

10TH MATHS GEOMETRY

SIMILAR TRIANGLE

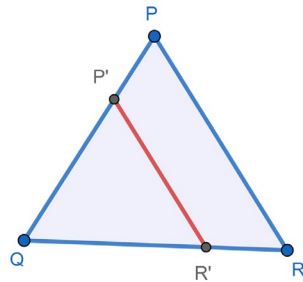
Note : Construction No Need Important

1. Construct a triangle similar to a given triangle PQR with its sides equal to $\frac{2}{3}$ of the corresponding sides of the triangle PQR (Scale Factor $\frac{2}{3} < 1$).

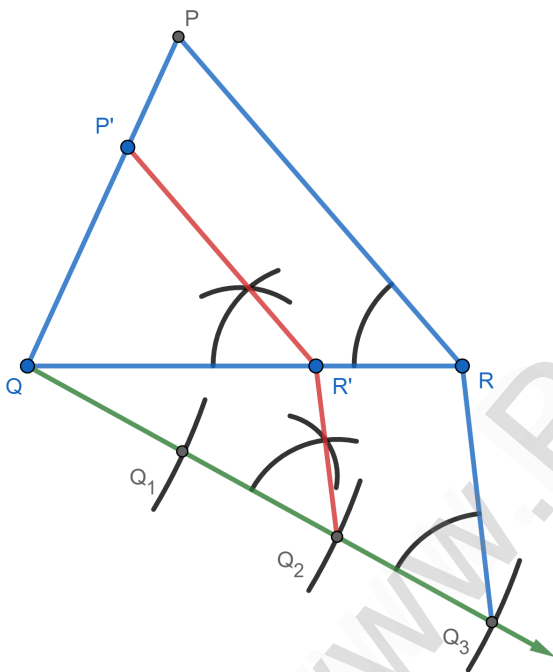
Solution:

Given
(Scale Factor $\frac{2}{3} < 1$)

Rough Diagram



Fair Diagram



Construction:

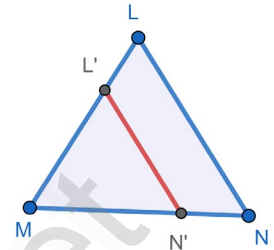
- ❖ Construct a ΔPQR with any measurement.
- ❖ Draw a ray QX making acute angle with QR on the side opposite to vertex P .
- ❖ Locate 3 (greater of 2 and 3 in $\frac{2}{3}$) points. Q_1, Q_2, Q_3 , on QX . $QQ_1 = Q_1Q_2 = Q_2Q_3$.
- ❖ Join Q_3R and draw a line through Q_2 (2 being smaller and 3 in $\frac{2}{3}$) parallel to Q_3R to intersect QR at R' .
- ❖ Draw line through R' parallel to the line RP to intersect QP at P' .
- ❖ $\Delta P'Q'R'$ is the required triangle of $\frac{2}{3}$ of the corresponding sides of ΔPQR .

2. Construct a triangle similar to a given triangle LMN with its sides equal to $\frac{4}{5}$ of the corresponding sides of the triangle LMN (Scale Factor $\frac{4}{5} < 1$).

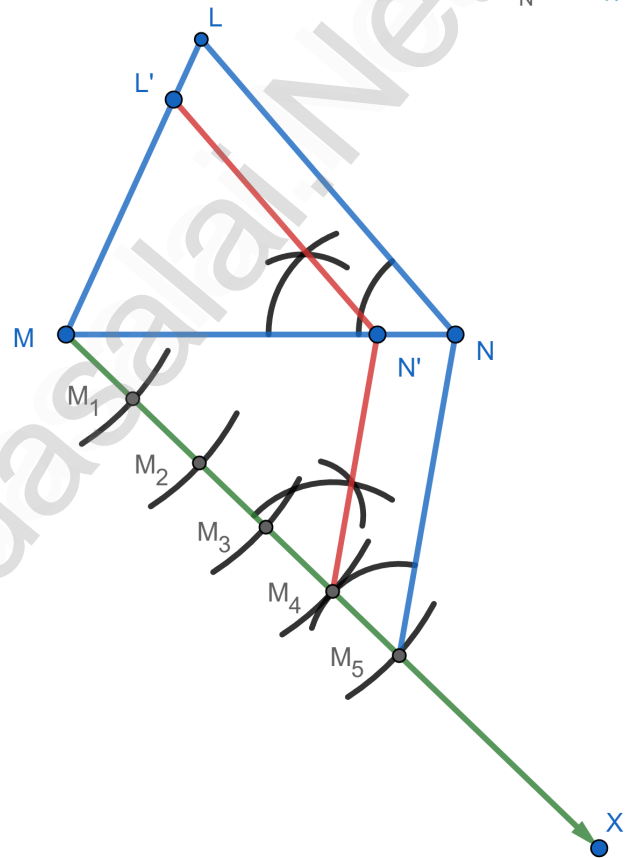
Solution:

Given
(Scale Factor $\frac{4}{5} < 1$)

Rough Diagram



Fair Diagram



Construction:

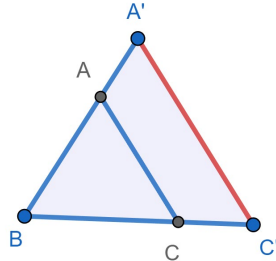
- ❖ Construct a ΔLMN with any measurement.
- ❖ Draw a ray MX making acute angle with MN on the side opposite to vertex L .
- ❖ Locate 5 (greater of 4 and 3 in $\frac{4}{5}$) points. M_1, M_2, M_3, M_4, M_5 , on MX . So $MM_1 = M_1M_2 = M_2M_3 = M_3M_4 = M_4M_5$.
- ❖ Join M_5N and draw a line through M_4 (4 being smaller of 4 and 5 in $\frac{4}{5}$) parallel to M_5N to intersect MN at N' .
- ❖ Draw line through N' parallel to the line NL to intersect ML at L' .
- ❖ $\Delta L'M'N'$ is the required triangle of $\frac{4}{5}$ of the corresponding sides of ΔLMN .

3. Construct a triangle similar to a given triangle ABC with its sides equal to $\frac{6}{5}$ of the corresponding sides of the triangle ABC (Scale Factor $\frac{6}{5} > 1$).

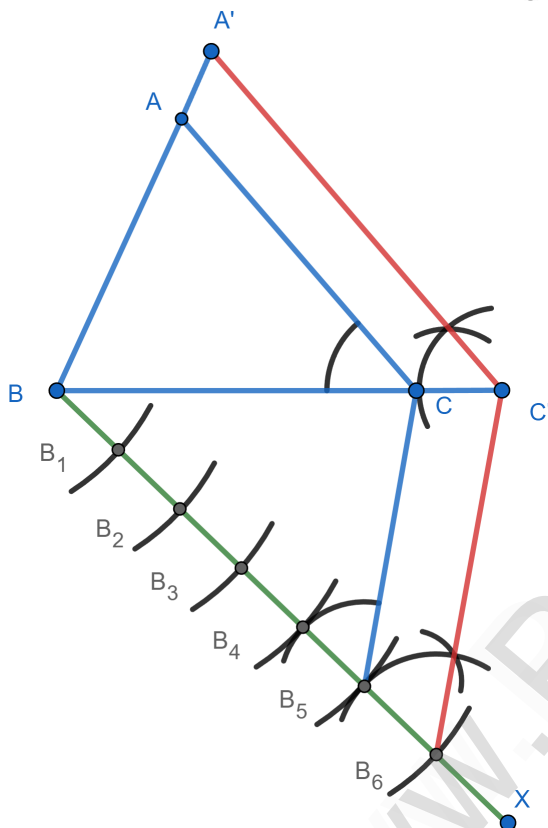
Solution:

Given
(Scale Factor $\frac{6}{5} > 1$)

Rough Diagram



Fair Diagram



Construction:

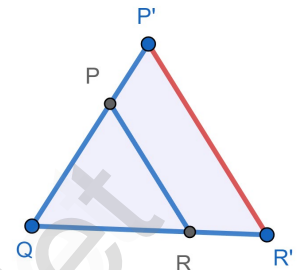
- ❖ Construct a ΔABC with any measurement.
- ❖ Draw a ray BX making acute angle with BC on the side opposite to vertex A .
- ❖ Locate 6 (greater of 6 and 5 in $\frac{6}{5}$) points. $B_1, B_2, B_3,$ on BX . So $BB_1 = B_1B_2 = B_2B_3 = B_3B_4 = B_4B_5 = B_5B_6$.
- ❖ Join B_5C and draw a line through B_6 (5 being smaller of 5 and 6 in $\frac{6}{5}$) parallel to B_5C to intersecting the extended line segment BC at C' .
- ❖ Draw line through C' parallel to the line CA to intersecting the extended line segment BA at A' .
- ❖ $\Delta A'B'C'$ is the required triangle of $\frac{6}{5}$ of the corresponding sides of ΔABC .

4. Construct a triangle similar to a given triangle PQR with its sides equal to $\frac{7}{3}$ of the corresponding sides of the triangle PQR (Scale Factor $\frac{7}{3} > 1$).

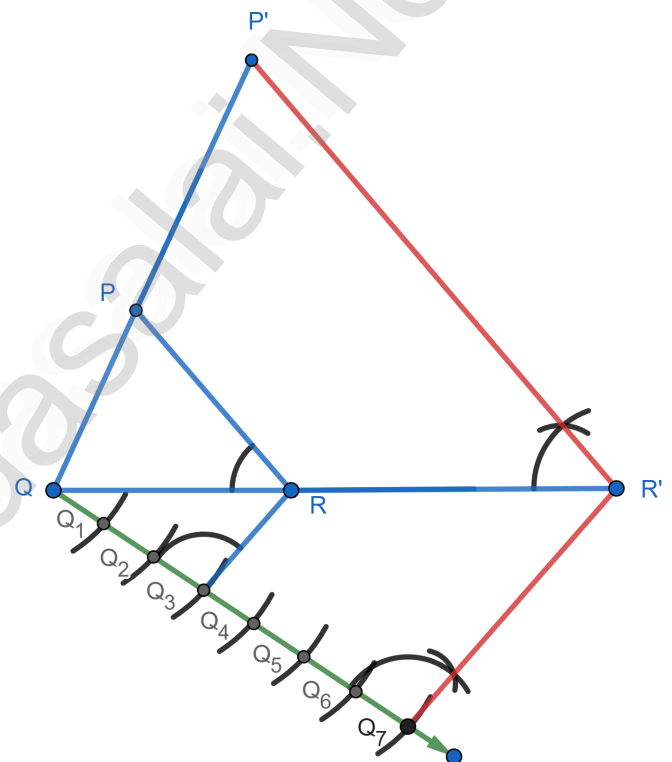
Solution:

Given
(Scale Factor $\frac{7}{3} > 1$)

Rough Diagram



Fair Diagram

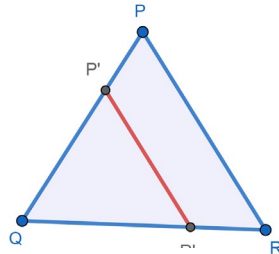
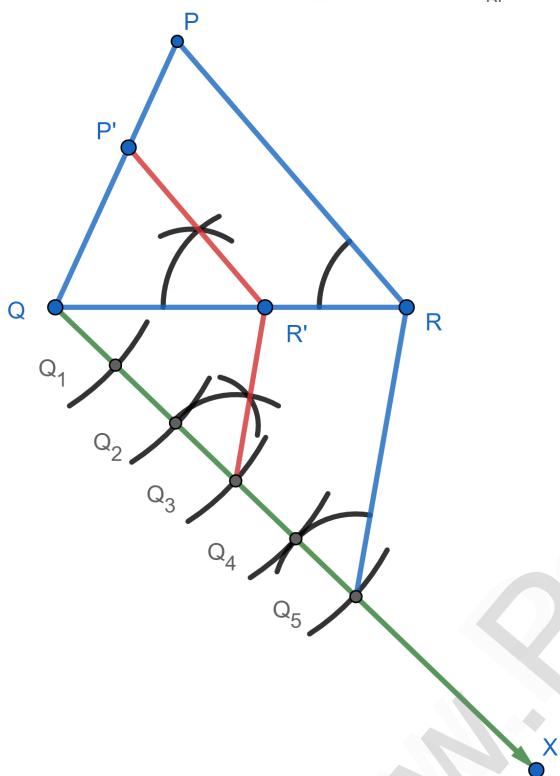


Construction:

- ❖ Construct a ΔPQR with any measurement.
- ❖ Draw a ray QX making acute angle with QR on the side opposite to vertex P .
- ❖ Locate 7 (greater of 7 and 3 in $\frac{7}{3}$) points. $Q_1, Q_2, Q_3, Q_4, Q_5, Q_6, Q_7,$ on QX . So $QQ_1 = Q_1Q_2 = Q_2Q_3 = Q_3Q_4 = Q_4Q_5 = Q_5Q_6 = Q_6Q_7$.
- ❖ Join Q_3R and draw a line through Q_7 (3 being smaller of 3 and 7 in $\frac{7}{3}$) parallel to Q_3R to intersecting the extended line segment QR at R' .
- ❖ Draw line through R' parallel to the line RP to intersecting the extended line segment QP at P' .
- ❖ $\Delta P'Q'R'$ is the required triangle of $\frac{7}{3}$ of the corresponding sides of ΔPQR .

Example : 4.10.

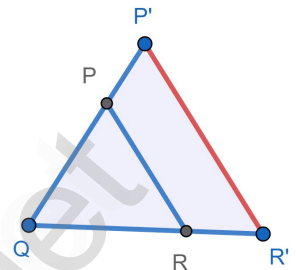
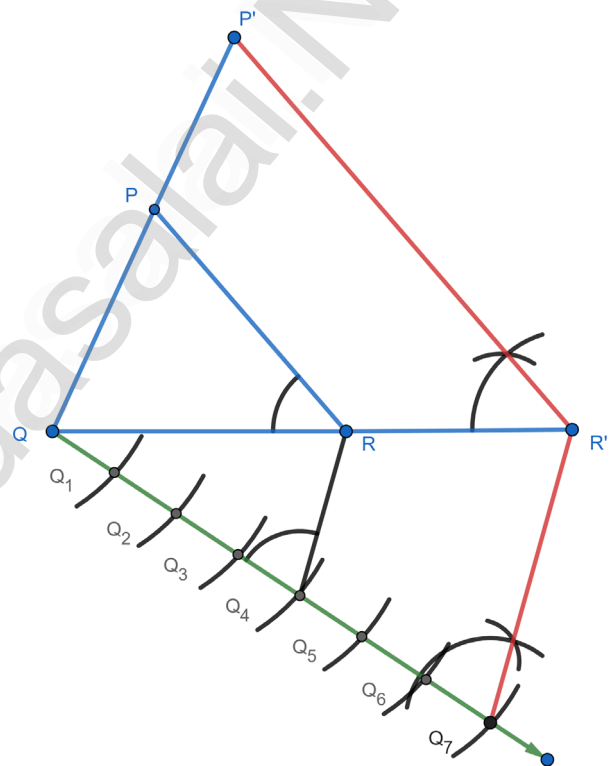
Construct a triangle similar to a given triangle PQR with its sides equal to $\frac{3}{5}$ of the corresponding sides of the triangle PQR (Scale Factor $\frac{3}{5} < 1$).

Solution:**Given**(Scale Factor $\frac{3}{5} < 1$)**Rough Diagram****Fair Diagram****Construction:**

- ❖ Construct a ΔPQR with any measurement.
- ❖ Draw a ray QX making acute angle with QR on the side opposite to vertex P .
- ❖ Locate 5 (greater of 3 and 5 in $\frac{3}{5}$) points. Q_1, Q_2, Q_3, Q_4, Q_5 , on QX . So $QQ_1 = Q_1Q_2 = Q_2Q_3 = Q_3Q_4 = Q_4Q_5$.
- ❖ Join Q_5R and draw a line through Q_3 (3 being smaller and 5 in $\frac{3}{5}$) parallel to Q_5R to intersect QR at R' .
- ❖ Draw line through R' parallel to the line RP to intersect QP at P' .
- ❖ $\Delta P'Q'R'$ is the required triangle of $\frac{3}{5}$ of the corresponding sides of ΔPQR .

Example : 4.11.

Construct a triangle similar to a given triangle PQR with its sides equal to $\frac{7}{4}$ of the corresponding sides of the triangle PQR (Scale Factor $\frac{7}{4} > 1$).

Solution:**Given**(Scale Factor $\frac{7}{4} > 1$)**Rough Diagram****Fair Diagram****Construction:**

- ❖ Construct a ΔPQR with any measurement.
- ❖ Draw a ray QX making acute angle with QR on the side opposite to vertex P .
- ❖ Locate 7 (greater of 7 and 4 in $\frac{7}{4}$) points. $Q_1, Q_2, Q_3, Q_4, Q_5, Q_6, Q_7$, on QX . So $QQ_1 = Q_1Q_2 = Q_2Q_3 = Q_3Q_4 = Q_4Q_5 = Q_5Q_6 = Q_6Q_7$.
- ❖ Join Q_4R and draw a line through Q_7 (4 being smaller of 4 and 7 in $\frac{7}{4}$) parallel to Q_4R to intersecting the extended line segment QR at R' .
- ❖ Draw line through R' parallel to the line RP to intersecting the extended line segment QP at P' .
- ❖ $\Delta P'Q'R'$ is the required triangle of $\frac{7}{4}$ of the corresponding sides of ΔPQR .

10TH MATHS GEOMETRY

TWO TANGENT AND TANGENT

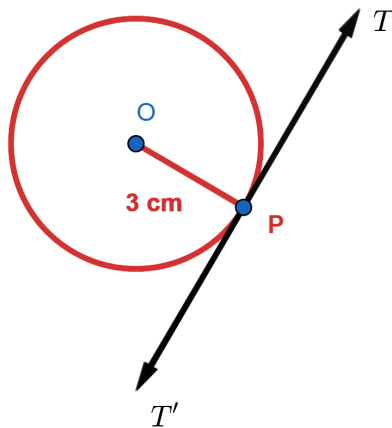
Example 4.29

Draw a circle of radius 3 cm. Take a point P on this circle and draw a tangent at P.

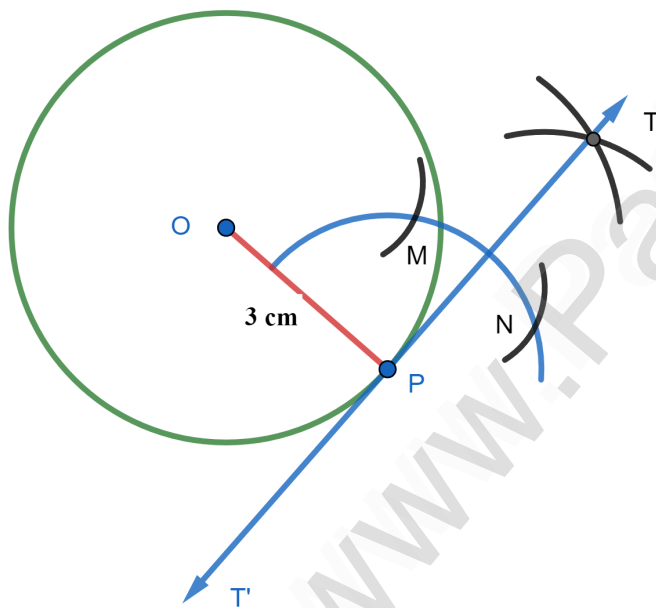
Solution:

Given
Radius $r = 3 \text{ cm}$

Rough Diagram



Fair Diagram



Construction:

- ❖ Draw a circle with centre at O of radius 3 cm.
- ❖ Take a point P on the circle. Join OP.
- ❖ Draw perpendicular line to OP which passes through P.
- ❖ TT' is the required tangent.

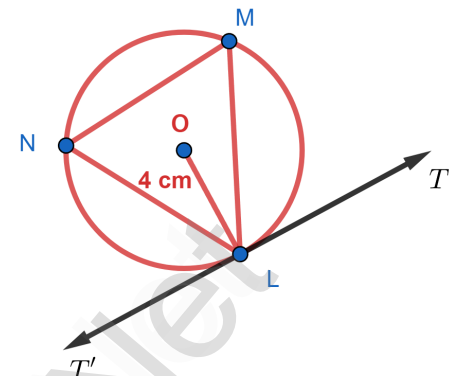
Example 4.30

Draw a circle of radius 4 cm. At a point L on it draw a tangent to the circle using the alternate segment.

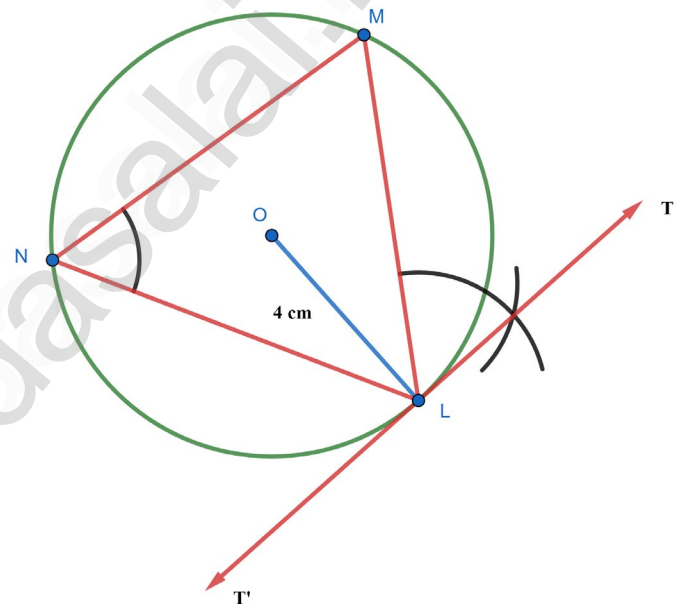
Solution:

Given
Radius $r = 4 \text{ cm}$

Rough Diagram



Fair Diagram



Construction:

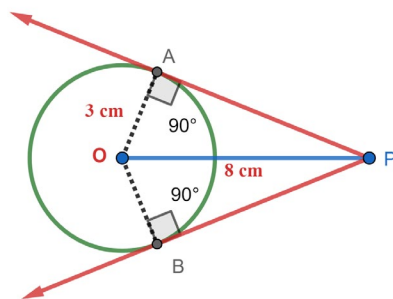
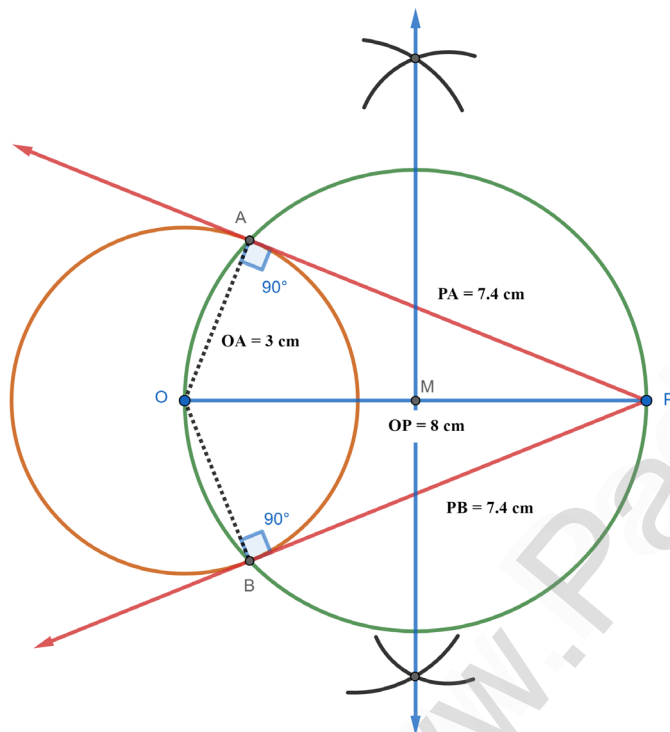
- ❖ With O as the centre, draw a circle of radius 4 cm.
- ❖ Take a point L on the circle. Through L draw any chord LM.
- ❖ Take a point N distinct from L and M on the circle, so that L, M and N are in anti-clockwise direction. Join LN and NM.
- ❖ Through L draw a tangent TT' such that $\angle TLM = \angle MNL$.
- ❖ TT' is the required tangent.

Example 4.31

Draw a circle of **diameter 6 cm** from a point P, which is **8 cm** away from its centre. Draw the **two tangents PA and PB** to the circle and measure their lengths.

Solution:

Given, $d = 6 \text{ cm}$
 Radius, $R = \frac{d}{2}$
 $= \frac{6}{2}$
 Radius $r = 3 \text{ cm}$

Rough Diagram**Fair Diagram****Construction:**

- ❖ With centre at O, draw a circle of radius 3 cm.
- ❖ Draw a line OP of length 8 cm.
- ❖ Draw a perpendicular bisector of OP, which cuts OP at M.
- ❖ With M as centre and MO as radius, draw a circle which cuts previous circle at A and B.
- ❖ Join AP and BP. AP and BP are the required tangents. Thus length of the tangents are $PA = PB = 7.4 \text{ cm}$.

Verification:

In the Right Angle triangle OAP,

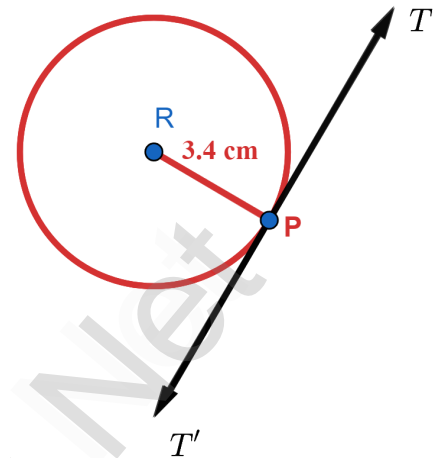
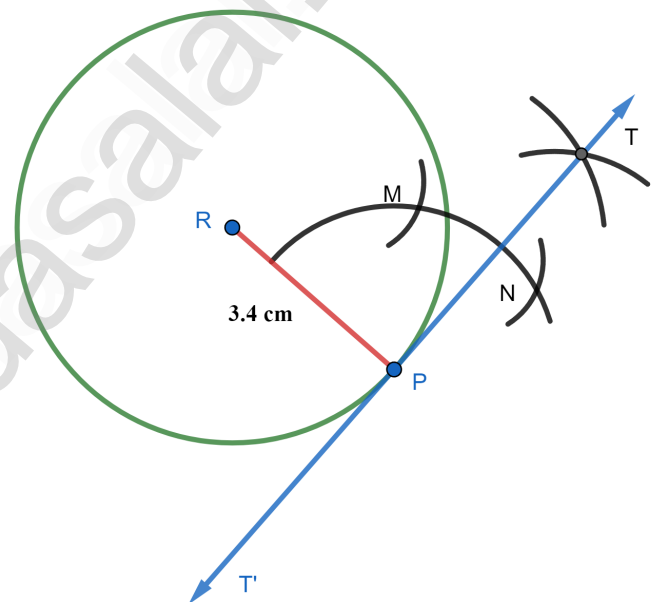
$$\begin{aligned} PA^2 &= OP^2 - OA^2 \\ &= 8^2 - 3^2 \\ &= 64 - 9 \\ &= 55 \end{aligned}$$

$$PA = \sqrt{55} = 7.4 \text{ cm (approximately)}$$

1. Draw a tangent at any point R on the circle of radius 3.4 cm and centre at P?.

Solution:

Given
 Radius $r = 3.4 \text{ cm}$

Rough Diagram**Fair Diagram****Construction:**

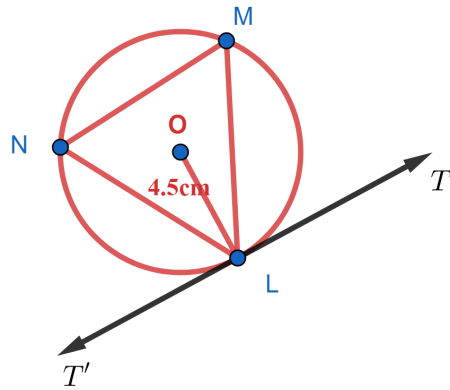
- ❖ Draw a circle with centre at O of radius 3.4 cm.
- ❖ Take a point P on the circle. Join OP.
- ❖ Draw perpendicular line to OP which passes through P.
- ❖ TT' is the required tangent.

2. Draw a circle of radius 4.5 cm . Take a point on the circle. Draw the tangent at that point using the Alternate Segment Theorem.

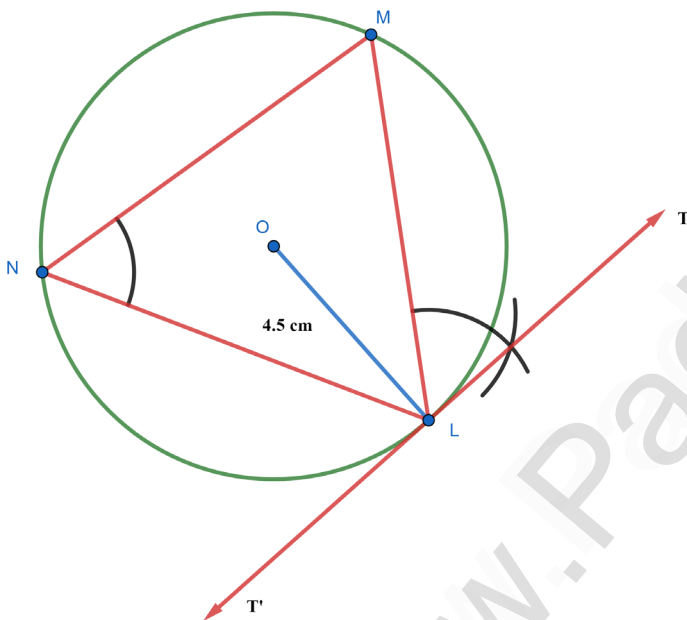
Solution:

Given
Radius $r = 4.5 \text{ cm}$

Rough Diagram



Fair Diagram



Construction:

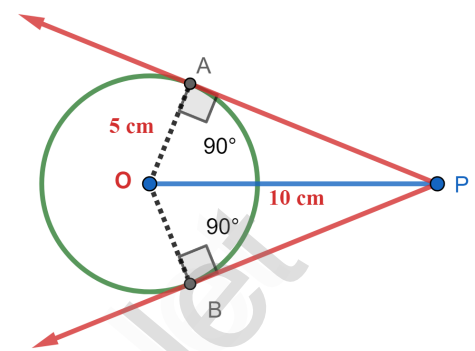
- ❖ With O as the centre, draw a circle of radius 4.5 cm.
- ❖ Take a point L on the circle. Through L draw any chord LM.
- ❖ Take a point N distinct from L and M on the circle, so that L, M and N are in anti-clockwise direction. Join LN and NM.
- ❖ Through L draw a tangent TT' such that $\angle TLM = \angle MNL$.
- ❖ TT' is the required tangent.

3. Draw the two tangents from a point which is 10 cm away from the centre of a circle of radius 5 cm. Also, measure the lengths of the tangents.

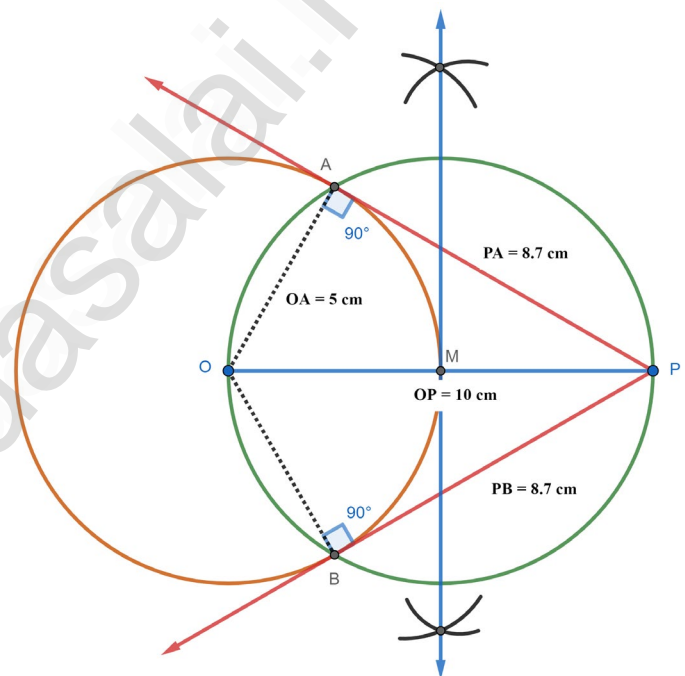
Solution:

Given,
Radius $r = 5 \text{ cm}$

Rough Diagram



Fair Diagram



Construction:

- ❖ With centre at O, draw a circle of radius 5 cm.
- ❖ Draw a line OP of length 10 cm.
- ❖ Draw a perpendicular bisector of OP, which cuts OP at M.
- ❖ With M as centre and MO as radius, draw a circle which cuts previous circle at A and B.
- ❖ Join AP and BP. AP and BP are the required tangents. Thus length of the tangents are $PA = PB = 8.7 \text{ cm}$.

Verification:

In the Right Angle triangle OAP,

$$\begin{aligned} PA^2 &= OP^2 - OA^2 \\ &= 10^2 - 5^2 \\ &= 100 - 25 \\ &= 75 \end{aligned}$$

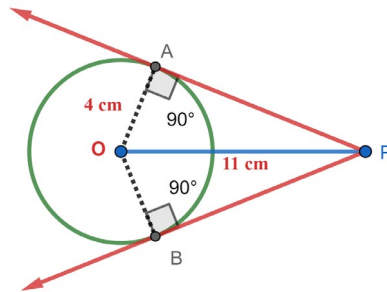
$$PA = \sqrt{75} = 8.7 \text{ cm (approximately)}$$

4. Take a point which is **11 cm** away from the centre of a circle of **radius 4 cm** and draw the **two tangents** to the circle from that point.

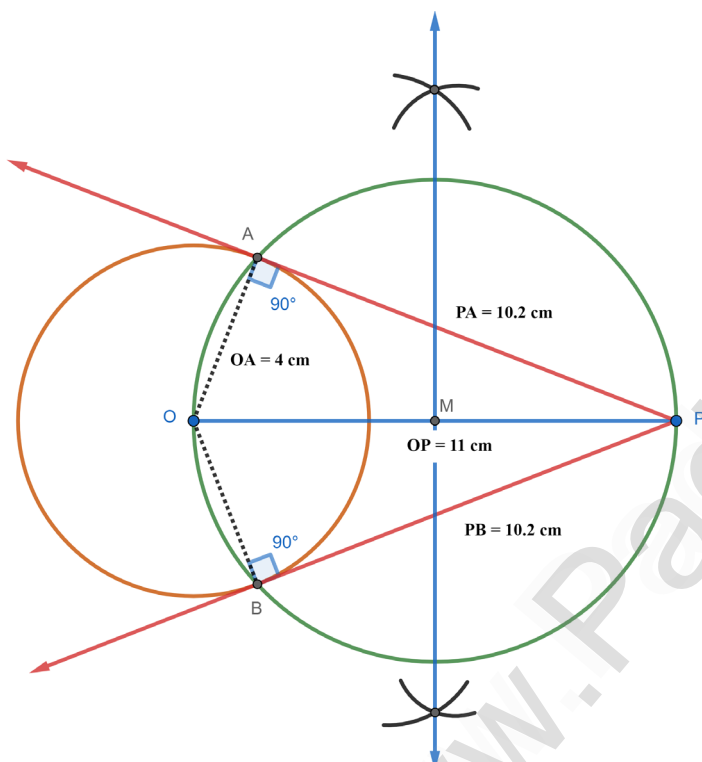
Solution:

Given,
Radius $r = 4 \text{ cm}$

Rough Diagram



Fair Diagram



Construction:

- ❖ With centre at O, draw a circle of radius 4 cm.
- ❖ Draw a line OP of length 11 cm.
- ❖ Draw a perpendicular bisector of OP, which cuts OP at M.
- ❖ With M as centre and MO as radius, draw a circle which cuts previous circle at A and B.
- ❖ Join AP and BP. AP and BP are the required tangents.
Thus length of the tangents are $PA = PB = 10.2 \text{ cm}$.

Verification:

In the Right Angle triangle OAP,

$$\begin{aligned} PA^2 &= OP^2 - OA^2 \\ &= 11^2 - 4^2 \\ &= 121 - 16 \\ &= 105 \end{aligned}$$

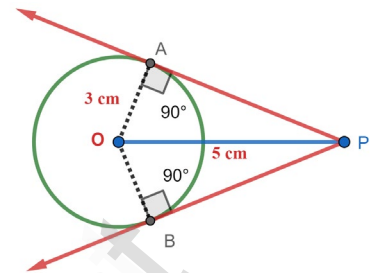
$$PA = \sqrt{105} = 10.2 \text{ cm (approximately)}$$

5. Draw the two tangents from a point which is **5 cm** away from the centre of a circle of **diameter 6 cm**. Also, measure the lengths of the tangents.

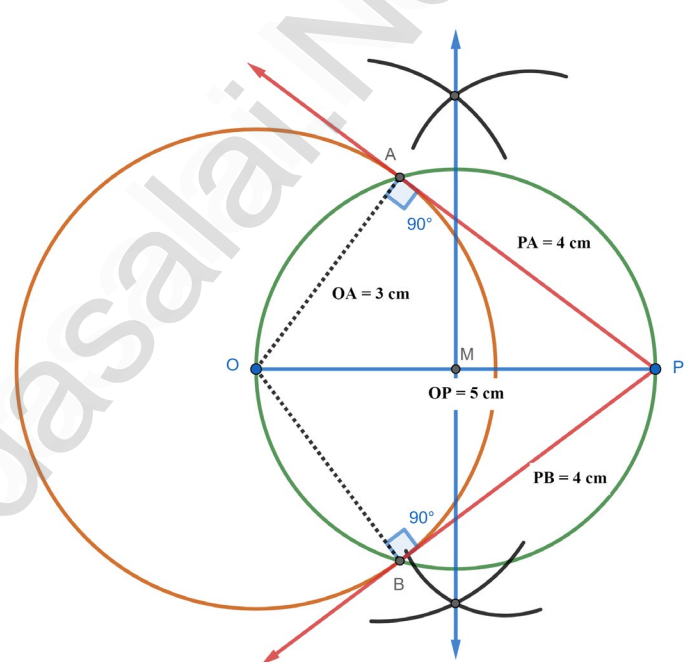
Solution:

Given, $d = 6 \text{ cm}$
Radius, $R = \frac{d}{2}$
 $= \frac{6}{2}$
Radius $r = 3 \text{ cm}$

Rough Diagram



Fair Diagram



Construction:

- ❖ With centre at O, draw a circle of radius 3 cm.
- ❖ Draw a line OP of length 5 cm.
- ❖ Draw a perpendicular bisector of OP, which cuts OP at M.
- ❖ With M as centre and MO as radius, draw a circle which cuts previous circle at A and B.
- ❖ Join AP and BP. AP and BP are the required tangents. Thus length of the tangents are $PA = PB = 4 \text{ cm}$.

Verification:

In the Right Angle triangle OAP,

$$\begin{aligned} PA^2 &= OP^2 - OA^2 \\ &= 5^2 - 3^2 \\ &= 25 - 9 \\ &= 16 \end{aligned}$$

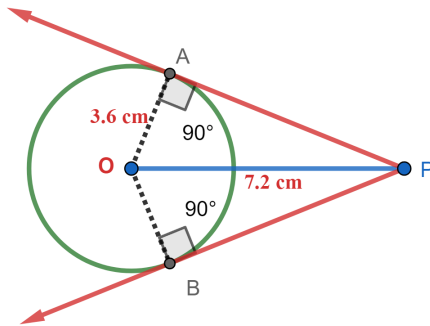
$$PA = \sqrt{16} = 4 \text{ cm (approximately)}$$

6. Draw a tangent to the circle from the point P having radius 3.6 cm. and centre O point P is at a distance 7.2 cm from the centre.

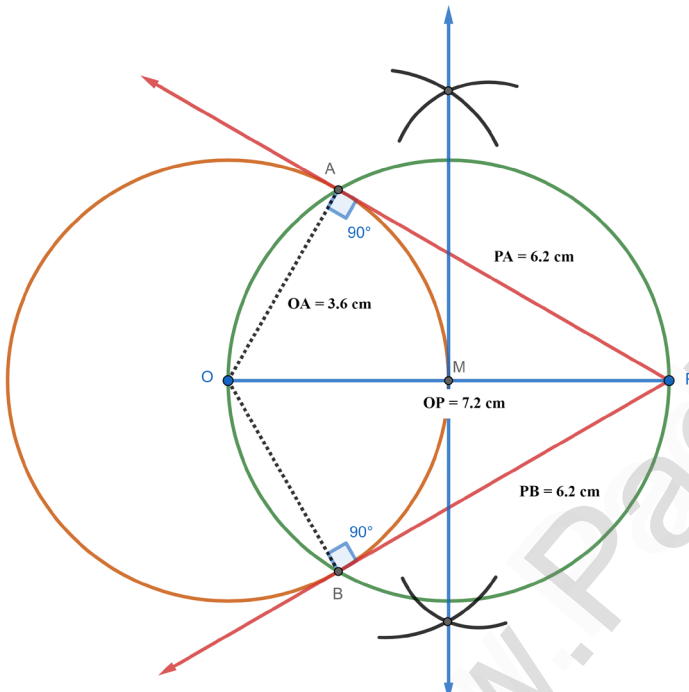
Solution:

Given,
 Radius $r = 3.6 \text{ cm}$

Rough Diagram



Fair Diagram



Construction:

- ❖ With centre at O, draw a circle of radius 3.6 cm.
- ❖ Draw a line OP of length 7.2 cm.
- ❖ Draw a perpendicular bisector of OP, which cuts OP at M.
- ❖ With M as centre and MO as radius, draw a circle which cuts previous circle at A and B.
- ❖ Join AP and BP. AP and BP are the required tangents.
 Thus length of the tangents are $PA = PB = 6.2 \text{ cm}$.

Verification:

In the Right Angle triangle OAP,

$$PA^2 = OP^2 - OA^2$$

$$= 7.2^2 - 3.6^2$$

$$= 51.84 - 12.96$$

$$= 38.88$$

$$PA = \sqrt{38.88} = 6.2 \text{ cm (approximately)}$$

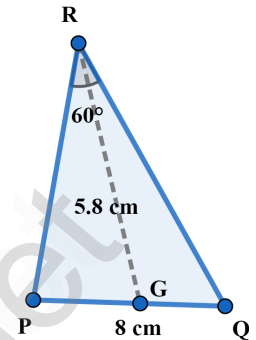
Construction of a Triangle

Example : 4.17

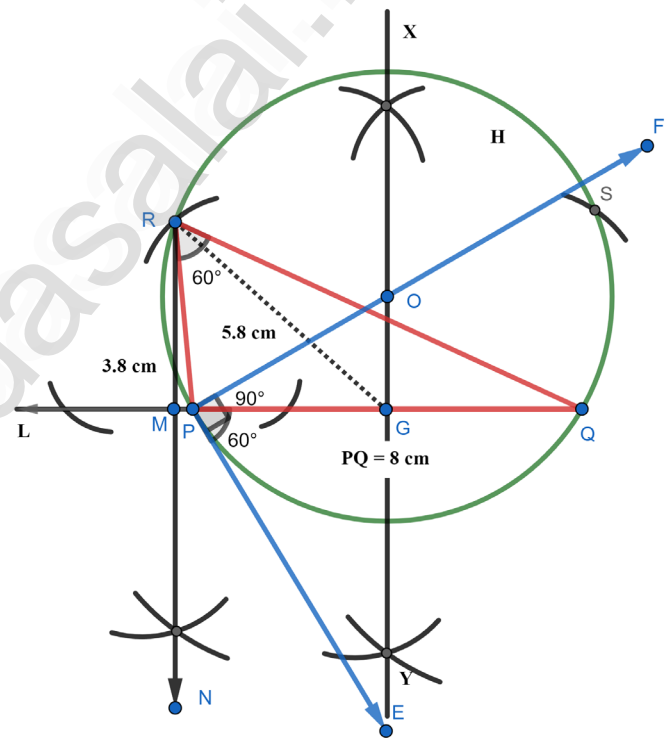
Construct a ΔPQR in which $PQ = 8 \text{ cm}$, $\angle R = 60^\circ$ and the Median RG from R to PQ is 5.8 cm. Find the length of the altitude from R to PQ .

Solution:

Rough Diagram



Fair Diagram



Construction:

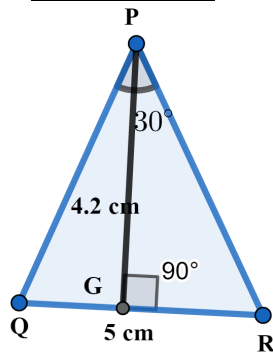
- ❖ Draw a line segment $PQ = 8 \text{ cm}$. At P, draw PE such that $\angle QPE = 60^\circ$. At P, draw PF such that $\angle EPF = 90^\circ$.
- ❖ Draw the perpendicular bisector to PQ, which intersects PF at O and PQ at G.
- ❖ With O as centre and OP as radius draw a circle.
- ❖ From G mark arcs of radius 5.8 cm on the circle. Mark them as R and S.
- ❖ Join PR and RQ. Then ΔPQR is the required triangle.
- ❖ From R draw a line RN perpendicular to LQ. LQ meets RN at M.
- ❖ The length of the altitude is $RM = 3.8 \text{ cm}$.

Example : 4.17

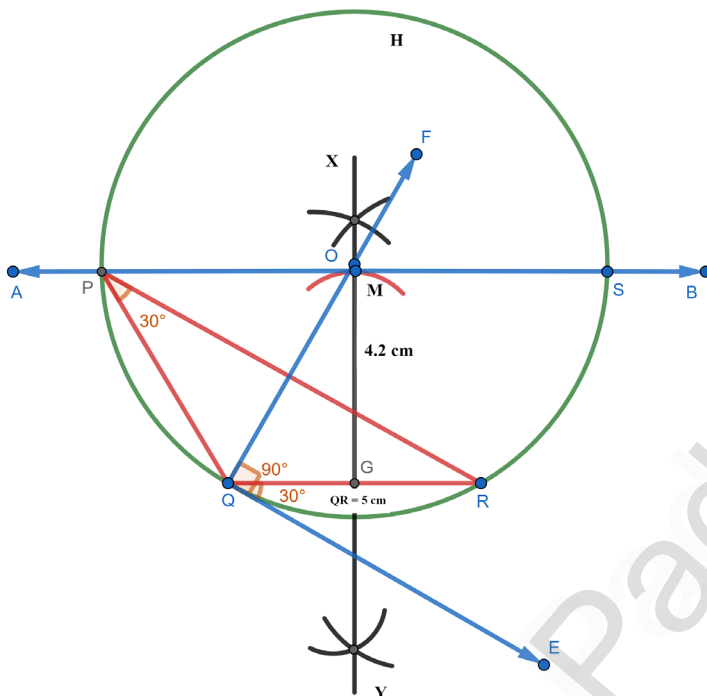
Construct a ΔPQR in which such that $QR = 5$ cm, $\angle P = 30^\circ$ and the Altitude from P to QR is of length 4.2 cm.

Solution:

Rough Diagram



Fair Diagram

**Construction:**

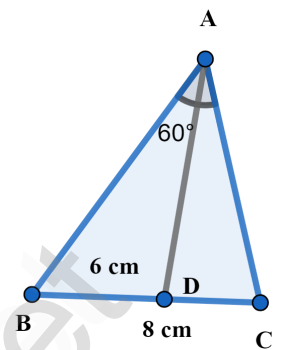
- ❖ Draw a line segment $QR = 8$ cm. At Q draw QE such that $\angle RQE = 30^\circ$. At Q draw QF such that $\angle EQF = 90^\circ$.
- ❖ Draw the perpendicular bisector XY to QR which intersects QF at O and QR at G .
- ❖ With O as centre and OQ as radius draw a circle.
- ❖ From G mark arcs in the line XY at M Such that $GM = 4.2$ cm.
- ❖ Draw AB through M which is parallel to QR .
- ❖ AB meets the circle at P and S .
- ❖ Join QP and RR . Then ΔPQR is the required triangle.

Example : 4.17

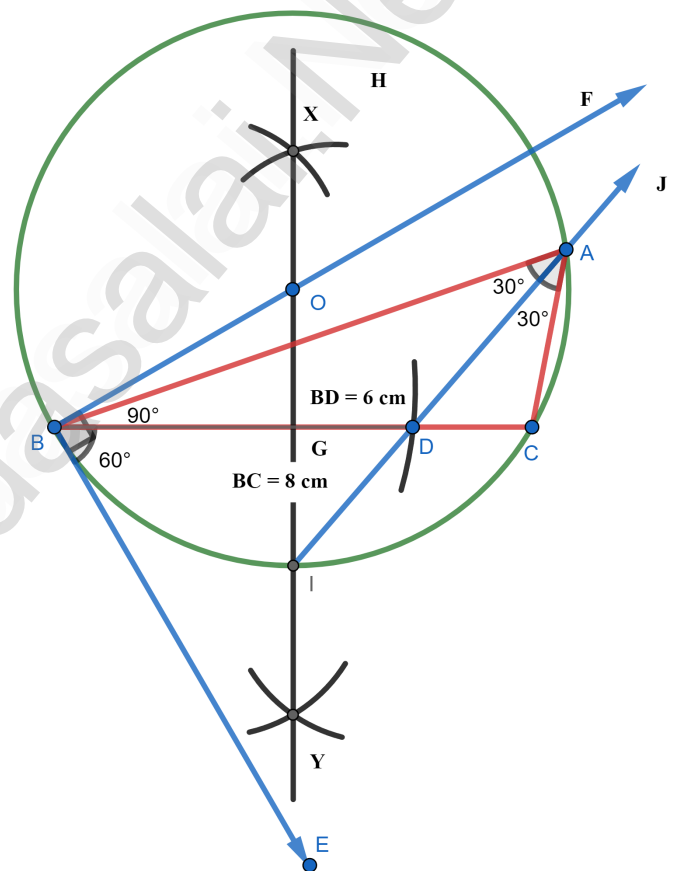
Draw a triangle ΔABC of base $BC = 8$ cm, $\angle A = 60^\circ$ and the Bisector of $\angle A$ meets BC at D such that $BD = 6$ cm.

Solution:

Rough Diagram



Fair Diagram

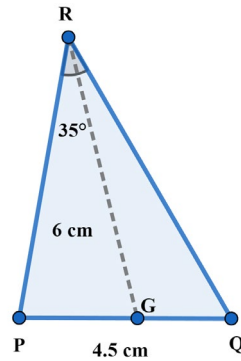
**Construction:**

- ❖ Draw a line segment $BC = 8$ cm. At B draw BE such that $\angle CBE = 60^\circ$. At B draw BF such that $\angle EBF = 90^\circ$.
- ❖ Draw the perpendicular bisector XY to BC which intersects BF at O and BC at G .
- ❖ With O as centre and OB as radius draw a circle.
- ❖ From B mark arc of 6 cm on BC at D .
- ❖ The perpendicular bisector intersects the circle at I . Join ID .
- ❖ ID produced meets the circle at A . Now join AB and AC . Then ΔABC is the required triangle.

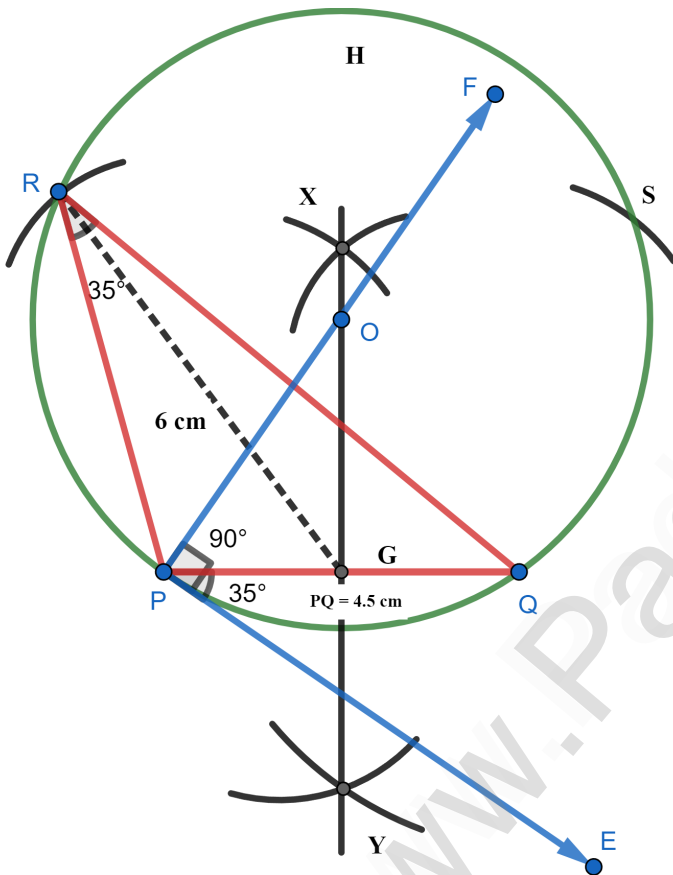
1. Construct a ΔPQR in which base $PQ = 4.5$ cm, $\angle R = 35^\circ$ and the Median RG from R to PQ is 6 cm.

Solution:

Rough Diagram



Fair Diagram



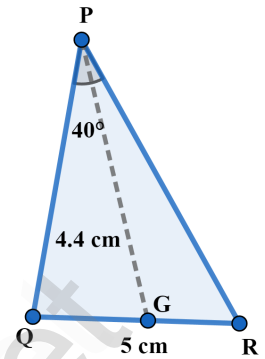
Construction:

- ❖ Draw a line segment $PQ = 4.5$ cm. At P , draw PE such that $\angle QPE = 35^\circ$. At P , draw PF such that $\angle EPF = 90^\circ$.
- ❖ Draw the perpendicular bisector to PQ , which intersects PF at O and PQ at G .
- ❖ With O as centre and OP as radius draw a circle.
- ❖ From G mark arcs of **radius 6 cm** on the circle. Mark them as R and S .
- ❖ Join PR and RQ . Then ΔPQR is the required triangle.

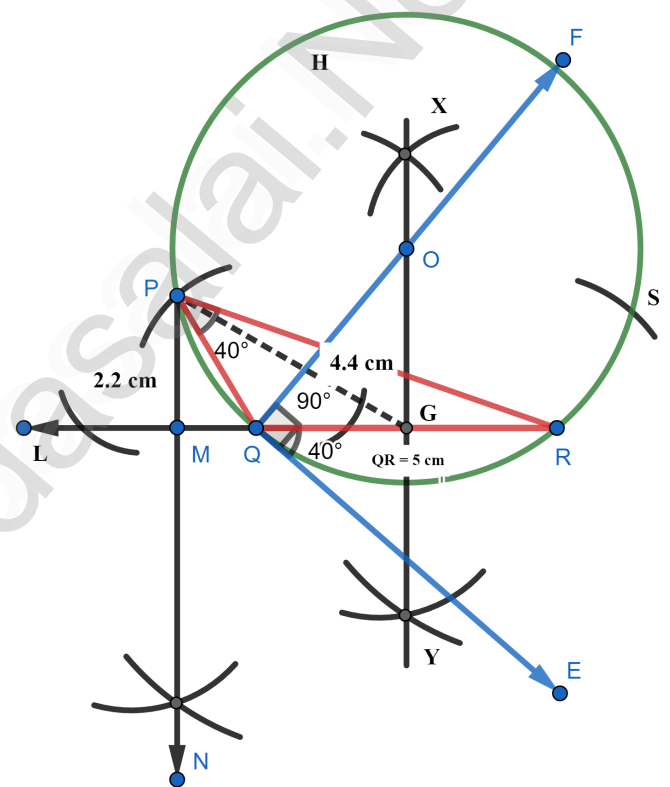
2. Construct a ΔPQR in which $QR = 5$ cm, $\angle P = 40^\circ$ and the Median PG from P to QR is 4.4 cm. Find the length of the Altitude from P to QR .

Solution:

Rough Diagram



Fair Diagram



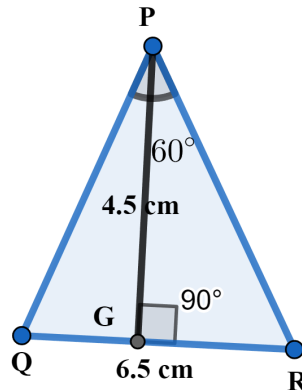
Construction:

- ❖ Draw a line segment $QR = 5$ cm. At P , draw PE such that $\angle QPE = 40^\circ$. At P , draw PF such that $\angle EPF = 90^\circ$.
- ❖ Draw the perpendicular bisector to QR , which intersects PF at O and QR at G .
- ❖ With O as centre and OP as radius draw a circle.
- ❖ From G mark arcs of **radius 4.4 cm** on the circle. Mark them as R and S .
- ❖ Join PR and RQ . Then ΔPQR is the required triangle.
- ❖ From P draw a line PN perpendicular to LQ . LQ meets PN at M .
- ❖ The length of the altitude is $PM = 2.2$ cm.

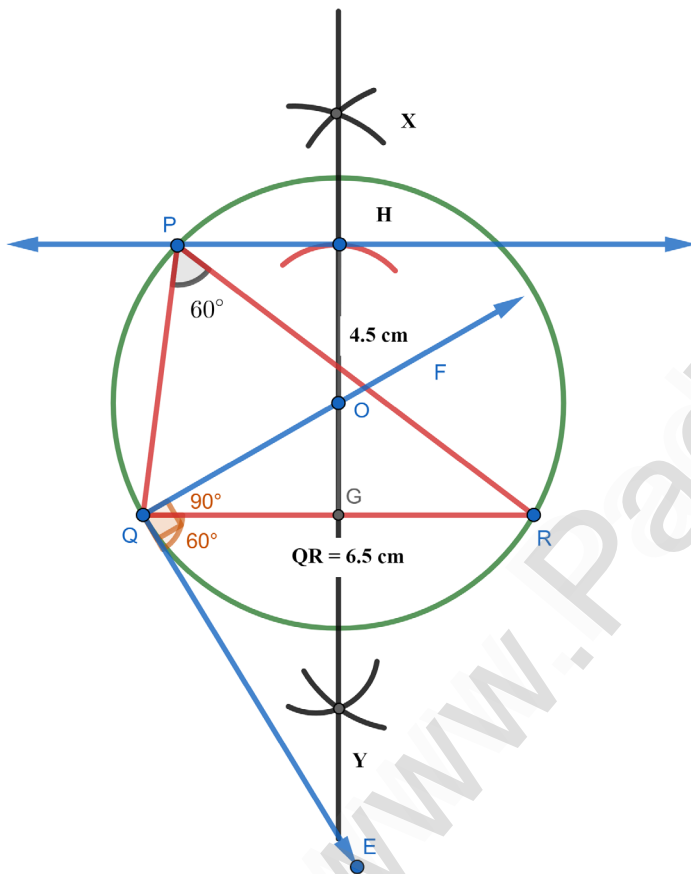
3. Construct a ΔPQR in which such that $QR = 6.5$ cm, $\angle P = 60^\circ$ and the Altitude from P to QR is of length 4.5 cm.

Solution:

Rough Diagram



Fair Diagram



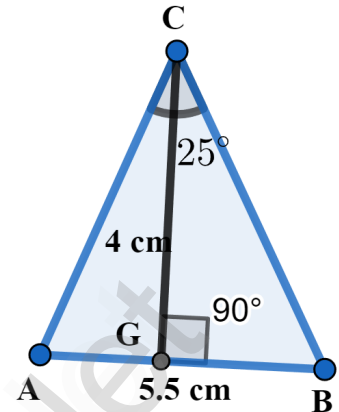
Construction:

- ❖ Draw a line segment $QR = 6.5$ cm. At Q draw QE such that $\angle RQE = 60^\circ$. At Q draw QF such that $\angle EQF = 90^\circ$.
- ❖ Draw the perpendicular bisector XY to QR which intersects QF at O and QR at G .
- ❖ With O as centre and OQ as radius draw a circle.
- ❖ From G mark arcs in the line XY at M Such that $GM = 4.5$ cm.
- ❖ Draw AB through M which is parallel to QR .
- ❖ AB meets the circle at P and S .
- ❖ Join QP and PR . Then ΔPQR is the required triangle.

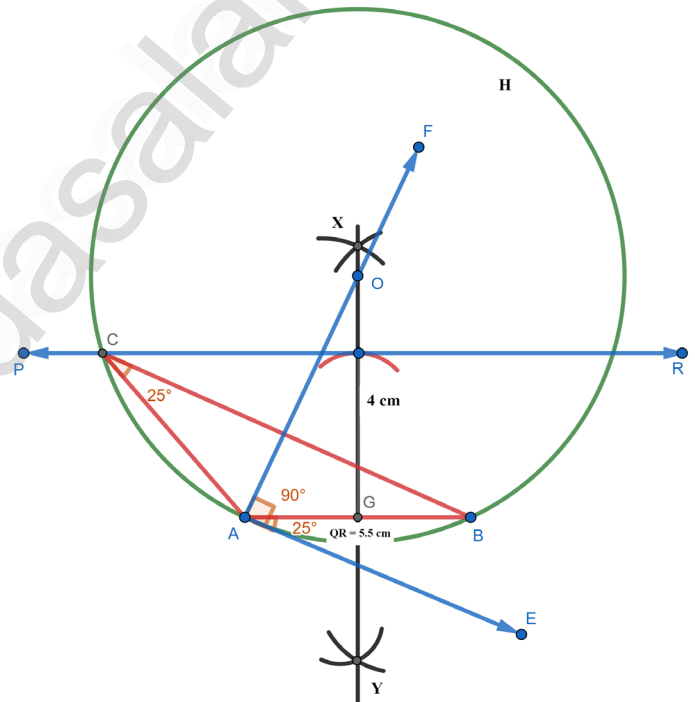
4. Construct a ΔPQR in which such that $QR = 6.5$ cm, $\angle P = 60^\circ$ and the Altitude from P to QR is of length 4.5 cm.

Solution:

Rough Diagram



Fair Diagram



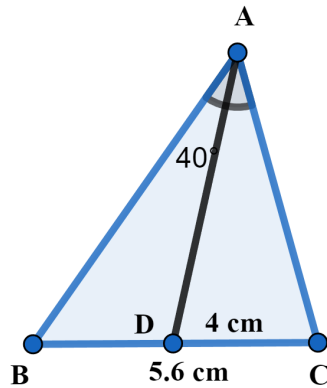
Construction:

- ❖ Draw a line segment $AB = 5.5$ cm. At A draw AE such that $\angle BAE = 25^\circ$. At B draw BF such that $\angle EBF = 90^\circ$.
- ❖ Draw the perpendicular bisector XY to AB which intersects BF at O and AB at G .
- ❖ With O as centre and OQ as radius draw a circle.
- ❖ From G mark arcs in the line XY at M Such that $GM = 4$ cm.
- ❖ Draw PR through M which is parallel to BC .
- ❖ AB meets the circle at P and S .
- ❖ Join AC and CB . Then ΔABC is the required triangle.

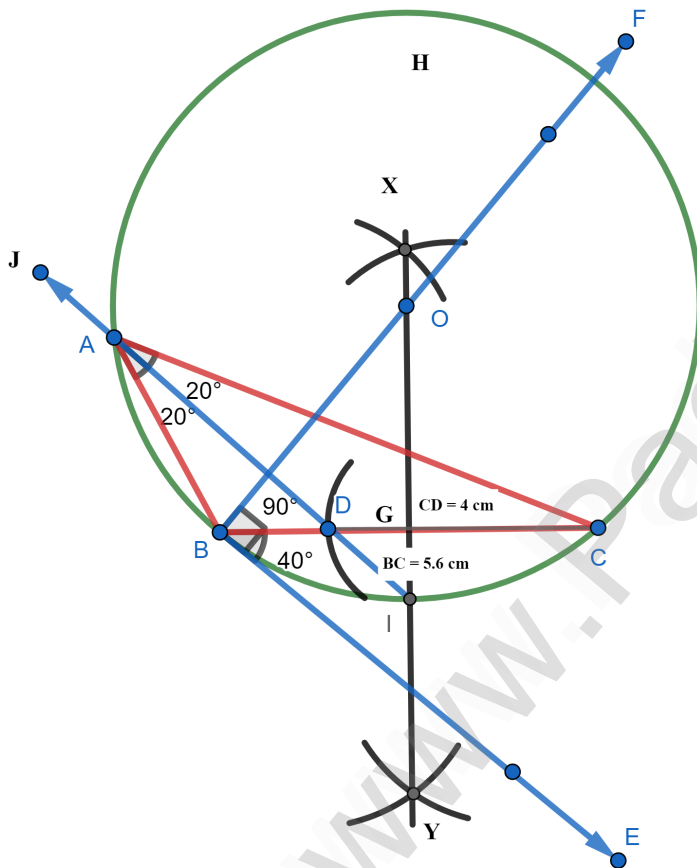
5. Draw a triangle ΔABC of base $BC = 5.6$ cm, $\angle A = 40^\circ$ and the **Bisector** of $\angle A$ meets BC at D such that $BD = 4$ cm.

Solution:

Rough Diagram



Fair Diagram



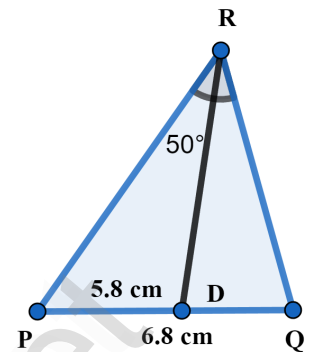
Construction:

- ❖ Draw a line segment $BC = 5.6$ cm. At B draw BE such that $\angle CBE = 40^\circ$. At B draw BF such that $\angle EBF = 90^\circ$.
- ❖ Draw the perpendicular bisector XY to BC which intersects BF at O and BC at G .
- ❖ With O as centre and OB as radius draw a circle.
- ❖ From C mark arc of 4 cm on CD at B .
- ❖ The perpendicular bisector intersects the circle at I . Joint ID .
- ❖ ID produced meets the circle at A . Now join AB and AC . Then ΔABC is the required triangle.

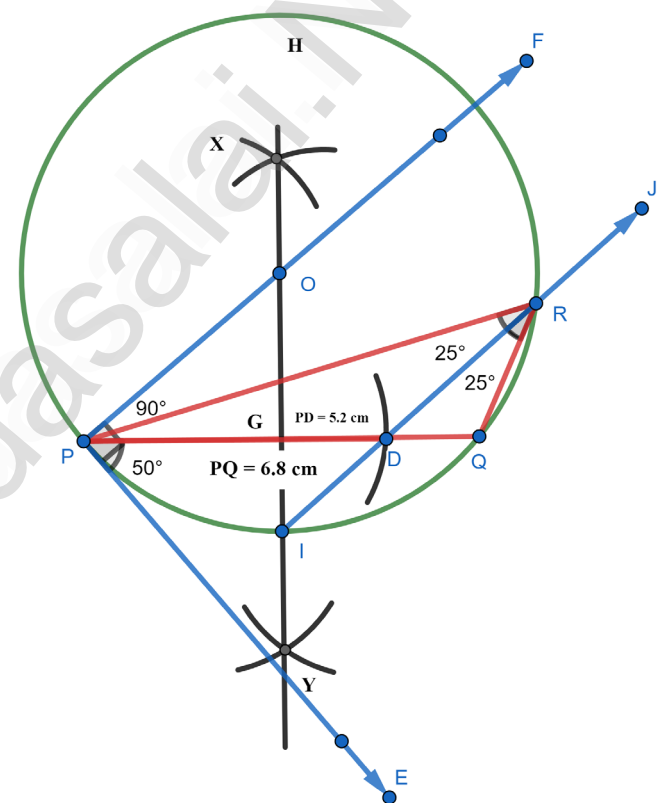
6. Draw a triangle ΔPQR such that $PQ = 6.8$ cm, vertical angle is 50° and the **Bisector** of vertical angle meets the base at D where $PD = 5.2$ cm.

Solution:

Rough Diagram



Fair Diagram



Construction:

- ❖ Draw a line segment $PQ = 6.8$ cm. At P draw PE such that $\angle QPE = 50^\circ$. At P draw PF such that $\angle EPF = 90^\circ$.
- ❖ Draw the perpendicular bisector XY to PQ which intersects PF at O and PQ at G .
- ❖ With O as centre and OP as radius draw a circle.
- ❖ From P mark arc of 5.2 cm on PD at Q .
- ❖ The perpendicular bisector intersects the circle at I . Joint ID .
- ❖ ID produced meets the circle at A . Now join PQ and QR . Then ΔPQR is the required triangle.

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P. G – TEACHER (MATHS)