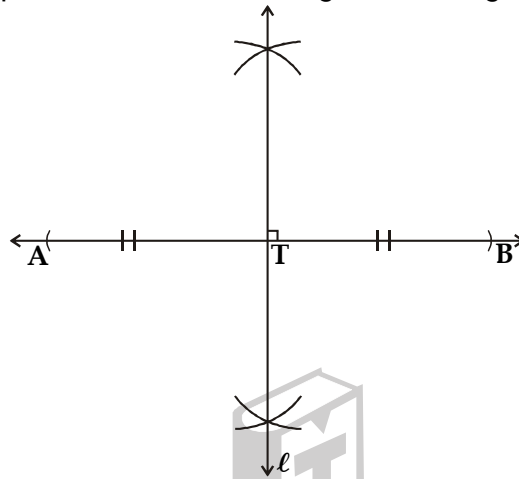


3. Geometric Constructions

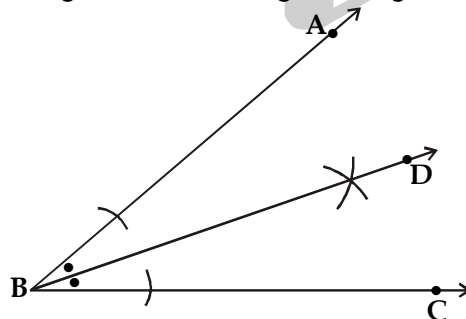
Construction of various geometrical figures is a very important part of the study of geometry for understanding the concepts learnt in theoretical geometry.

BASIC CONSTRUCTIONS

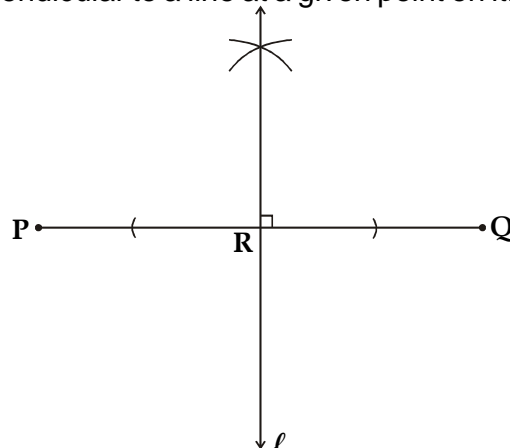
- (i) To draw a perpendicular bisector of a given line segment.



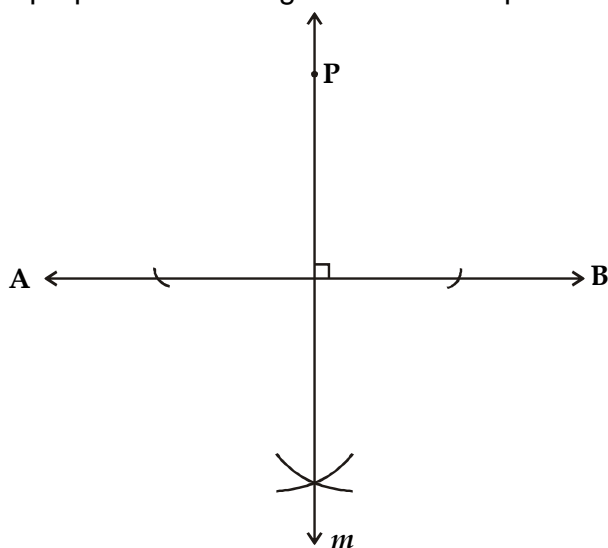
- (ii) To draw an angle bisector of a given angle.



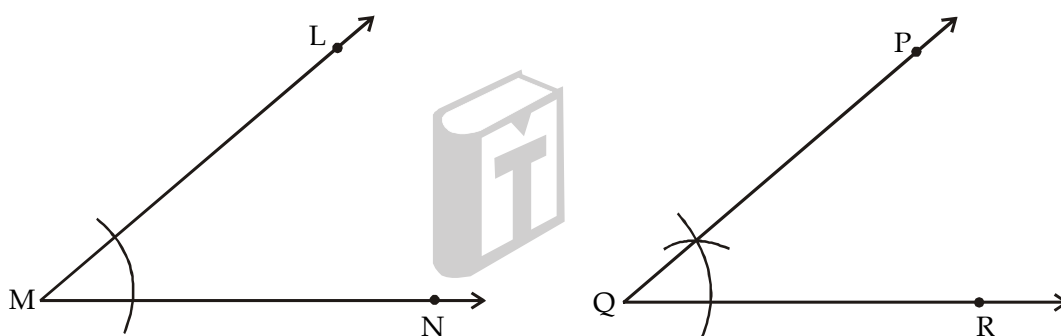
- (iii) To draw a perpendicular to a line at a given point on it.



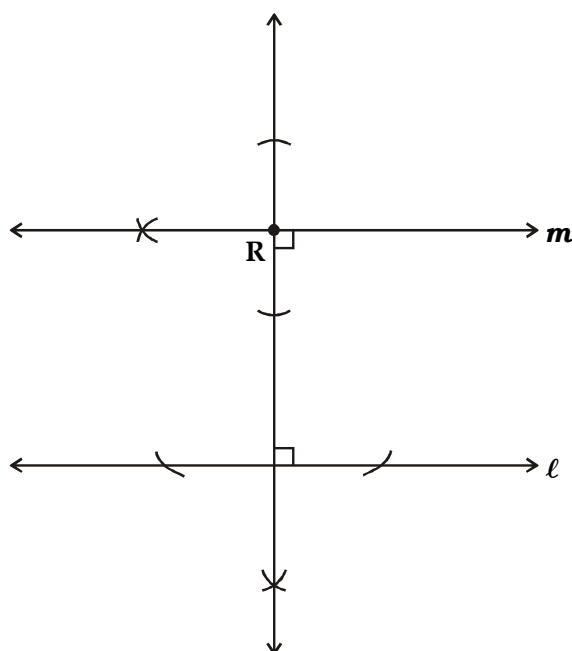
(iv) To draw a perpendicular to a given line from a point outside it.



(v) To draw an angle congruent to a given angle.

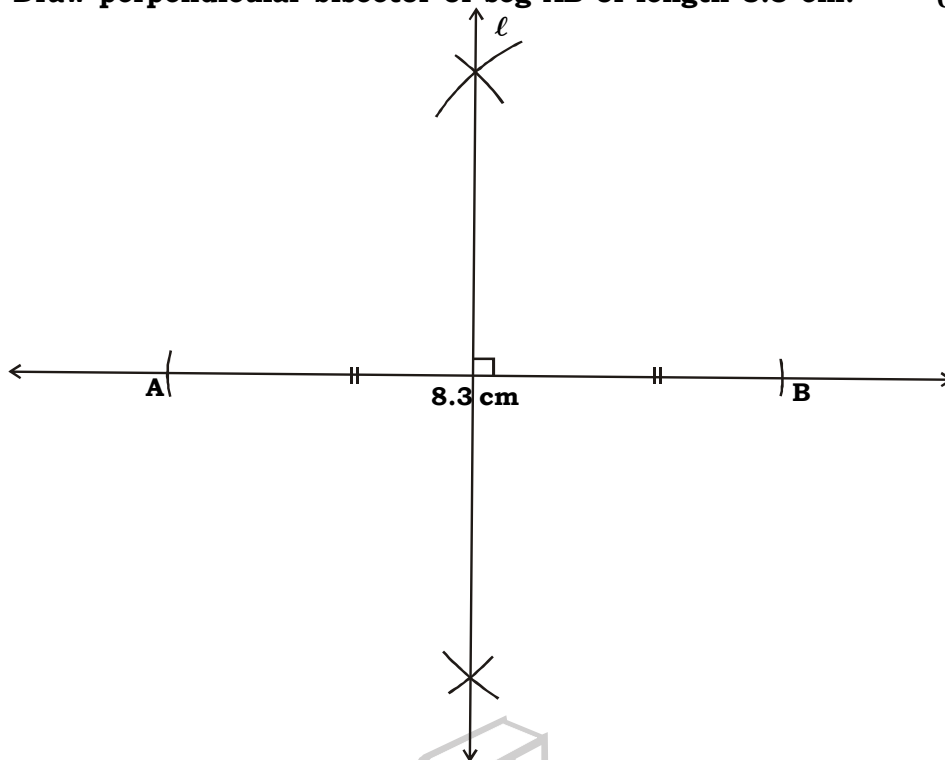


(vi) To draw a line parallel to a given line through a point outside it.



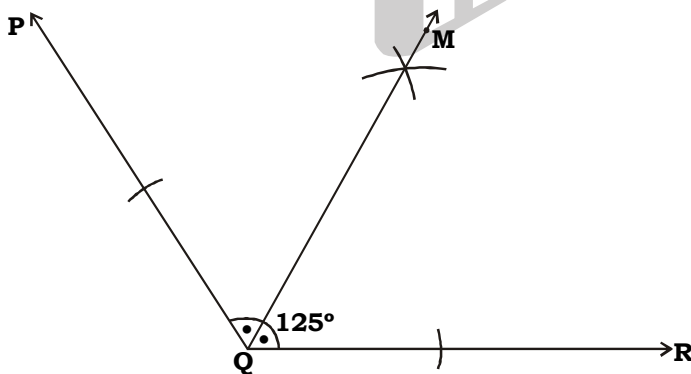
PROBLEM SET - 3 (TEXT BOOK PAGE NO. 196)

1. Draw perpendicular bisector of seg AB of length 8.3 cm. (2 marks)



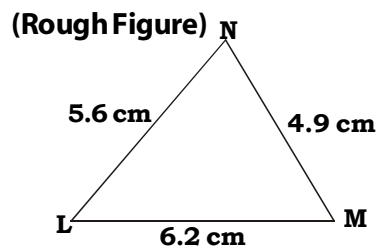
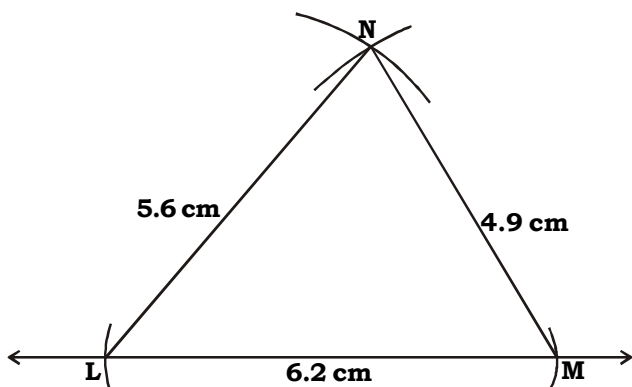
PROBLEM SET - 3 (TEXT BOOK PAGE NO. 196)

2. Draw an angle of 125° and bisect it. (2 marks)



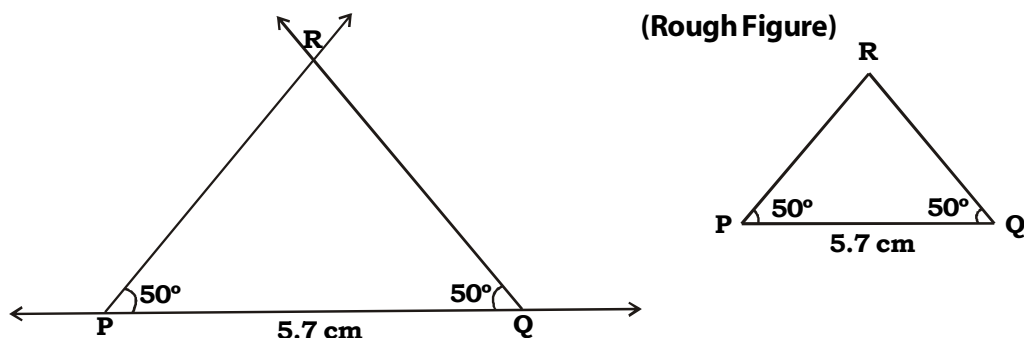
PROBLEM SET - 3 (TEXT BOOK PAGE NO. 196)

3. Construct $\triangle LMN$, such that $LM = 6.2$ cm, $MN = 4.9$ cm, $LN = 5.6$ cm. (2 marks)



PROBLEM SET - 3 (TEXT BOOK PAGE NO. 196)

4. Construct $\triangle PQR$ such that $PQ = 5.7$ cm, $\angle P = \angle Q = 50^\circ$. (2 marks)



PROBLEM SET - 3 (TEXT BOOK PAGE NO. 196)

5. Construct $\triangle DEF$ such that, $DE = 6.5$ cm, $\angle E = 50^\circ$, $\angle F = 30^\circ$; and draw $EM \perp DF$, measure the length EM . (3 marks)

Analysis :

In $\triangle DEF$,

$$m \angle D + m \angle E + m \angle F = 180^\circ$$

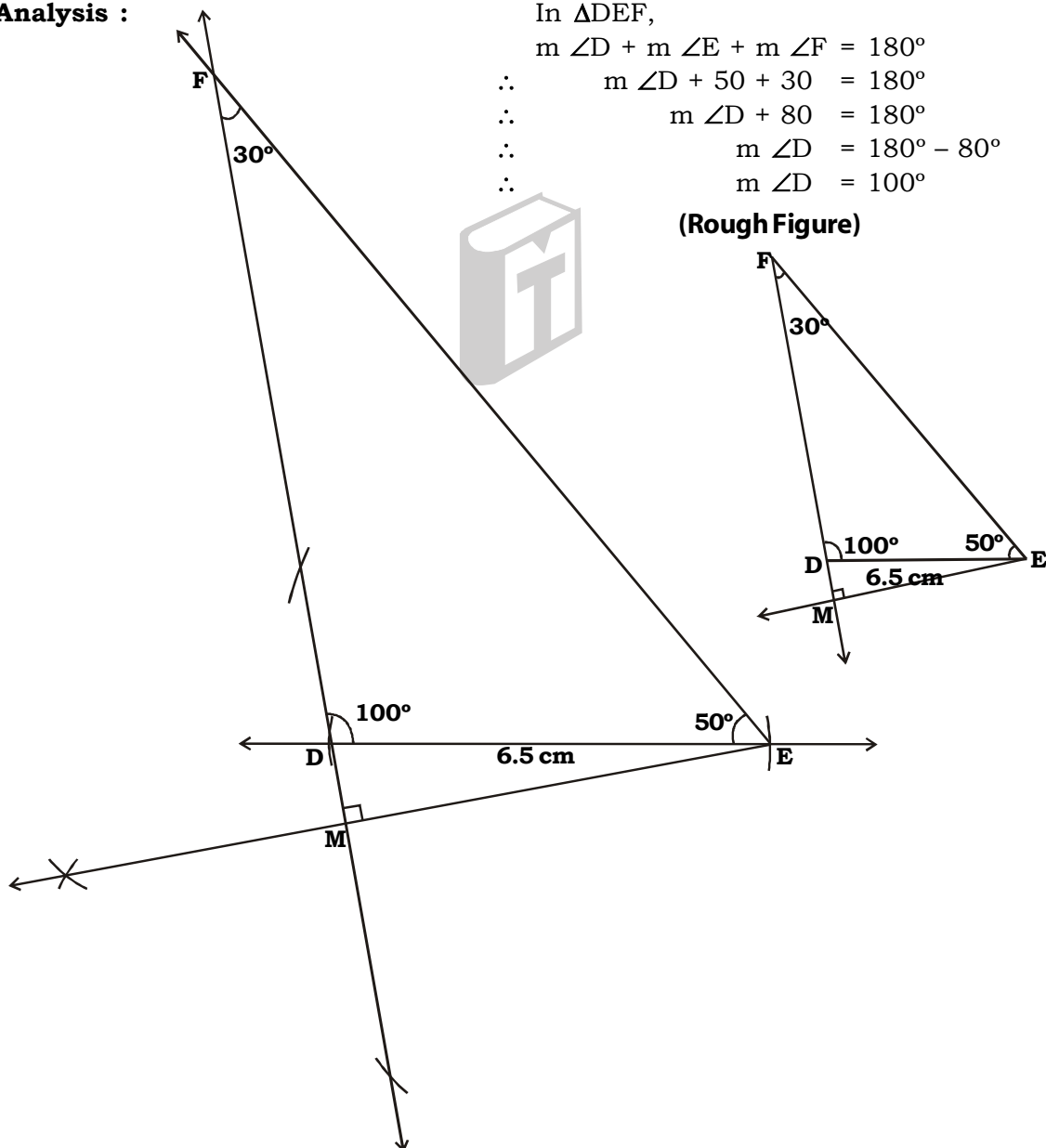
$$\therefore m \angle D + 50 + 30 = 180^\circ$$

$$\therefore m \angle D + 80 = 180^\circ$$

$$\therefore m \angle D = 180^\circ - 80^\circ$$

$$\therefore m \angle D = 100^\circ$$

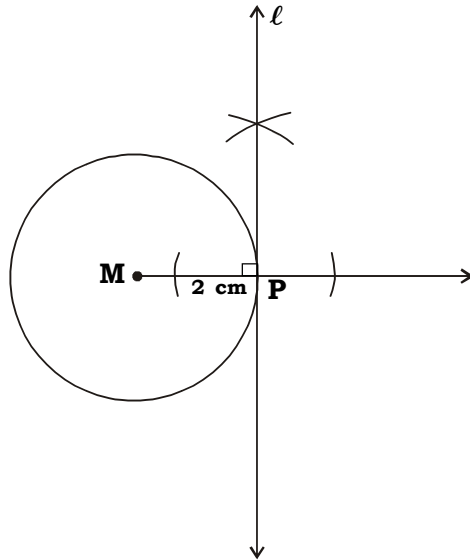
(Rough Figure)



TYPE : 1

[A] Constructing tangents to a circle from a point on the circle.

Example : Draw a tangent to a circle of radius 2 cm at a point on it.

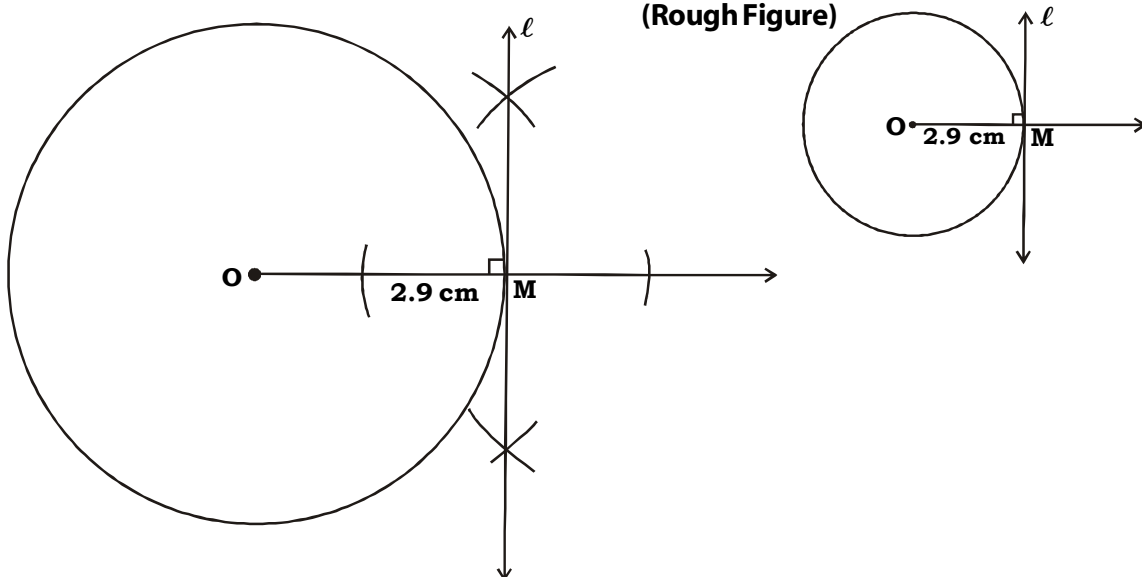


Steps of construction :

1. Draw a circle with radius 2 cm. Let 'M' be the centre of the circle.
2. Take any point 'P' on the circle
3. Draw ray MP.
4. Draw the line ' l ' perpendicular to the ray MP at point 'P'. Line ' l ' is the required tangent to the circle.

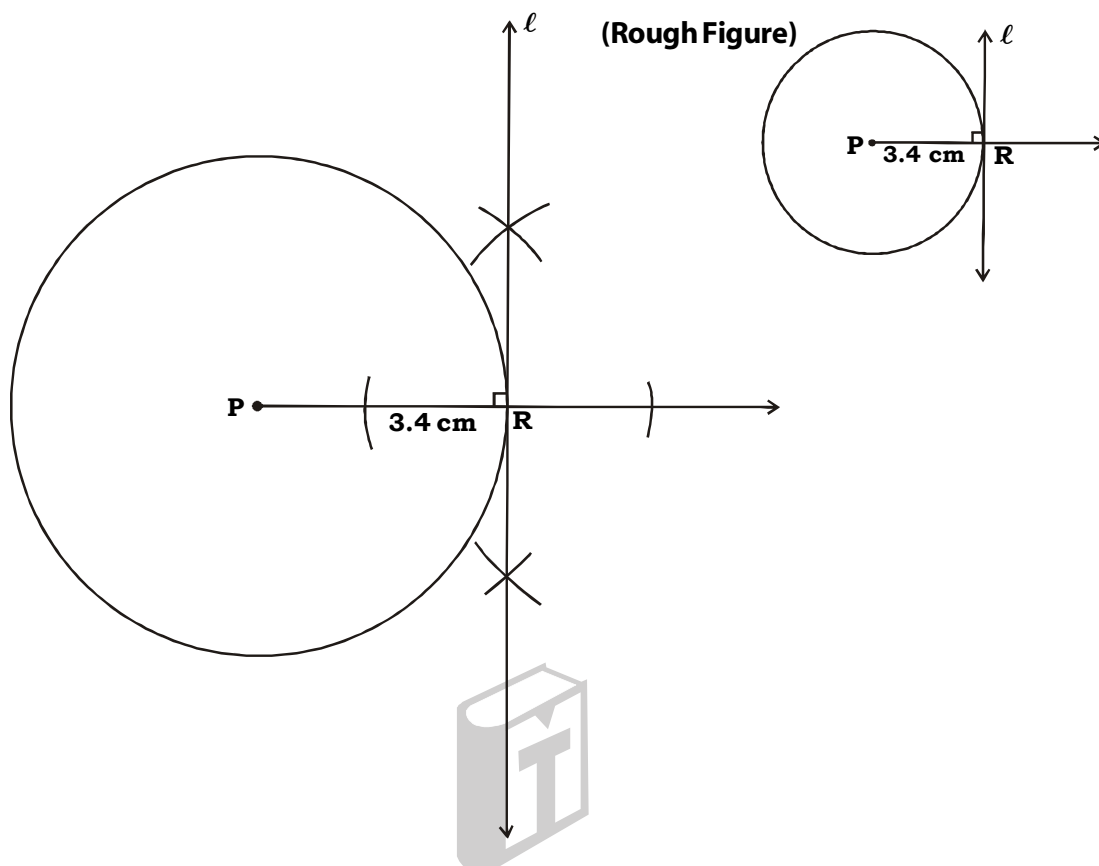
EXERCISE - 3.2 (TEXT BOOK PAGE NO. 93)

1. Draw a tangent at any point 'M' on the circle of radius 2.9 cm and centre 'O'. (2 marks)



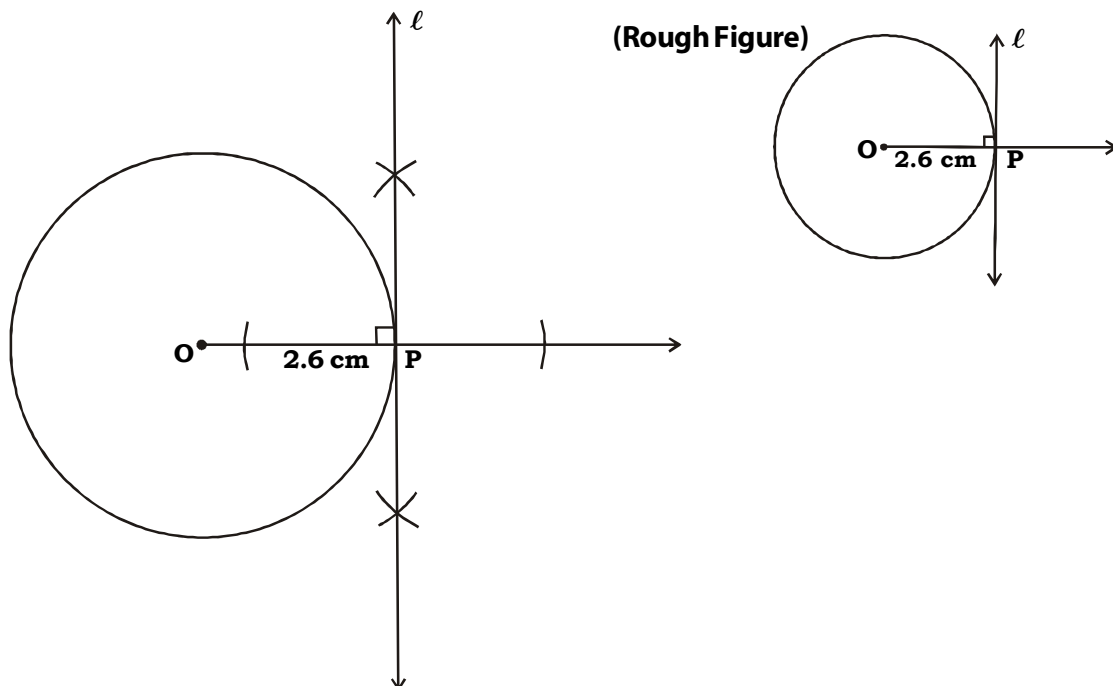
EXERCISE - 3.2 (TEXT BOOK PAGE NO. 93)

2. Draw a tangent at any point R on the circle of radius 3.4 cm and centre 'P'. (2 marks)



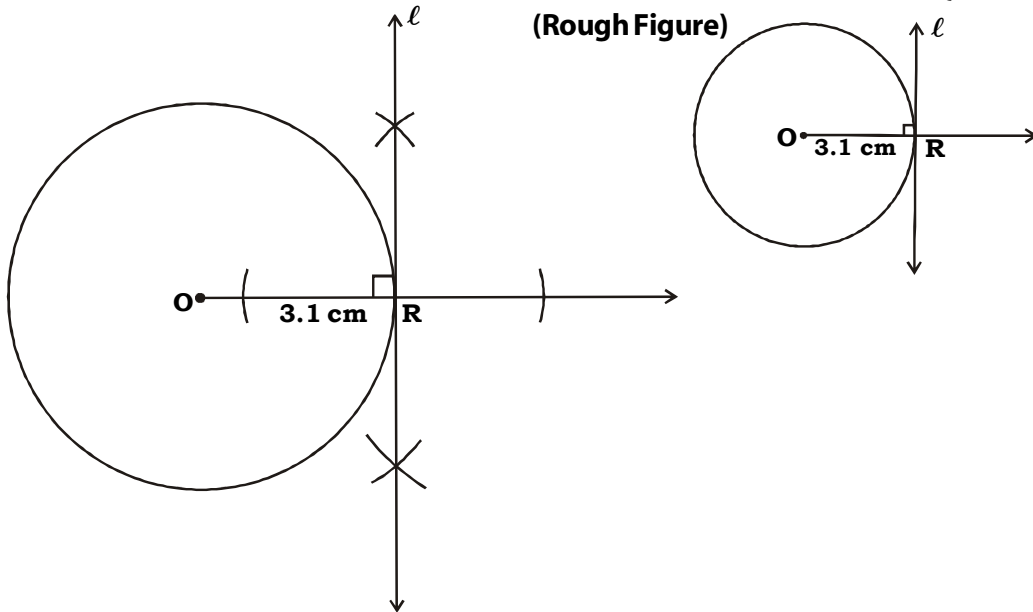
EXERCISE - 3.2 (TEXT BOOK PAGE NO. 93)

3. Draw a circle of radius 2.6 cm. Draw tangent to the circle from any point on the circle using centre of the circle. (2 marks)



PROBLEM SET - 3 (TEXT BOOK PAGE NO. 197)

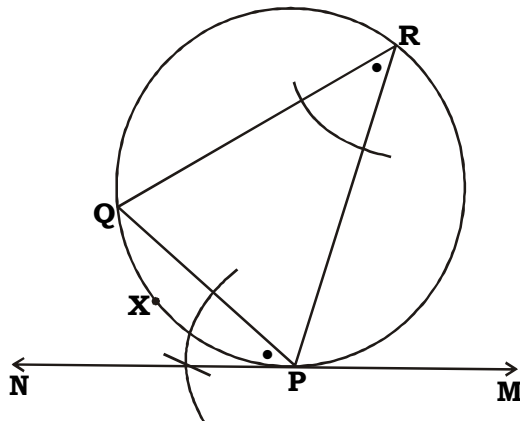
12. Draw a tangent to a circle of a radius 3.1 cm and centre O at any point 'R' on the circle. (2 marks)



TYPE : 1

[B] Constructing tangents to a circle from a point on the circle without using centre.

Example : Given a circle, with a point P on it. Draw a tangent to the circle without using its centre.

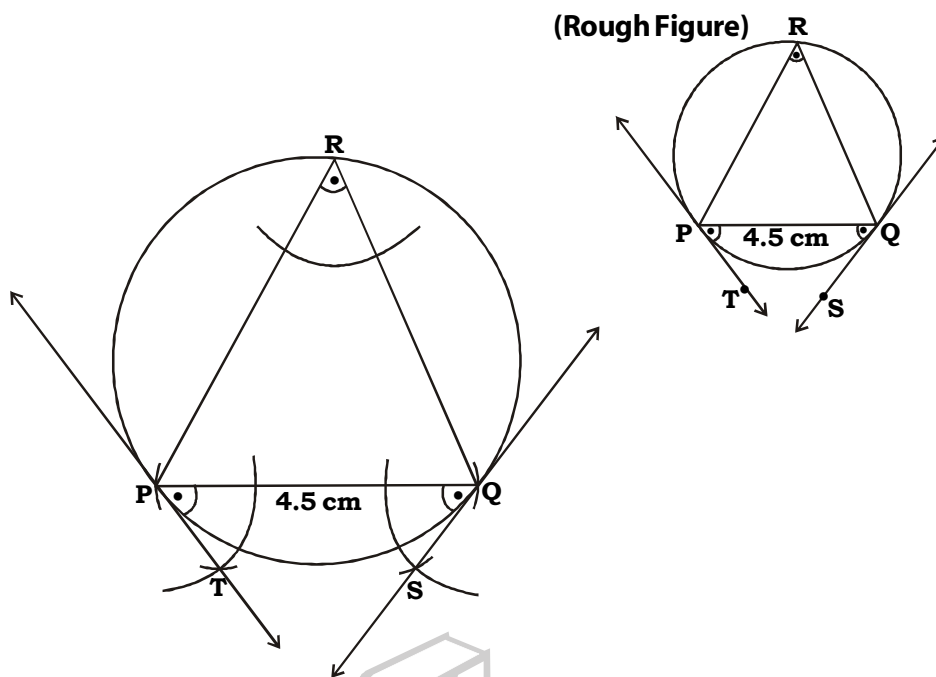


Steps of construction :

1. Draw the required circle.
2. Take any point 'P' on it.
3. Draw chord PQ.
4. Take any point 'R' on the alternate arc of arc PXQ other points than P and Q.
5. Join QR and RP.
6. Draw a ray PN making an angle congruent to $\angle QRP$, taking QP as one side and point P as vertex.
7. The line containing ray PN is the required tangent.

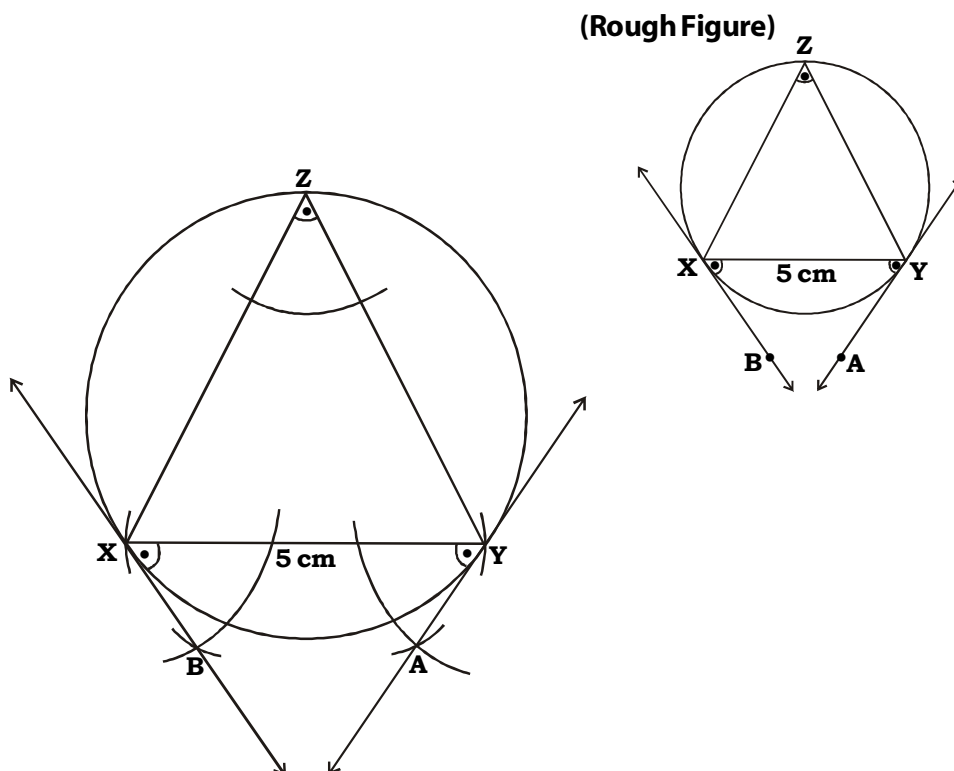
EXERCISE - 3.2 (TEXT BOOK PAGE NO. 93)

6. Draw a circle of radius 2.7 cm and draw chord PQ of length 4.5 cm. Draw tangents at P and Q without using centre. (3 marks)



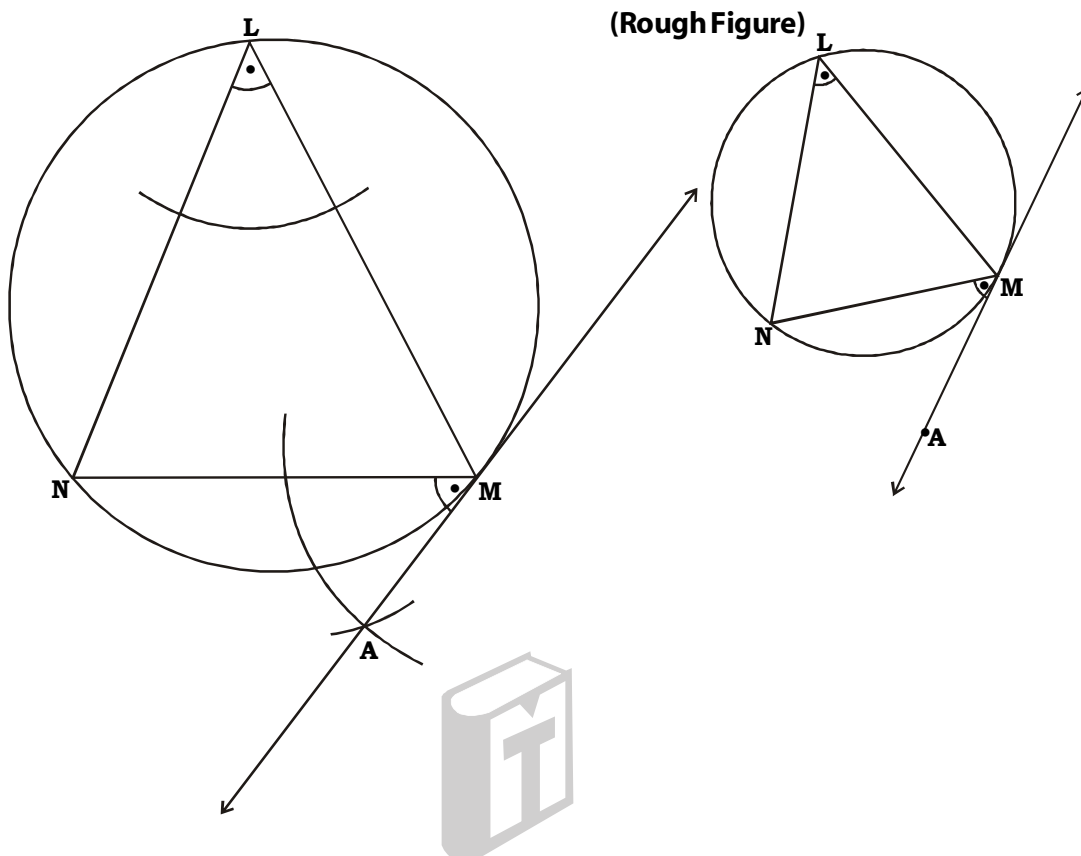
EXERCISE - 3.2 (TEXT BOOK PAGE NO. 93)

7. Draw a circle having radius 3 cm draw a chord XY = 5 cm. Draw tangents at point X and Y without using centre. (3 marks)



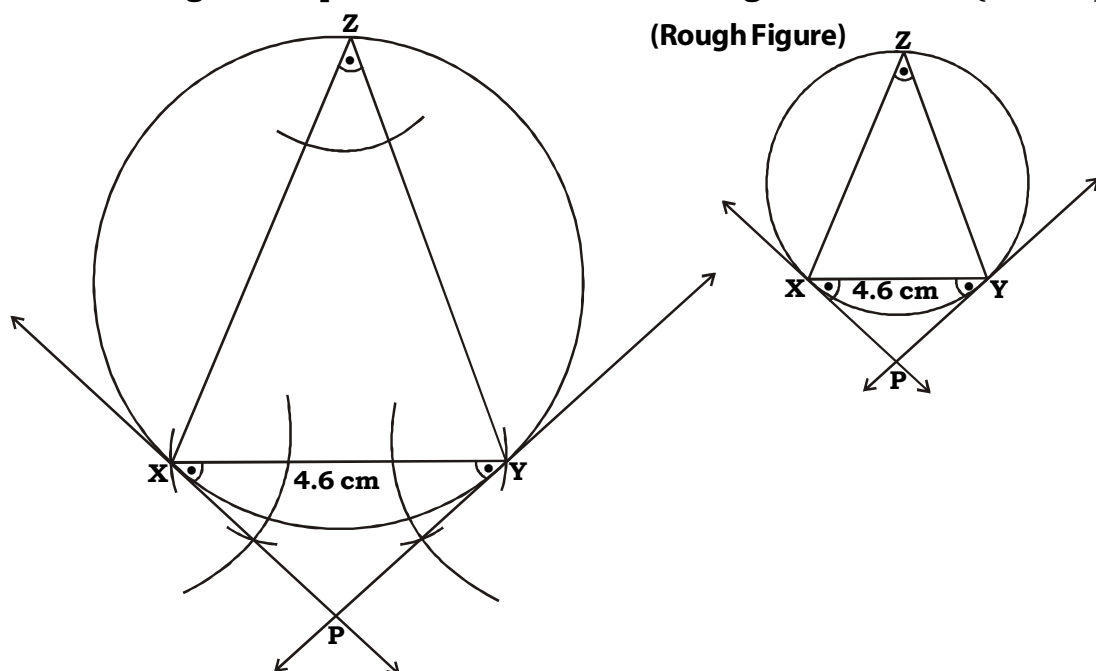
PROBLEM SET - 3 (TEXT BOOK PAGE NO. 197)

13. Draw a circle of radius 3.6 cm, take a point M on it. Draw a tangent to the circle at M without using centre of the circle. (2 marks)



PROBLEM SET - 3 (TEXT BOOK PAGE NO. 197)

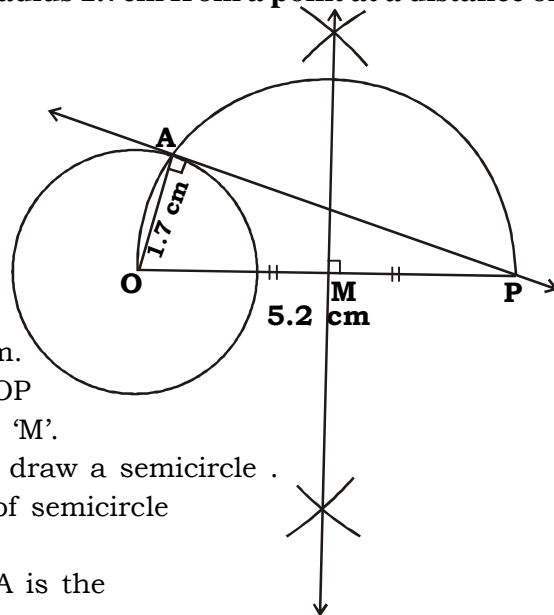
14. Draw a circle of suitable radius and draw a chord XY of length 4.6 cm. Draw tangents at points X and Y without using centre. (3 marks)



TYPE : 2

[A] Constructing tangents to a circle from a point outside the circle.

Example : Draw a tangent to the circle of radius 1.7cm from a point at a distance of 5.2 cm from the centre.



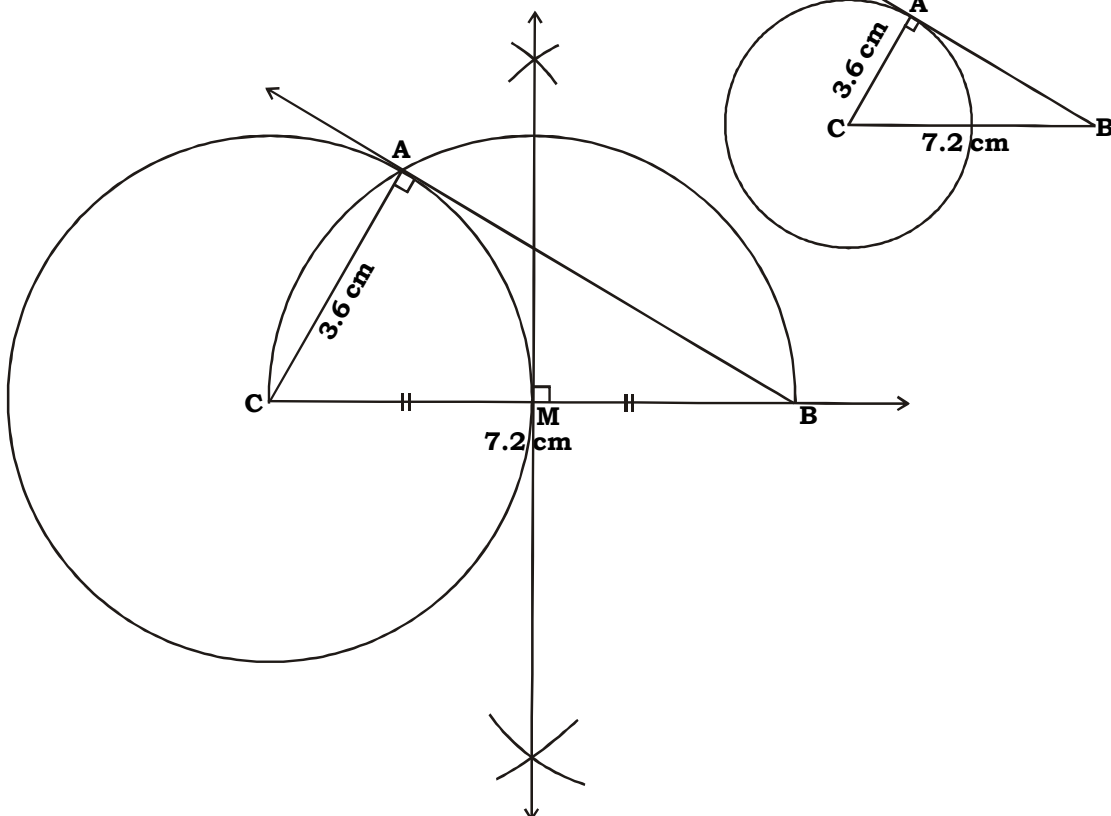
Steps of construction :

1. Draw a circle with radius 1.7 cm. Let O be the centre of the circle.
2. Take a point P such that $OP = 5.2\text{cm}$.
3. Draw perpendicular bisector of seg OP and mark the midpoint of seg OP as 'M'.
4. With 'M' as a centre and radius MP draw a semicircle .
5. Let 'A' be the point of intersection of semicircle and the circle.
6. Draw a line joining P and A. Line PA is the required tangent.

EXERCISE - 3.2 (TEXT BOOK PAGE NO. 93)

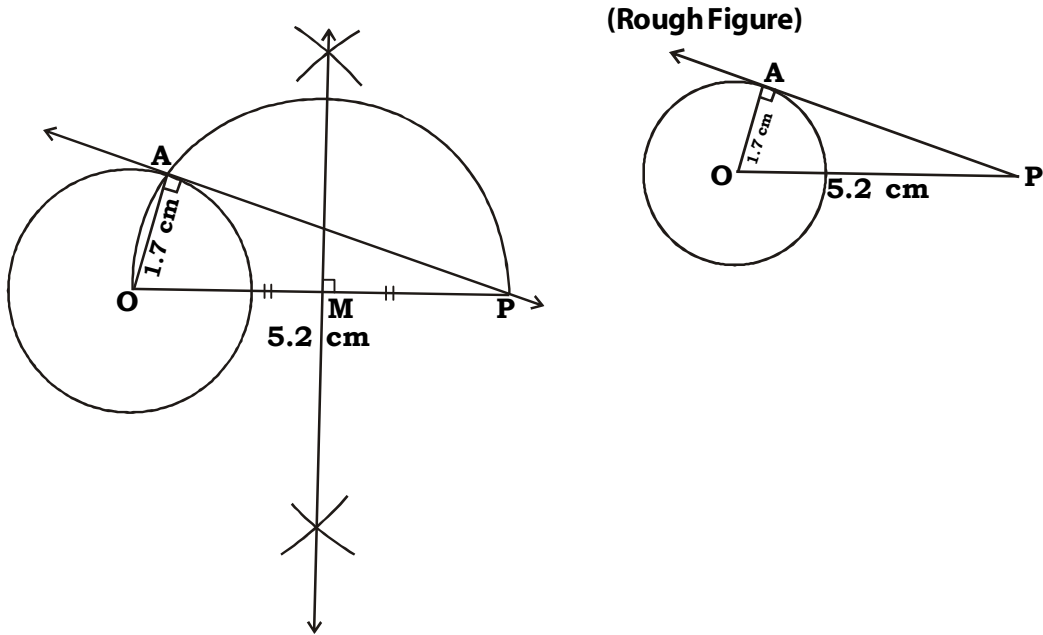
8. Draw a tangent to the circle from the point B, having radius 3.6 cm and centre 'C'. Point B is at a distance 7.2 cm from the centre. (3 marks)

(Rough Figure)



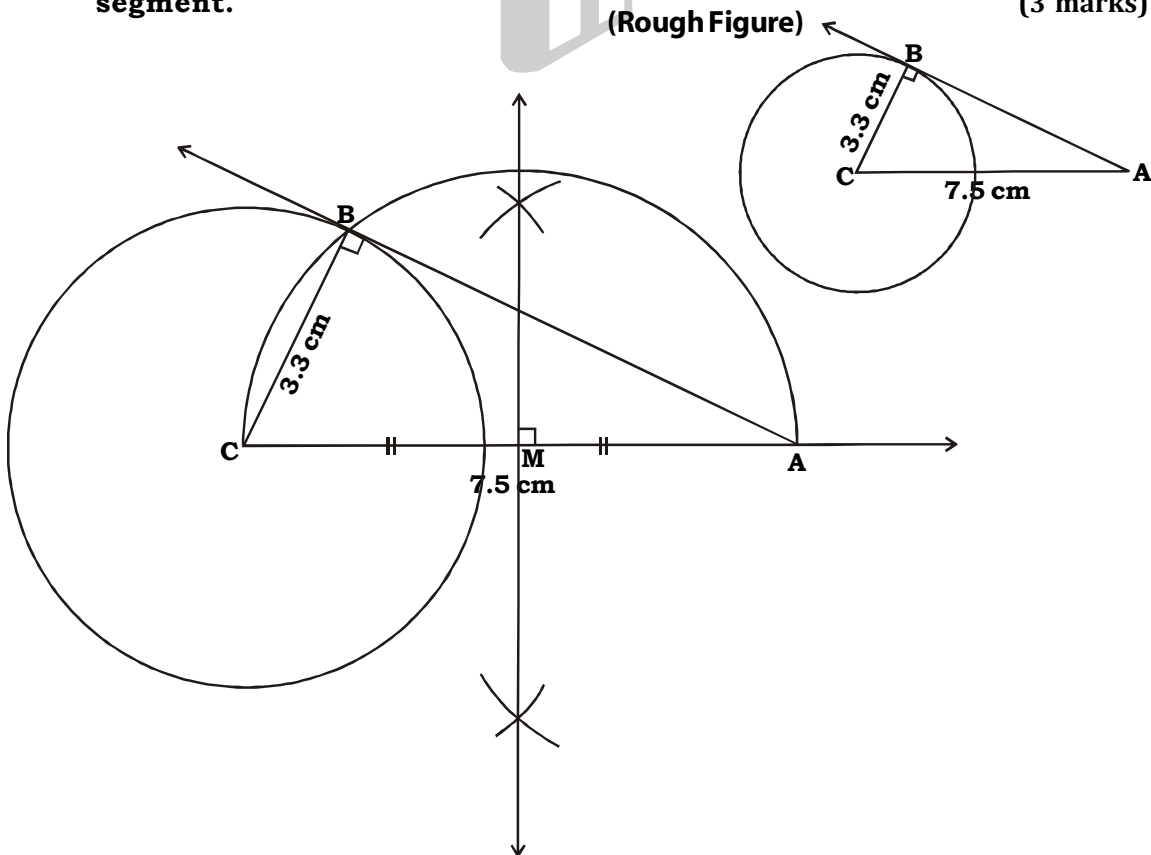
EXERCISE - 3.2 (TEXT BOOK PAGE NO. 93)

9. Draw a tangent to the circle from the point L with radius 2.8 cm. Point 'L' is at a distance 5 cm from the centre 'M'. (3 marks)



EXERCISE - 3.2 (TEXT BOOK PAGE NO. 93)

10. Draw a tangent to the circle with centre O and radius 3.3 cm from a point A such that $d(O, A) = 7.5$ cm. Measure the length of tangent segment. (3 marks)

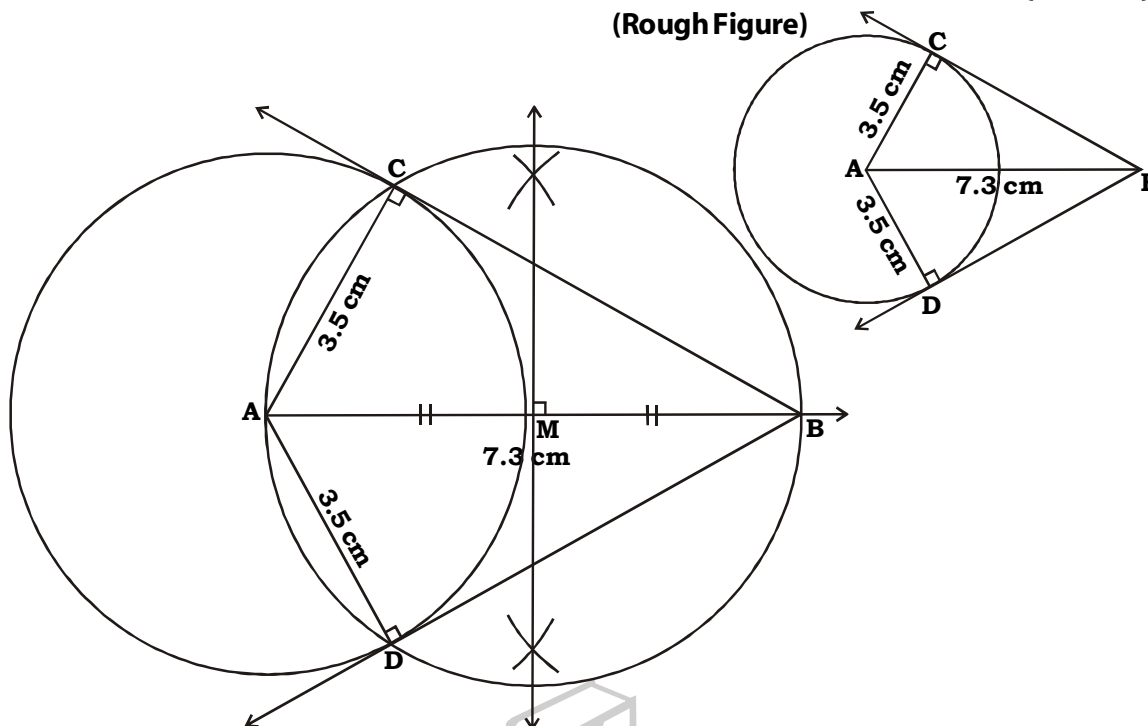


The length of tangent segment AB is 6.7 cm.

PROBLEM SET - 3 (TEXT BOOK PAGE NO. 197)

15. Construct tangents to the circle from point B with radius 3.5 cm and centre A. Point B is at a distance 7.3 cm from the centre. (3 marks)

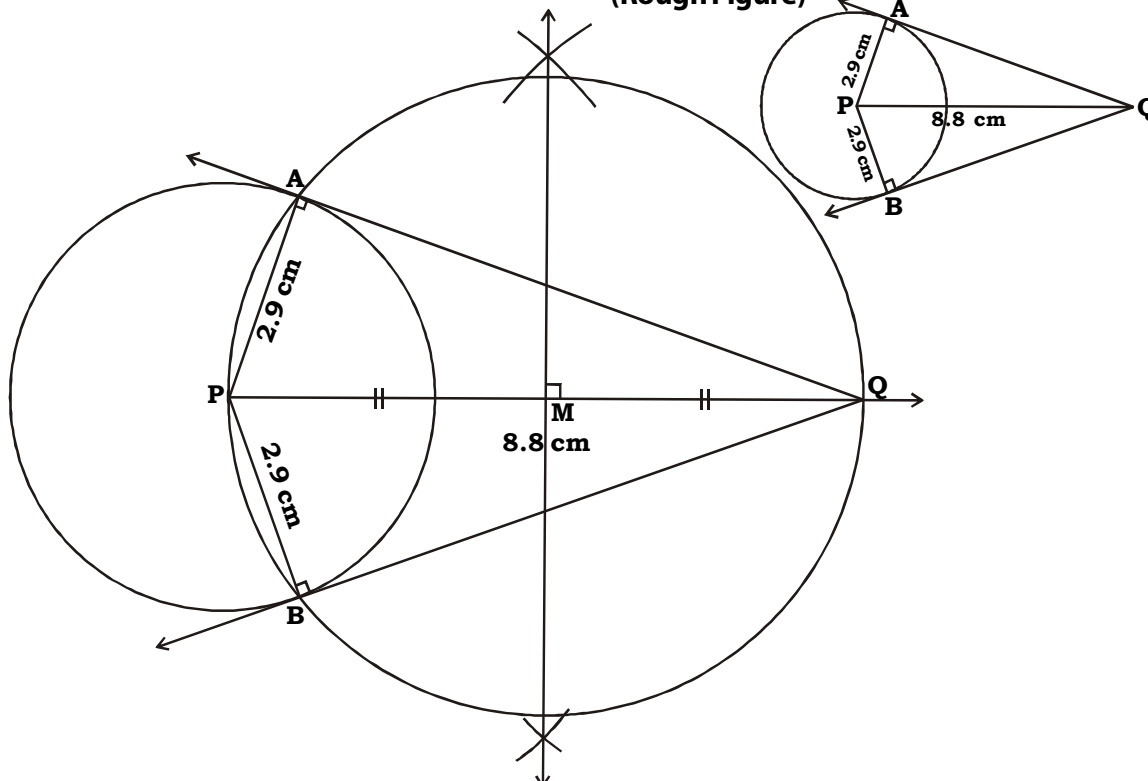
(Rough Figure)



PROBLEM SET - 3 (TEXT BOOK PAGE NO. 197)

16. Draw tangents to the circle with centre P and radius 2.9 cm. From a point Q which is at a distance 8.8 cm from the centre. (3 marks)

(Rough Figure)



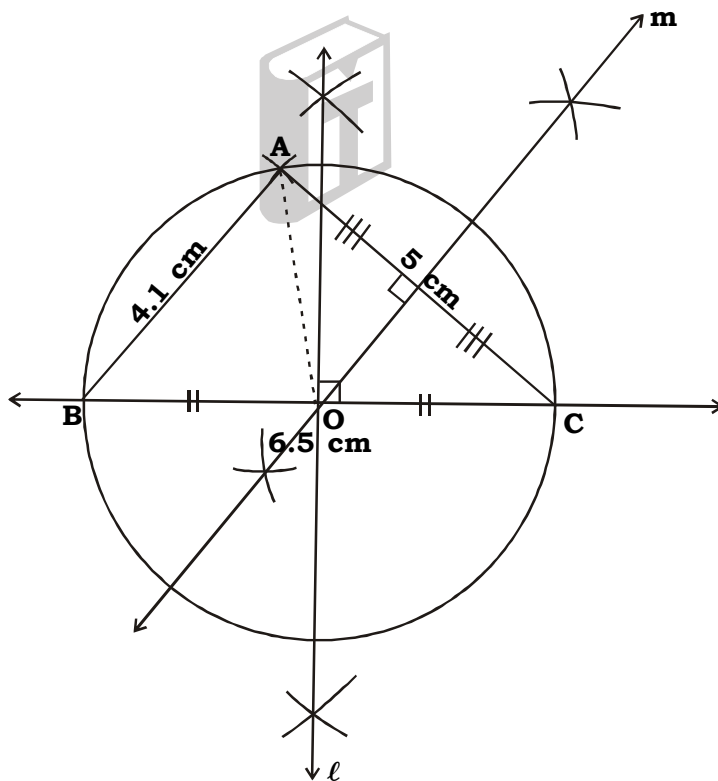
TYPE : 3**Constructing circumcircle of triangles**

1. A circle passing through the vertices of the triangle is called the circumcircle of a triangle.
2. Circumcentre can be obtained by drawing perpendicular bisectors of any two sides of a triangle.
3. The point of intersection of the perpendicular bisectors is called circumcentre and it is equidistant from the vertices of the triangle.

The position of circumcentre depends upon the type of a triangle.

- (i) **If the triangle is an obtuse angled triangle, the circumcentre lies outside the triangle.**
- (ii) **If the triangle is an acute angled triangle, the circumcentre lies inside the triangle.**
- (iii) **If the triangle is a right angled triangle, the circumcentre lies on the midpoint of the hypotenuse.**

Example : Draw $\triangle ABC$, with $AB = 4.1$ cm, $BC = 6.5$ cm and $AC = 5$ cm. Construct circumcircle of $\triangle ABC$. Measure the radius of the circle.

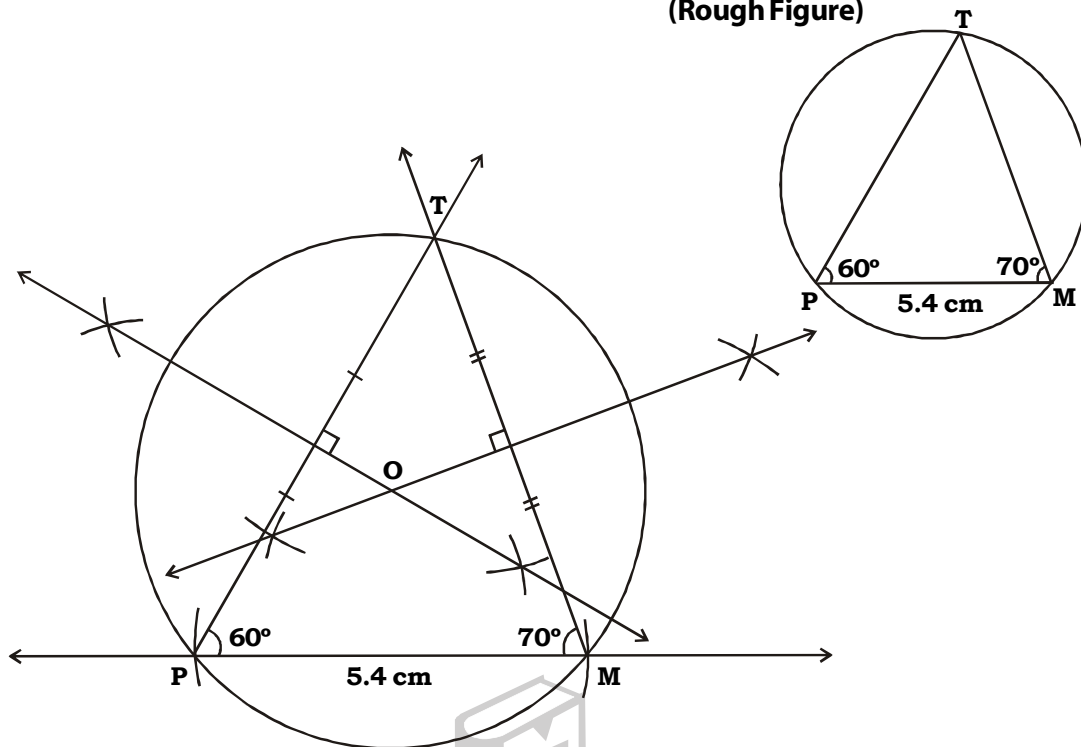
**Steps of construction :**

1. Construct $\triangle ABC$, with $AB = 4.1$ cm, $BC = 6.5$ cm and $AC = 5$ cm.
2. Draw perpendicular bisectors of any two sides of $\triangle ABC$ and let them intersect at point O.
3. Draw a circle with centre O and radius OA.
4. This circle is the circumcircle of $\triangle ABC$.

EXERCISE - 3.1 (TEXT BOOK PAGE NO. 84)

1. Draw the circumcircle of ΔPMT such that, $PM = 5.4$ cm, $\angle P = 60^\circ$, $\angle M = 70^\circ$. (3 marks)

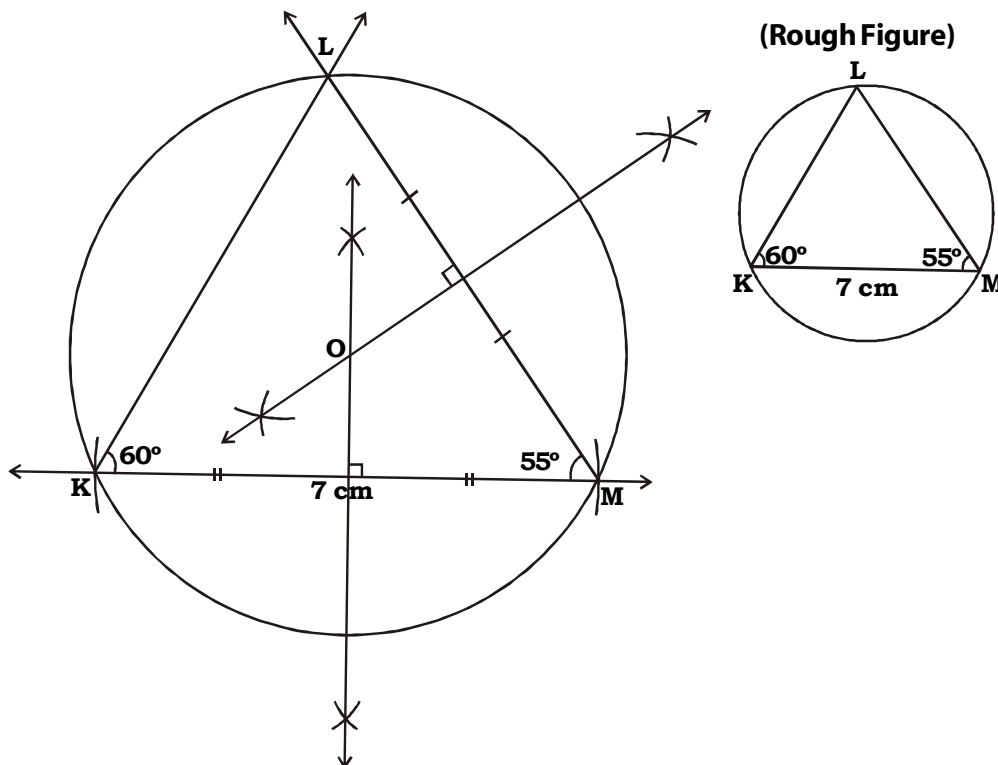
(Rough Figure)



EXERCISE - 3.1 (TEXT BOOK PAGE NO. 84)

3. Construct the circumcircle of ΔKLM in which $KM = 7$ cm, $\angle K = 60^\circ$, $\angle M = 55^\circ$. (3 marks)

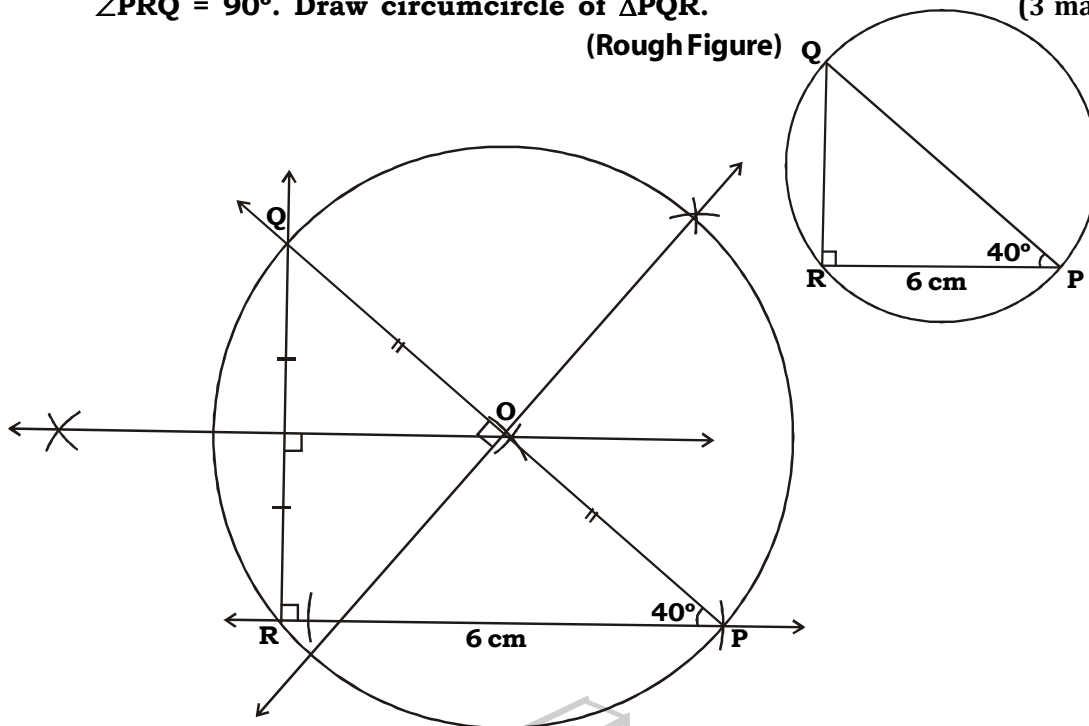
(Rough Figure)



EXERCISE - 3.1 (TEXT BOOK PAGE NO. 84)

4. Construct a right angled triangle ΔPQR where $PQ = 6$ cm, $\angle QPR = 40^\circ$, $\angle PRQ = 90^\circ$. Draw circumcircle of ΔPQR . (3 marks)

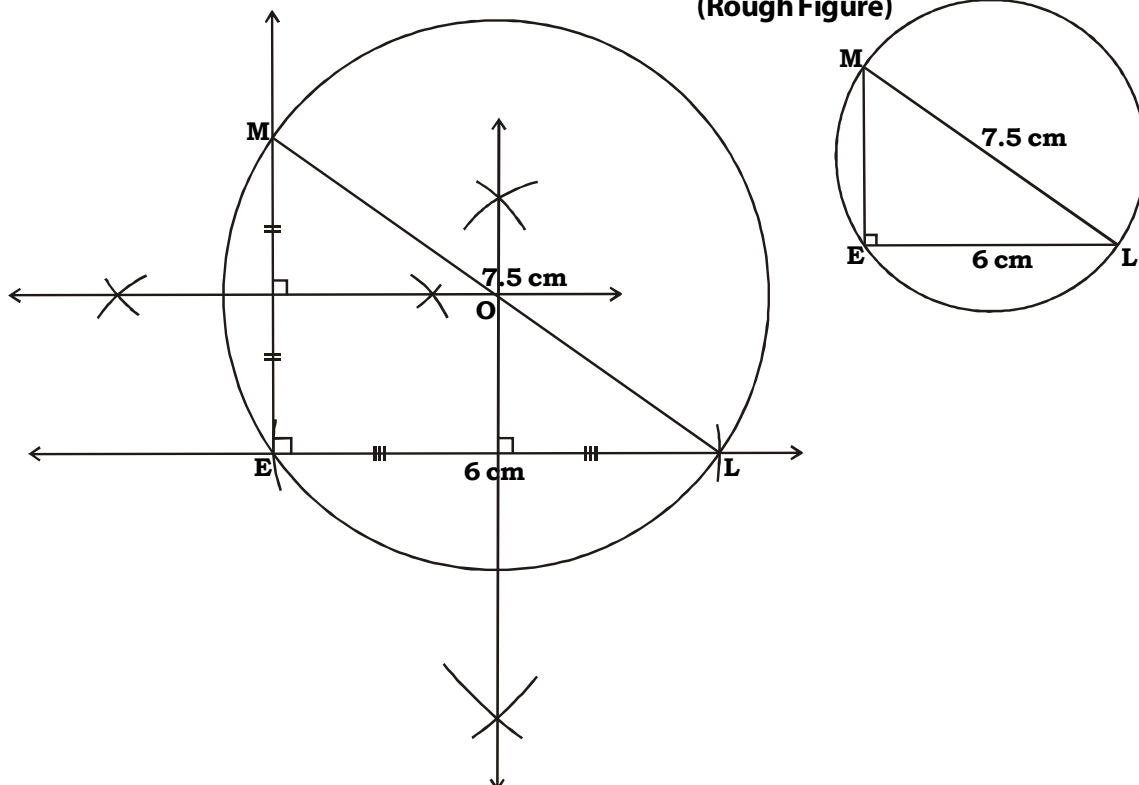
(Rough Figure)



PROBLEM SET - 3 (TEXT BOOK PAGE NO. 196)

6. Construct ΔLEM such that, $LE = 6$ cm, $LM = 7.5$ cm, $\angle LEM = 90^\circ$ and draw its circumcircle. (3 marks)

(Rough Figure)



PROBLEM SET - 3 (TEXT BOOK PAGE NO. 197)

26. In ΔPQR , $\angle Q = 90^\circ$, seg QM is the median. $PQ^2 + QR^2 = 169$. Draw a circumcircle of ΔPQR . (4 marks)

Analysis : $PQ^2 + QR^2 = 169$ (i) [Given]

But,

$PQ^2 + QR^2 = PR^2$ (ii) [By Pythagoras theorem]

$\therefore PR^2 = 169$

$\therefore PR = 13$

$PM = MR = \frac{1}{2} PR$ [By definition of median]

$= \frac{1}{2} \times 13$

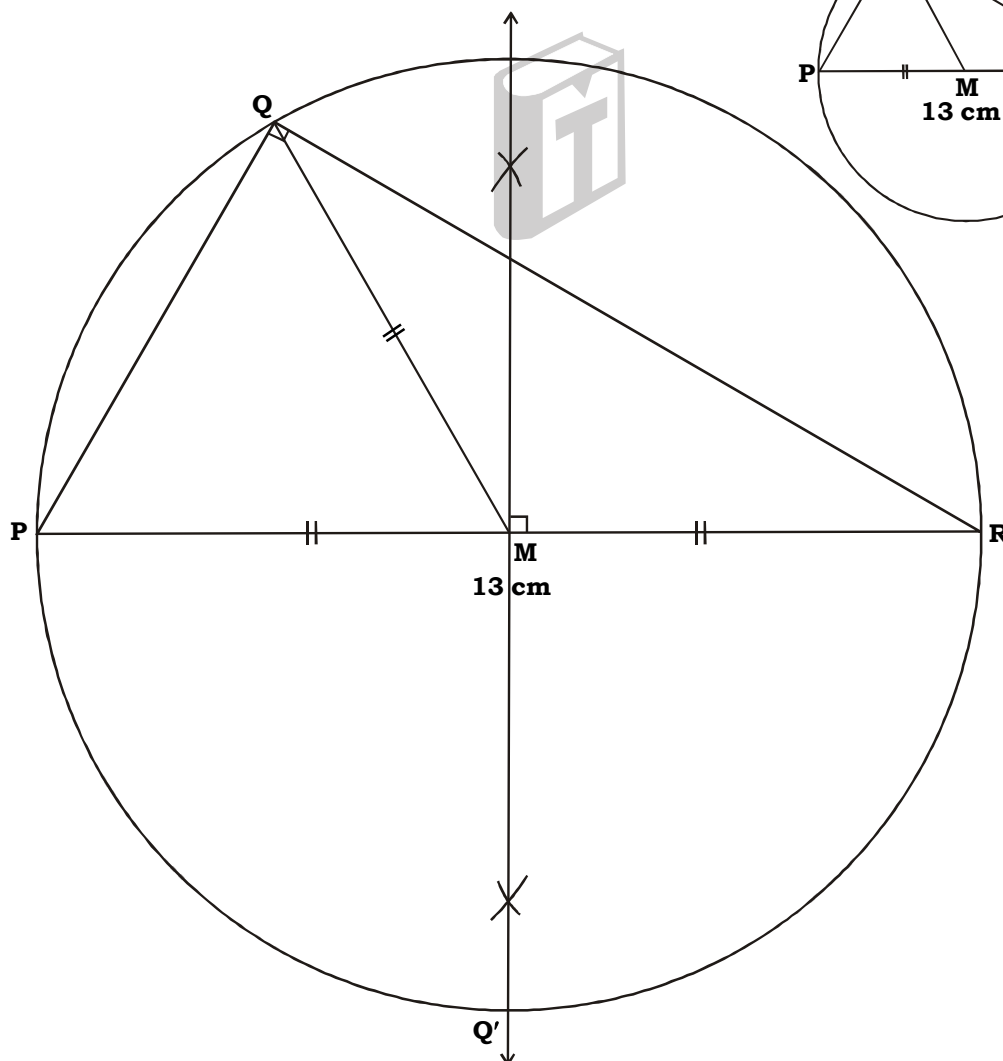
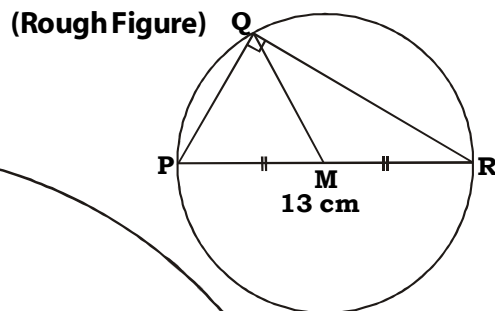
$\therefore PM = MR = 6.5 \text{ cm}$

In ΔPQR ,
 $m \angle PQR = 90^\circ$

$QM = \frac{1}{2} PR$ [Median drawn to the hypotenuse is half of hypotenuse]

$= \frac{1}{2} \times 13$

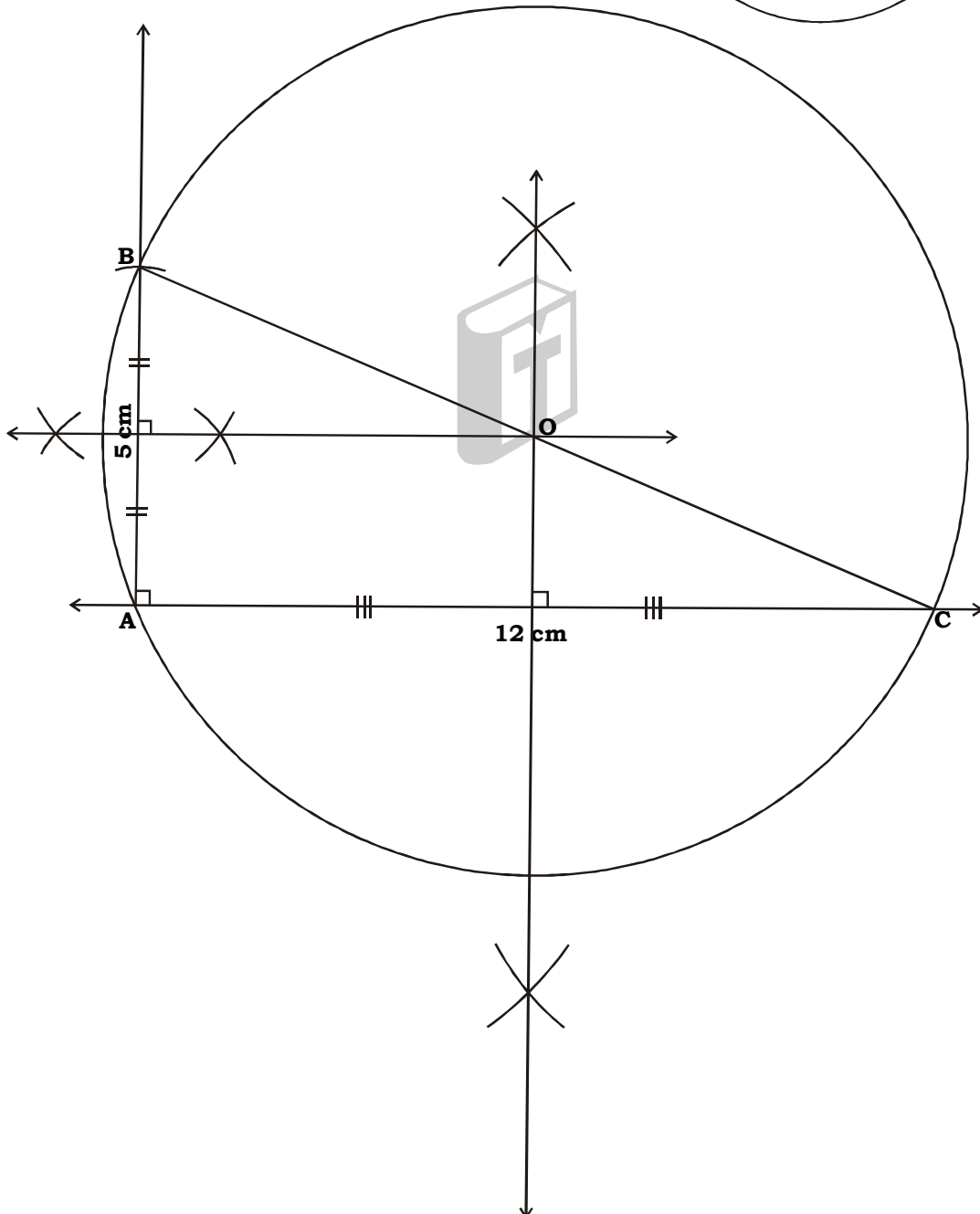
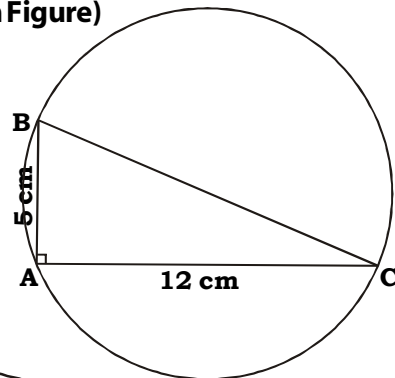
$\therefore QM = 6.5 \text{ cm}$



PROBLEM SET - 3 (TEXT BOOK PAGE NO. 197)

25. Construct a circumcircle of $\triangle ABC$ such that $AB = 5$ cm, $AC = 12$ cm, $\angle BAC = 90^\circ$. (3 marks)

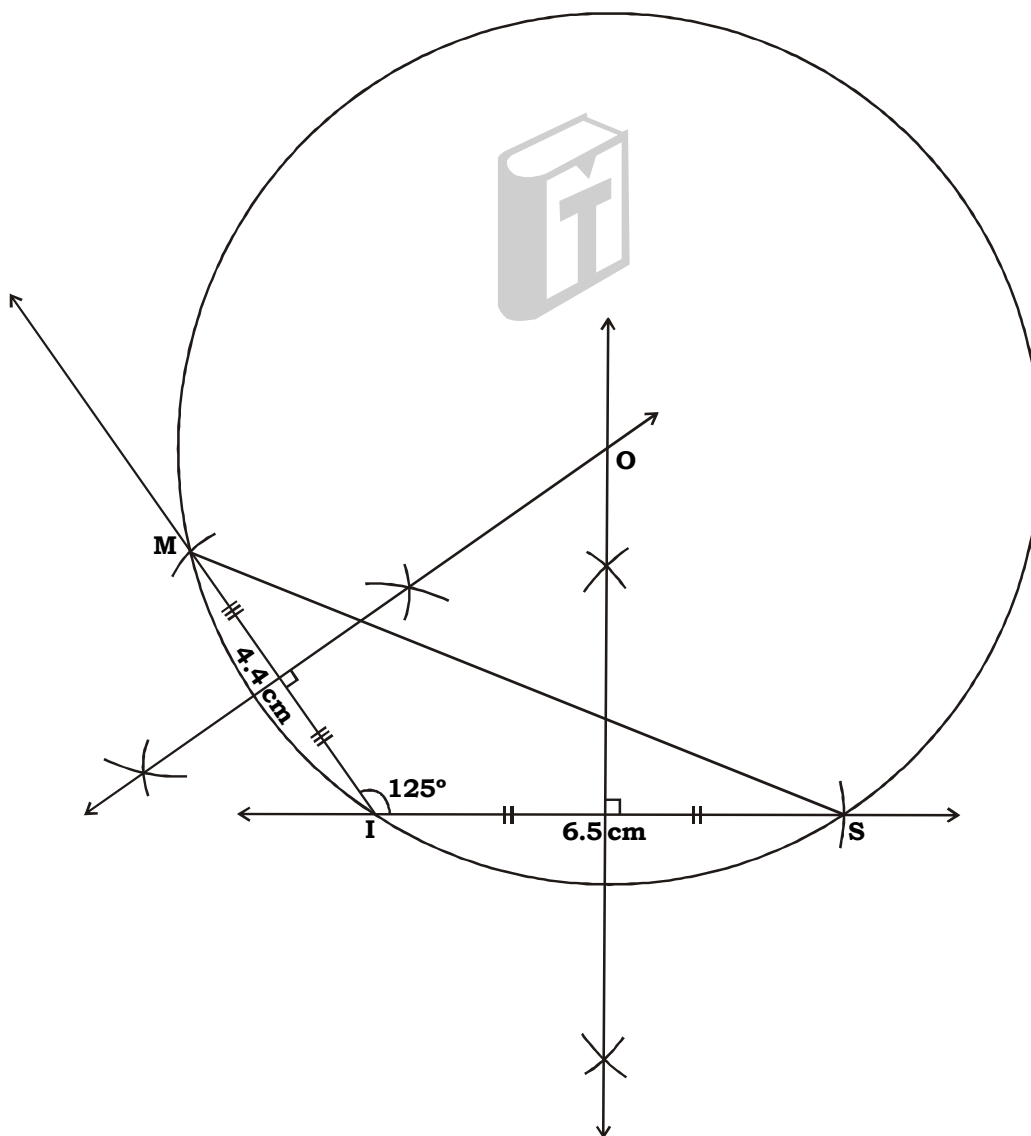
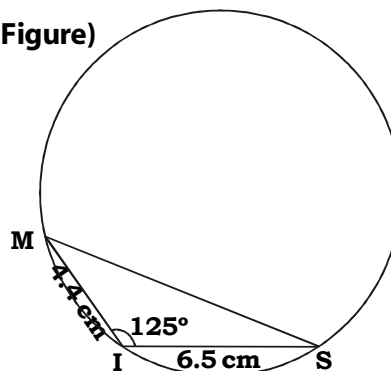
(Rough Figure)



EXERCISE - 3.1 (TEXT BOOK PAGE NO. 84)

2. Construct the circumcircle of $\triangle SIM$ in which $SI = 6.5$ cm, $\angle I = 125^\circ$, $IM = 4.4$ cm. (3 marks)

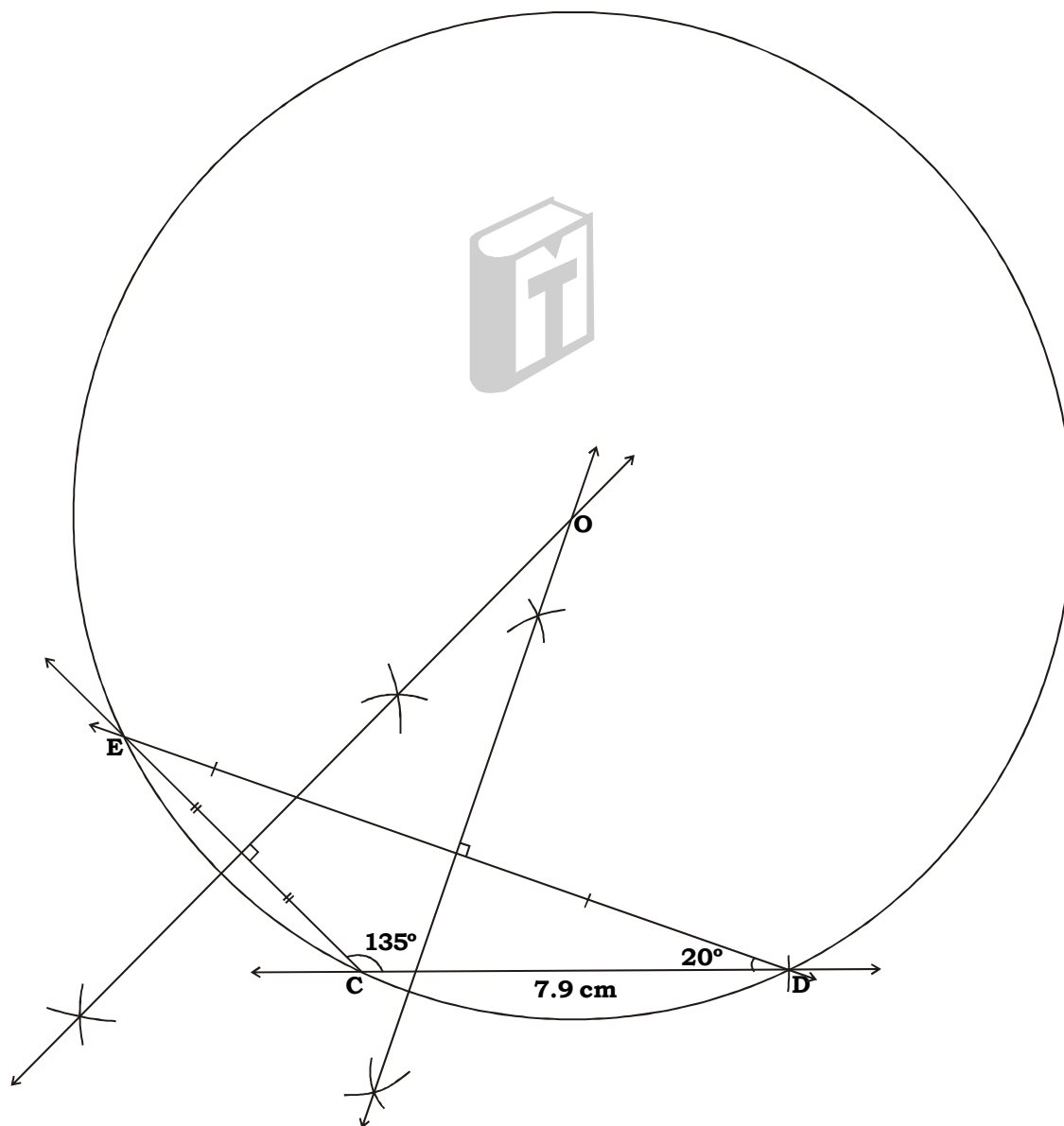
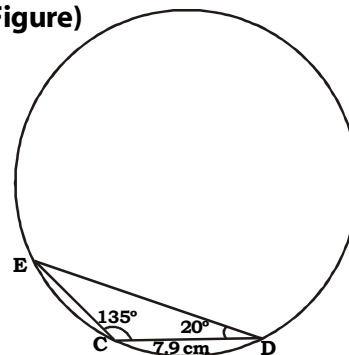
(Rough Figure)



PROBLEM SET - 3 (TEXT BOOK PAGE NO. 196)

7. Construct $\triangle DCE$, such that, $DC = 7.9 \text{ cm}$, $\angle C = 135^\circ$, $\angle D = 20^\circ$ and draw circumcircle. (3 marks)

(Rough Figure)



Note : This figure is drawn proportionally and not with given measurements.

TYPE : 4

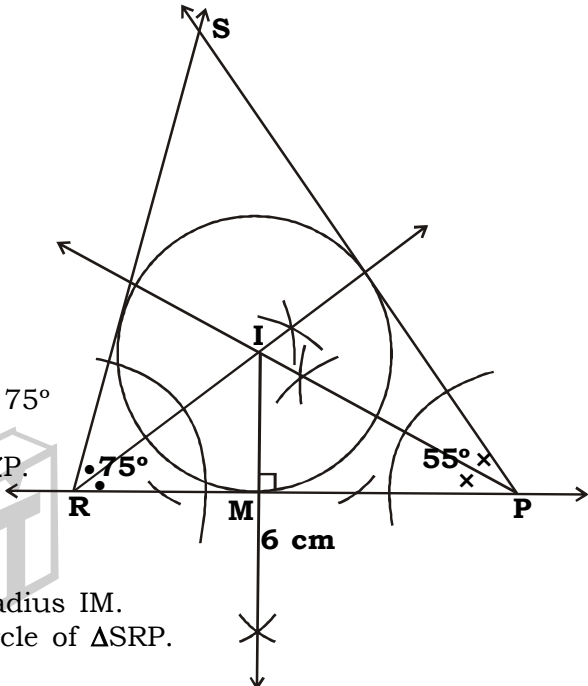
Constructing incircle of triangles

1. A circle which touches all the sides of a triangle is called the incircle of the triangle. The centre of the incircle is called incentre.
2. Incentre is obtained by drawing angle bisectors of the triangle.
3. The angle bisectors are concurrent and their point of intersection is equidistant from the sides of the triangle.

Example : Construct ΔSRP such that $RP = 6$ cm, $\angle R = 75^\circ$ and $\angle P = 55^\circ$.

Steps of construction :

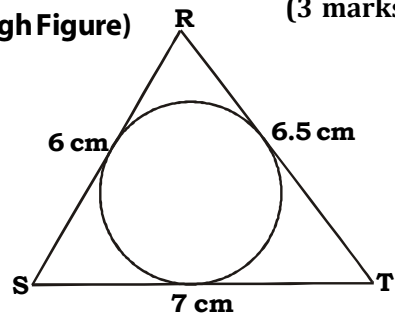
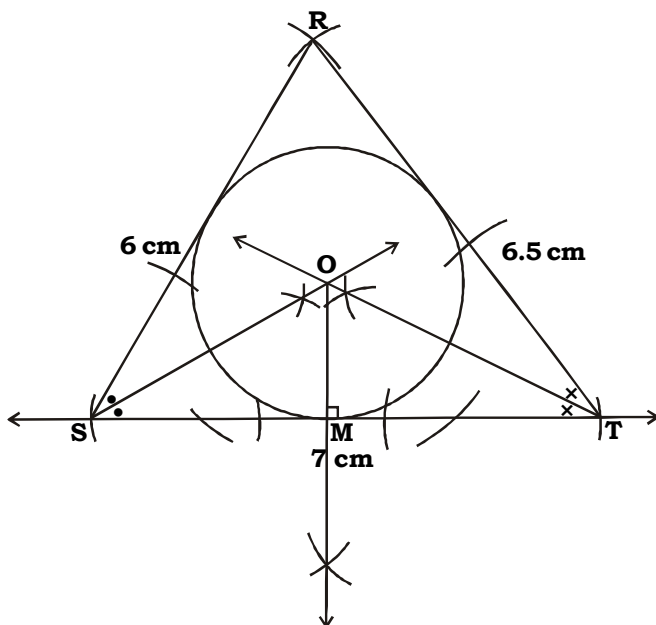
1. Draw ΔSRP with $RP = 6$ cm, $\angle R = 75^\circ$ and $\angle P = 55^\circ$
2. Draw angle bisectors of $\angle R$ and $\angle P$.
3. Let 'I' be the point of intersection of these angle bisectors .
3. Draw seg $IM \perp$ side RP .
4. Draw a circle with centre I and radius IM .
The circle so obtained is the incircle of ΔSRP .



EXERCISE - 3.1 (TEXT BOOK PAGE NO. 84)

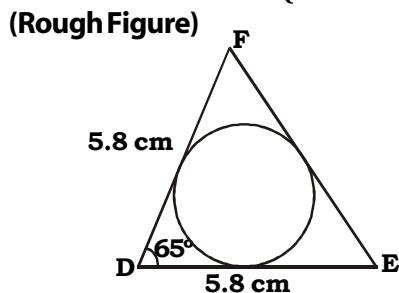
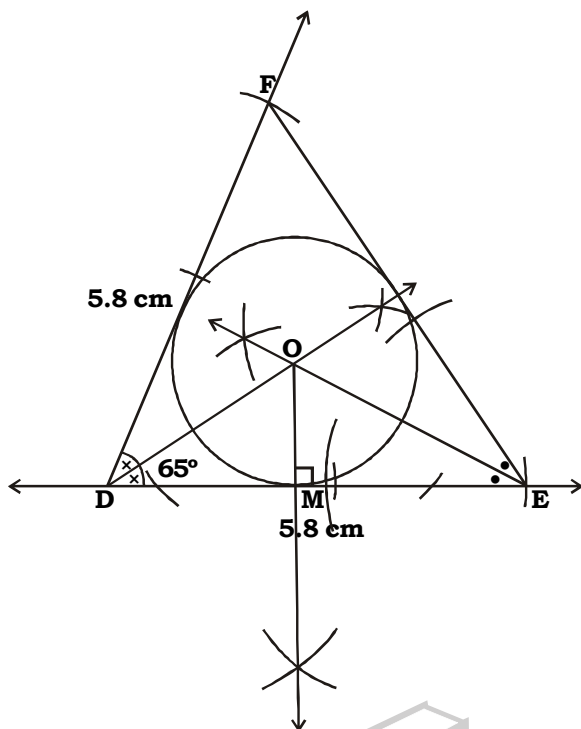
5. Construct the incircle of ΔRST in which $RS = 6$ cm, $ST = 7$ cm and $RT = 6.5$ cm. (3 marks)

(Rough Figure)



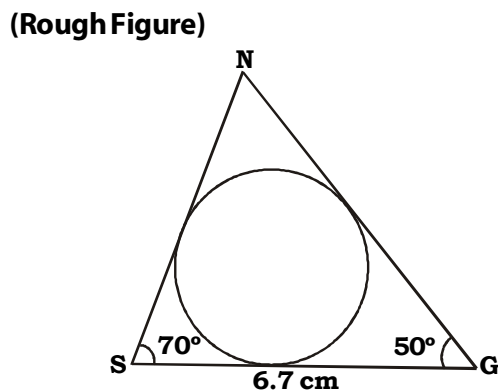
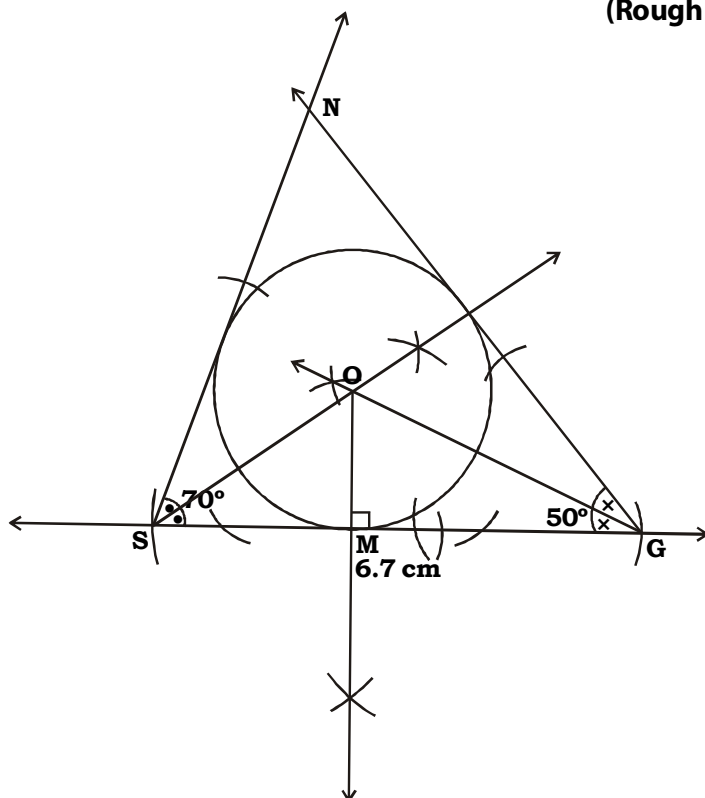
EXERCISE - 3.1 (TEXT BOOK PAGE NO. 84)

7. Construct the incircle of $\triangle DEF$ in which $DE = DF = 5.8$ cm, $\angle EDF = 65^\circ$. (3 marks)



PROBLEM SET - 3 (TEXT BOOK PAGE NO. 197)

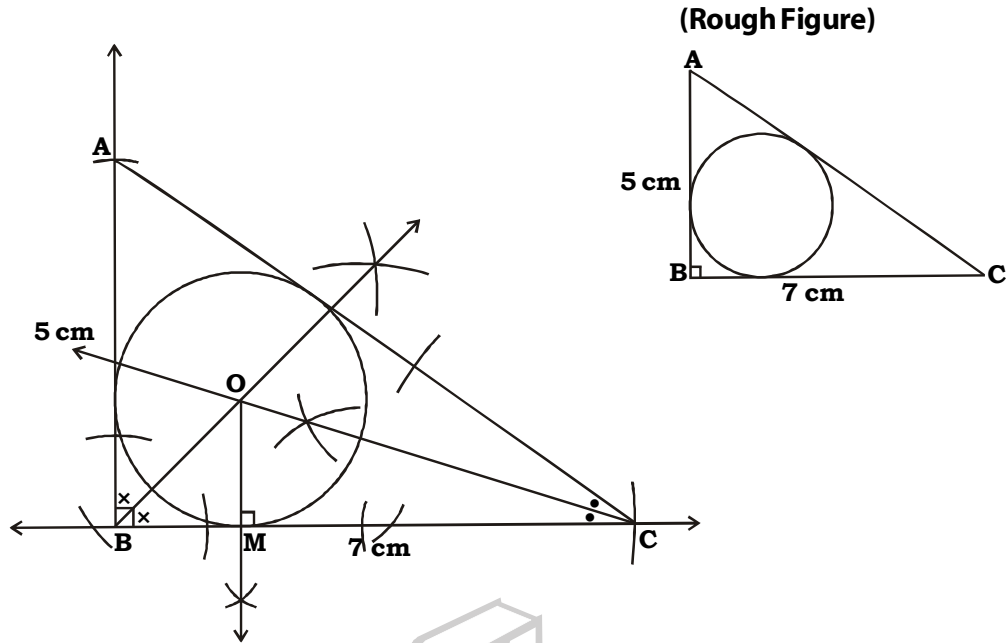
8. Construct incircle of $\triangle SGN$ such that $SG = 6.7$ cm, $\angle S = 70^\circ$, $\angle G = 50^\circ$ and draw incircle of $\triangle SGN$. (3 marks)



EXERCISE - 3.1 (TEXT BOOK PAGE NO. 84)

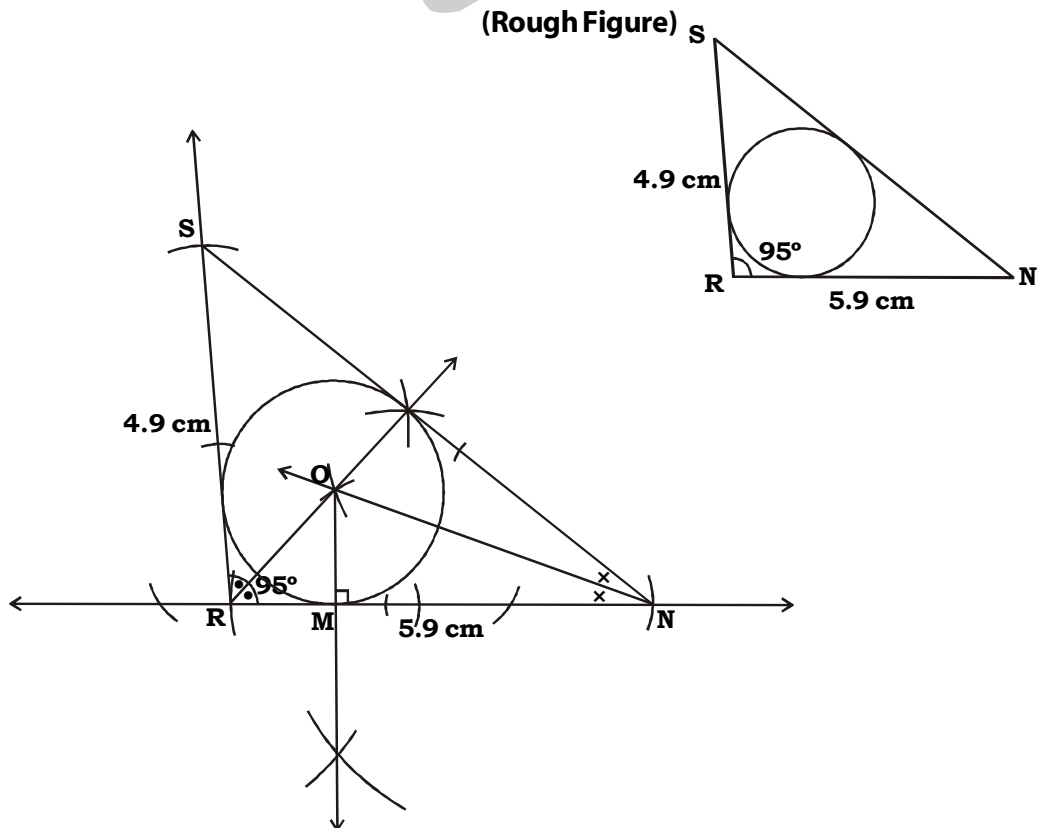
8. Construct any right angled triangle and draw incircle of that triangle. (3 marks)

ΔABC is the required right angled triangle.
Such that $AB = 5$ cm, $BC = 7$ cm and $m \angle ABC = 90^\circ$



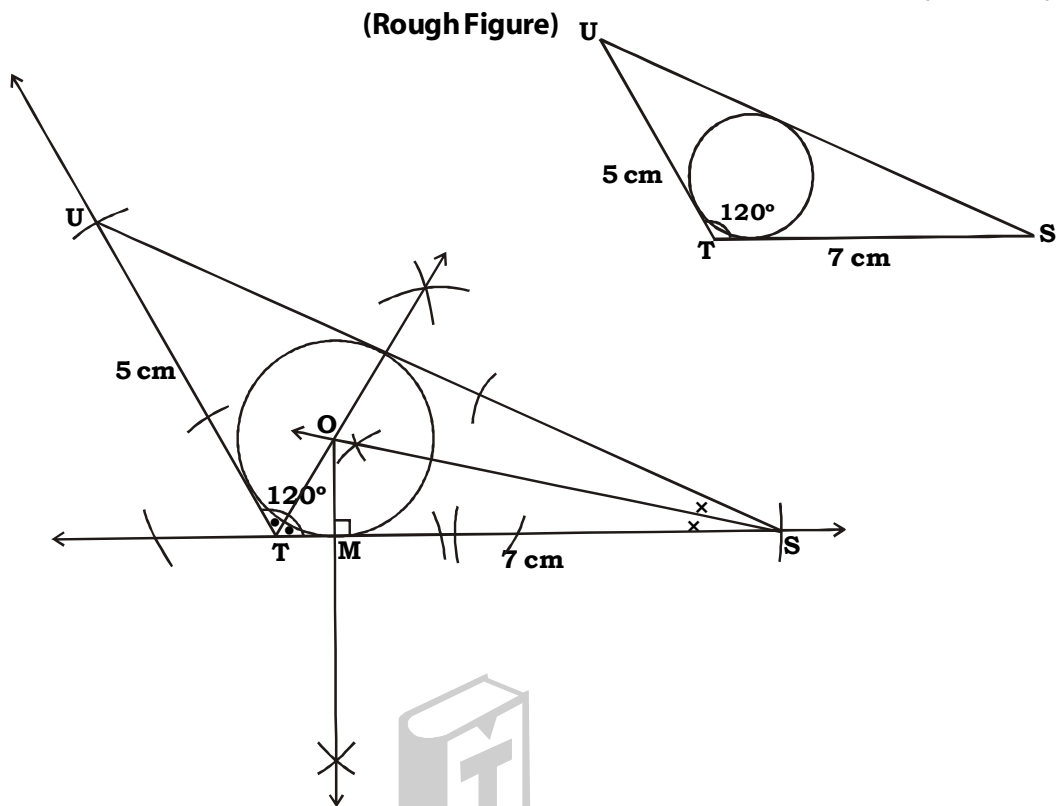
PROBLEM SET - 3 (TEXT BOOK PAGE NO. 197)

9. Construct the incircle of ΔSRN , such that $RN = 5.9$ cm, $RS = 4.9$ cm, $\angle R = 95^\circ$. (3 marks)



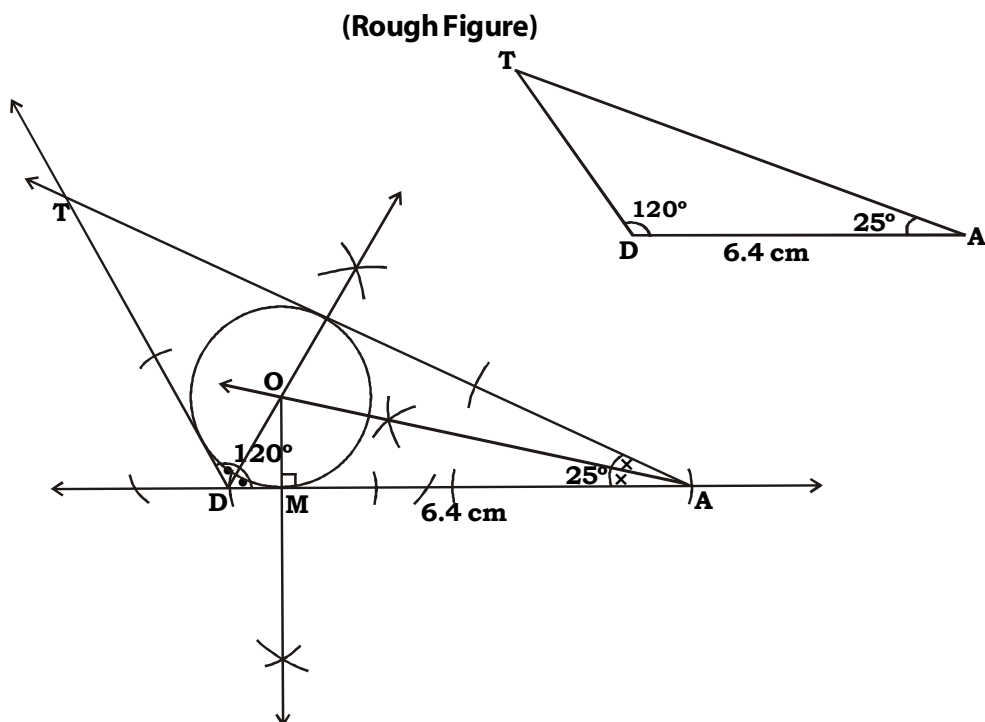
EXERCISE - 3.1 (TEXT BOOK PAGE NO. 84)

6. Construct the incircle of ΔSTU in which, $ST = 7 \text{ cm}$, $\angle T = 120^\circ$, $TU = 5 \text{ cm}$. (3 marks)



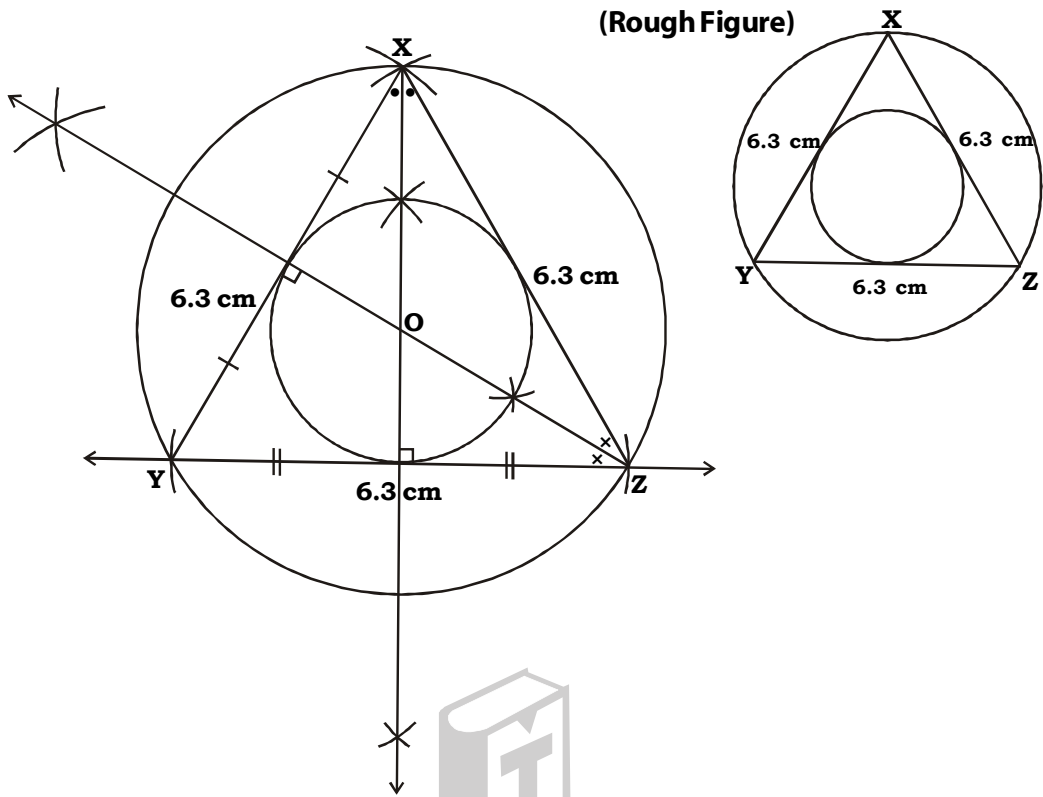
PROBLEM SET - 3 (TEXT BOOK PAGE NO. 197)

10. Construct ΔDAT such that $DA = 6.4 \text{ cm}$, $\angle D = 120^\circ$, $\angle A = 25^\circ$ and draw incircle of ΔDAT . (3 marks)



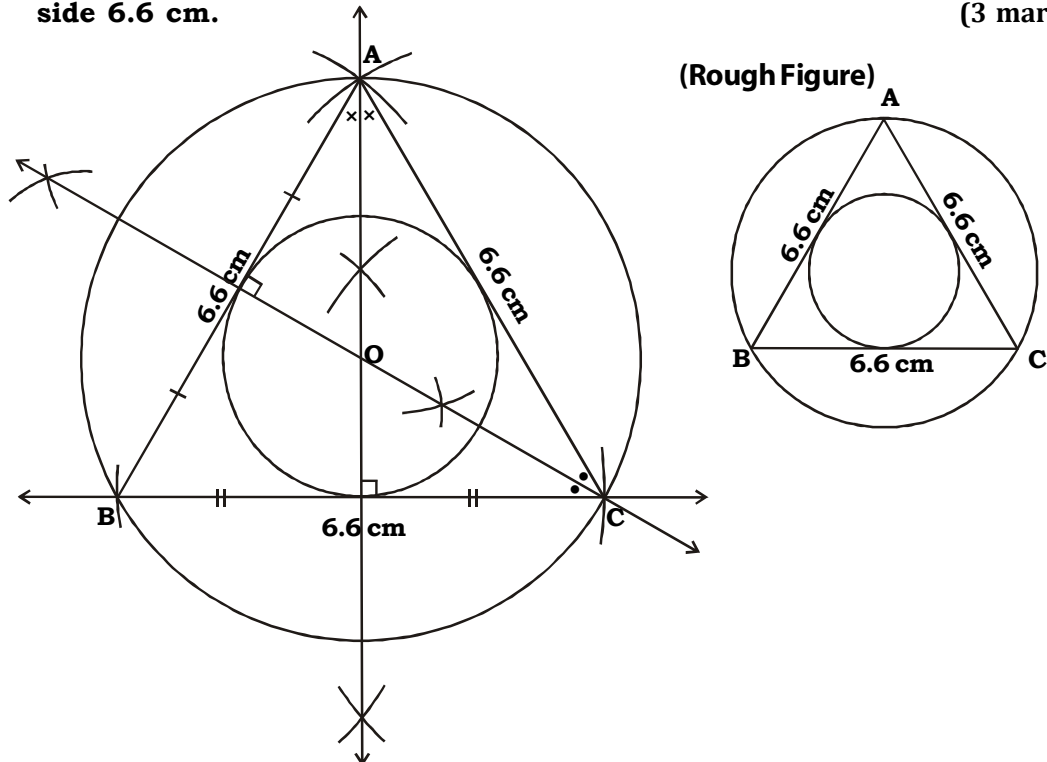
EXERCISE - 3.1 (TEXT BOOK PAGE NO. 84)

9. Construct the circumcircle and incircle of an equilateral ΔXYZ with side 6.3 cm. (3 marks)



PROBLEM SET - 3 (TEXT BOOK PAGE NO. 197)

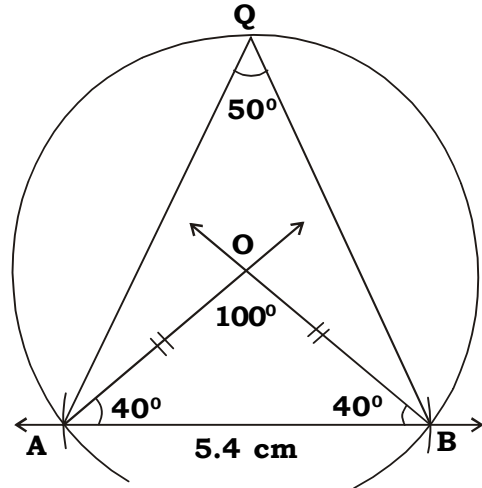
11. Draw the circumcircle and incircle of an equilateral triangle ABC with side 6.6 cm. (3 marks)



TYPE : 5

To construct an arc having the given segment as its chord and subtending a given angle at any point on the arc.

Example : Draw an arc such that seg AB of length 5.4 cm subtends an $\angle AQB$ of 50° on it.



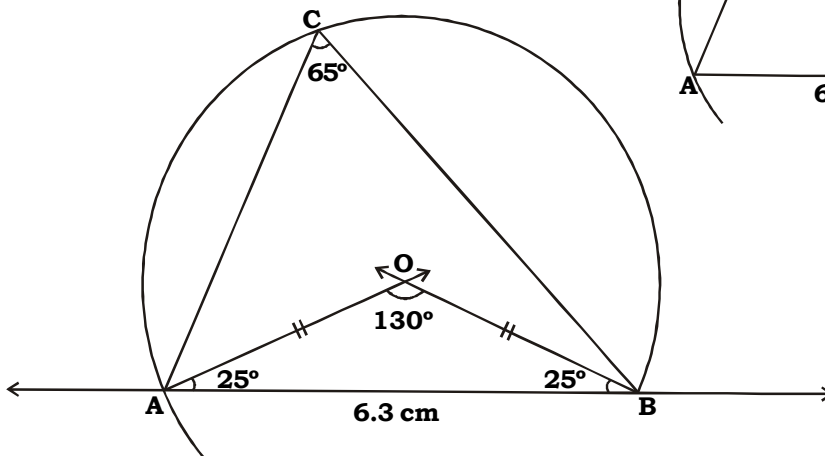
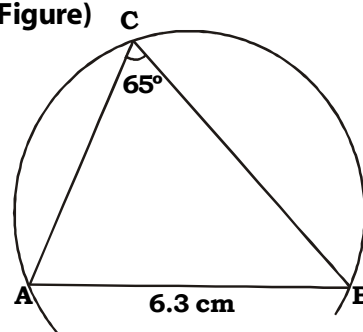
Step of construction :

1. Draw seg AB of length 5.4 cm.
2. Draw rays AO and BO making an angle of 40° with seg AB on the same side.
3. Draw an arc with O as the centre and radius OA.
4. Take any point Q on the arc. Draw $\angle AQB$.
5. Arc AQB is the required arc.

EXERCISE - 3.2 (TEXT BOOK PAGE NO. 93)

11. Draw an arc with seg AB = 6.3 cm, inscribing $\angle ACB = 65^\circ$. (3 marks)

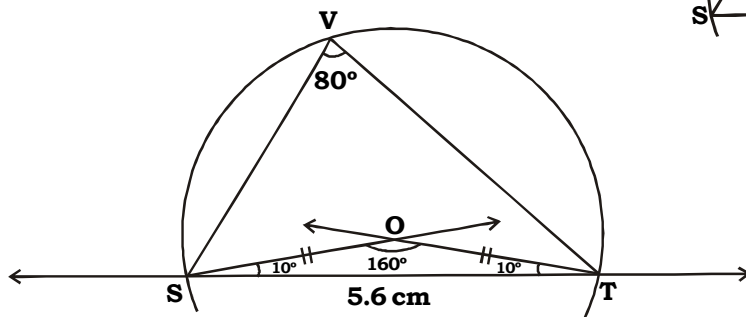
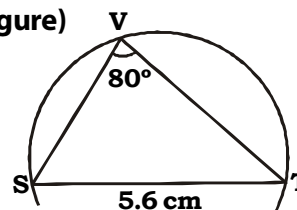
(Rough Figure)



EXERCISE - 3.2 (TEXT BOOK PAGE NO. 93)

13. Draw an arc such that chord $ST = 5.6$ cm, inscribing $\angle SVT = 80^\circ$.
(3 marks)

(Rough Figure)

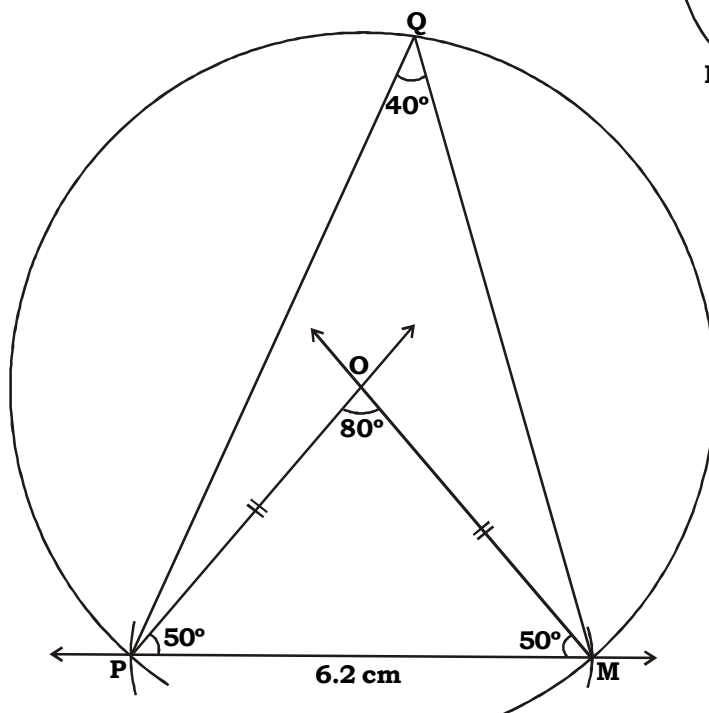
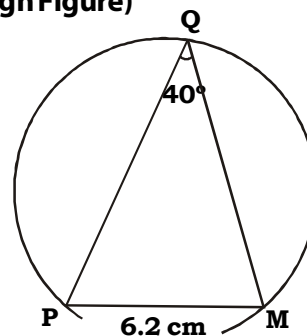


PROBLEM SET - 3 (TEXT BOOK PAGE NO. 197)

17. Construct an arc PQM such that seg PM of length 6.2 cm subtends an angle of 40° on it.
(3 marks)



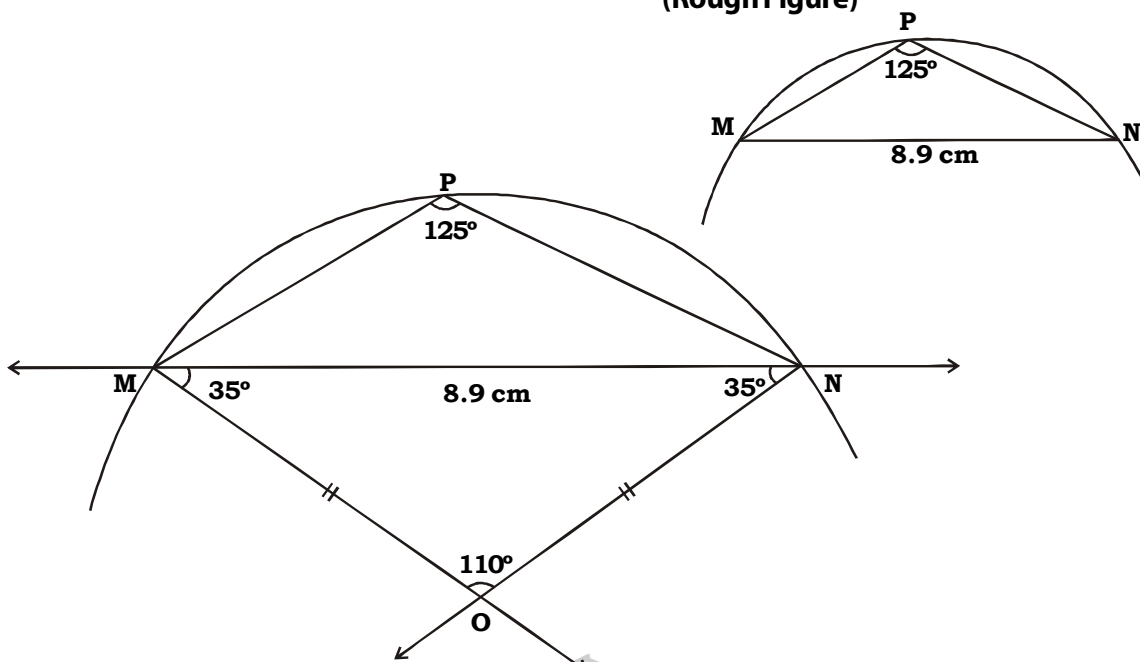
(Rough Figure)



EXERCISE - 3.2 (TEXT BOOK PAGE NO. 93)

12. Draw an arc with seg $MN = 8.9$ cm, inscribing $\angle MPN = 125^\circ$. (2 marks)

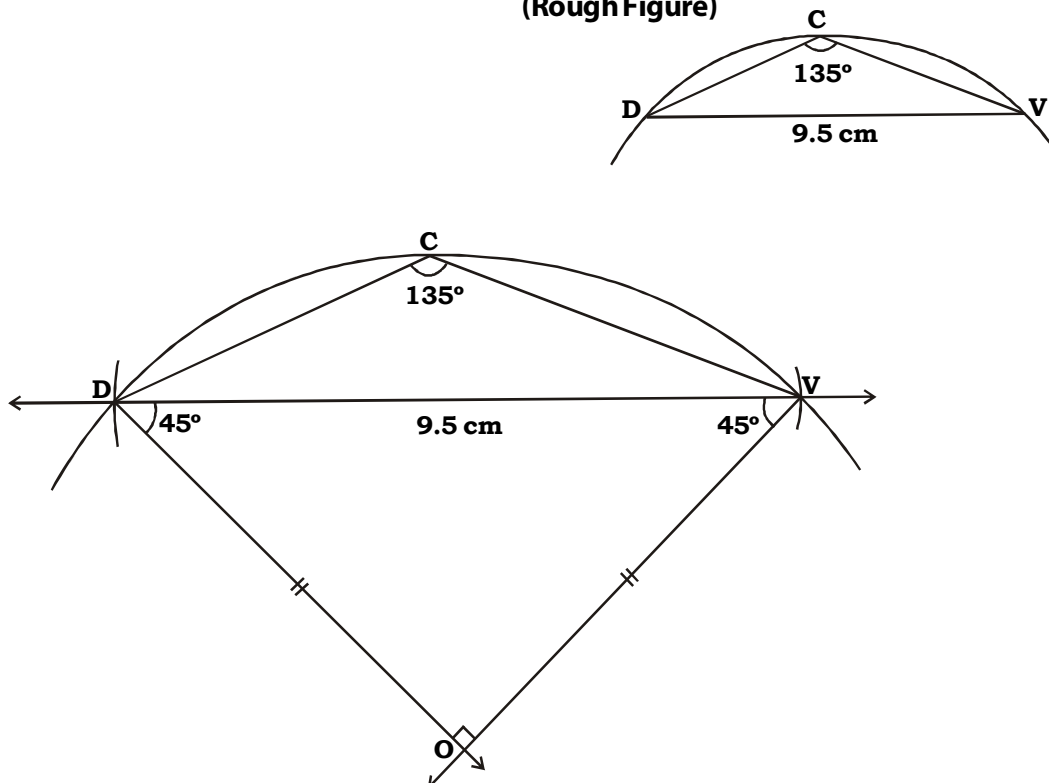
(Rough Figure)



PROBLEM SET - 3 (TEXT BOOK PAGE NO. 197)

18. Construct an arc DCV such that seg DV of length 9.5 cm subtends an angle of 135° on it. (2 marks)

(Rough Figure)



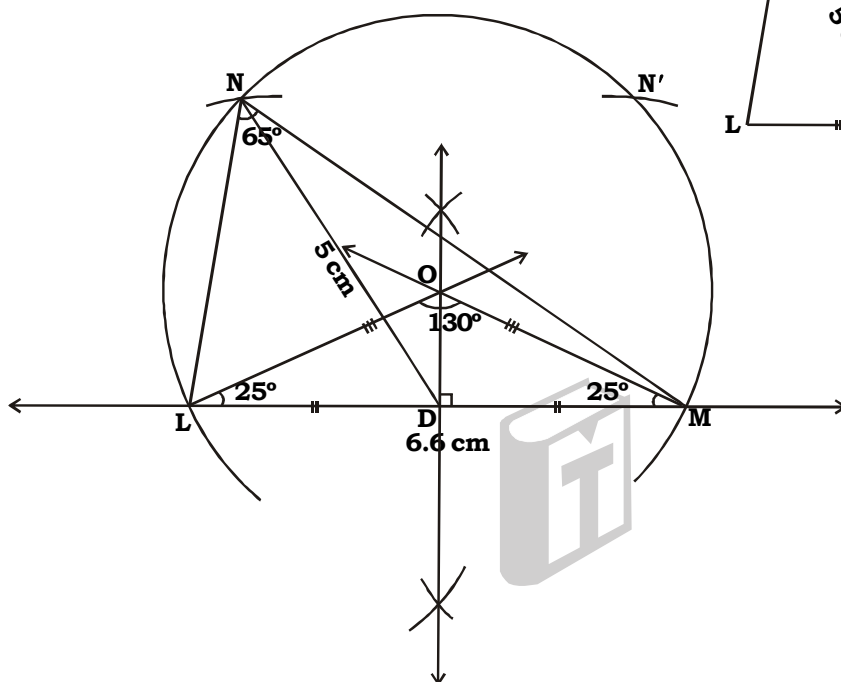
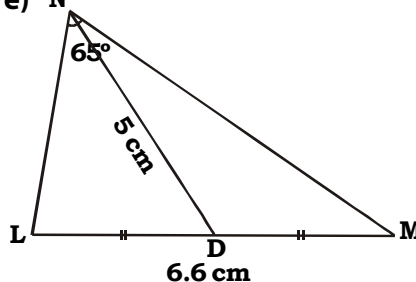
TYPE : 6

Constructing triangles with a given base, angle opposite to the base and median.

EXERCISE - 3.4 (TEXT BOOK PAGE NO. 101)

1. Construct $\triangle LMN$ such that $LM = 6.6$ cm, $\angle LNM = 65^\circ$ and ND is median $ND = 5$ cm. (4 marks)

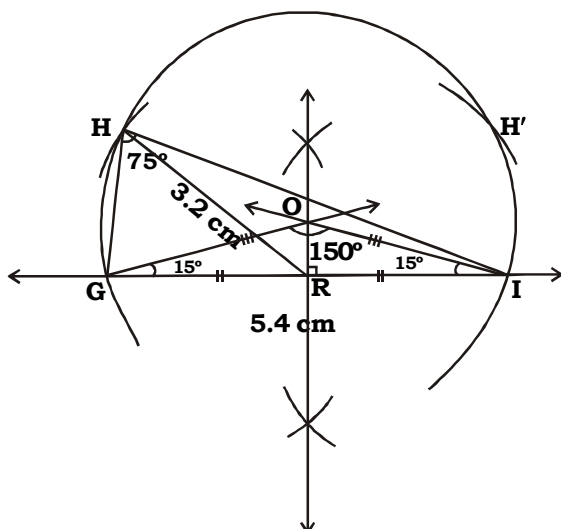
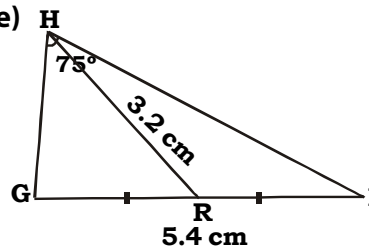
(Rough Figure) N



EXERCISE - 3.3 (TEXT BOOK PAGE NO. 101)

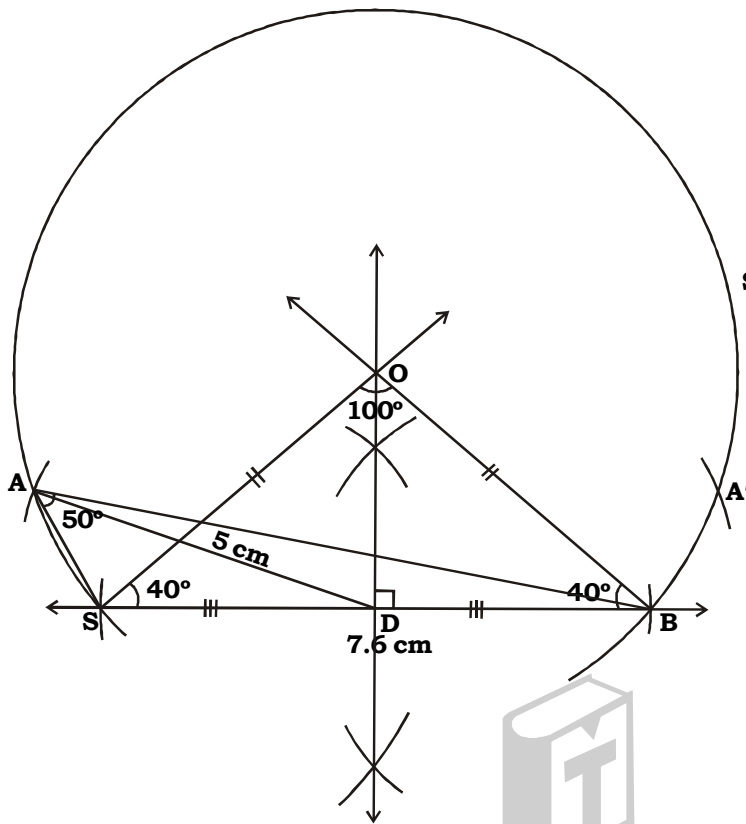
2. Construct $\triangle GHI$ such that $GI = 5.4$ cm, $\angle GHI = 75^\circ$. HR is median. $HR = 3.2$ cm. (4 marks)

(Rough Figure) H

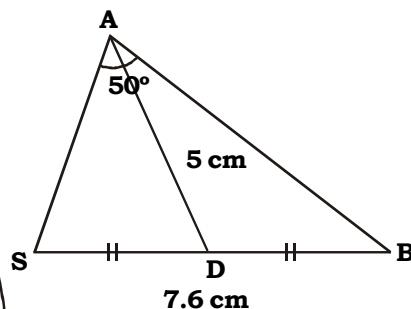


PROBLEM SET - 3 (TEXT BOOK PAGE NO. 197)

19. Construct $\triangle SAB$ such that $SB = 7.6$ cm, $\angle SAB = 50^\circ$ seg AD is median and $AD = 5$ cm. (4 marks)

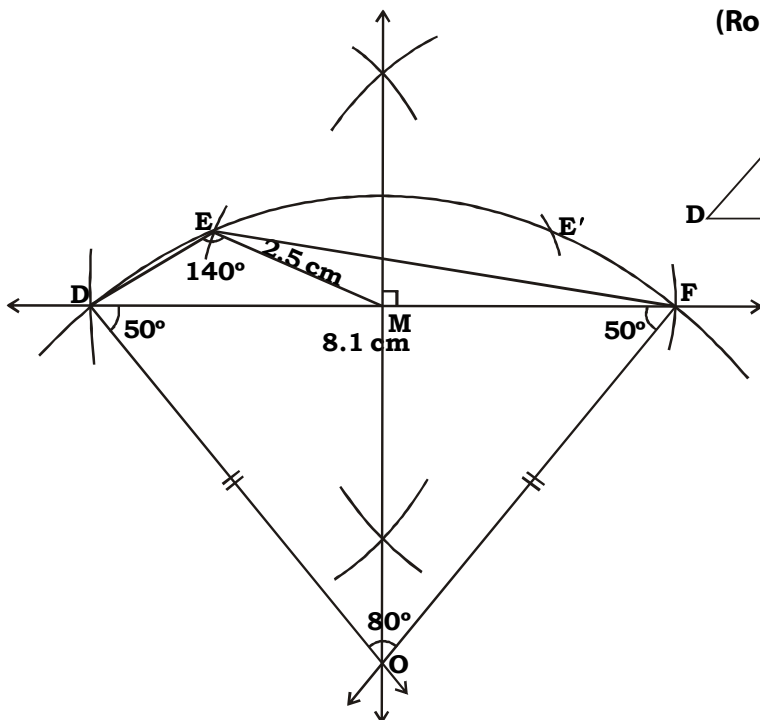


(Rough Figure)

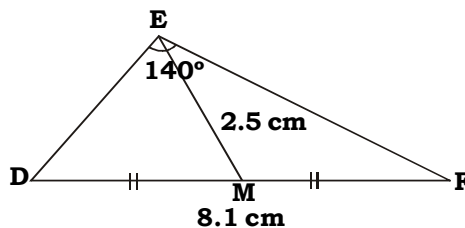


PROBLEM SET - 3 (TEXT BOOK PAGE NO. 197)

21. Construct $\triangle DEF$ such that $DF = 8.1$ cm, $\angle DEF = 140^\circ$ and median $EM = 2.5$ cm. (4 marks)



(Rough Figure)

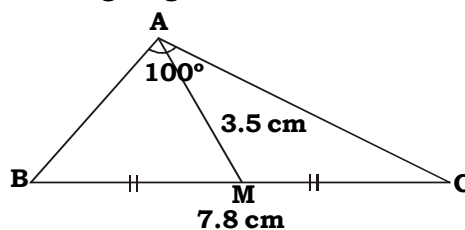
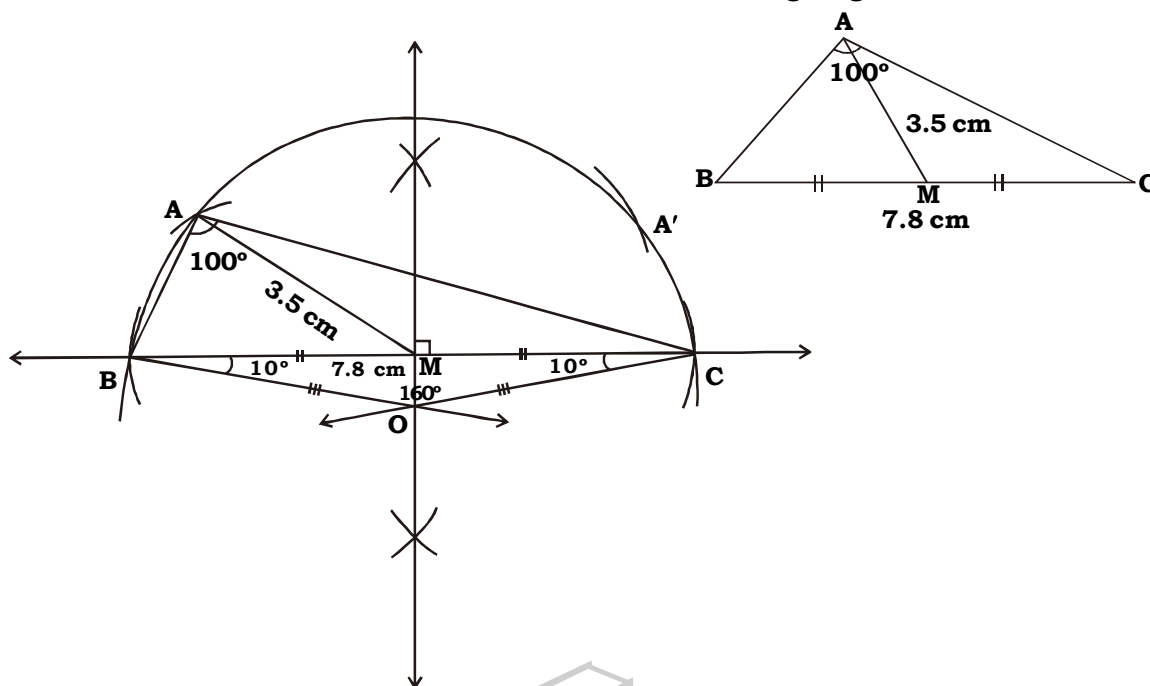


EXERCISE - 3.3 (TEXT BOOK PAGE NO. 101)

3. Construct $\triangle ABC$ such that $BC = 7.8$ cm, $\angle BAC = 100^\circ$ and median $AM = 3.5$ cm.

(Rough Figure)

(4 marks)

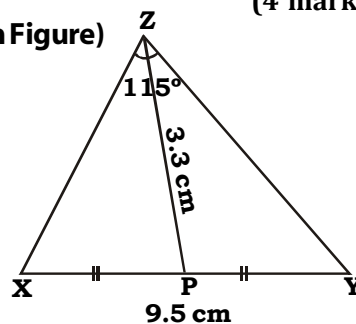
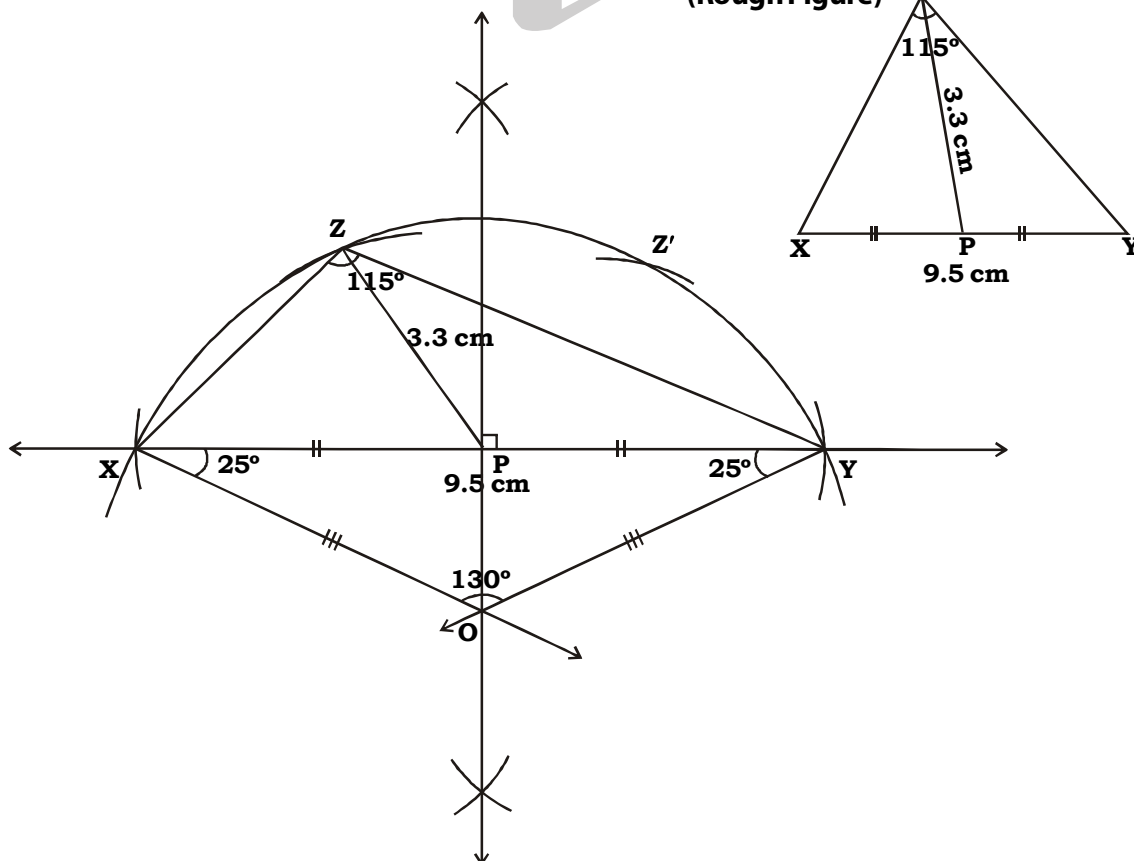


EXERCISE - 3.3 (TEXT BOOK PAGE NO. 101)

4. Construct $\triangle XYZ$ such that $XY = 9.5$ cm, $\angle XZY = 115^\circ$, ZP is median. $ZP = 3.3$ cm.

(Rough Figure)

(4 marks)

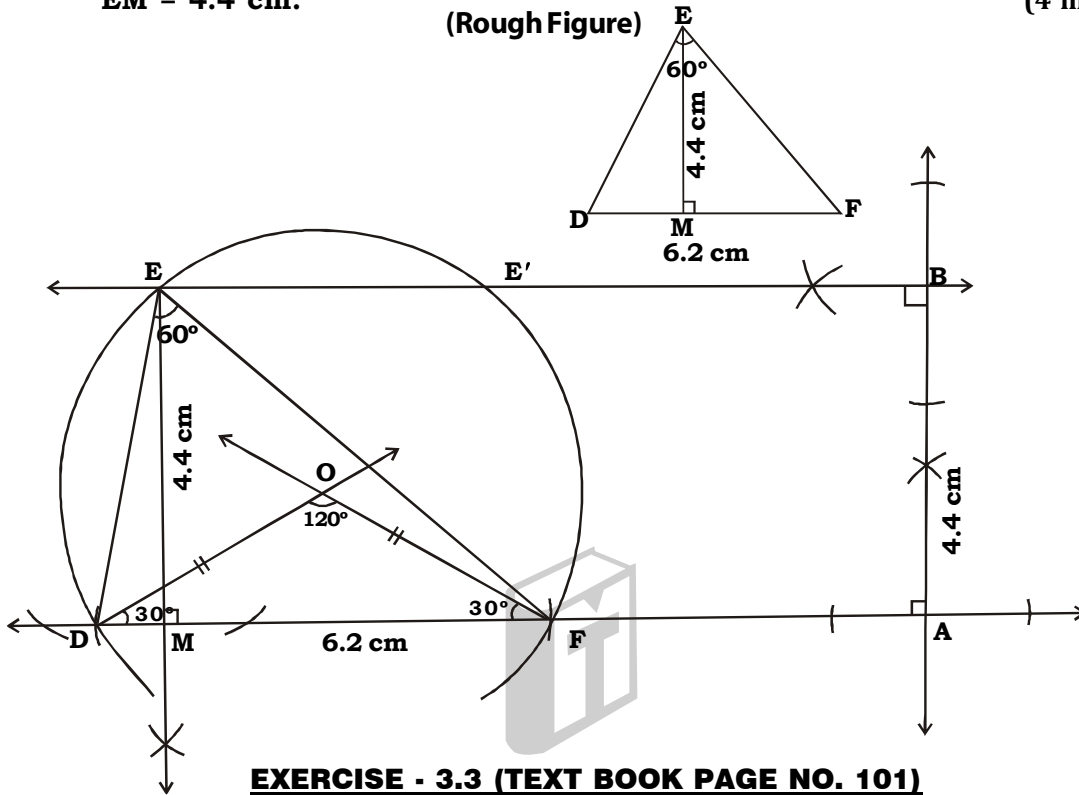


TYPE : 7

Constructing triangles with a given base, angle opposite to the base and an altitude.

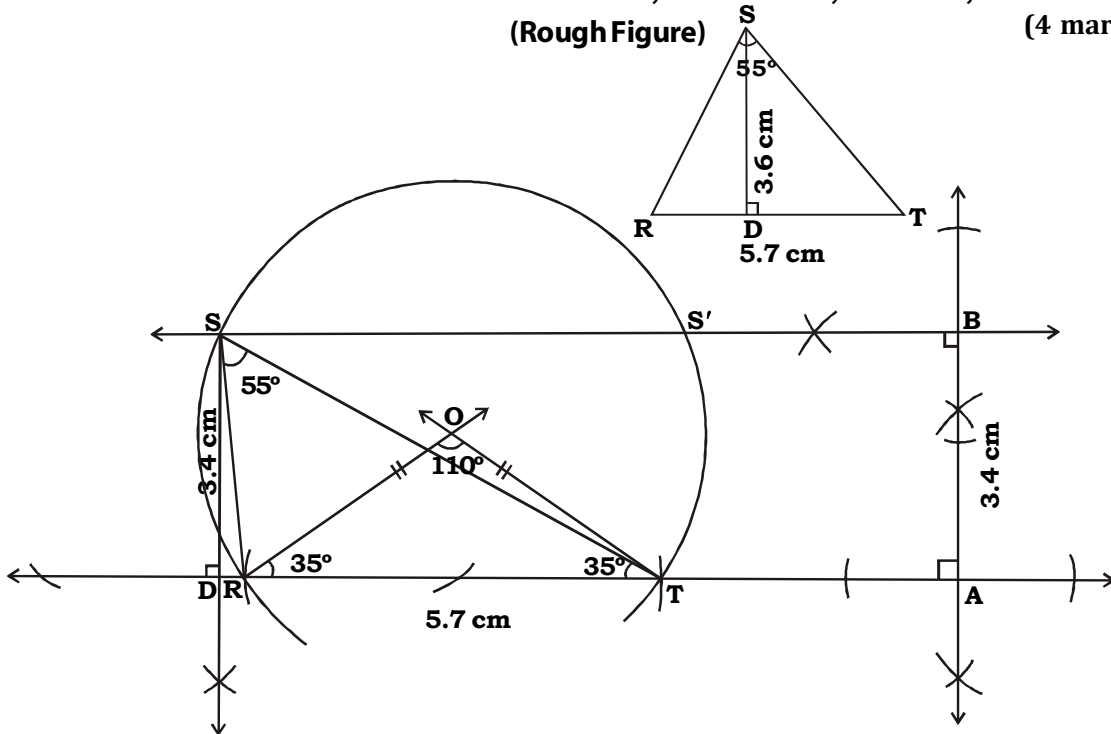
EXERCISE - 3.3 (TEXT BOOK PAGE NO. 101)

5. Construct $\triangle DEF$ such that $DF = 6.2$ cm, $\angle DEF = 60^\circ$, $EM \perp DF$ and $EM = 4.4$ cm. (4 marks)



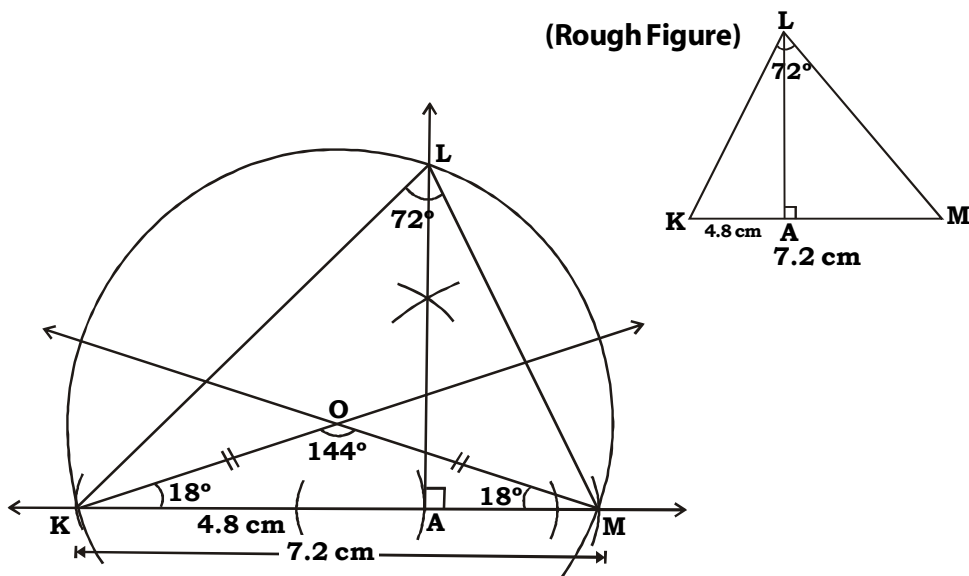
EXERCISE - 3.3 (TEXT BOOK PAGE NO. 101)

6. Construct $\triangle RST$ such that $RT = 5.7$ cm, $\angle RST = 55^\circ$, $SD \perp RT$, $SD = 3.4$ cm. (4 marks)



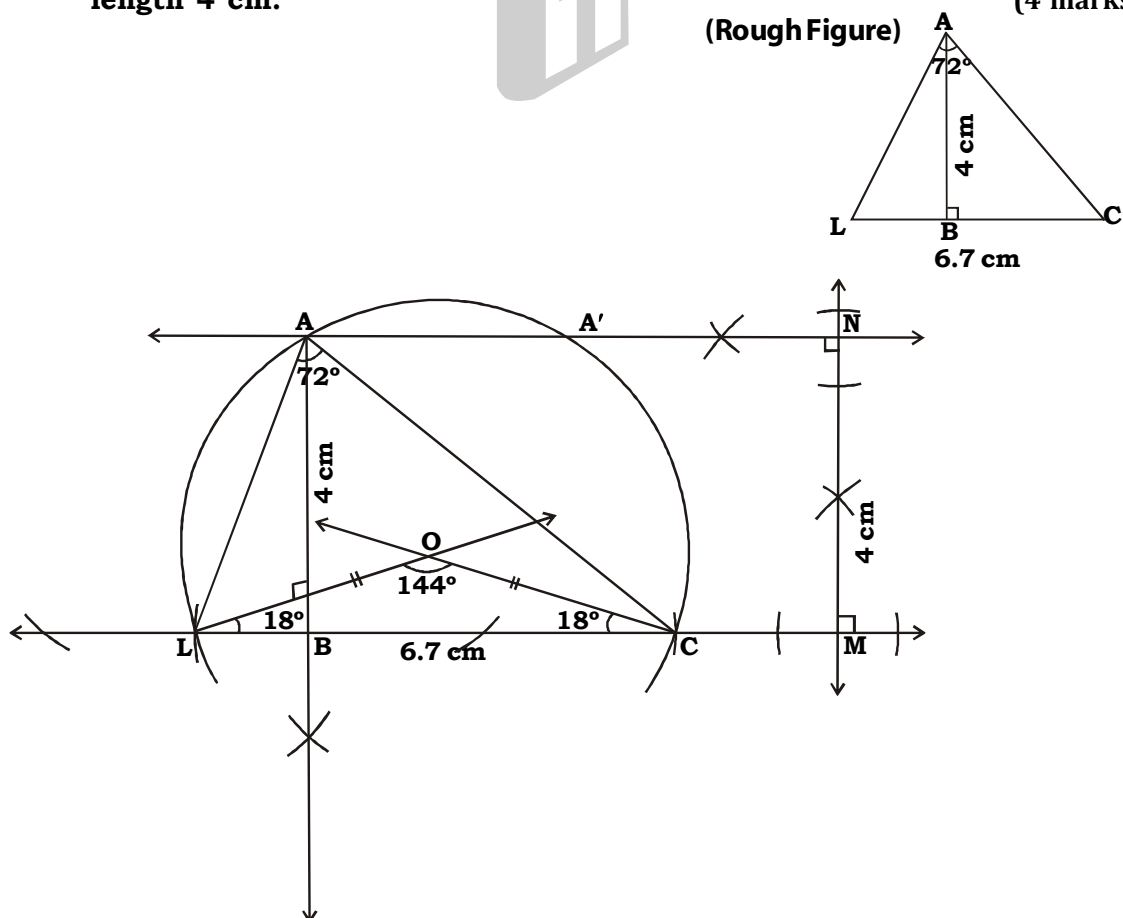
EXERCISE - 3.3 (TEXT BOOK PAGE NO. 101)

9. Construct ΔKLM such that $KM = 7.2$ cm, $\angle KLM = 72^\circ$, $LA \perp KM$, $KA = 4.8$ cm. (4 marks)



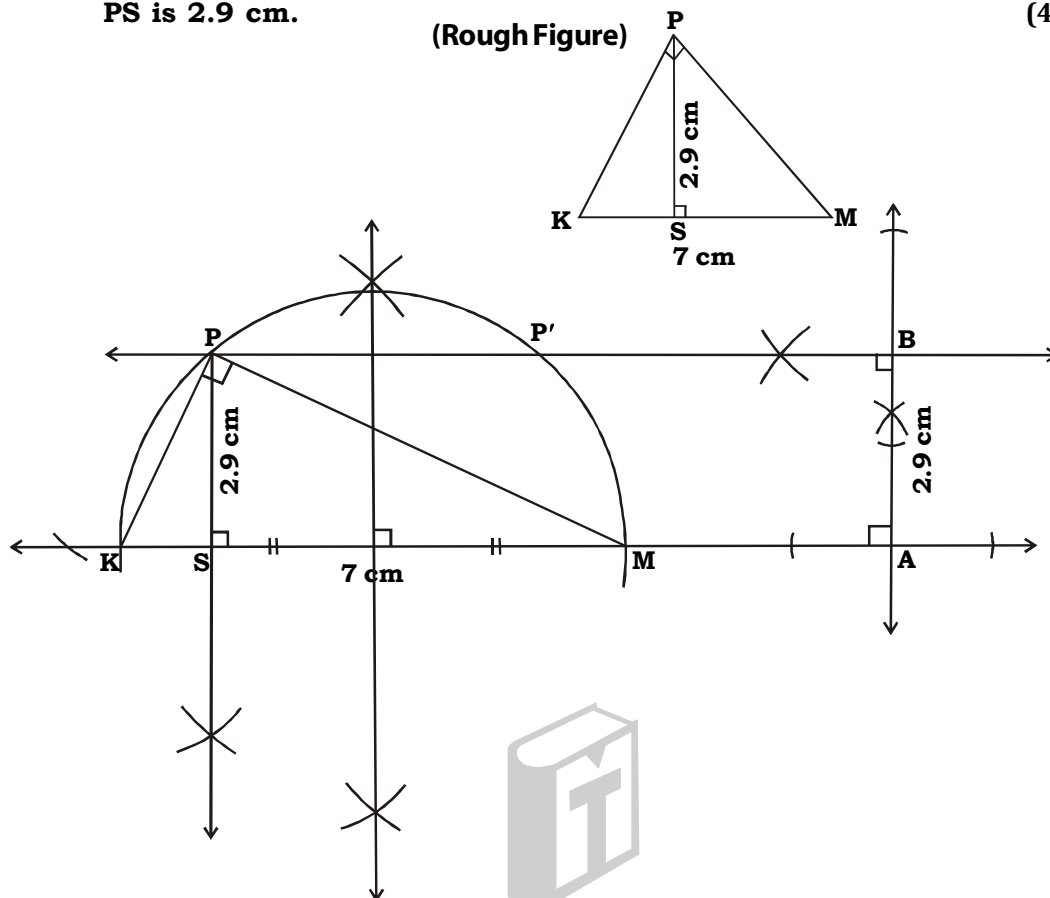
PROBLEM SET - 3 (TEXT BOOK PAGE NO. 197)

22. Construct ΔLAC such that $LC = 6.7$ cm, $\angle LAC = 72^\circ$ and altitude AB has length 4 cm. (4 marks)



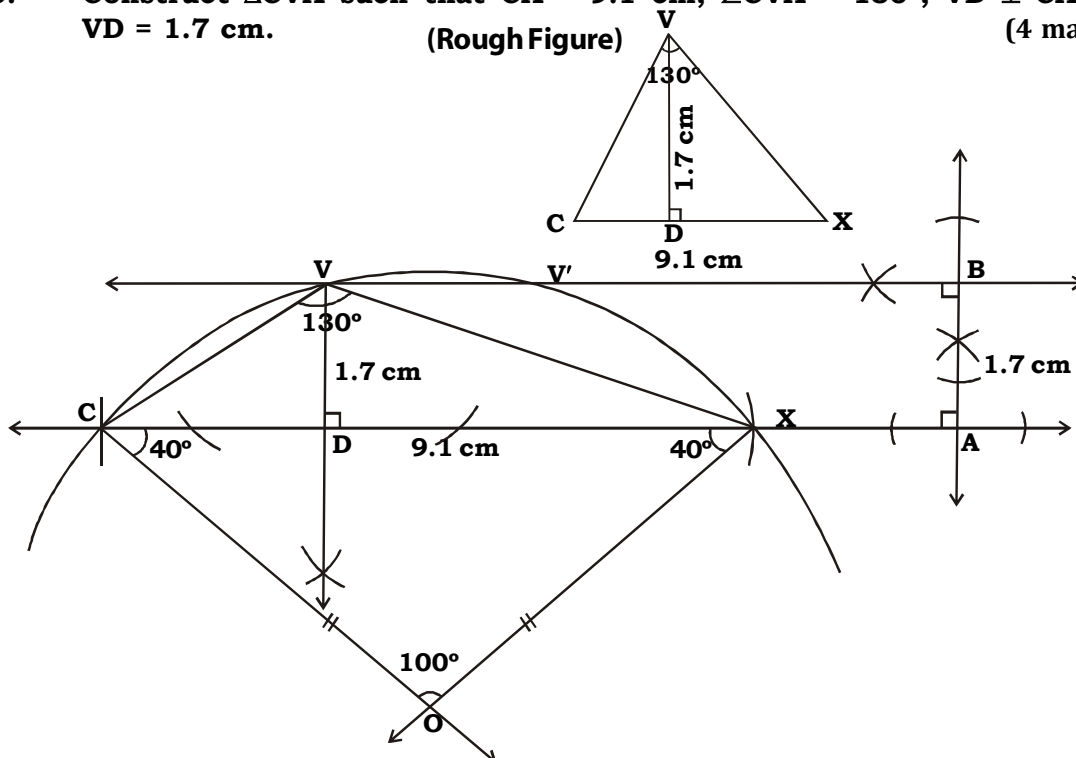
PROBLEM SET - 3 (TEXT BOOK PAGE NO. 197)

20. Construct ΔKPM such that $KM = 7$ cm, $\angle KPM = 90^\circ$ and length of altitude PS is 2.9 cm. (4 marks)



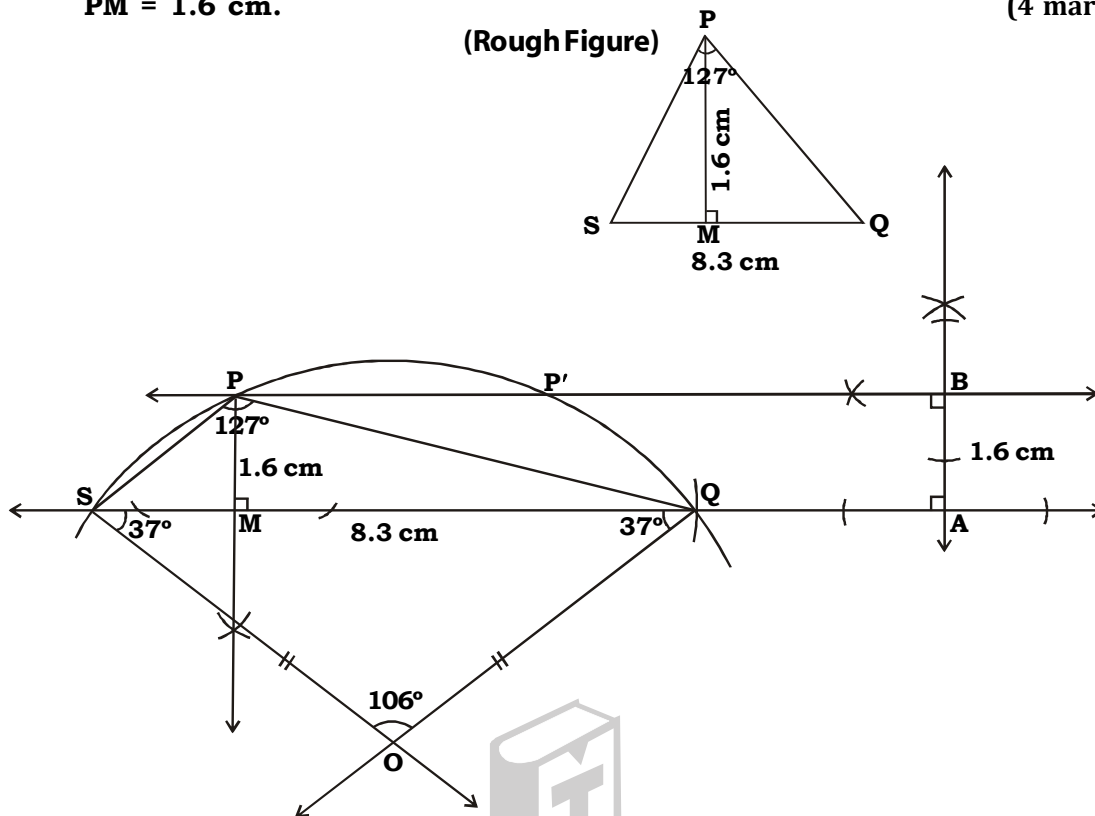
EXERCISE - 3.3 (TEXT BOOK PAGE NO. 101)

8. Construct ΔCVX such that $CX = 9.1$ cm, $\angle CVX = 130^\circ$, $VD \perp CX$ and $VD = 1.7$ cm. (4 marks)



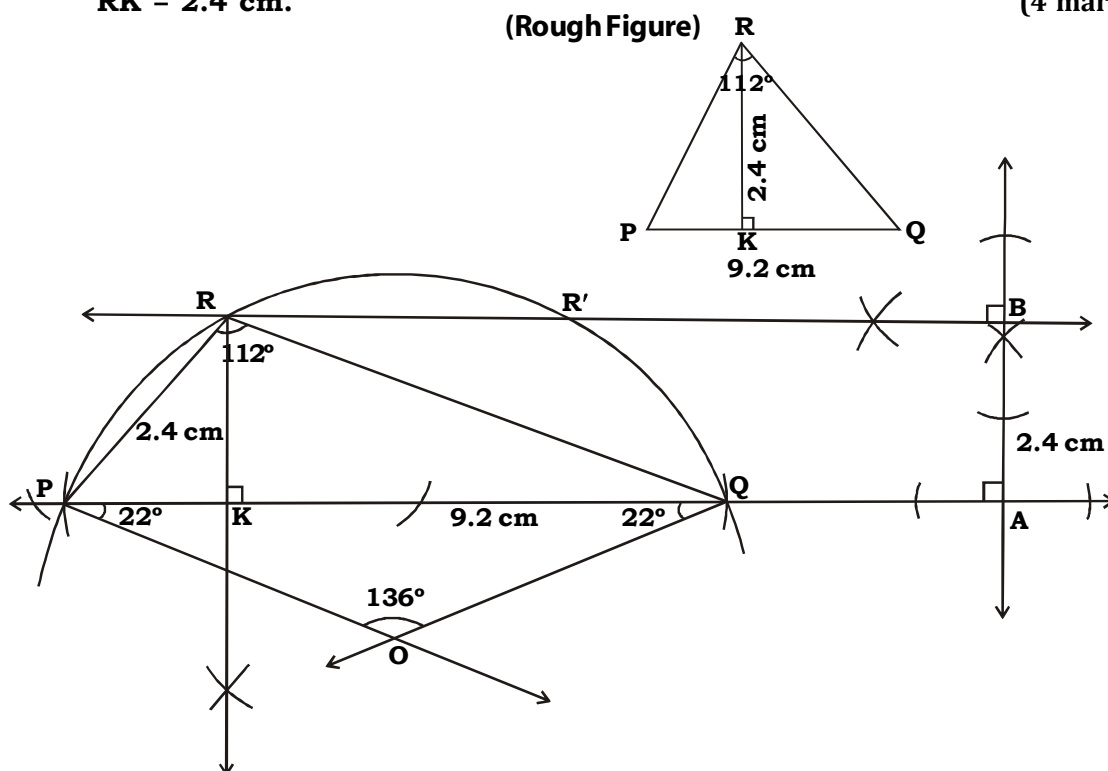
EXERCISE - 3.3 (TEXT BOOK PAGE NO. 101)

10. Construct ΔSPQ such that $SQ = 8.3$ cm, $\angle SPQ = 127^\circ$, $PM \perp SQ$, $PM = 1.6$ cm. (4 marks)



EXERCISE - 3.3 (TEXT BOOK PAGE NO. 101)

7. Construct ΔPQR such that $PQ = 9.2$, $\angle PRQ = 112^\circ$, RK is an altitude, $RK = 2.4$ cm. (4 marks)



TYPE : 8

Constructing similar triangles

EXERCISE - 3.4 (TEXT BOOK PAGE NO. 105)

1. $\triangle ABC \sim \triangle DEF$, In $\triangle ABC$, $AB = 5.2$ cm, $BC = 4.6$ cm, $\angle B = 45^\circ$ and $\frac{BC}{EF} = \frac{2}{3}$; **construct $\triangle DEF$.** (4 marks)

Analysis : $\triangle ABC \sim \triangle DEF$

[Given]

$$\therefore \frac{AB}{DE} = \frac{BC}{EF} = \frac{AC}{DF} = \frac{2}{3} \quad \dots\dots(i)$$

[c.s.s.t.]

$$\angle B = \angle E = 45^\circ$$

[c.a.s.t.]

$$\therefore \frac{AB}{DE} = \frac{2}{3} \quad [\text{From (i)}]$$

$$\therefore \frac{BC}{EF} = \frac{2}{3} \quad [\text{From (i)}]$$

$$\therefore \frac{5.2}{DE} = \frac{2}{3}$$

$$\therefore \frac{4.6}{EF} = \frac{2}{3}$$

$$\therefore \frac{15.6}{2} = DE$$

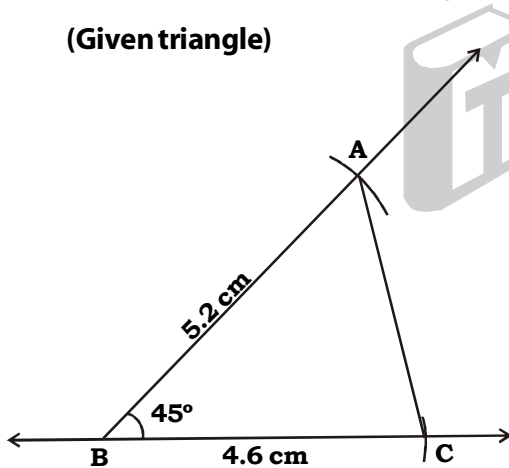
$$\therefore \frac{13.8}{2} = EF$$

$$\therefore DE = 7.8 \text{ cm}$$

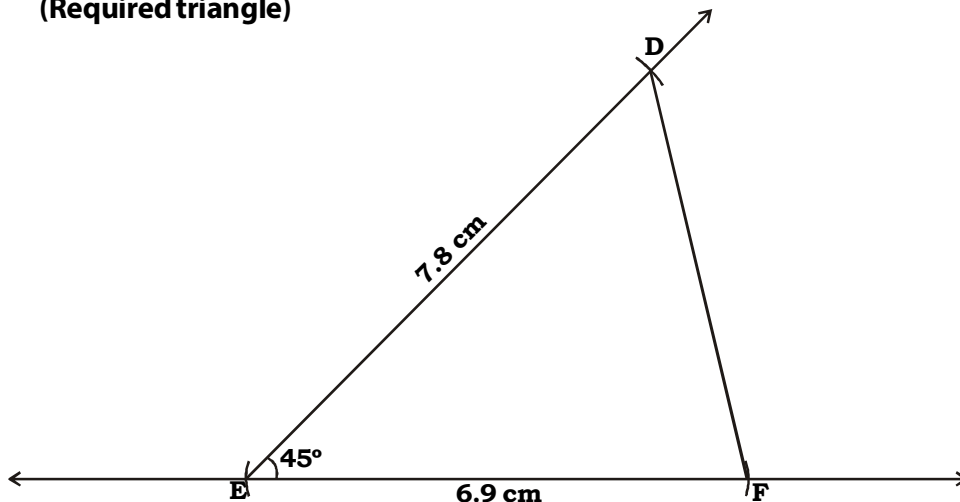
$$\therefore EF = 6.9 \text{ cm}$$

Information for constructing $\triangle DEF$ is complete.

(Given triangle)



(Required triangle)



EXERCISE - 3.4 (TEXT BOOK PAGE NO. 105)

2. $\triangle LMN \sim \triangle XYZ$, In $\triangle LMN$, $LM = 6$ cm, $MN = 6.8$ cm, $LN = 7.6$ cm and $\frac{LM}{XY} = \frac{4}{3}$; construct $\triangle XYZ$. (4 marks)

Analysis : $\triangle LMN \sim \triangle XYZ$

[Given]

$$\therefore \frac{LM}{XY} = \frac{MN}{YZ} = \frac{LN}{XZ} = \frac{4}{3} \quad \dots\dots (i) \quad [c.s.s.t.]$$

$$\therefore \frac{LM}{XY} = \frac{4}{3} \quad [From (i)] \quad \therefore \frac{MN}{YZ} = \frac{4}{3} \quad [From (i)] \quad \therefore \frac{LN}{XZ} = \frac{4}{3} \quad [From (i)]$$

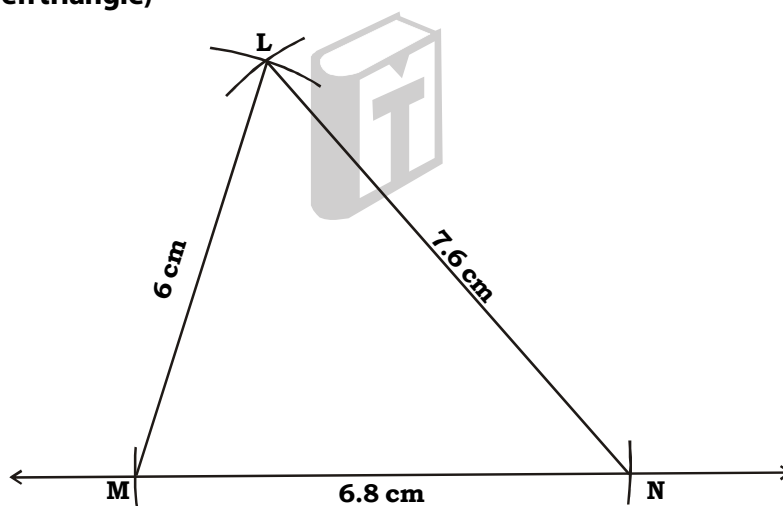
$$\therefore \frac{6}{XY} = \frac{4}{3} \quad \therefore \frac{6.8}{YZ} = \frac{4}{3} \quad \therefore \frac{7.6}{XZ} = \frac{4}{3}$$

$$\therefore \frac{18}{4} = XY \quad \therefore \frac{20.4}{4} = YZ \quad \therefore \frac{22.8}{4} = XZ$$

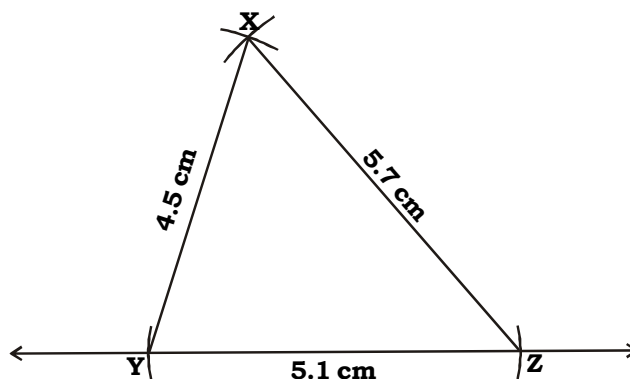
$$\therefore XY = 4.5 \text{ cm} \quad \therefore YZ = 5.1 \text{ cm} \quad \therefore XZ = 5.7 \text{ cm}$$

Information for constructing $\triangle XYZ$ is complete.

(Given triangle)



(Required triangle)



EXERCISE - 3.4 (TEXT BOOK PAGE NO. 105)

3. $\Delta RHP \sim \Delta NED$, In ΔNED , $NE = 7$ cm, $\angle D = 30^\circ$, $\angle N = 20^\circ$ and $\frac{HP}{ED} = \frac{4}{5}$;

construct ΔRHP .

(4 marks)

Analysis : $\Delta RHP \sim \Delta NED$

[Given]

$$\therefore \frac{RH}{NE} = \frac{HP}{ED} = \frac{RP}{ND} = \frac{4}{5} \quad \dots\dots(i) \quad [c.s.s.t.]$$

$$\left. \begin{aligned} \angle R &= \angle N = 20^\circ \\ \angle P &= \angle D = 30^\circ \\ \angle H &= \angle E = 130^\circ \end{aligned} \right\} [c.a.s.t.]$$

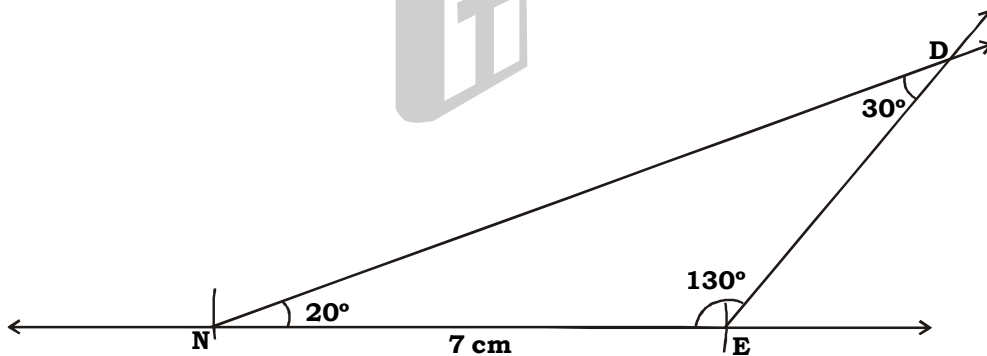
$$\therefore \frac{RH}{NE} = \frac{4}{5} \quad [From (i)]$$

$$\therefore \frac{RH}{7} = \frac{4}{5}$$

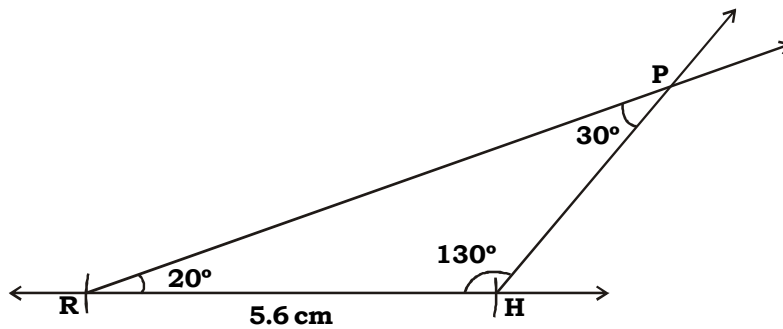
$$\therefore RH = \frac{28}{5} = 5.6 \text{ cm}$$

Information for constructing ΔRHP is complete.

(Given triangle)



(Required triangle)

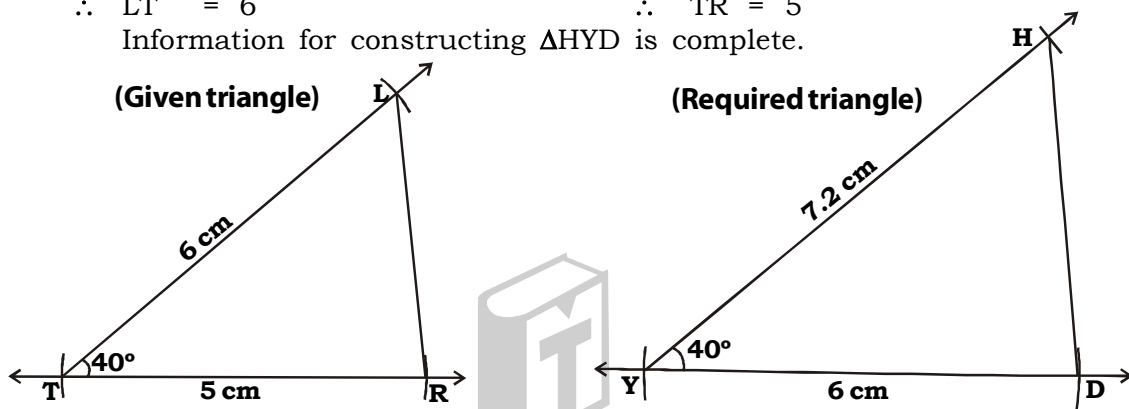


EXERCISE - 3.4 (TEXT BOOK PAGE NO. 105)

4. $\Delta LTR \sim \Delta HYD$, In ΔHYD , $HY = 7.2$ cm, $YD = 6$ cm, $\angle Y = 40^\circ$ and $\frac{LR}{HD} = \frac{5}{6}$,
 construct ΔLTR . (4 marks)

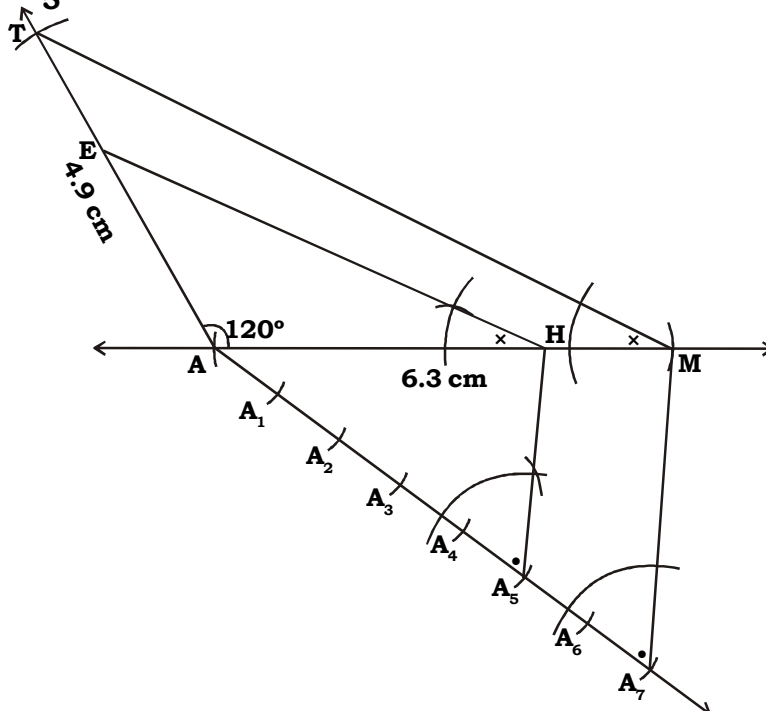
Sol. $\Delta RHP \sim \Delta NED$ [Given]
 $\therefore \frac{LT}{HY} = \frac{TR}{YD} = \frac{LR}{HD} = \frac{5}{6}$ (i) [c.s.s.t.]
 $\angle T = \angle Y = 40^\circ$ [c.a.s.t.]
 $\therefore \frac{LT}{HY} = \frac{5}{6}$ [From (i)] $\therefore \frac{TR}{YD} = \frac{5}{6}$ [From (i)]
 $\therefore \frac{LT}{7.2} = \frac{5}{6}$ $\therefore \frac{TR}{6} = \frac{5}{6}$
 $\therefore LT = \frac{36}{6}$ $\therefore TR = \frac{30}{6}$
 $\therefore LT = 6$ $\therefore TR = 5$

Information for constructing ΔHYD is complete.



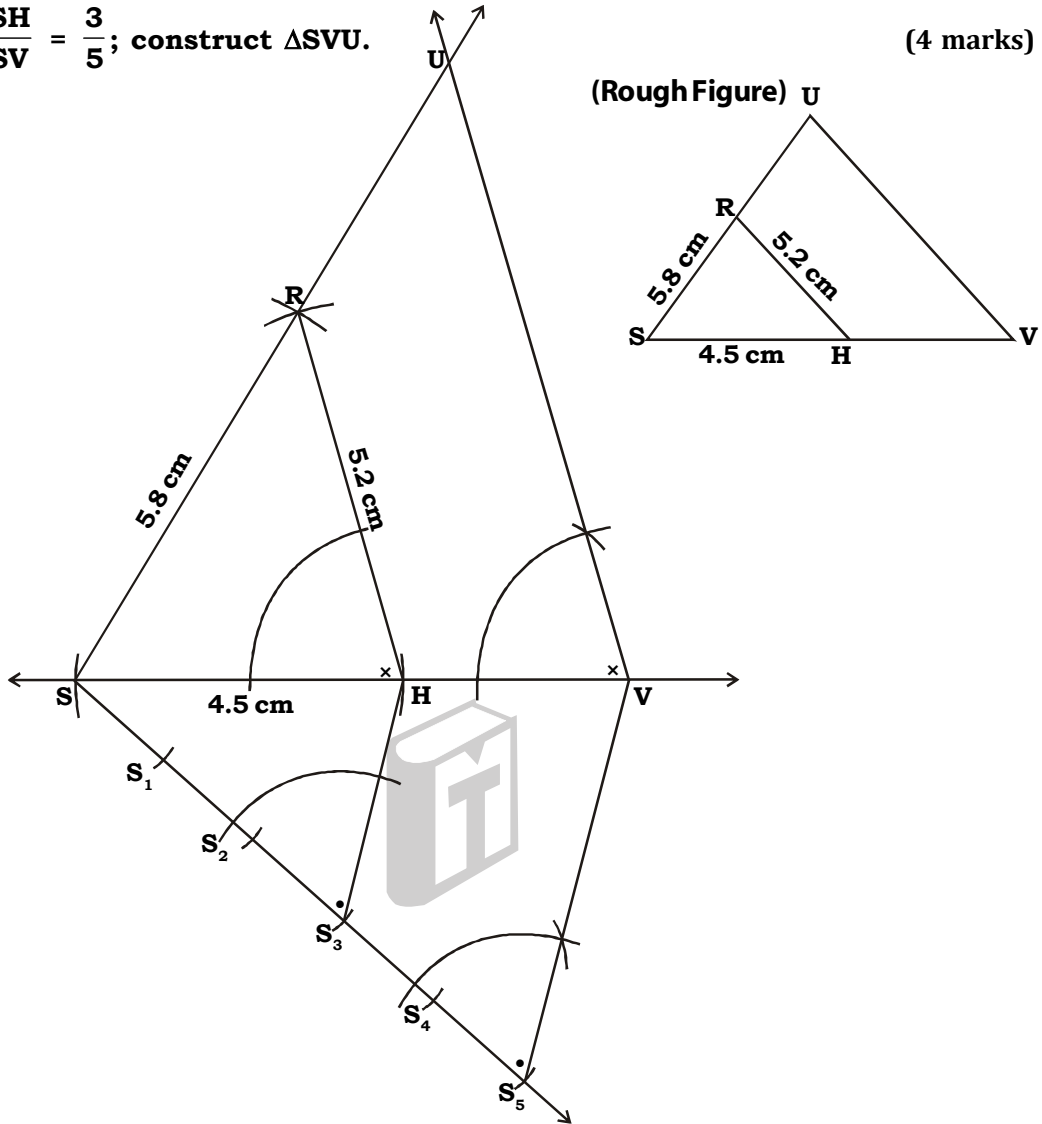
EXERCISE - 3.4 (TEXT BOOK PAGE NO. 105)

5. $\Delta AMT \sim \Delta AHE$, In ΔAMT , $MA = 6.3$ cm, $\angle MAT = 120^\circ$, $AT = 4.9$ cm and $\frac{MA}{HA} = \frac{7}{5}$, construct ΔAHE . (4 marks)



EXERCISE - 3.4 (TEXT BOOK PAGE NO. 105)

6. $\triangle SHR \sim \triangle SVU$, In $\triangle SHR$, $SH = 4.5$ cm, $HR = 5.2$ cm, $SR = 5.8$ cm and $\frac{SH}{SV} = \frac{3}{5}$; construct $\triangle SVU$. (4 marks)

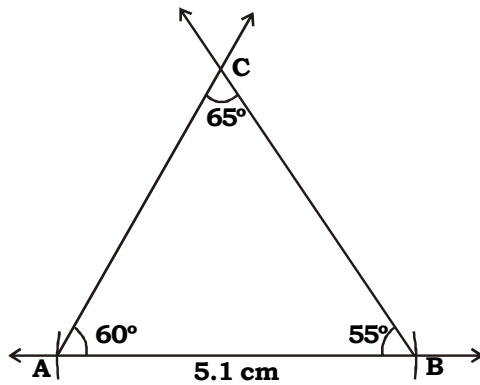


PROBLEM SET - 3 (TEXT BOOK PAGE NO. 197)

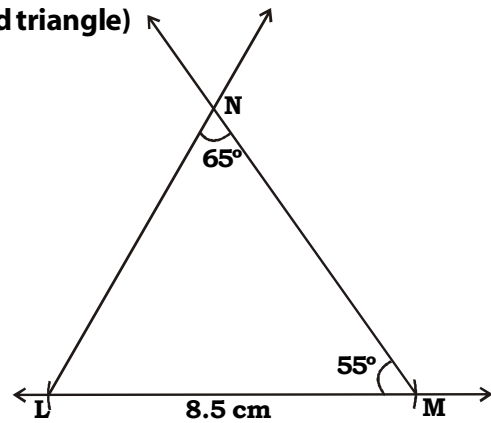
23. $\triangle ABC \sim \triangle LMN$. In $\triangle ABC$, $AB = 5.1$ cm, $\angle B = 55^\circ$, $\angle C = 65^\circ$ and $\frac{AC}{LN} = \frac{3}{5}$. then construct $\triangle LMN$. (4 marks)

Sol. $\triangle ABC \sim \triangle LMN$ [Given]
 $\therefore \frac{AB}{LM} = \frac{BC}{MN} = \frac{AC}{LN} = \frac{3}{5}$ (i) [c.s.s.t]
 $\therefore \frac{AB}{LM} = \frac{3}{5}$ [From (i)]
 $\therefore \frac{5.1}{LM} = \frac{3}{5}$
 $\therefore \frac{25.5}{3} = LM$
 $\therefore LM = 8.5$
 Information for constructing $\triangle LMN$ is complete.

(Given triangle)



(Required triangle)



PROBLEM SET - 3 (TEXT BOOK PAGE NO. 197)

24. $\triangle XYZ \sim \triangle DEF$, in $\triangle DEF$, $DE = 5.5$ cm, $\angle E = 40^\circ$, $EF = 4$ cm and $\frac{XY}{DE} = \frac{6}{5}$
then construct $\triangle XYZ$. (4 marks)

Ans. $\triangle XYZ \sim \triangle DEF$ [Given]

$$\therefore \frac{XY}{DE} = \frac{YZ}{EF} = \frac{XZ}{DF} = \frac{6}{5} \dots\dots(i) \text{ [c.s.s.t.]}$$

$$\therefore \frac{XY}{DE} = \frac{6}{5} \text{ [From (i)]}$$

$$\therefore \frac{XY}{5.5} = \frac{6}{5}$$

$$\therefore xy = \frac{33}{5}$$

$$\therefore XY = 6.6$$



$$\therefore \frac{YZ}{EF} = \frac{6}{5} \text{ [From (i)]}$$

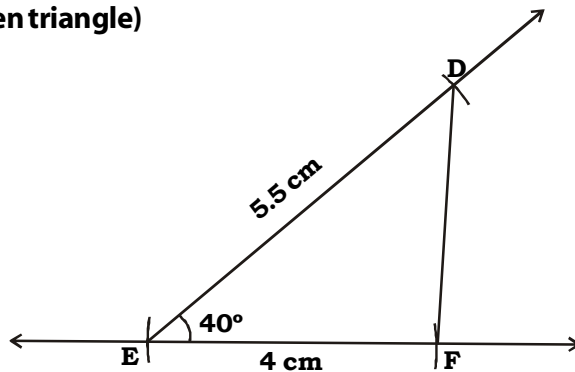
$$\therefore \frac{YZ}{4} = \frac{6}{5}$$

$$\therefore YZ = \frac{24}{5}$$

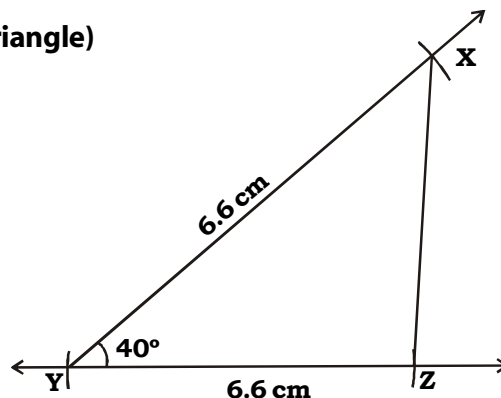
$$\therefore YZ = 4.8$$

Information for constructing $\triangle XYZ$ is complete.

(Given triangle)



(Required triangle)



HOTS PROBLEM

(Problems for developing Higher Order Thinking Skill)

14. To draw seg AB of length $\sqrt{65}$ without using Pythagoras theorem.

(4 marks)

Analysis : In $\triangle ABC$,

$$\angle ABC = 90^\circ$$

seg $BD \perp$ hypotenuse AC

$$\therefore \triangle ABC \sim \triangle ADB \quad [\text{Theorem on similarity of right angled triangle}]$$

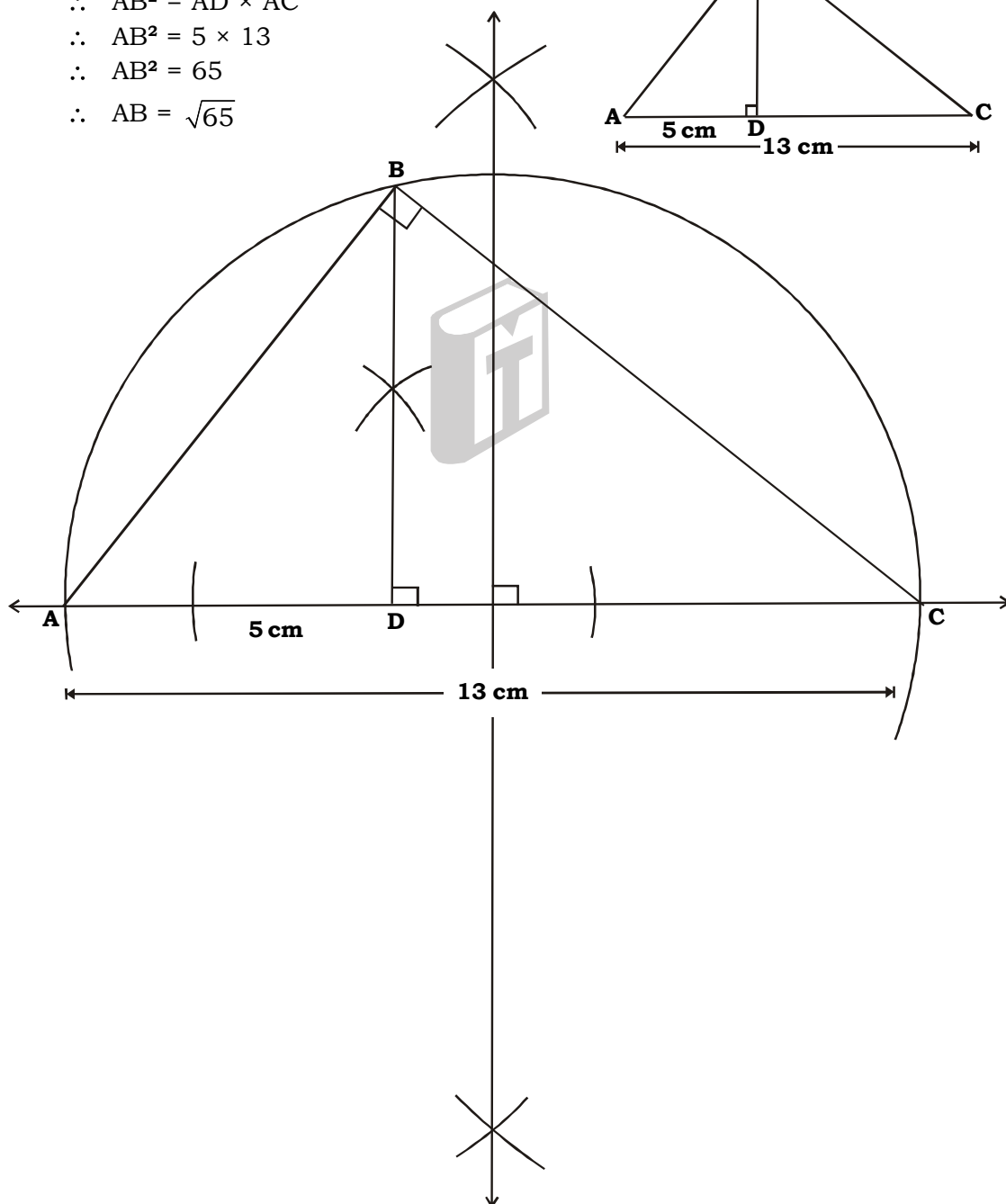
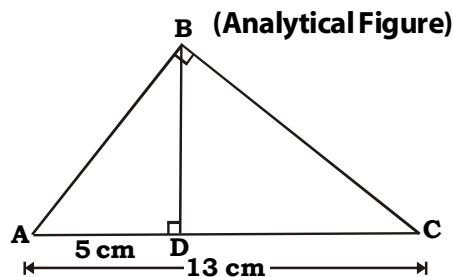
$$\therefore \frac{AB}{AD} = \frac{AC}{AB} \quad [\text{c.s.s.t.}]$$

$$\therefore AB^2 = AD \times AC$$

$$\therefore AB^2 = 5 \times 13$$

$$\therefore AB^2 = 65$$

$$\therefore AB = \sqrt{65}$$



OR

Analysis : In $\triangle CAD$,

$$m \angle CAD = 90^\circ$$

seg $AB \perp$ hypotenuse CD

$$\therefore AB^2 = CB \times BD$$

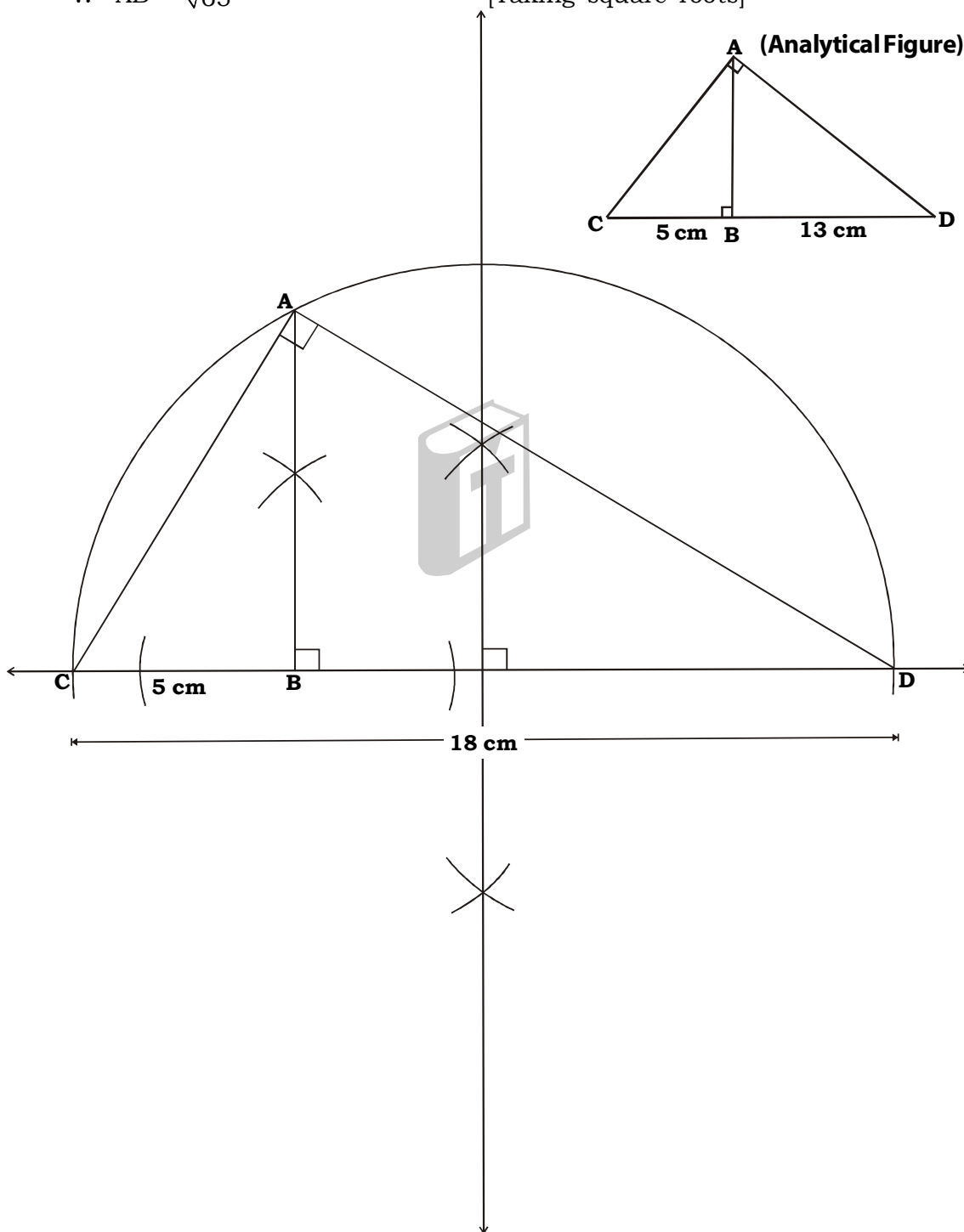
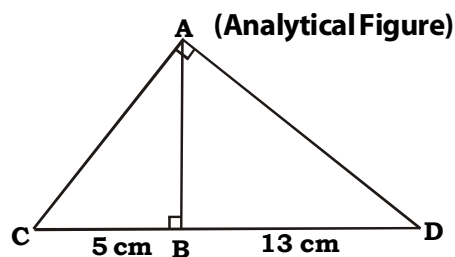
[Property of Geometric mean]

$$\therefore AB^2 = 5 \times 13$$

$$\therefore AB^2 = 65$$

$$\therefore AB = \sqrt{65}$$

[Taking square roots]

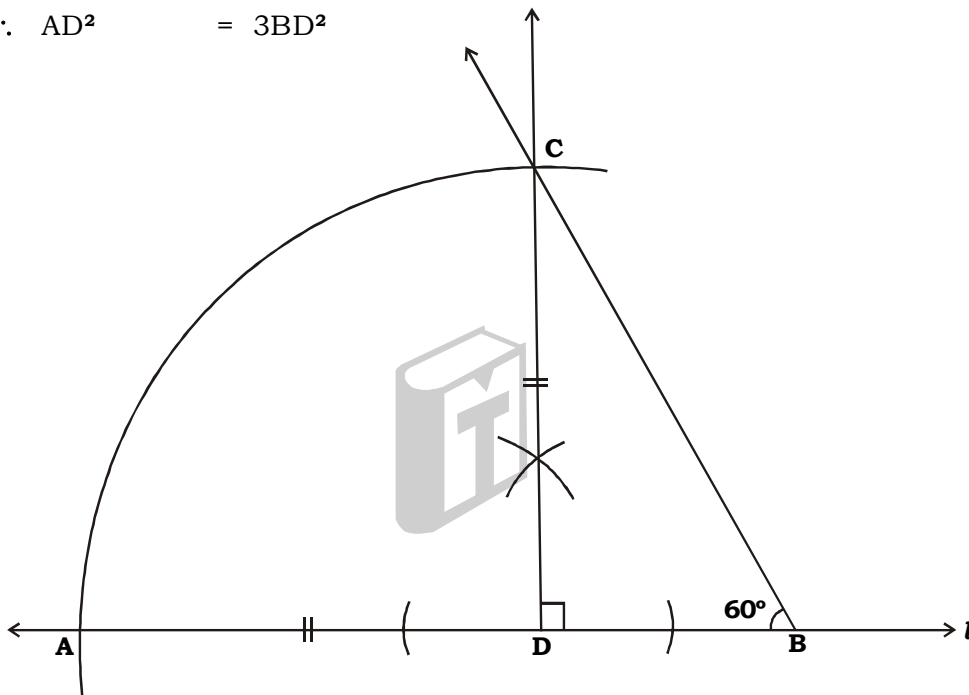
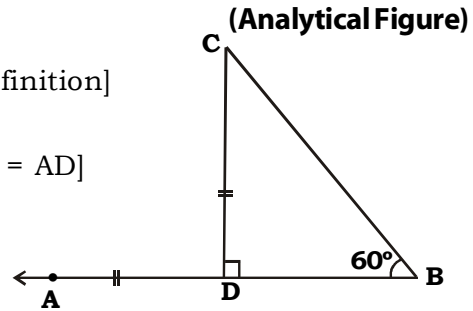


Note : This figure is drawn proportionally and not with given measurements.

16. Draw segment AB of any length. Take point D on AB such that $AD^2 = 3BD^2$. (4 marks)

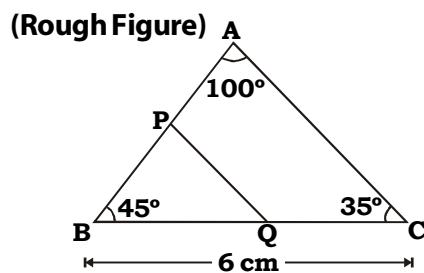
Analysis : In $\triangle CDB$,

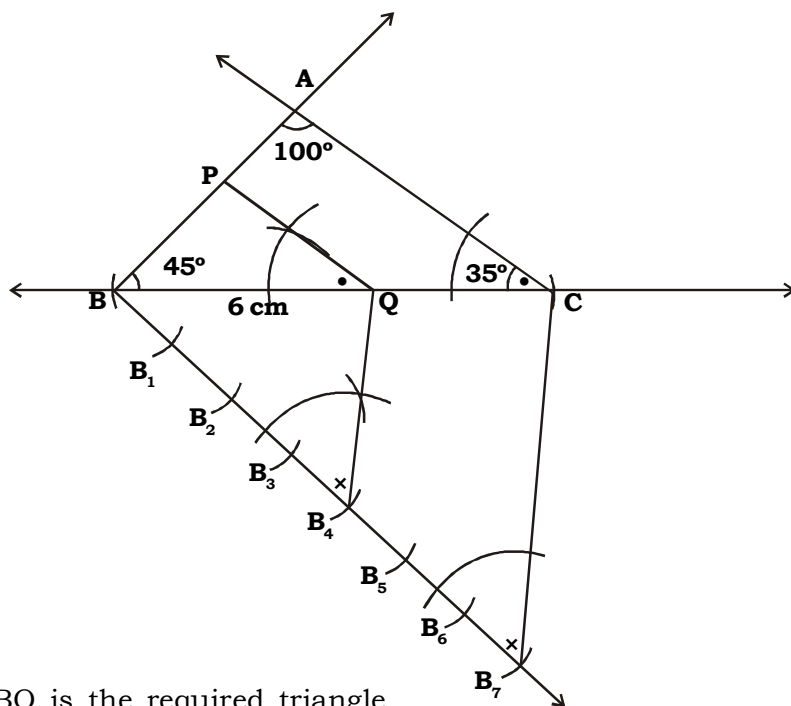
$$\begin{aligned} \tan \angle CBD &= \frac{CD}{BD} && \text{[By definition]} \\ \therefore \tan 60 &= \frac{AD}{BD} && [\because CD = AD] \\ \therefore \sqrt{3} &= \frac{AD}{BD} \\ \therefore 3 &= \frac{AD^2}{BD^2} && \text{[Squaring both sides]} \\ \therefore AD^2 &= 3BD^2 \end{aligned}$$



22. Draw a triangle ABC with side BC = 6 cm, $\angle B = 45^\circ$ and $\angle A = 100^\circ$, then construct a triangle whose sides are $\frac{4}{7}$ times the corresponding sides of $\triangle ABC$. (4 marks)

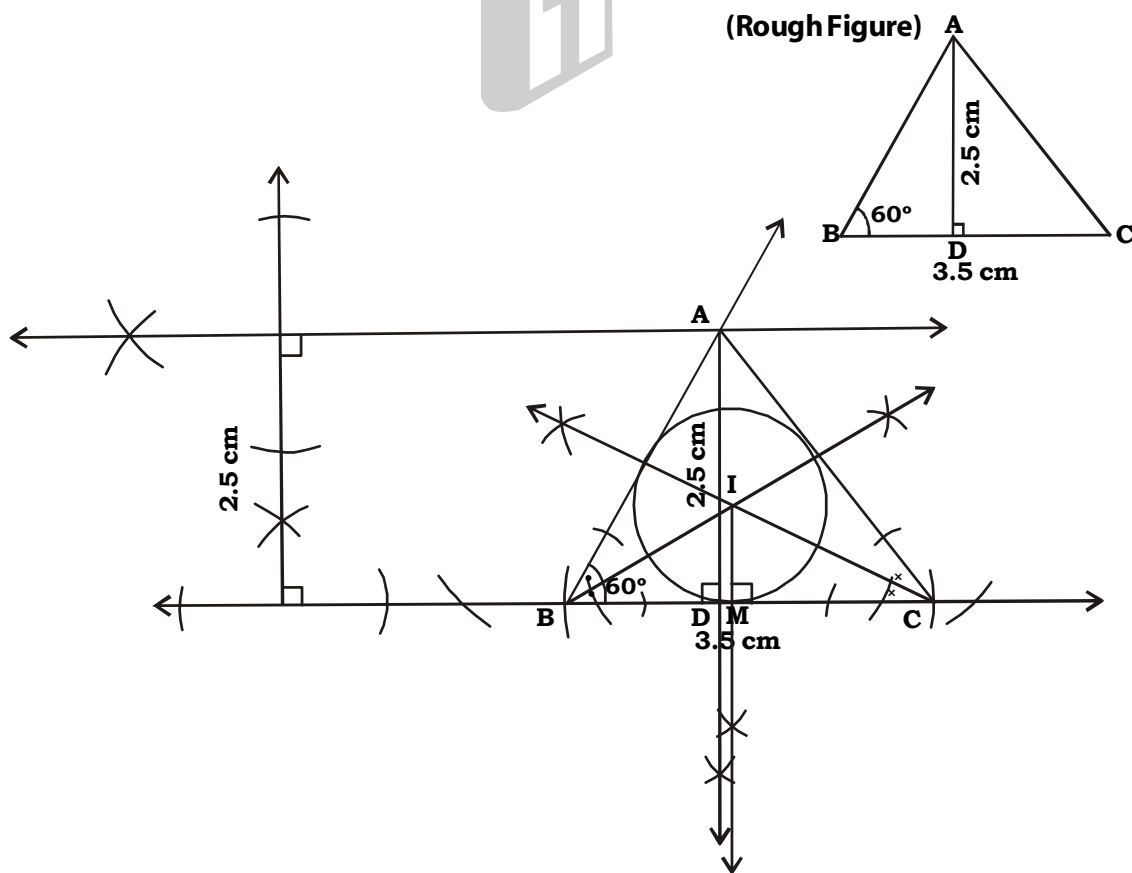
Analysis : In $\triangle ABC$,
 $m \angle A = 100^\circ$ [Given]
 $m \angle B = 45^\circ$
 $\therefore m \angle C = 35^\circ$ [Remaining angle]





ΔPBQ is the required triangle
 whose sides are $\frac{4}{7}$ times the corresponding sides of ΔABC

23. Construct a triangle ABC , in which $BC = 3.5$ cm, $\angle B = 60^\circ$ and altitude $AD = 2.5$ cm and draw its incircle and measure its radius. (4 marks)



Note : This figure is drawn proportionally and not with given measurements.

24. Construct an isosceles triangle whose base is 8 cm and altitude 4 cm. Draw its circumcircle and measure its radius. (4 marks)

Analysis : $\triangle ABC$ is an isosceles triangle with $AB = AC$
 seg $AD \perp$ side BC

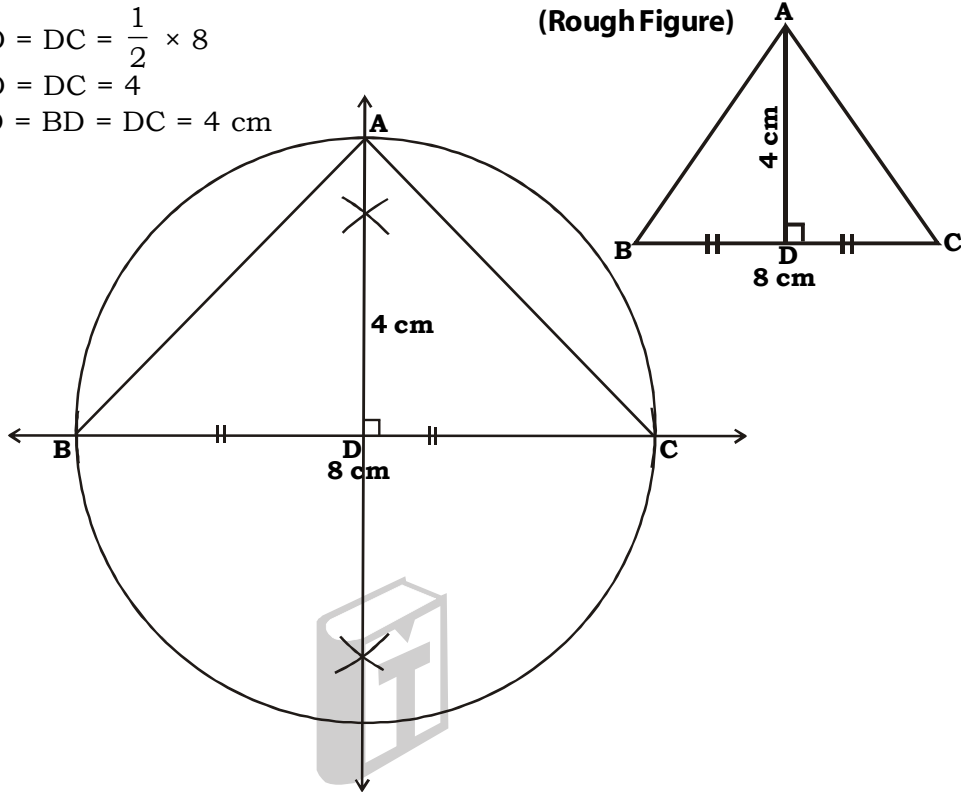
$$BD = DC = \frac{1}{2}BC \quad [\text{Perpendicular drawn to the base, bisects the base}]$$

$$BD = DC = \frac{1}{2} \times 8$$

$$BD = DC = 4$$

$$\therefore AD = BD = DC = 4 \text{ cm}$$

(Rough Figure)



25. In $\triangle PQR$, $QR = 7.5 \text{ cm}$, $\angle QPR = 110^\circ$ and $PQ + PR = 8.3 \text{ cm}$ then construct $\triangle PQR$ and measure $\angle PQR$. Construct its circumcircle. (5 marks)

Analysis : line l is perpendicular bisector of side TR

$$\therefore PT = PR \quad \dots\dots(i) \quad [\text{Perpendicular bisector theorem}]$$

$$QT = 8.3 \text{ cm}$$

$$\therefore PQ + PT = 8.3 \quad [Q - P - T]$$

$$\therefore PQ + PR = 8.3 \quad [\text{From (i)}]$$

In $\triangle PTR$,

$$\text{side } PT \cong \text{side } PR \quad [\text{From (i)}]$$

$$\therefore \angle PTR \cong \angle PRT \quad [\text{Isosceles triangle theorem}]$$

$$\text{Let, } \angle PTR = \angle PRT = x$$

Now, $\angle QPR$ is an exterior angle of $\triangle PTR$,

$$\therefore \angle QPR = \angle PTR + \angle PRT \quad [\text{Remote interior angles theorem}]$$

$$\therefore 110 = x + x$$

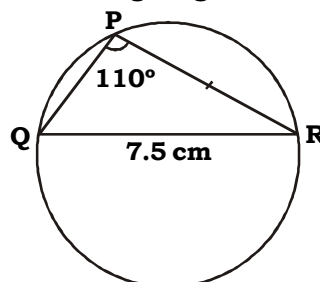
$$\therefore 110 = 2x$$

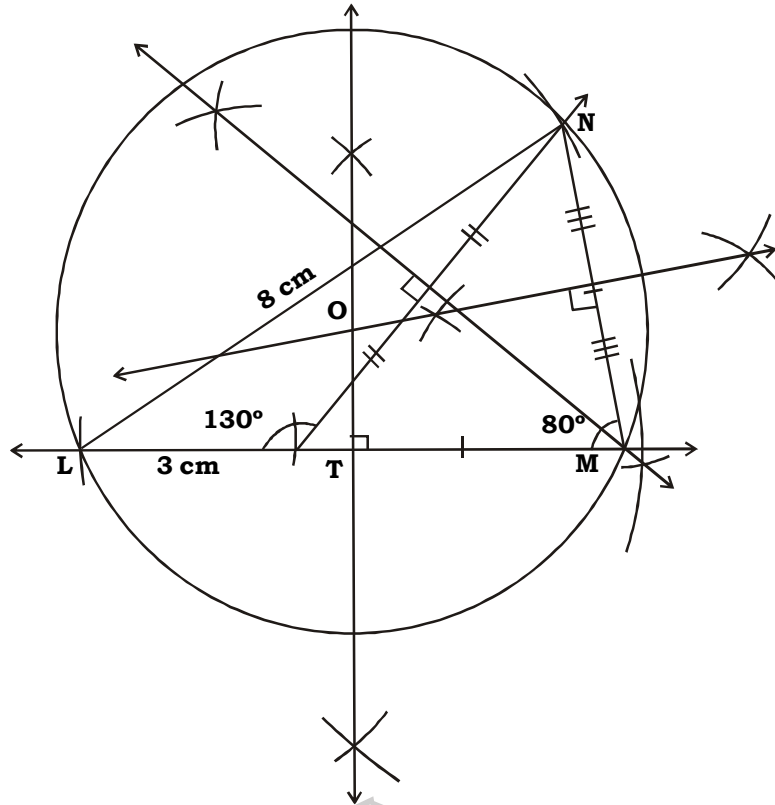
$$\therefore x = 55$$

$$\therefore \angle PTR = \angle PRT = 55^\circ$$

\therefore Information to draw $\triangle RQT$ is complete.

(Rough Figure)

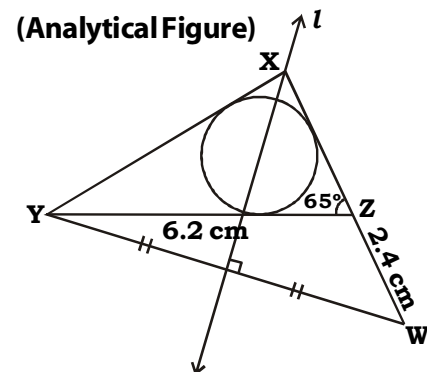
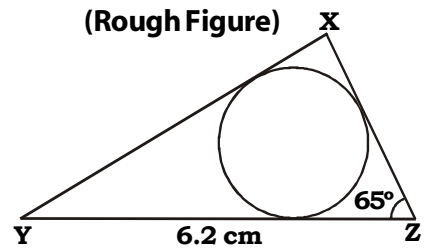
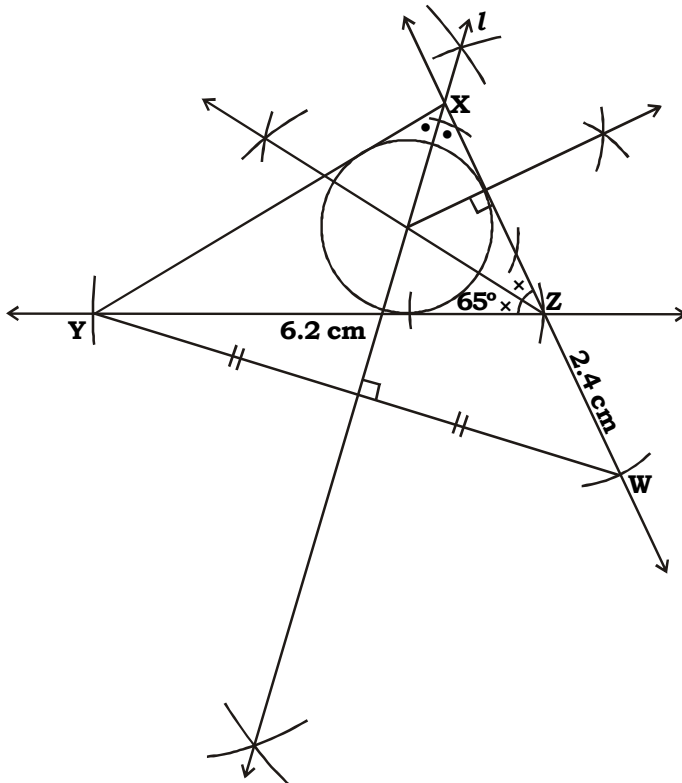




27. Construct $\triangle XYZ$ such that, $YZ = 6.2$ cm, $\angle Z = 65^\circ$ and $XY - XZ = 2.4$ cm and draw incircle of it. (4 marks)

Analysis : Line l is a perpendicular bisector of side YW

$$\begin{aligned} \therefore XY &= XW && \text{.....(i)} && \text{[Perpendicular bisector theorem]} \\ XW &= XZ + ZW && && \text{[X - Z - W]} \\ \therefore XY &= XZ + 2.4 && && \text{[From (i)]} \\ \therefore XY - XZ &= 2.4 \end{aligned}$$



GEOMETRY

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28. In ΔRST , $RS = 5$ cm, $RT = 6.8$ cm and median $RM = 5.3$ cm construct a circumcircle of ΔRST . (4 marks)

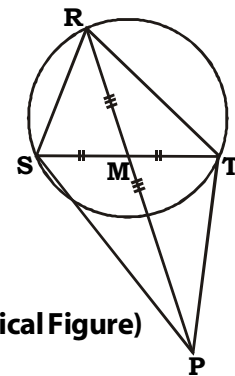
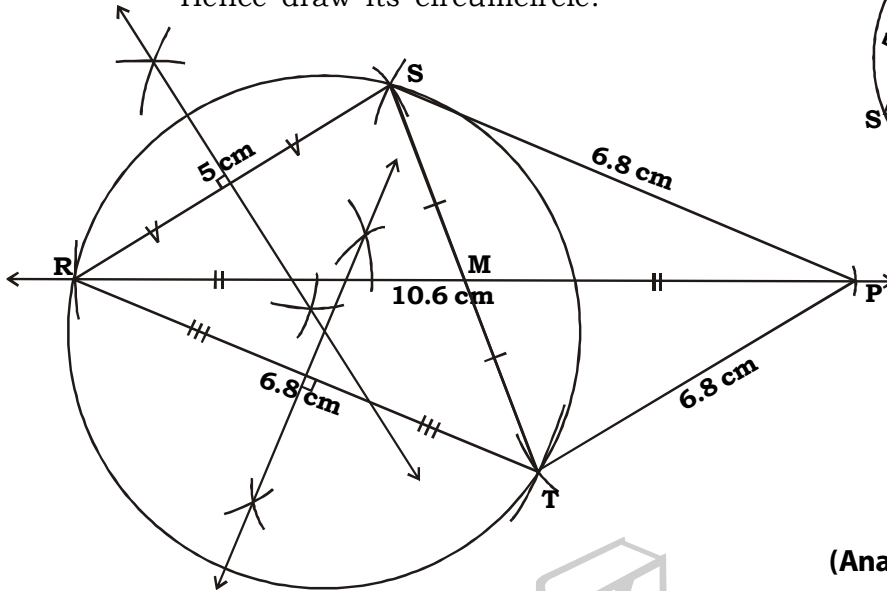
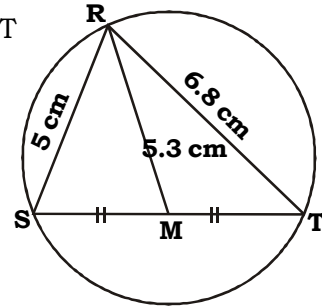
Analysis : In ΔRST extend median RM to point P such that $R - M - P$ and $RM = MP$ also $SM = MT$

\therefore $\square PSRT$ is a parallelogram

Information to constructing parallelogram $PSRT$ is complete and ΔRST can be obtained.

Hence draw its circumcircle.

(Rough Figure)



(Analytical Figure)

29. In ΔABC , $BC = 6$ cm and median $AM = 5.1$ cm. G is the centroid of ΔABC and $\angle BGC = 130^\circ$. Construct ΔABC . (4 marks)

Analysis : In ΔABC , G is the centroid on median AM

$\therefore GM = \frac{1}{3} AM$ [Centroid bisects each median]

$\therefore GM = \frac{1}{3} \times 5.1 = 1.7$ cm

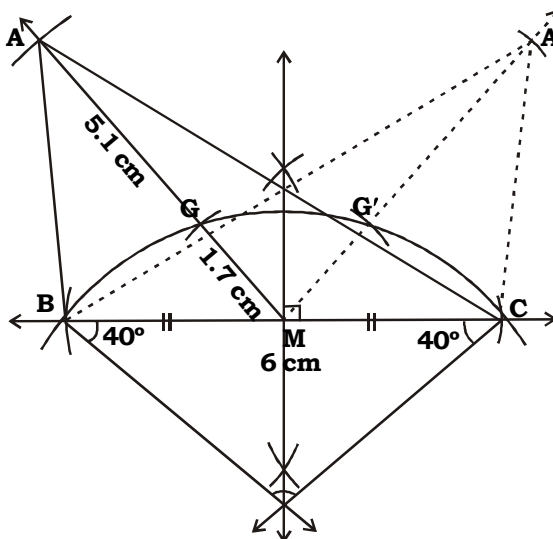
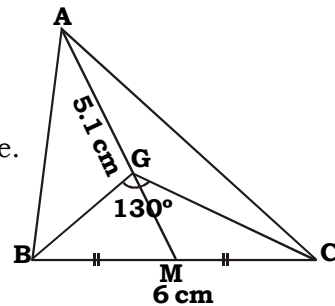
Also, $\angle BGC = 130^\circ$ and $BC = 6$ cm

Information for constructing ΔBGC is complete.

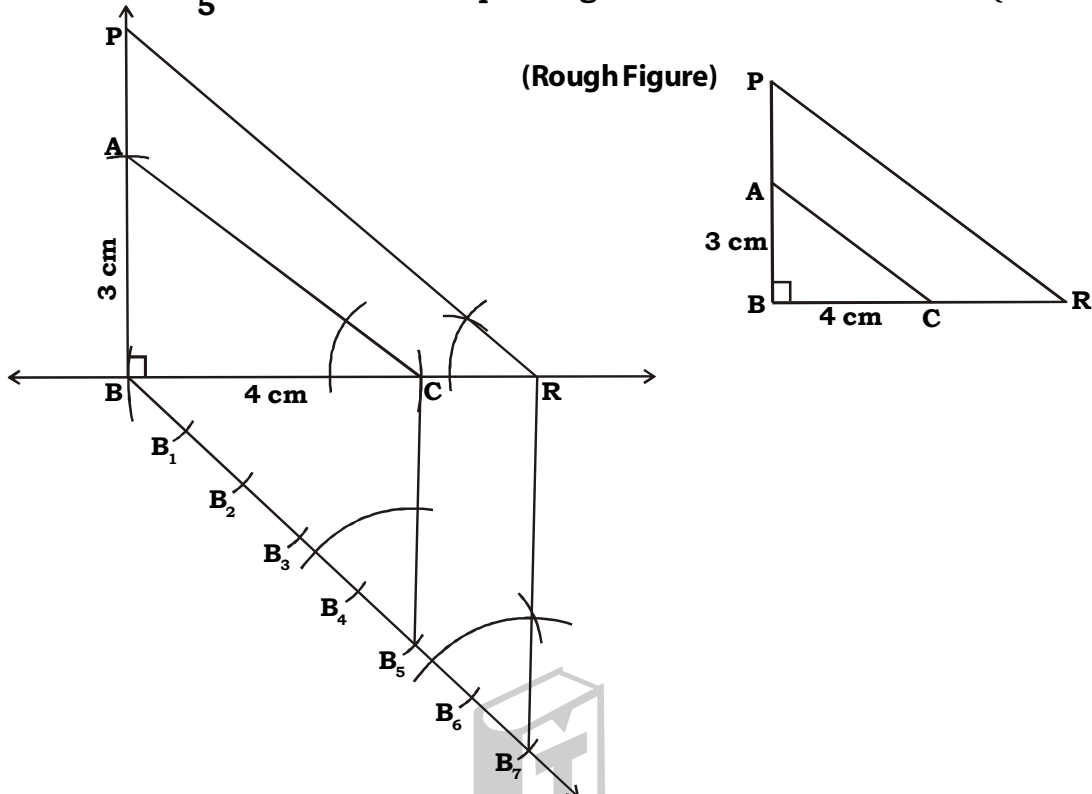
Position of A can be obtained on line GM .

Hence draw ΔABC .

(Rough Figure)



30. Draw a triangle ABC, right angled at B such that, AB = 3 cm and BC = 4 cm. Now construct a triangle similar to $\triangle ABC$, each of whose sides is $\frac{7}{5}$ times the corresponding side of $\triangle ABC$. (4 marks)



MCQ's

- What is the point of concurrence of the medians of a triangle called ?
 (a) Circumcentre (b) Incentre
 (c) Orthocentre (d) Centroid
- What is the point of concurrence of the altitudes of a triangle called ?
 (a) circumcentre (b) incentre
 (c) orthocentre (d) centroid
- What is the point of concurrence of the angle bisectors of a triangle called ?
 (a) circumcentre (b) incentre
 (c) orthocentre (d) centroid
- An arc of a circle containing an angle of 70° is to be drawn on the upper side of seg AB. What are the measures of the angles to be drawn at points A and B ?
 (a) 20° on the upper side of seg AB (b) 70° on the upper side of seg AB
 (c) 20° on the lower side of seg AB (d) 70° on the lower side of seg AB
- An arc of a circle containing an angle of 140° is to be drawn on the upper side of seg AB. What are the measures of the angles to be drawn at points A and B.
 (a) 70° on the upper side of seg AB (b) 50° on the upper side of seg AB
 (c) 50° on the lower side of seg AB (d) 70° on the lower side of seg AB
- To find the circumcentre of $\triangle ABC$, we bisect of $\triangle ABC$.
 (a) side AB (b) all sides
 (c) any two sides (d) any two angles

7. To find incentre of a given triangle, we bisect
 (a) any two angles (b) all sides
 (c) all angles (d) one side and one angle
8. From a point outside a circle, tangents can be drawn
 (a) one (b) two
 (c) at the most two (d) none of these
9. The circumcentre of an acute angled triangle is of the triangle.
 (a) on one side (b) in the interior
 (c) in the exterior (d) none of these
10. If the circumcentre lies in the exterior of the triangle, then it is triangle.
 (a) a right angled (b) an acute angled
 (c) an isosceles (d) an obtuse angled
11. Tangent drawn from a point M on the circle is perpendicular to the
 (a) chord MP (b) diameter MN
 (c) chord AB (d) radius OP
12. To draw arc of measure 120° on seg AB, we first construct isosceles triangle with base angle of
 (a) 30° (b) 60°
 (c) 90° (d) 120°
13. Three sides of ΔABC are given. To construct similar ΔPQR , at least of ΔPQR must be given.
 (a) one angle (b) any two angles
 (c) any one side (d) all sides
14. The circumcentre and incentre of triangle are at the same point.
 (a) a scalene (b) an isosceles
 (c) an equilateral (d) an acute angled
15. To construct ΔABC of base $AB = 5$ cm and height $CP = 6$ cm, we draw parallel line at a distance of cm.
 (a) 1 (b) 5
 (c) 6 (d) 11
16. The sides of ΔABC are 6 cm, 8 cm, 10 cm. A circumcentre of ΔABC is drawn. What is the radius of the circumcircle ?
 (a) 5 cm (b) 10 cm
 (c) 4 cm (d) 24 cm
17. $\Delta ABC \sim \Delta XYZ \therefore \dots \cong \dots$
 (a) AB, XY (b) BC, YZ
 (c) AC, AZ (d) $\angle B, \angle Y$
18. To draw a tangent at point be on arc ABC must be given.
 (a) centre (b) none
 (c) diameter (d) length of chord AC
19. $\Delta ABC \sim \Delta XYZ$ and $\frac{AB}{XY} = \frac{2}{1}$
 $\therefore \frac{m \angle ABC}{m \angle XYZ} = \dots$

- (a) $\frac{1}{2}$ (b) 2
(c) 1 (d) $\frac{1}{3}$

20. O is the centre of a circle with radius 5 cm, the length of the tangent segment drawn from the point 13 cm from centre O is cm.
(a) 5 (b) 13
(c) 12 (d) 18

: ANSWERS :

- | | |
|---|---|
| 1. (d) Centroid | 2. (c) orthocentre |
| 3. (b) incentre | 4. (a) 20° on the upper side of seg AB |
| 5. (b) 50° on the upper side of seg AB | 6. (c) any two sides |
| 7. (a) any two angles | 8. (b) two |
| 9. (b) in the interior | 10. (d) an obtuse angled |
| 11. (b) diameter MN | 12. (a) 30° |
| 13. (c) any one side | 14. (c) an equilateral |
| 15. (c) 6 | 16. (a) 5 cm |
| 17. (d) $\angle B, \angle Y$ | 18. (a) none |
| 19. (c) 1 | 20. (c) 12 |



S.S.C.

MAHESH TUTORIALS

Marks : 30

SCHOOL SECTION **CHAPTER 3 : Geometric Construction****SET - A****GEOMETRY****Duration : 1 hr. 15 min.****Q.I. Solve the following :** (4)

- (i) Draw an angle of 125° and bisect it.
- (ii) Draw a circle of radius 3.6 cm, take a point M on it. Draw a tangent to the circle at M without using centre of the circle.

Q.II. Attempt the following : (9)

- (i) Draw a tangent to the circle with centre O and radius 3.3 cm from a point A such that $d(O, A) = 7.5$ cm. Measure the length of tangent segments.
- (ii) Construct the incircle of $\triangle DEF$ in which $DE = DF = 5.8$ cm, $\angle EDF = 65^\circ$.
- (iii) $\triangle ABC \sim \triangle DEF$, In $\triangle ABC$, $AB = 5.2$ cm, $BC = 4.6$ cm, $\angle B = 45^\circ$ and $\frac{BC}{EF} = \frac{2}{3}$; construct $\triangle DEF$.

Q.III. Solve the following : (12)

- (i) Construct $\triangle DEF$ such that $DF = 8.1$ cm, $\angle DEF = 140^\circ$ and median $EM = 2.5$ cm.
- (ii) Construct $\triangle PQR$ such that $PQ = 9.2$, $\angle PRQ = 112^\circ$, RK is an altitude, $RK = 2.4$ cm.
- (iii) In $\triangle PQR$, $\angle Q = 90^\circ$, seg QM is the median. $PQ^2 + QR^2 = 169$. Draw a circumcircle of $\triangle PQR$.

Q.IV. Solve the following : (5)

- (i) $\triangle AMT \sim \triangle AHE$, In $\triangle AMT$, $MA = 6.3$ cm, $\angle MAT = 120^\circ$, $AT = 4.9$ cm and $\frac{MA}{HA} = \frac{7}{5}$, construct $\triangle AHE$.

Best of Luck

CHAPTER 3 : Geometric Construction**SET - B****Q.I. Solve the following :** (4)

- (i) Draw a tangent at any point R on the circle of radius 3.4 cm and centre 'P'.
- (ii) Draw an arc with seg AB = 6.3 cm, inscribing $\angle ACB = 65^\circ$.

Q.II. Attempt the following : (9)

- (i) Construct the incircle of $\triangle SRN$, such that RN = 5.9 cm, RS = 4.9 cm, $\angle R = 95^\circ$.
- (ii) Construct $\triangle LEM$ such that, LE = 6cm, LM = 7.5 cm, $\angle LEM = 90^\circ$ and draw its circumcircle.
- (iii) Draw tangents to the circle with centre P and radius 2.9 cm. From a point Q which is at a distance 8.8 cm from the centre.

Q.III. Solve the following : (12)

- (i) Construct $\triangle LMN$ such that LM = 6.6 cm, $\angle LNM = 65^\circ$ and ND is median ND = 5 cm.
- (ii) Construct $\triangle LAC$ such that LC = 6.7 cm, $\angle LAC = 72^\circ$ and altitude AB has length 4 cm.
- (iii) $\triangle LMN \sim \triangle XYZ$, In $\triangle LMN$, LM = 6 cm, MN = 6.8 cm, LN = 7.6 cm and $\frac{LM}{XY} = \frac{4}{3}$; construct $\triangle XYZ$.

Q.IV. Solve the following : (5)

- (i) $\triangle SHR \sim \triangle SVU$, In $\triangle SHR$, SH = 4.5 cm, HR = 5.2 cm, SR = 5.8 cm and $\frac{SH}{SV} = \frac{3}{5}$; construct $\triangle SVU$.

Best of Luck