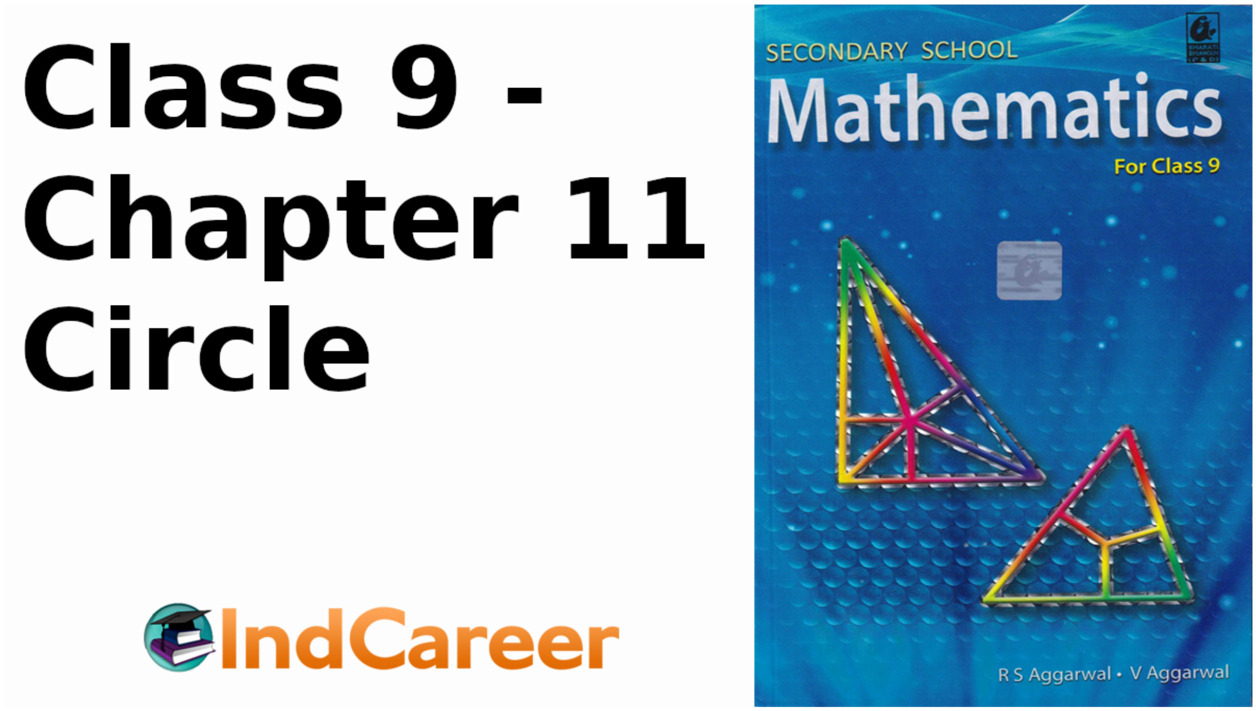
RS Aggarwal Solutions for Class 9 Maths Chapter 11–Circle



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RS Aggarwal Solutions for Class 9 Maths Chapter 11–Circle

Class 9: Maths Chapter 11 solutions. Complete Class 9 Maths Chapter 11 Notes.

RS Aggarwal Solutions for Class 9 Maths Chapter 11–Circle

RS Aggarwal 9th Maths Chapter 11, Class 9 Maths Chapter 11 solutions

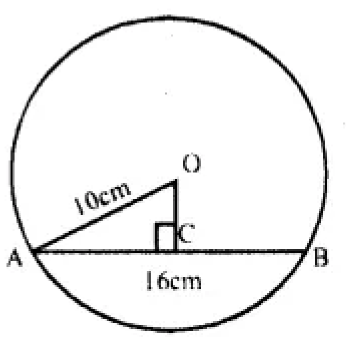
Ex 11A

Question 1.

Solution:

Let AB be a chord of a circle with centre O. OC⊥AB and OA be the radius of the circle, then

AB = 16cm, OA = 10cm .



OC ⊥ AB.

OC bisects AB at C

AC = 12 AB = 12 x 16 = 8cm

Now, in right triangle OAC,

$OA^2 = AC^2 + OC^2$ (Pythagoras Theorem)

$\Rightarrow (10)^2 = (8)^2 + OC^2 \quad \Rightarrow 100 = 64 + OC^2 \quad \Rightarrow OC^2 = 100 - 64 = 36 = (6)^2$

$\therefore OC = 6$

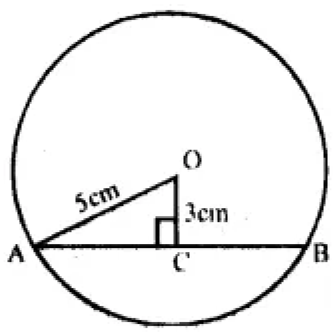
Hence, distance from centre is 6cm Ans.

Question 2.

Solution:

Let AB be the chord of the circle with centre O and OC ⊥ AB, OA be the radius of the circle,

then OC = 3cm, OA = 5cm



Now in right Δ OAC,

$OA^2 = AC^2 = OC^2$ (Pythagoras Theorem)

$\Rightarrow (5)^2 = AC^2 + (3)^2$

$\Rightarrow 25 = AC^2 + 9$

$\Rightarrow AC^2 = 25 - 9 = 16 = (4)^2$

$\therefore AC = 4$

But $AB = 2AC = 2 \times 4 = 8$cm

Hence chord AB = 8cm. Ans.

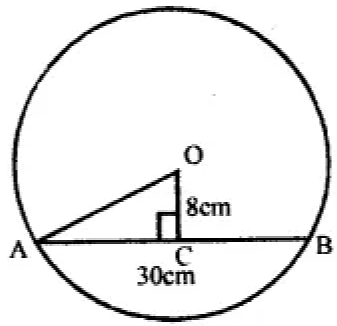
Question 3.

Solution:

Let AB be the chord, OA be the radius of

the circle OC ⊥ AB

then AB = 30 cm, OC = 8cm



∴ OC ⊥ AB

∴ OC bisects AB at C

$\therefore AC = \frac{1}{2} \times 30 = 15$ cm

Now, in right Δ OAC

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

(Pythagoras Theorem)

$\Rightarrow OA^2 = (15)^2 + (8)^2 = 225 + 64 = 289$

$= (17)^2$

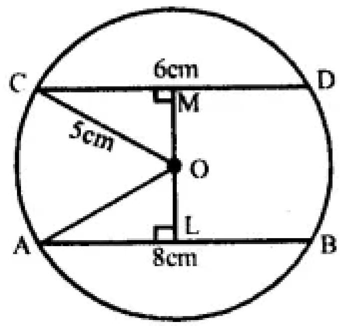
$\therefore OA = 17$

Hence, radius of the circle = 17 cm Ans.

Question 4.

Solution:

AB and CD are parallel chords of a circle with centre O.



OA and OC are the radii of the circle

Draw a perpendicular to AB and CD from O which meet AB at L and CD at M.

Then AB = 8cm, CD = 6 cm

OA = OC = 5 cm.

$\because$ OL, OM are perpendicular to AB and CD

$\therefore$ They bisects the respective chords at L and M respectively.

In right Δ OAL,

$OA^2 = OL^2 + AL^2$ (Pythagoras Theoram)

$\Rightarrow (5)^2 = OL^2 + (4)^2 \quad (\because AL = \frac{1}{2} AB)$

$\Rightarrow 25 = OL^2 + 16$

$\Rightarrow OL^2 = 25 - 16 = 9$

$\Rightarrow OL^2 = 9 = (3)^2$

$\therefore OL = 3$ cm

Similarly, in right Δ OCM,

$OC^2 = OM^2 + CM^2$

$\Rightarrow (5)^2 = OM^2 + (3)^2 \ (\because CM = \frac{1}{2} CD)$

$\Rightarrow 25 = OM^2 + 9$

$\Rightarrow OM^2 = 25 - 9 = 16 \ (4)^2$

$\therefore OM = 4$ cm ...(ii)

(i) when the chords are on the same sides of the centre.

$\therefore LM = OM - OL$

$= 4 - 3 = 1$cm

(ii) when the chords are on the opposite sides of the centre.

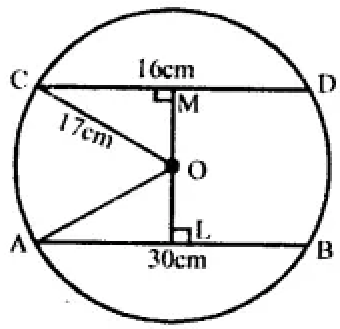
$\therefore LM = OM + OL = 3 + 4 = 7$cm Ans.

Question 5.

Solution:

Let AB and CD be two chords of a circle with centre O.

OA and OC are the radii of the circle. OL⊥AB and OM⊥CD.



∴ L and M are the midpoints of AB and CD respectively.

Now AB = 30 cm, CD = 6 cm

Radius OA = OC = 17 cm

Now in right Δ OAL,

$OA^2 = AL^2 + OL^2$

(Pythagoras Theorem)

Question 6.

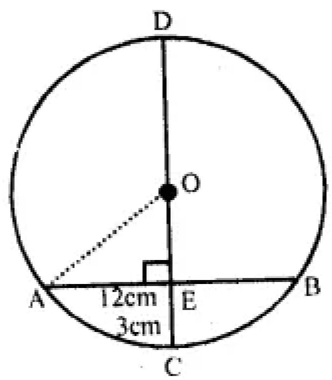
Solution:

In the figure, a circle with centre O, CD is its diameter AB is a chord such that CD⊥AB.

AB = 12cm, CE = 3cm.

Join OA.

∵ COD⊥AB which intersects AB at E



$\therefore$ AE $= \frac{1}{2}$AB $= \frac{1}{2} \times 12 = 6$cm

Let radius of the circle be r

Then OA = OC = r

$\therefore$ OE $= r - 3$ $\quad$ ($\because$ EC = 3cm)

Question 7.

Solution:

A circle with centre O, AB is diameter which bisects chord CD at E

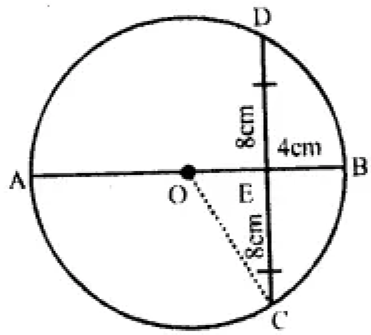
i.e. CE = ED = 8cm and EB = 4cm

Join OC.

Let radius of the circle = r

But EB = 4cm

$\therefore$ OE = OB – EB = $r - 4$



Now, in right Δ OCB,

$OC^2 = CE^2 + OE^2$ (Pythagoras Theorem)

$\Rightarrow r^2 = (8)^2 + (r - 4)^2$

$\Rightarrow r^2 = 64 + r^2 + 16 - 8r$

$\Rightarrow r^2 - r^2 + 8r = 64 + 16$

$\Rightarrow 8r = 80$

$\Rightarrow r = \frac{80}{8} = 10$

Hence, radius of the circle = 10 cm Ans.

Question 8.

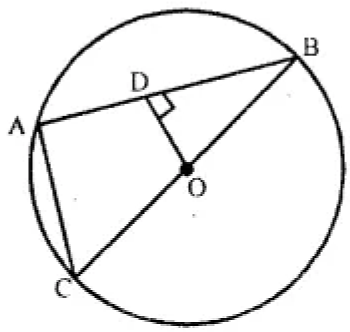
Solution:

Given : O is the centre of a circle AB is a chord and BOC is the diameter. OD$\perp$AB

To prove : AC || OD and AC = 20D

Proof : OD$\perp$AB

$\because$ D is midpoint of AB



Now, in Δ ABC,

O and D are the midpoints of sides BC and AB respectively.

$\therefore$ OD || AC and OD = $\frac{1}{2}$ AC

$\Rightarrow$ 2OD = AC

Hence AC || OD and AC = 2 × OD.

Hence proved.

Question 9.

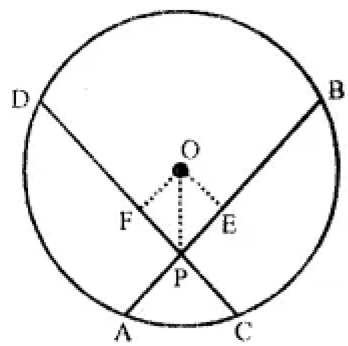
Solution:

Given : O is the centre of the circle two

chords AB and CD intersect each other at P inside the circle. PO bisects ∠BPD.

To prove : AB = CD.

Const. Join OP and draw $OE \perp AB$, $OF \perp CD$



Proof : In ΔOEP and ΔOFP,

OP = OP (common)

$\angle E = \angle F$ (each 90°)

$\angle OPE = \angle OPF$ ($\because$ OP is the bisector of $\angle BPD$)

$\therefore \Delta OEP \cong \Delta OFP$ (AAS axiom)

$\therefore$ OE = OF (c.p.c.t.)

But OE and OF are perpendicular on AB and CD they are equal

Hence AB = CD ($\because$ equal chords are equidistant from the centre)

Hence proved.

Question 10.

Solution:

Given : PQ is the diameter of the circle with centre O which is perpendicular to one chord AB and chord AB || CD.

PQ intersects AB and CD at E and F respectively

To prove : $PQ \perp CD$ and PQ bisects CD.

Proof : $\because$ POQ $\perp$ AB

$\therefore$ $\angle PEB = 90^o$

or But AB || CD (given)

$\therefore$ $\angle PEB = \angle PFD$ (corresponding angles)

$\therefore$ $\angle PFD$ or $\angle OFD = 90^o$

$\therefore$ OF $\perp$ CD or PQ $\perp$ CD

$\therefore$ CF = FD

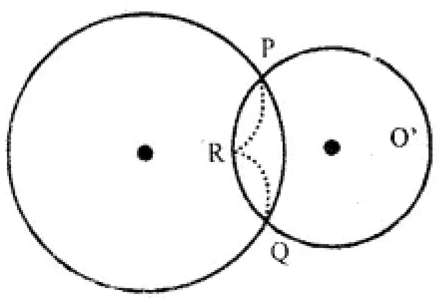
Hence, PQ bisects CD

Hence proved.

Question 11.

Solution:

Two circles with centre O and O’ intersect each other.



To prove : The two circles cannot intersect each other at more than two points.

Proof : Let if opposite, the two circles intersect each other at three points P, Q and R.

Then these three points are non-collinear. But, we know that through three non- collinear points, one and only one circle can be drawn.

$\because$ Our supposition is wrong

Hence two circle can not intersect each other at not more than two points.

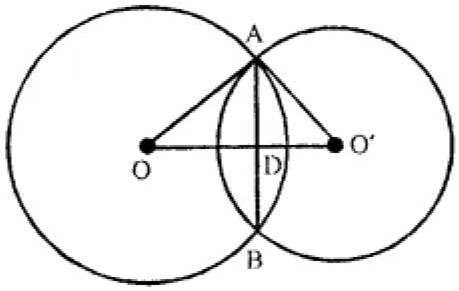
Hence proved

Question 12.

Solution:

Given : Two circles with centres O and O’ intersect each other at A and B. AB is a common chord. OO’ is joined.

AO and AO is joined.



OA = 10cm, O'A = 8cm, AB = 12cm.

Now, we have to found OO'.

Solution. we know that the line joining the two intersecting circle bisects the common chord.

$\therefore$ OD and O'D are $\perp$ on AB and AD = DB = 6cm

Now, in right Δ OAD,

$OA^2 = OD^2 + AD^2$ (Pythagoras theorem)

$\Rightarrow (10)^2 = OD^2 + (6)^2$

$\Rightarrow 100 = OD^2 + 36$

$\Rightarrow OD^2 = 100 - 36 = 64 = (8)^2$

$\therefore OD = 8cm$

Similarly in right Δ O'AD,

$O'A = O'D^2 + AD^2$

$(8)^2 = O'D^2 + (6)^2$

$\Rightarrow 64 = O'D^2 + 36$

$O'D^2 = 64 - 36 = 28$

$\Rightarrow O'D = \sqrt{28} = \sqrt{4 \times 7}$

$O'D = 2\sqrt{7}$ cm

Now OO' = OD + O'D

$= (8 + 2\sqrt{7})$ cm Ans.

Question 13.

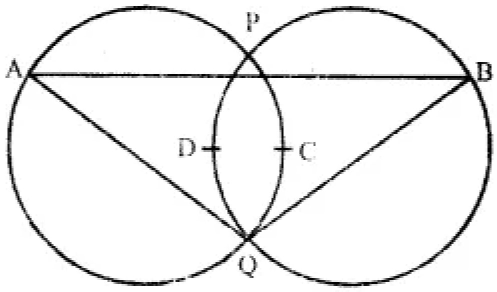
Solution:

Given : Two equal circles intersect each other at P and Q.

A straight line drawn through

P, is drawn which meets the circles at A and B respectively

To prove : QA = QB



Proof : PQ is a common chord of two congruent circles

$\therefore$ arc CPCQ = arc PDQ

$\therefore$ $\angle PAQ = \angle PBQ$

(equal arcs subtends equal angles)

Now, in Δ ABQ,

$\because$ $\angle PAQ = \angle PBQ$ (proved)

$\therefore$ QB = QA (sides opposite to equal angles)

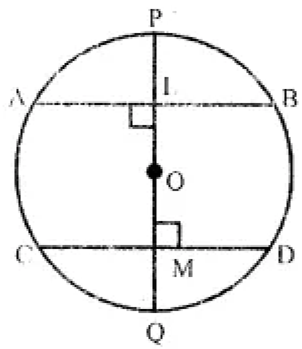
or QA = QB Hence proved.

Question 14.

Solution:

Given : A circle with centre 0. AB and CD are two chords and diameter PQ bisects AB and CD at L and M

To Prove : AB || CD.



Proof : ∵ Diameter PQ bisects AB and CD at L and M respectively.

∴ OL ⊥ AB and OM ⊥ CD

∴ ∠ALM = ∠LMD (each = 90°)

But, these are alternate angles

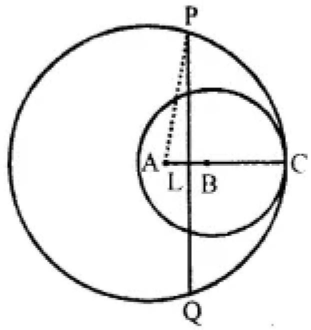
∴ AB ∥ CD Hence proved.

Question 15.

Solution:

Given : Two circles with centres A and B touch each other at C internally. A, B arc joined. PQ is the perpendicular bisector of AB intersecting it at L and meeting the bigger circle at P and Q respectively and radii of the circles are 5cm and 3cm. i.e. AC = 5cm,BC = 3cm

Required : To find the lenght of PQ



Join AP

$\because$ AC = 5cm and BC = 3cm

$\therefore$ AB = 5cm – 3cm = 2cm

$\because$ PQ bisects AB at L

$\therefore AL = \frac{1}{2} AB = \frac{1}{2} \times 2cm$

= 1cm

Now, in right Δ ALP

$AP^2 = AL^2 + LP^2$ (Pythagoras Theorem)

$(5)^2 = (1)^2 + LP^2$

$\Rightarrow 25 = 1 + LP^2$

$\Rightarrow LP^2 = 25 - 1 = 24$

$\Rightarrow LP = \sqrt{24}$

$\because$ PQ is chord and AL $\perp$ PQ.

$\therefore$ L is midpoint of PQ

$\therefore PL = \frac{1}{2} PQ.$

$\therefore PQ = 2 \times LP = 2 \times \sqrt{24}$

$= 2\sqrt{4 \times 6} = 2 \times 2 \times \sqrt{6}$ cm

$=4\sqrt{6}$ cm Ans.

Question 16.

Solution:

Given : AB is a chord of a circle with centre O. AB is produced to C such that BC = OB, CO is joined and produced to meet the circle at D.

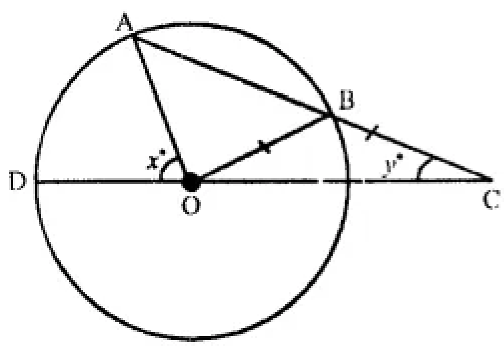
∠ ACD = y°, ∠ AOD = x°

To prove : x = 3y

Proof : In Δ OBC,

OB = OC (given)

$\therefore \angle BOC = \angle BCO = y^\circ$



and Ext. $\angle ABO = \angle BOC + \angle BCO = y^\circ + y^\circ = 2y^\circ$

In Δ AOB, OA = OB (radii of the circle)

$\therefore \angle OBA = \angle OAB = 2y^\circ$

In Δ OAC,

Ext. $AOD = \angle OAC + \angle OCA = \angle OAB + \angle OCB$

$x^\circ = 2y^\circ + y^\circ = 3y^\circ$

Hence proved.

Question 17.

Solution:

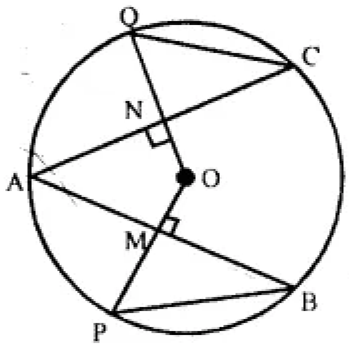
Given : O is the centre of a circle AB and AC are two chords such that AB = AC

OP $\perp$ AB and OQ $\perp$ AC.

which intersect AB and AC at M and N

respectively. PB and QC are joined.

To prove : PB = QC.



Proof : $\because$ OP or OM $\perp$ AB

and OQ or ON $\perp$ AC

$\therefore \frac{1}{2} AB = \frac{1}{2} AC \Rightarrow MB = NC$

(Half of equals)

Again AB = AC and OM and ON are perpendiculars on them

$\therefore$ OM = ON (Equal chords are equidistant from the centre)

But QP = OQ (radii of the same circle)

$\therefore$ OP – OM = OQ – ON

$\Rightarrow$ MP = NQ

ON and OM are perpendicular

$\therefore$ $\angle$BMP = $\angle$CNQ (each = 90°)

Now in ΔBMP and ΔCNQ,

MB = NC (proved)

MP = NQ (proved)

and $\angle$BMP = $\angle$CNQ (each 90°)

$\therefore$ ΔBMP $\cong$ ΔCNQ. (SAS axiom)

$\therefore$ PB = QC (c.p.c.t.)

Hence proved.

Question 18.

Solution:

Given : In a circle with centre O, BC is its diameter. AB and CD are two chords such that AB || CD.

To prove : AB = CD

Const. Draw OL ⊥ AB

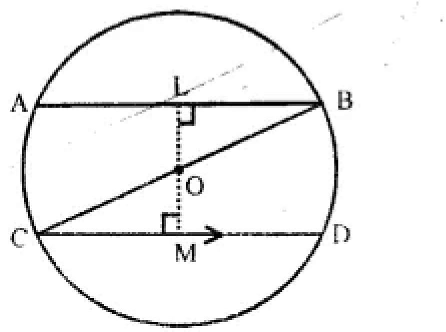
OM ⊥ CD.

Proof : In Δ OLB and Δ OCM,

OB = OC (radii of the same circle)

∠ OLB = ∠ OMC (each 90°)

∠ OBL = ∠ OCM (alternate angles)



∴ $\Delta OLB \cong \Delta OCM$ (AAS axiom)

∴ OL = OM (c.p.c.t)

But these are the distance of chords from the centre of the circle.

∴ AB = CD Hence proved.

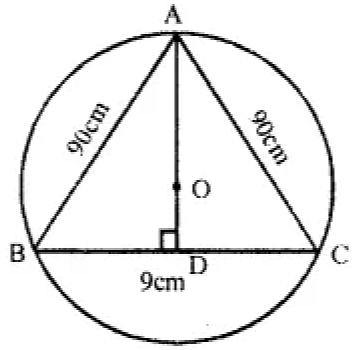
Question 19.

Solution:

Equilateral Δ ABC in inscribed in a circle in which

AB = BC = CA = 9cm.

From A, draw AD ⊥ BC
which passes through the centre O.
∵ AOD ⊥ BC



$\therefore$ BD = DC = $\frac{9}{2}$ = 4.5 cm (Half of BC)

In right Δ ABD,
$AB^2 = AD^2 + BD^2$ (Pythagoras Theorem)

$\Rightarrow (9)^2 = AD^2 + \left(\frac{9}{2}\right)^2$

$\Rightarrow 81 = AD^2 + \frac{81}{4}$

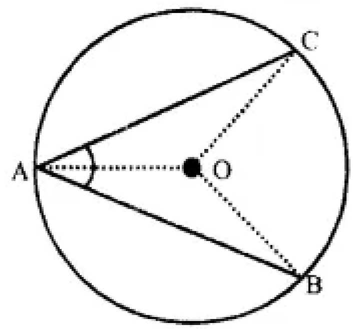
$= AD^2 = 81 - \frac{81}{4} = \frac{324-81}{4} = \frac{3\times81}{4}$

$\therefore AD = \sqrt{\frac{3\times81}{4}} = \sqrt{3}\times\frac{9}{2} = \frac{9\sqrt{3}}{2}$ cm

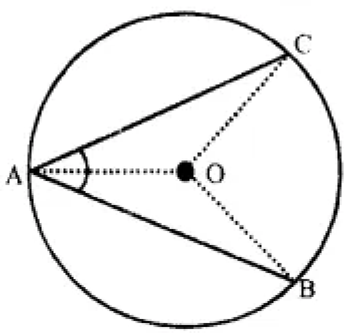
∵ In an equilateral triangle.
centroid, incentre and circumcentre
coincide each other
$\therefore$ AO : OD = 2 : 1

$$\therefore \ AO = \frac{2}{3} \ AD = \frac{2}{3} \times \frac{9\sqrt{3}}{2} = 3\sqrt{3} \text{ cm}$$

Hence radius of the circle = $3\sqrt{3}$ cm Ans.



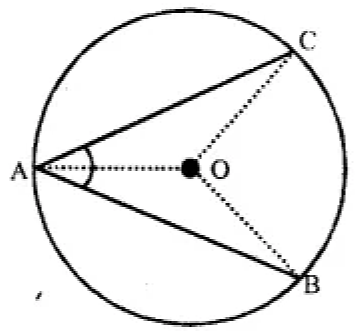
Question 20.



Solution:

Given : AB and AC are two equal chords of a circle with centre O

To Prove : O lies on the bisector of ∠ BAC



Proof : In ΔOAB and ΔOAC,

OA = OA (common)

OB = OC (radii of the same circle)

AB = AC (given)

$\therefore$ $\Delta OAB \cong \Delta OAC$ (SSS axiom)

$\therefore$ $\angle OAB = \angle OAC$ (c.p.c.t.)

$\therefore$ OA is the bisector of $\angle BAC$

Hence, O lies on the bisector of $\angle BAC$

Hence proved.

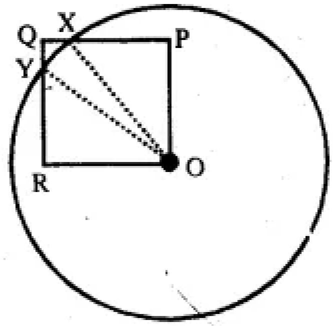
Question 21.

Solution:

Given : OPQR is a square with centre O, a circle is drawn which intersects the square at X and Y.

To Prove : Q = QY

Const. Join OX and OY



Proof : In ΔOXP and ΔORY,

OX = OY (radii of the same circle)

OP = OR (sides of a square)

$\angle OPX = \angle ORY$ (each 90^o)

$\therefore \Delta OXP \cong \Delta ORY$ (A.S.S. axiom)

$\therefore PX = RY$ (c.p.c.t.)

But PQ = RQ (sides of a square)

$\therefore PQ - PX = RQ - RY$

$\Rightarrow QX = QY$

Hence proved.

Ex 11B

Question 1.

Solution:

(i) O is the centre of the circle

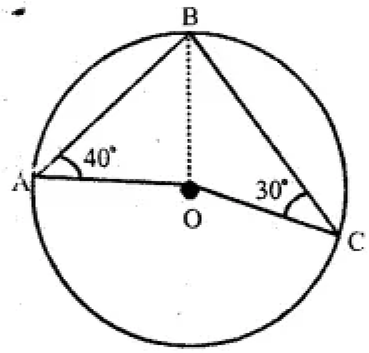
∠OAB = 40°, ∠OCB = 30°

Join OB.

In Δ OAB, OA = OB

(radii of the same circle)

$\therefore$ $\angle$OBA = $\angle$OAB = 40°



Similarly in Δ OBC,

OB = OC (radii of the same circle)

$\therefore$ $\angle$OBC = $\angle$OCB = 30°

$\therefore$ $\angle$ABC = $\angle$OBA + $\angle$OBC

= 40° + 30° = 70°

Now arc AOC subtends $\angle$AOC at centre and $\angle$ABC at the remaining part of the circle.

$\therefore$ $\angle$AOC = 2$\angle$ABC = 2 × 70°

= 140° Ans.

(ii) O is the centre of the circle. A, B and C are the points on the circle such that $\angle$AOB = 90°, $\angle$AOC = 110°

Ref. $\angle$AOC = $\angle$AOB + $\angle$AOC = 90° + 110° = 200°

$\therefore$ $\angle$AOB = 360° – 200° = 160°

Now arc BC subtends ∠BOC at the centre and ∠BAC at the remainder part of the circle

$$\therefore \angle BAC = \frac{1}{2} \angle BOC$$

$$= \frac{1}{2} \times 160^\circ$$

$$= 80^\circ \text{ Ans.}$$

Now arc BC subtends ∠BOC at the centre and ∠BAC at the remainder part of the circle

$$\therefore \angle BAC = \frac{1}{2} \angle BOC$$

$$= \frac{1}{2} \times 160^\circ$$

$$= 80^\circ \text{ Ans.}$$

Question 2.

Solution:

O is the centre of the cirlce and ∠AOB = 70°

∵ Arc AB subtends ∠AOB at the centre and ∠ACB at the remaining part of the circle.

∵ ∠ACB = 12 ∠AOB = 12 x 70°

=> ∠ACB = 35°

or ∠OCA = 35°

In ∆OAC,

OA = OC (radii of the same circle)

∴ ∠OAC = ∠OCA = 35° Ans.

Question 3.

Solution:

In the figure, O is the centre of the circle. ∠PBC = 25°, ∠APB =110°

∠ APB + ∠ BPC = 180° (Linear pair)

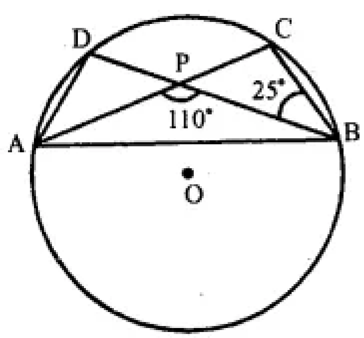
=> 110° + ∠ BPC = 180°

$\Rightarrow \angle BPC = 180^\circ - 110^\circ$

$\Rightarrow \angle BPC = 70^\circ$

In ΔPBC,

$\angle PBC + \angle BPC + \angle BCP = 180^\circ$ (Angles of a triangle)



$\Rightarrow 25^\circ + 70^\circ + \angle BCP = 180^\circ$

$\Rightarrow 95^\circ + \angle BCP = 180^\circ$

$\Rightarrow \angle BCP = 180^\circ - 95^\circ$

$\Rightarrow \angle BCP = 85^\circ$ or $\angle ACB = 85^\circ$

But $\angle ACB = \angle ADB$

(Angles in the same segment of a circle)

$\therefore \angle ADB = 85^\circ$ Ans.

Question 4.

Solution:

O is the centre of the circle

∠ABD = 35° and ∠B AC = 70°

BOD is the diameter of the circle

∠BAD = 90° (Angle in a semi circle)

But ∠ADB + ∠ABD + ∠BAD = 180° (Angles of a triangle)

=> ∠ADB + 35° + 90° = 180°

=> ∠ADB + 125° = 180°

=> ∠ADB = 180° – 125° = 55°

But ∠ACB = ∠ADB (Angles in the same segment of the circle)

∠ACB = 55° Ans.

Question 5.

Solution:

O is the centre of a circle and ∠ACB = 50°

∴ arc AB subtends ∠ AOB at the centre and ∠ ACB at the remaining part of the circle.

∴ ∠ AOB = 2 ∠ ACB

= 2 x 50° = 100

∴ OA = OB (radii of the same circle)

∴ ∠ OAB = ∠ OBA (Angles opposite to equal sides)

Now in Δ OAB,

∠ OAB + ∠ OBA + ∠ AOB = 180°

=> ∠ OAB + ∠ OAB + ∠ AOB = 180° (∠OAB = ∠OBA)

=> 2 ∠ OAB + 100°= 180°

=> 2 ∠ OAB = 180° – 100° = 80°

=> ∠OAB = 80o2 = 40°

Hence, OAB = 40° Ans.

Question 6.

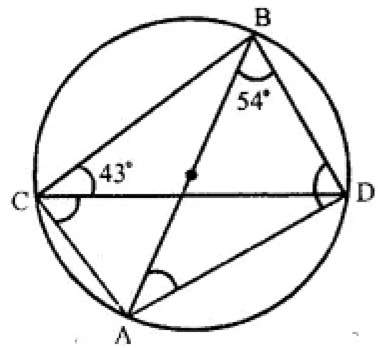
Solution:

(i) In the figure,

∠ABD = 54° and ∠BCD = 43°

∠BAD = ∠BCD (Angles in the same segment of a circle)

∠BAD = 43°



Similarly

(ii) $\angle ACD = \angle ABD$

$\therefore \angle ACD = 54^\circ$

(iii) $\therefore \angle ACB$

$= \angle ACD + \angle BCD$

$= 54^\circ + 43^\circ = 97^\circ$

But $\angle ACB + \angle BDA = 180^\circ$

(opposite angles of a cyclic quad.)

$\Rightarrow 97^\circ + \angle BDA = 180^\circ$

$\Rightarrow \angle BDA = 180^\circ - 97^\circ = 83^\circ$

Hence $\angle BDA = 83^\circ$ Ans.

Question 7.

Solution:

Chord DE || diameter AC of the circle with centre O.

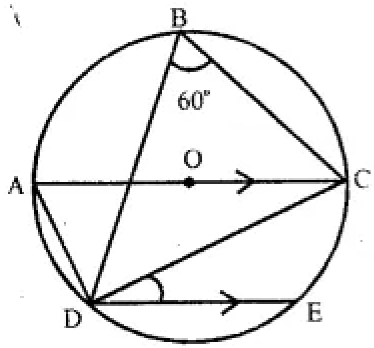
$\angle CBD = 60^\circ$

$\angle CBD = \angle CAD$

(Angles in the same segment of a circle)

$\angle CAD = 60^\circ$

Now in Δ ADC,



$\angle ADC = 90^\circ$ (Angle in a semi circle)

and $\angle ACD + \angle ADC + \angle CAD = 180^\circ$

(Angles of a triangle)

$\Rightarrow \angle ACD + 90^\circ + 60^\circ = 180^\circ$

$\Rightarrow \angle ACD + 150^\circ = 180^\circ$

$\Rightarrow \angle ACD = 180^\circ - 150^\circ = 30^\circ$

But $\angle ACD = \angle CDE$ (Alternate angles)

$\Rightarrow \angle CDE = 30^\circ$ Ans.

Question 8.

Solution:

In the figure,

chord CD || diameter AB of the circle with centre O.

∠ ABC = 25°

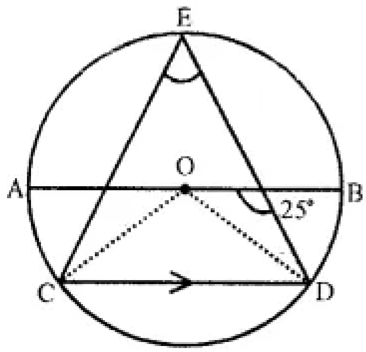
Join CD and DO.

AB || CD

∠ ABC = ∠ BCD (alternate angles)

Now arc AC subtends $\angle AOC$ at the centre and $\angle ABC$ at the remaining part of the circle

$\therefore \angle AOC = 2 \angle ABC = 2 \times 25^\circ = 50^\circ$



Similarly

$\angle BOD = 2\angle BCD = 2 \times 25^\circ = 50^\circ$

But $\angle AOC + \angle BOD + \angle COD = 180^\circ$

(Angles on a st. line)

$\Rightarrow 50^\circ + 50^\circ + \angle COD = 180^\circ$

$\Rightarrow 100^\circ + \angle COD = 180^\circ$

$\Rightarrow \angle COD = 180^\circ - 100^\circ = 80^\circ$

Now arc CD substends $\angle COD$ at the centre O and $\angle CED$ at the remaining part of the circle.

$\therefore \quad \angle COD = 2\angle CED$

$\Rightarrow \quad \angle CED = \frac{1}{2}\angle COD \times 80^\circ = 40^\circ$

Hence $\angle CED = 40^\circ$ Ans.

Question 9.

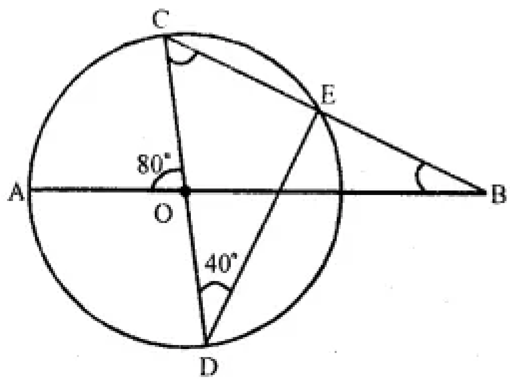
Solution:

AB and CD are two straight lines passing through O, the centre of the circle and ∠AOC = 80°, ∠CDE = 40°

∠ CED = 90° (Angle in a semi circle)

and ∠CDE = 40°

∴ In Δ CDE,



∠DCE + ∠CDE + ∠CFD = 180°
(Angles of a triangle)

⇒ ∠DCE + 40° + 90° = 180°

⇒ ∠DCE + 130° = 180°

⇒ ∠DCE = 180° – 130° = 50°

and in Δ OBC,

Ext. ∠AOC = ∠OCB + ∠OBC

∠AOC = ∠DCE + ∠ABC

⇒ 80° = 50° + ∠ABC

∴ ∠ABC = 80° – 50° = 30° Ans.

Question 10.

Solution:

O is the centre of the circle and ∠AOB = 40°, ∠BDC = 100°

Arc AB subtends ∠AOB at the centre and ∠ ACB at the remaining part of the circle

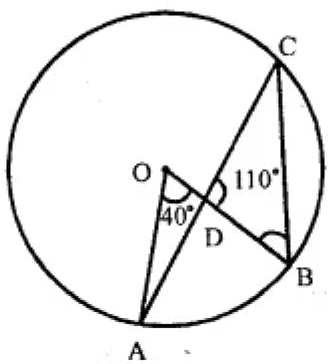
∠ AOB = 2 ∠ ACB

$$\Rightarrow \angle ACB = \frac{1}{2} \angle AOB = \frac{1}{2} \times 40^{\circ} = 20^{\circ}$$

In Δ BCD,

$\angle BDC + \angle DBC + \angle ACB = 180^{\circ}$ (Angles of a triangle)

$\Rightarrow 100^{\circ} + \angle DBC + 20^{\circ} = 180^{\circ}$ ($\because \angle DCB$ and $\angle ACB$ are same)



$$\Rightarrow \angle DBC + 120^{\circ} = 180^{\circ}$$

$$\Rightarrow \angle DBC = 180^{\circ} - 120^{\circ} = 60^{\circ}$$

or $\angle OBC = 60^{\circ}$ Ans.

Question 11.

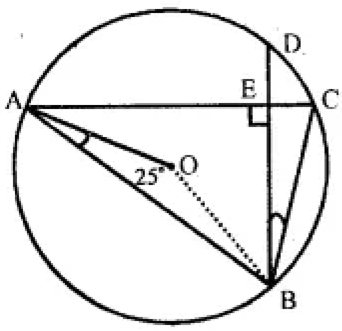
Solution:

Chords AC and BD of a circle with centre O, intersect each other at E at right angles.

∠ OAB = 25°. Join OB.

In Δ OAB,

OA = OB (radii of the same circle)



$\therefore\ \angle OAB = \angle OBA$

$\therefore\ \angle OBA = 25^\circ \qquad (\because \angle OAB = 25^\circ)$

$\therefore\ \angle AOB = 180^\circ - (\angle OAB + \angle OBA)$

$= 180^\circ - (25^\circ + 25^\circ)$

$= 180^\circ - 50^\circ = 130^\circ$

Now arc AB subtends $\angle AOB$ at the centre and $\angle ACB$ at the remaining part of the circle.

$\therefore\ \angle ACB = \frac{1}{2} \angle AOB = \frac{1}{2} \times 130^\circ = 65^\circ$

Now in Δ EBC,

$\angle CEB = 90^\circ$

$\therefore\ \angle ECB + \angle EBC + \angle CEB = 180^\circ$

$\Rightarrow 65^\circ + \angle EBC + 90^\circ = 180^\circ$

$\Rightarrow \angle EBC + 155^\circ = 180^\circ$

$\Rightarrow \angle EBC = 180^\circ - 155^\circ$

$\angle EBC = 25^\circ$ Ans.

Question 12.

Solution:

In the figure, O is the centre of a circle ∠ OAB = 20° and ∠ OCB = 55° .

In Δ OAB,

OA = OB (radii of the same circle)

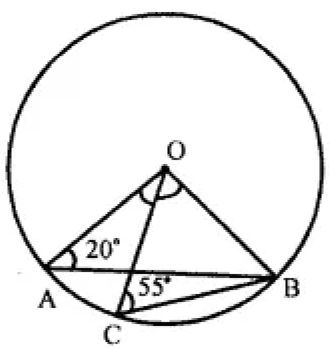
$\therefore\ \angle OBA = \angle OAB = 20^o$

Similarly OC = OB.

$\therefore\ \angle OBC = \angle OCB = 55^o$

Now, in Δ OBC,

$\angle BOC + \angle OCB + \angle OBC = 180^o$
(sum of angles of the triangle)



$\Rightarrow\ \angle BOC + 55^o + 55^o = 180^o$

$\Rightarrow\ \angle BOC + 110^o = 180^o$

$\Rightarrow\ \angle BOC = 180^o - 110^o$

$\therefore\ \angle BOC = 70^o$

Similarly in Δ OAB,

$\angle OAB + \angle OBA + \angle AOB = 180^o$

$\Rightarrow\ 20^o + 20^o + \angle AOB = 180^o$

$\Rightarrow\ \angle AOB + 40^o = 180^o$

$\Rightarrow\ AOB = 180^o - 40^o = 140^o$

But $\angle BOC = 70^o$ proved.

$\therefore\ \angle AOC = \angle AOB - \angle BOC = 140^o -$
$70^o = 70^o$ Ans.

Question 13.

Solution:

Given : A Δ ABC is inscribed in a circle with centre O and $\angle$ BAC = 30°

To Prove : BC = radius of the circle

Const. Join OB and OC

Proof : Arc BC subtends $\angle$BOC at the centre and $\angle$BAC at the remaining part of the circle.

$\therefore \quad \angle BOC = 2\angle BAC = 2 \times 30^\circ = 60^\circ$

In Δ OBC,

OB = OC radii of the circle

$\therefore \quad \angle OBC = \angle OCB$

But $\angle OBC + \angle OCB + \angle BOC = 180^\circ$

(Angles of a triangle)

$\Rightarrow \quad \angle OBC + \angle OBC + \angle BOC = 180^\circ$

$\Rightarrow \quad 2\angle OBC + 60^\circ = 180^\circ$

$\Rightarrow \quad 2\angle OBC = 180^\circ - 60^\circ = 120^\circ$

$\Rightarrow \quad \angle OBC = \dfrac{120^\circ}{2} = 60^\circ$

$\therefore \quad \Delta$ OBC is an equilateral triangle

$\therefore$ **OB** = BC = OC.

Hence, BC is equal to the radius of the **circle.**

Question 14.

Solution:

In a circle with centre O and PQ is its diameter. $\angle$PQR = 65°, $\angle$SPR = 40° and $\angle$PQM = 50°

(i) ∠PRQ = 90° (Angle in a semicircle) and ∠PQR + ∠RPQ + ∠PQR = 180° (Angles of a triangle)

$\Rightarrow 65^\circ + \angle RPQ + 90^\circ = 180^\circ$

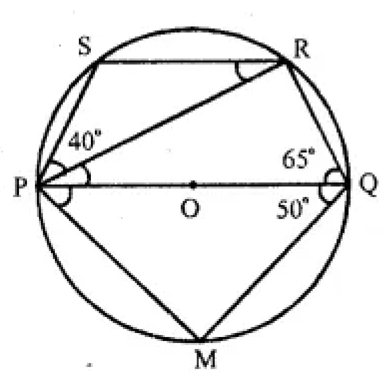
$\Rightarrow \angle RPQ + 155^\circ = 180^\circ$

$\Rightarrow \angle RPQ = 180^\circ - 155^\circ = 25^\circ$

or $\angle QPR = 25^\circ$

(ii) Similarly in Δ PQM,

$\angle PMQ = 90^\circ$ (Angle in a semicircl



and $\angle PQM + \angle PMQ + \angle QPM = 180^\circ$
(Angle of a triangle)

$\Rightarrow 50^\circ + 90^\circ + \angle QPM = 180^\circ$

$\Rightarrow \angle QPM + 140^\circ = 180^\circ$

$\Rightarrow \angle QPM = 180^\circ - 140^\circ = 40^\circ$

(iii) $\because$ PQRS is a cylic quadrilateral

$\therefore \angle PQR + \angle PSR = 180^\circ$

$\Rightarrow 65^\circ + \angle PSR = 180^\circ$

$\Rightarrow \angle PSR = 180^\circ - 65^\circ = 115^\circ$

Now in Δ PRS,

$\angle PRS + \angle SPR + \angle PSR = 180^\circ$

$\Rightarrow \angle PRS + 40^\circ + 115^\circ = 180^\circ$

$\Rightarrow \angle PRS + 155^\circ = 180^\circ$

$\Rightarrow \angle PRS = 180^\circ - 155^\circ = 25^\circ$ Ans.

Ex 11C

Question 1.

Solution:

In cyclic quad. ABCD, ∠ DBC = 60° and ∠BAC = 40°

∴∠ CAD and ∠ CBD are in the same segment of the circle.

∴∠ CAD = ∠ CBD or ∠ DBC

=> ∠ CAD = 60°

∴∠BAD = ∠BAC + ∠CAD

= 40° + 60° = 100°

But in cyclic quad. ABCD,

∠BAD + ∠BCD = 180°

(Sum of opposite angles)

=> 100° + ∠BCD = 180°

=> ∠BCD = 180° – 100°

∴ ∠ BCD = 80°

Hence (i) ∠BCD = 80° and

(ii) ∠CAD = 60° Ans.

Question 2.

Solution:

In the figure, POQ is diameter, PQRS is a cyclic quad, and ∠ PSR =150° In cyclic quad. PQRS.

∠ PSR + ∠PQR = 180°

(Sum of opposite angles)

=> 150° + ∠PQR = 180°

=> ∠PQR = 180°- 150° = 30°

=> ∠PQR =180° – 150° = 30°

Now in Δ PQR,

∴∠ PRQ = 90° (Angle in a semicircle)

∴ ∠ RPQ + ∠PQR = 90°

=> ∠RPQ + 30° = 90°

=> ∠RPQ = 90° – 30° = 60° Ans.

Question 3.

Solution:

In cyclic quad. ABCD,

AB || DC and ∠BAD = 100°

∠ ADC = ∠BAD =180°

(co-interior angles)

=> ∠ ADC + 100° = 180°

=> ∠ADC = 180° – 100° = 80°

∴ ABCD is a cyclic quadrilateral.

∴ ∠BAD + ∠BCD = 180°

=> 100° + ∠ BCD = 180°

=> ∠BCD = 180° – 100°

=> ∠BCD = 80°

Similarly ∠ABC + ∠ADC = 180°

=> ∠ABC + 80° = 180°

=> ∠ABC = 180° – 80° = 100°

Hence (i) ∠BCD = 80° (ii) ∠ADC = 80° and (iii) ∠ABC = 100° Ans.

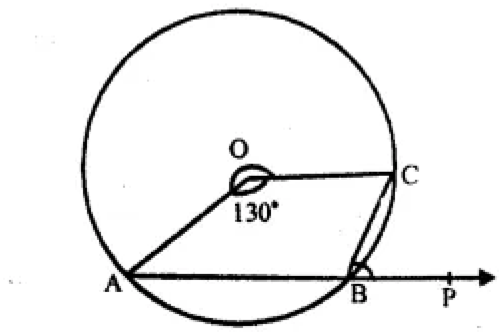
Question 4.

Solution:

O is the centre of the circle and arc ABC subtends an angle of 130° at the centre i.e. ∠AOC = 130°. AB is produced to P

Reflex ∠AOC = 360° – 130° = 230°

Now, arc AC subtends reflex ∠ AOC at the centre and ∠ ABC at the remaining out of the circle.



$\therefore$ Reflex $\angle AOC = 2\angle ABC$

$\Rightarrow \angle ABC = \frac{1}{2}\angle AOC = \frac{1}{2} \times 230^\circ - 115^\circ$

But $\angle ABC + \angle PBC = 180^\circ$ [Linear pair]

$\Rightarrow 115^\circ + \angle PBC = 180^\circ$

$\Rightarrow \angle PBC = 180^\circ - 115^\circ = 65^\circ$ Ans.

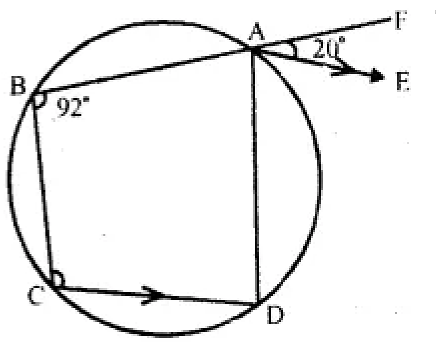
Question 5.

Solution:

In the figure, ABCD is a cyclic quadrilateral in which BA is produced to F and AE is drawn parallel to CD.

∠ABC = 92° and ∠FAE = 20°

ABCD is a cyclic quadrilateral.



$\therefore \quad \angle ABC + \angle ADC = 180^\circ$

$\Rightarrow \quad 92^\circ + \angle ADC = 180^\circ$

$\angle ADC = 180^\circ - 92^\circ = 88^\circ$

$\because \quad AE \parallel CD$

$\therefore \quad \angle EAD = \angle EDC$ (alternate angles)

$= 88^\circ$

$\therefore \quad \angle FAD = \angle FAE + \angle EAD$

$= 20^\circ + 88^\circ = 108^\circ$

But $\angle BAD + \angle FAD = 180^\circ$ (Linear pair)

$\Rightarrow \quad \angle BAD = 108^\circ = 180^\circ$

$\Rightarrow \quad \angle BAD = 180^\circ - 108^\circ = 72^\circ$

But $\angle BAD + \angle BCD = 180^\circ$ (opposite angles of a cyclic qudrilateral)

$\Rightarrow \quad 72^\circ + \angle BCD = 180^\circ$

$\Rightarrow \quad \angle BCD = 180^\circ - 72^\circ = 108^\circ$ Ans.

Question 6.

Solution:

In the figure, BD = DC and $\angle CBD = 30^\circ$

In Δ BCD,

BD = DC (given)

∠ BCD = ∠ CBD

(Angles opposite to equal sides)

= 30°

But ∠BCD + ∠CBD + ∠BDC = 180° (Angles of a triangle)

=> 30°+ 30°+ ∠BDC = 180°

=> 60°+ ∠BDC = 180°

=> ∠ BDC =180° – 60° = 120°

But ABDC is a cyclic quadrilateral

∠BAC + ∠BDC = 180°

=> ∠BAC + 120°= 180°

=> ∠ BAC = 180° – 120° = 60°

Hence ∠ BAC = 60° Ans.

Question 7.

Solution:

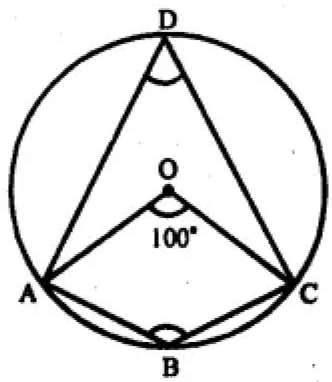
(i) Arc ABC subtends ∠ AOC at the centre , and ∠ ADC at the remaining part of the circle.

∠ AOC = 2 ∠ ADC

$\Rightarrow \quad \angle ADC = \frac{1}{2} \angle AOC$

$= \frac{1}{2} \times 100° = 50°$

$\because$ ABCD is a cyclic quadrilateral.



(ii) $\therefore \angle ABC + \angle ADC = 180°$
(opposite angles of cyclic quad.)

$\Rightarrow \quad \angle ABC + 50° = 180°$

$\Rightarrow \quad \angle ABC = 180° - 50° = 130°$

Hence $\angle ADC = 50°$ and $\angle ABC = 130°$

Ans.

Question 8.

Solution:

In the figure, ABC is an equilateral triangle inscribed is a circle

Each angle is of 60°.

∠ BAC = ∠ BDC

(Angles in the same segment)

∠BDC = 60°

BECD is a cyclic quadrilateral.

∠BDC + ∠BEC = 180°

(opposite angles of cyclic quad.)

=> 60°+ ∠BEC = 180°

=> ∠BEC = 180° – 60°= 120°

Hence ∠BDC = 60° and ∠BEC = 120° Ans.

Question 9.

Solution:

ABCD is a cyclic quadrilateral.

∠BCD + ∠BAD = 180°

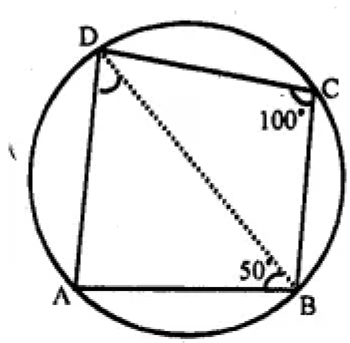
(opposite angles of a cyclic quad.)

=> 100°+ ∠BAD = 180°

so ∠BAD = 180° – 100° = 80°

Now in Δ ABD,

∠BAD + ∠ABD + ∠ADB = 180° (Angles of a triangle)



=> 80° + 50° + ∠ADB = 180°

=> 130°+ ∠ADB = 180°

=> ∠ADB = 180° – 130° = 50°

Hence, ∠ADB = 50° Ans.

Question 10.

Solution:

Arc BAD subtends ∠ BOD at the centre and ∠BCD at the remaining part of the circle.

$$\therefore \quad \angle BCD = \frac{1}{2} \angle BOD$$

$$= \frac{1}{2} \times 150^\circ = 75^\circ$$

$$\therefore \quad y = 75^\circ$$

But ABCD is a cyclic quadrilateral.

$$\therefore \quad \angle BAD + \angle BCD = 180^\circ$$

(opposite angles)

$$\Rightarrow \quad x - y = 180^\circ$$

$$x + 75^\circ = 180^\circ$$

$$x = 180^\circ - 75^\circ = 105^\circ$$

Hence $x = 105^\circ$ and $y = 75^\circ$ Ans.

Question 11.

Solution:

In Δ OAB,

OA = OB (radii of the same circle)

∠OAB = ∠OBA = 50°

and Ext ∠BOD = ∠OAB + ∠OBA

=>x° = 50° + 50° – 100°

ABCD is a cyclic quadrilateral

∠BAD + ∠BCD = 180°

(opposite angles of a cyclic quad.)

=> 50°+ y° = 180°

=> y° = 180° – 50° = 130°

Hence x = 100° and y = 130° Ans.

Question 12.

Solution:

Sides AD and AB of cyclic quadrilateral ABCD are produced to E and F respectively.

∠CBF = 130°, ∠CDE = x.

∠CBF + ∠CBA = 180° (Linear pair)

=> 130°+ ∠CBA = 180°

=> ∠CBA = 180° – 130° = 50°

But Ext. ∠ CDE = Interior opp. ∠ CBA (In cyclic quad. ABCD)

=> x = 50° Ans.

Question 13.

Solution:

In a circle with centre O AB is its diameter and DO || CB is drawn. ∠BCD = 120°

To Find : (i) ∠BAD (ii) ABD

(iii) ∠CBD (iv) ∠ADC

(v) Show that Δ AOD is an equilateral triangle.

(i) ABCD is a cyclic quadrilateral.

∠BCD + ∠BAD = 180°

120° + ∠BAD = 180°

$\Rightarrow \angle BAD = 180^\circ - 120^\circ = 60^\circ$

(ii) In ΔABD,

$\angle ADB = 90^\circ$ (Angle in a semi circle.)

$\therefore \angle ABD = 90^\circ - \angle BAD = 90^\circ - 60^\circ = 30^\circ$

(iii) In ΔOAD,

$\because OA = OD$ (radii of the same circle)

$\therefore \angle OAD = \angle ADO = 60^\circ$

($\because \angle BAD$ or $\angle OAD = 60^\circ$)

$\therefore \angle ODB = 90^\circ - 60^\circ = 30^\circ$

($\because ADB = 90^\circ$)

$\because DO \parallel CB$.

$\therefore \angle ODB = \angle DBC$ (Alternate angles.)

$= \angle CBD = 30^\circ$.

(iv) Now $\angle ADC = \angle ADB + \angle BDC = 90^\circ + 30^\circ = 120^\circ$

(v) In ΔOAD,

$\angle OAD = \angle ADO = 60^\circ$

$\therefore \angle AOD = 60^\circ$ (Third angle)

$\therefore OA = OD = AD$

Hence ΔAOD is an equilateral triangle.

Hence proved.

Question 14.

Solution:

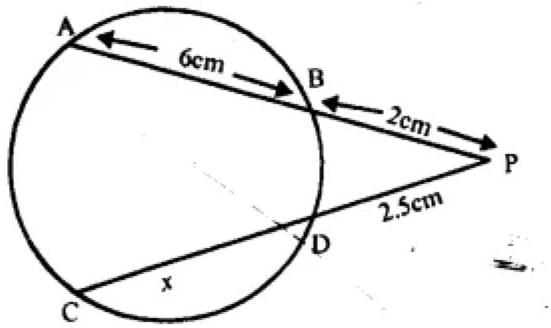
AB = 6cm, BP = 2cm, DP = 2.5cm

Let CD = xcm

Two chords AB and CD

intersect eachother at P outside the circle.

$\therefore$ $AP \times PB = CP \times PD$



$\Rightarrow$ $(AB + BP) \times PB = (CD + DP) \times PD$

$\Rightarrow$ $(6 + 2) \times 2 = (x + 2.5) \times 2.5$

$\Rightarrow$ $8 \times 2 = (x + 2.5) \times 2.5$

$\Rightarrow$ $x + 2.5 = \frac{8 \times 2}{2.5} = \frac{8 \times 2 \times 10}{25} = \frac{32}{5} = 6.4$

$\therefore$ $x = 6.4 - 2.5 = 3.9$

Hence CD = 3.9 cm Ans.

Question 15.

Solution:

O is the centre of the circle

∠ AOD = 140° and ∠CAB = 50°

BD is joined.

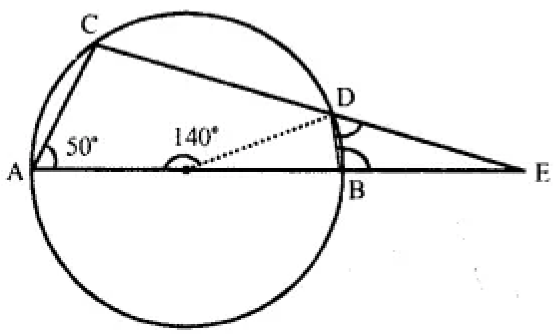
(i) ABDC is a cyclic quadrilateral.

$\therefore$ Ext. $\angle EDB$ = (interior opposite) $\angle CAB$
= 50°

In ODB,

OB = OD (radii of the same circle)

$\therefore \quad \angle OBD = \angle ODB$



and Ext. $\angle AOD = \angle OBD + \angle ODB =$
$\angle OBD + \angle OBD$

$\Rightarrow \quad 140^\circ = 2\angle OBD$

$$\therefore \quad \angle OBD = \frac{140^\circ}{2} = 70^\circ$$

But $\angle EBD + \angle OBD = 180^\circ$ (Linear pair)

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

$\Rightarrow \quad \angle EBD = 180^\circ - 70^\circ = 110^\circ$

Hence $\angle EDB = 50^\circ$

and $\angle EBD = 110^\circ$ Ans.

Question 16.

Solution:

Given : ABCD is a cyclic quadrilateral whose sides AB and DC are produced to meet each other at E.

To Prove : Δ EBC ~ Δ EDA

Proof : In ∆ EBC and ∆ EDA

∠ E = ∠ E (common)

∠ECB = ∠EAD

{Exterior angle of a cyclic quad, is equal to its interior opposite angle}

and ∠ EBC = ∠EDA

∆ EBC ~ ∆ EDA (AAS axiom)

Hence proved

Question 17.

Solution:

Solution Given : In an isosceles ∆ ABC, AB = AC

A circle is drawn x in such a way that it passes through B and C and intersects AB and AC at D and E respectively.

DE is joined.

To Prove : DE || BC

Proof : In ∆ ABC,

AB = AC (given)

∠ B = ∠ C (angles opposite to equal sides)

But ∠ ADE = ∠ C (Ext. angle of a cyclic quad, is equal E to its interior opposite angle)

∠ADE = ∠B

But, these are corresponding angles

DE || BC.

Hence proved.

Question 18.

Solution:

Given : Δ ABC is an isosceles triangle in which AB = AC.

D and E are midpoints of AB and AC respectively.

DE is joined.

To Prove : D, B, C, E are concyclic.

Proof: D and E are midpoints of sides AB and AC respectively.

DE || BC

In Δ ABC, AB = AC

∠B = ∠C

But ∠ ADE = ∠ B (alternate angles)

∠ADE =∠C

But ∠ADE is exterior angle of quad. DBCE which is equal to its interior opposite angle C.

DBCE is a cyclic quadrilateral.

Hence D, B, C, E are con cyclic.

Hence proved.

Question 19.

Solution:

Given : ABCD is a cyclic quadrilateral whose perpendicular bisectors l, m, n, p of the side are drawn

To prove : l, m, n and p are concurrent.

Proof : The sides AB, BC, CD and DA are the chords of the circle passing through the vertices's of quad. A, B, C and D. and perpendicular bisectors of a chord always passes through the centre of the circle.

l,m, n and p which are the perpendicular bisectors of the sides of cyclic quadrilateral will pass through O, the same point Hence, l, m, n and p are concurrent.

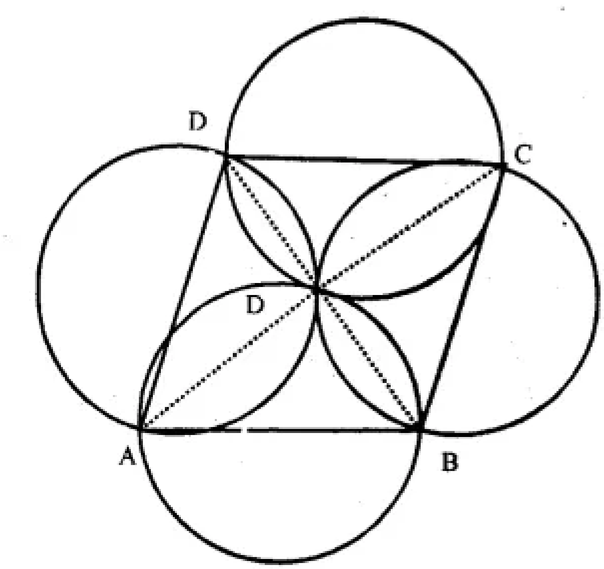
Hence proved.

Question 20.

Solution:

Given : ABCD is a rhombus and four circles are drawn on the sides AB, BC, CD and DA as diameters. Diagonal AC and BD intersect each other at O.

To Prove : The four crcles intersect each other at O.

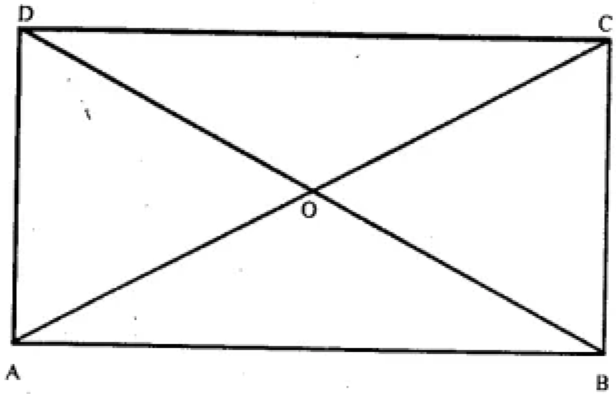


Question 21.

Solution:

Given: ABCD is a rectangle whose diagonals AC and BD intersect each other at O.

To prove : O is the centre of the circle passing through A, B, C and D



∴ AO = OC and BO = OD

∴ The diagonals of a rectangle are equal

∴ OA = OB = OC = OD

Hence O is the centre of the circle passing through A, B, C and D.

Question 22.

Solution:

Construction.

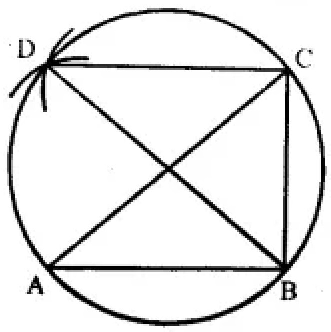
(i) Let A, B and C are three points

(ii) With A as centre and BC as radius draw an arc

(iii) With centre C, and radius AB, draw another arc which intersects the first arc at D.

D is the required point.

Join BD and CD, AC and BA and CB



Proof : In Δ ABC and Δ DBC,

BC = BC (common)

AC = BD (const.)

AB = DC

∴ Δ ABC ≅ Δ DBC (SSS axiom)

∴ ∠BAC ≅ ∠BDC (c.p.c.t.)

But these are angles on the same sides of BC

Hence these are angles in the same segment of a circle

A, B, C, D are concyclic Hence D lies on the circle passing througtvA, B and C.

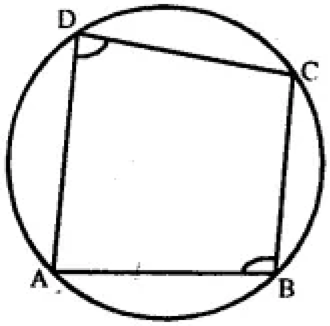
Hence proved.

Question 23.

Solution:

Given : ABCD is a cylic quadrilateral (∠B – ∠D) = 60°

To prove : The small angle of the quad, is 60°



Proof : ∵ ABCD is a cylic quadrilateral

∴ $\angle B + \angle D = 180^\circ$

But $\angle B - \angle D = 60^\circ$ (given)

Adding we get,

$2\angle B = 240^\circ \Rightarrow \angle B = \frac{240^\circ}{2} = 120^\circ$

and subtracting, we get

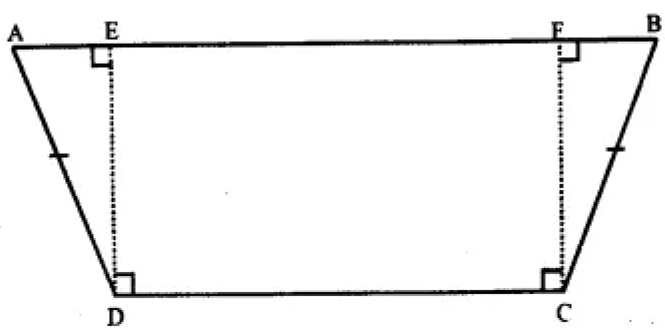
$2\angle D = 120^\circ$

$\Rightarrow \angle D = \frac{120^\circ}{2} = 60^\circ$

Hence smaller $\angle D = 60^\circ$

Hence proved.

Question 24.



Solution:

Given : ABCD is a quadrilateral in which AD = BC and ∠ ADC = ∠BCD

To prove : A, B, C and D lie on a circle

Const. Draw DE and CF $\perp$s on AB

Proof : $\because$ DE $\perp$ AB and CF $\perp$ AB

$\therefore \quad \angle EDC = \angle FCD = 90^\circ$

But $\angle ADC = \angle BCD$ (given)

$\therefore \angle ADC - \angle EDC = \angle BCD - \angle FCD$

$\Rightarrow \quad \angle ADE = \angle BCF$

Now in Δ ADE and Δ BCF

AD = BC (given)

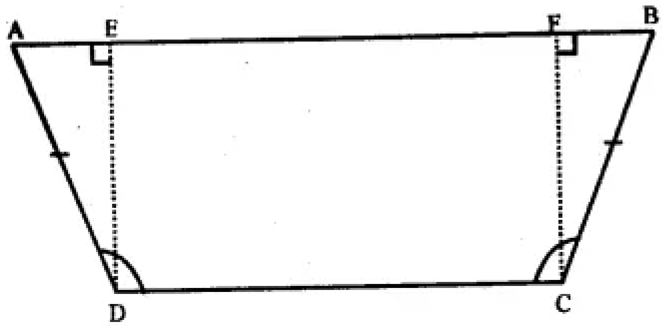
$\angle ADE = \angle BCF$ (proved)

$\angle AED = \angle BFC$ (each 90°)

$\therefore \Delta ADE \cong \Delta BCF$ (A.A.S. axiom)

$\therefore \angle A = \angle B$

But $\angle A + \angle B + \angle C + \angle D = 360^\circ$
(Angles of a quad.)



$\Rightarrow \angle A + \angle A + \angle C + \angle C = 360^\circ$

$\Rightarrow 2\angle A + 2\angle C = 360^\circ$

$\Rightarrow 2(\angle A + \angle C) = 360^\circ$

$\Rightarrow \angle A + \angle C = \frac{360^\circ}{2} = 180^\circ$

But these are the sum of opposite angles of a quad.

$\therefore$ ABCD is a cyclic quadrilateral.

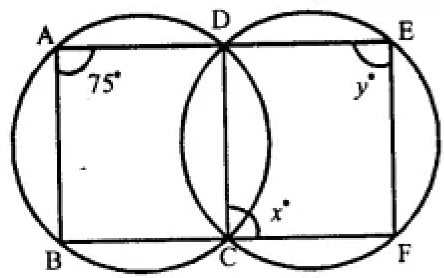
Hence proved.

Question 25.

Solution:

Given : In the figure, two circles intersect each other at D and C

$\angle BAD = 75^\circ$, $\angle DCF = x^\circ$ and $\angle DEF = y^\circ$



To find. x and y

Solution. In cyclic quad. ABCD.

Ext. DCF = $\angle$BAD (Ext. angle of a cyclic quad. is equal to its interior opposite angle)

$\Rightarrow \quad 75^o = x^o$

$\therefore \quad x = 75^o$

Again, in cyclic quad. CFED,

$\angle DCF + \angle DEF = 180^o$

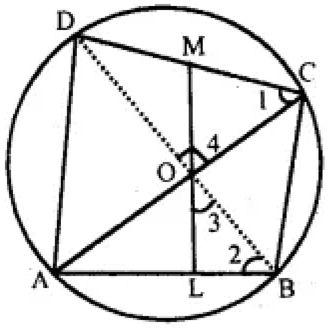
(opposite angles of a cyclic quad.)

Question 26.

Solution:

Given : ABCD is a cyclic quadrilateral whose diagonals AC and BD intersect at O at right angle.

From O, $OL \perp AB$ which meets DC at M when produced.



To Prove : M is the midpoint of DC.

Proof : $\angle 1 = \angle 2$

(Angles in the same segment)

$\because \quad \angle L = 90^\circ$ (given $OL \perp AB$)

$\therefore \quad \angle 2 + \angle 3 = 90^\circ$ ...(i)

$\because \quad \angle 3 + \angle BOC + \angle 4 = 180^\circ$

$\Rightarrow \quad \angle 3 + \angle 4 + 90^\circ = 180^\circ$

($AC \perp BD$)

$\Rightarrow \quad \angle 3 + \angle 4 = 180^\circ - 90^\circ = 90^\circ$ ...(ii)

from (i) and (ii)

$\therefore \quad \angle 2 + \angle 3 = \angle 3 + \angle 4$

$\Rightarrow \quad \angle 2 = \angle 4$

But $\angle 1 = \angle 2$ (proved)

$\therefore \quad \angle 1 = \angle 4$

Now in ΔOCM

$\because \quad \angle 1 = \angle 4$

$\therefore \quad OM = CM$ ...(iii)

Similarly, we can prove that

OM = MD ...(iv)

from (iii) and (iv)

CM = MD

Hence M is the midpoint of CD.

Hence proved.

Question 27.

Solution:

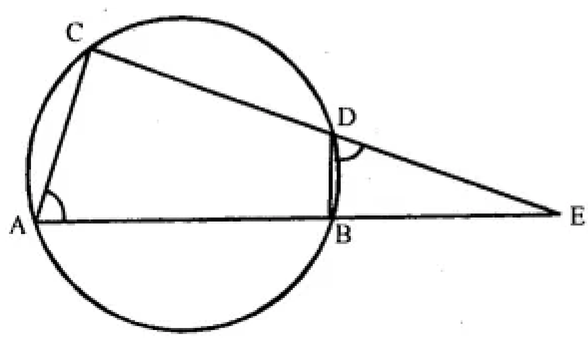
In a circle, two chords AB and CD intersect each other at E when produced.

AD and BC are joined.

To Prove : $\Delta EDB \cong \Delta EAC$

Proof : In ΔEDB and ΔEAC

$\angle E = \angle E$ (common)



$\angle EDB = \angle EAC$ (Ext. angle of a cyclic quad. is equal to with interior opposite angles)

$\therefore \quad \Delta EDB \cong \Delta EAD$ (A.A. axiom)

Hence proved.

Question 28.

Solution:

Given : Two parallel chords AB and CD of a circle BD and AC are joined and produced to meet at E.

To Prove : Δ AEB is an isosceles.

Proof : ABDC is a cylic quadrilateral.

$\therefore$ Ext. $\angle$EDC = $\angle$A (Ext. angle of a cyclid quad. is equal to its interior opposite angle)

But AB || CD (given)

$\angle$EDC = $\angle$B (corresponding angles)

$\therefore$ $\angle$A = $\angle$B

$\therefore$ EB = EA (opposite to equal angles)

Hence Δ AEB is an isosceles.

Hence proved.

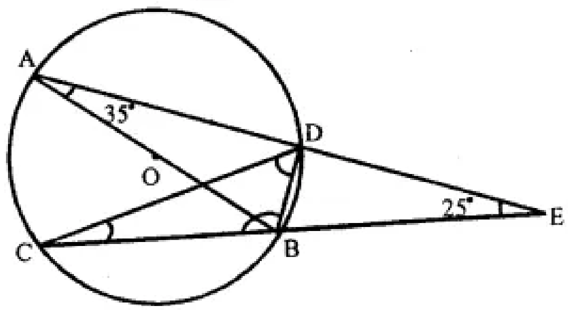
Question 29.

Solution:

Given : In a circle with centre O, AB is its diameter. ADE and CBE are lines meeting at E such that $\angle$BAD = 35° and $\angle$BED = 25°.

To Find : (i) $\angle$DBC (ii) $\angle$DCB (iii) $\angle$BDC

Solution. Join BD and AC,



$\angle DAB = \angle DCB$ (Angles in the same segment of a circle)

$\therefore \angle DCB = 35^\circ$ ($\because \angle DAB = 35^\circ$)

$\because \angle ADB = 90^\circ$ (Angle in a semicircle)

$\therefore \angle EDB = 90^\circ$

But $\angle EDB + \angle DEB + \angle EBD = 180^\circ$ (Angles of a triangle)

$\Rightarrow 90^\circ + 25^\circ + \angle EBD = 180^\circ$

$\Rightarrow 115^\circ + \angle EBD = 180^\circ \Rightarrow \angle EBD = 180^\circ - 115^\circ = 65^\circ$

But $\angle DBC + \angle EBD = 180^\circ$ (Linear pair)

$\Rightarrow \angle DBC + 65^\circ = 180^\circ \Rightarrow \angle DBC = 180^\circ - 65^\circ = 115^\circ$

Now in ΔBDC,

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

$\Rightarrow 35^\circ + 115^\circ + \angle BDC = 180^\circ \Rightarrow 150^\circ + \angle BDC = 180^\circ$

$\Rightarrow \angle BDC = 180^\circ - 150^\circ = 30^\circ$

Hence $\angle DBC = 115^\circ$, $\angle DCB = 35^\circ$ and $\angle BDC = 30^\circ$

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He was born on January 2, 1946 in a village of Delhi. He graduated from Kirori Mal College, University of Delhi. After completing his M.Sc. in Mathematics in 1969, he joined N.A.S. College, Meerut, as a lecturer. In 1976, he was awarded a fellowship for 3 years and joined the University of Delhi for his Ph.D. Thereafter, he was promoted as a reader in N.A.S. College, Meerut. In 1999, he joined M.M.H. College, Ghaziabad, as a reader and took voluntary retirement in 2003. He has authored more than 75 titles ranging from Nursery to M. Sc. He has also written books for competitive examinations right from the clerical grade to the I.A.S. level.

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