# CIRCLES - CHAPTER- 12

## EXERCISE 12A

**ANSWER1** (by fig1)
Let the length of the chord be 16cm. AB
Radius of circle be 10cm
Then, OA = 10, from O draw OL⊥AB.
we know that perpendicular from the centre of a circle
to a chord bisects the chord.

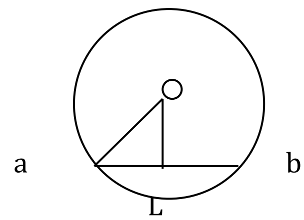


Fig1

$\therefore AL = \frac{1}{2}AB = \left(\frac{1}{2} \times 16\right) = 8cm$

Because, the angle subtended by arc of a circle at the centre is double the angle subtended by it at any point on the remaining part of the circle.

From, △OLA
$OA^2 = OL^2 + AL^2$
$\Rightarrow OL^2 = OA^2 - AL^2 = [(10)^2 - (8)^2] = 100-64$
$= 36$
$OL = \sqrt{36} = 6cm$

**ANSWER2** (by fig1)
Given , distance centre from chord is 3cm. radius is given 5cm.
Then, in △AOL
$OA^2 = OL^2 + AL^2$
$(5)^2 = (3)^2 + AL^2$
$AL^2 = 25-9 = 16$
$AL = \sqrt{16} = 4cm$
Hence, length of the chord be calculated and, OL⊥AB , AL= LB
AB = AL +LB = 4 +4 = 8cm

**ANSWER3** (by fig1.)
Given, length of the chord = 30cm
Then, OA = 30, from O draw OL⊥AB.
we know that perpendicular from the centre of a circle
to a chord bisects the chord.
As we know the angle subtended by arc of a circle at the centre is double the angle subtended by it at any point on the remaining part of the circle.

$$AL = \frac{1}{2}AB = \frac{1}{2} \times 30 = 15cm$$

And the distance from centre to the chord be 8cm
Then, in △AOL
$OA^2 = OL^2 + AL^2$
$OA^2 = (15)^2 + (8)^2$
$OA^2 = 225 + 64 = 289$
$OA = \sqrt{289} = 17cm$

**ANSWER4**

Given, radius = 5cm

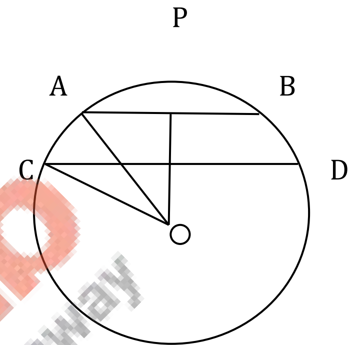
AB and CD are 2 parallel cords AB= 8cm, CD= 6cm

(i) Same side of the centre

Since, OP⊥AB , OQ⊥CD and AB∥CD,

The points O, P, Q are collinear.

As we know the angle subtended by arc of a circle at the centre is double the angle subtended by it at any point on the remaining part of the circle.




Bisects the chord on perpendicular lines

$\therefore AP = \frac{1}{2}AB = \frac{1}{2} \text{ x } 8 = 4cm$

And, $CQ = \frac{1}{2}CD = \frac{1}{2} \text{ x } 6 = 3cm$

Join OA and OC.

Then, OA = OC = 5cm

In △OPA , we have

$OP^2 = OA^2 - AP^2 = [(5)^2 - (4)^2] = 9$

$OP = \sqrt{9} = 3cm$

From △OQC, we have

$OQ^2 = OC^2 - CQ^2 = [(5)^2 - (3)^2] = 16$

$OQ = \sqrt{16} = 4cm$

∴ PQ = OP –OQ = 4-3 = 1cm

(ii) We know that ⊥ from the centre of a circle to a chord bisects the chord.

As we know the angle subtended by arc of a circle at the centre is double the angle subtended by it at any point on the remaining part of the circle.

$\therefore AP = \frac{1}{2}AB = \frac{1}{2} \text{ x } 8 = 4\text{cm}$

$CQ = \frac{1}{2}CD = \frac{1}{2} \text{ x } 6 = 3cm$

Join OA and OC

Then, OA = OC = 5cm

From the right – angles △OPA , we have

$OP^2 = OA^2 + AP^2 = [(5)^2 + (4)^2] = 9cm^2$

OP = 3cm

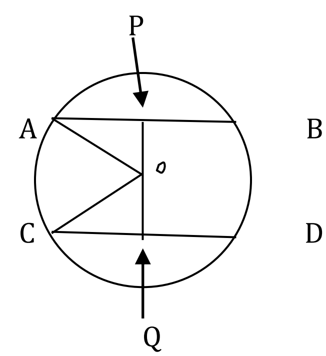
From the right angled △OCQ, we have

$OQ^2 = OC^2 - CQ^2 = [5^2 - 3^2] = 16cm^2$

OQ = 4cm

Since, OP⊥AB, OQ⊥CD and AB∥CD, the points P,O,Q are collinear.

$\therefore \; PQ = OP + OQ = (3 + 4) = 7cm$




**ANSWER5**

Given,let AB= 30 and CD= 16cm . and radius = 17cm

We know that ⊥ from the centre of a circle to a chord bisects the chord.

As we know the angle subtended by arc of a circle at the centre is double the angle subtended by it at any point on the remaining part of the circle.

$$\therefore AP = \frac{1}{2}AB = \frac{1}{2}\text{x}30 = 15\text{cm}$$

$$CQ = \frac{1}{2}CD = \frac{1}{2}\text{x}16 = 8cm$$

Join OA and OC

Then, OA = OC = 17cm

From the right – angles △OPA , we have

$$OP^2 = OA^2 + AP^2 = [(17)^2 + (15)^2] = 64cm^2$$

OP = 8cm

From the right angled △OCQ, we have

$$OQ^2 = OC^2 - CQ^2 = [17^2 - 8^2] = 225cm^2$$

OQ = 15cm

Since, OP⊥AB, OQ⊥CD and AB∥CD, the points P,O,Q are collinear.

$$\therefore \; PQ = OP + OQ = (8 + 15) = 23cm$$

**ANSWER6**

Given, CD is diameter of a circle with centre O. OE⊥AB , AB= 12cm and CE= 3cm

If diameter of circle is CD then radius is OC (by fig)

As we know the angle subtended by arc of a circle at the centre is double the angle subtended by it at any point on the remaining part of the circle.

$$AE = \frac{1}{2}AB = \frac{1}{2}\text{ x }12 = 6\text{cm}$$

Let OC = OA = r²

Then , in △AOE

$$OA^2 = AE^2 + OE^2 = [(6)^2 + (r-3)^2]$$
$$r^2 = 36 + r^2 - 6r + 9$$
$$6r = 36 + 9 = 45$$
$$r = 7.5cm$$

**ANSWER7**

Given, CD is diameter of a circle with centre O. OE⊥CD , CE=ED=8cm, and EB= 4cm

If diameter of circle is CD then radius is OC (by fig)

$$CE = 8\text{cm}$$

Let OD = OB = r²

Then , in △AOE

$$OD^2 = OE^2 + ED^2 = [(r-4)^2 + (8)^2]$$
$$r^2 = r^2 - 8r + 16 + 64$$
$$8r = 16 + 64 = 80$$
$$r = 8cm$$

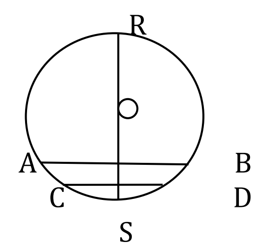
**ANSWER8**
Given, OD⊥AB, BC is diameter , so radius is OB=OC,
Here, AD=DB meANSWER D is mid point of AB
And O is midpoint of BC
Join AC
In △ABC
D is mid point of AB, and O is midpoint of BC

∴ AC∥OD and DO = $\frac{1}{2}AC$

Hence , $AC = 2$ x $AC$

**ANSWER9**
Given, 2 chords AB and CD intersect each other at P. PO bisects ∠BPD
Let, draw OE ⊥AB and OF⊥CD
Now, DC= DF +FC , ∴ DF = FC
And AB = EB + EA ∴ AE = EB
P is intersecting point
So, ∠OEP= ∠OFP = 90°
Also, OP = OP , ∠OPE =∠OPF
Hence, $\Delta OEP \cong \Delta OFP$ , and hence $OE = OF$
Also, chords which are equidistant from the centre are equal
Hence, AB = CD

**ANSWER10**
Let the chords of the circle be AB and CD and both are parallel with centre O.
Let ROS be the diameter of the circle. Such that ∠REB = 90°
Then, ∠REB=∠RFD = 90° [ corresponding angles]
Thus, we can say that
RF⊥CD , and so, OF⊥CD
Hence, ⇒ CF= FD




**ANSWER11**
Let suppose 2 different circles intersect at three points A, B, C . then, these points are not collinear.
They cant fall on same line of bisection.
So, we have create unique circle to pass through above points . so these statement is contradict.
Hence, 2 different circles cannot intersect each other at more than 2 points.

**ANSWER12**
Given,
Radius of 1st circle is 10cm and 2nd circle be 8cm. chord length = 12cm for both of circle.

So, AO = 10cm and AO’ = 8cm
Here, D is midpoint of chord 12cm
AD=DB ,
As we know the angle subtended by arc of a circle at the centre is double the angle subtended by it at any point on the remaining part of the circle.

$$AD = \frac{1}{2}AB = \frac{1}{2} \text{ x } 12 = 6cm$$

In △AOD,

$$AO^2 = OD^2 + AD^2$$
$$OD^2 = AO^2 - AD^2$$
$$OD^2 = [10^2 - 6^2] = 100 - 36 = 64$$
$$OD = \sqrt{64} = 8cm$$

In △AO’D

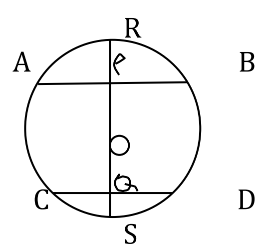
$$AO'^2 = O'D^2 + AD^2$$
$$O'D^2 = AO'^2 - AD^2$$
$$O'D^2 = [8^2 - 6^2] = 64 - 36 = 28$$
$$O'D = \sqrt{28} = 2\sqrt{7}cm$$

Hence, the distance between centre
OO’ = OD + DO’ = (8+ 2√7) cm

**ANSWER13**
Given,
Equal circles intersect at P and Q.
P is straight line meets the circles in A and B.
Join PQ,
So, PQ is common chord for both circles.
So, arc PDQ = arc PCQ
QP⊥AB (by fig)
Hence, ∠QAP=∠QBP

$$AQ = QB$$

**ANSWER14**
Let the chord of the circles be AB and CD with center O.
Suppose the diameter of the circle be ROS bisects them at P and Q.
Then the distance OP = OQ
As , OP⊥AB and OQ⊥CD
Thus, ∠APQ = ∠PQD ⇒ AB∥CD.




**ANSWER15** given,
Radius of bigger circle 5cm and smaller one 3cm.
Join PA ,

$$AB = (5 - 3) = 2cm$$

So, acc to fig,

PQ⊥AB, As we know the angle subtended by arc of a circle at the centre is double the angle subtended by it at any point on the remaining part of the circle.

$$AL = \frac{1}{2}AB = \frac{1}{2} \text{ x } 2 = 1cm$$

In △PAL

$$PA^2 = PL^2 + AL^2$$
$$PL^2 = PA^2 - AL^2 = [5^2 - 1^2]$$
$$PL = \sqrt{25-1} = \sqrt{24} = 2\sqrt{6}$$

So, $PL = 2 \text{ x } PL = 2\text{x}2\sqrt{6} = 4\sqrt{6}$

**ANSWER16**

Given, BC= OB , ∠ACD= y° , ∠AOD = x°
If OB = OC , Then ∠BOC = ∠BCO = y°
In △ OBC
∠OBC=∠BOC+∠OCB
= y° + y° = 2y°
As fig , OA = OB (radius of circle)
∠OAC = ∠OBC = 2y°
Then, acc to theorem,
If one side of a triangle is produced then the exterior angle so formed is equal to the sum of the two interior opposite angles.
∠AOD = ∠OAC + ∠ACO
= ∠OAB + ∠BCO
x°= y° + 2y° = 3y°

**ANSWER17**

given, radius be r such that AB = 2AC
let AC = x. then AB = 2x .
acc to fig, OL⊥AB and OM⊥AC.
Then, OL = p ,OM = q and OA = r.
As we know the angle subtended by arc of a circle at the centre is double the angle subtended by it at any point on the remaining part of the circle.

Also, $AM = \frac{1}{2}AC = \frac{x}{2}$ and $AL = \frac{1}{2}AB = x$

In △AOL

$$OA^2 = OL^2 + AL^2$$
$$r^2 = p^2 + x^2$$

In △AOM

$$OA^2 = OM^2 + AM^2$$
$$r^2 = q^2 + (\frac{x}{2})^2$$

$$\therefore \quad q^2 = r^2 - \frac{x^2}{4}$$
$$4q^2 = 4r^2 - x^2$$
$$\Rightarrow 4q^2 = 4r^2 - (r^2 - p^2)$$
$$\text{Hence, } 4q^2 = 3r^2 + p^2$$

**ANSWER18**
Given , AB= AC , OP⊥AB and OQ⊥AC,
From centre O, OP = OQ (radius)
As given 2 chords AB and AC
Then, $AB = AC$

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

Also, ∠PMB =∠QNC = 90°
Equal chords are equidistance from the centre ⇒ OM =ON
As we know
OP = OQ ⇒ OP – OM = OQ – ON
⇒ PM = QN
$\therefore \Delta MPB \cong \Delta NQC$
⇒ PB = QC

**ANSWER19**
Given, AB∥AC
Q and P is midpoint of both the chords CD and AB resp.
If Draw OQ⊥CD and OP⊥AB, then
In $\Delta OPB \cong \Delta OQC$
Here, ∠OBP=∠OCP
OB = OC = r (radius)
∠OPB = ∠OQC = 90°
∴ OP = OQ
But, the chords equidistance from the centre are equal
Hence, AB =CD

**ANSWER20**
Let suppose we make equilateral △ of sides 9cm.
So. AD be the median of the △
Then, AD⊥BC and
As D is midpoint of the chord BC
$BD = \frac{1}{2}BC = \frac{1}{2}$ x 9 $= 4.5cm$

In △ABD

$$AB^2 = AD^2 + BD^2$$
$$AD^2 = AB^2 - BD^2$$

$$AD^2 = \left[9^2 - \left(\frac{9}{2}\right)^2\right] = \frac{243}{4}$$

$AD = \sqrt{\frac{243}{4}} = \frac{9\sqrt{3}}{2}$cm

In an equilateral △ the centroid and circumcentre coincide and AG:GD = 2:1
As we know the angle subtended by arc of a circle at the centre is double the angle subtended by it at any point on the remaining part of the circle.

∴ radius $AG = \frac{2}{3}AG = \left(\frac{2}{3} \text{x} \frac{9\sqrt{3}}{2}\right) = 3\sqrt{3}cm$

**ANSWER21**
given
AB = AC are equal chords with centre O.
Lets join OC, OB, OA
In $\Delta OAB \cong OAC$
OA =OA
AB= AC (given)
OB=OC = r
Hence, ∠OAB = ∠OAC

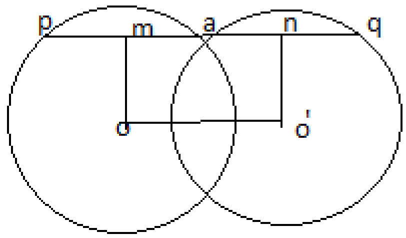
**ANSWER22**
Join OX and OY , so we get r = OX = OY

$\Delta OXP \cong OYR$

∴ OP = OR,
OX= OY = r
∠OPX = ∠ORY = 90°

⇒ PX = RY ⇒ PQ – PX = QR – RY [PQ = QR]
⇒ QX = QY

**ANSWER23**




Draw OM⊥PQ and O'N⊥PQ . then
OM⊥ chord PA
So, PM = MA
⇒ PM = 2PM = 2MA
Similarly, AQ = 2AN.
∴ $PQ = PA + AQ = 2MA + 2AN$
$2(MA + AN) = 2MN$
$= 2OO'$

# EXERCISE 12B

**ANSWER1**

(i) Given O is the centre

AO = OC , ∠BAO = 40° , ∠OCB = 30°

Join OB

Here, OA =OB

Then, ∠BAO =∠OBA= 40°

Also, OC =OB

∠OCB =∠BCO = 30°

∴ ∠ABC =∠ABO +∠OBC

= (40° + 30°) = 70°

Now, ∠AOC = 2∠ABC = 2x70 = 140°

(ii) Given,

∠AOB =90° , ∠AOC = 110°

Here, OB = OC = OA (radius)

As we know sum of all angles of circle be 360°

Then, by adding angles.

∠AOB +∠AOC +∠BOC = 360

90° + 110° + ∠BOC = 360°

∠BOC = 360 – 110 – 90

∠BOC = 160°

Hence, ∠BAC = $\frac{1}{2}\angle BOC = \frac{1}{2}$x160 = 80°

**ANSWER2**

Given,

∠AOB = 70°

As we know that exterior angle is equal some of 2 angles then.

∠AOB = ∠OCA +∠OAC

⇒ OA = OC (radius)

∴ ∠OCA = ∠OAC

We can calculate, the angle subtended by arc of a circle at the centre is double the angle subtended by it at any point on the remaining part of the circle.

$$\angle OCA = \frac{1}{2}\angle AOB = \frac{1}{2}\text{x}70 = 35°$$

Hence, ∠OCA = ∠OAC = 35°

**ANSWER3**

Given, O is the centre

∠APB = 110° , ∠PBC = 25°

In liner APC ,

180 = ∠APB + ∠BPC

∠BPC = 180 – 110 = 70°

So, ∠ACB = ∠PCB
Then, In △CPB
∠PCB = 180 - ∠PCB - ∠PBC
∠PCB = 180 – 25 -70 = 85°
Hence, ∠PCB = ∠ACB
Angle with same segment .
∠ACB = ∠ADB = 85°

**ANSWER4**
Given, o is centre of the circle.
∠ABD= 35° , ∠BAC =70°
By fig, AD⊥AB, ∠A = 90°
Then, In △ADB
∠DAB + ∠ADB + ∠DBA = 180°
90° + ∠ADB + 35° = 180°
∠ADB = 180 − 90 − 35 = 55°
Angle with same segment
∠ADB = ∠ACB = 55°

**ANSWER5**
Given, O is the centre of the circle.
∠ACB = 50°
So, ∠AOB = 2 x ∠ACB = 2x50 = 100°
Then, let the radius be r ,
On the same segment ∠OAB = ∠OBA = r°
In △AOB
∠OAB + ∠OBA + ∠AOB = 180°
r + r + 100 = 180
2r = 180-100= 80
r = $\frac{80}{2}$ = 40°

**ANSWER6**
Given, ∠ABD = 45° , ∠BCD = 43°
(i) As we know that angle on same segment are equals
So, on chord AD
∠ABD = ∠ACD = 54°
(ii) On chord BD
∠DCB = ∠BAD = 43°
(iii) In △ABD
∠BAD= ∠ 43° , ∠ABD = 54°
Sum of all the angles be 180°
∠BAD +∠ABD+∠ADB = 180
54 + 43 + ∠ADB = 180
∠ADB = 180 – 54 – 43
∠ADB = 83 °

**ANSWER7**

Given , AC∥DE , ∠CBD = 60°

On same line segment chord CD

∠DBC = ∠DAC = 60°

And ∠ADC = 90° angle is in semi circle.

In △ADC

As we know that sum of all the angles in the triangle 180

∠ADC +∠DAC +∠ACD = 180°

∠ADC +60+ 90 = 180

∠ADC= 180-60-90

Hence, ∠ADC = 30°

**ANSWER8**

Given, AB∥CD, ∠ABC = 25°

Draw joining line OC and OD

Here, ∠ABC = ∠BCD = 25°……..[alternative int. angles ]

Then, arc BD makes ∠BOD at the centre and ∠BCD at a point on the circle.

∠BOD =2∠BCD = 50°

Similary,

∠AOC = 2∠ABC = 50°

In liner segment AOB

Sum of all the angles on the line segment is 180°

Then,

∠AOC +∠COD +∠BOD = 180°

∠COD + 50 +50 = 180

∠COD = 180 – 50-50 = 80°

Hence, similarly ∠CED = $\frac{1}{2}$ ∠$COD$ = 40°

**ANSWER9**

Given, ∠AOC = 80° , ∠CDE = 40°

(i) In △CDE

Here, ∠CDE= 90°……… [with in semicircle make angle at 90°]

So, ∠CDE +∠EDC +∠DCE = 180

∠DCE = 180 – 90- 40 = 50°

Hence, ∠DCE =50°

(ii) In line segment AOB

∠BOC = 180 - ∠AOC

∠BOC = 180 – 80 = 100°

So, in △BOC

∠BOC +∠CBO+∠OCB = 180°

∠CBO = 180 - ∠BOC - ∠OCB

∠CBO = 180 – 50 – 100 = 40°

Hence, ∠ABC = ∠CBO = 30°

**ANSWER10**

Given,

∠AOB = 40° , ∠BDC = 100°

Here, ∠ACB = $\frac{1}{2}\angle AOB = \frac{1}{2}$x40 $= 20°$

So, in △DBC

∠DCB +∠DBC +∠CDB = 180°

∠DCB = 180 - ∠DBC +∠CDB

∠DCB = 180 – 100 – 20 = 60°

Hence, ∠DCB = 60°

**ANSWER11**

Given ∠OAB = 25°

Join OB we get radius of circle is same

OB = OA and ∠OAB = ∠OBA = 25°

Then, In △AOB

∠AOB +∠OAB +∠ABO = 180°

∠AOB + 25 +25 = 180°

∠AOB = 180 – 25 – 25

∠AOB = 130°

As we know the angle subtended by arc of a circle at the centre is double the angle subtended by it at any point on the remaining part of the circle.

Then, ∠ACB = $\frac{1}{2}\angle AOB = \frac{1}{2}$x130 $= 65°$

In △EBC

So, ∠CEB = 90°……..[by fig]

∠CEB +∠ECB +∠CEB = 180

∠EBC + 90 + 65 = 180°

∠EBC = 180 – 90 -65

∠EBC = 25°

**ANSWER12**

Given , ∠OAB = 20°, ∠OCB = 55°

(i) As we know that equal chords of a circles subtend equal angles at the centre

Here, OC = OB (radius) and ∠OCB = ∠OBC = 55°

In △OCB

∠OCB +∠OBC +∠BOC = 180°

55° + 55° + ∠BOC = 180°

∠BOC = 180° - 55 – 55 = 70°

(ii) In △AOB

OA = OB and ∠OAB = ∠OBA

Sum of all the angles is 180°

∠AOB +∠OAB +∠OBA = 180°

∠AOB + 20 + 20 = 180

∠AOB = 180 – 20-20 = 140°

And ∠AOB = ∠BOC + ∠AOC

∠AOC = ∠AOB - ∠BOC = 140 – 70

Hence, ∠AOC = 70°

**ANSWER13**
Given ∠BCO = 30°
And by fig, ∠AOD = ∠OEC = 90°…[ corresponding angles]
OD∥BC , OC is trANSWERversal
∠DOC = ∠OCE = 30°…..[alternative int angles]
As we know the angle subtended by arc of a circle at the centre is double the angle subtended by it at any point on the remaining part of the circle.
Then, $\angle CBD = \frac{1}{2}\angle COD = \frac{1}{2}$ x 30 $= 15°$
Hence, y = 15° centre
∠AOD = 90° (given)
And $\angle ABC = \frac{1}{2}\angle AOD = \frac{1}{2}$x90 $= 45°$
In △ABE
∠A+∠B+∠E = 180°
∠A = 180 -∠B - ∠E
∠A = 180 -90-(45+y°) = 180 – 90 – (45 +15)
∠A= 180 – 90 – 60 = 30°
Hence, ∠A = x= 30°

**ANSWER14**
Given, BD = OD , CD⊥AB
Join CA
By fig, BD = OD and OD = OB (radius of circle)
BD = OD = OB ….. [equilateral triangle]
Sum of angles will be 180° in equilateral so, each angles is divided into 60°
In △DBO
∠DBO = ∠BDO = ∠BOD = 60°
Since altitudes of an angle of an equilateral △ bisects the vertical angle
So, ∠BDE =∠ODE = 30°
Angles on the segment will be equal , on segment of CB
∠CAB = ∠CDB = 30°

**ANSWER15**
Given PQ is diameter . ∠PQR =65° , ∠SPR =40° , ∠PQM = 50°
In △QPR , ∠QRP = 90° …………..[angle in the semicircle is right angle]
∠QRP+∠QPR+∠PQR = 180°
∠QPR = 180 -∠QRP - ∠PQR
∠QPR = 180 – 65 – 90
Hence, ∠QPR = 25°
⇒∠QPR = ∠PRS = 25°…..[alternative int angles]
Similarly, △QPM
∠QPM +∠PMQ +∠PQM = 180°
∠QPM + 50 + 90 = 180
∠QPM = 180-50-90 = 40°
Hence, ∠QPM = 40°

**ANSWER16**

Given, ∠APB = 150° , join BC which is common chord of the angles

As we know the angle subtended by arc of a circle at the centre is double the angle subtended by it at any point on the remaining part of the circle.

$\therefore \angle ACB = \frac{1}{2}\angle APB = \frac{1}{2}$x150 $= 75°$

In linear segment ACD

∠ACB +∠CBD = 180°

∠CBD = 180 - ∠ACB

∠CBD = 180 – 75 = 105°

Similarly, in second circle

∠BCD = $\frac{1}{2}$reflex ∠BQD .........[angle made by the major arc BFD at the centre 2∠BCD]

105° = $\frac{1}{2}$(360-x)

⇒ 210° = 360- x°

⇒ x° = 360-210 = 150°

**ANSWER17**

Given , ∠BAC= 30°

As we know the angle subtended by arc of a circle at the centre is double the angle subtended by it at any point on the remaining part of the circle.

$$\angle BOC = 2\angle ABC = 2\text{x}30 = 60°$$

Here, OB = OC is radius of the circle

Then, from above in △OBC

Since, OB = OC (radius)

∠OBC = ∠OCB

Sum of all the angles is 180°

∠OBC +∠OCB +∠BOC = 180°

∠OBC + ∠OBC = 180 - ∠BOC

2∠OBC = 180 – 60 = 120

∠OBC = 120/2 = 60°

Hence, △OBC is equilateral △ then, all the sides are equal too

BC is equal to radius of the circumcircle.

**ANSWER18**

Join AC, BC , BD

Given AB is the chord ,

And angle subtended by an arc CXA = ∠AOC , Angle subtended by arc DYB = ∠DOB

As we know the angle made by an arc at the centre is twice the angle made by this arc at a point on the remaining part of the circle.

∠AOC = 2∠ABC ..........(1)

Similarly , ∠DOB = 2∠DCB .......(2)

Adding both equation

∴ ∠AOC +∠DOB = 2∠ABC + 2∠DCB = 2∠AEC

Hence, ∠AEC = $\frac{1}{2}(\angle AOC + \angle DOB)$

# EXERCISE12C

**ANSWER1**

Given, ∠DBC = 60° , ∠BAC= 40°

(i) On same chord CB
∠BAC = ∠BDC = 40°
In △DBC
∠DCB +∠CBD +∠CDB = 180°
∠DCB + 40° + 60° = 180°

(ii) On same chord CD
∠CBD = ∠CAD = 60°

**ANSWER2**

Given , ∠PSR = 150°
As we know that the sum of either pair of the opposite angles of a cyclic quadrilateral is 180°
∠PSR +∠PQR = 180°
∠PQR = 180 – 150 = 30°
Here, angle in semicircle make 90°
∠PRQ = 90°
△In PQR
∠PQR +∠RPQ +∠QRP = 180°
∠RPQ + 90+30 = 180°
∠RPQ = 180 – 90 -30 = 60°

**ANSWER3**

As we know the angle subtended by arc of a circle at the centre is double the angle subtended by it at any point on the remaining part of the circle.

$$\angle PBC = \frac{1}{2}\angle AOC = \frac{1}{2}\text{x}130 = 65°$$

**ANSWER4**

Given ∠FAE = 20° , ∠ABC= 92°
As we know that the sum of either pair of the opposite angles of a cyclic quadrilateral is 180°
Then, ∠ABC + ∠ADC =180
∠ABC = 180 – 92 = 88°
So, by the fig CD∥AE ,
∠ADC = ∠ADF ………..(alt int ∠)
∠ADF = ∠ADE + ∠FAE
∠ADF = 88 + 20 = 108°
As we know that exterior angle is equal to the int opposite angles
∠BCD = ∠ADF = 108°
Hence , ∠BCD = 108°

**ANSWER5**

Given, BD = DC , ∠CBD =30°
∠CBD = ∠DCB = 30°
In △CBD

∠CBD +∠CDB +∠BCD = 180°
∠CDB + 30 +30 = 180
∠CDB = 180 -30-30 = 120°
As we know that the sum of either pair of the opposite angles of a cyclic quadrilateral is 180°
∠BAC + ∠BDC = 180°
∠BAC + 120° = 180°
Hence , ∠BAC = 180 -120 = 60°

**ANSWER6**
Given , ∠AOC = 100°
As we know the angle subtended by arc of a circle at the centre is double the angle subtended by it at any point on the remaining part of the circle.

$$\angle ADC = \frac{1}{2}\angle AOC = \frac{1}{2}\text{x}100 = 50°$$

So, As we know that the sum of either pair of the opposite angles of a cyclic quadrilateral is 180°
Then, ∠ADC +∠ABC = 180°
∠ABC = 180 - ∠ADC = 180 – 50
Hence, ∠ADC = 130°

**ANSWER7**
(i) Given △ABC is equilateral △
∴ AB= BC= AC
And ∠ABC= ∠BAC = ∠ACB = 60°
On same segment of chord BC
(ii) So, As we know that the sum of either pair of the opposite angles of a cyclic quadrilateral is 180°
∠BDC + ∠BEC = 180°
∠BEC = 180 - ∠BDC
hence ∠BEC = 180 – 60 = 120°

**ANSWER8**
Given, ∠BCD = 100° , ∠ABD = 50°
As we know that the sum of either pair of the opposite angles of a cyclic quadrilateral is 180°
∠BAD + ∠BCD = 180°
∠BAD + 100 = 180°
∠BAD = 180 – 100 = 80°
So, in △ADB
∠ADB +∠DBA +∠BAD = 180°
∠ADB + 50 + 80 = 180°
∠ADB = 180 – 50 -80
Hence, ∠ADB = 50°

**ANSWER9**
Given, ∠BOD = 150°
As we know the angle subtended by arc of a circle at the centre is double the angle subtended by it at any point on the remaining part of the circle

$$\angle DCB = \frac{1}{2}\angle DOB = \frac{1}{2}\text{x}150 = 75°$$

Hence, y° = 75

Then, As we know that the sum of either pair of the opposite angles of a cyclic quadrilateral is 180°

∠DCB +∠BAD = 180°

∠BAD + 75 = 180°

Hence, ∠BAD = 105°

**ANSWER10**

Then, As we know that the sum of either pair of the opposite angles of a cyclic quadrilateral is 180°

∠DCB +∠BAD = 180°

y + 50° = 180°

y = 180 – 50 = 130°

In equilateral △OAB

OA = OB , ∠OBA = ∠OAB = 50°

As we know that exterior angle is equal to the int opposite angles

∠BOD = 180 – (∠OAB + ∠OBA)

∠BOD = 180 – (50 + 50) = 80°

**ANSWER11**

As we know that exterior angle is equal to the int opposite angles

Then, ∠CBF = 130° (given)

Now, ∠CDE = 180 - ∠CBF

= 180 – 130= 50°

Hence , x = ∠CDE = 50°

**ANSWER12**

Given, DO ∥CB and ∠BCD = 120°

(i) As we know that the sum of either pair of the opposite angles of a cyclic quadrilateral is 180°

∠BAD = 180- ∠BCD

∠BAD = 180 – 120 = 60°

(ii) So, ∠BDA = 90°

In △ADB

∠ADB +∠BAD +∠ABD = 180°

∠ABD + 60 + 90 = 180°

∠ABD = 180 – 60-90 = 30

Hence, ∠ABD = 30°

(iii) △AOD

OA = OD ,

And ∠ODA = ∠BAD =∠OAD = 60°

In semicircle △ADB

∴ ∠ODB = 90 - ∠ODA

= 90 – 60

∠ODB = 30°

OD∥CB , DB is trANSWERversal

∠ODB = ∠CBD = 30°……………[alt int angles]

(iv) In △CBD

∠CBD +∠BDC +∠DCB = 180°

∠BDC + 120 +30 = 180°

∠BDC = 180 – 120 -30 = 30°

Then, by fig

∠ADC = ∠BDC + ∠BDA (Above values)

Hence, ∠ADC = 90 + 30 = 120°

△AOD

OA = OD (radius)

∠AOD = ∠ADO = ∠OAD = 60°

Hence, it is proved equilateral △

**ANSWER13**

As we know that AB and CD are the chords intersect at point then

AP x BP = CP x CD

(AB+BP) x BP = (CD+DP) x CD

(6+2) x 2 = (CD +2.5) x 2.5

⇒8 x 2 = 2.5CD + 6.25

⇒2.5 CD = 16 – 6.25 = 9.75

⇒CD = $\frac{9.75}{2.5} = 3.9cm$

**ANSWER14**

Given, ∠AOD = 140° , ∠CAB = 50°

(i) we know that the sum of either pair of the opposite angles of a cyclic quadrilateral is 180°

So, ∠BAC +∠BDC = 180°

∠BDC + 50 = 180°

∠BDC = 180 – 50 = 130°

Then, in line segment CDE

∠BDC + ∠EDB = 180°

∠EDB = 180 – 130 = 50°

Hence, ∠EDB = 50°

(ii) here, ∠BOD = 180 - ∠AOD (given)

∠BOD = 180 – 140 = 40°

Also, OD = OB so, the angles ∠OBD = ∠ODB

We can calculate by △ODB

∠ODB +∠OBD + ∠BOD = 180

2∠ODB + 40 = 180

2∠ODB = 180 – 40 = 140°

∠ODB = $\frac{140}{2} = 70°$

∠ODB = ∠OBD = 70°

In line segment OBE

180 = ∠OBD + ∠EBD

∠EBD= 180 - ∠OBD
Hence, ∠EBD = 180 – 70 = 110°

**ANSWER15**
Given, In △ABC
AB = AC
D is intersecting at AB and E is intersecting AC
∴ ∠CBA = ∠BCA
As we know that exterior angle is equal to the int opposite angles
And ext.∠ADE = ∠CBA = ∠BCA
Hence, ∠ADE = ∠ABC , DE∥BC

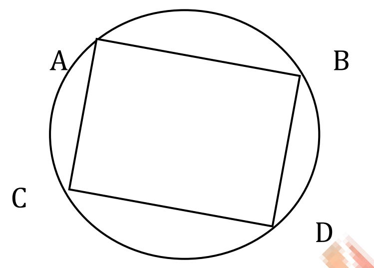
**ANSWER16**
As we know that exterior angle is equal to the int opposite angles
Ext ∠EDC = ∠A , Ext ∠DCE = ∠B
AB∥CD (given)
So, ∠A = ∠B
Hence, △AEB is isosceles
∠A = ∠B, AE = BE

**ANSWER17**
Given ∠BAD = 75°
we know that the sum of either pair of the opposite angles of a cyclic quadrilateral is 180°
then in first Quadrilateral ABCD
∠BAD + ∠BCD = 180°
∠BCD = 180 - ∠BAD
∠BCD = 180 – 75 = 105°
As we know that exterior angle is equal to the int opposite angles
Then, ∠BCD = ∠DEF = 105°
y = 105°
In line segment BCF
∠BCD + ∠DCF = 180°
⇒ ∠DCF = 180 - ∠BCD = 180 – 105 = 75°
Hence, ∠DCF = 75°
x = 75°

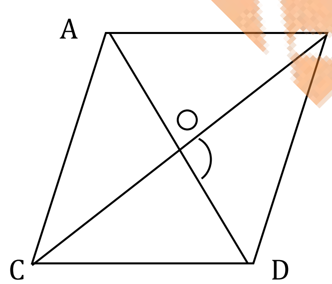
**ANSWER18**
Given , ABCD is quadrilateral AD=BC and ∠ADC = ∠BCD
Draw ⊥ lines on AB such that DE⊥AB and CF⊥AB
So, ∠DEA = ∠CFB = 90°
In △ADE and △BCF , we have
∠ADE = ∠ADC - 90°
⇒∠BCD - 90° = ∠BCF [ ∠ADC = ∠BCD ]
AD = BC
And ∠ADE = ∠BFC = 90°
∴ $\Delta ADE \cong \Delta BCF$
∠A =∠B
∴∠A+∠B +∠C+∠D = 360°

2∠B +2∠D =360 ……..[ ∠ADC = ∠BCD (Given)]
Then, ∠B +∠D = 180°
Similarly, ∠A + ∠C = 180°
Because we know that the sum of either pair of the opposite angles of a cyclic quadrilateral is 180°
Hence proved ABCD is lie on circle

**ANSWER19**
Suppose, ABCD be a cyclic quadrilaterals and O be the centre of the circle.
Then, AB ,BC, CD DA are the chords of the circle , and its bisector must pass through the centre of the circle, O .
Hence, we can say that right bisector of AB, BC , CD and DA pass through O so, it is concurrent.

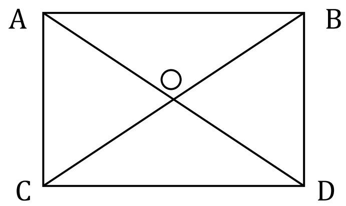



**ANSWER20**



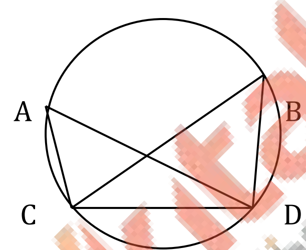

Let AD and BC is the diagonal of a rhombus ABCD intersect at O.
As we know that the diagonals of a rhombus bisects at 90° right angle ∆
So, ∠BOD = 90°
Also, ∠BOD is lies in the semicircle.
Thus, the circle drawn with BD as diameter will pass through O
Similarly, AB , CD, AC are the diameter as pass through O.

**ANSWER21**




Let O be the intersection point of the diagonals AC and BD of rect, ABCD .
Since the diagonals of a rectangles are equal and bisects each other , we have ,
OA = OB = OC = OD.
Hence, O is centre of the circle through A, B,C,D.

**ANSWER22**

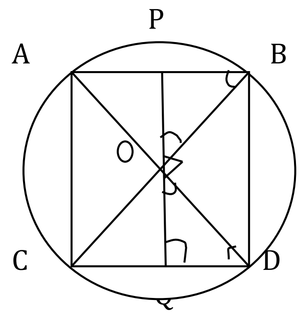



Let ACD are the given points . with the B as an center radius equal to AD draw an arc. With D as centre and CB as radius draw another arc, intersecting the previous arc at B. then B is the desired point
PROOF join AD and BC
$\Delta ADC \cong BCD \ldots \ldots [\,AC = BD\,, CB = AD\,, CD = CD]$
$\Rightarrow \angle DAC = \angle CBD$
Thus, CD subtends equal angles ∠ACD and ∠CBD on the same side of it.
∴ A , B, C, D are cyclic .

**ANSWER23**
Given, ABCD is cyclic equilateral , (∠B -∠D) = 60°
As we know that the sum of either pair of the opposite angles of a cyclic quadrilateral is 180°
∠B +∠D = 180°
∴ by solving above equation
⇒ ∠B -∠D = 60°
∠B + ∠D = 180
2∠B = 240°
∠B = $\frac{240}{2} = 120°$

And ∠D = 180 - ∠B
⇒∠D = 180 – 120 = 60°

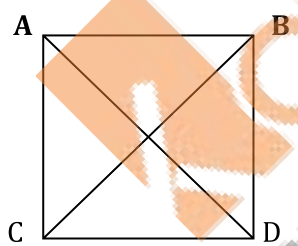
**ANSWER24**




Let ABCD is the cyclic quadrilaterals whose diagonals AC and BD intersect at O at the right angles.
Let OQ⊥CD such that OQ produced to P meet at AB chord

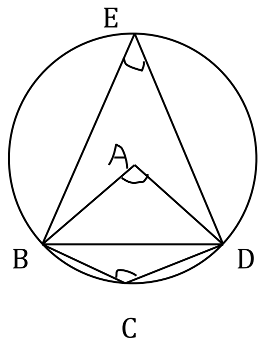
Then by fig,
We have to prove that CM = MD
Clearly, ∠CBA = ∠ADC …..[same line segment]
∠QDO + ∠DOQ = 90° [ ∵ ∠OQD = 90°]
∠QOD + ∠POB = 90° [ ∵ POQ is linear segment and ∠BOD = 90°]
∴ ∠QDO + ∠DOQ = ∠QOD + ∠POB ⇒ ∠QDO = ∠POB
Thus, , ∠CBA = ∠ADC and ∠QDO = ∠POB ⇒ ∠CBA = ∠POB
∴ OP= PB and OP = PA
Hence, PB = PA

**ANSWER25**




By fig, ∠ACB = 90° ∠ADB = 90°
As we know that the opposite angles of quadrilateral ABCD are supplementary or 180°
Then , ABCD is cyclic quadrilateral
This meANSWER circles pass through the points A, B, C, D
∴ ∠BAC = ∠BDC ……. [ angles in the same segment

**ANSWER26**




Given, ABCD is a quadrilateral such that A is the centre of the circle passing through B,C and D.
Take Point E on the circle outside arc BCD. Join BE, DE and BD
As we know the angle subtended by arc of a circle at the centre is double the angle subtended by it at any point on the remaining part of the circle
Clearly , $\angle BAD = 2\angle BED$
Now, EBCD ia cyclic quadrilateral .
$\therefore \angle BED + \angle BCD = 180°$
$\Rightarrow \angle BCD = 180° - \angle BED$
$\Rightarrow \angle BCD = 180° - \frac{1}{2}\angle BAD$ ……..[$\angle BAD = 2\angle BED$]

In $\triangle BCD$, we have
$\angle BCD + \angle CBD + \angle BDC = 180°$
$\angle CBD + \angle CDB = 180° - \angle BCD$
$= 180° - (180 - \frac{1}{2}\angle BAD) = \frac{1}{2}\angle BAD$
Hence $\angle CBD + \angle CDB = \frac{1}{2}\angle BAD$ .

# MULTIPLE-CHOICE QUESTIONS

**ANSWER 1:**

(b) 12 cm
Let PQ be the chord of the given circle with centre O and a radius of 13 cm.
Then, PQ = 10 cm and OQ = 13 cm
From O, draw OX perpendicular to PQ.
We know that the perpendicular from the centre of a circle to a chord bisects the chord.
$\therefore$ QX = $\left(\frac{10}{2}\right)$cm=5cm
From the right ΔOXQ, we have:
$OQ^2 = OX^2 + XQ^2$
$\Rightarrow 13^2 = OX^2 + 5^2$
$\Rightarrow 169 = OX^2 + 25$
$\Rightarrow OX^2 = (169 - 25) = 144$
$\Rightarrow OX = \sqrt{144}$cm=12cm
Hence, the distance of the chord from the centre is 12 cm.

**ANSWER 2:**

(c) 30 cm
Let PQ be the chord of the given circle with centre O and a radius of 17 cm.
From O, draw OX perpendicular to PQ.
Then OX = 8 cm and OQ = 17 cm
From the right ΔOXQ, we have:
$OQ^2 = OX^2 + XQ^2$
$\Rightarrow 17^2 = 8^2 + XQ^2$
$\Rightarrow 289 = 64 + XQ^2$
$\Rightarrow XQ^2 = (289 - 64) = 225$
$\Rightarrow XQ = \sqrt{225}$cm=15cm
The perpendicular from the centre of a circle to a chord bisects the chord.
$\therefore$PQ = 2 × XQ = (2 x 15) cm = 30 cm
Hence, the required length of the chord is 30 cm.

**ANSWER 3:**

(b) 45°

Since an angle in a semicircle is a right angle, ∠BAC = 90°
$\therefore$ ∠ABC + ∠ACB = 90°

Now, AB = AC (Given)
⇒ ∠ABC = ∠ACB = 45°

**ANSWER 4:**

(c) 60°
As the angle at the centre of a circle is twice the angle at any point on the remaining part of the circumference.
Thus, ∠AOB = (2 × ∠ACB) = (2 × 30°) = 60°

**ANSWER 5:**

(b) 50°
OA = OB
⇒ ∠OBA = ∠OAB = 40°
Now, ∠AOB = 180° - (40° + 40°) = 100°
$\therefore \angle ACB = \frac{1}{2}\angle AOB = (\frac{1}{2} \times 100)° = 50°$

**ANSWER 6:**

(a) 8 cm
Join OC. Then OC = radius = 17 cm
$CL = \frac{1}{2}CD = (\frac{1}{2} \times 30)cm = 15cm$
In right ΔOLC, we have:
$OL^2 = OC^2 - CL^2 = (17)^2 - (15)^2 = (289 - 225) = 64$
$\Rightarrow OL = \sqrt{64} = 8cm$
∴ Distance of CD from AB = 8 cm

**ANSWER 7:**

(b) 80°
Given: AB = CD
We know that equal chords of a circle subtend equal angles at the centre.
∴ ∠COD = ∠AOB = 80°

**ANSWER8:**

(c) 7.5 cm
Let OA = OC = $r$ cm.
Then OE = ($r$ - 3) cm and AE= $\frac{1}{2}$ AB =6cm
Now, in right ΔOAE, we have:
$OA^2 = OE^2 + AE^2$
$\Rightarrow (r)^2 = (r-3)^2 + 6^2$
$\Rightarrow r^2 = r^2 + 9 - 6r + 36$
$\Rightarrow 6r = 45$
$\Rightarrow r = \frac{45}{6} = 7.5$cm
Hence, the required radius of the circle is 7.5 cm.

**ANSWER9:**

(a) 10 cm
Let the radius of the circle be $r$ cm.
Let OD = OB = $r$ cm.
Then OE = ($r$ - 4) cm and ED = 8 cm
Now, in right ΔOED, we have:
$OD^2 = OE^2 + ED^2$
$\Rightarrow (r)^2 = (r-4)^2 + 8^2$
$\Rightarrow r^2 = r^2 + 16 - 8r + 64$
$\Rightarrow 8r = 80$
$\Rightarrow r = 10$ cm
Hence, the required radius of the circle is 10 cm.



**ANSWER 10:**

(d) 10 cm
Draw OM ⊥ AB and ON ⊥ CD.
In Δ OMB and ΔONC, we have:
OB = OC (Radius of a circle)
∠BOM = ∠CON (Vertically opposite angles)
∠OMB = ∠ONC (90° each)
∴ ΔOMB ≅ ΔONC (By AAS congruency rule)
∴ OM = ON
Chords equidistant from the centre are equal.
∴ CD = AB = 10 cm

**ANSWER 11:**

(b) 75°
OB = BC (Given)
⇒ ∠BOC = ∠BCO = 25°
Exterior ∠OBA = ∠BOC + ∠BCO = (25° + 25°) = 50°
OA = OB (Radius of a circle)
⇒ ∠OAB = ∠OBA = 50°
In Δ AOC, side CO has been produced to D.
∴ Exterior ∠AOD = ∠OAC + ∠ACO
= ∠OAB + ∠BCO
= (50° + 25°) = 75°

**ANSWER12:**

(b) 12 cm
OD ⊥ AB
i.e., D is the mid point of AB.
Also, O is the mid point of BC.
Now, in Δ BAC, D is the mid point of AB and O is the mid point of BC.
∴ OD= $\frac{1}{2}$AC (By mid point theorem)
⇒ AC = 2OD = (2 × 6) cm = 12 cm

**ANSWER13:**

(c) $3\sqrt{3}$ cm

Let ΔPQR be an equilateral triangle of side 9 cm.
Let PM be one of its mediANSWER.
Then PM ⊥ QR and QM = 4.5 cm
$\therefore PM=\sqrt{PQ^2 + OM^2} = \sqrt{81 - \frac{81}{4}} = \frac{9\sqrt{3}}{2}$ cm

Let O be the centroid of ΔPQR
Then PO : OM = 2 : 1
∴ Radius = PO = $\frac{2}{3}$PM= ($\frac{2}{3} \times \frac{9\sqrt{3}}{2}$)cm = $3\sqrt{3}$cm

**ANSWER 14:**

(c) 90°
The angle in a semicircle measures 90°.

**ANSWER 15:**

(a) equal
The angles in the same segment of a circle are equal.

**ANSWER 16:**

(c) 70°
∠BDC = ∠BAC = 60° (Angles in the same segment of a circle)
In Δ BDC, we have:
∠DBC + ∠BDC + ∠BCD = 180° (Angle sum property of a triangle)
∴ 50° + 60° + ∠BCD = 180°
⇒ ∠BCD = 180° - (50° + 60°) = (180° - 110°) = 70°

**ANSWER 17:**

(c) 60°
Angles in a semi circle measure 90°.
∴ ∠BAC = 90°
In Δ ABC, we have:
∠BAC + ∠ABC + ∠BCA = 180° (Angle sum property of a triangle)
∴ 90° + ∠ABC + 30° = 180°
⇒ ∠ABC = (180° - 120°) = 60°
∴ ∠CDA = ∠ABC = 60° (Angles in the same segment of a circle)

**ANSWER 18:**

(b) 50°
∠ODB =∠OAC = 50° (Angles in the same segment of a circle)

**ANSWER 19:**

(c) 100°
In Δ OAB, we have:
OA = OB (Radii of a circle)
⇒ ∠OAB = ∠OBA = 20°
In ΔOAC, we have:
OA = OC (Radii of a circle)
⇒ ∠OAC = ∠OCA = 30°
Now, ∠BAC = (20° + 30°) = 50°
∴ ∠BOC = (2 × ∠BAC) = (2 × 50°) = 100°

**ANSWER 20:**

(a) 85°

We have:

∠BOC + ∠BOA + ∠AOC = 360°

⇒ ∠BOC + 100° + 90° = 360°

⇒ ∠BOC = (360° - 190°) = 170°

∴ $\angle BAC=(\frac{1}{2}\times\angle BOC)=(\frac{1}{2}\times170°)=85°$

**ANSWER 21:**

(d) 65°

We have:

OA = OB (Radii of a circle)

Let ⍰ OAB = ∠ OBA = $x$°

In Δ OAB, we have:

$x$° + $x$° + 50° = 180°   (Angle sum property of a triangle)

⇒ 2$x$° = (180° - 50°) = 130°

⇒ $x=(\frac{130}{2})°=65°$

Hence, ⍰OAB = 65°

**ANSWER 22:**

(c) 30°

∠COB = 180° - 120° = 60°  (Linear pair)

Now, arc BC subtends ∠COB at the centre and ∠BDC at the point D of the remaining part of the circle.

∴ ∠COB = 2∠BDC

⇒ $\angle BDC=\frac{1}{2}\angle COB=(\frac{1}{2}\times60°)=30°$

**ANSWER 23:**

(b) 50°

We have:

OA = OB (Radii of a circle)

⇒ ∠OBA = ∠OAB = 50°

∴ ∠CDA = ∠OBA = 50°   (Angles in the same segment of  a circle)

**ANSWER 24:**

(b) 60°
We have:
∠CDB = ∠CAB = 40° (Angles in the same segment of a circle)
In Δ CBD, we have:
∠CDB + ∠BCD +∠CBD = 180° (Angle sum property of a triangle)
⇒ 40° + 80° + ∠CBD = 180°
⇒ ∠CBD = (180° - 120°) = 60°

**ANSWER 25:**

(c) 80°
We have:
∠AEB + ∠CEB = 180° (Linear pair angles)
⇒ 110° + ∠CEB = 180°
⇒ ∠CEB = (180° - 110°) = 70°
In ΔCEB, we have:
∠CEB + ∠EBC + ∠ECB = 180° (Angle sum property of a triangle)
⇒ 70° + 30° + ∠ECB = 180°
⇒ ∠ECB = (180° - 100°) = 80°
The angles in the same segment are equal.
Thus, $\angle ADB$ = ∠ECB = 80°

**ANSWER 26:**

(d) 60°
We have:
OA = OB (Radii of a circle)
⇒ ∠OBA= ∠OAB = 20°
In ΔOAB, we have:
∠OAB + ∠OBA + ∠AOB = 180° (Angle sum property of a triangle)
⇒ 20° + 20° + ∠AOB = 180°
⇒ ∠AOB = (180° - 40°) = 140°

Again, we have:
OB = OC (Radii of a circle)
⇒ ∠OBC = ∠OCB = 50°
In ΔOCB, we have:
∠OCB + ∠OBC + ∠COB = 180° (Angle sum property of a triangle)
⇒ 50° + 50° + ∠COB = 180°
⇒ ∠COB = (180° - 100°) = 80°
Since ∠AOB = 140°, we have:
∠AOC + ∠COB = 140°

⇒∠AOC + 80° = 140°
⇒ ∠AOC = (180° - 80°) = 60°

**ANSWER 27:**

(b) 30°
We have:
∠ABC + ∠ADC = 180° (Opposite angles of a cyclic quadrilateral)
⇒ ∠ABC + 120° = 180°
⇒ ∠ABC = (180° - 120°) = 60°
Also, ∠ACB = 90° (Angle in a semicircle)
In ΔABC, we have:
∠BAC + ∠ACB + ∠ABC = 180° (Angle sum property of a triangle)
⇒ ∠BAC + 90° + 60° = 180°
⇒ ∠BAC = (180° - 150°) = 30°

**ANSWER 28:**

(b) 100°
Since ABCD is a cyclic quadrilateral, we have:
∠BAD + ∠BCD = 180° (Opposite angles of a cyclic quadrilateral)
⇒ 100° + ∠BCD = 180°
⇒ ∠BCD = (180° - 100°) = 80°
Now, AB || DC and CB is the trANSWERversal.
∴ ∠ABC + ∠BCD = 180°
⇒ ∠ABC + 80° = 180°
⇒ ∠ABC = (180° - 80°) = 100°



**ANSWER 29:**

(c) 115°
Take a point X on the remaining part of the circumference.
Join AX and CX.
Then $\angle AXC = \frac{1}{2}\angle AOC = (\frac{1}{2}\times 130°) = 65°$
In cyclic quadrilateral ABCX, we have:
∠ABC + ∠AXC = 180° (Opposite angles of a cyclic quadrilateral)
⇒ ∠ABC + 65° = 180°
⇒ ∠ABC = (180° - 65°) = 115°

**ANSWER 30:**

(a) 30°
∠ADC = ∠BAD = 30° (Alternate angles)
∠ADB = 90° (Angle in semicircle)
∴ ∠CDB = (90° + 30°) = 120°
But ABCD being a cyclic quadrilateral, we have:
∠BAC + ∠CDB = 180°
⇒ ∠BAD + ∠CAD + ∠CDB = 180°
⇒ 30° + ∠CAD + 120° = 180°
⇒ ∠CAD = (180° - 150°) = 30°

**ANSWER 31:**

(a) 50°
Take a point X on the remaining part of the circumference.
Join AX and CX.
Then ∠AXC= $\frac{1}{2}$∠AOC=( $\frac{1}{2}$×100°)=50°
Now, side AB of the cyclic quadrilateral ABCX has been produced to D.
∴ Exterior ∠CBD = ∠AXC = 50°

**ANSWER 32:**

(c) 100°
OA = OB (Radii of a circle)
⇒ ∠OBA = ∠OAB = 50°
In Δ OAB, we have:
∠ OAB + ∠OBA + ∠AOB = 180° (Angle sum property of a triangle)
⇒ 50° + 50° + ∠AOB = 180°
⇒ ∠AOB = (180° - 100°) = 80°
Since ∠AOB + ∠BOD = 180° (Linear pair)
∴ ∠BOD = (180° - 80°) = 100°

**ANSWER 33:**

(b) 70°
BC = CD (given)
⇒ ∠BDC = ∠CBD = 35°
In Δ BCD, we have:
∠BCD + BDC + ∠CBD = 180° (Angle sum property of a triangle)
⇒ ∠BCD + 35° + 35° = 180°
⇒ ∠BCD = (180° - 70°) = 110°

In cyclic quadrilateral ABCD, we have:
∠BAD + ∠BCD = 180°
⇒ ∠BAD + 110° = 180°
∴ ∠BAD = (180° - 110°) = 70°

**ANSWER 34:**

(c) 120°
Since ΔABC is an equilateral triangle, each of its angle is 60°.
∴ ∠BAC = 60°
In a cyclic quadrilateral ABCD, we have:
∠BAC + ∠BDC = 180°
⇒ 60° + ∠BDC = 180°
⇒ ∠BDC = (180° - 60°) = 120°

**ANSWER 35:**

(b) 80°
In a cyclic quadrilateral ABCD, we have:
Interior opposite angle, ∠ADC = exterior ∠CBE = 100°
∴ ∠CDF = (180° - ∠ADC) = (180° - 100°) = 80° (Linear pair)

**ANSWER 36:**

(c) 110°
Join AB.
Then chord AB subtends ∠AOB at the centre and ∠AXB at a point X of the remaining parts of a circle.
∴∠AOB = 2∠AXB
$\Rightarrow \angle AXB = \frac{1}{2}\angle AOB = (\frac{1}{2} \times 140°) = 70°$
In the cyclic quadrilateral, we have:
∠AXB + ∠ACB = 180°
⇒ 70° + ∠ACB = 180°
∴∠ACB = (180° - 70°) = 110°

**ANSWER 37:**

(c) 115°
Join AB.
Then chord AB subtends ∠AOB at the centre and ∠AXB at a point X of the remaining parts of a circle.
∴∠AOB = 2∠AXB
⇒∠AXB= $\frac{1}{2}$∠AOB=($\frac{1}{2}$×130°)=65°

In cyclic quadrilateral, we have:
∠AXB + ∠ACB = 180°
⇒ 65° + ∠ACB = 180°
∴∠ACB = (180° - 65°) = 115°

**ANSWER 38:**

(d) 110°
Since ABCD is a cyclic quadrilateral, we have:
∠BAD + ∠BCD = 180°
⇒ ∠BAD + 110° = 180°
⇒∠BAD = (180° - 110°) = 70°
Similarly in ABEF, we have:
∠BAD + ∠BEF = 180°
⇒ 70° + ∠BEF = 180°
⇒ ∠BEF = (180° - 70°) = 110°

**ANSWER 39:**

(c) 105°
We have:
∠ABC + ∠ADC = 180°
⇒ ∠ABC + 95° = 180°
⇒∠ABC = (180° - 95°) = 85°
Now, CF || AB and CB is the trANSWERversal.
∴ ∠BCF = ∠ABC = 85° (Alternate interior angles)
⇒ ∠BCE = (85° + 20°) = 105°
⇒ ∠DCB = (180° - 105°) = 75°
Now, ∠BAD + ∠BCD = 180°
⇒ ∠BAD + 75° = 180°
⇒ ∠BAD = (180° - 75°) = 105°

**ANSWER 40:**

(c) 8.5 cm
Join AC.
Then AE : CE = DE : BE (Intersecting secant theorem)
∴ AE × BE = DE × CE
Let CD = $y$ cm
Then AE = (AB + BE) = (11 + 3) cm = 14 cm; BE = 3cm; CE = ($y$ + 3.5) cm; DE = 3.5 cm
∴ 14 × 3 = ($y$ + 3.5) × 3.5
$\Rightarrow y+3.5=\frac{14\times3}{3.5}=\frac{42}{3.5}=12$
⇒ $y$ = (12 - 3.5) cm = 8.5 cm
Hence, CD = 8.5 cm

**ANSWER 41:**

(b) 6 cm
We know that the line joining their centres is the perpendicular bisector of the common chord.
Join AP.
Then AP = 5 cm; AB = 4 cm
Also, $AP^2 = BP^2 + AB^2$
Or $BP^2 = AP^2 - AB^2$
Or $BP^2 = 5^2 - 4^2$
Or BP = 3 cm
∴ ΔABP is a right angled and PQ = 2 × BP = (2 × 3) cm = 6 cm

**ANSWER 42:**

(c) 60°
We have:
∠AOB = 2∠ACB
$\Rightarrow \angle ACB=\frac{1}{2}\angle AOB=(\frac{1}{2}\times 90°)=45°$
∠COA = 2∠CBA = (2 × 30°) = 60°
∴ ∠COD = 180° - ∠COA = (180° - 60°) = 120°
$\Rightarrow \angle CAO=\frac{1}{2}\angle COD=(\frac{1}{2}\times 120°)=60°$