9. Practical geometry

Exercise 9.1

1. Question

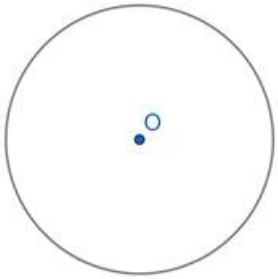
Draw a circle of radius 4.2 cm, and take any point on the circle. Draw the tangent at that point using the centre.

Answer

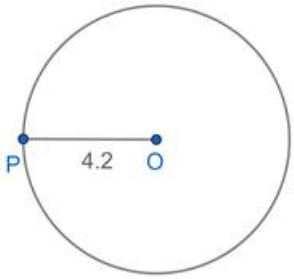
Radius of the circle = 4.2 cm

The steps of construction:

Step 1: With O as the center draw a circle of radius 4.2cm

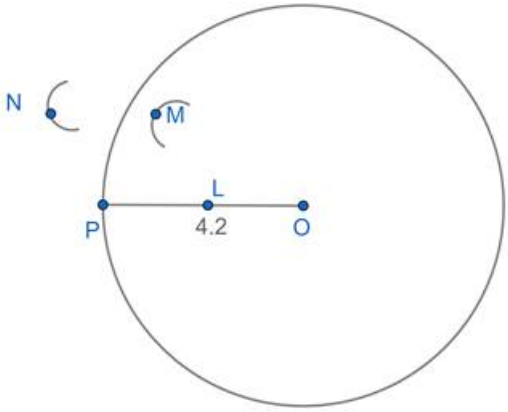


Step 2: Take a point P on the circle and join OP.

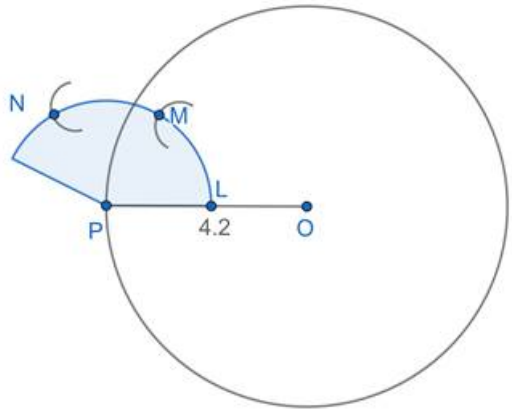


Step 3: Draw an arc of a circle with center at P cutting OP at L.

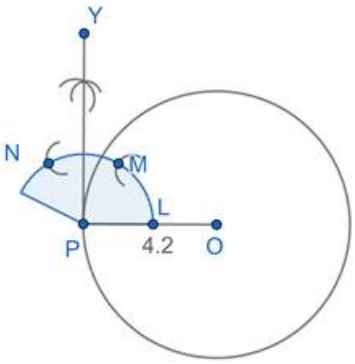
Mark M and N on the arc such that $\overset{\frown}{LM} = \overset{\frown}{MN} = LP$



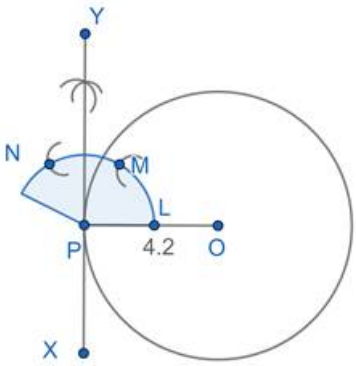
Step 4: LM = MN = LP



Step 5: Draw the bisector YP of the ∠MPN.



Step 6: Produce YP to X and get required tangent.



Thus, this is the resulting figure.

2. Question

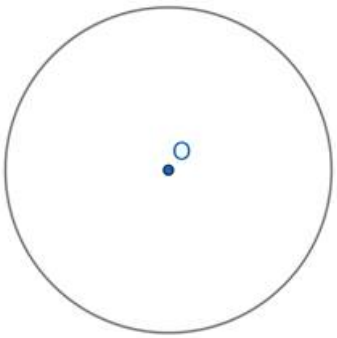
Draw a circle of radius 4.8 cm. Take a point on the circle. Draw the tangent at that point using the tangent-chord theorem.

Answer

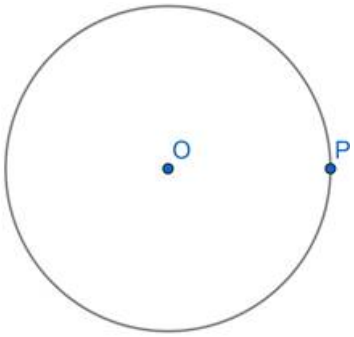
Radius of the circle = 4.8 cm.

The steps for construction:

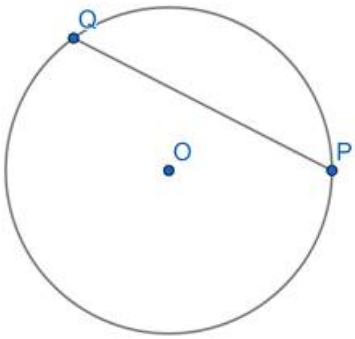
Step 1: With O as the center, draw a circle of radius 4.8cm.



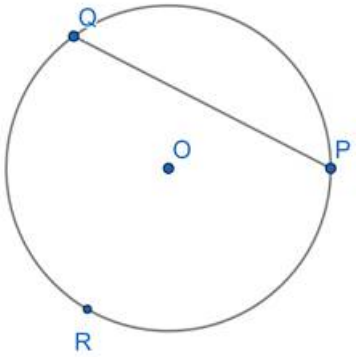
Step 2: Take a point P on the circle.



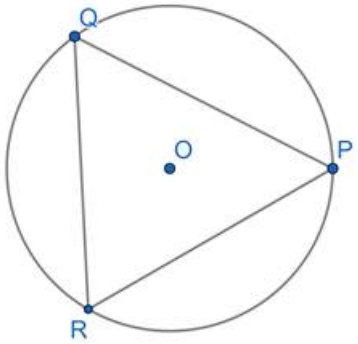
Step 3: Through P, draw any chord PQ.



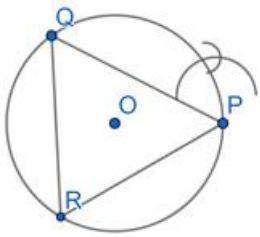
Step 4: Mark a point R distinct from P and Q on the circle so that P,Q and R are in counter clockwise direction.



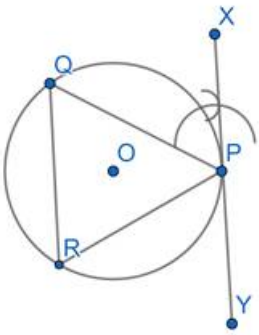
Step 5: Join PR and QR.



Step 6: At P, construct ∠QPX = ∠PRQ



Step 7: Produce XP to Y get the required tangent line XY.



Thus, this is the resulting figure.

3. Question

Draw a circle of diameter 10 cm. From a point *P,* 13 cm away from its centre, draw the two tangents *PA* and *PB* to the circle, and measure their lengths.

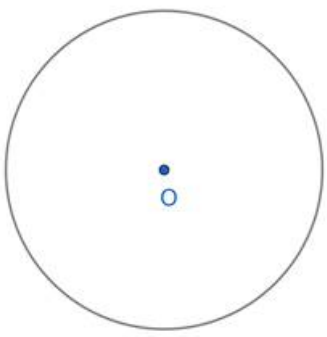
Answer

Radius of the circle = 5cm

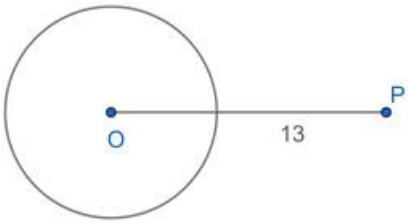
Distance of the point from the center = 13 cm.

The steps for construction are:

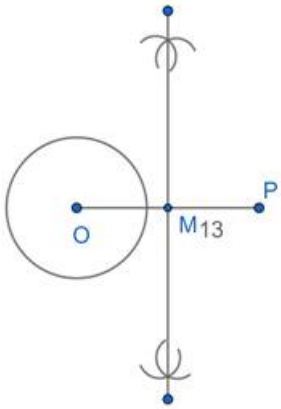
Step 1: With O as the center draw a circle of radius 5 cm.



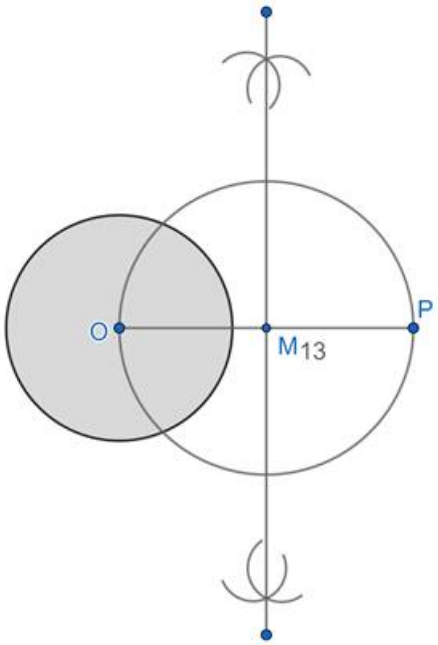
Step 2: Mark a point P at a distance of 13 cm from O and join OP.



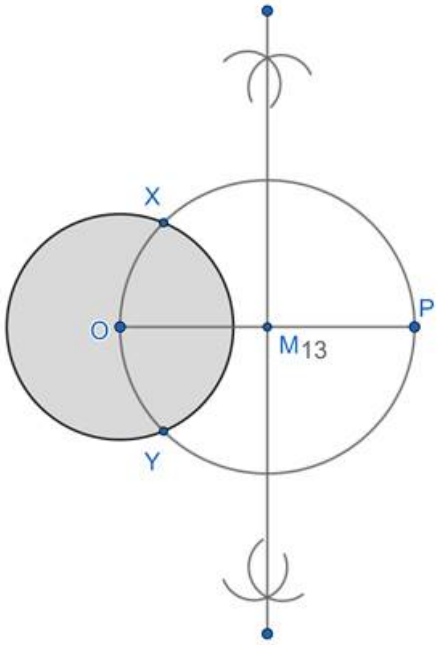
Step 3: Draw the perpendicular bisector of OP. Let it meet OP at M.



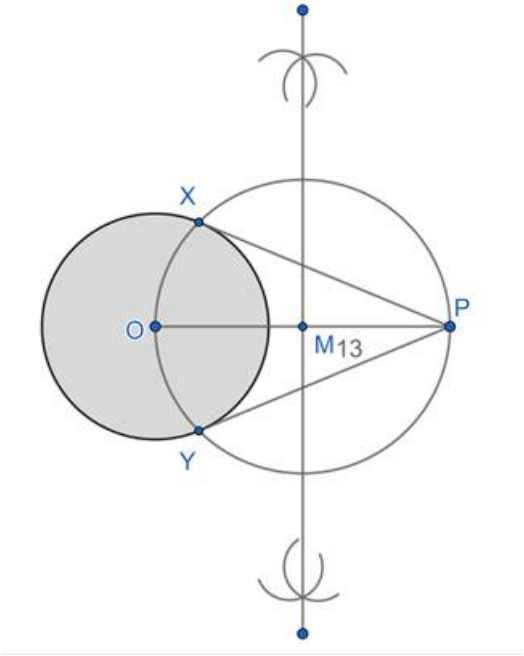
Step 4: With M as center and MO as radius, draw another circle.



Step 5: Let the two circles intersect at X and Y.

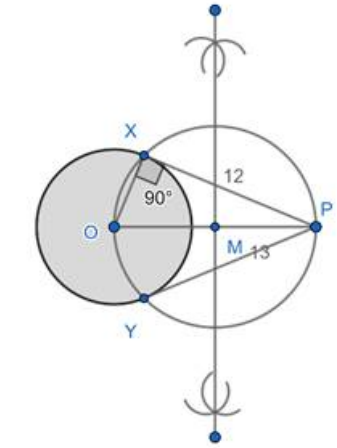


Step 6: Join PX and PY. They are required tangents.



Thus, this is the resulting figure.

To determine the length of the tangent, consider the triangle OXP and apply Pythagoras theorem to it:



$\sqrt{OX^2} + \sqrt{PX^2} = OP$

$\Rightarrow OX^2 + PX^2 = OP^2$

$\Rightarrow 5^2 + PX^2 = 13^2$

$\Rightarrow PX^2 = 13^2 - 5^2$

$\Rightarrow PX^2 = 169 – 25$

$\Rightarrow PX^2 = 144$

$\Rightarrow PX = \sqrt{144}$

$\Rightarrow PX = 12$ cm

Thus, the length of the tangents is 12cm.

4. Question

Draw the two tangents from a point which is 10 cm away from the centre of a circle of radius 6 cm. Also, measure the lengths of the tangents.

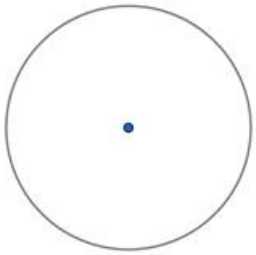
Answer

Radius of the circle = 6cm

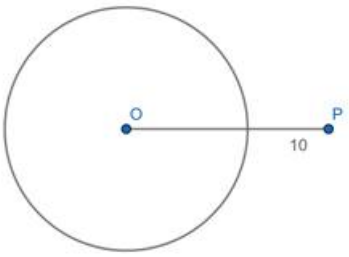
Distance of the point from the center = 10 cm.

The steps for construction are:

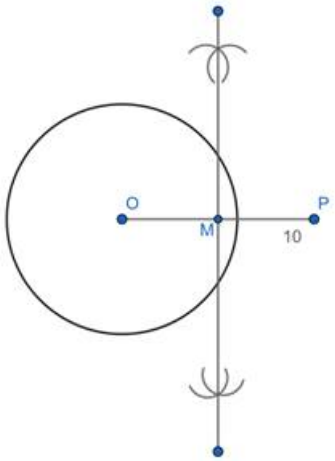
Step 1: With O as the center draw a circle of radius 6 cm.



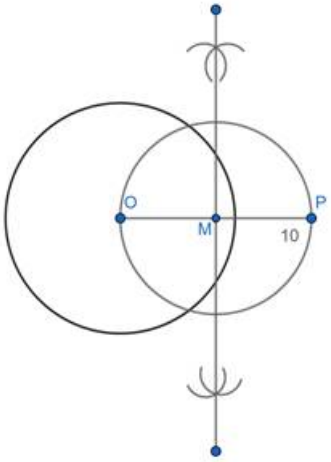
Step 2: Mark a point P at a distance of 10 cm from O and join OP.



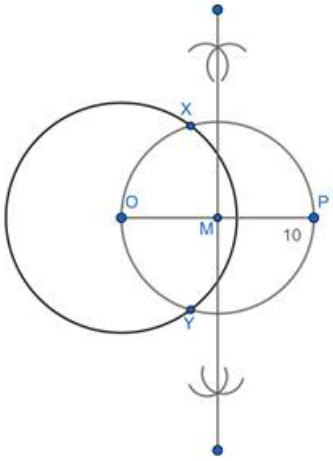
Step 3: Draw the perpendicular bisector of OP. Let it meet OP at M.



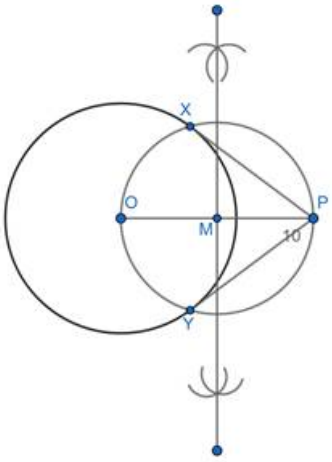
Step 4: With M as center and MO as radius, draw another circle.



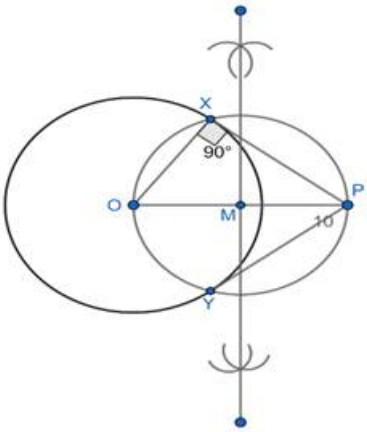
Step 5: Let the two circles intersect at X and Y.



Step 6: Join PX and PY. They are required tangents.



Thus, this is the resulting figure.



To determine the length of the tangent, consider the triangle OXP and apply Pythagoras theorem to it:

$\sqrt{OX^2} + \sqrt{PX^2} = OP$

$\Rightarrow OX^2 + PX^2 = OP^2$

$\Rightarrow 6^2 + PX^2 = 10^2$

$\Rightarrow PX^2 = 10^2 - 6^2$

$\Rightarrow PX^2 = 100 – 36$

$\Rightarrow PX^2 = 64$

$\Rightarrow PX = \sqrt{64}$

$\Rightarrow PX = 8$ cm

Thus, the length of the tangents is 8 cm.

5. Question

Take a point which is 9 cm away from the centre of a circle of radius 3 cm, and draw the two tangents to the circle from that point.

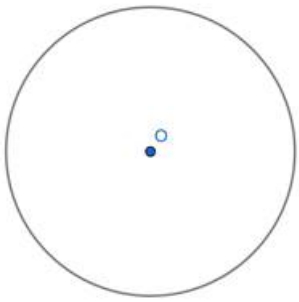
Answer

Radius of the circle = 3 cm

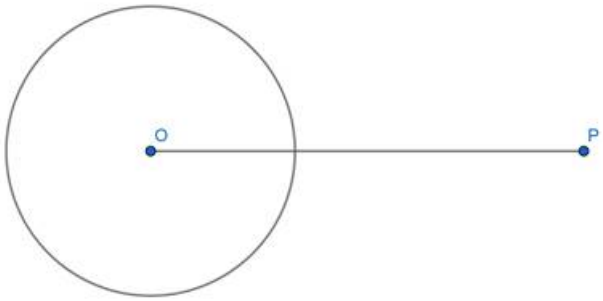
Distance of the point from the center = 9 cm.

The steps for construction are:

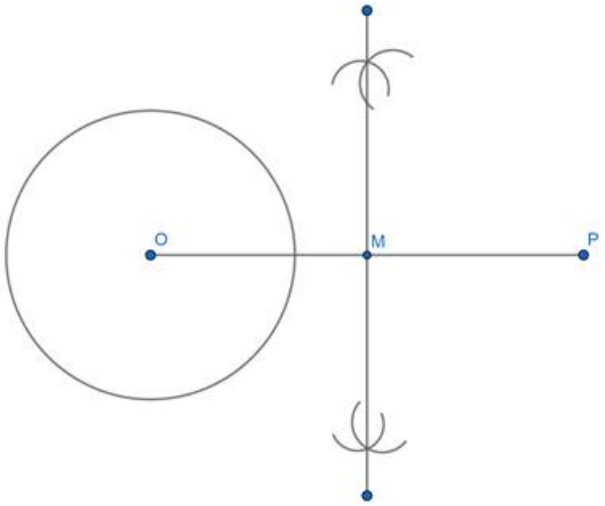
Step 1: With O as the center draw a circle of radius 3 cm.



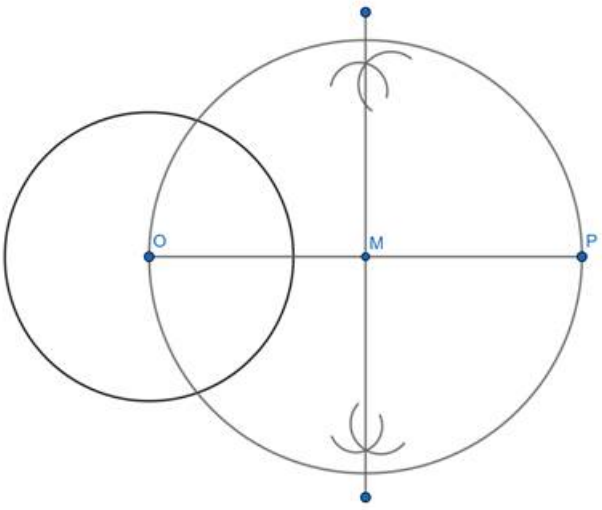
Step 2: Mark a point P at a distance of 9 cm from O and join OP.



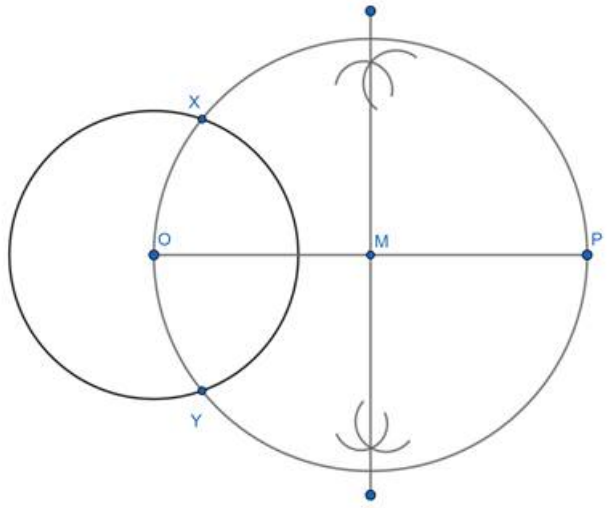
Step 3: Draw the perpendicular bisector of OP. Let it meet OP at M.



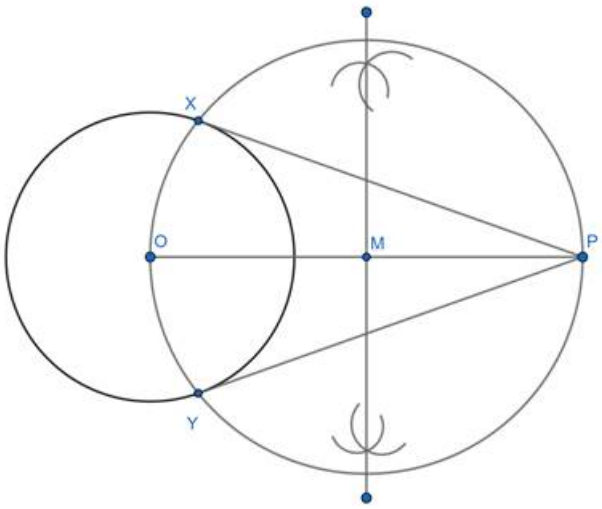
Step 4: With M as center and MO as radius, draw another circle.



Step 5: Let the two circles intersect at X and Y.



Step 6: Join PX and PY. They are required tangents.



Thus, this is the resulting figure.

Exercise 9.2

1. Question

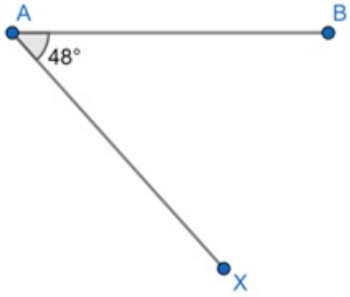
Construct a segment of a circle on a given line segment AB = 5.2 cm containing an angle 48°.

Answer

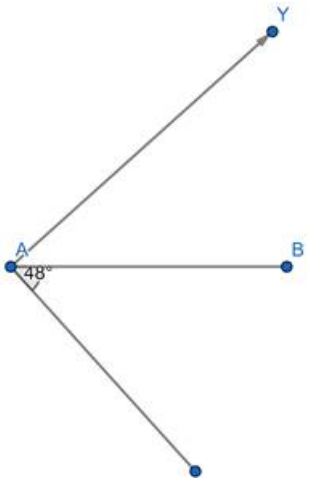
Steps for construction:

Step 1: Draw a line segment AB = 5.2 cm

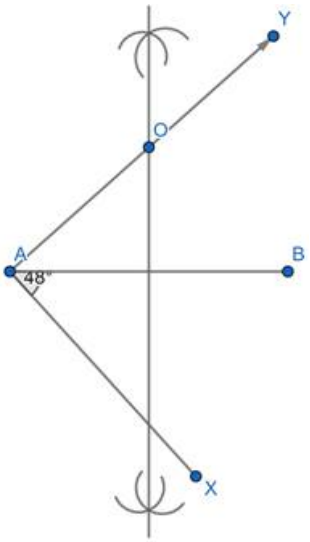
Step 2: At A, make ∠BAX = 48°.



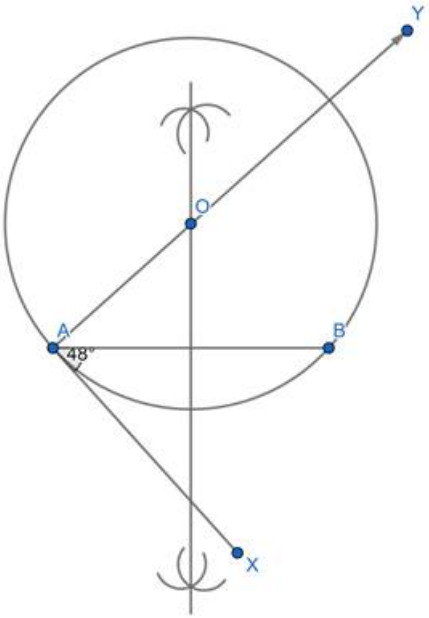
Step 3: Draw AY⊥AX.



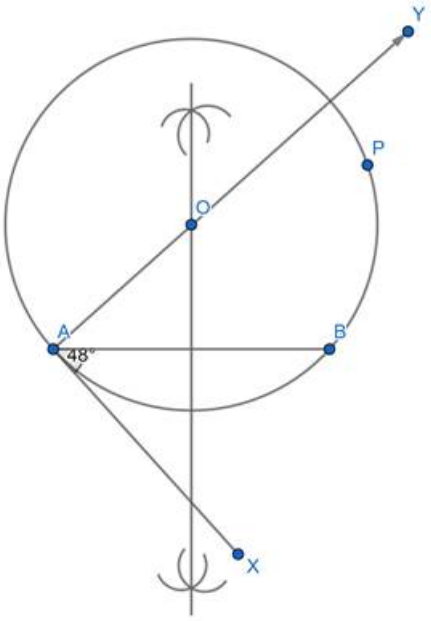
Step 4: Draw the perpendicular bisector of AB which meets AY at O.



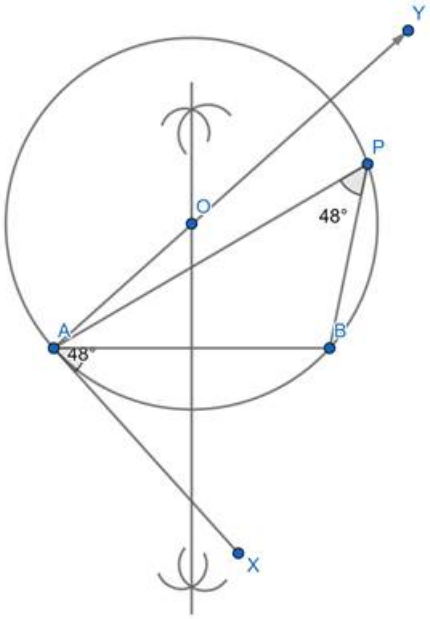
Step 5: With O as center and OA as radius draw a circle.



Step 6: Take any point P on the circle.



Step 7: By the tangent- chord theorem, the major arcAPB is the required segment of the circle containing the angle 48°.



2. Question

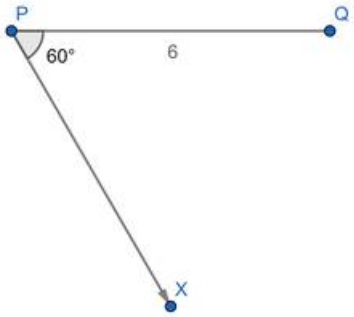
Construct a Δ *PQR* in which the base *PQ* = 6 cm, ∠*R* = 60° and the altitude from *R* to *PQ* is 4 cm.

Answer

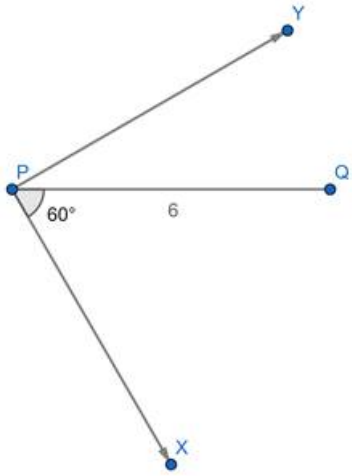
Steps for construction:

Step 1: Draw a line segment PQ = 6 cm

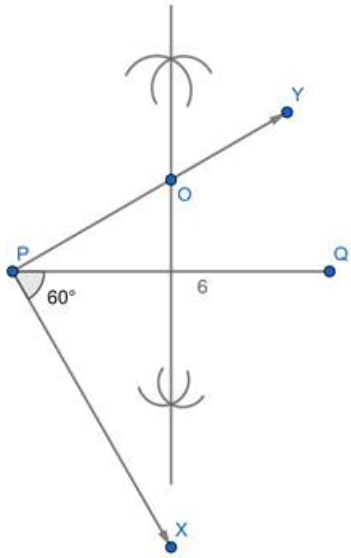
Step 2: At A, make ∠QPX = 60°.



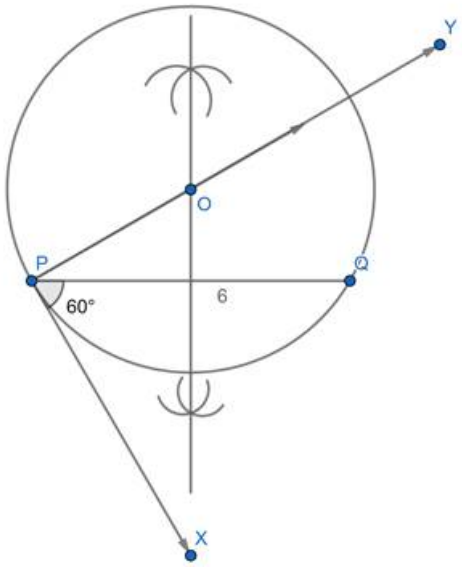
Step 3: Draw PY⊥PX.



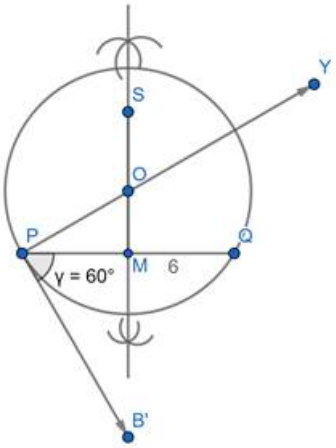
Step 4: Draw the perpendicular bisector of PQ which meets PY at O.



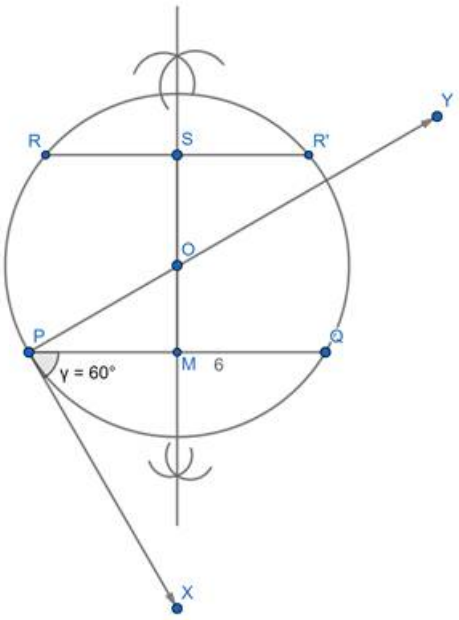
Step 5: With O as center and OP as radius draw a circle.



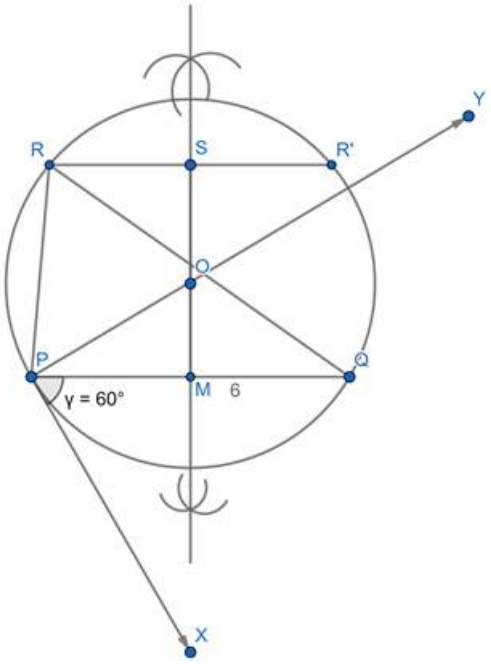
Step 6: On the perpendicular bisector MO, mark a point S such that MS = 4cm.



Step 7: Draw RSR’ parallel to PQ meeting the circle at R and at R’.



Step 8: Complete DPQR which is one of the required triangles.



3. Question

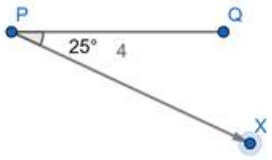
Construct a Δ *PQR* such that *PQ* = 4 cm, ∠*R* = 25° and the altitude from *R* to *PQ* is 4.5 cm.

Answer

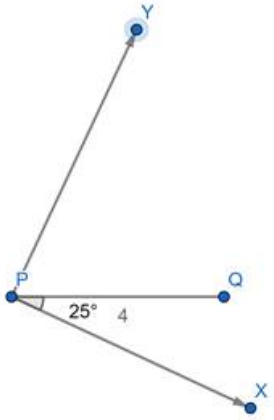
Steps for construction:

Step 1: Draw a line segment PQ = 4 cm.

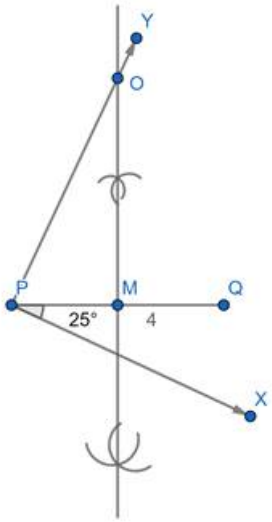
Step 2: At P, make ∠QPX = 25°.



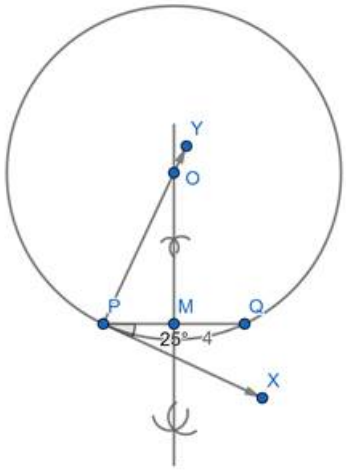
Step 3: Draw PY⊥PX.



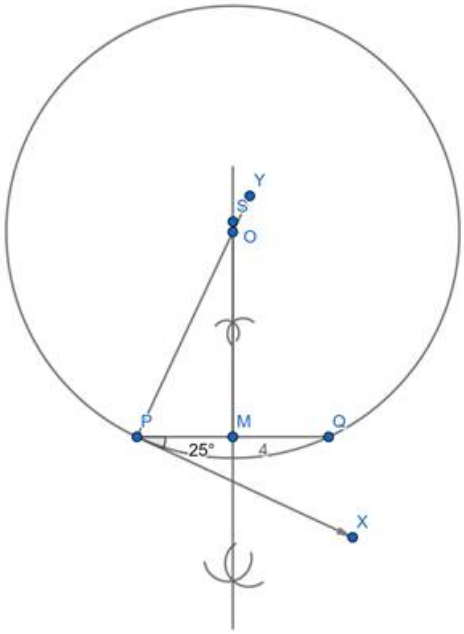
Step 4: Draw the perpendicular bisector of PQ intersecting at O and PQ at M.



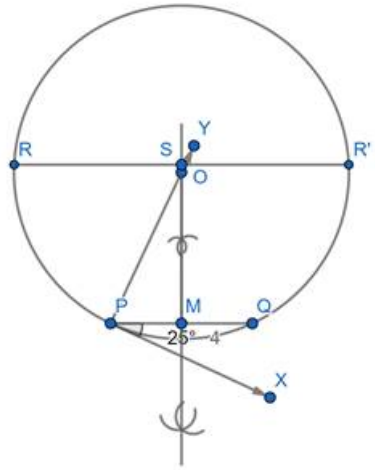
Step 5: With O as center and OP as radius draw a circle.



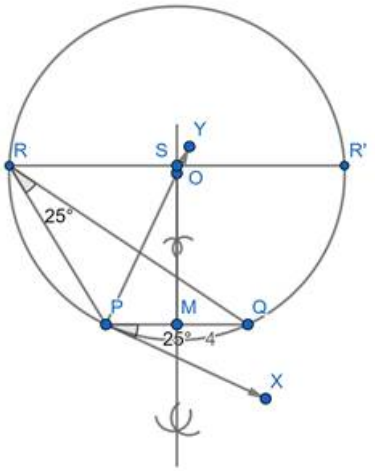
Step 6: On the perpendicular bisector MO, mark a point S such that MS = 4.5 cm.



Step 7: Draw RSR’ parallel to PQ meeting the circle at R and R’.



Step 8: Complete the ΔPQR which is one of the required triangles.



4. Question

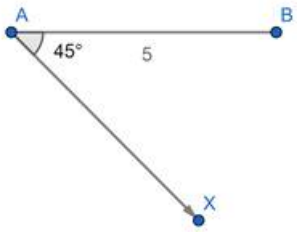
Construct a ABC such that AB = 5 cm. A = 45° and the median from A to BC is 4 cm.

Answer

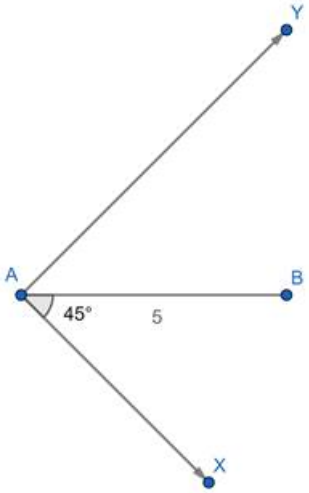
Steps of construction:

Step 1: Draw a line segment AB = 5 cm

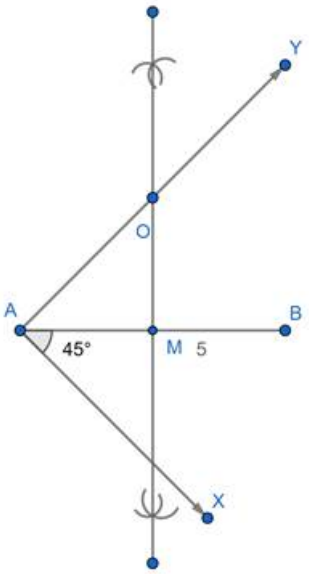
Step 2: Draw BX such that ∠ BAX = 45°



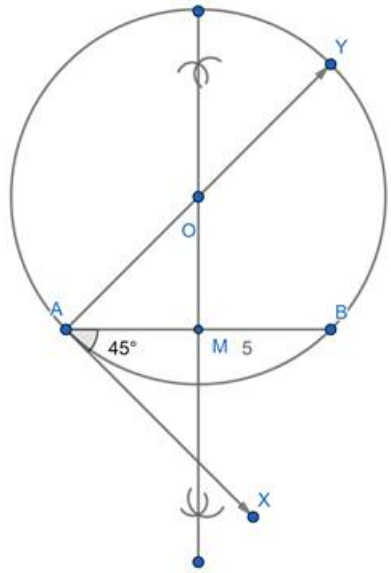
Step 3: Draw AY ⊥ AX.



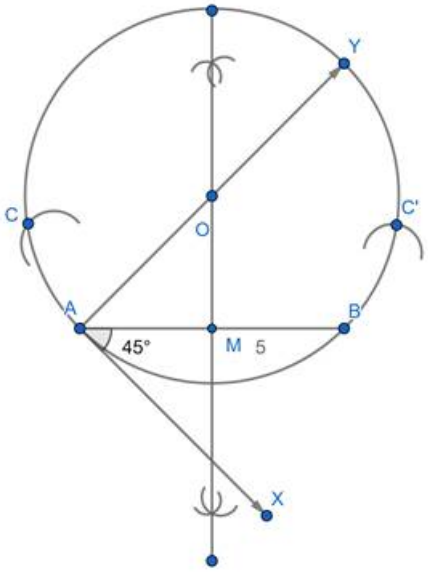
Step 4: Draw the perpendicular bisector of AB intersecting AY at O and AB at M.



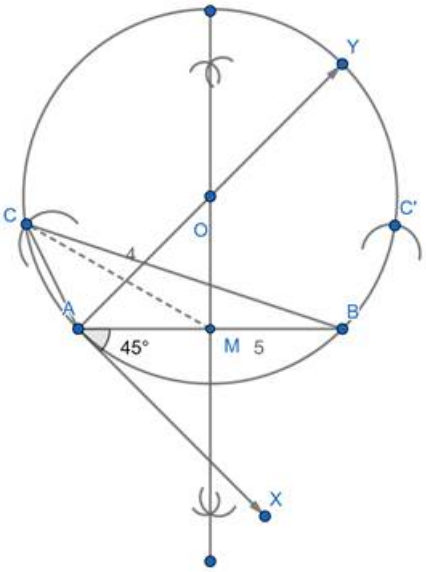
Step 5: With O as center and OA as radius, draw the circle.



Step 6: With M as center, draw an arc of radius 4 cm meeting the circle at C and at C’.



Step 7: Complete the Δ ABC which is the required triangle.



5. Question

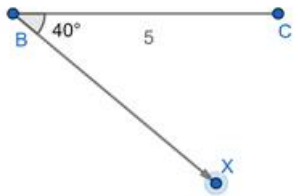
Construct a Δ ABC in which the base BC = 5 cm, ∠BAC = 40° and the median from A to BC is 6 cm. Also, measure the length of the altitude from A.

Answer

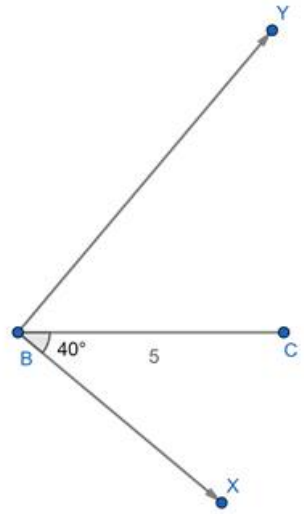
Step of construction:

Step 1: Draw a line segment BC = 5 cm

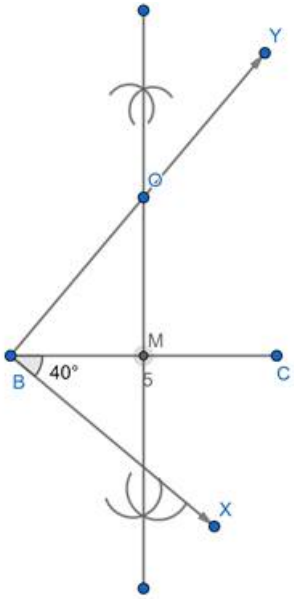
Step 2: Draw BX such that ∠ CBX = 40°



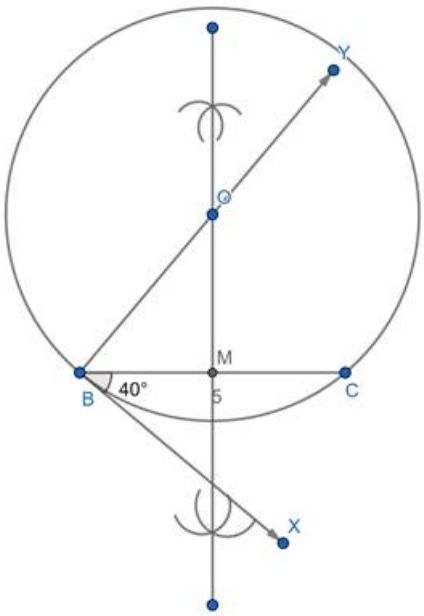
Step 3: Draw BY ⊥ BX.



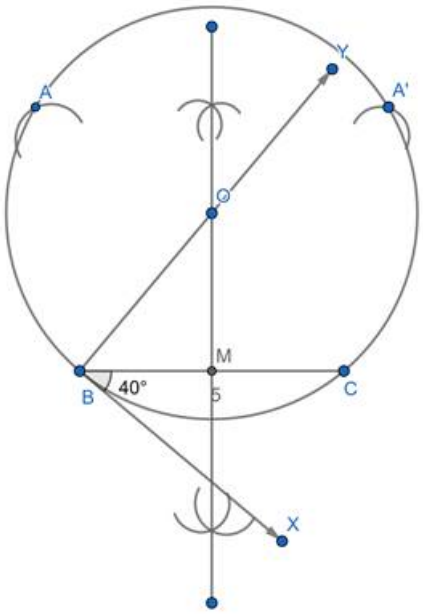
Step 4: Draw the perpendicular bisector of BC intersecting BY at O and BC at M.



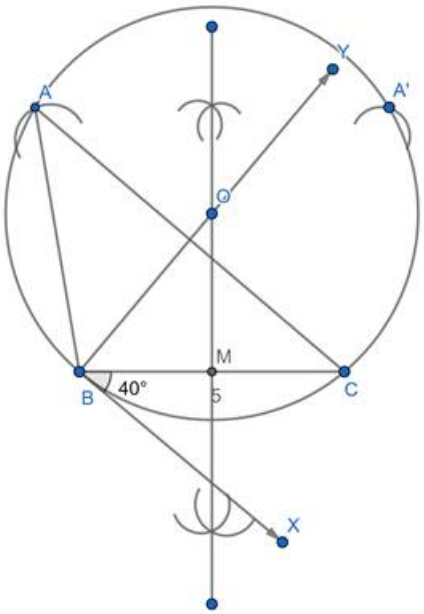
Step 5: With O as centre and OB as radius, draw the circle.



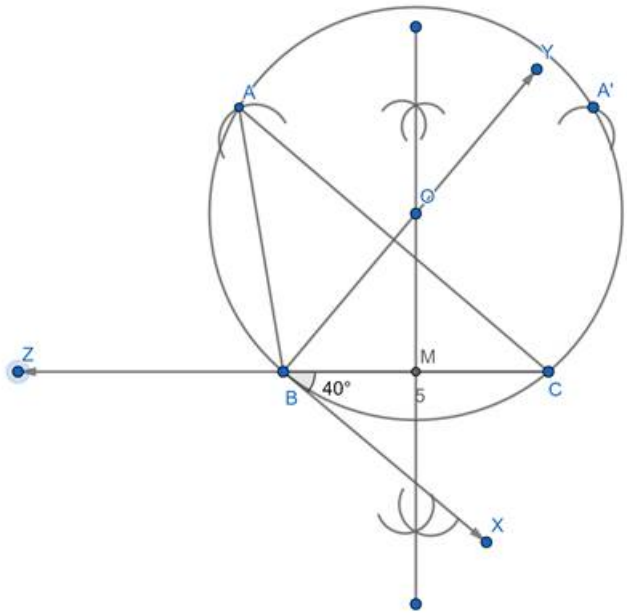
Step 6: With M as centre, draw an arc of radius 6 cm meeting the circle at A and at A’



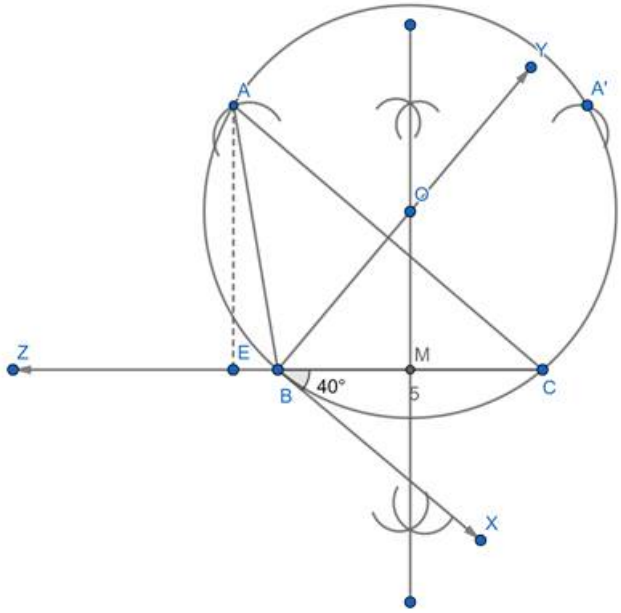
Step 7: Complete the Δ ABC which is the required triangle.



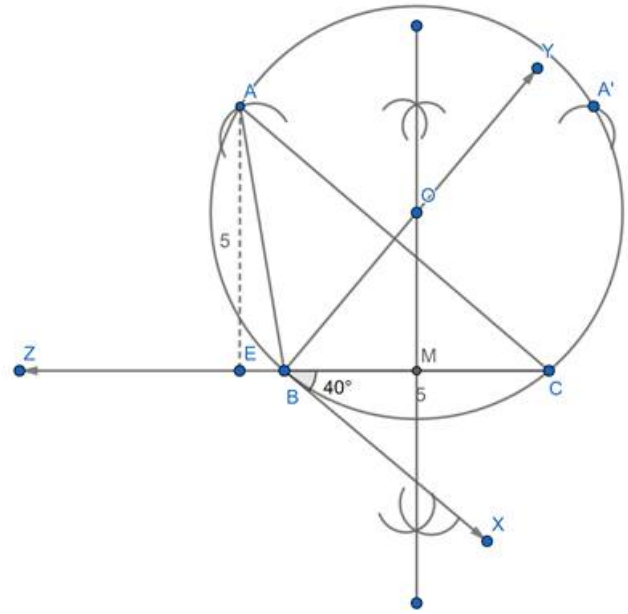
Step 8: Produce CB to CZ.



Step 9: Draw AE ⊥ CZ.



Step 10: Length of the altitude AE is 5cm.



Exercise 9.3

1. Question

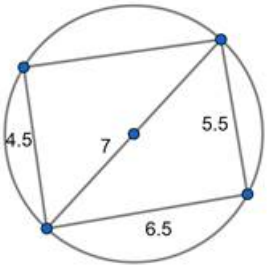
Construct a cyclic quadrilateral PQRS, with PQ = 6.5 cm, QR = 5.5 cm, PR = 7cm and PS = 4.5 cm.

Answer

We need to construct the required quadrilateral, when three sides and one diagonal of a cyclic quadrilateral are given.

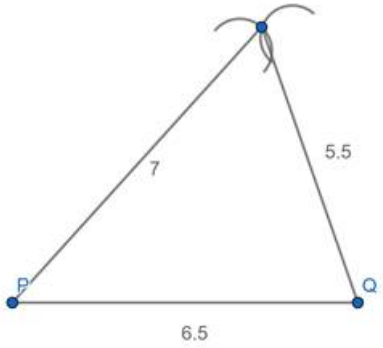
Steps of construction:

Step 1: Draw a rough diagram and mark the measurements

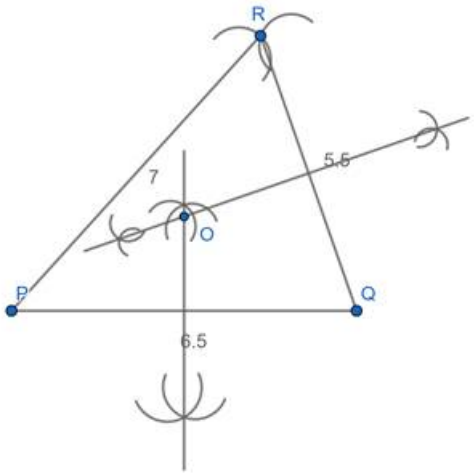


Step 2: Draw a line segment PQ = 6.5 cm.

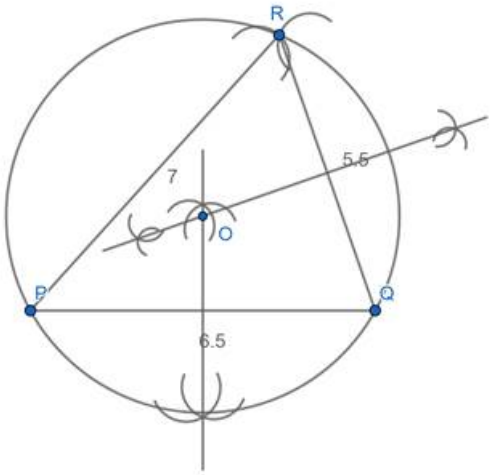
Step 3: With P and Q as centres, draw arc with radii 7 cm and 5.5cm respectively, to intersect at R. join PR and QR.



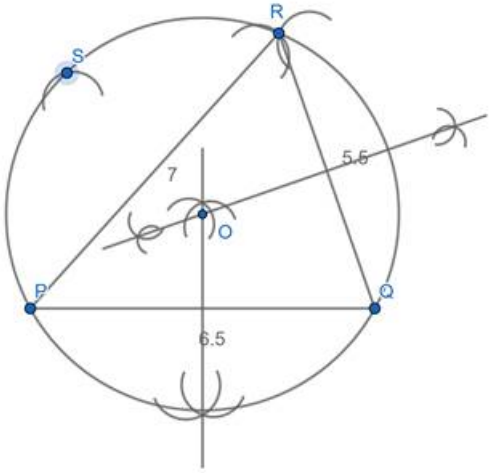
Step 4: Draw the perpendicular bisectors of PQ and QR to intersect at O.



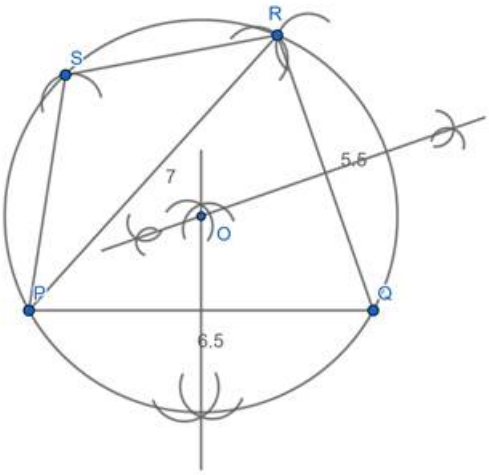
Step 5: With O as the centre and OP (=OQ = OR) as radius draw the circumcircle of Δ PQR



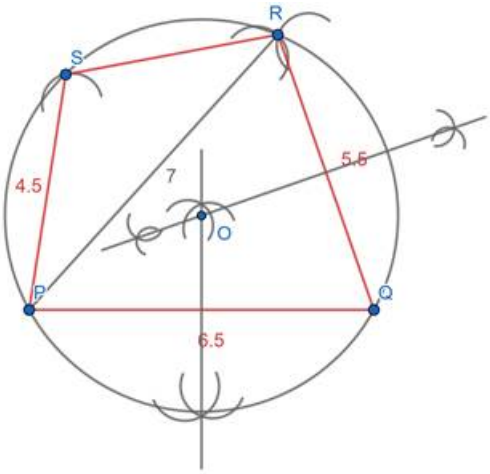
Step 6: With P as the centre and radius 4.5 cm draw an arc intersecting the circumcircle at S.



Step 7: Join PS and RS.



Step 8: PQRS is the required cyclic quadrilateral.



2. Question

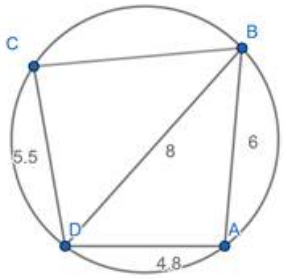
Construct a cyclic quadrilateral ABCD where AB = 6 cm, AD = 4.8 cm, BD = 8 cm and CD = 5.5 cm.

Answer

We need to construct the required quadrilateral, when three sides and one diagonal of a cyclic quadrilateral are given.

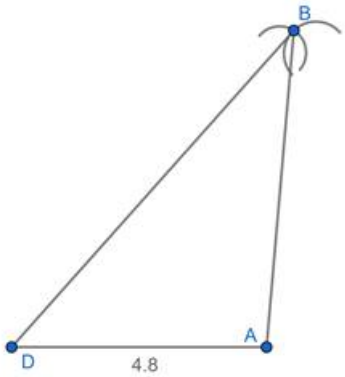
Steps of construction:

Step 1: Draw a rough diagram and mark the measurements.

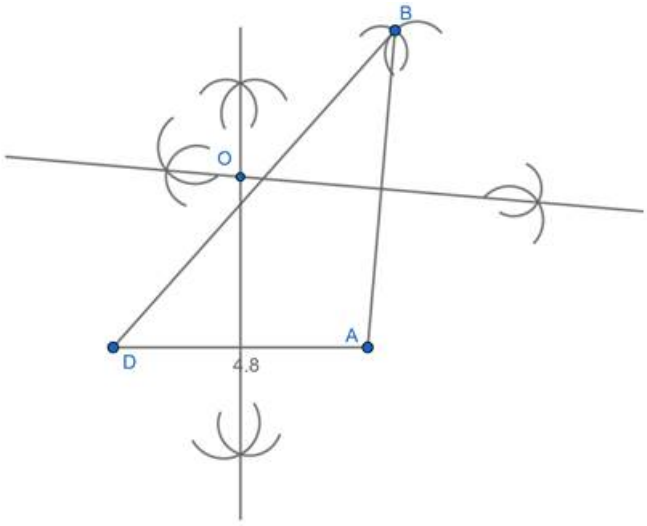


Step 2: Draw a line segment DA = 4.8 cm.

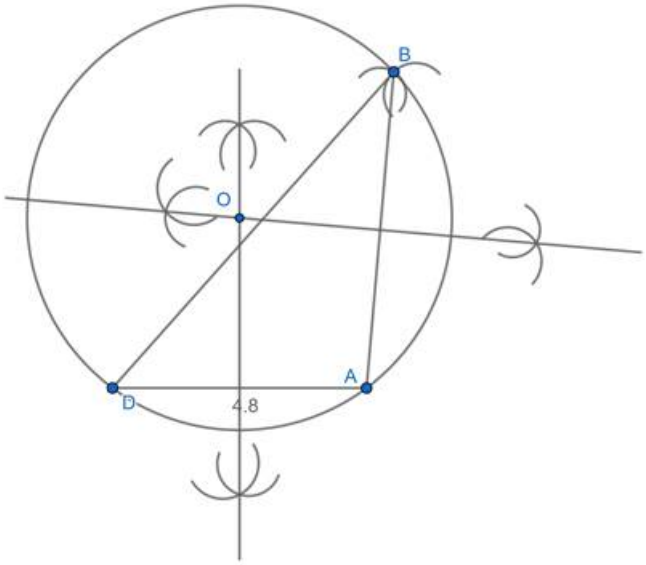
Step 3: With D and A as centres, draw arc with radii 8 cm and 6 cm respectively, to intersect at B. join AB and DB.



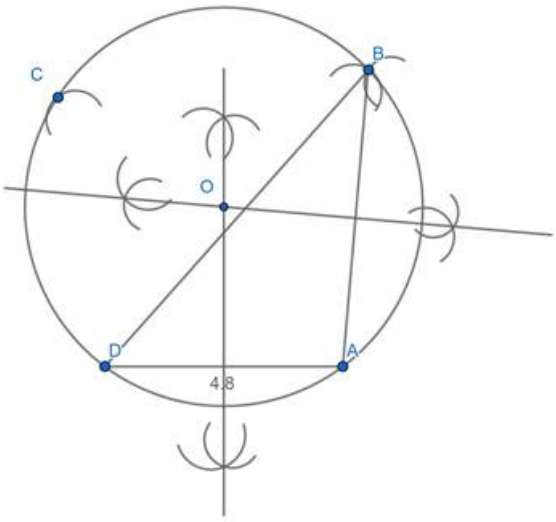
Step 4: Draw the perpendicular bisectors of DA and AB intersect at O.



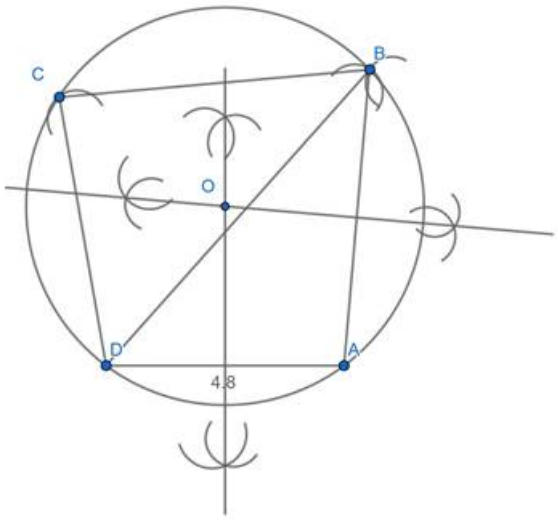
Step 5: With O as the centre and OD (=OA=OB) as radius draw the circumcircle of Δ ABD



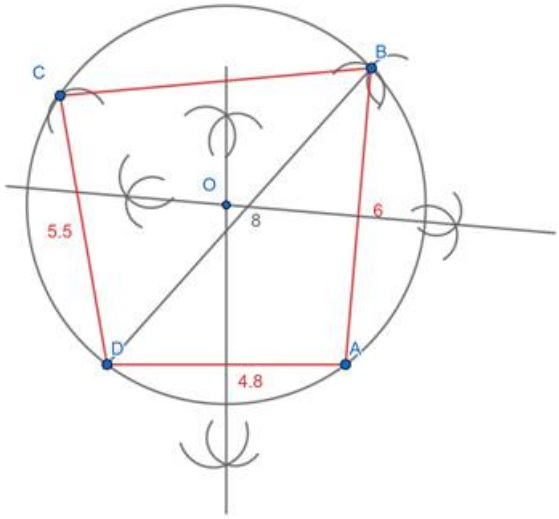
Step 6: With d as the centre and radius 5.5 cm. draw an arc intersecting the circumcircle at C.



Step 7: Join DC and BC.



Step 8: ABCD is the required cyclic quadrilateral.



3. Question

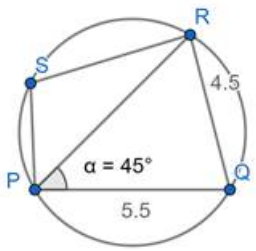
Construct a cyclic quadrilateral PQRS such that PQ = 5.5 cm, QR = 4.5 cm, ∠QPR = 45° and PS = 3 cm.

Answer

We need to construct the required quadrilateral, when three sides and one diagonal of a cyclic quadrilateral are given.

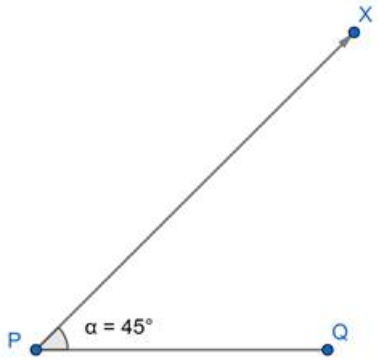
Steps of construction:

Step 1: Draw a rough diagram and mark the measurements.

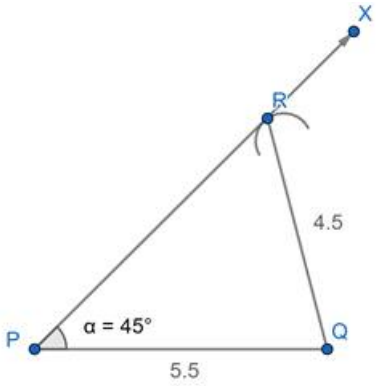


Step 2: Draw a line segment PQ = 5.5 cm.

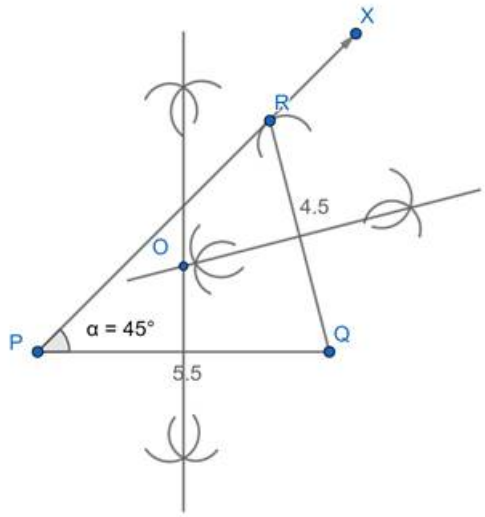
Step 3: Through P draw PX such that ∠ QPX = 45°



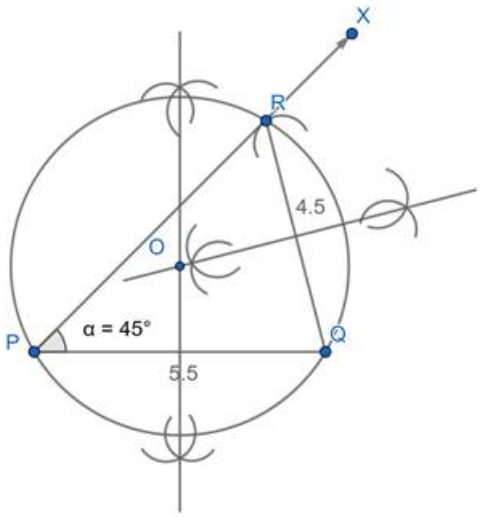
Step 4: With Q as centre and radius 4.5 cm, draw an arc intersecting QX at R and join QR.



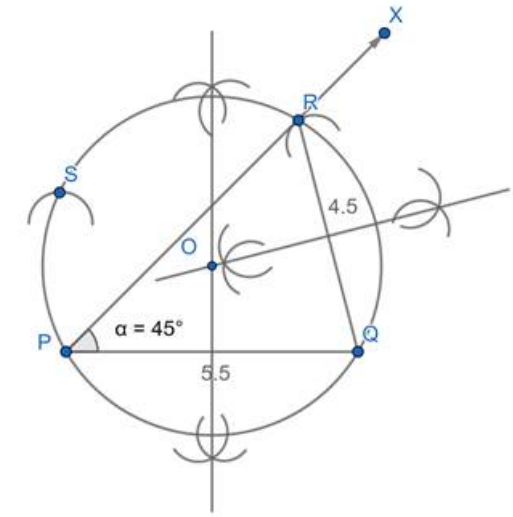
Step 5: Draw the perpendicular bisectors of PQ and QR intersecting each other at O.



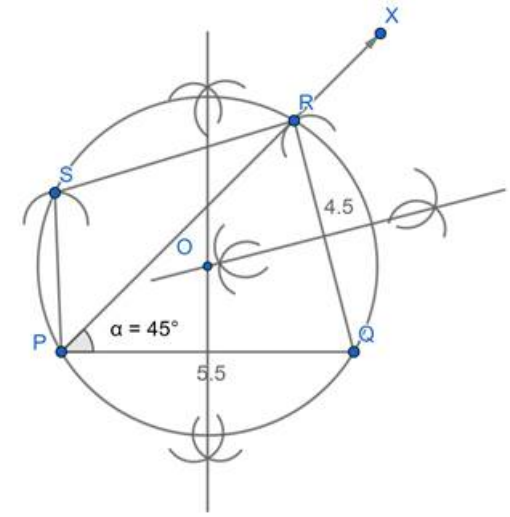
Step 6: With O as centre and OP (= OQ = OR)as radius, draw the circumcircle of DPQR.



Step 7: With P as centre and radius 3 cm, draw an arc intersecting the circle at S.



Step 8: Join PS and RS.



Thus, PQRS is the required cyclic quadrilateral.

4. Question

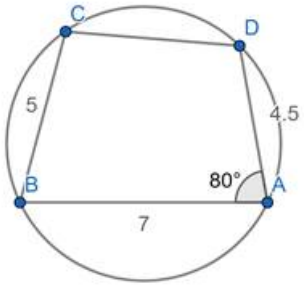
Construct a cyclic quadrilateral ABCD with AB = 7 cm, ∠A = 80°, AD = 4.5 cm and BC = 5 cm.

Answer

We need to construct the required quadrilateral, when three sides and one diagonal of a cyclic quadrilateral are given.

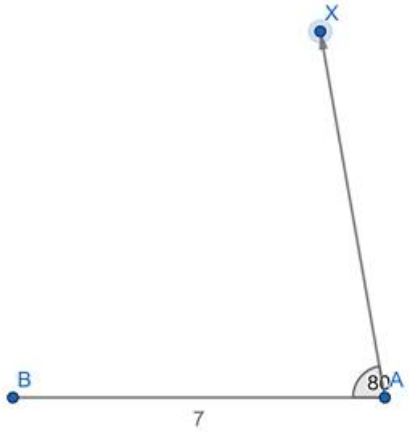
Steps of construction:

Step 1: Draw a rough diagram and mark the measurements.

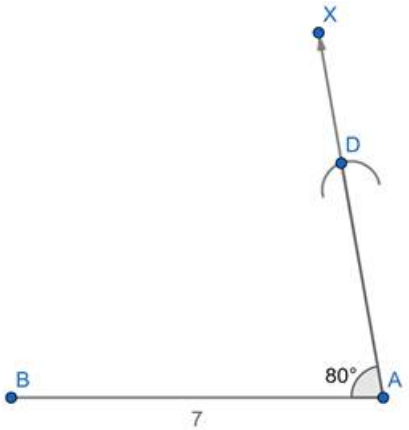


Step 2: Draw a line segment BA = 7cm.

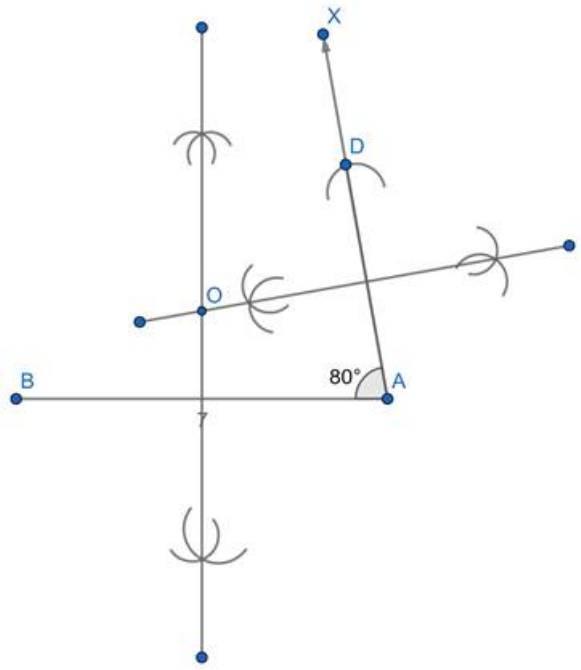
Step 3: Through A draw AX such that ∠ BAX = 80°



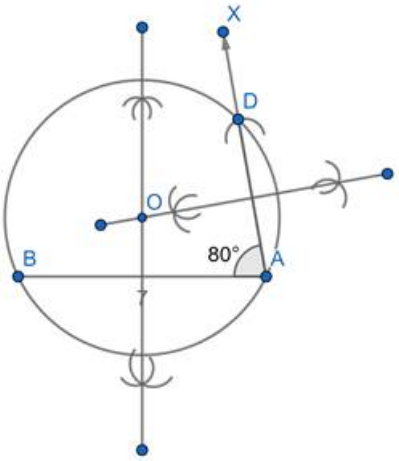
Step 4: With A as centre and radius 4.5 cm, draw an arc intersecting AX at D and join AD.



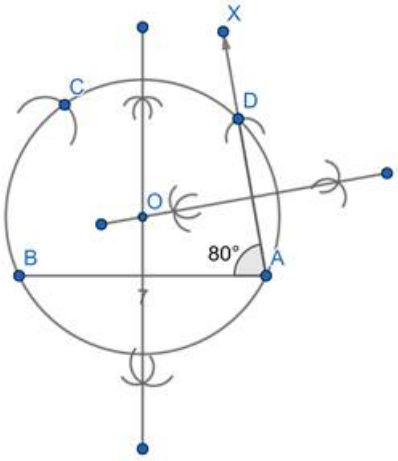
Step 5: Draw the perpendicular bisectors of BA and AD intersecting each other at O.



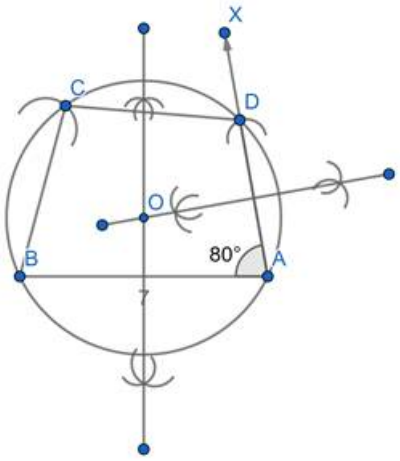
Step 6: With O as centre and OA (=OB =OD) as radius, draw the circumcircle of Δ ABD.



Step 7: With B as centre and radius 5 cm, draw an arc intersecting the circle at C.



Step 8: Join BC and CD.



Thus, ABCD is the required cyclic quadrilateral.

5. Question

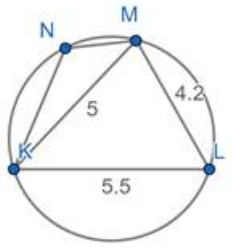
Construct a cyclic quadrilateral KLMN such that KL = 5.5 cm, KM = 5 cm, LM = 4.2 cm and LN = 5.3 cm.

Answer

We need to construct the required quadrilateral, when three sides and one diagonal of a cyclic quadrilateral are given.

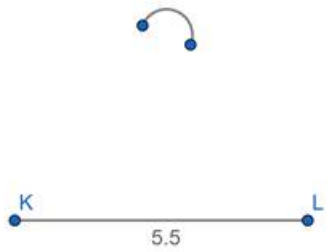
Steps of construction:

Step 1: Draw a rough diagram and mark the measurements.

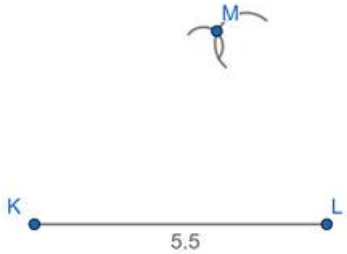


Step 2: Draw a line segment KL = 5.5 cm

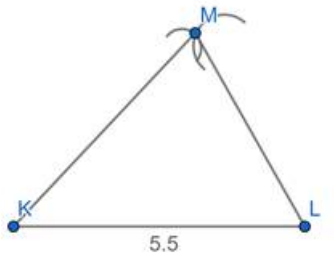
Step 3: With K as centre and radius 5cm draw an arc.



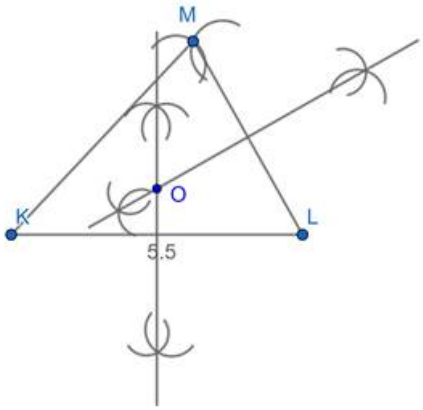
Step 4: With L as centre and radius 4.2 cm, draw another arc intersecting the previous arc at M.



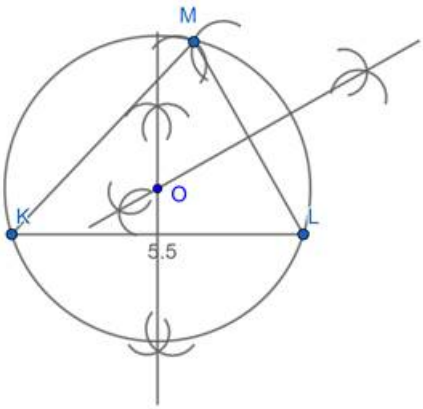
Step 5: Join KM and LM



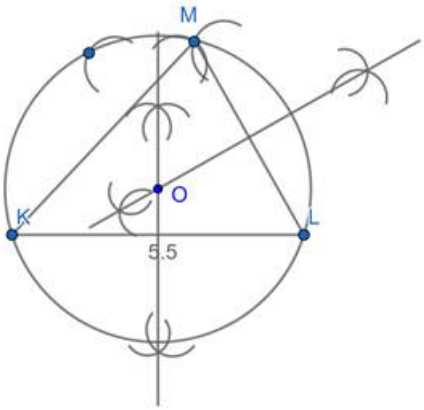
Step 6: Draw the perpendicular bisectors of KL and LM intersecting each other at O.



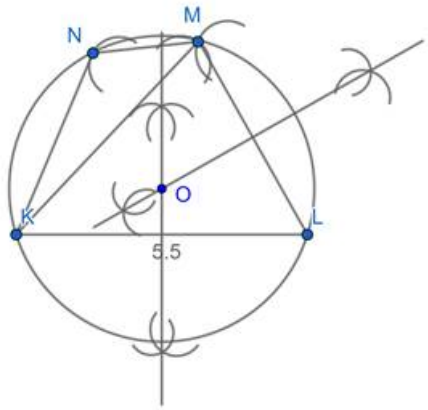
Step 7: With O as centre and OK (=OL=OM) as radius, draw the circumcircle of Δ KLM.



Step 8: With L as centre and radius 5.3 cm, draw an arc intersecting the circle at N.



Step 9: Join KN and MN.



Thus, KLMN is the required cyclic quadrilateral.

6. Question

Construct a cyclic quadrilateral EFGH where EF = 7 cm, EH = 4.8 cm, FH = 6.5 cm and EG = 6.6 cm.

Answer

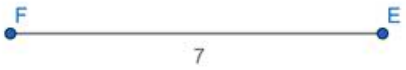
We need to construct the required quadrilateral, when three sides and one diagonal of a cyclic quadrilateral are given.

Steps of construction:

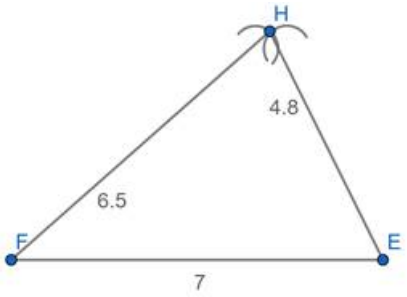
Step 1: Draw a line segment FE = 7cm

Step 2: With F as centre and radius 6.5 cm draw an arc.

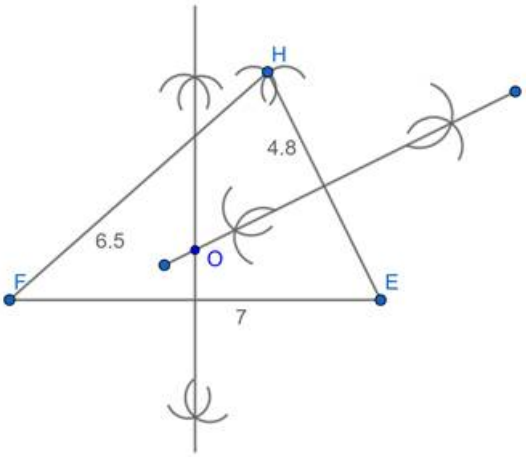
Step 3: With E as centre and radius 4.8 cm, draw another arc intersecting the previous arc at H.



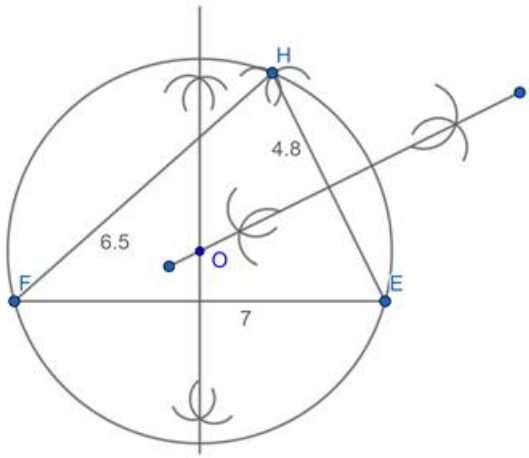
Step 4: Join FH and EH.



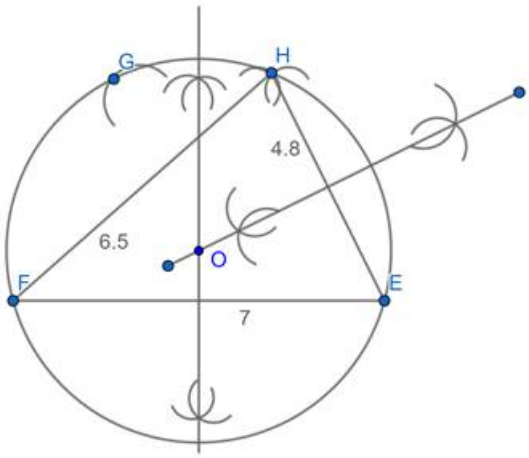
Step 5: Draw the perpendicular bisectors of FE and EH intersecting each other at O.



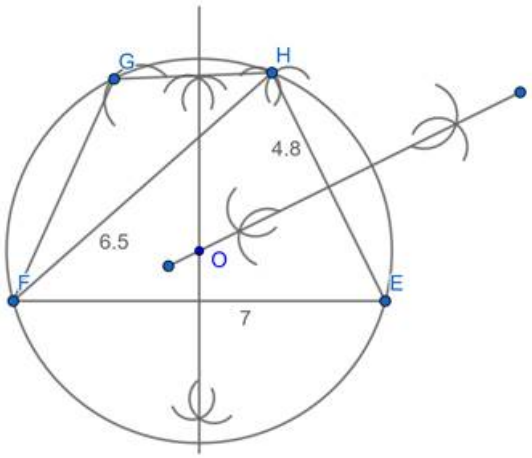
Step 6: With O as centre and OF (= OE = OH) as radius, draw the circumcircle of Δ EFH.



Step 7: With E as centre and radius 6.6cm, draw an arc intersecting the circle at G.



Step 8: Join FG and GH.



Thus, EFGH is the required cyclic quadrilateral.

7. Question

Construct a cyclic quadrilateral ABCD, given AB = 6 cm, ∠ABC = 70°, BC = 5 cm and ∠ACD = 30°

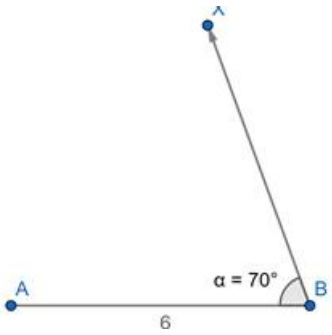
Answer

We need to construct the required quadrilateral, when three sides and one diagonal of a cyclic quadrilateral are given.

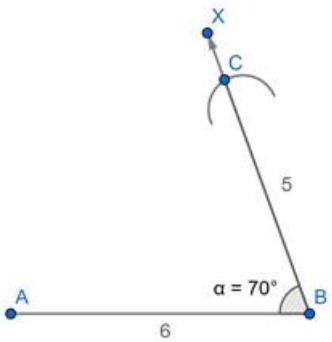
Steps of construction:

Step 1: Draw a line segment AB = 6 cm.

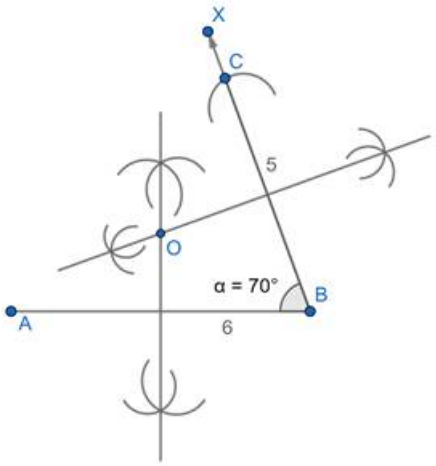
Step 2: Through A draw BX such that ∠ ABX = 70°



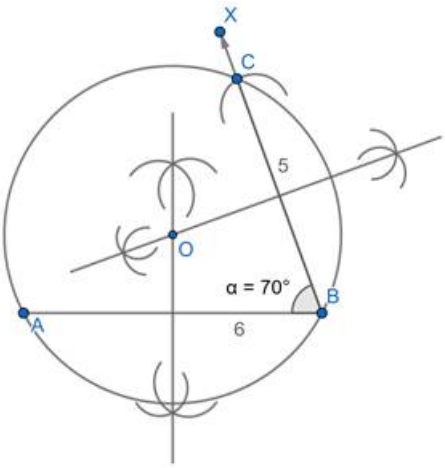
Step 3: With B as centre and radius 5 cm, draw an arc intersecting BX at C and join BC.



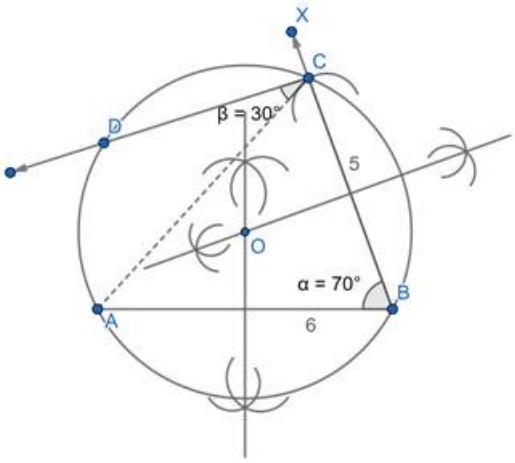
Step 4: Draw the perpendicular bisectors of AB and BC intersecting each other at O.



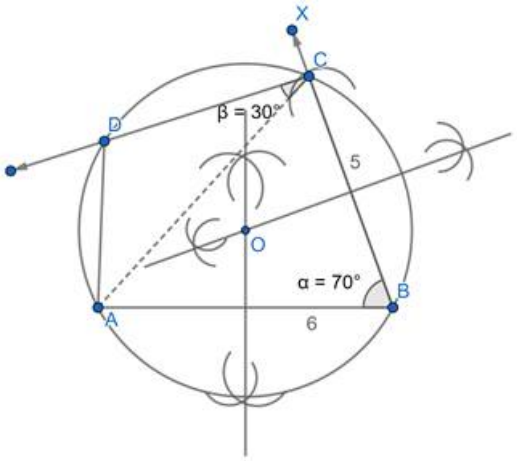
Step 5: With O as centre and OA (= OB =OC) as radius, draw the circumcircle of Δ ABC.



Step 6: From C, draw CY such that ∠ ACD =30° , which intersects the circle at D.



Step 7: Join AD.



Thus, ABCD is the required cyclic quadrilateral.

8. Question

Construct a cyclic quadrilateral PQRS given PQ = 5 cm, QR = 4 cm, ∠QPR = 35° and ∠PRS = 70°

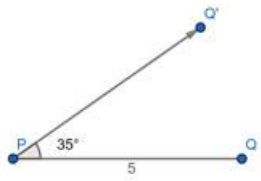
Answer

We need to construct the required quadrilateral, when three sides and one diagonal of a cyclic quadrilateral are given.

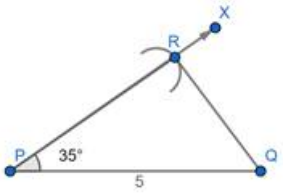
Steps of construction:

Step 1: Draw a line segment PQ = 5 cm.

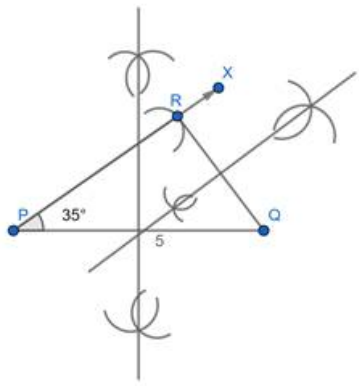
Step 2: Through P draw PX such that ∠ QPX = 35°



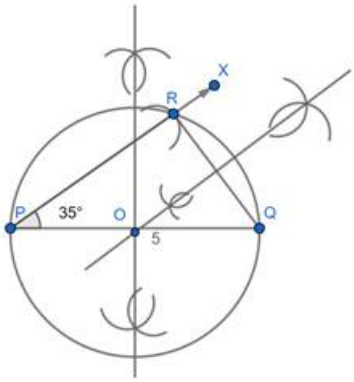
Step 3: With Q as centre and radius 4 cm, draw an arc intersecting PX at R and join QR..



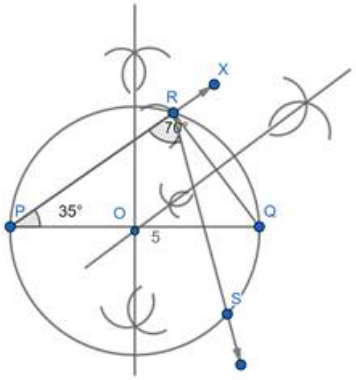
Step 4: Draw the perpendicular bisectors of PQ and QR intersecting each other at O.



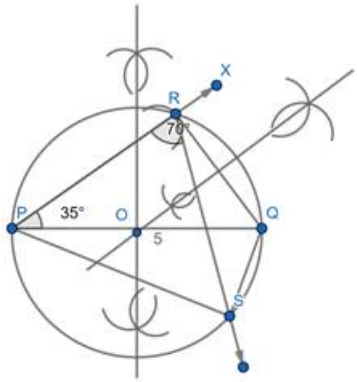
Step 5: With O as centre and OP (= OQ = OR) as radius, draw the circumcircle of Δ PQR.



Step 6: From R, draw RY such that ∠ PRS = 70° , which intersects the circle at S.



Step 7: Join PS.



Thus, PQRS is required cyclic quadrilateral.

9. Question

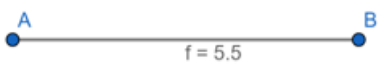
Construct a cyclic quadrilateral ABCD such that AB = 5.5 cm ∠ABC = 50°, ∠BAC = 60° and ∠ACD = 30°

Answer

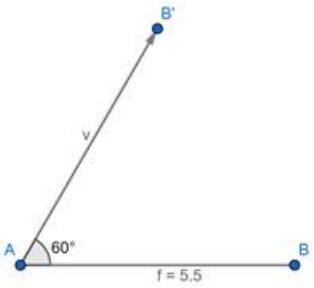
We need to construct the required quadrilateral, when three sides and one diagonal of a cyclic quadrilateral are given.

Steps of construction:

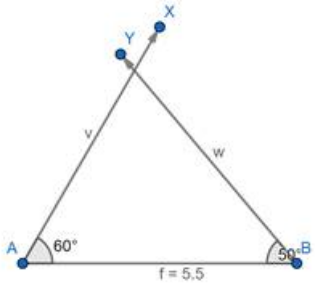
Step 1: Draw a line segment AB = 5.5 cm



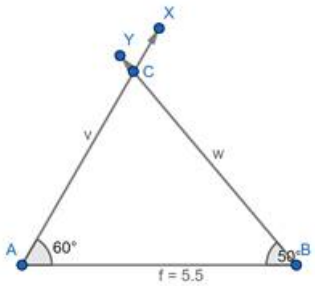
Step 2: Through A draw AX such that ∠ BAX = 60°



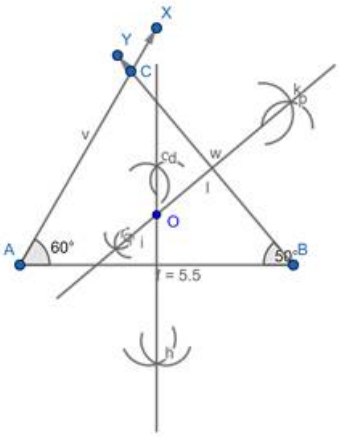
Step 3: Through b draw BY such that ∠ ABY = 50°



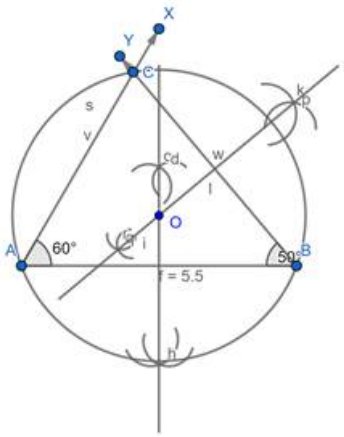
Step 4: Mark the point where BY meets AX and label it as C.



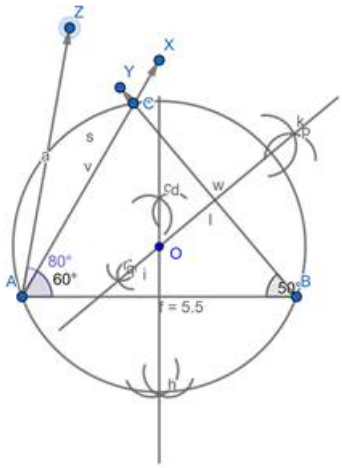
Step 5: Draw the perpendicular bisectors of AB and BC intersecting each other at O.



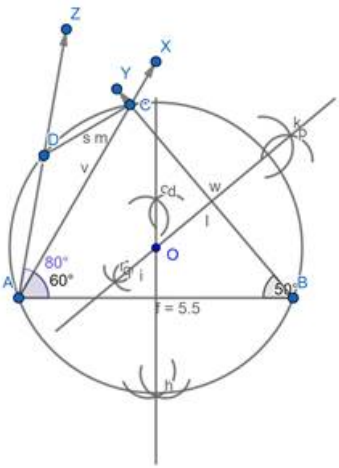
Step 6: With O as centre and OA (= OB = OC) as radius, draw the circumcircle of Δ ABC.



Step 7: From A, draw AZ such that ∠ BAZ = 80° , which intersects the circle at D.



Step 8: Join AD and CD.



Thus, ABCD is the required cyclic quadrilateral.

10. Question

Construct a cyclic quadrilateral ABCD, where AB = 6.5 cm, ABC = 110°, BC = 5.5 cm and AB || CD.

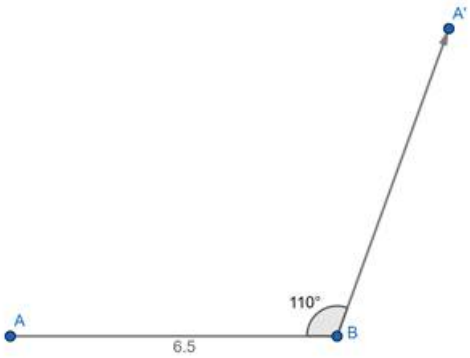
Answer

We need to construct the required quadrilateral, when three sides and one diagonal of a cyclic quadrilateral are given.

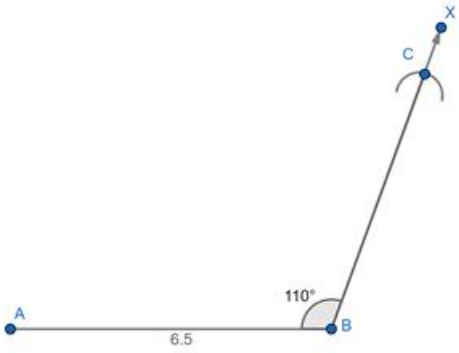
Steps of construction:

Step 1: Draw a line segments AB = 6.5 cm

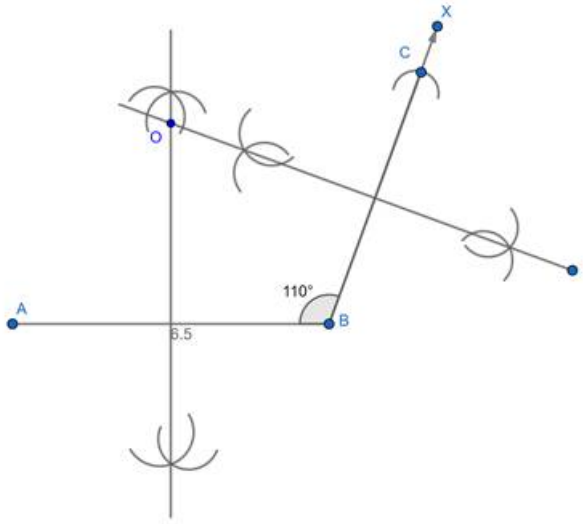
Step 2: Through B draw BX such that ∠ ABX = 110°



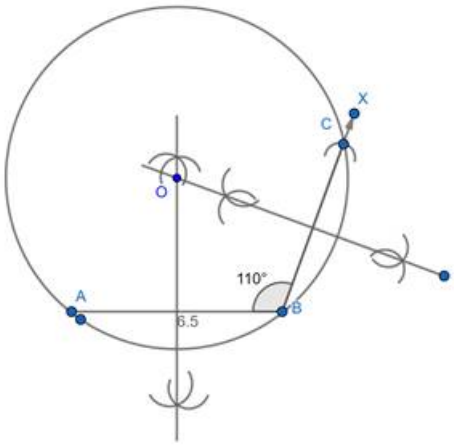
Step 3: With B as centre and radius 5.5 cm, draw an arc intersecting BX at C.



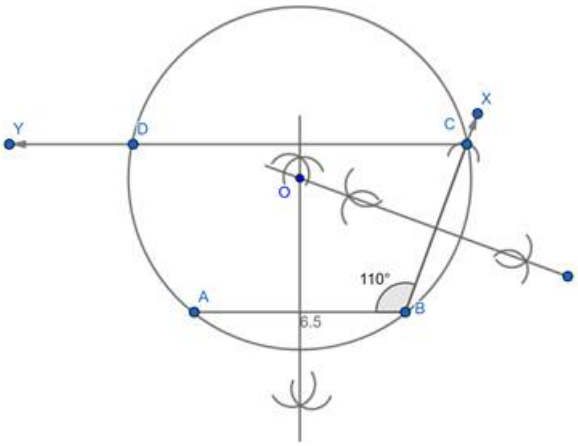
Step 4: Draw the perpendicular bisectors of AB and BC intersecting each other at O.



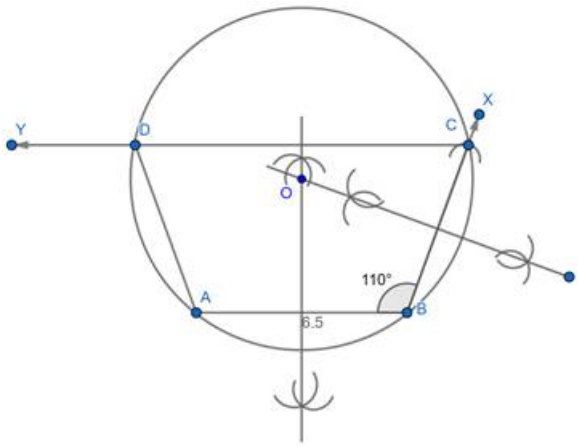
Step 5: With O as centre and OA (= OB = OC) as radius, draw the circumcircle of Δ ABC.



Step 6: From C, draw CY such that CY || AB, which intersects the circle at D.



Step 7: Join AD.



Thus, ABCD is the required cyclic quadrilateral.