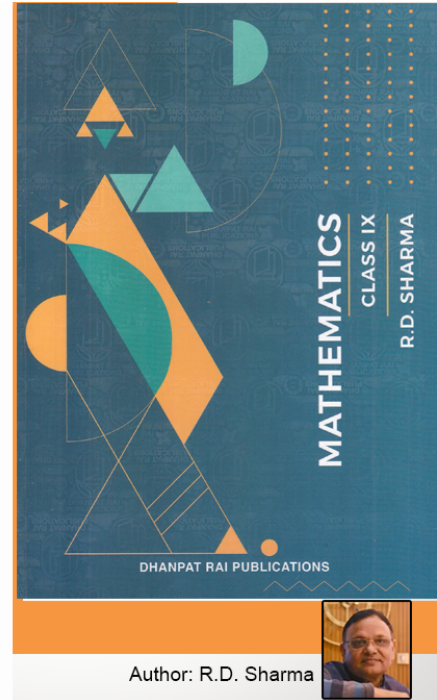


Class 9 - Chapter 16 Circles



RD Sharma Solutions for Class 9 Maths Chapter 16–Circles

Class 9: Maths Chapter 16 solutions. Complete Class 9 Maths Chapter 16 Notes.

RD Sharma Solutions for Class 9 Maths Chapter 16–Circles

RD Sharma 9th Maths Chapter 16, Class 9 Maths Chapter 16 solutions

Exercise 16.1 Page No: 16.5

Question 1: Fill in the blanks:

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- (i) All points lying inside/outside a circle are called _____ points/ _____ points.
- (ii) Circles having the same centre and different radii are called _____ circles.
- (iii) A point whose distance from the center of a circle is greater than its radius lies in _____ of the circle.
- (iv) A continuous piece of a circle is _____ of the circle.
- (v) The longest chord of a circle is a _____ of the circle.
- (vi) An arc is a _____ when its ends are the ends of a diameter.
- (vii) Segment of a circle is a region between an arc and _____ of the circle.
- (viii) A circle divides the plane, on which it lies, in _____ parts.

Solution:

- (i) Interior/Exterior
- (ii) Concentric
- (iii) The Exterior
- (iv) Arc
- (v) Diameter
- (vi) Semi-circle
- (vii) Center
- (viii) Three

Question 2: Write the truth value (T/F) of the following with suitable reasons:

- (i) A circle is a plane figure.
- (ii) Line segment joining the center to any point on the circle is a radius of the circle,
- (iii) If a circle is divided into three equal arcs each is a major arc.
- (iv) A circle has only finite number of equal chords.

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(v) A chord of a circle, which is twice as long as its radius is the diameter of the circle.

(vi) Sector is the region between the chord and its corresponding arc.

(vii) The degree measure of an arc is the complement of the central angle containing the arc.

(viii) The degree measure of a semi-circle is 180° .

Solution:

(i) T

(ii) T

(iii) T

(iv) F

(v) T

(vi) T

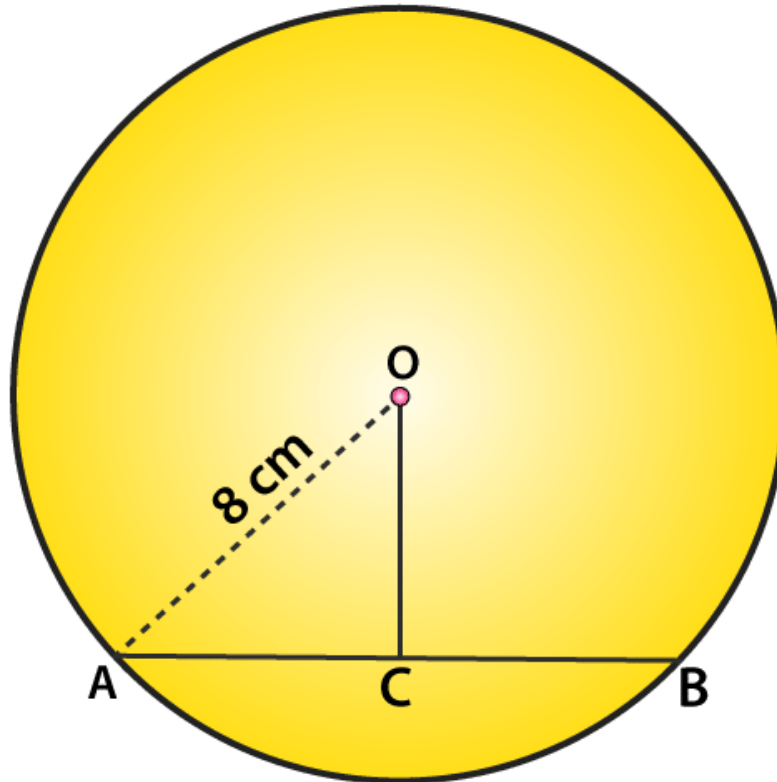
(vii) F

(viii) T

Exercise 16.2 Page No: 16.24

Question 1: The radius of a circle is 8 cm and the length of one of its chords is 12 cm. Find the distance of the chord from the centre.

Solution:



Radius of circle (OA) = 8 cm (Given)

Chord (AB) = 12cm (Given)

Draw a perpendicular OC on AB.

We know, perpendicular from centre to chord bisects the chord

Which implies, $AC = BC = 12/2 = 6$ cm

In right $\triangle OCA$:

Using Pythagoras theorem,

$$OA^2 = AC^2 + OC^2$$

$$64 = 36 + OC^2$$

$$OC^2 = 64 - 36 = 28$$

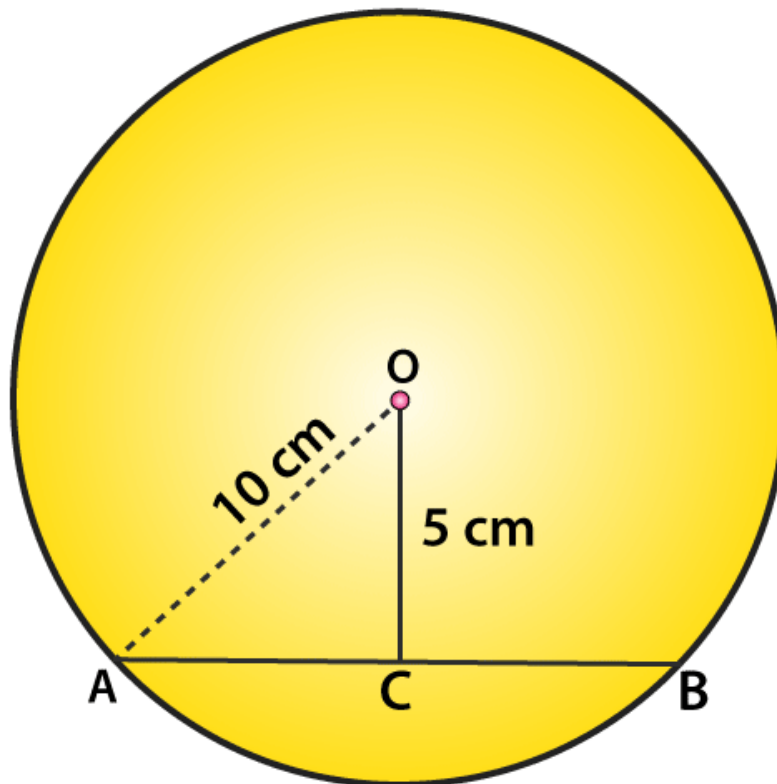
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or $OC = \sqrt{28} = 5.291$ (approx.)

The distance of the chord from the centre is 5.291 cm.

Question 2: Find the length of a chord which is at a distance of 5 cm from the centre of a circle of radius 10 cm.

Solution:



Distance of the chord from the centre = $OC = 5$ cm (Given)

Radius of the circle = $OA = 10$ cm (Given)

In $\triangle OCA$:

Using Pythagoras theorem,

$$OA^2 = AC^2 + OC^2$$

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$$100 = AC^2 + 25$$

$$AC^2 = 100 - 25 = 75$$

$$AC = \sqrt{75} = 8.66$$

As, perpendicular from the centre to chord bisects the chord.

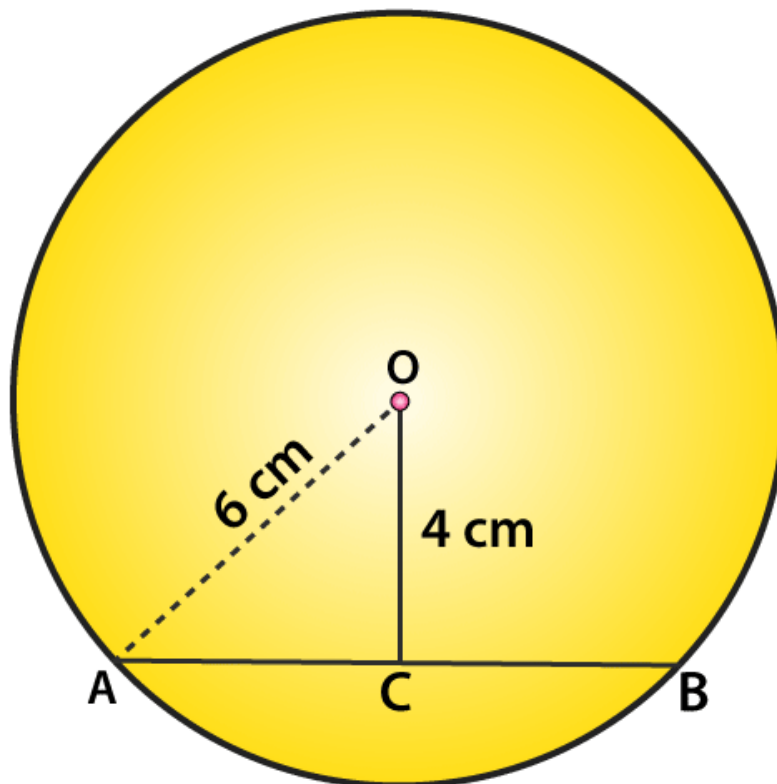
Therefore, $AC = BC = 8.66$ cm

$$\Rightarrow AB = AC + BC = 8.66 + 8.66 = 17.32$$

Answer: $AB = 17.32$ cm

Question 3: Find the length of a chord which is at a distance of 4 cm from the centre of a circle of radius 6 cm.

Solution:



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Distance of the chord from the centre = $OC = 4$ cm (Given)

Radius of the circle = $OA = 6$ cm (Given)

In $\triangle OCA$:

Using Pythagoras theorem,

$$OA^2 = AC^2 + OC^2$$

$$36 = AC^2 + 16$$

$$AC^2 = 36 - 16 = 20$$

$$AC = \sqrt{20} = 4.47$$

$$\text{Or } AC = 4.47 \text{ cm}$$

As, perpendicular from the centre to chord bisects the chord.

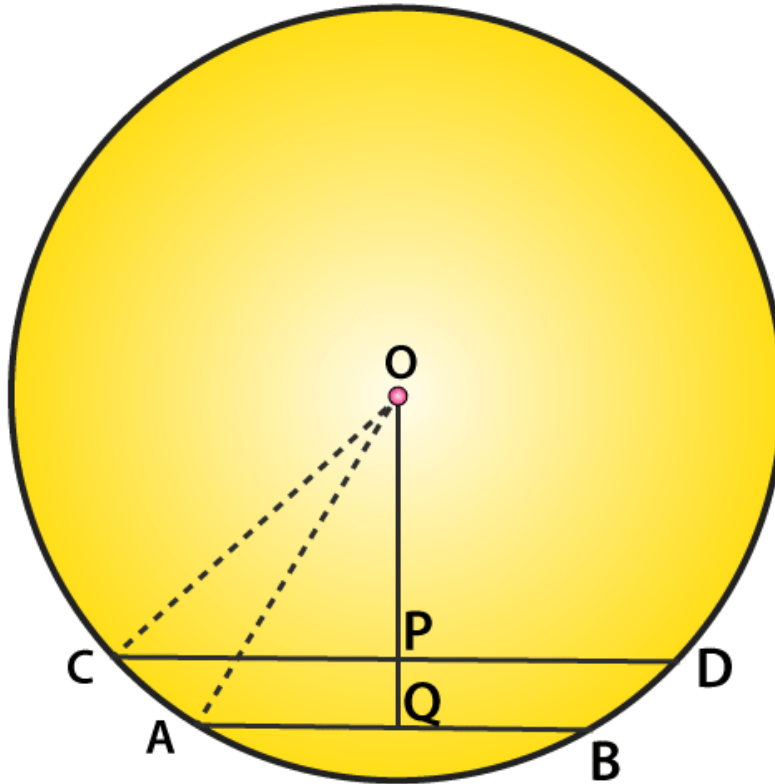
Therefore, $AC = BC = 4.47$ cm

$$\Rightarrow AB = AC + BC = 4.47 + 4.47 = 8.94$$

Answer: $AB = 8.94$ cm

Question 4: Two chords AB , CD of lengths 5 cm, 11 cm respectively of a circle are parallel. If the distance between AB and CD is 3 cm, find the radius of the circle.

Solution:



Given: $AB = 5$ cm, $CD = 11$ cm, $PQ = 3$ cm

Draw perpendiculars OP on CD and OQ on AB

Let $OP = x$ cm and $OC = OA = r$ cm

We know, perpendicular from centre to chord bisects it.

Since $OP \perp CD$, we have

$$CP = PD = 11/2 \text{ cm}$$

And $OQ \perp AB$

$$AQ = BQ = 5/2 \text{ cm}$$

In $\triangle OCP$:

By Pythagoras theorem,

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$$OC^2 = OP^2 + CP^2$$

$$r^2 = x^2 + (11/2)^2 \dots\dots(1)$$

In ΔOQA :

By Pythagoras theorem,

$$OA^2 = OQ^2 + AQ^2$$

$$r^2 = (x+3)^2 + (5/2)^2 \dots\dots(2)$$

From equations (1) and (2), we get

$$(x+3)^2 + (5/2)^2 = x^2 + (11/2)^2$$

Solve above equation and find the value of x.

$$x^2 + 6x + 9 + 25/4 = x^2 + 121/4$$

(using identity, $(a+b)^2 = a^2 + b^2 + 2ab$)

$$6x = 121/4 - 25/4 - 9$$

$$6x = 15$$

$$\text{or } x = 15/6 = 5/2$$

Substitute the value of x in equation (1), and find the length of radius,

$$r^2 = (5/2)^2 + (11/2)^2$$

$$= 25/4 + 121/4$$

$$= 146/4$$

$$\text{or } r = \sqrt{146/4} \text{ cm}$$

Question 5: Give a method to find the centre of a given circle.

Solution:

Steps of Construction:

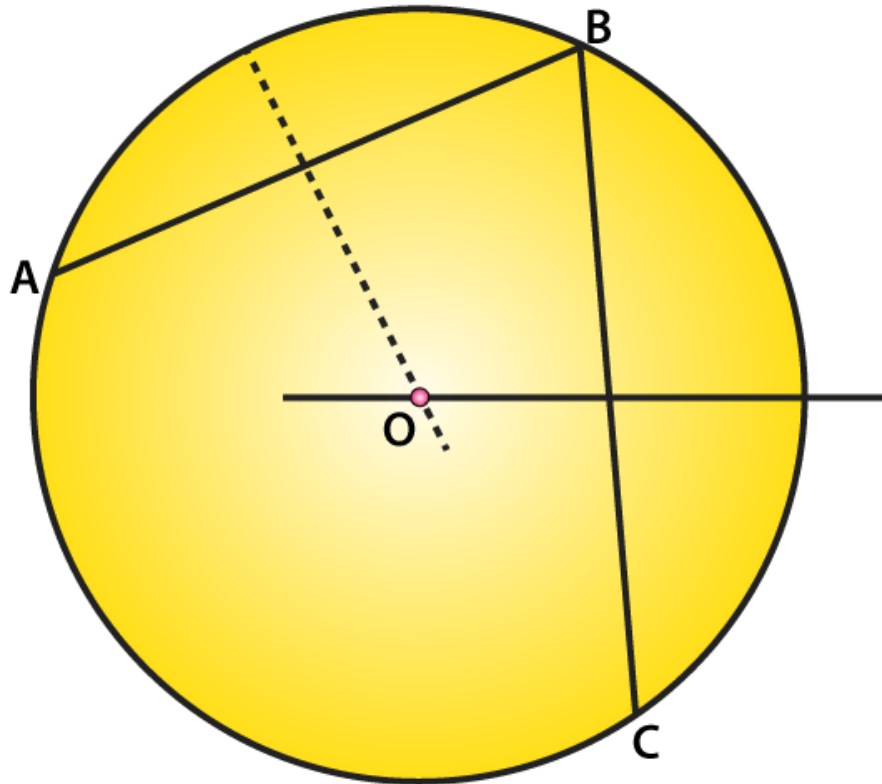
Step 1: Consider three points A, B and C on a circle.

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Step 2: Join AB and BC.

Step 3: Draw perpendicular bisectors of chord AB and BC which intersect each other at a point, say O.

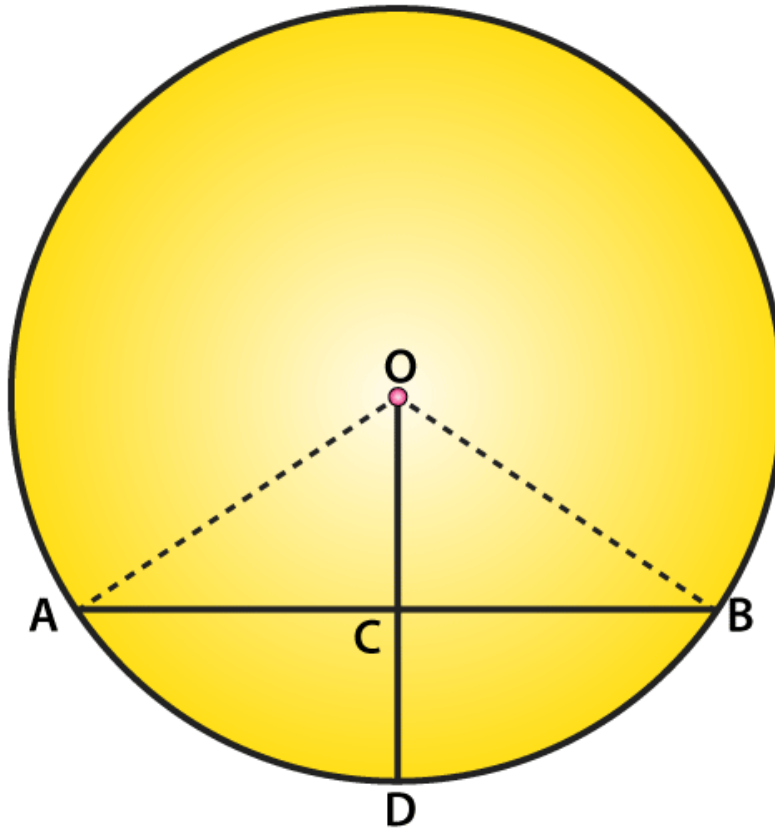
Step 4: This point O is a centre of the circle, because we know that, the Perpendicular bisectors of chord always pass through the centre.



Question 6: Prove that the line joining the mid-point of a chord to the centre of the circle passes through the mid-point of the corresponding minor arc.

Solution:

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From figure, Let C is the mid-point of chord AB.

To prove: D is the mid-point of arc AB.

Now, In $\triangle OAC$ and $\triangle OBC$

$OA = OB$ [Radius of circle]

$OC = OC$ [Common]

$AC = BC$ [C is the mid-point of chord AB (given)]

So, by SSS condition: $\triangle OAC \cong \triangle OBC$

So, $\angle AOC = \angle BOC$ (BY CPCT)

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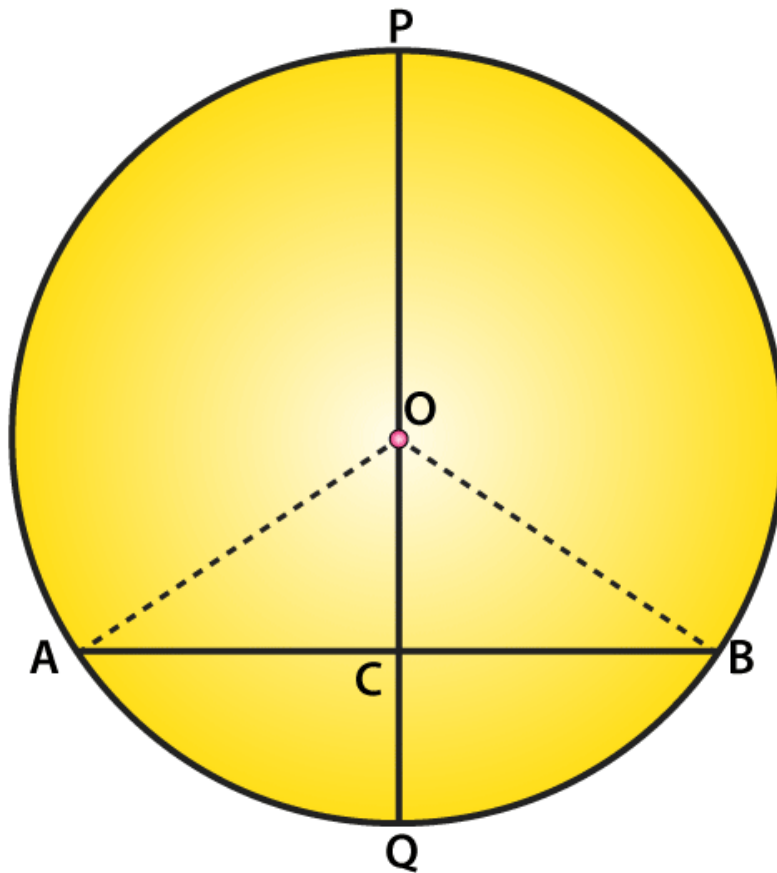
$$\Rightarrow m\bar{AD} \cong m\bar{BD}$$

$$\Rightarrow \bar{AD} \cong \bar{BD}$$

Therefore, D is the mid-point of arc AB. Hence Proved.

Question 7: Prove that a diameter of a circle which bisects a chord of the circle also bisects the angle subtended by the chord at the centre of the circle.

Solution:



From figure: PQ is a diameter of circle which bisects the chord AB at C. (Given)

To Prove: PQ bisects $\angle AOB$

Now,

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In $\triangle BOC$ and $\triangle AOC$

$OA = OB$ [Radius]

$OC = OC$ [Common side]

$AC = BC$ [Given]

Then, by SSS condition: $\triangle AOC \cong \triangle BOC$

So, $\angle AOC = \angle BOC$ [By c.p.c.t.]

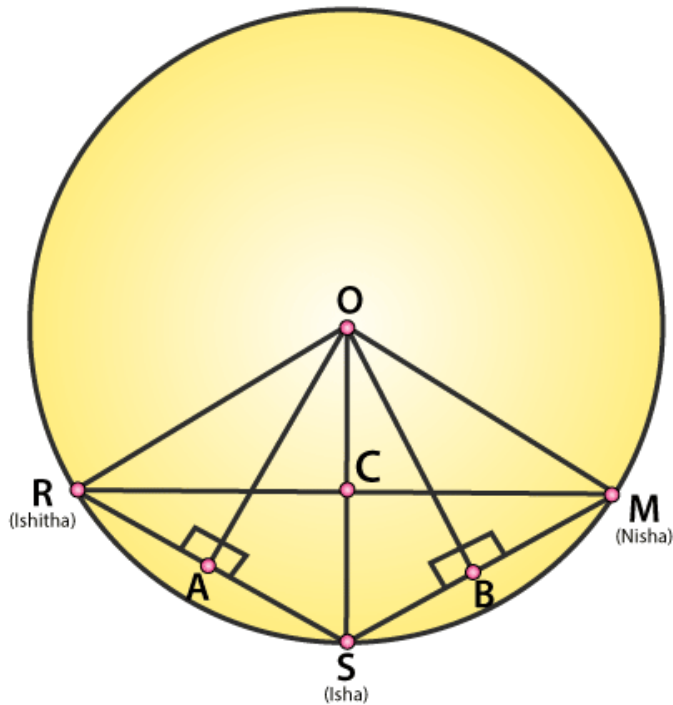
Therefore, PQ bisects $\angle AOB$. Hence proved.

Exercise 16.3 Page No: 16.40

Question 1: Three girls Ishita, Isha and Nisha are playing a game by standing on a circle of radius 20 m drawn in a park. Ishita throws a ball to Isha, Isha to Nisha and Nisha to Ishita. If the distance between Ishita and Isha and between Isha and Nisha is 24 m each, what is the distance between Ishita and Nisha.

Solution:

Let R, S and M be the position of Ishita, Isha and Nisha respectively.



Since OA is a perpendicular bisector on RS, so $AR = AS = 24/2 = 12$ cm

Radii of circle = $OR = OS = OM = 20$ cm (Given)

In $\triangle OAR$:

By Pythagoras theorem,

$$OA^2 + AR^2 = OR^2$$

$$OA^2 + 12^2 = 20^2$$

$$OA^2 = 400 - 144 = 256$$

$$\text{Or } OA = 16 \text{ m } \dots(1)$$

From figure, OABC is a kite since $OA = OC$ and $AB = BC$. We know that, diagonals of a kite are perpendicular and the diagonal common to both the isosceles triangles is bisected by another diagonal.

So in $\triangle RSM$, $\angle RCS = 90^\circ$ and $RC = CM \dots(2)$

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Now, Area of $\triangle ORS$ = Area of $\triangle ORS$

$$\Rightarrow \frac{1}{2} \times OA \times RS = \frac{1}{2} \times RC \times OS$$

$$\Rightarrow OA \times RS = RC \times OS$$

$$\Rightarrow 16 \times 24 = RC \times 20$$

$$\Rightarrow RC = 19.2$$

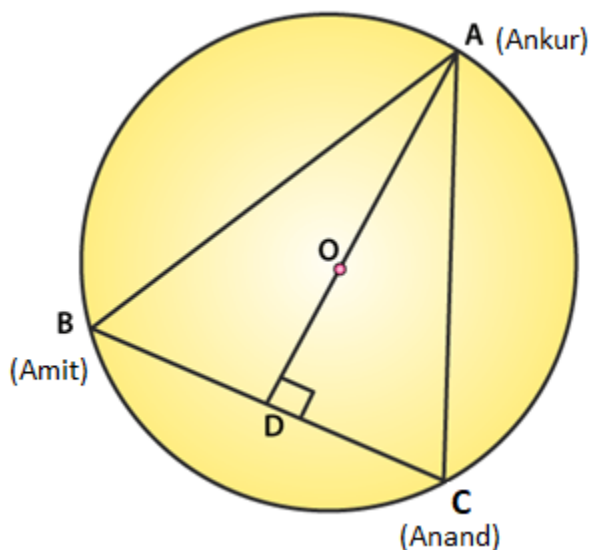
Since $RC = CM$ (from (2)), we have

$$RM = 2(19.2) = 38.4$$

So, the distance between Ishita and Nisha is 38.4 m.

Question 2: A circular park of radius 40 m is situated in a colony. Three boys Ankur, Amit and Anand are sitting at equal distance on its boundary each having a toy telephone in his hands to talk to each other. Find the length of the string of each phone.

Solution:



Since, $AB = BC = CA$. So, ABC is an equilateral triangle

Radius = $OA = 40$ m (Given)

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We know, medians of equilateral triangle pass through the circumcentre and intersect each other at the ratio 2 : 1.

Here AD is the median of equilateral triangle ABC, we can write:

$$OA/OD = 2/1$$

$$\text{or } 40/OD = 2/1$$

$$\text{or } OD = 20 \text{ m}$$

$$\text{Therefore, } AD = OA + OD = (40 + 20) \text{ m} = 60 \text{ m}$$

Now, In $\triangle ADC$:

By Pythagoras theorem,

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

$$AC^2 = 60^2 + (AC/2)^2$$

$$AC^2 = 3600 + AC^2 / 4$$

$$3/4 AC^2 = 3600$$

$$AC^2 = 4800$$

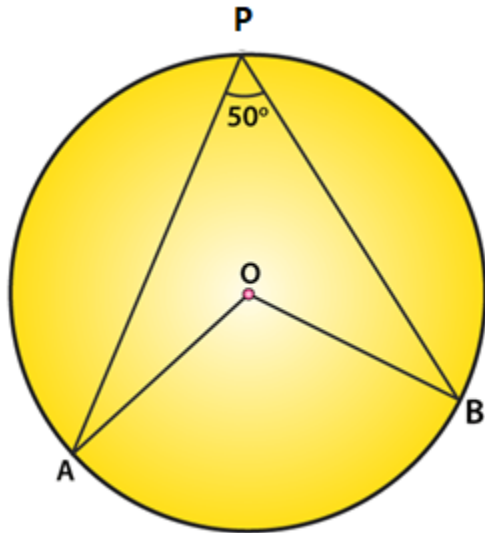
$$\text{or } AC = 40\sqrt{3} \text{ m}$$

Therefore, length of string of each phone will be $40\sqrt{3}$ m.

Exercise 16.4 Page No: 16.60

Question 1: In figure, O is the centre of the circle. If $\angle APB = 50^\circ$, find $\angle AOB$ and $\angle OAB$.

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Solution:

$$\angle APB = 50^\circ \text{ (Given)}$$

By degree measure theorem: $\angle AOB = 2\angle APB$

$$\angle AOB = 2 \times 50^\circ = 100^\circ$$

Again, $OA = OB$ [Radius of circle]

Then $\angle OAB = \angle OBA$ [Angles opposite to equal sides]

Let $\angle OAB = m$

In $\triangle OAB$,

By angle sum property: $\angle OAB + \angle OBA + \angle AOB = 180^\circ$

$$\Rightarrow m + m + 100^\circ = 180^\circ$$

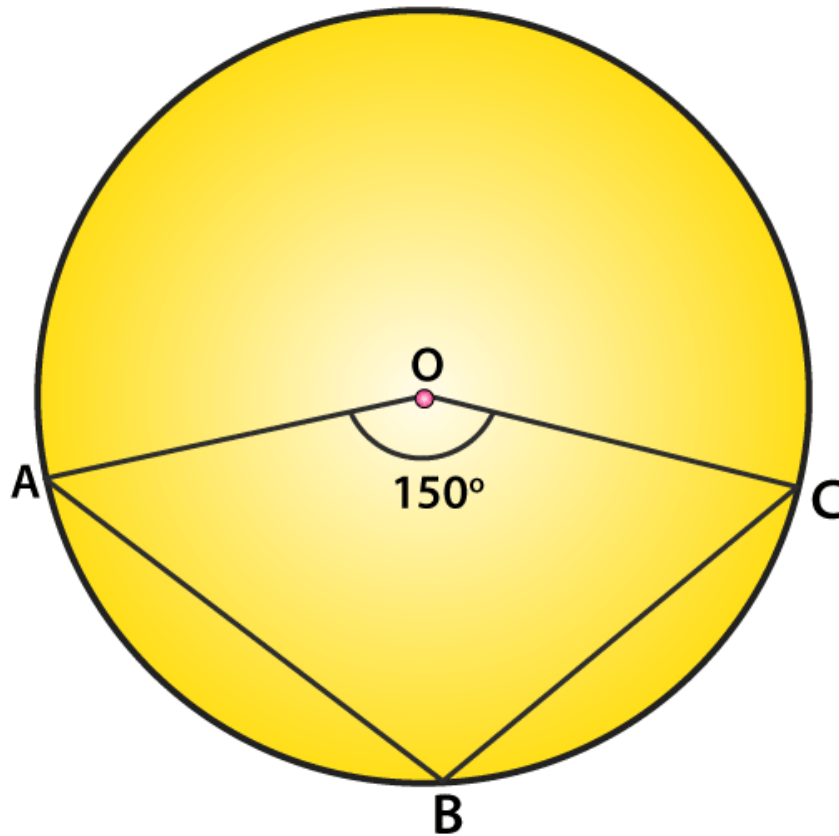
$$\Rightarrow 2m = 180^\circ - 100^\circ = 80^\circ$$

$$\Rightarrow m = 80^\circ / 2 = 40^\circ$$

$$\angle OAB = \angle OBA = 40^\circ$$

Question 2: In figure, it is given that O is the centre of the circle and $\angle AOC = 150^\circ$. Find $\angle ABC$.

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Solution:

$$\angle AOC = 150^\circ \text{ (Given)}$$

$$\text{By degree measure theorem: } \angle ABC = (\text{reflex } \angle AOC)/2 \dots(1)$$

We know, $\angle AOC + \text{reflex}(\angle AOC) = 360^\circ$ [Complex angle]

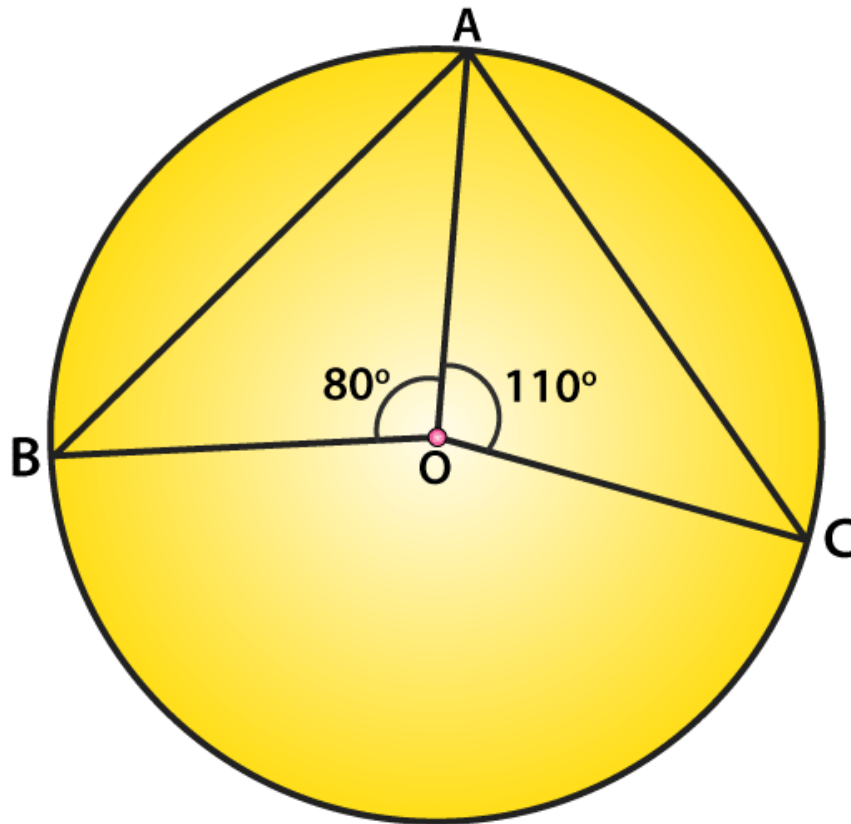
$$150^\circ + \text{reflex } \angle AOC = 360^\circ$$

$$\text{or reflex } \angle AOC = 360^\circ - 150^\circ = 210^\circ$$

$$\text{From (1) } \Rightarrow \angle ABC = 210^\circ / 2 = 105^\circ$$

Question 3: In figure, O is the centre of the circle. Find $\angle BAC$.

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**Solution:**

Given: $\angle AOB = 80^\circ$ and $\angle AOC = 110^\circ$

Therefore, $\angle AOB + \angle AOC + \angle BOC = 360^\circ$ [Complete angle]

Substitute given values,

$$80^\circ + 110^\circ + \angle BOC = 360^\circ$$

$$\angle BOC = 360^\circ - 80^\circ - 110^\circ = 170^\circ$$

$$\text{or } \angle BOC = 170^\circ$$

Now, by degree measure theorem

$$\angle BOC = 2\angle BAC$$

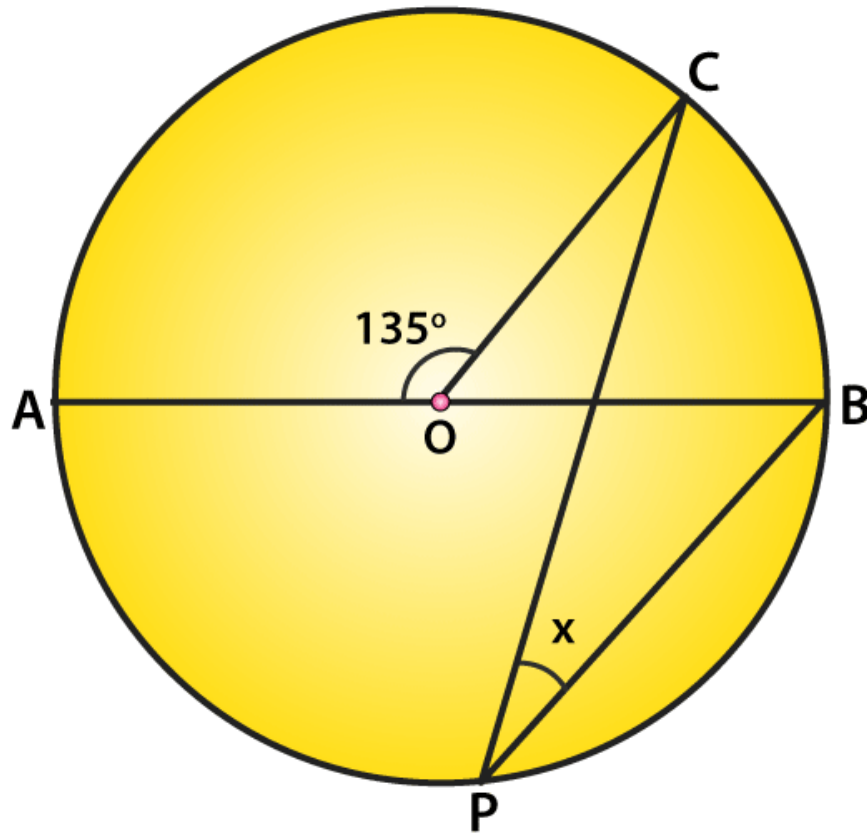
$$170^\circ = 2\angle BAC$$

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Or $\angle BAC = 170^\circ/2 = 85^\circ$

Question 4: If O is the centre of the circle, find the value of x in each of the following figures.

(i)



Solution:

$$\angle AOC = 135^\circ \text{ (Given)}$$

From figure, $\angle AOC + \angle BOC = 180^\circ$ [Linear pair of angles]

$$135^\circ + \angle BOC = 180^\circ$$

$$\text{or } \angle BOC = 180^\circ - 135^\circ$$

$$\text{or } \angle BOC = 45^\circ$$

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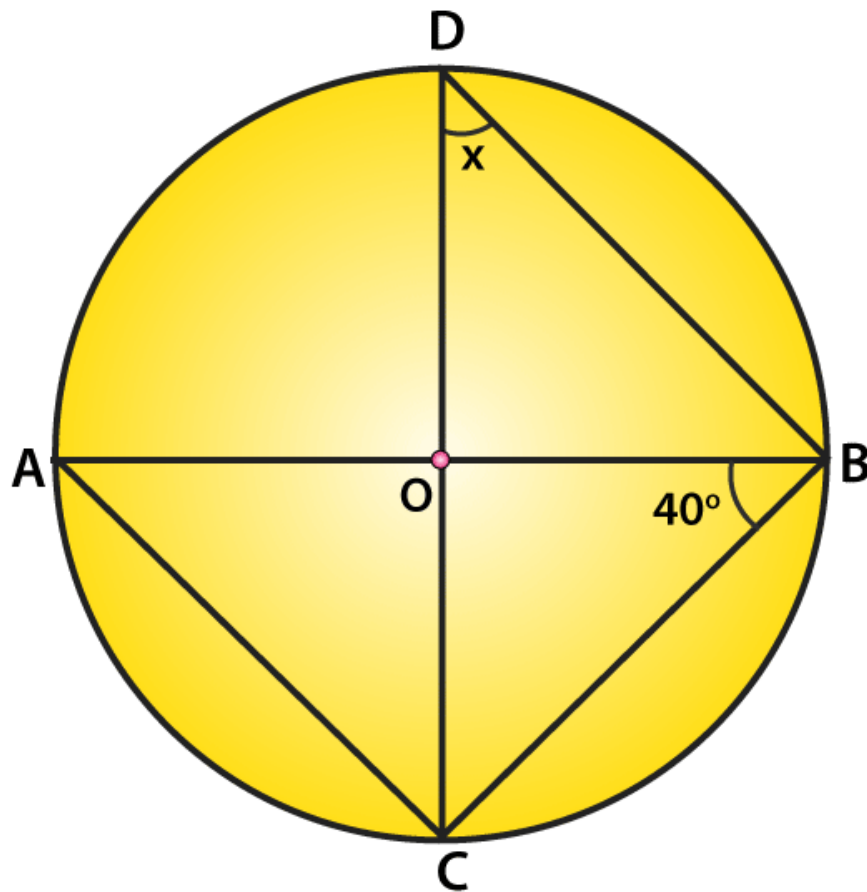
Again, by degree measure theorem

$$\angle BOC = 2\angle CPB$$

$$45^\circ = 2x$$

$$x = 45^\circ/2$$

(ii)



Solution:

$$\angle ABC = 40^\circ \text{ (given)}$$

$$\angle ACB = 90^\circ \text{ [Angle in semicircle]}$$

In $\triangle ABC$,

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$$\angle CAB + \angle ACB + \angle ABC = 180^\circ \text{ [angle sum property]}$$

$$\angle CAB + 90^\circ + 40^\circ = 180^\circ$$

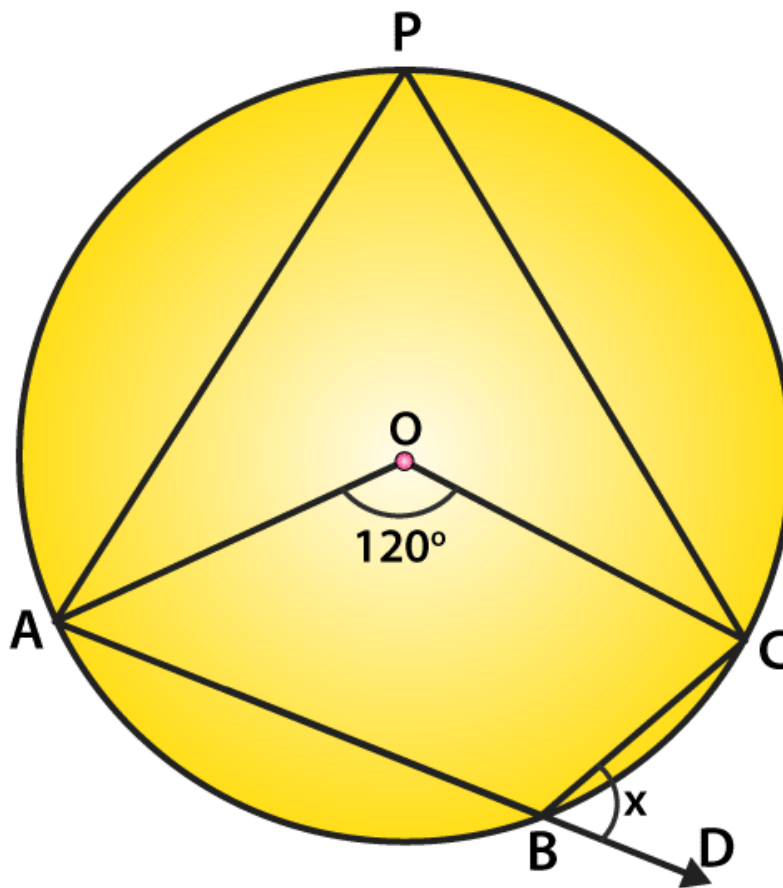
$$\angle CAB = 180^\circ - 90^\circ - 40^\circ$$

$$\angle CAB = 50^\circ$$

Now, $\angle CDB = \angle CAB$ [Angle is on same segment]

This implies, $x = 50^\circ$

(iii)



Solution:

$$\angle AOC = 120^\circ \text{ (given)}$$

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By degree measure theorem: $\angle AOC = 2\angle APC$

$$120^\circ = 2\angle APC$$

$$\angle APC = 120^\circ/2 = 60^\circ$$

Again, $\angle APC + \angle ABC = 180^\circ$ [Sum of opposite angles of cyclic quadrilaterals = 180°]

$$60^\circ + \angle ABC = 180^\circ$$

$$\angle ABC = 180^\circ - 60^\circ$$

$$\angle ABC = 120^\circ$$

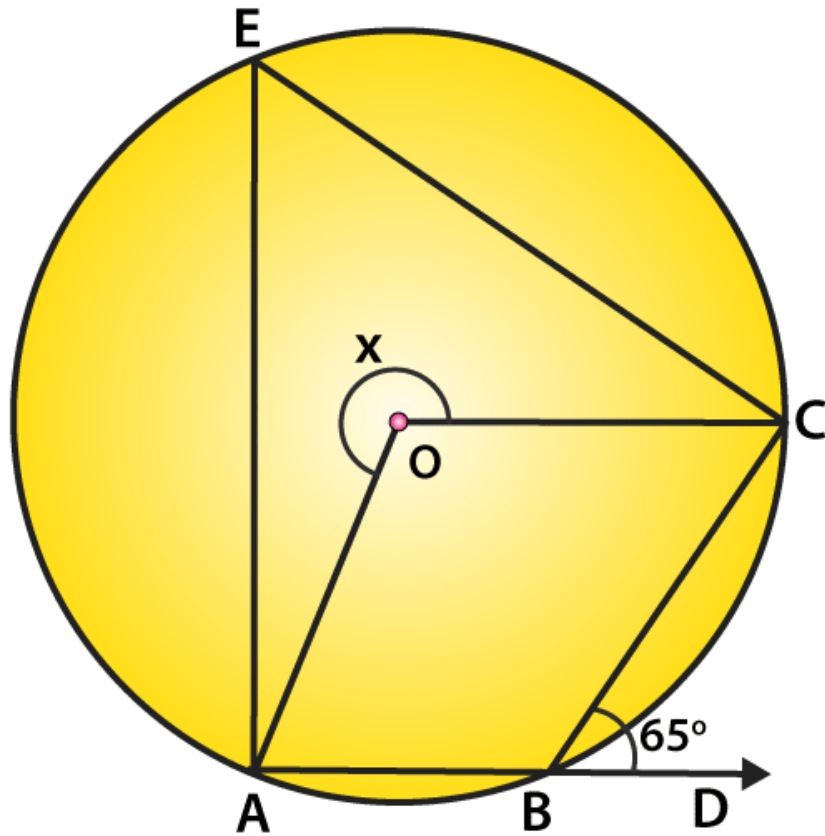
$\angle ABC + \angle DBC = 180^\circ$ [Linear pair of angles]

$$120^\circ + x = 180^\circ$$

$$x = 180^\circ - 120^\circ = 60^\circ$$

The value of x is 60°

(iv)



Solution:

$$\angle CBD = 65^\circ \text{ (given)}$$

From figure:

$$\angle ABC + \angle CBD = 180^\circ \text{ [Linear pair of angles]}$$

$$\angle ABC + 65^\circ = 180^\circ$$

$$\angle ABC = 180^\circ - 65^\circ = 115^\circ$$

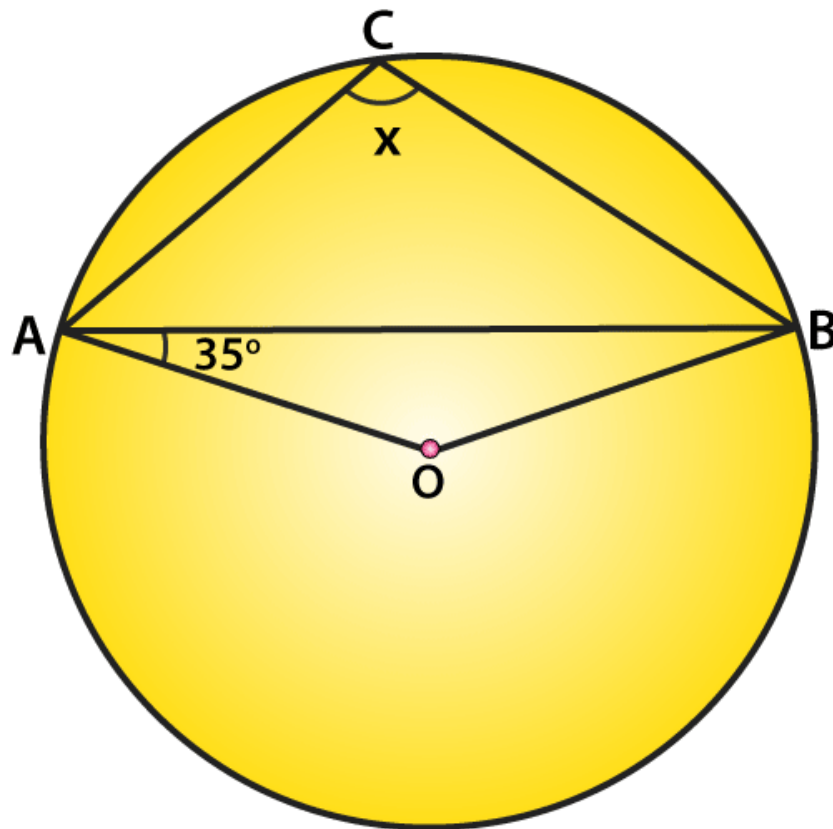
Again, reflex $\angle AOC = 2\angle ABC$ [Degree measure theorem]

$$x = 2(115^\circ) = 230^\circ$$

The value of x is 230°

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(v)



Solution:

$$\angle OAB = 35^\circ \text{ (Given)}$$

From figure:

$$\angle OBA = \angle OAB = 35^\circ \text{ [Angles opposite to equal radii]}$$

In $\triangle AOB$:

$$\angle AOB + \angle OAB + \angle OBA = 180^\circ \text{ [angle sum property]}$$

$$\angle AOB + 35^\circ + 35^\circ = 180^\circ$$

$$\angle AOB = 180^\circ - 35^\circ - 35^\circ = 110^\circ$$

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Now, $\angle AOB + \text{reflex} \angle AOB = 360^\circ$ [Complex angle]

$$110^\circ + \text{reflex} \angle AOB = 360^\circ$$

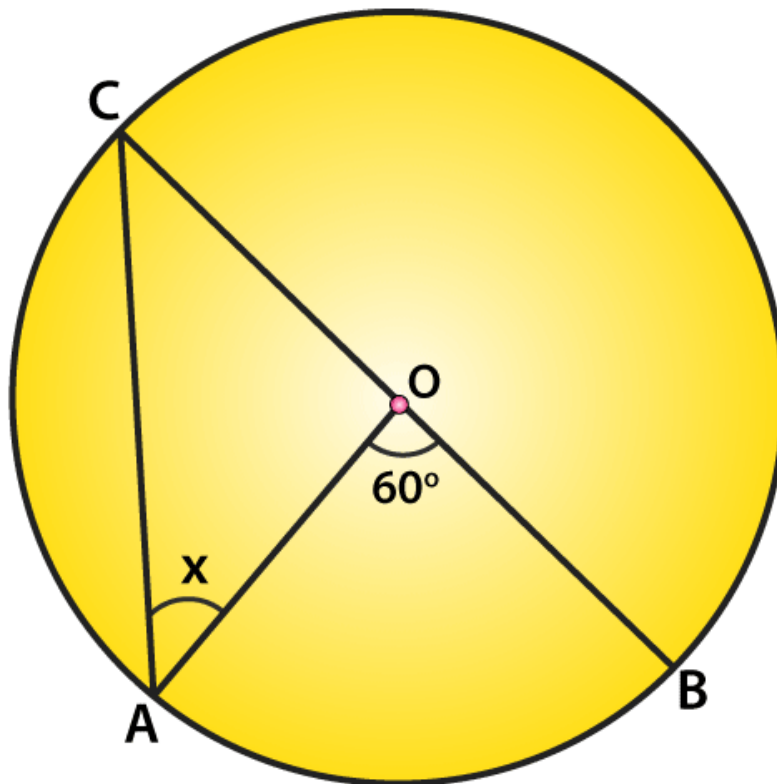
$$\text{reflex} \angle AOB = 360^\circ - 110^\circ = 250^\circ$$

By degree measure theorem: $\text{reflex} \angle AOB = 2 \angle ACB$

$$250^\circ = 2x$$

$$x = 250^\circ / 2 = 125^\circ$$

(vi)



Solution:

$$\angle AOB = 60^\circ \text{ (given)}$$

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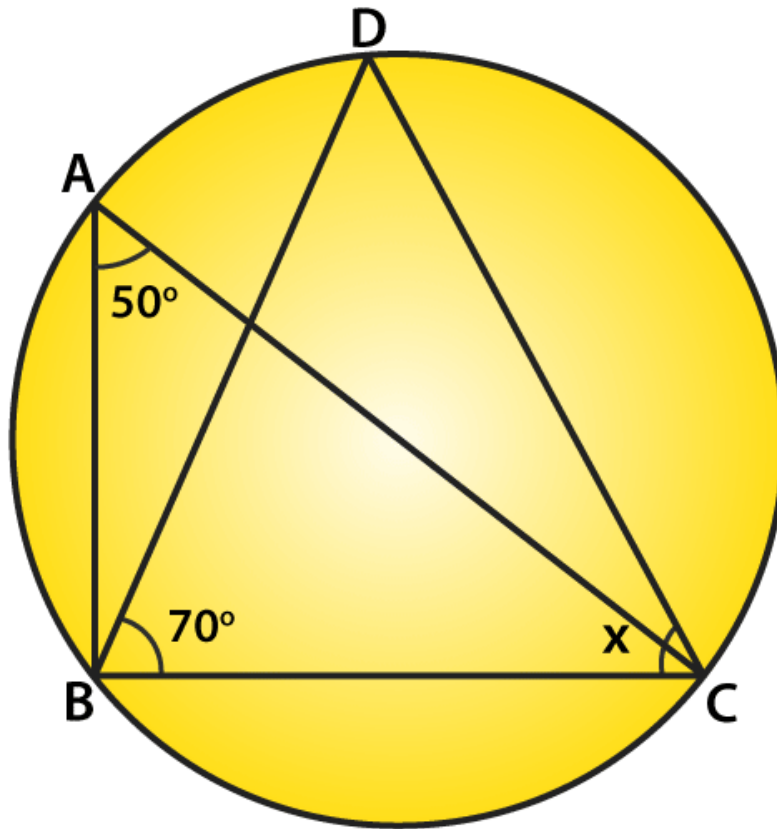
By degree measure theorem: reflex $\angle AOB = 2\angle OAC$

$$60^\circ = 2\angle OAC$$

$$\angle OAC = 60^\circ / 2 = 30^\circ \text{ [Angles opposite to equal radii]}$$

$$\text{Or } x = 30^\circ$$

(vii)



Solution:

$$\angle BAC = 50^\circ \text{ and } \angle DBC = 70^\circ \text{ (given)}$$

From figure:

$$\angle BDC = \angle BAC = 50^\circ \text{ [Angle on same segment]}$$

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Now,

In $\triangle BDC$:

Using angle sum property, we have

$$\angle BDC + \angle BCD + \angle DBC = 180^\circ$$

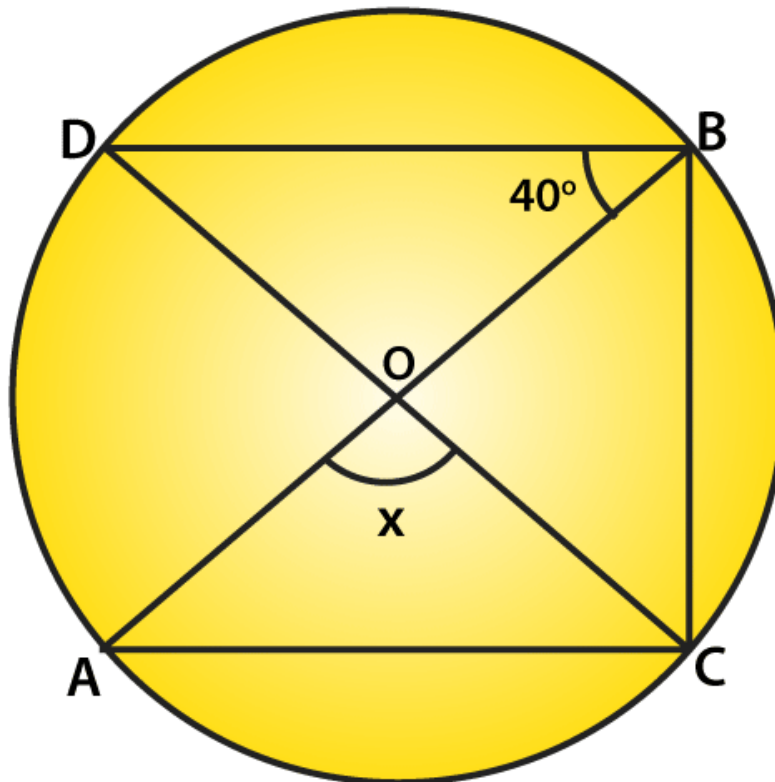
Substituting given values, we get

$$50^\circ + x^\circ + 70^\circ = 180^\circ$$

$$x^\circ = 180^\circ - 50^\circ - 70^\circ = 60^\circ$$

or $x = 60^\circ$

(viii)



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Solution:

$$\angle DBO = 40^\circ \text{ (Given)}$$

From figure:

$$\angle DBC = 90^\circ \text{ [Angle in a semicircle]}$$

$$\angle DBO + \angle OBC = 90^\circ$$

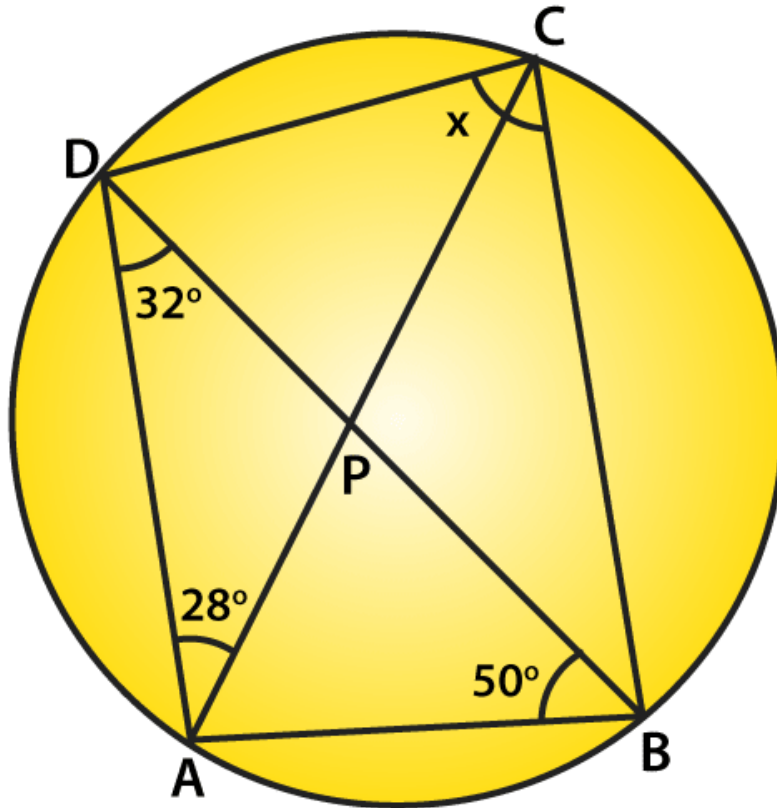
$$40^\circ + \angle OBC = 90^\circ$$

$$\text{or } \angle OBC = 90^\circ - 40^\circ = 50^\circ$$

Again, By degree measure theorem: $\angle AOC = 2\angle OBC$

$$\text{or } x = 2 \times 50^\circ = 100^\circ$$

(ix)



Solution:

$\angle CAD = 28$, $\angle ADB = 32$ and $\angle ABC = 50$ (Given)

From figure:

In $\triangle DAB$:

Angle sum property: $\angle ADB + \angle DAB + \angle ABD = 180^\circ$

By substituting the given values, we get

$$32^\circ + \angle DAB + 50^\circ = 180^\circ$$

$$\angle DAB = 180^\circ - 32^\circ - 50^\circ$$

$$\angle DAB = 98^\circ$$

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Now,

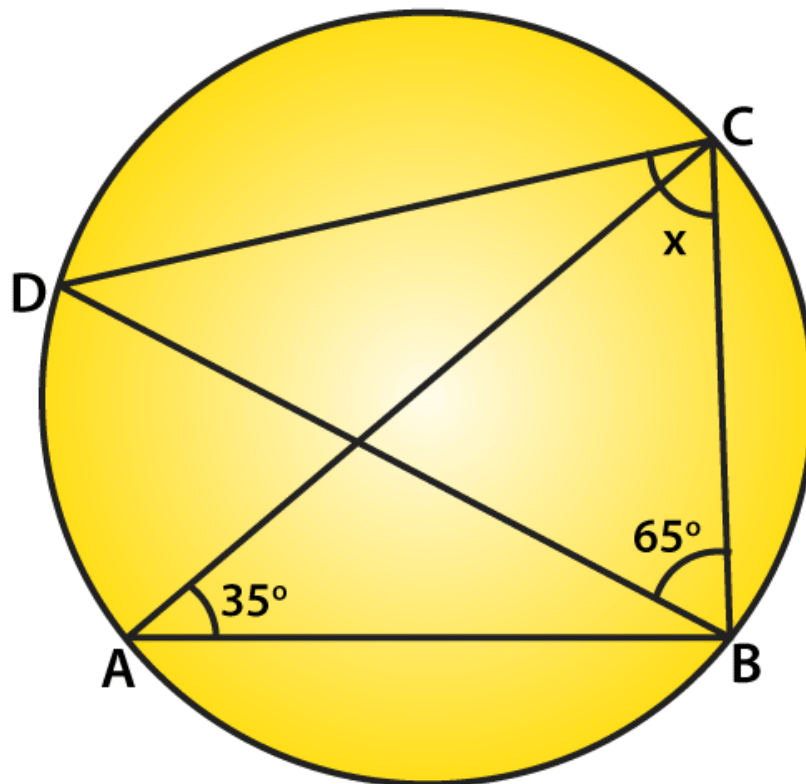
$\angle DAB + \angle DCB = 180^\circ$ [Opposite angles of cyclic quadrilateral, their sum = 180 degrees]

$$98^\circ + x = 180^\circ$$

$$\text{or } x = 180^\circ - 98^\circ = 82^\circ$$

The value of x is 82 degrees.

(x)



Solution:

$$\angle BAC = 35^\circ \text{ and } \angle DBC = 65^\circ$$

From figure:

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$\angle BDC = \angle BAC = 35^\circ$ [Angle in same segment]

In $\triangle BCD$:

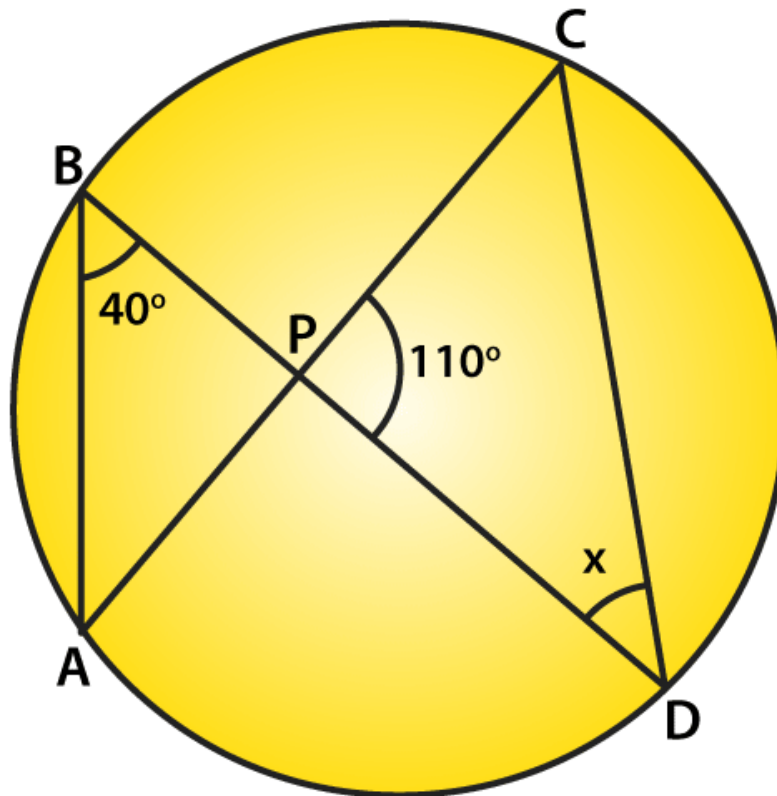
Angle sum property, we have

$$\angle BDC + \angle BCD + \angle DBC = 180^\circ$$

$$35^\circ + x + 65^\circ = 180^\circ$$

$$\text{or } x = 180^\circ - 35^\circ - 65^\circ = 80^\circ$$

(xi)



Solution:

$\angle ABD = 40^\circ$, $\angle CPD = 110^\circ$ (Given)

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From figure:

$$\angle ACD = \angle ABD = 40^\circ \text{ [Angle in same segment]}$$

In $\triangle PCD$,

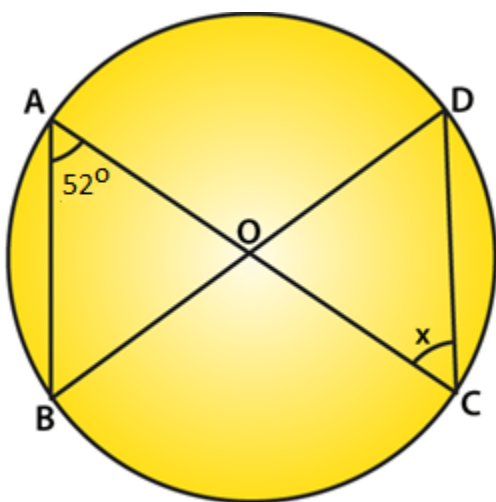
$$\text{Angle sum property: } \angle PCD + \angle CPO + \angle PDC = 180^\circ$$

$$400 + 110^\circ + x = 180^\circ$$

$$x = 180^\circ - 150^\circ = 30^\circ$$

The value of x is 30 degrees.

(xii)



Solution:

$$\angle BAC = 52^\circ \text{ (Given)}$$

From figure:

$$\angle BDC = \angle BAC = 52^\circ \text{ [Angle in same segment]}$$

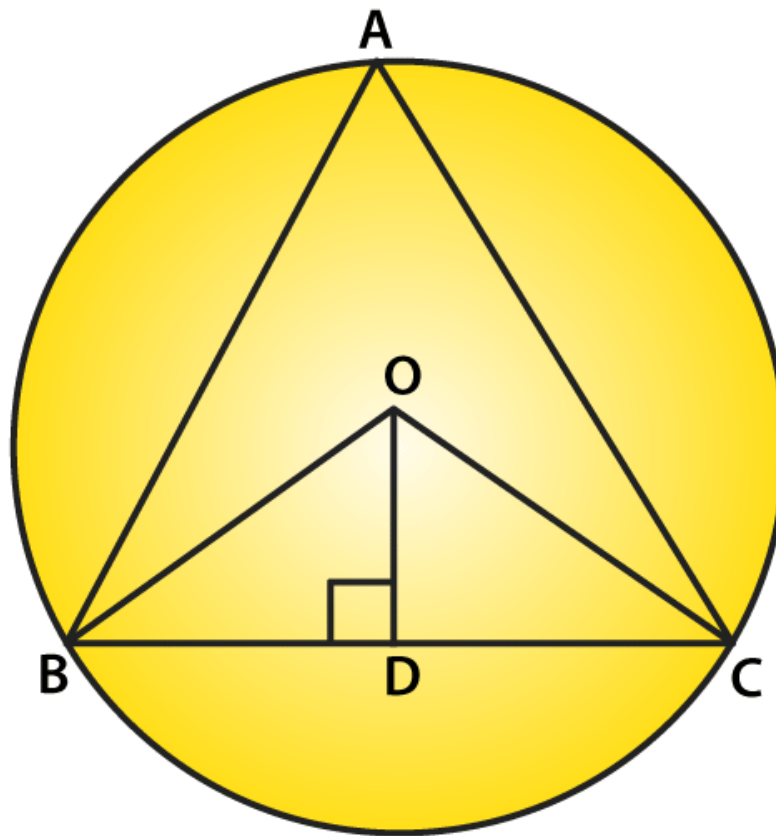
Since $OD = OC$ (radii), then $\angle ODC = \angle OCD$ [Opposite angle to equal radii]

$$\text{So, } x = 52^\circ$$

Question 5: O is the circumcentre of the triangle ABC and OD is perpendicular on BC. Prove that $\angle BOD = \angle A$.

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Solution:



In $\triangle OBD$ and $\triangle OCD$:

$OB = OC$ [Radius]

$\angle ODB = \angle ODC$ [Each 90°]

$OD = OD$ [Common]

Therefore, By RHS Condition

$\triangle OBD \cong \triangle OCD$

So, $\angle BOD = \angle COD$(i)[By CPCT]

Again,

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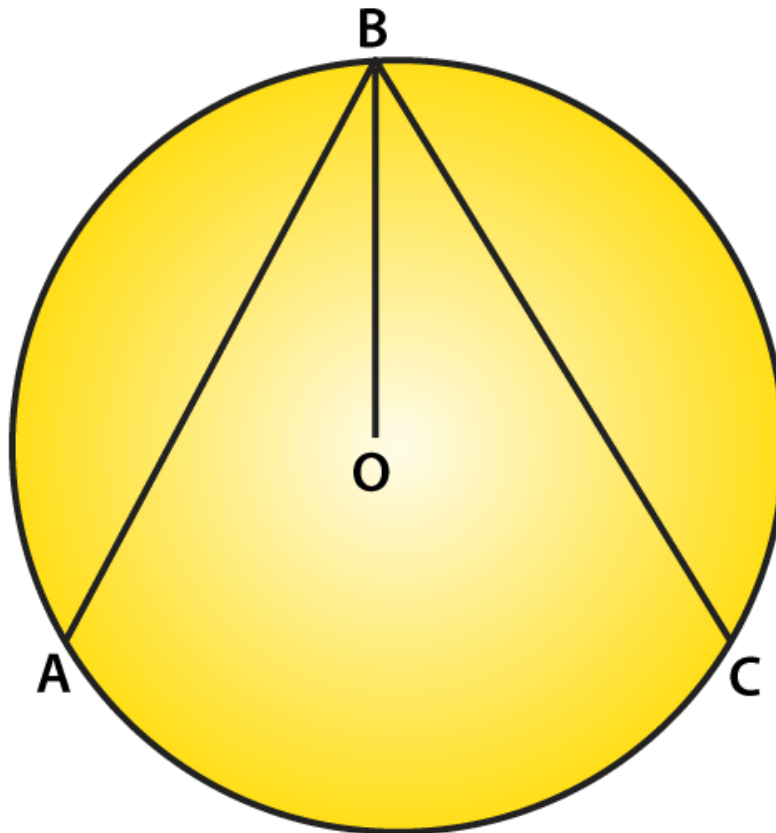
By degree measure theorem: $\angle BOC = 2\angle BAC$

$2\angle BOD = 2\angle BAC$ [Using(i)]

$\angle BOD = \angle BAC$

Hence proved.

Question 6: In figure, O is the centre of the circle, BO is the bisector of $\angle ABC$. Show that $AB = AC$.



Solution:

Since, BO is the bisector of $\angle ABC$, then,

$\angle ABO = \angle CBO$ (i)

From figure:

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Radius of circle = $OA = OB = OC$

$\angle OAB = \angle OCB$ (ii) [opposite angles to equal sides]

$\angle ABO = \angle DAB$ (iii) [opposite angles to equal sides]

From equations (i), (ii) and (iii), we get

$\angle OAB = \angle OCB$ (iv)

In $\triangle OAB$ and $\triangle OCB$:

$\angle OAB = \angle OCB$ [From (iv)]

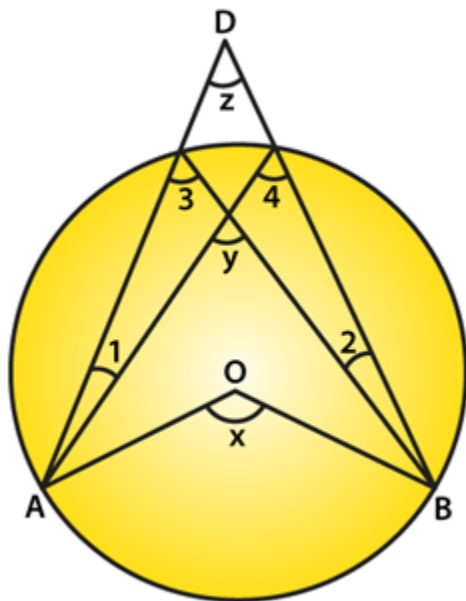
$OB = OB$ [Common]

$\angle OBA = \angle OBC$ [Given]

Then, By AAS condition : $\triangle OAB \cong \triangle OCB$

So, $AB = BC$ [By CPCT]

Question 7: In figure, O is the centre of the circle, then prove that $\angle x = \angle y + \angle z$.



Solution:

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From the figure:

$$\angle 3 = \angle 4 \dots(i) \text{ [Angles in same segment]}$$

$$\angle x = 2\angle 3 \text{ [By degree measure theorem]}$$

$$\angle x = \angle 3 + \angle 3$$

$$\angle x = \angle 3 + \angle 4 \text{ (Using (i)) } \dots(ii)$$

Again, $\angle y = \angle 3 + \angle 1$ [By exterior angle property]

$$\text{or } \angle 3 = \angle y - \angle 1 \dots(iii)$$

$$\angle 4 = \angle z + \angle 1 \dots (iv) \text{ [By exterior angle property]}$$

Now, from equations (ii) , (iii) and (iv), we get

$$\angle x = \angle y - \angle 1 + \angle z + \angle 1$$

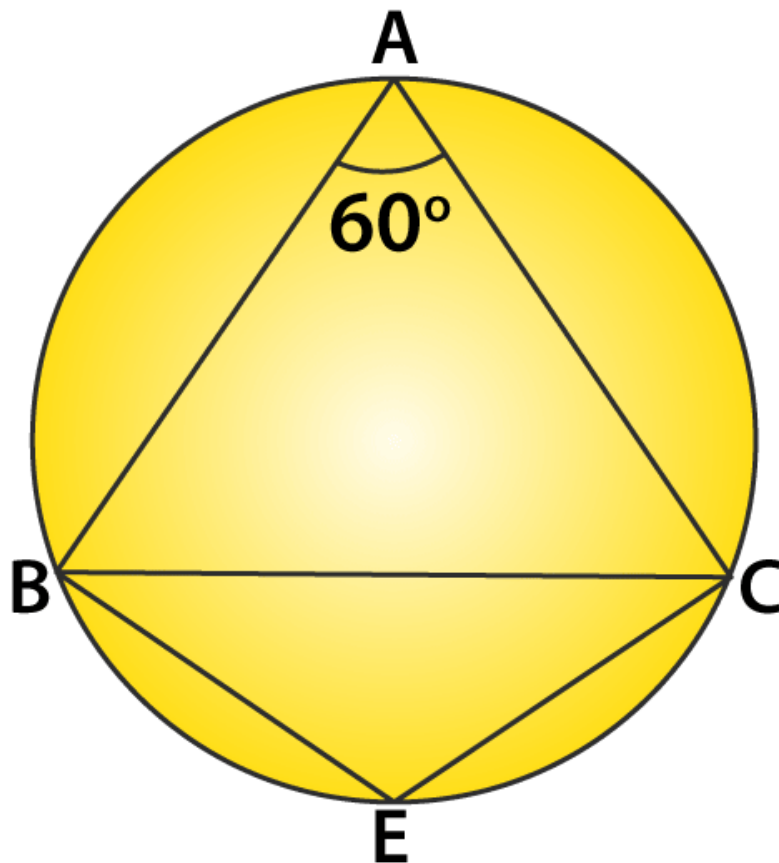
$$\text{or } \angle x = \angle y + \angle z + \angle 1 - \angle 1$$

$$\text{or } x = \angle y + \angle z$$

Hence proved.

Exercise 16.5 Page No: 16.83

Question 1: In figure, $\triangle ABC$ is an equilateral triangle. Find $m\angle BEC$.



Solution:

ΔABC is an equilateral triangle. (Given)

Each angle of an equilateral triangle is 60 degrees.

In quadrilateral ABEC:

$$\angle BAC + \angle BEC = 180^\circ \text{ (Opposite angles of quadrilateral)}$$

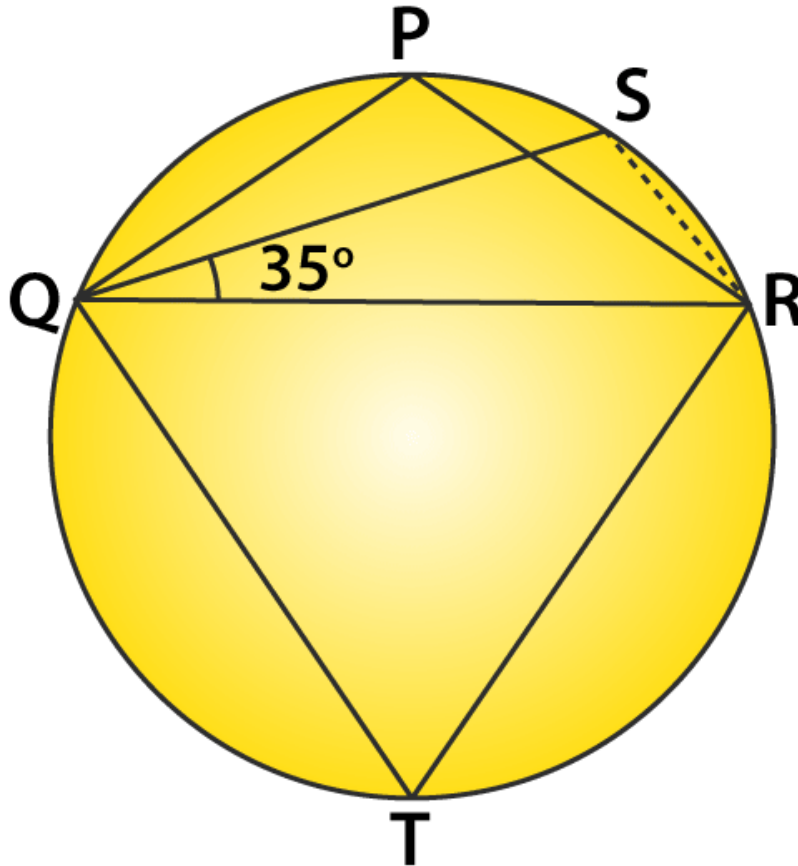
$$60^\circ + \angle BEC = 180^\circ$$

$$\angle BEC = 180^\circ - 60^\circ$$

$$\angle BEC = 120^\circ$$

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Question 2: In figure, ΔPQR is an isosceles triangle with $PQ = PR$ and $m\angle PQR = 35^\circ$. Find $m\angle QSR$ and $m\angle QTR$.



Solution:

Given: ΔPQR is an isosceles triangle with $PQ = PR$ and $m\angle PQR = 35^\circ$

In ΔPQR :

$$\angle PQR = \angle PRQ = 35^\circ \text{ (Angle opposite to equal sides)}$$

Again, by angle sum property

$$\angle P + \angle Q + \angle R = 180^\circ$$

$$\angle P + 35^\circ + 35^\circ = 180^\circ$$

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$$\angle P + 70^\circ = 180^\circ$$

$$\angle P = 180^\circ - 70^\circ$$

$$\angle P = 110^\circ$$

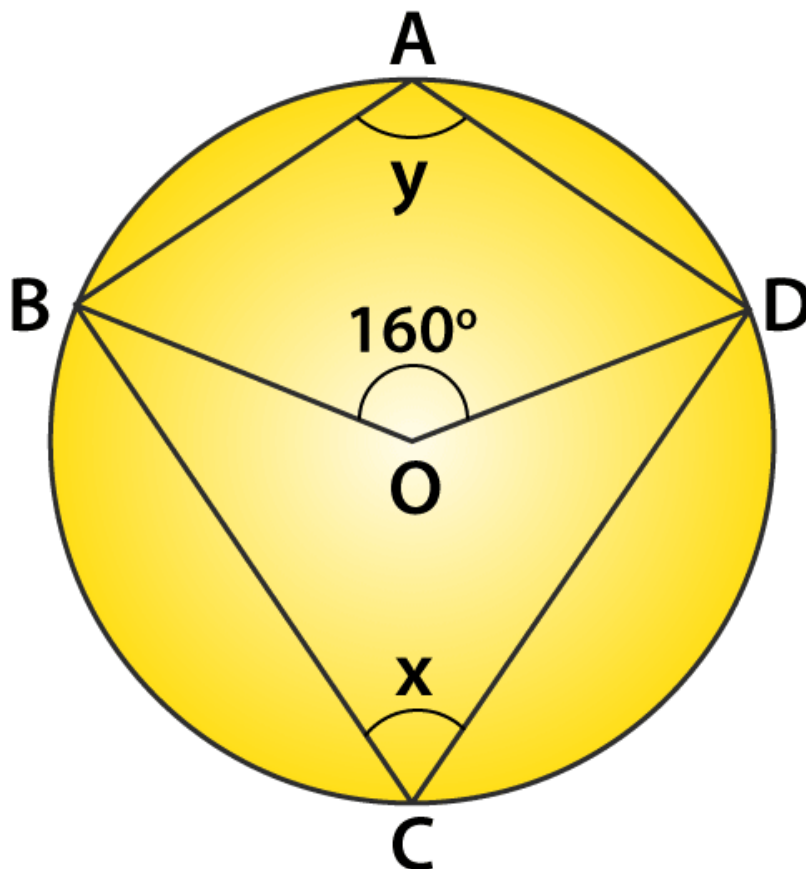
Now, in quadrilateral SQTR,

$$\angle QSR + \angle QTR = 180^\circ \text{ (Opposite angles of quadrilateral)}$$

$$110^\circ + \angle QTR = 180^\circ$$

$$\angle QTR = 70^\circ$$

Question 3: In figure, O is the centre of the circle. If $\angle BOD = 160^\circ$, find the values of x and y.



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Solution:

From figure: $\angle BOD = 160^\circ$

By degree measure theorem: $\angle BOD = 2 \angle BCD$

$$160^\circ = 2x$$

$$\text{or } x = 80^\circ$$

Now, in quadrilateral ABCD,

$\angle BAD + \angle BCD = 180^\circ$ (Opposite angles of Cyclic quadrilateral)

$$y + x = 180^\circ$$

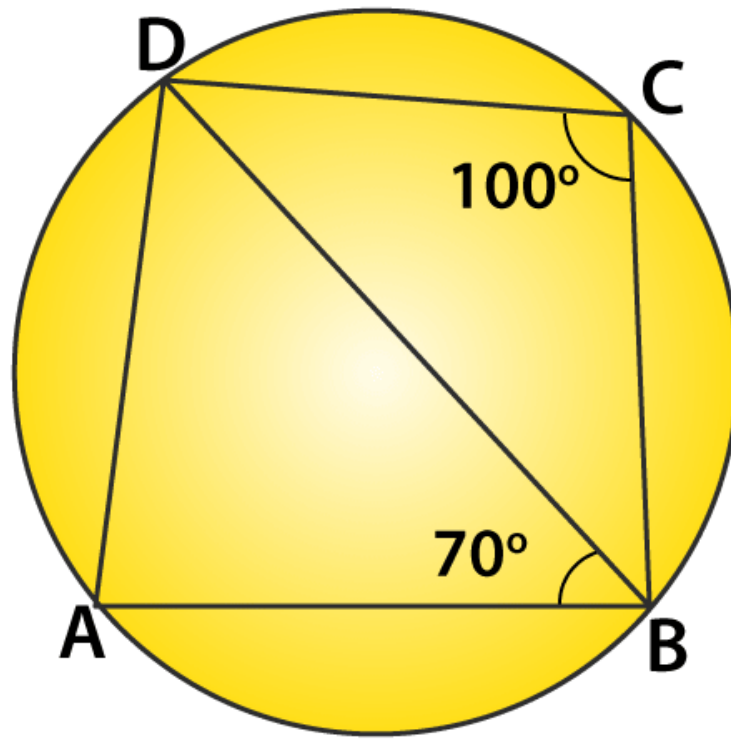
Putting value of x,

$$y + 80^\circ = 180^\circ$$

$$y = 100^\circ$$

Answer: $x = 80^\circ$ and $y = 100^\circ$.

Question 4: In figure, ABCD is a cyclic quadrilateral. If $\angle BCD = 100^\circ$ and $\angle ABD = 70^\circ$, find $\angle ADB$.



Solution:

From figure:

In quadrilateral ABCD,

$\angle DCB + \angle BAD = 180^\circ$ (Opposite angles of Cyclic quadrilateral)

$$100^\circ + \angle BAD = 180^\circ$$

$$\angle BAD = 80^\circ$$

In $\triangle BAD$:

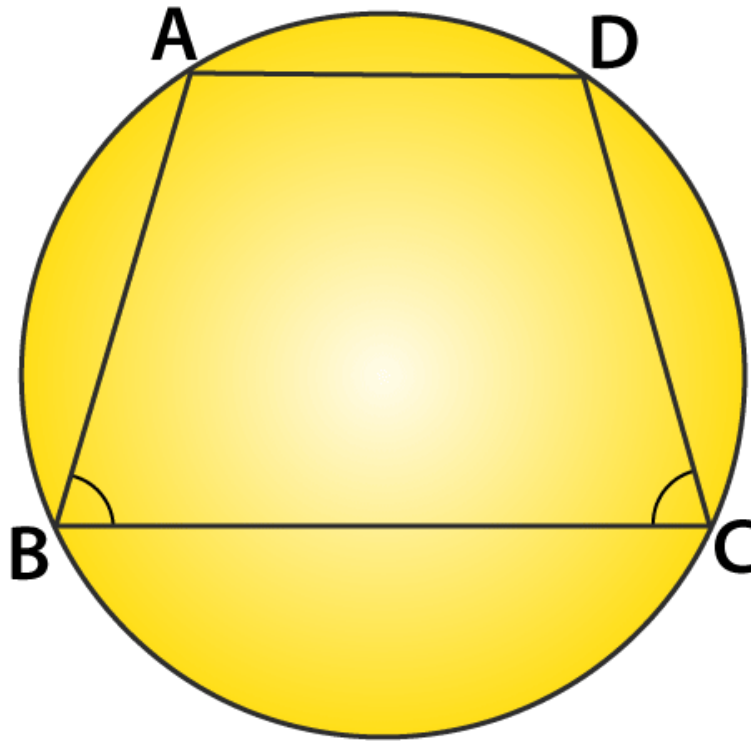
By angle sum property: $\angle ADB + \angle DAB + \angle ABD = 180^\circ$

$$\angle ADB + 80^\circ + 70^\circ = 180^\circ$$

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$$\angle ADB = 30^\circ$$

Question 5: If ABCD is a cyclic quadrilateral in which $AD \parallel BC$ (figure). Prove that $\angle B = \angle C$.



Solution:

Given: ABCD is a cyclic quadrilateral with $AD \parallel BC$

$$\Rightarrow \angle A + \angle C = 180^\circ \dots\dots\dots(1)[\text{Opposite angles of cyclic quadrilateral}]$$

$$\text{and } \angle A + \angle B = 180^\circ \dots\dots\dots(2)[\text{Co-interior angles}]$$

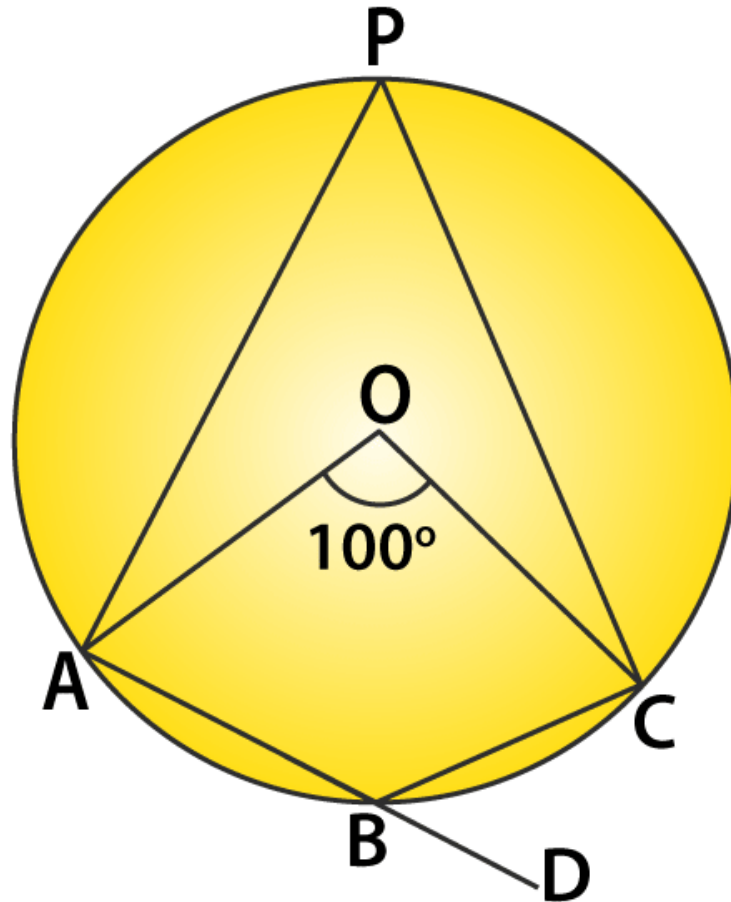
From (1) and (2), we have

$$\angle B = \angle C$$

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Hence proved.

Question 6: In figure, O is the centre of the circle. Find $\angle CBD$.



Solution:

Given: $\angle BOC = 100^\circ$

By degree measure theorem: $\angle AOC = 2 \angle APC$

$$100^\circ = 2 \angle APC$$

$$\text{or } \angle APC = 50^\circ$$

Again,

$$\angle APC + \angle ABC = 180^\circ \text{ (Opposite angles of a cyclic quadrilateral)}$$

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$$50^\circ + \angle ABC = 180^\circ$$

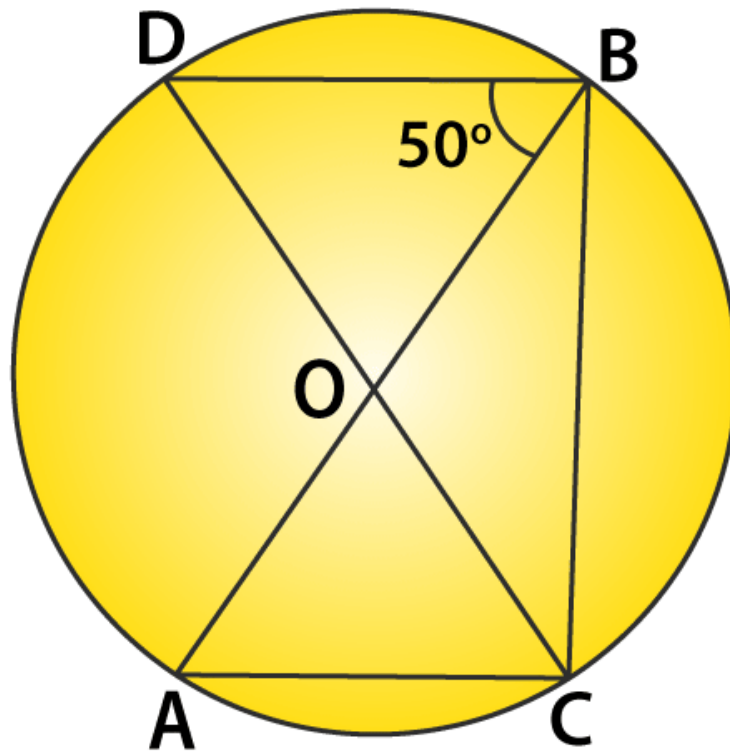
$$\text{or } \angle ABC = 130^\circ$$

Now, $\angle ABC + \angle CBD = 180^\circ$ (Linear pair)

$$130^\circ + \angle CBD = 180^\circ$$

$$\text{or } \angle CBD = 50^\circ$$

Question 7: In figure, AB and CD are diameters of a circle with centre O. If $\angle OBD = 50^\circ$, find $\angle AOC$.



Solution:

Given: $\angle OBD = 50^\circ$

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Here, AB and CD are the diameters of the circles with centre O.

$$\angle DBC = 90^\circ \dots(i)[\text{Angle in the semi-circle}]$$

$$\text{Also, } \angle DBC = 50^\circ + \angle OBC$$

$$90^\circ = 50^\circ + \angle OBC$$

$$\text{or } \angle OBC = 40^\circ$$

Again, By degree measure theorem: $\angle AOC = 2 \angle ABC$

$$\angle AOC = 2 \angle OBC = 2 \times 40^\circ = 80^\circ$$

Question 8: On a semi-circle with AB as diameter, a point C is taken, so that $m(\angle CAB) = 30^\circ$. Find $m(\angle ACB)$ and $m(\angle ABC)$.

Solution:

$$\text{Given: } m(\angle CAB) = 30^\circ$$

To Find: $m(\angle ACB)$ and $m(\angle ABC)$.

Now,

$$\angle ACB = 90^\circ \text{ (Angle in semi-circle)}$$

Now,

In $\triangle ABC$, by angle sum property: $\angle CAB + \angle ACB + \angle ABC = 180^\circ$

$$30^\circ + 90^\circ + \angle ABC = 180^\circ$$

$$\angle ABC = 60^\circ$$

Answer: $\angle ACB = 90^\circ$ and $\angle ABC = 60^\circ$

Question 9: In a cyclic quadrilateral ABCD if $AB \parallel CD$ and $\angle B = 70^\circ$, find the remaining angles.

Solution:

A cyclic quadrilateral ABCD with $AB \parallel CD$ and $\angle B = 70^\circ$.

$$\angle B + \angle C = 180^\circ \text{ (Co-interior angle)}$$

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$$70^\circ + \angle C = 180^\circ$$

$$\angle C = 110^\circ$$

And,

$$\Rightarrow \angle B + \angle D = 180^\circ \text{ (Opposite angles of Cyclic quadrilateral)}$$

$$70^\circ + \angle D = 180^\circ$$

$$\angle D = 110^\circ$$

Again, $\angle A + \angle C = 180^\circ$ (Opposite angles of cyclic quadrilateral)

$$\angle A + 110^\circ = 180^\circ$$

$$\angle A = 70^\circ$$

Answer: $\angle A = 70^\circ$, $\angle C = 110^\circ$ and $\angle D = 110^\circ$

Question 10: In a cyclic quadrilateral ABCD, if $m \angle A = 3(m \angle C)$. Find $m \angle A$.

Solution:

$$\angle A + \angle C = 180^\circ \dots(1) \text{ [Opposite angles of cyclic quadrilateral]}$$

Since $m \angle A = 3(m \angle C)$ (given)

$$\Rightarrow \angle A = 3 \angle C \dots(2)$$

$$\text{Equation (1)} \Rightarrow 3 \angle C + \angle C = 180^\circ$$

$$\text{or } 4 \angle C = 180^\circ$$

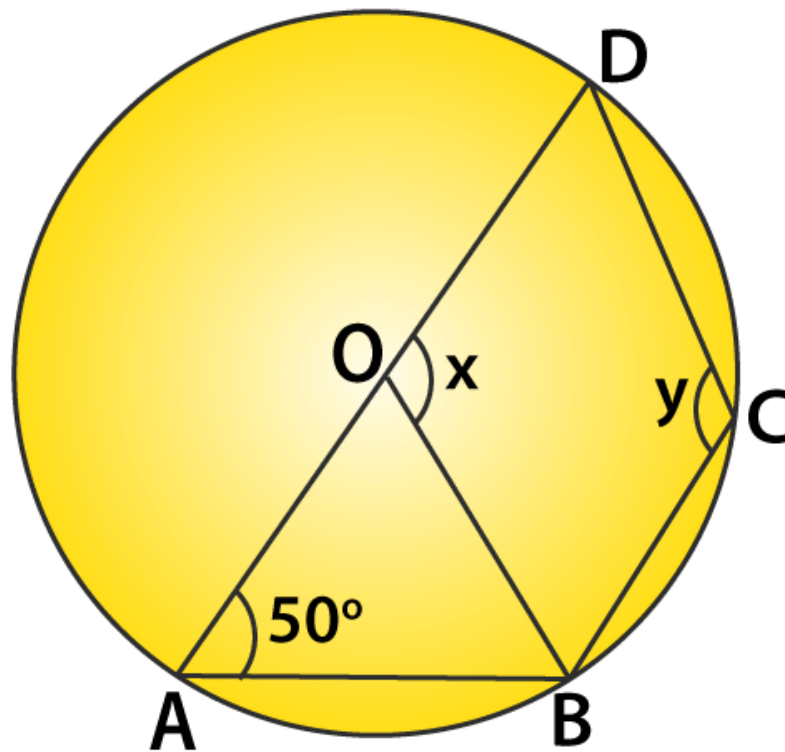
$$\text{or } \angle C = 45^\circ$$

From equation (2)

$$\angle A = 3 \times 45^\circ = 135^\circ$$

Question 11: In figure, O is the centre of the circle $\angle DAB = 50^\circ$. Calculate the values of x and y.

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Solution:

Given : $\angle DAB = 50^\circ$

By degree measure theorem: $\angle BOD = 2 \angle BAD$

so, $x = 2(50^\circ) = 100^\circ$

Since, ABCD is a cyclic quadrilateral, we have

$$\angle A + \angle C = 180^\circ$$

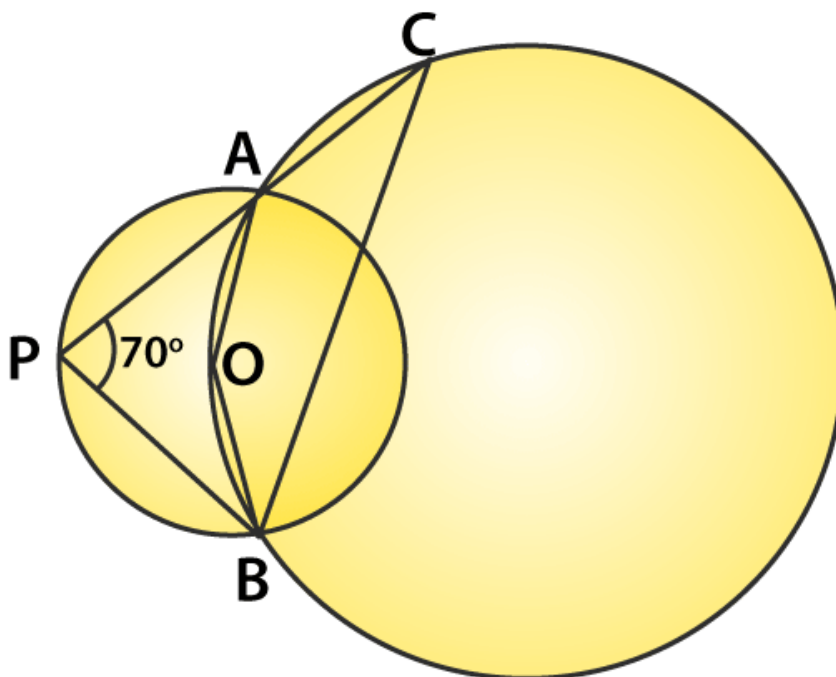
$$50^\circ + y = 180^\circ$$

$$y = 130^\circ$$

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Exercise VSAQs Page No: 16.89

Question 1: In figure, two circles intersect at A and B. The centre of the smaller circle is O and it lies on the circumference of the larger circle. If $\angle APB = 70^\circ$, find $\angle ACB$.



Solution:

By degree measure theorem: $\angle AOB = 2 \angle APB$

so, $\angle AOB = 2 \times 70^\circ = 140^\circ$

Since AOBC is a cyclic quadrilateral, we have

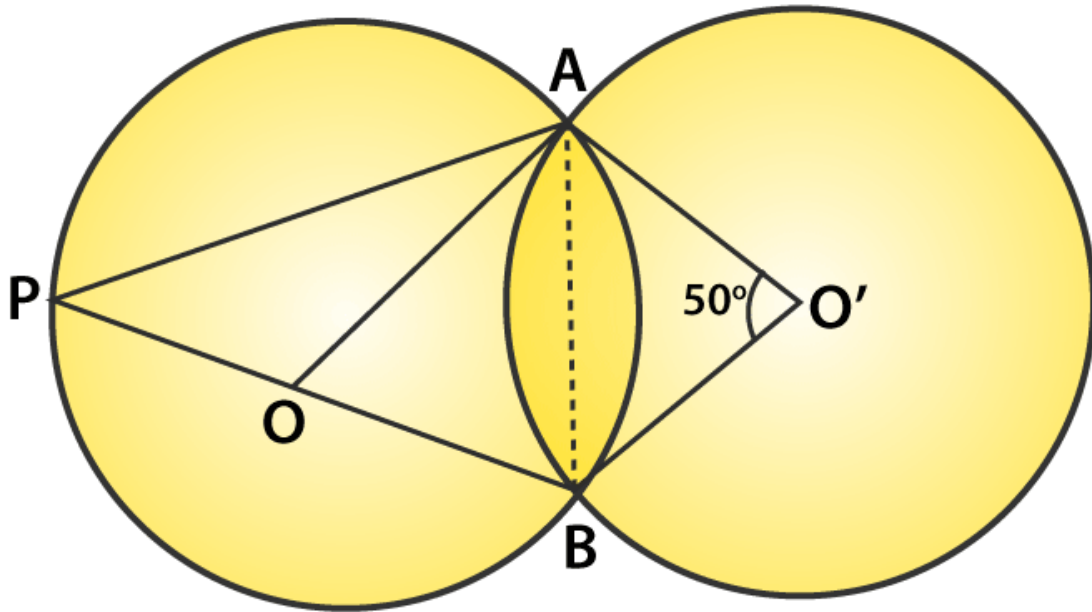
$$\angle ACB + \angle AOB = 180^\circ$$

$$\angle ACB + 140^\circ = 180^\circ$$

$$\angle ACB = 40^\circ$$

Question 2: In figure, two congruent circles with centres O and O' intersect at A and B. If $\angle AO'B = 50^\circ$, then find $\angle APB$.

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Solution:

As we are given that, both the triangles are congruent which means their corresponding angles are equal.

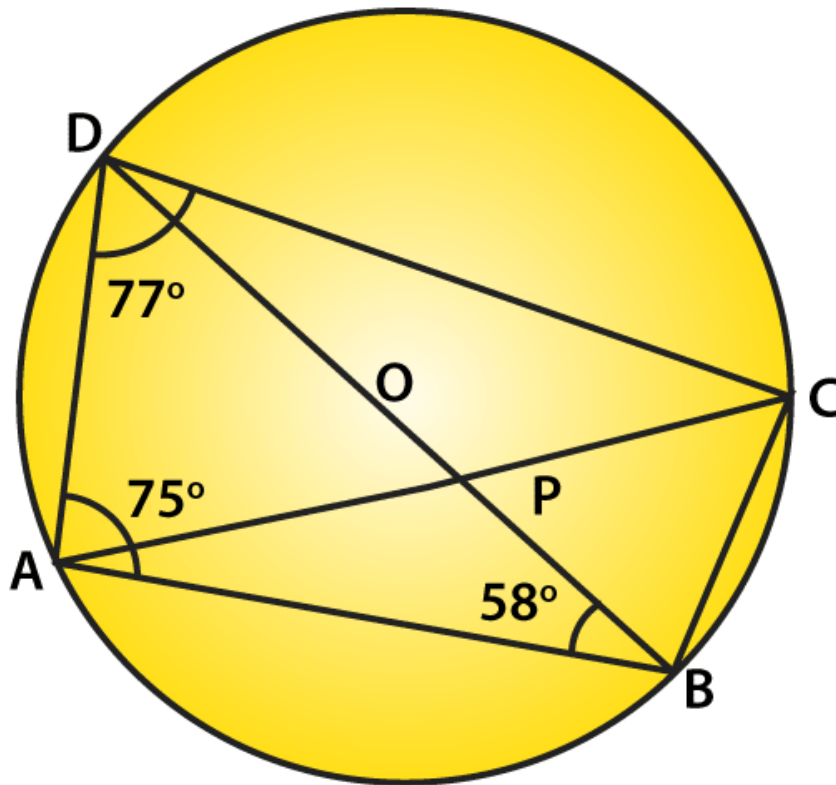
Therefore, $\angle AOB = \angle AO'B = 50^\circ$

Now, by degree measure theorem, we have

$$\angle APB = \frac{\angle AOB}{2} = 25^\circ$$

Question 3: In figure, ABCD is a cyclic quadrilateral in which $\angle BAD=75^\circ$, $\angle ABD=58^\circ$ and $\angle ADC=77^\circ$, AC and BD intersect at P. Then, find $\angle DPC$.

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Solution:

$$\angle DBA = \angle DCA = 58^\circ \dots(1)[\text{Angles in same segment}]$$

ABCD is a cyclic quadrilateral :

Sum of opposite angles = 180 degrees

$$\angle A + \angle C = 180^\circ$$

$$75^\circ + \angle C = 180^\circ$$

$$\angle C = 105^\circ$$

Again, $\angle ACB + \angle ACD = 105^\circ$

$$\angle ACB + 58^\circ = 105^\circ$$

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or $\angle ACB = 47^\circ \dots(2)$

Now, $\angle ACB = \angle ADB = 47^\circ$ [Angles in same segment]

Also, $\angle D = 77^\circ$ (Given)

Again From figure, $\angle BDC + \angle ADB = 77^\circ$

$$\angle BDC + 47^\circ = 77^\circ$$

$$\angle BDC = 30^\circ$$

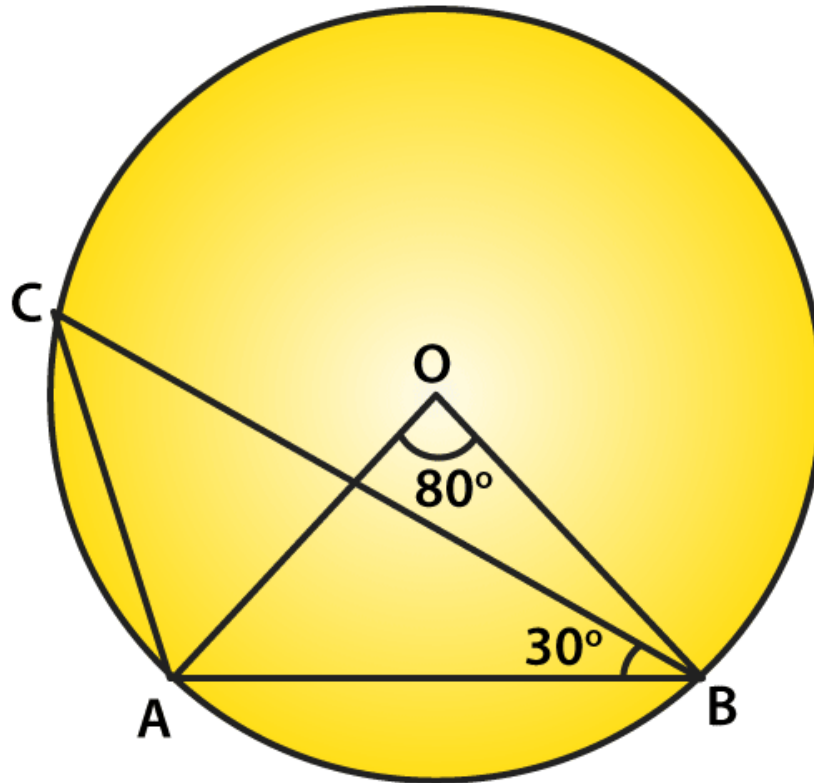
In triangle DPC

$$\angle PDC + \angle DCP + \angle DPC = 180^\circ$$

$$30^\circ + 58^\circ + \angle DPC = 180^\circ$$

$$\text{or } \angle DPC = 92^\circ$$

Question 4: In figure, if $\angle AOB = 80^\circ$ and $\angle ABC = 30^\circ$, then find $\angle CAO$.

**Solution:**

Given: $\angle AOB = 80^\circ$ and $\angle ABC = 30^\circ$

To find: $\angle CAO$

Join OC.

Central angle subtended by arc AC = $\angle COA$

then $\angle COA = 2 \times \angle ABC = 2 \times 30^\circ = 60^\circ \dots(1)$

In triangle OCA,

$OC = OA$ [same radii]

$\angle OCA = \angle CAO \dots(2)$ [Angle opposite to equal sides]

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In triangle COA,

$$\angle OCA + \angle CAO + \angle COA = 180^\circ$$

From (1) and (2), we get

$$2\angle CAO + 60^\circ = 180^\circ$$

$$\angle CAO = 60^\circ$$



Chapterwise RD Sharma Solutions for Class 9 Maths :

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- Chapter 2–Exponents of Real Numbers
- Chapter 3–Rationalisation
- Chapter 4–Algebraic Identities
- Chapter 5–Factorization of Algebraic Expressions
- Chapter 6–Factorization Of Polynomials
- Chapter 7–Introduction to Euclid’s Geometry
- Chapter 8–Lines and Angles
- Chapter 9–Triangle and its Angles
- Chapter 10–Congruent Triangles
- Chapter 11–Coordinate Geometry
- Chapter 12–Heron’s Formula
- Chapter 13–Linear Equations in Two Variables
- Chapter 14–Quadrilaterals
- Chapter 15–Area of Parallelograms and Triangles
- Chapter 16–Circles
- Chapter 17–Construction
- Chapter 18–Surface Area and Volume of Cuboid and Cube
- Chapter 19–Surface Area and Volume of A Right Circular Cylinder
- Chapter 20–Surface Area and Volume of A Right Circular Cone
- Chapter 21–Surface Area And Volume Of Sphere
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- Chapter 23–Graphical Representation of Statistical Data
- Chapter 24–Measure of Central Tendency
- Chapter 25–Probability

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About RD Sharma

RD Sharma isn't the kind of author you'd bump into at lit fests. But his bestselling books have helped many CBSE students lose their dread of maths. Sunday Times profiles the tutor turned internet star

He dreams of algorithms that would give most people nightmares. And, spends every waking hour thinking of ways to explain concepts like 'series solution of linear differential equations'. Meet Dr Ravi Dutt Sharma — mathematics teacher and author of 25 reference books — whose name evokes as much awe as the subject he teaches. And though students have used his thick tomes for the last 31 years to ace the dreaded maths exam, it's only recently that a spoof video turned the tutor into a YouTube star.

R D Sharma had a good laugh but said he shared little with his on-screen persona except for the love for maths. "I like to spend all my time thinking and writing about maths problems. I find it relaxing," he says. When he is not writing books explaining mathematical concepts for classes 6 to 12 and engineering students, Sharma is busy dispensing his duty as vice-principal and head of department of science and humanities at Delhi government's Guru Nanak Dev Institute of Technology.

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