE 11.2

Q.1 ***In a triangle ABC, ∠C is a right angle. In parts (i) to (iv) find the length of the remaining side.***

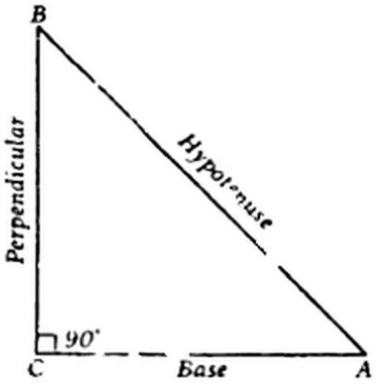
(i) ***AC = 6cm, BC = 8cm***

(ii) ***BC = 24cm, AB = 25cm***

(iii) ***AC = 9cm, AB = 41cm***

(iv) ***Ab = 10 cm, BC = 9cm***

Solution:



(i) (Perpendicular)^2 + (Base)^2 = (Hypotenuse)^2

Perpendicular = 6cm (given)

Base = 8cm (given)

$(6)^2 + (8)^2 = (AB)^2$

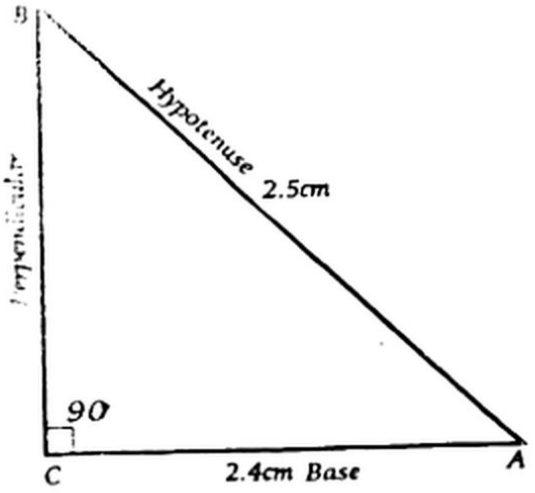
$36 + 64 = AB^2$

$100 = AB^2$

$\sqrt{100} = AB$

$10 = AB$

$AB = 10cm$, **Ans**



(ii) (Perpendicular)^2 + (Base)^2= (Hypotenuse)^2

$(AC)^2 + (BC)^2 = (AB)^2$

or $(AC)^2 = (AB)^2 - (BC)^2$

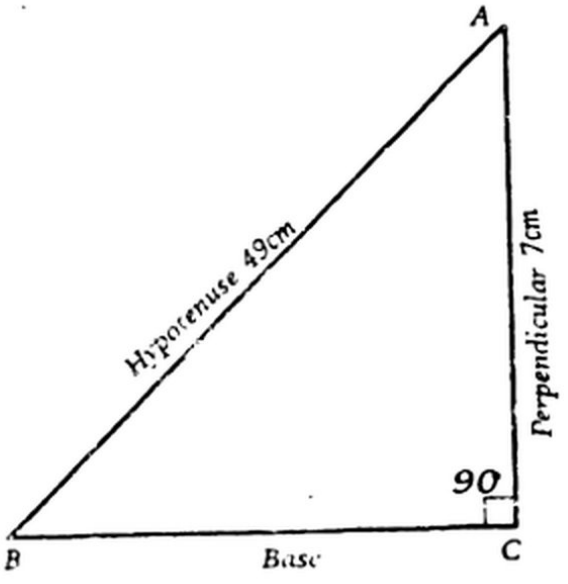
or $(AC)^2 = (25)^2 - (24)^2$

or $(AC)^2 = 625 - 576$

or $(AC)^2 = 49$

or $AC = \sqrt{49}$

or $AC = 7$ units. ***Ans***



(iii) (Perpendicular)^2 + (Base)^2= (Hypotenuse)^2

(Base)^2 = (Hypotenuse)^2 – (Perpendicular)^2

$(BC)^2 = (AB)^2 - (AC)^2$

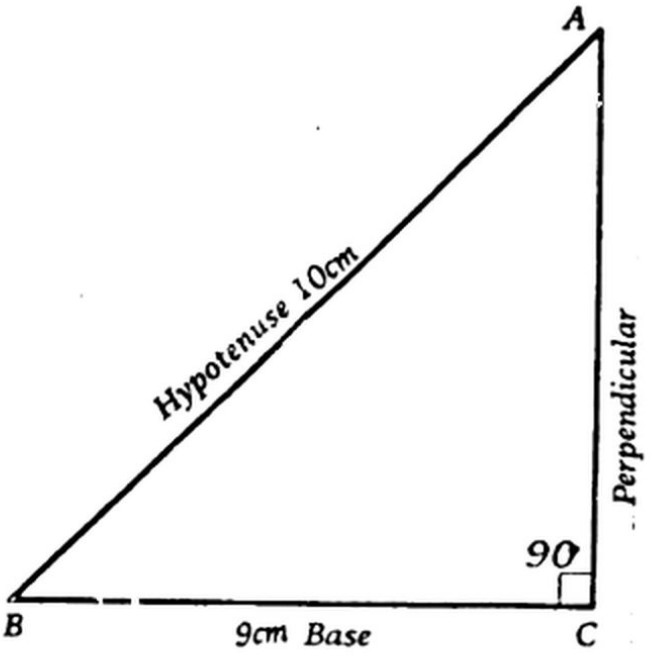
$(BC)^2 = (41)^2 - (9)^2$

$(BC)^2 = 1681 - 81$

$(BC)^2 = 1600$

$BC = \sqrt{1600}$

$BC = 40cm.$ **Ans**



(iv) (Perpendicular)^2 + (Base)^2= (Hypotenuse)^2

$(AC^2) + (BC)^2 - (AB)^2$

$(AC)^2 = (AB)^2 - (BC)^2$

$(AC)^2 = (10)^2 - (9)^2$

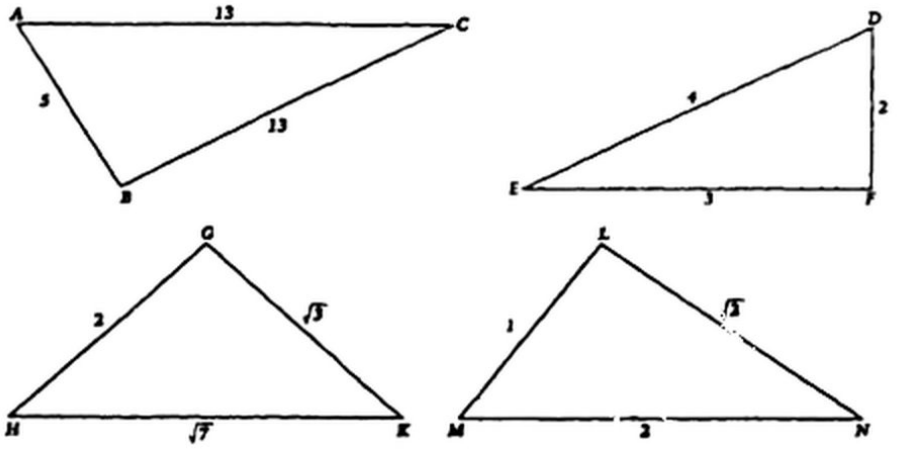
$(AC)^2 = 100 - 81$

$(AC)^2 = 19$

$AC = \sqrt{19}$

$AC = 4.4,$ **Ans**

Q.2 ***Which of the following triangle are right-angled? Answer without measuring the angles.***



Solution:

(i) $(BC)^2 = (AB)^2 + (AC)^2$

or $(13)^2 = (5)^2 + (12)^2$

or $169 = 25 + 144$

or $169 = 169$

Hence ABC is a right-angled tirangle.

(ii) $(DE)^2 = (DF)^2 + (FE)^2$

or $(4)^2 = (2)^2 + (3)^2$

or $16 = 4 + 9$

or $16 = 13$

$\because$ DEF is not a right-angled triangle.

(iii) $(KH)^2 = (GH)^2 + (GK)^2$

or $(\sqrt{7})^2 = (\sqrt{3})^2 + (2)^2$

or $7 = 3 + 4$

or $7 = 7$

$\because$ GHK is a right-angled triangle.

(iv) $(MN)^2 = (LN)^2 + (LM)^2$

or $(2)^2 = (\sqrt{3})^2 + (1)^2$

or $4 = 3 + 1$

or $4 = 4$

$\because$ LMN is a right-angled triangle.

Q.3 ***Elements of which of the following sets can represent the lengths of the sides of the right-angled triangle?***

$A = \{5, 6, 7\}$, $B = \{2.5, 6, 6.5\}$

$C = \{1, 10, 3\sqrt{11}\}$ $D = \{1, 1, \sqrt{2}\}$

Solution:

A, $\{5, 6, 7\}$

$(7)^2 = (5)^2 + (6)^2$

or $49 = 25 + 36$

or $49 + 61$

$\because$ The Δ is not a right-angled one.

B, $\{2.5, 6, 6.5\}$

$(6.5)^2 + (6)^2 + (2.5)^2$

$2.25 = 6.25 + 36$

or $42.25 = 24.25$

$\because$ The elements represents a right-angle triangle.

C $C = \{1, 10, 3\sqrt{11}\}$

$(10)^2 = (1)^2 + (3\sqrt{11})^2$

$100 = 1 + 99$

$100 = 100$

$\because$ The element represent a right-angled triangle.

D, $\{1, 1, \sqrt{2}\}$

$(\sqrt{2})^2 = (1)^2 + (1)^2$

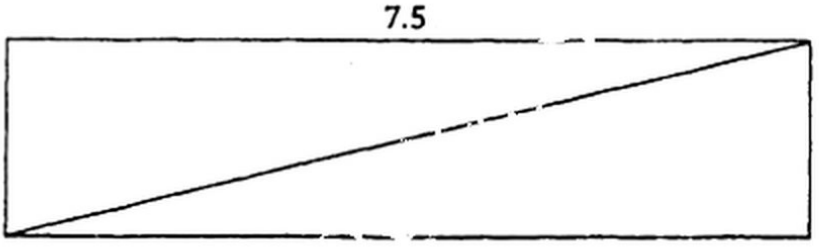
$2 = 1 + 1$

$2 = 2$

$\therefore$ The element represent a right-angled triangle.

Q.4 Compute the lengths of diagonals of rectangular figures described below:

(i) Rectangular lawn whose length is $7.5m$ and breadth is $4m$, respectivley.



Solution:

(length)^2 + (breadth)^2 = (diagonal)^2

(diagonal)^2 $= (7.5)^2 + (4)^2$

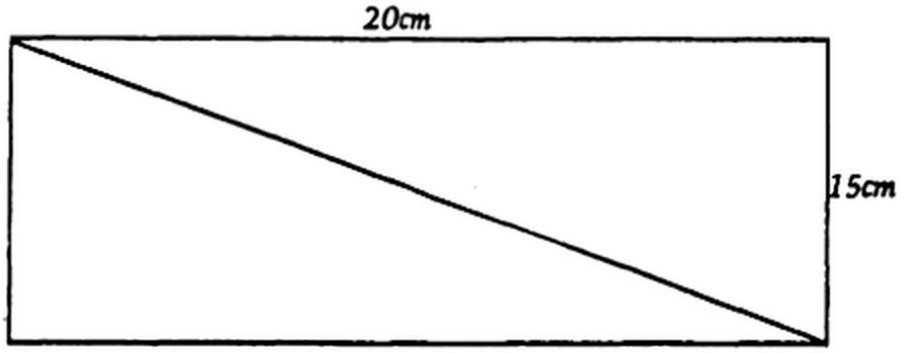
or (diagonal)$^2 = 56.25 + 16$

or (diagonal)$^2 = 72.25$

or diagonal $= \sqrt{72.25}$

or diagonal = $8.5m$. ***Ans***

(ii) A hall whose length and breadth are $20m$, and $15n$ respectively.



Solution:

$(\text{diagonal})^2 = (\text{length})^2 + (\text{breadth})^2$

$(\text{diagonal})^2 = (20)^2 + (15)^2$

$(\text{diagonal})^2 = 400 + 225$

$\text{diagonal}^2 = 625$

$(\text{diagonal})^2 = \sqrt{625}$

$\text{diagonal} = 25\text{m. } \textbf{Ans}$

(iii) A play-ground whose length and breadth are 120m and 50m, respectively.

Solution:

$(\text{diagonal})^2 = (\text{length})^2 + (\text{breadth})^2$

$(\text{diagonal})^2 = (120)^2 + (50)^2$

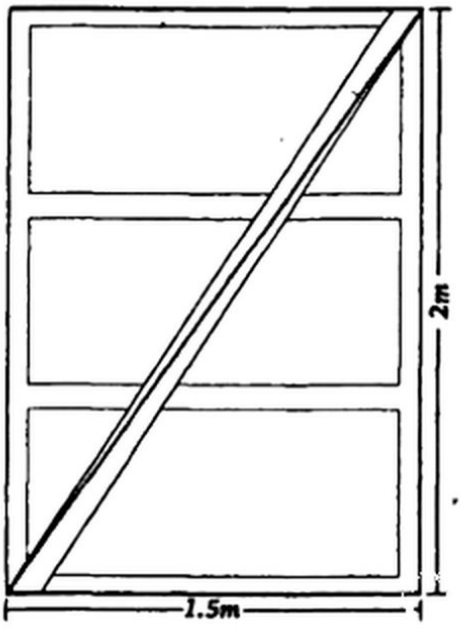
$(\text{diagonal})^2 = 14400 + 2500$

$(\text{diagonal})^2 = 16900$

$(\text{diagonal})^2 = (\sqrt{16900})^2$

$\text{diagonal} = 130\text{m. } \textbf{Ans}$

Q.5 The gate of a garden 2.5m, high and 1.5m, broad, is made up of horizontal wonden bars. For the sake of added strength another bar has to be fixed along a diagonal. What should be the length of this bar?



Solution:

$(\text{diagonal})^2 = (\text{length})^2 + (\text{breadth})^2$

$(\text{diagonal})^2 = (2.25)^2 + (1.5)^2$

$(\text{diagonal})^2 = 6.25 + 2.25$

$(\text{diagonal})^2 = 8.50$

$\text{diagonal} = \sqrt{8.50}$

$\text{diagonal} = 2.9m.$ ***Ans***

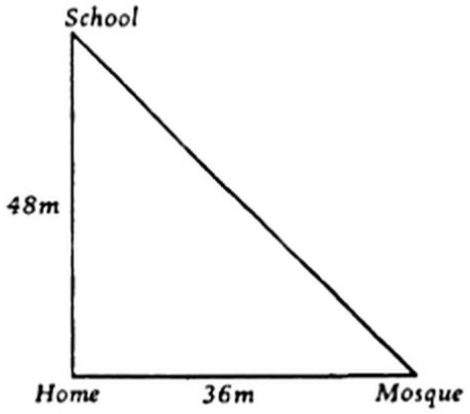
Q.6 The mosque is 36 meters due East of Hamid's house and the school is 48 meters due North of the house. What is the distance between the mosque and the school.

Solution:

Let *H* represent the house

S represent the school

M represent the mosque



$$(SM)^2 = (SH)^2 + (MH)^2$$

$$(SM)^2 = (48)^2 + (36)^2$$

$$(SM)^2 = 2304 + 1296$$

$$(SM)^2 = \sqrt{3600}$$

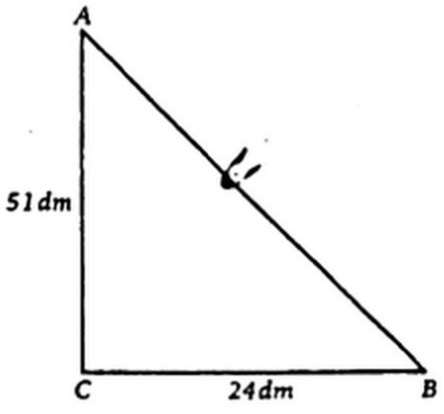
$SM = 60$ meters. **Ans**

Q.7 A labourer placed a ladder, 51dm, long, against a wall in such a way that its lower end was at a distance of 24dm. At what height does the other and of the ladder touch the wall?

Solution:

Let AB stand for the wall

AC stand for the ladder



$$(AB)^2 + (BC)^2 = (AC)^2$$

or $(AB)^2 + (AC)^2 - (BC)^2$

or $(AB)^2 + (51)^2 - (24)^2$

or $(AB)^2 + 2601 - 576$

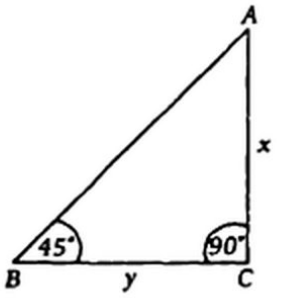
or $(AB)^2 = 2025$

or $AB = \sqrt{2025}$

$AB = 45$ **Ans**

EXERCISE 11.3

Q.1 ***Find the lengths of the remaining sides in each of the following right-angled triangle.***



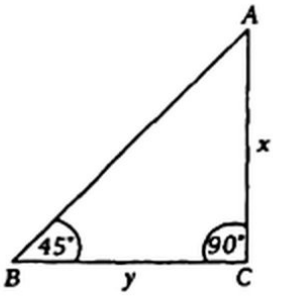
Solution:

(i) (Hypotenuse)^2 = (Perpendicular)^2 + (Base)^2

or (Hypotenuse)^2 = $x^2 + y^2$

or $(AB)^2 = x^2 + y^2$

or $AB = \sqrt{x^2 + y^2}$



(ii) Since $m\angle F = 30°$

$\therefore$ $DF = 2\overline{(DE)}$

$\because$ $DF = 2x$

(Perpendicular)^2 + (Base)^2 = (Hypotenuse)^2

or (Base)^2 = (Hypotenuse)^2 − (Perpendicular)^2

or $(EF)^2 = (DF)^2 - (DE)^2$

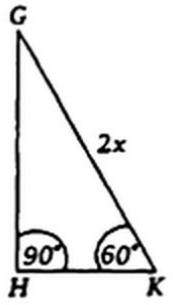
or $(EF)^2 = (2x)^2 - x^2$

or $(EF)^2 = 4x^2 - x^2$

or $(EF)^2 = 3x^2$

or $EF = \sqrt{3x^2}$

$EF = \sqrt{3x^2}$ **Ans.**



(iii) In triangle GHK

Since $m\angle K + m\angle G = 90^o$

$\because$ $m\angle G = 90^o - m\angle K$

or $m\angle G = 90^o - 60^o$

Since $m\angle G + 30^o$

$\because$ $HK \frac{1}{2} (GK)$

or $HK \frac{1}{2} \times 2x$

or $HK = x$

or (Perpendicular)^2 + (Base)^2 = (Hypotenuse)^2

or (Perpendicular)^2 + (Hypotenuse)^2 − (Base)^2

or $(GH)^2 = (GK)^2 - (HK)^2$

or $(GH)^2 = (2x)^2 - x^2$

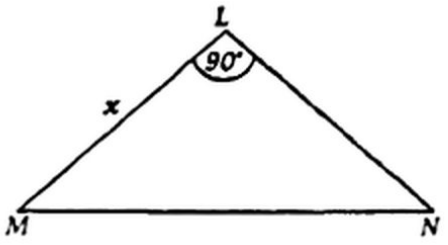
$GH^2 = 4x^2 - x^2$

or $(GH)^2 = 3x^2$

or $GH = \sqrt{3x^2}$

$HK = x$

$GH = \sqrt{3x^2}$ **Ans**



(iv) Since: $m\angle M = m\angle N = 45$

$\because \quad \overline{LM} = \overline{LN}$

$\because \quad \overline{LN} = x$

i.e, Perpendicular = Base

(Hypotenuse)^2 = (Base)^2 + (Perpendicular)^2

or $(MN)^2 = (LH)^2 + (LN)^2$

or $(MN)^2 = x^3 + x^2$

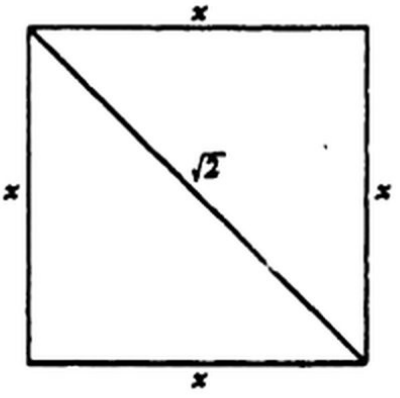
or $(MN)^2 = 2x^2$

or $MN = \sqrt{2x^2}$

$LN = x$

$MN = \sqrt{2x^2}$ Ans.

Q.2 ***Does a diagonal of a square divide it into two isoceles triangles.***



Solution:

All the four sides of a square are equal in measure. A diagonal will divide the square into two

having two sides equal, i.e, each triangle will be isoceless.

Q.3 ***If the length of the diagonal of a square is $\sqrt{2}$. Units what is the length of each sides.***

Solution:

All four sides of a square are equal in length.

Suppose in given square $ABCD$. $AB = x$

$\because$ $BC = x$. $CD = x$ and $AD = x$.

or in ΔABD

$$(BD)^2 = (AB)^2 + (AD)^2$$

or $$(\sqrt{2})^2 = (x)^2 + (x)^2$$

or $$(\sqrt{2})^2 = x^2 + x^2$$

or $$2 = 2x^2$$

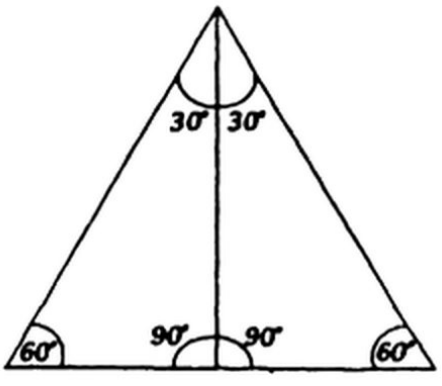
or $$2/2 = 2x^2$$

or $$1 = x^2$$

or $$1 = x$$

$\therefore$ Each side will be of 1 units. ***Ans***

Q.4 ***If a perpendicular is drawn from the vertex of an equilateral triangle to its base, shall we get two triangles of angles 30°, 60° and 90°?***



Solution:

In an equilateral Δ *(a)* all sides are equal in length *(b)* all angles are equal in measure, i.e, of 60°.

Now *ABC* is an equilateral Δ.

$\overline{AD}$ has been drawn perpendicular to $\overline{BC}$ for vertex A.

$\overline{AD}$ divides ΔABC into two triangles *ABD* & *ACD*.

Now in ΔABD.

$m\angle B = 60^\circ$ (given, angle of an equilaterla Δ).

$m\angle ADB = 90^\circ$ (As $\overline{AD}$ is perpendicular to $\overline{BC}$).

$\because \quad m\angle BAD = m\angle ADB - m\angle B$

$\because \quad m\angle BAD = 90 - 60^\circ$

or $\quad m\angle BAD = 30^\circ$

$\because \quad m\angle BAD = 30^\circ$

In ΔABD

$m\angle BAD = 30^\circ$

$m\angle B = 60^\circ$

$m\angle ADB = 90^\circ$

Similarly, we can prove that in ΔADC.

$m\angle C = 60^\circ$

$m\angle ADC = 90^\circ$

$m\angle CAD = 30^\circ$

Q.5 ***What is the ratio between the length of the shortest and longest sides of a triangle with angles of 30°, 60° and 90°.***

Solution:

In Δ having angles 30°, 60° and 90°.

The longest side is the hypotenuse, i.e, opposite to right-angle.

The shortest side altitude or opposite side of angle 30^o.

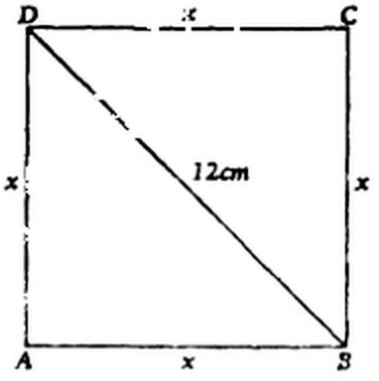
Side opposite to $\angle 30^o$ is of the length of the hypotenuse.

Hence ratio between the shortest and longest sides of such triangle will be

shortest side : longest side

$1 : 2$ ***Ans***

Q.6 For the sake of strength two opposite corners of a square frame have been joined by a stretched wire. The length of the wire is 12cm. What is the length of each side of the frame?



Solution:

Let $ABCD$ be the square frame and $\overline{BD}$ be the stretched wire joining opposite corners B and D.

Since all sides of a square are equal in length.

$\because \quad AB = AD = BC = CD$

How in ΔABD

Suppose $AB = AD = x$

$$(AB)^2 + (AD)^2 = (BD)^2$$

$$x^2 + x^2 = (12)^2$$

$$2x^2 = 144$$

or $$x^2 = 72$$

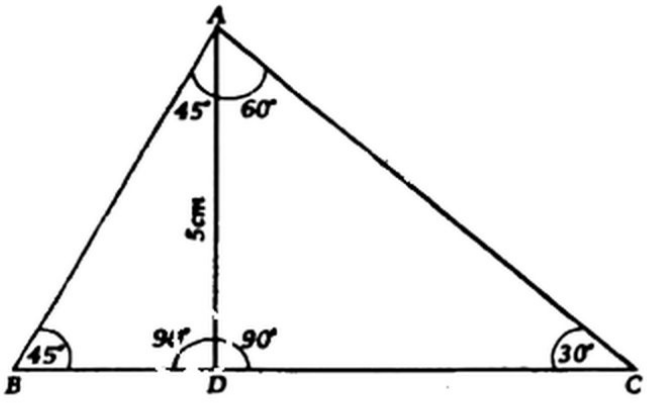
or $$x = \sqrt{72}$$

or $$x = \sqrt{36 \times 2}$$

or $$x = 6\sqrt{2}$$

$\therefore$ Length of each side of the rectangle is $6\sqrt{2}$ cm.

Q.7 Find the lengths of $\overline{AC}, \overline{AB}, \overline{BD}$ and $\overline{DC}$ with reference to the following figures.



Solution:

Given: The adjacent right-angled triangle ABD and ACD.

$$\overline{AD} = 5cm$$

$$m\angle B = 45^o$$

$$m\angle C = 30^o$$

$$m\angle ADB = m\angle ADC = 90^o$$

$$m\angle DAB = 45^o$$

$$m\angle DAD = 60^o$$

In Δ ADB

$m\angle B = m\angle DAB = 45^\circ$ (given)

$\because$ ADB is an isoceles triangle.

$\overline{AD} = \overline{BD}$

But $AD = 5cm$

$\because$ $\overline{BD} = 5cm$

(Perpendicular)^2 + (Base)^2 = (Hypotenuse)^2

$\because$ $(AB)^2 = (AD)^2 + (BD)^2$

or $(AB)^2 = (5)^2 + (5)^2$

$(AB)^2 = 25 + 25$

$(AB)^2 = \sqrt{50} = \sqrt{25 \times 2}$

or $AB = 5\sqrt{2}$

In ΔADC

$m\angle C = 30^\circ$ (given)

Side opposite to $\angle C$ is $\frac{1}{2}$ of side opposite to an angle.

or Hypotenuse is 2 AD.

But $AD = 5cm$ (Given)

$\because$ Hypotenuse $AC = 2 \times 5 = 10cm$

In ΔADC

$(ADP) + (DC) = (AC)^2$

$(5)^2 + (DC)^2 + (10)^2$

or $25 + (DC)^2 = 100$

or $(DC)^2 = 100 - 25$

or $(DC)^2 = 75$

or $\overline{DC} = \sqrt{75}$

or $\overline{DC} = \sqrt{25 \times 3}$

$\overline{DC} = 5\sqrt{3}$

Answers:

$\overline{AB} = 5\sqrt{2}cm$

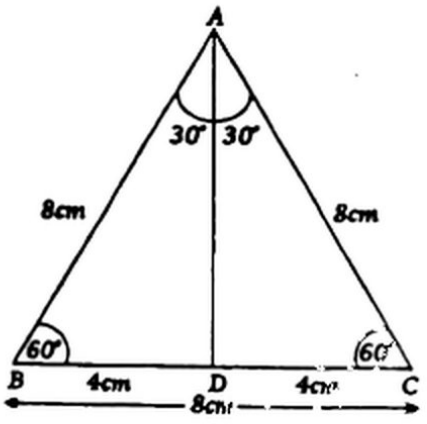
$\overline{BD} = 5cm$

$\overline{AC} = 10cm$

$\overline{DC} = 10cm$

$\overline{DC} = 5\sqrt{5}$

Q.9 ***Each side of an equilateral triangle is 8cm, long. What is its height? Find the area of the region bounded by it.***



Solution:

Perpendicular drawn from the vertex of an isoceles of equilateral Δ so the opposite side bisects the side into two equal halves.

So $\overline{BD} = \overline{CD} = 4cm$

Now $(AD)^2 + (DC)^2 = (AC)^2$ (for ΔADC)

or $(AD)^2 = (AC)^2 - (DC)^2$

or $(AD)^2 = (8)^2 - (4)^2$

or $(AD)^2 = 64 - 16$

or $(AD)^2 = 48 = 16 \times 3$

or $AD = \sqrt{16 \times 3}$

or $AD = 4\sqrt{3}$

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

$\because$ Area of $\Delta ABC = \frac{1}{2} BC - AD$

$= \frac{1}{2} \times 8 - 4\sqrt{3}$

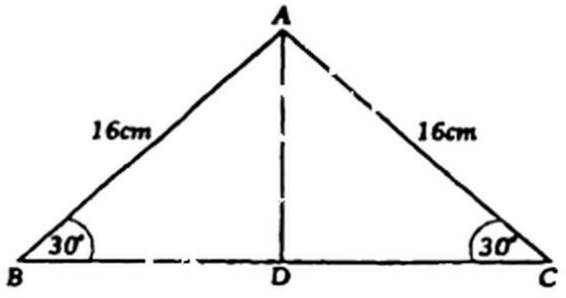
$= 4 \times 4\sqrt{3}$

$= 16\sqrt{3}$

Ans. Height of the $\Delta = 4\sqrt{3}$

Area $= 16\sqrt{3}$

Q.10 ***Each of the congruent sides of an isoceles triangular region is 16 cm, long and the measure of each of the congruent angle is 30°. Find the area of the region.***



Let ABC be the trianglular regions

$\because$ $m\angle B = 30^o$

$m\angle C = 30^o$

$m\overline{AB} = 16cm$

$m\overline{AC} = 16cm$

Since $m\angle C = 30^o$

$\because$ Side opposite to C i.e, $\overline{AD} = \frac{1}{2} AC$

or $\overline{AD} = \frac{1}{2} \times 16$

or $AD = 8cm$

For ΔADC

$(AD)^2 + (DC)^2 = (AC)^2$

$$(DC)^2 = (AC)^2 - (AD)^2$$

$$(DC)^2 = (16)^2 - (8)^2$$

$$(DC)^2 = 256 - 64$$

$$(DC)^2 = 192$$

or $\overline{DC} = \sqrt{192} = \sqrt{64 \times 3} = 8\sqrt{3}$

Since altitude divides the base of an isoceles Δ into two equal parts.

$\because$ $BC = 2\,DC$

or $BC = 16\sqrt{3}$

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

$= \frac{1}{2} \times 16\sqrt{3} \times 8$

$= 8\sqrt{3} \times 8$

$= 64\sqrt{3}$ ***Ans.***

EXERCISE 11.4

Q.1 Which of the following statements are correct and which are incorrect?

(i) Congruent triangles are similar

Solution:

Statement is correct.

(ii) Similar triangles are congruent.

Solution:

Statement is incorrect.

(iii) Two similar triangles may be congruent.

Solution:

Statement is correct.

(iv) All equivalent triangles are similar.

Solution:

Statement is correct.

(v) Two rectangles are always similar.

Solution:

Statement is correct.

(vi) If an angle of rhombus is congruent to an angle of another rhombus, the rhombuses are similar.

Solution:

Statement is correct.

(vii) If corresponding sides of two quadrilaterals are proportional, their corresponding angles are congruent.

Solution:

Statement is incorrect.

(viii) ***If corresponding sides of two triangles are proportional, their corresponding angles are congruent.***

Solution:

Statement is correct.

Q.2 ***Below are given the lengths of sides of four triangles. Tell which of them are similar.***

(i) ***ΔABC: 1.2, 3, 2.5 units:***

(ii) ***ΔDEF: 3.3, 4, 2.8 units:***

(iii) ***ΔGHK: 13.2, 16, 11.2 units:***

(iv) ***ΔLMN: 3.6, 9, 7.5 units:***

Solution:

→ In triangles (i) and (ii)

The ratio between the sides are:

1st side $3.6/1.2 = 3$

2nd side $8/3 = 3$

3rd side $7.5/2.5 = 3$

Since the ratio between the three sides of triangles (i) and (ii) is equal, hence the two triangles are similar.

→ Again in triangle (ii) and (iii)

The ratio between the sides are:

1st side $13/2\ 3.3 = 3$

2nd side $16/4 = 4$

3nd side $11\ 2/2 = 4$

Since the ratio between the three sides of triangles (ii) and (iii) is equal, hence the two triangles are similar.

Q.3 ***ΔABC and ΔDEF are similar triangles. The length of the sides of the ΔABC are 6,9,15cm, and the shortest side of ΔDEF is 3 cm long. Find the length of the remainign sides of the latter triangle.***

Solution:

Ratio between the sides of similar triangles are always equal.

Shortest side of ΔABC is 6cm.

Shortest side of ΔDEF is 3cm.

$\because$ Ratio of shortest sides $= 6 : 3$ or $2 : 1$.

Let the remaining sides of the ΔDEF be x and $5cm$ in length.

Ratio between 9 and the length of side x will be the same as $2 : 1$.

$\because$ $2 : 1 :: 9 : x$

or $2x = (9)$

or $x = 9/2$

or $x = 4.5cm$

Similarly

$2 : 1 :: 15 : x$

or $2x = 15$

or $x = 15/2$

or $x = 7.5$

Lengths of other sides of ΔDEF are

4.5 and 7.5cm. ***Ans***

Q.4 ***One pair of corresponding sides of two similar triangles is congruent. Are the triangles congruent.***

Solution:

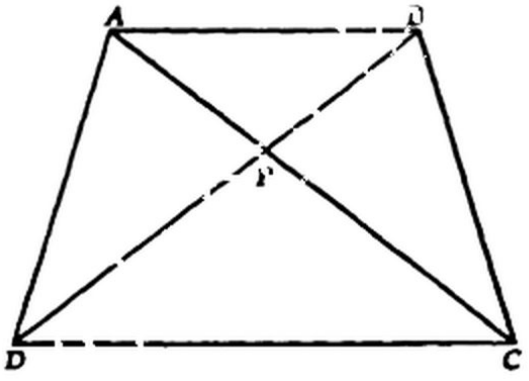
Corresponding angles of similar triangles are always congruent.

Hence, if one pair of sides of the triangle is congruent the corresponding pair of sides of another Δ then two sides and included angle of one will be congruent to corresponding sides and included angles of the other.

∵ $SAS \cong SAS$

Hence the Δs will be congruent.

Q.5 ***The diagonals of a trapezium ABCD intersect in a point P. Prove that the triangles PAB and PCD are similar.***



Solution:

Given: Trapezium *ABCD*,

$AB \parallel CD$

Proof: In Δs *PAB* and *PCD*

$m\angle APB \cong m\angle CPD$ *(vertical angles)*

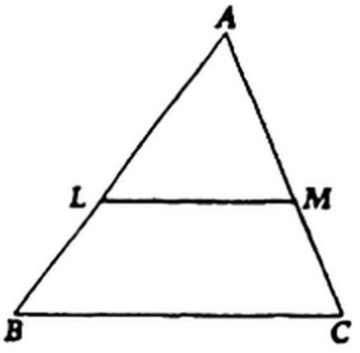
$m\angle PAB \cong m\angle PCD$ *(internal alternate angles)*

$m\angle PBA \cong m\angle PDC$ *(internal alternate angles)*

Since three angles of Δ*PAB* and congruent to the corresponding three angles of Δ*PCD*.

∵ Δ*PAB* is similar to Δ*PCD*. (Proved)

Q.6 ***In a triangle ABC the line-segment LM joins the mid-points L and M of two sides. Are the triangles ALM and ABC similar? What is the ratio between $\overline{LM}$ and $\overline{BC}$? Is $\overline{LM}$ parallel to $\overline{BC}$? Justify your answers?***



Solution:

Given: ΔABC

L is mid-point of $\overline{AB}$

M is mid-pcint of $\overline{AC}$

(i) In Δs ABC and ALM.

Ratio between $\overline{AB}$ & its corresponding side $\overline{AL}$

$= 2 : 1$ (L is mid-point of $\overline{AB}$)

Ratio between $\overline{AM}$ & its corresponding side $\overline{AC}$

Included $\angle A$ between the proportional side is common.

$\therefore$ ΔABC and ΔALM are similar.

(ii) Since ΔABC and ΔALM are similar and the ratio between the sides of corresponding sides of similar triangles is also similar.

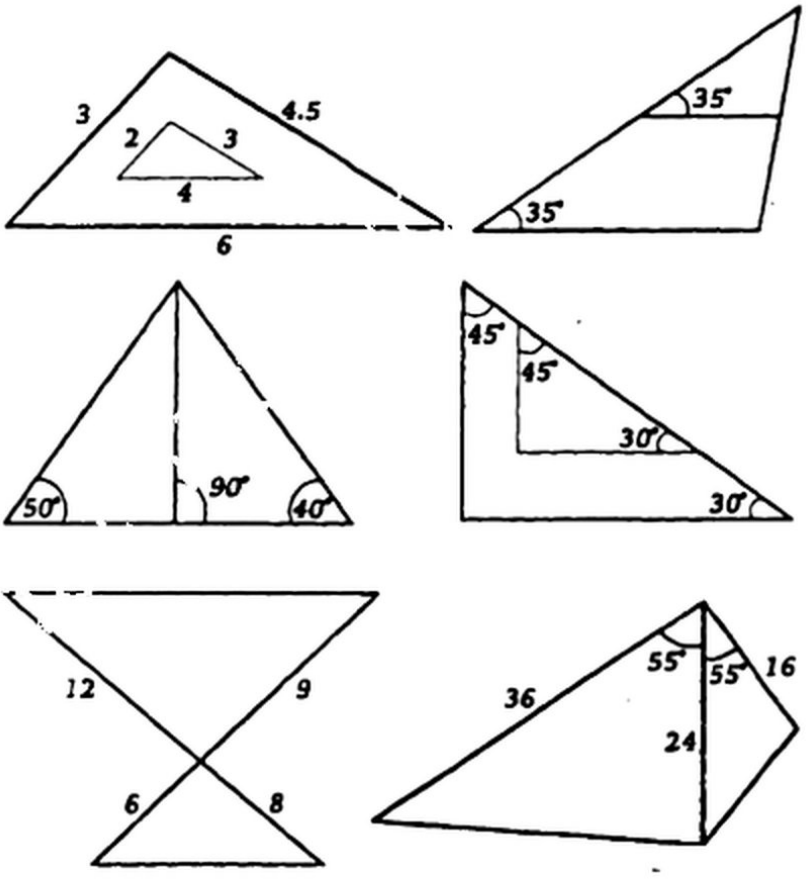
$\therefore$ Ratio between LM and BC is $1 : 2$

(iii) $\overline{AB}$ intersects $\overline{LM}$ and BC and $\angle ALM$ and ΔLBC are corresponding angles moreover $\angle ALM = \angle LBC$

(corresponding angles of similar Δs)

$\because \quad \overline{LM} : BC$

Q.7 ***Below are given six pairs of triangles. Which pairs are similar? In case of similarity of a pair the argument may be stated like this: The corresponding angles are congruent. The corresponding sides are proportional. Two corresponding sides are proportional and their included angles are congruent.***



Solution:

(i) Similar, the corresponding sides are proportional.

(ii) Similar, the corresponding angles are congruent.

(iii) Similar, the corresponding angles are congruent.

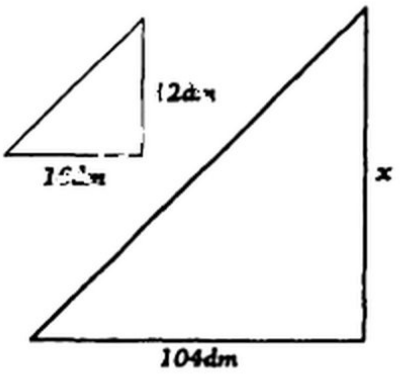
(iv) Similar, the corresponding angles are congruent.

(v) Similar, the two corresponding sides are proportional and their included angles are congruent.

(vi) Not similar.

Q.8 ***The shadow cast by a tree on a horizontal ground is 104 dm, long. At the same time a man notes that his shadow is 16 dm, long whereas his height is 12dm. Using the property of similar triangles find the height of the tree.***

Solution:



Since the Δs *ABC* and *DEF* are similar, therefore, between their corresponding side is equal.

$\because$ $AB : DE : CB : FE$

or $AB : 12 :: 104 : 16$

or Product of means = Product of extreme

$\because$ $16AB = 12 \times 104$

or $AB = \frac{12 \times 104}{16}$

or $AB = 78\ dm$

$\therefore$ The tree is $78dm$. high. ***Ans***

Q.9 How will you find the height of an electric pole without actually measuring it?

Solution:

We will fix a stick of known height vertically on the ground. We will measure the shadow of the stick and shadow of the pole.

Now

Pole height : Stick height :: Pole shadow : stick shadow

Pole height × Stick height = Pole shadow × Pole shadow

$$\text{or} \quad \text{Pole height} = \frac{\text{Stick height} \times \text{Pole shadow}}{\text{Stick height}}$$

EXERCISE 11.5

Q.1 ***The sides of a triangular piece of land are 80, 150 and 160 meters long. What are the measures of the angles at its corners?***

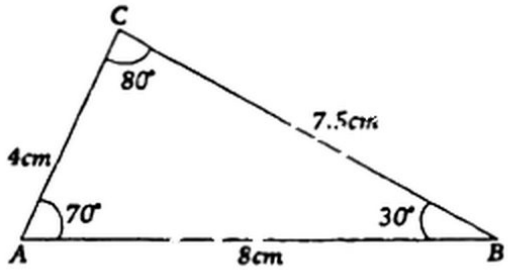
(Hint: Draw a scale drawing on a convenient scale and measure the angles at the vertices).

Solution:

Suppose 20 meters $= 1cm$

$\because$ $1:0$ meters $= 7.5cm$

160 meters $= 8cm$



ΔABC is similar to the triangular piece of land. Hence the angles of ΔABC congruent to the angles of triangular piece of land.

On measuring

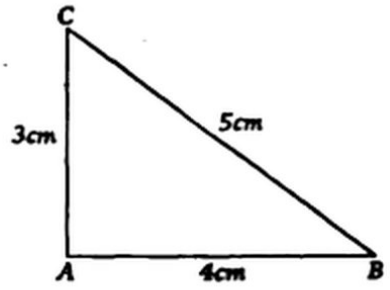
$m\angle = 80^o$

$m\angle = 30^o$

$m\angle = 70^o$

Q.2 ***One angle of a triangular machine part is a right angle and sides determining the right angle have the lengths 3cm and 4cm, respectively. Construct two scale drawings of the part in one of which the lengths of the***

sides are 5 times and in the other it is 10 times.



Solution:

The given triangle is *ABC*.

To be drawn two similar triangles having sides 5 times and 10 times of *ABC*.

If sides are 5 times.

then $AB = 15cm$

$BC = 20cm$

If sides are 10 times

then $AB = 30cm$

$BC = 40cm$

Construction of these triangles is not possible on a page of the copy as big size of paper is needed for it.

Q.3 ***The vertical angle "B" of an isoceles triangle is ABC is of 45° and each of the congruent sides is 6cm long. Construct a triangle PQR whose base is, in length 2/3 of the base of ΔABC.***

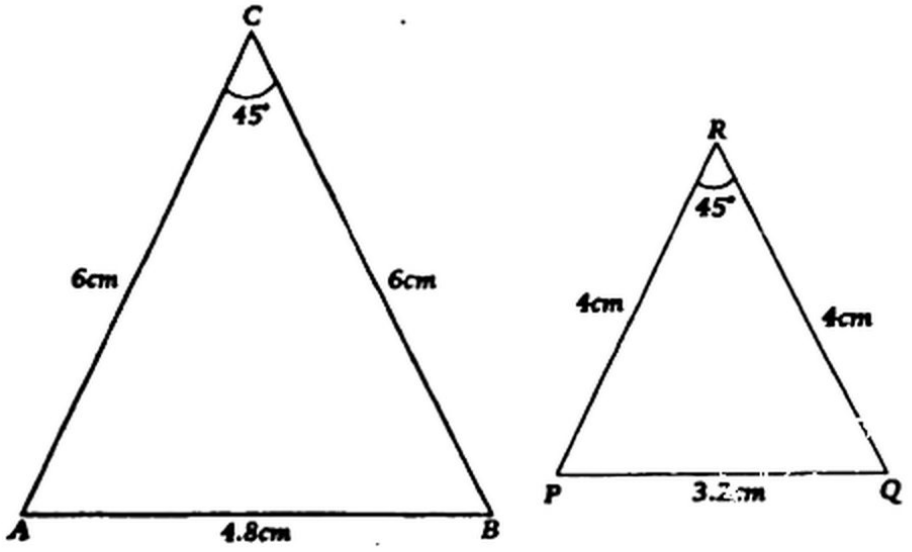
Solution:

Ratio is the base is 2/3

$\because$ Ratio between the other side is also 2/3

$\because$ $PQ = 2/3$ of AB, i.e, 2/3 of $6 = 4cm$

$QR = 2/3$ of BC, i.e, 2/3 of $6 = 4cm$



Q.4 ***A badminton court is 13m long and 6m wide. There is a service lines at a distance of 2m, on either sides of the centre line. Make a scale drawing of the court by taking the scale 1 m = 1cm. What is the length of a diagonal of the court?***

Solution:

Given scale is $1m = 1cm$

$\because \quad 13\ m = 13cm$

$6m = 6cm$

$m = 2cm$

$\because \quad \overline{AC}$ is a diagonal of the court.

or $\quad \overline{(AC)^2} = \overline{(AB)^2} + \overline{(BC)^2}$

or $\quad \overline{(AC)^2} = (6)^2 + (13)^2$

or $\quad \overline{(AC)^2} = 36 + 169$

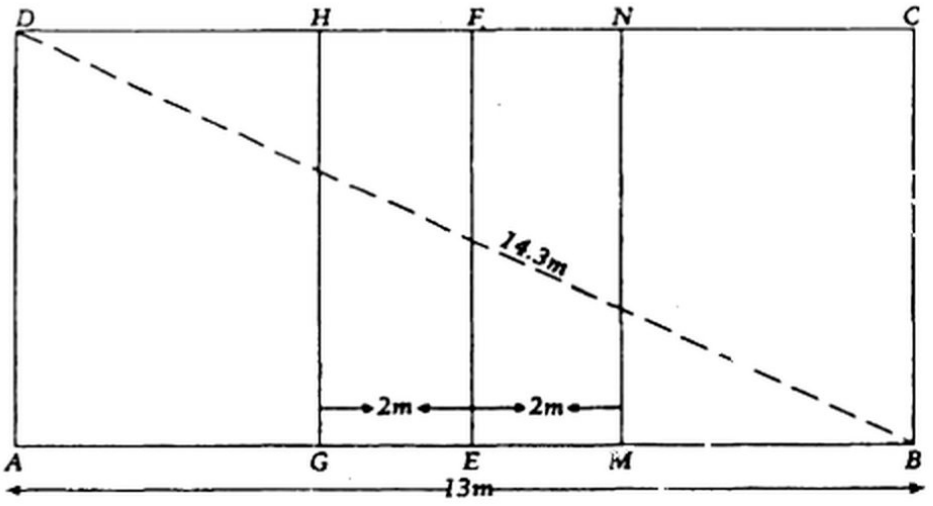
or $\quad \overline{(AC)^2} = 205$

or $\quad \overline{(AC)^2} = \sqrt{205}$

or $\overline{AC} = 14.2cm$

Since $1\,cm = 1m.$

Diagonal of the court is $14.3m$. ***Ans***



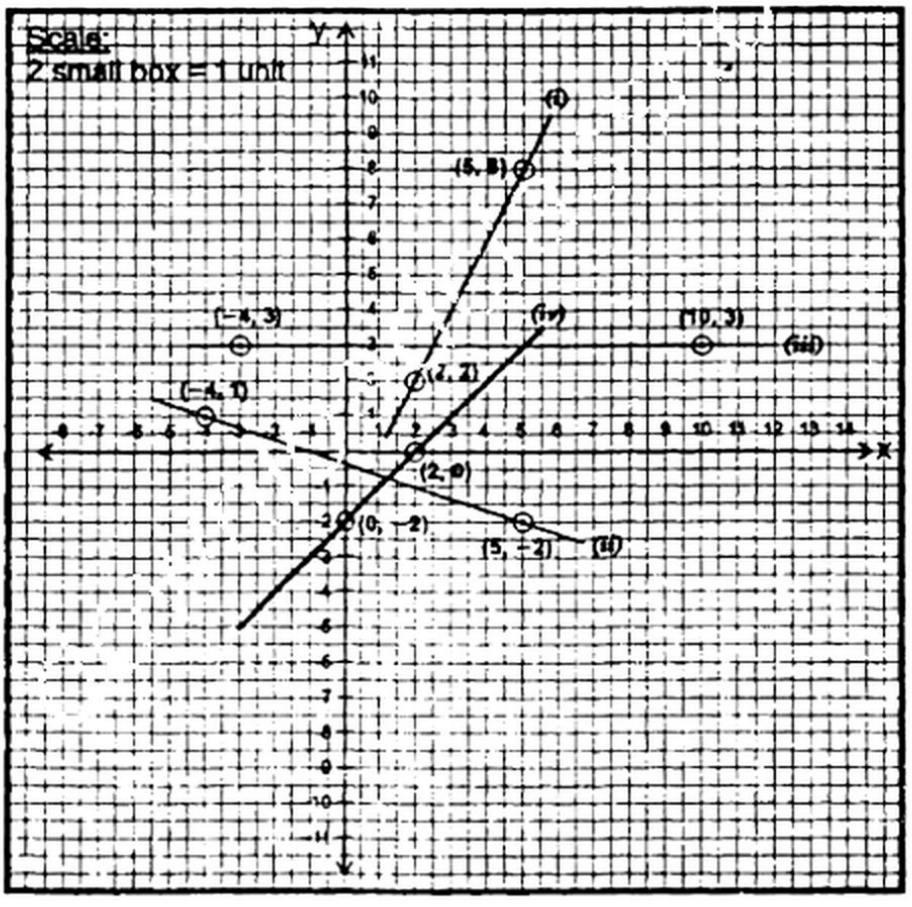
EXERCISE 11.6

Q.1 Plot the following pairs of points on the Cartisian Plan and find the slopes of the line determined by them:

(i) (2, 2) (5, 8)

(ii) (−4, 1), (5, −2)

(iii) (10, 3), (−3, 3) (iv) (3, 0), (0, −2)



Solution:

$$\text{slope} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{8-2}{5-2} = \frac{6}{3} = 2. \quad \textit{Ans}$$

II slope $= \frac{y_2 - y_1}{x_2 - x_1} = \frac{-2-1}{5+4} = \frac{-3}{9} = -\frac{1}{2}$. ***Ans***

III slope $= \frac{y_2 - y_1}{x_2 - x_1} = \frac{3-3}{-3-10} = \frac{0}{13} = 0$. ***Ans***

IV slope $= \frac{y_2 - y_1}{x_2 - x_1} = \frac{-2-0}{0-3} = \frac{2}{3}$. ***Ans***

Q.2 $\overline{AB}$ ***is parallel to x-axis. What is its slope***

P.

Solution:

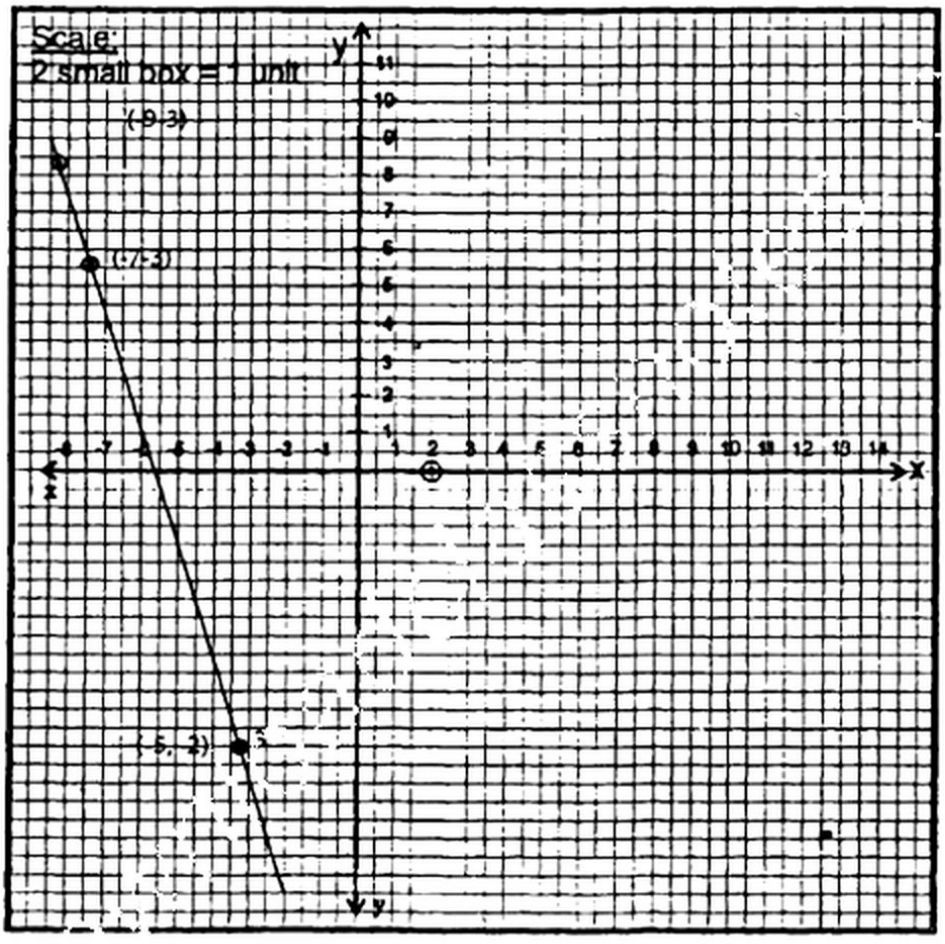
Since AB is parallel to x-axis.

$\because$ Value of y is same in all pairs of points.

$\because$ $y_2 - y_1 = 0$

slope $= \frac{y_2 - y_1}{x_2 - x_1} = \frac{0}{x - x_1} = 0$ ***Ans***

Q.3 ***Co-ordinates of the points A & B are (−7, 3) (−5, −2) respectively. Do the points (6, 10) and (−9, 8) line on the line*** $\overline{AB}$ ***?***



Solution:

As apparent from the figure point *(−9, 8)* lie on $\overline{AB}$. But point *(6, 10)* do not lie on line $\overline{AB}$.

Q.4 ***Co-ordinate of points A and B are (2, 3) ad (8, 5) and co-ordinates of C and D are (3, 6) and (6, 7) respectively. Show that*** $\overline{AB}$ ***and*** $\overline{CD}$ ***are parallel.***

Solution:

$$\text{Slope of } \overleftrightarrow{AB} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{5-3}{8-2} = \frac{2}{6} = \frac{1}{2}$$

$$\text{Slope of } \overleftrightarrow{CD} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{7-6}{6-3} = \frac{1}{2}$$

Since the slope of both the lines are equal and lines having similar slope are parallel.

$\because$ $\overleftrightarrow{AB}$ and $\overleftrightarrow{CD}$ are parallel.

EXERCISE 11.7

Q.1 ***Line AB passes through the point (1, 2) and its slope is −3/2 Write it in the equation form.***

Solution:

Suppose $\overline{AB}$ passes through a point (x, y).

Now slope of $\overline{AB} = -\frac{3}{2}$ (given)

$$\therefore \quad \frac{y-2}{x-1} = \frac{3}{2}$$

or $2(y-2) = -3(x-1)$

or $2y - 4 = -3x + 3$

or $3x + 2y = 3 + 4$

or $3x + 2y = 7$

or $3x + 2y - 7 = 0$. ***Ans***

Q.2 ***Write down the equation of the which passes through the point (1, 3) and whose slope is 1.***

Solution:

Suppose the line is $\overleftrightarrow{AB}$ & point (x, y) lies on it.

Now $\frac{y-3}{x-1} = 1$

$y - 3 = x - 1$

$y - x - 3 + 1 = 0$

$y - x - 2 = 0$

$\therefore \quad x - y + 2 = 0$. ***Ans***

Q.3 ***Line LM passes through (0, 0) and its slope is 0 find its equation.***

Solution:

Suppose a point (x, y) lies on LM.

$\because \quad \frac{y-0}{x-0} = 0$

or $\quad Y - 0 = x - 0 = 0$

or $\quad y = x = 0$

or $\quad x = 0, y = 0$. ***Ans***

Q.4 ***Find the slope of the line and co-ordinates of a point on the line represented by each of the equations:***

Solution:

(i) $\quad y - 3 = 2/5\ (x - 0)$

(ii) $\quad y + 2 = 5/2\ (x - 3)$

(iii) $\quad y = x$

(iv) $\quad y + 0 = x$

Solution:

(i) $\quad y - 3 = 2/5\ (x - 0)$

$\frac{y-3}{x-0} = \frac{3}{5}$ (dividing both sides by $x - 0$)

$\because$ the slope of the line is $2/5$ and its co-ordinates $(0, 3)$. ***Ans***

Solution:

(ii) $\quad y + 2 = 5/2\ (x - 3)$

or $\quad \frac{y+2}{x-3} = \frac{2}{5}$ (dividing both sides by $x - 3$)

$\because$ the slope is $2/5$ and co-ordinates $(-3, 2)$.

Solution:

(iii) $y = x$

$x = 1$

or $\frac{y-0}{x-0} = 1$

$\because$ the slope is one & co-ordinate (0, 0). ***Ans***

Solution:

(iv) $y + 6 = x$

or $y + 6 = 1\,(x - 0)$

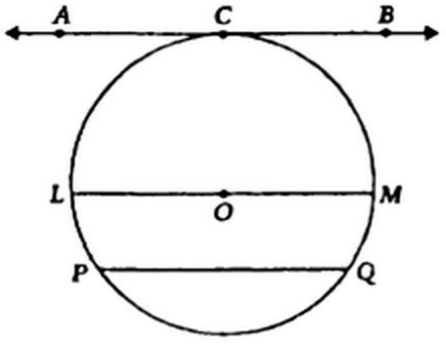
or $\frac{y+6}{x-0} = 1$

$\because$ the slope is one & co-ordinate are (0, 6).

Ans

EXERCISE 11.8

Q.1 ***In the adjoining figure (Fig. 17) name the following: Chord (which is not a diameter). Diameter; Tangnet point of contact; Semi-circle.***



Solution:

Chord is $\overline{PQ}$

D ameter is $\overline{LM}$

Tangent is $\overleftrightarrow{AB}$

Point of contact is C

Semi-circle: $\overset{\frown}{LCM}$ and $\overset{\frown}{LPM}$

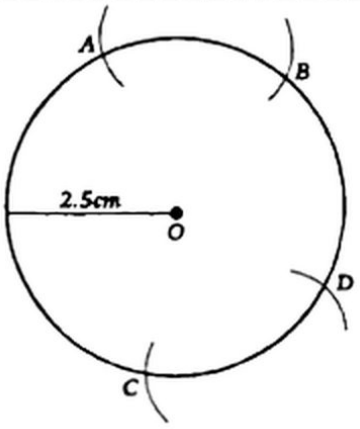
Q.2 ***Draw a circle of radius of 5cm. Show in it two minor arcs and the corresponding major arcs.***

Solution:

Draw a circle of 5cm radius.

(i) 2 minor arcs are $\overset{\frown}{PQ}$ and $\overset{\frown}{QR}$

(ii) 2 major orcs are $\overset{\frown}{PQR}$ and $\overset{\frown}{RPQ}$



Q.3 Is a semi-circle a minor arc or a major arc?

Solution:

A semi-cirlce is neither a majo: arc not a minor arc.

Q.4 Is every diameter of a cirlce its chord? Its every chord a diameter?

Solution:

(i) Yes, every diameter of a circle is a chord.

(ii) No, every chord of a circle is not its diameter.

Q.5 How many diameter can be drawn through a point of a circle? How many chords? Is the set of diameter of a circle a sub-set of the set of its chords?

Solution:

(i) Only one diameter can be drawn through the point of a circle; as the diameter must pass through the centre and one and only straight line can be drawn between two points.

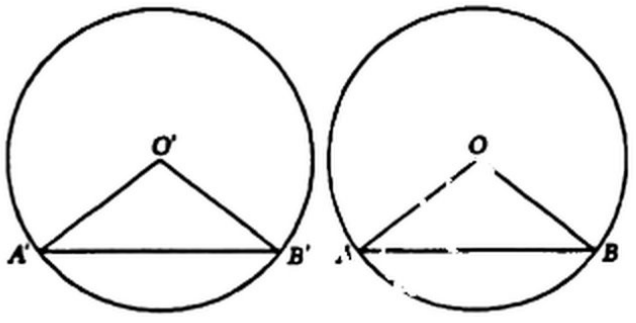
(ii) Indefinite number of chords can be drawn through the point of a circle.

(iii) Diameter are also a sort of chords in the circle, so these are sub-sets of the chords of the circle.

Q.6 ***If $\widehat{AB}$ is an arc of a circle, $\overline{AB}$ is called the chord of the arc. Prove that:***

(i) If two chords of a circle (or congruent circles) are congruent, the corresponding arcs are also congruent.

(ii) If two arcs of a circle (or congruent, circles) are congruent, the corresponding chords are also congruent.



Solution:

Part (i) of the question has already been solved in the text-book.

Part (ii)

Given: In two congruent circles.

With centre O and O' arc $\widehat{OAB} \cong$ arc $\widehat{O'A'B'}$

To prove: $\overline{AB} \cong A'B'$

Construction: Join OAB and $O'A'B'$ to make the triangle OAB and $O'A'B'$.

Proof: In Δs OAB and $O'A'B'$.

$\overline{OA} = O'A'$ (Radii of congruent circle)

$\overline{OB} = O'B'$ (Radii of congruent circle)

$m\angle AOB \cong m\angle A'O'B'$ (arc $\overset{\frown}{OAB}$ $\cong$ arc $\overset{\frown}{OA'B'}$ given)

$\because$ $SAS \cong SAS$

$\because$ $\Delta OAB \cong \Delta A'O'B'$

$\because$ $\overrightarrow{AB} \cong \overrightarrow{A'B'}$

And $\overline{AB}$ and $\overline{A'B'}$ are the cross-panking arcs of the congruent chords $\overset{\frown}{AB}$ and $\overset{\frown}{AB}$. Proved

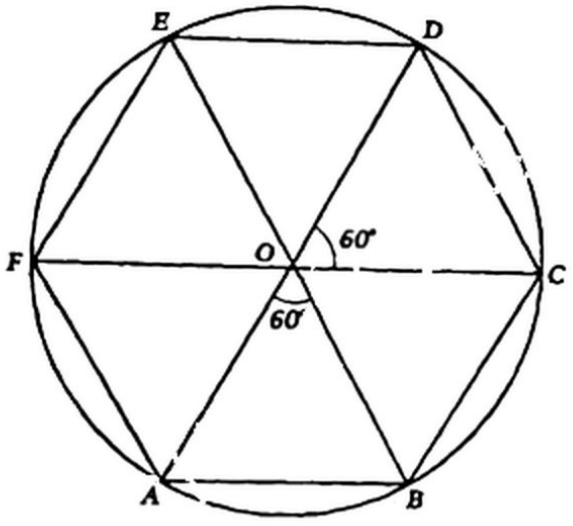


EXERCISE 11.9

(N.B -Use pythogoras Theorem wherever necessary)

Q.1 ***Draw a circle 6cm radius. construct a regular hexagon whose vertices lie on the circle. Measure the length of each of its sides.***

[Hint: Construct six angles at the centre of the circle, adjacent to one another measure of each angle bearing 60°]



Solution:

Suppose $2cm = 1cm$

$\therefore$ $6cm = 3cm$

Construction: With centre O and 3 radius cm. we draw a circle.

Join $\overline{OA}$ to make a radius. At point O draw an angle OA of $60°$. Measure AB which equal to $3cm$. We divide the circumference in 6 equal parts with the help of compass and radius of 3 cm.

Required hexagon is *ABCDEF*.

Each side of which is *3cm*.

But *3 cm = 6cm*.

∵ Each side of the hexagon will be *6cm*. ***Ans***

Q.2 If three points A, B, C divides circle into congruent parts $\overset{\frown}{AB}$, $\overset{\frown}{BC}$, $\overset{\frown}{CA}$, what will be the measure of central angle of each arc?

Solution:

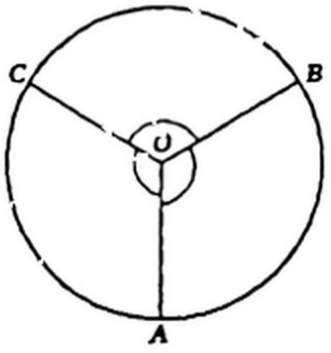
Since arc $\overset{\frown}{AB}$ = arc $\overset{\frown}{BC}$ = arc $\overset{\frown}{CA}$.

∵ $m\angle AOB \cong m\angle BOC \cong m\angle COA$

But $m\angle ACB + m\angle BOC + m\angle COA = 360^\circ$

∵ $m\angle AOB$ or $m\angle BOC$ or $m\angle COA = 120^\circ$

∵ measure of central angle of each arc will be 120°. ***Ans***



Q.3 If eight points lie in order on a circle and are the end-points of congruent arcs. What is the measure of the central angle of each arc?

Solution:

Since there are eight arcs.

∵ There will be eight angles formed on the centre.

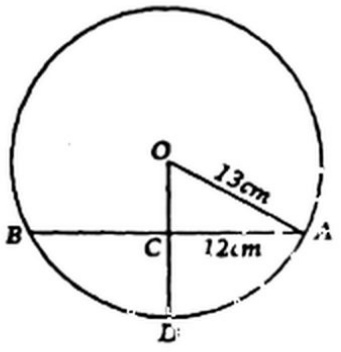
Since each arc is congruent.

So each angle will also be congruent.

And the sum of all (eight) angles at the centre of a circle is 360^o.

$\therefore$ measure of each angle will be $= \frac{360}{8} = 45^\circ$

Q.4 ***The radius of a circle is 5cm. A chord is at a distance of 4cm, from the centre. Find the length of the chord.***



Solution:

Draw a circle with radius $\overline{OA} = 5cm$.

From $\overline{OA}$ cut $\overline{OB} = 4cm$.

At B make an angle $OBQ = 90^o$

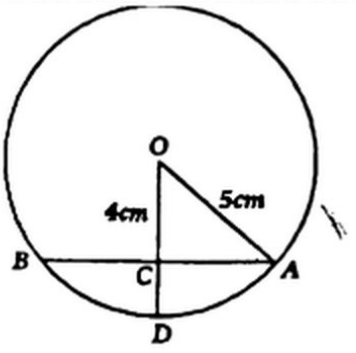
Extend $\overline{QB}$ to join P.

$\overline{PQ}$ is the required chord.

On measuring $\overline{PQ}$ it was found that $\overline{PQ} = 6cm$.

Ans

Q.5 ***The radius of a circle is 13cm. One of its chords is 24cm long. Find the distance of the chord from the centre.***



Solution:

A circle was drawn with a radius of *13cm*.

$\overline{AC}$ is a chord measuring *24cm*.

$\overline{OB}$ is the perpendicular distance of the chord $\overline{AC}$ from the centre *O*. Since I drawn from the centre of the circle to its chord.

$\because \quad \overline{AB} = \overline{AC} = 12cm$

Join $\overline{AO}$ to make a ΔAOB with angle *OBA* as right angles, as $\overline{OB} \perp$ is to $\overline{AC}$,

Required the length of $\overline{OB}$.

Since ΔOAB is a right-angled Δ.

And in ΔOAB $\overline{OA} = 13cm$. (radius of the circle given *13cm*).

$\overline{AB} = 12cm$ ($\overline{OB}$ is from the centre *O* to chord $\overline{AC}$ hence $\overline{AC}$ has been bisected).

Now $(OB)^2 + (AB)^2 = (OA)^2$ *(Pythagoras Theorem)*

or $(OB)^2 = (OA)^2 - (AB)^2$

or $(OB)^2 = (13)^2 - (12)^2$

or $(OB)^2 = 169 - 144$

or $(OB)^2 = 25$

or $OB = \sqrt{25}$

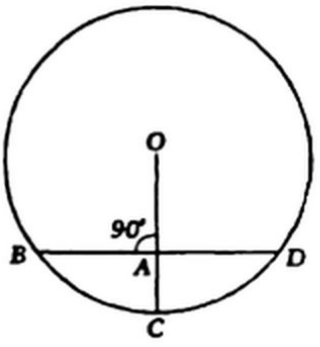
or $OB = 5cm$. **Ans**

Q.6 ***Draw a circle of 5cm radius. Take any point A inside the circle construct the chord of the circle which has A as its mid-point.***

Solution:

Suppose $2cm = 1cm$

$\therefore$ $5cm = 2.5cm$



Construct:

Draw a cirlce with centre O and radius $2.5cm$.

Take "A" a point inside the circle.

Join $\overline{OA}$.

At "A" draw $\overline{QA}$ perpendicular to A and extend $\overline{QA}$ to join the circumference at P.

$\overline{PQ}$ is the required are which passes through A and "A" is the middle-point of $\overline{PQ}$.

Q.7 ***Take three non-clinear points and draw a circle passing through them points.***

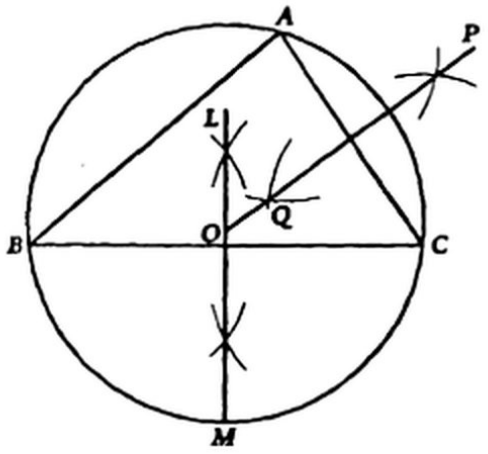
Solution:

Construction:

Take three non-colinear points C and join them to make a triangle ABC.

Draw $\overline{PQ}$ bisector of $\overline{AC}$ and $\overline{RS}$ bisector o.

$\overline{PQ}$ and $\overline{RS}$ meet each other at O.



With centre O and radius $\overline{OA}$ or $\overline{OB}$ or $\overline{OC}$ draw a circle which will pass through A, B and C is the required circle.

Q.8 ***Construct a. Δ, the lengths of whose sides are 4cm, 7cm and 8cm,. Draw a circle passing through its vertices.***

Solution:

Suppose ABC is the Δ.

Where $\overline{AB} = 4cm$

$\overline{BC} = 7.5cm$

$\overline{AC} = 8cm$

Required a circle to be drawn to pass through A, B and C.

Construction: Suppose $2cm = 1cm$.

$\therefore$ $\overline{AB} = 2cm$

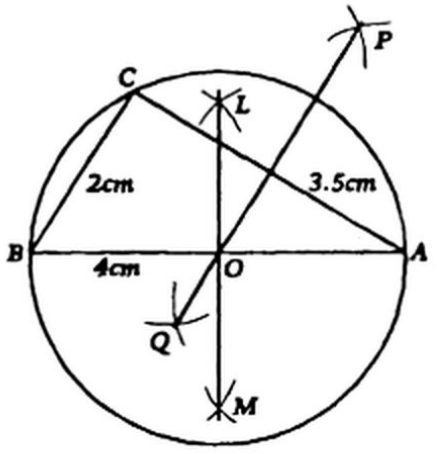
$\overline{BC} = 3.5cm$

$\overline{AC} = 4cm$

Construct a ΔABC according to the given data.

Draw $\overline{PQ}$ perpendicular bisector to $\overline{BC}$.

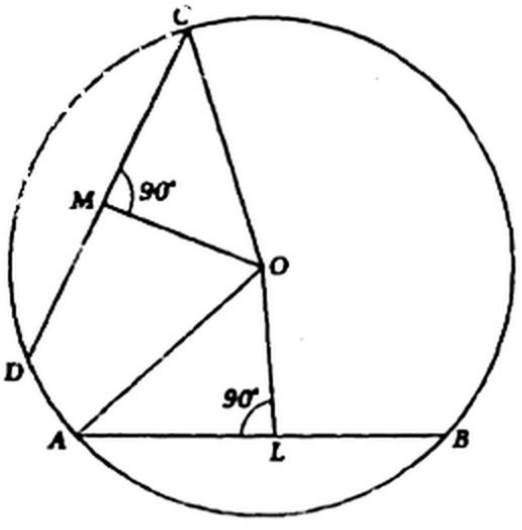
Draw $\overline{RS}$ perpendicular bisector of $\overline{AC}$.



Let $\overline{PQ}$ and $\overline{RS}$ meet at O.

With centre O and radius $\overline{OA}$ draw a circle which will pass through A, B and C and is the required circle.

Q.9 Prove that if two chords of a circle are equidistant from the centre, they are congruent.



Solution:

Given:

Two chords $\overline{AB}$ & $\overline{CD}$ of a circle with centre O.

$$\overline{OP} = \overline{OQ}$$

To prove that $\overline{AB} \cong \overline{CD}$

Construct: Join $\overline{OD}$ and $\overline{OB}$

$\overline{OA}$ and $\overline{OC}$

Proof: Since OP is $\perp$ from the centre of the circle to the chord $\overline{AB}$ and $\overline{OQ}$ $\perp$ from the centre of the of the circle to the chord $\overline{CD}$.

$$\overline{AP} = \overline{PB}$$

$$\overline{CQ} = \overline{QD}$$

In Δs AOP and COQ.

$\overline{AO} = \overline{CO}$ (Radii of the same circle)

$\overline{OP} = \overline{OQ}$ (Given)

$m\angle OPA = m\angle OQA$ (Right angle)

$\therefore$ $\Delta AOP \cong \Delta COQ$

$\therefore$ $\overline{AP} = \overline{CQ}$

Similarly we can prove that $\overline{BP} = \overline{DQ}$

$\therefore$ $\overline{AP} + \overline{BP} \cong \overline{CQ} + \overline{DQ}$

$\therefore$ $\overline{AB} = \overline{CD}$ ***(Proved)***

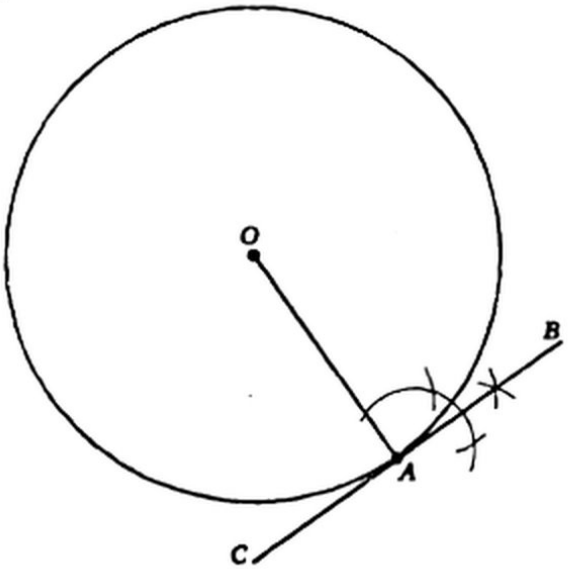
Q.10 Draw a circle of 4.5cm, radius. Take any point A on it and draw a tangent of circle at this point.

Construction:

Draw a circle with central O and radius 4.5 cm. A is a point on its circumference.

Join $\overline{OA}$

Solution:



At point A draw an angle $XAO = 90^{\circ}$ with the help of either compass or protector.

Extend $\overline{XA}$ to Y.

$\overleftrightarrow{XY}$ is the required tangent,

Q.11 Draw a circle with the radius equal to 5cm. Draw a chord of the circle which is 8cm, long. Construct the tangents at the end-point of the chord.

Solution:

Construction: Suppose $2cm = 1cm$

$5cm = 2.5\ cm$

$8\ cm = 4cm$

Draw a circle with centre O and radius 2.5 (To scale).

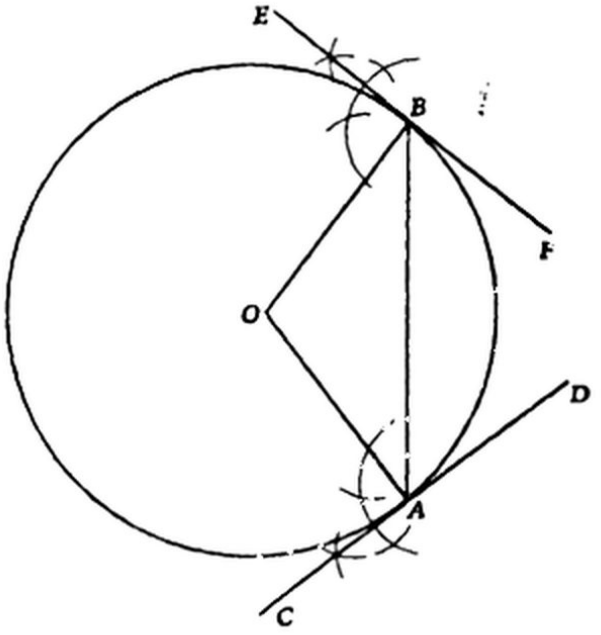
Take a point B at its circumsference. With centre B and radius $4cm$. Draw an arc to cut the circumsference at C.

Join $\overline{BC}$. $\overline{BC}$ is the required chord.

At B draw $\overline{XY} \perp$ to B.

At C draw $\overline{DE} \perp$ to C.

$\overline{XY}$ and $\overline{DE}$ arc the required tangents.



Q.12 Draw a circle of 4.3cm radius. Construct tangents of the circle from an exterior point

Construction:

(1) Draw a circle with centre O and 4.3 cm radius.

(2) Take a point P outside the circle and join PO.

(3) Bisect PO with the help of compass at C.

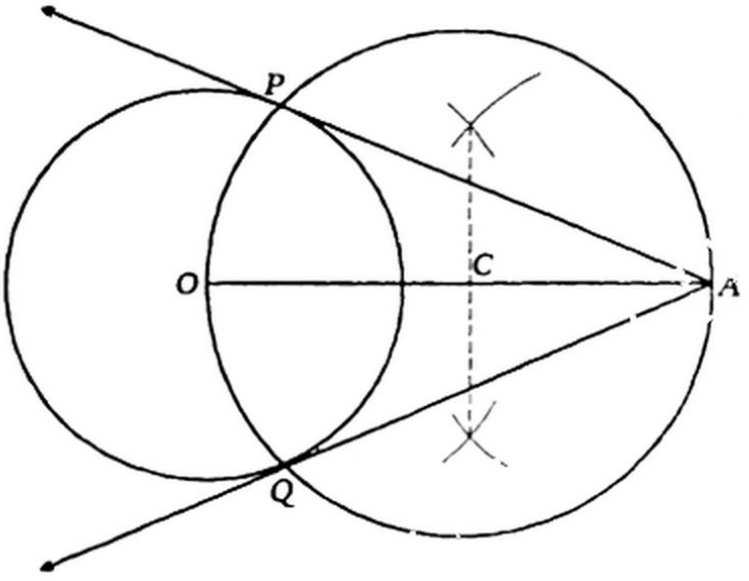
(4) With centre C and radius $\overline{CO}$ draw an arc to cut the circle at A and B.

(5) Join PA and extend it towards A.

(6) Join PB and extend it towards B.

PA and PB are the required tangents.

Q.13 ***Draw a circle of 6cm, radius. Take a point P at distance of 10cm from its centre. Construct the tangents of the circle from P. Measure each tangent segment and verify the measurement by Pythogoras Theorem.***



Solution:

Construction:

Suppose $4cm = 1cm$

$\therefore$ $6cm = 1.5cm$

$10cm = 2.5cm$

(1) Draw a circle with centre O and radius 1.5 (i.e, $6cm$).

2) Take a point P outside the circle at a distance of 2.5 (i.e $10cm$) from O. Bisect $\overline{OP}$ at C.

3) With centre C and radius $\overline{CO}$ draw an arc to cut the circle at A and B.

(4) Join $\overline{PA}$ and $\overline{PB}$ which arc the required tangents on measurement $\overline{PA} = \overline{PB} = 2cm.$ (i.e $8cm.$)
Proof by Pythagoras Theorem:

Construction:

Join $\overline{OA}$ and $\overline{OB}$ to make two right angled ΔOAP and OAB.

In ΔOAP

$$(AP)^2 + (AO)^2 = (OP)^2$$

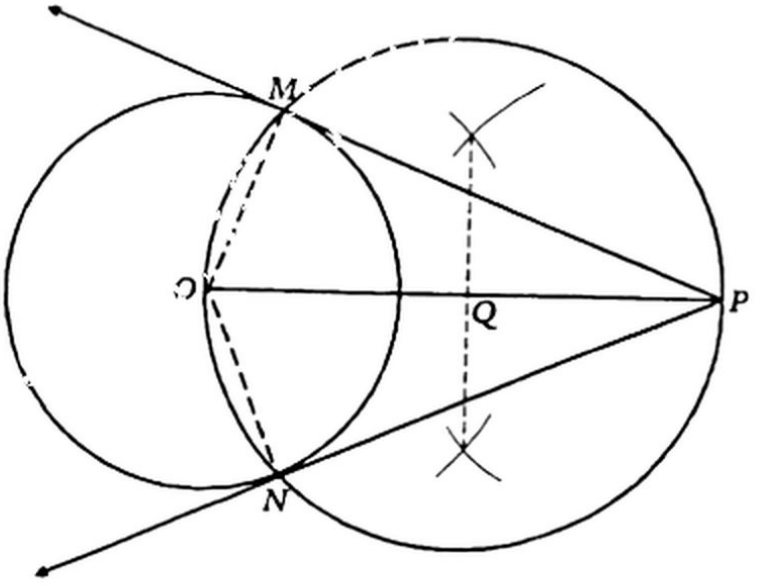
or $(AP)^2 = (OP)^2 - (AO)^2$

or $(AP)^2 = (10)^2 - (6)^2$

or $(AP)^2 = 100 - 36$

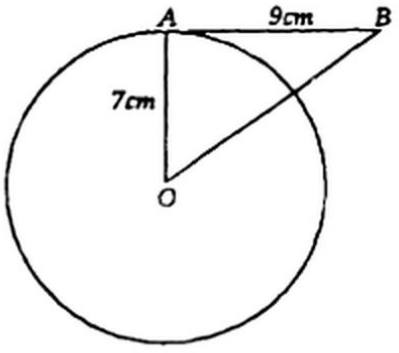
or $(AP)^2 = 64$

Similarly, we can prove that $\overline{PB} = 8cm$



Q.14 The radius of a circle is 7cm, and the tangent segment from an exterior point is 9cm long. How far is the point from the centre of the circle?

Solution:



Given: $\overline{OA} = 7cm$

$\overline{PA} = 9cm$

$\overline{PO} = ?$

According to Pythogoras Theorem:

$(OP)^2 = (OA)^2 + (AP)^2$

or $(OP)^2 = (7)^2 + (9)^2$

or $(OP)^2 = 49 + 81$

or $(OP)^2 = 130$

or $OP = \sqrt{130}$

$OP = 11.4cm$

Point P is at a distance of $11.4cm$ from the centre of the circle.

EXERCISE 11.10

Q.1 ***A circle is of 6cm, radius. Find the length of a 60° arc of the circle and also the area of the sector of the same angle.***

Solution:

$\angle x = 60^\circ$

$r = 6cm$

(i) Length of the arc

$= 2\pi r \times \frac{x}{360}$

or $2 \times \frac{22}{7} \times 6 \times \frac{60}{360}$

or $\frac{44}{7} cm$

or $6.28cm$ or $6.3cm$. ***Ans***

(ii) Area of the sector.

$= \pi r^2 \times \frac{x}{360}$

$\frac{22}{7} \times 6 \times 6 \times \frac{60}{160}$

or $\frac{132}{7}$

or 18.15 sqcm. ***Ans***

Q.2 ***The radius of a circular garden is 8 decameter. Find the area and perimeter of its 60° sector.***

Solution:

$\angle x = 60^\circ$

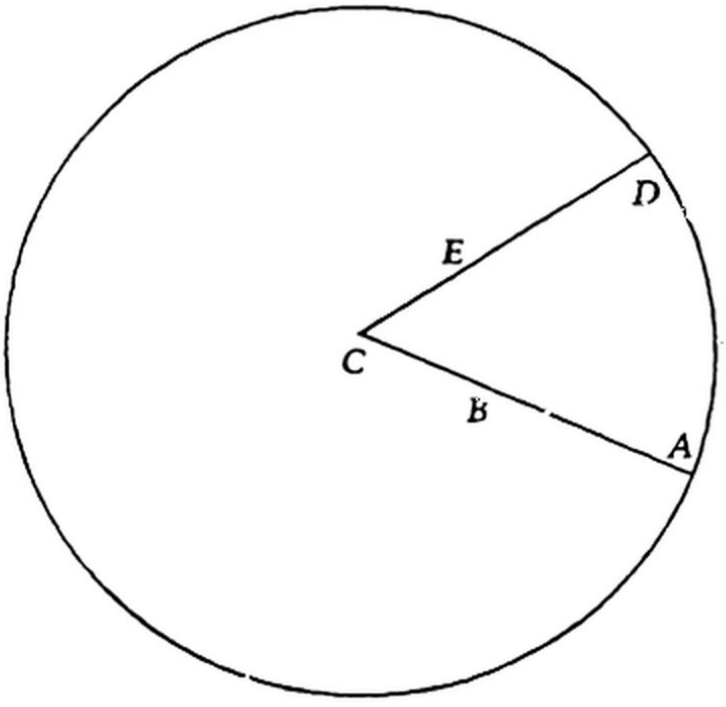
$r = 8$ decameter

(i) Area of the sector

$$\pi r^2 \times \frac{x}{360}$$

or $$\frac{22}{7} \times 8 \times 8 \times \frac{60}{360} = \frac{704}{21}$$

$$= 33.5 \text{ decameter. } \textit{Ans}$$



(ii) Length of the arc of $60°$

$$= 2\pi r \times \frac{x}{360}$$

or $$2 \times \frac{22}{7} \times 8 \times \frac{60}{360}$$

$$\frac{176}{21} = 8.838$$

Parameter $$\overline{OA} + \overline{OB} + \overline{AB}$$

or $$8 + 8 + 8.38$$

or $$24.38$$

or 24.4 decameter. ***Ans***

Q.3 ***The area of a sector for a circle is 10m radi is 40π. Find the measure of the angle of the sector and the length of the corresponding arc.***

Solution:

(i) Area of the sector

$$= \pi r^2 \times \frac{x}{360}$$

$$40\pi \times \frac{22}{7} \times 10 \times 10 \times \frac{x}{360}$$

$$40 \times \frac{22}{7} = \frac{55x}{63}$$

$$\frac{880}{7} = \frac{55x}{63}$$

$$385x = 63 \times 880$$

$$x = \frac{63 \times 880}{385} = 144^\circ \quad \textbf{Ans}$$

(ii) Length of the arc

$$= 2\pi r \times \frac{x}{360}$$

or $$2 \times \frac{22}{7} \times 10 \times \frac{144}{360} = \frac{176}{7}$$

or $25.14m$ **Ans**

Q.4 ***Find the area of 120° sector and the length of the corresponding arc of a circle of 9 m radius.***

Solution:

(i) Area of the sector

$$= \pi r^2 \times \frac{x}{360}$$

$$= \frac{22}{7} \times 9 \times 9 \times \frac{120}{360}$$

$$= \frac{594}{7} = 84.8 \text{ sq meter.} \quad \textbf{Ans}$$

(ii) Length of the arc

$$= 2\pi r \times \frac{x}{360}$$

$$= 2 \times \frac{22}{7} \times 9 \times \frac{120}{360}$$

$$= \frac{132}{7}$$

$= 18.85$ meter. ***Ans***

Q.5 ***The radius of each of two circular region is 12cm. and the distance between their centres is also 12cm. Find the areas of their union and intersection.***

$$m\angle CAD = 120^o$$

or $$x = 120^o$$

$$r = 12cm$$

Solution:

(i) Area of intersection

$$= \pi r^2 \times \frac{x}{360}$$

$$= \frac{22}{7} \times 12 \times 12 \times \frac{120}{360}$$

$$= \frac{1056}{7} = 150.85 \text{ sq. cm. } \textbf{Ans}$$

(ii) Area of union of circle.

= Area of B circle + Area of section $\overset{\frown}{CED}$.

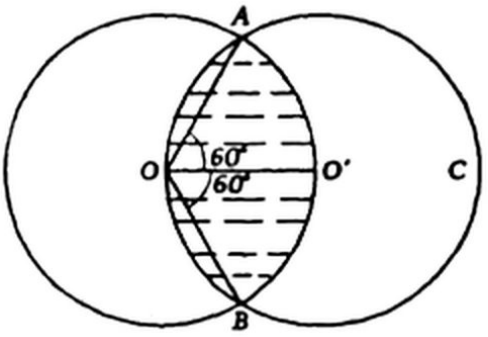
Now $x = 360 - 120 = 240^o$

$$= \pi r^2 \times \pi r^2 \times \frac{x}{360}$$

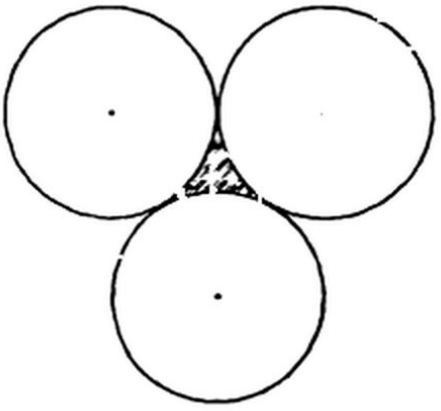
$$\pi r^2 + \pi r^2 \times \frac{240}{360}$$

$$\frac{22}{7} \times 12 \times 12 + \frac{22}{7} \times 12 \times 12 \times \frac{240}{360}$$

$= \frac{2112}{7} + \frac{3168}{7} = \frac{5280}{7}$ 754.28sq.cm. **Ans**



Q.8 ***The radius of each circle in the adjoining figure is 3cm. Find the area of the shaded region.***



Solution:

The area of the required region.

= Area of ΔABC − Area of 3 section

$= \frac{\sqrt{3}}{4} \times 6^2 - \left(\pi r^2 \times \frac{60}{360}\right)$

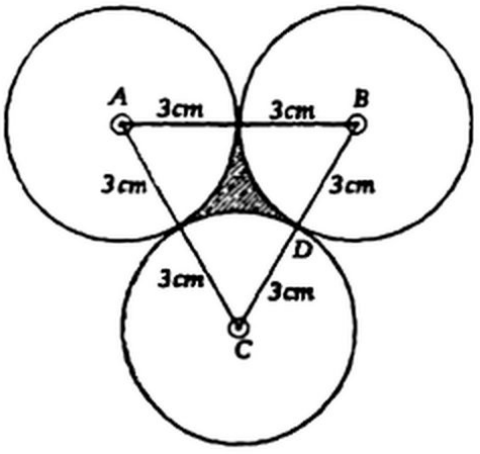
$= 9\sqrt{3} - 3\left(\frac{22}{7} \times 9 \times \frac{60}{360}\right)$

$= 9\sqrt{3} - 3(\pi\, 3/2)$

$= 9\sqrt{3} - 9/2\pi$

$= 9(\sqrt{3} - \pi/2)$. **Ans**

Q.6 ***The radius of each circle of the adjoining figure is 4cm. Find the area of the shaded region.***



Solution:

ThE area of the required regior.

= Area of the square $ABCD$ – Area of 4 sections

$= 8^2 - 4\left(\pi r^2 \frac{x}{360}\right)$

$= 8^2 - 4\left(\pi \times 16 \times \frac{90}{360}\right)$

$= 8^2 - 3(4\pi)$

$= 8^2 - 16x$

$= (64 - 16x)$ sq.cm. **Ans**

Q.7 ***The radius of each circle of the adjoining figure is 4cm. Find the area of the shaded region.***

Solution:

The area of the required region

= Area of square $ABCD$ - Area of 4 sections.

$$= 8^2 - 4\left(\pi r^2 \frac{x}{360}\right)$$

$$= 8^2 - 4\left(\pi \times 16 \times \frac{90}{360}\right)$$

$$= 8^2 - 4(4\pi)$$

$$= 8^2 - 16\pi$$

$$= (64 - 16\pi) \text{ sq. cm. } \textbf{Ans}$$

