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Objective Questions
CLASS : 9 th
SUB : Maths
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CHAPTER 10

Circles

1. OBJECTIVE QUESTIONS

1. In a cyclic quadrilateral, the difference between two opposite angles is $58°$, the measures of opposite angles are
(a) $158°, 22°$ (b) $129°, 51°$
(c) $109°, 71°$ (d) $119°, 61°$

Ans : (d) $119°, 61°$

If $\angle A - \angle C = 58°$ ...(1)

$\angle A + \angle C = 180°$ ...(2)

Adding (1) & (2), we get $2\angle A = 238°$

$\angle A = 119°$

Subtracting (1) from (2), we get $2\angle C = 122°$

$\angle C = 61°$

$\angle A = 119°$ and $\angle C = 61°$

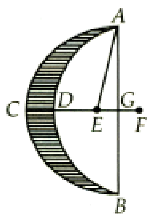
2. Which of the following statements is true for a regular pentagon?
(a) All vertices are con-cyclic.
(b) All vertices are not con-cyclic.
(c) Only four vertices are con-cyclic
(d) Cannot say anything about regular pentagon

Ans : (a) All vertices are con-cyclic.

3. In a cyclic quadrilateral $ABCD$, if two sides are parallel, which of the following statements is definitely false?
(a) Remaining two sides are equal
(b) Diagonals are not equal
(c) Diagonals intersect at the centre of circle
(d) Both (a) and (c)

Ans : (b) Diagonals are not equal

4. A crescent is formed of two circular arcs ACB, ADB of equal radius with respective, centres E and F as shown in the given figure.



The perpendicular bisector of AB cuts the crescent at C and D, where $CD = 12$ cm, $AB = 16$ cm. The radius of arc ACB is
(a) 18 cm (b) 16 cm
(c) 12 cm (d) 10 cm

Ans : (d) 10 cm

$AB = 16$ cm

$EC = FD$

Subtracting DE from both sides, we get $CD = EF = 12$cm

$\Delta AEG \cong \Delta AFG$, $EG = GF = 6$ cm

In ΔAEG, $AG = \frac{1}{2}AB = 8$ cm

and $AE^2 = AG^2 + EG^2$

$r^2 = 8^2 + 6^2$

$= 64 + 36 \Rightarrow r = 10$ cm

5. Which of the following statements is true for the longest chord of a circle?
(a) It is equal to radius
(b) It is two times of radius
(c) It is never equal to diameter
(d) It is two times of diameter

Ans : (b) It is two times of radius

6. The region between a chord and either of the arcs is called
(a) an arc (b) a sector
(c) a segment (d) a semicircle

Ans : (c) a segment

7. When two chords of a circle bisect each other, then which of the following statements is true?
(a) Both chords are perpendicular to each other
(b) Both chords are parallel to each other
(c) Both chords are unequal
(d) Both are diameters of the circle.

Ans : (d) Both are diameters of the circle.

8. Equal chords of a circle subtend equal angles at
(a) centre (b) circumference
(c) Both (a) and (b) (d) None of these

Ans : (c) Both (a) and (b)

9. The line joining the centre of a circle to the midpoint of a chord is always
(a) parallel to the chord
(b) perpendicular to the chord

(c) equal to the chord

(d) tangent to the chord

Ans : (b) perpendicular to the chord

10. There is one and only one circle passing through three given .... points

(a) collinear (b) non-collinear

(c) far-off (d) nearest

Ans : (b) non-collinear

11. Diagonals of a cyclic quadrilateral are the diameters of that circle, then quadrilateral is a

(a) parallelogram (b) square

(c) rectangle (d) trapezium

Ans : (c) rectangle

12. When two circles intersect at points A and B with AC and AD being the diameters of the first and second circle then the points B, C and D are

(a) concurrent (b) circumcentre

(c) orthocenter (d) collinear

Ans : (d) collinear

B, C and D are collinear.

13. If PQ is a chord of a circle with radius r units and R is a point on the circle such that $\angle PRQ = 90°$, then the length of PQ is

(a) r units (b) $2r$ units

(c) $\frac{r}{2}$ units (d) $4r$ units

Ans : (b) $2r$ units

Since PQ is a chord of a circle and R is a point on the circle such that $\angle PRQ = 90°$, therefore, the arc PRQ is a semicircle. PQ is a diameter.

Hence, Length of $PQ = 2 \times \text{radius} = 2r$ units

14. If an equilateral triangle PQR is inscribed in a circle with centre O, then $\angle QOR$ is equal to

(a) $60°$ (b) $30°$

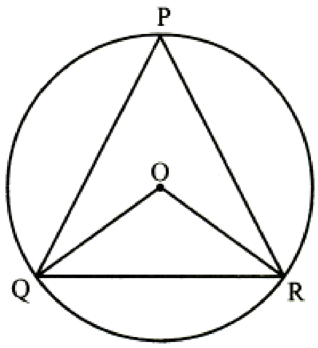
(c) $120°$ (d) $90°$

Ans : (c) $120°$

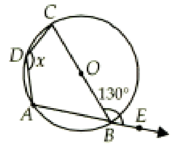
As PQR is an equilateral triangle inscribed in a circle,

$$\angle QPR = 60°$$

Hence, $$\angle QOR = 2 \times \angle QPR = 2 \times 60° = 120°$$



15. $ABCD$ is a cyclic quadrilateral with centre O in the given figure. Chord AB is produced to E where $\angle CBE = 130°$, the value of x is equal to



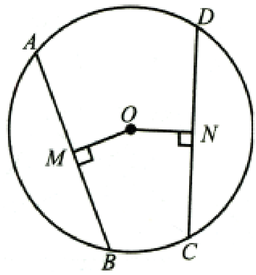
(a) $130°$ (b) $260°$

(c) $140°$ (d) $280°$

Ans : (a) $130°$

$$\angle ADC = 180° - \angle CBA$$
$$= \angle CBE = 130°$$
$$x = \angle ADC = 130°$$

16. In the given figure, O is the centre of a circle. AB and CD are its two chords. If $OM \perp AB$, $ON \perp CD$ and $OM = ON$, then



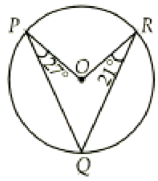
(a) $AB \neq CD$ (b) $AB < CD$

(c) $AB > CD$ (d) $AB = CD$

Ans : (d) $AB = CD$

Chords of a circle which are equidistant from the centre of the circle are equal.

17. In the given figure, O is the centre of circle. $\angle OPQ = 27°$ and $\angle ORQ = 21°$. The values of $\angle POR$ and $\angle PQR$ respectively are



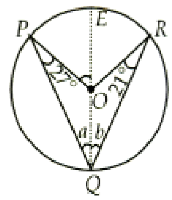
(a) $84°, 42°$ (b) $96°, 48°$

(c) $54°, 42°$ (d) $108°, 54°$

Ans : (b) $96°, 48°$

Draw a line passing through Q and O.

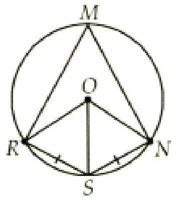
$$a = 27° \quad [OP = OQ]$$
$$b = 21° \quad [OR = OQ]$$



$$\angle PQR = a + b$$

$$= 27^\circ + 21^\circ = 48^\circ$$
$$\angle POR = 2 \times \angle PQR = 2 \times 48^\circ = 96^\circ$$

18. In the given figure, chord $RS =$ chord NS. How $\widehat{RS}$ is related with $\widehat{NS}$?

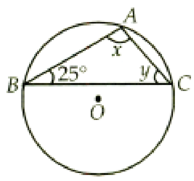


(a) $\widehat{RS}$ is smaller than $\widehat{NS}$ (b) Both are equal
(c) $\widehat{RS}$ is greater than $\widehat{NS}$ (d) None of these

Ans : (b) Both are equal

When chords are equal, their arcs are also equal.

19. In the given figure, O is the centre of the circle. For what values of x and y, chord BC will pass through the centre of circle where points A, B and C are on the circle?



(a) $x = 90^\circ, y = 60^\circ$ (b) $x = 75^\circ, y = 30^\circ$
(c) $x = 65^\circ, y = 90^\circ$ (d) $x = 90^\circ, y = 65^\circ$

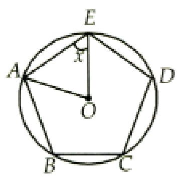
Ans : (d) $x = 90^\circ, y = 65^\circ$

When chord BC passes through centre,

then, $x = 90^\circ$.

Now, $x + y + 25^\circ = 180^\circ$
$$90^\circ + y + 25^\circ = 180^\circ$$
$$y = 65^\circ$$

20. In the given pentagon $ABCDE$, $AB = BC = CD = DE = AE$. The value of x is



(a) 36° (b) 54°
(c) 72° (d) 108°

Ans : (b) 54°

Since, equal chords subtend equal angles at the centre.

$$\angle AOE = \frac{360^\circ}{5} = 72^\circ$$

Now, $OE = OA$
$$\angle OEA = \angle OAE = x$$

In ΔOAE, $x + x + \angle AOE = 180^\circ$
$$2x + 72^\circ = 180^\circ$$
$$x = \frac{108^\circ}{2} = 54^\circ$$

21. In the given figure, E is any point in the interior of the circle with centre O. Chord $AB = AC$. If $\angle OBE = 20^\circ$, the value of x is

(a) 40° (b) 45°
(c) 50° (d) 70°

Ans : (d) 70°

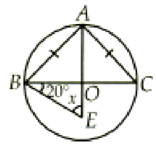
Since, $AB = AC$

Hence, $\angle AOB = \angle AOC$

[Equal chords subtend equal angles at the centre]

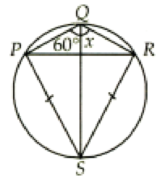
$AO \perp BC$ $[\angle BOA + \angle COA = 180^\circ]$

Now, in ΔOBE
$$20^\circ + x + \angle BOE = 180^\circ$$



$$20^\circ + x + 90^\circ = 180^\circ$$
$$x = 70^\circ$$

22. In the given figure, $PQRS$ is a cyclic quadrilateral in which $PS = RS$ and $\angle PQS = 60^\circ$. The value of x is



(a) 30° (b) 60°
(c) 75° (d) 80°

Ans : (b) 60°

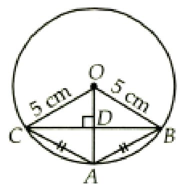
$$\angle RPS = \angle RQS = x$$

(Angles in the same segment)

$$\angle PRS = \angle PQS = 60^\circ$$
$$\angle RPS = \angle PRS = 60^\circ \quad [PS = RS]$$

Hence, $x = \angle RPS = \angle RQS = \angle PRS = 60^\circ$

23. In the given figure, chords $AB = AC = 6$ cm. The length of BC, if radius is 5 cm, is



(a) 9.6 cm (b) 4.8 cm
(c) 19.2 cm (d) 8.0 cm

Ans : (a) 9.6 cm

Let $OD = x \Rightarrow AD = 5 - x$

In ΔOCD, $OC^2 = OD^2 + CD^2$
$$5^2 = x^2 + CD^2$$
$$CD^2 = 25 - x^2 \quad ...(1)$$

In ΔACD, $AC^2 = AD^2 + CD^2$

$6^2 = (5-x)^2 + CD^2$

$CD^2 = 11 + 10x - x^2$ ...(2)

From (1) and (2), we get

$11 + 10x - x^2 = 25 - x^2$

$10x = 14 \Rightarrow x = 1.4$ cm

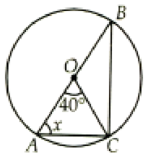
Hence, $CD^2 = 25 - (1.4)^2 = 23.04$

$CD = 4.8$ cm

Hence, $BC = 2 \times CD = 2 \times 4.8$ cm

$= 9.6$ cm

24. In the given figure, AB is diameter, $\angle AOC = 40^\circ$. The value of x is



(a) 50° (b) 60°
(c) 70° (d) 80°

Ans : (c) 70°

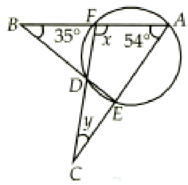
$\angle BCA = 90^\circ$ [Since AB is diameter]

Also, $\angle ABC = \frac{1}{2} \times \angle AOC = 20^\circ$

[Angle subtended by an arc at centre is double the angle subtended by it at remaining part of the circle.]

In ΔABC, $20^\circ + x + 90^\circ = 180^\circ \Rightarrow x = 70^\circ$

25. In the given figure, $AEDF$ is a cyclic quadrilateral. The values of x and y respectively are



(a) $79^\circ, 47^\circ$ (b) $89^\circ, 37^\circ$
(c) $89^\circ, 47^\circ$ (d) $79^\circ, 37^\circ$

Ans : (b) $89^\circ, 37^\circ$

In ΔABE,

$35^\circ + 54^\circ + \angle AEB = 180^\circ$

$\angle AEB = 91^\circ$

$\angle AFD + \angle AED = 180^\circ$

[Opposite angles of cyclic quadrilateral]

$x + \angle AEB = 180^\circ$

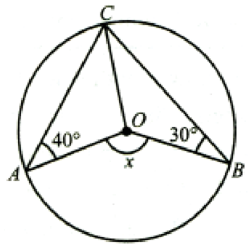
$x + 91^\circ = 180^\circ \Rightarrow x = 89^\circ$

In ΔACF, $54^\circ + y + x = 180^\circ$

$54^\circ + y + 89^\circ = 180^\circ$

$y = 180^\circ - 143^\circ = 37^\circ$

26. In the given figure, O is the centre of the circle. The value of x is



(a) 140° (b) 70°
(c) 290° (d) 210°

Ans : (a) 140°

In ΔOAC

as, $OA = OC =$ radius of circle

Hence, $\angle OAC = \angle OCA = 40^\circ$

Similarly, in ΔOBC

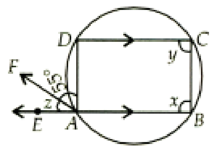
$\angle OBC = \angle OCB = 30^\circ$

We know that angle subtended at the arc is half of the angle subtended at the centre.

Hence, $\angle ACB = \frac{1}{2} \angle AOB$

$\angle AOB = 2(\angle ACB) = 2(70) = 140^\circ$

27. In the given figure, $ABCD$ is a cyclic quadrilateral. BA is produced to E and $DC || AB$. If $y : x$ is equal to 4:5, then value of z is



(a) 15° (b) 20°
(c) 25° (d) 30°

Ans : (c) 25°

$DC || AB$ $y + x = 180^\circ$ [Co-interior angles]

But $y : x = 4 : 5$

$y = \frac{180^\circ}{4 + 5 \times 4} = 80^\circ$

and $x = \frac{180^\circ}{4+5} \times 5 = 100^\circ$

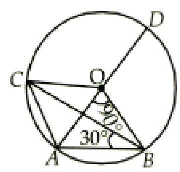
Also, $\angle EAD = y$

[Exterior angle of cyclic quadrilateral $ABCD$]

$\angle EAF + \angle FAD = y \Rightarrow z + 55^\circ = 80^\circ$

$z = 80^\circ - 55^\circ = 25^\circ$

28. In the given figure, $\angle AOB = 90^\circ$ and $\angle ABC = 30^\circ$. Then, $\angle CAO$ is



(a) 30° (b) 45°
(c) 60° (d) 90°

Ans : (c) 60°

$$\angle AOB = 2\angle ACB$$

$$\angle ACB = \frac{1}{2}\angle AOB = \left(\frac{1}{2}\times 90^\circ\right) = 45^\circ$$

Now, $\angle COA = 2\angle CBA = (2\times 30^\circ) = 60^\circ$

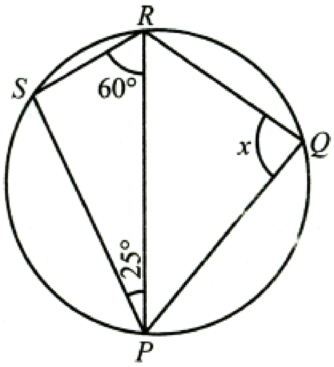
$$\angle COD = 180^\circ - \angle COA$$

$$= (180^\circ - 60^\circ) = 120^\circ$$

$$\angle CAO = \frac{1}{2}\angle COD = \left(\frac{1}{2}\times 120^\circ\right)$$

$$= 60^\circ$$

29. In the given figure, $PQRS$ is a cyclic quadrilateral. If $\angle SPR = 25^\circ$ and $\angle PRS = 60^\circ$, then the value of x is



(a) 105°
(b) 95°
(c) 115°
(d) 85°

Ans : (d) 85°

In ΔPRS, $\angle PSR + 25^\circ + 60^\circ = 180^\circ$

$$\angle PSR = 95^\circ$$

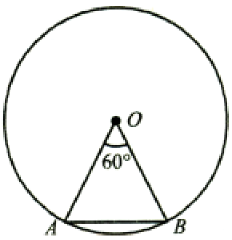
Now, $\angle PQR + \angle PSR = 180^\circ$

(sum of opp. angles of a cyclic quad. is 180°)

$$x + 95^\circ = 180^\circ$$

$$x = 85^\circ$$

30. In the given figure, chord AB subtends $\angle AOB$ equal to 60° at the centre of the circle. If $OA = 5\,\text{cm}$, then length of AB (in cm) 0 is



(a) $\frac{5}{2}$ cm
(b) $\frac{5\sqrt{3}}{2}$ cm
(c) 5 cm
(d) $\frac{5\sqrt{3}}{4}$ cm

Ans : (c) 5 cm

$$OA = OB$$

(radius of circle)

$$5 = OB$$

Thus, $\angle A = \angle B$ (since $OA = OB$)

Thus, in ΔOAB

$$\angle A + \angle B + \angle O = 180^\circ$$

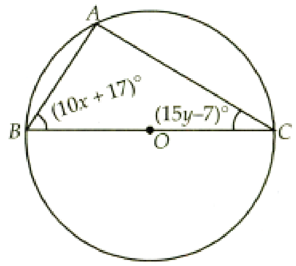
$$2\angle A + 60^\circ = 180^\circ$$

$$\angle A = 60^\circ$$

Hence, $\angle A = \angle B = \angle O = 60^\circ$

ΔOAB is an equilateral triangle.

31. In the given figure, BC passes through the centre of a circle where points A, B and C are con-cylic and $\angle B$ is 44° more than $\angle C$. The values of x and y respectively are



(a) $x = 4;\ y = 3$
(b) $x = 3;\ y = 5$
(c) $x = 7;\ y = 2$
(d) $x = 5;\ y = 2$

Ans : (d) $x = 5;\ y = 2$

$$\angle B - \angle C = 44^\circ \qquad ...(1)$$

and $\angle C + \angle B = 90^\circ$ ...(2)

[BC is diameter of circle; $\angle A = 90^\circ$]

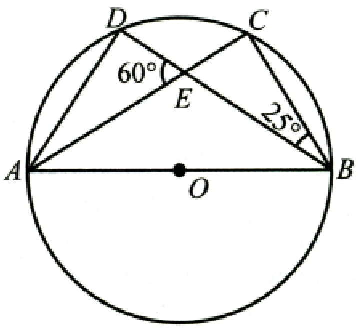
From (1) and (2), we get

$$\angle B = 67^\circ \text{ and } \angle C = 23^\circ$$

$\Rightarrow$ $10x + 17 = 67$ and $15y - 7 = 23$

$\Rightarrow$ $x = 5$ and $y = 2$

32. In the given figure, O is the centre of the circle, $\angle CBE = 25^\circ$ and $\angle DEA = 60^\circ$. The measure of $\angle ADB$ is



(a) 90°
(b) 85°
(c) 95°
(d) 120°

Ans : (c) 95°

$$\angle DEA = \angle BEC$$

(Vertices. opp. angles)

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

Now, in ΔBEC

$$\angle E + \angle B + \angle C = 180^\circ$$

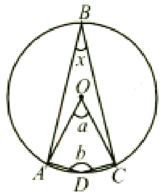
$$60 + 25 + \angle C = 180^\circ$$

$$\angle C = 95^\circ$$

Also, $\angle C = \angle D$

$$\angle D = 95^\circ$$

33. In the given figure, $ABCD$ is a cyclic quadrilateral, O is the centre of the circle and $a:b = 2:5$. The value of x is



(a) $20°$ (b) $25°$
(c) $30°$ (d) $35°$

Ans : (c) $30°$

$$\frac{a}{b} = \frac{2}{5} \Rightarrow 5a - 2b = 0 \qquad ...(1)$$

and $x + b = 180°$

$$\frac{a}{2} + b = 180° \qquad \left(x = \frac{a}{2}\right)$$

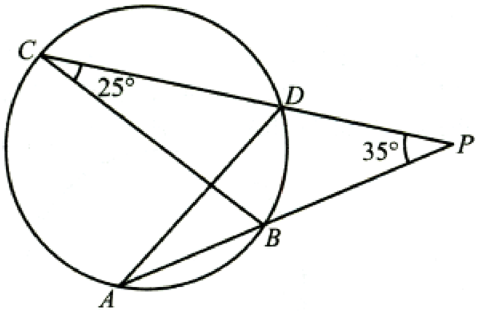
$$a + 2b = 360° \qquad ...(2)$$

From (i) and (ii), we get

$$a = 60°,\ b = 150°.$$

Also, $x = \frac{a}{2} = 30°$

34. In the given figure, chords AB and CD of a circle when produced meet at P. If $\angle APD = 35°$ and $\angle BCD = 25°$, then $\angle ADC$ is equal to



(a) $60°$ (b) $70°$
(c) $50°$ (d) $120°$

Ans : (a) $60°$

$\angle BAD = \angle BCD$

(angles in the same segment of a circle)

$\angle PAD = \angle BAD = 25°$

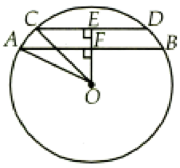
(since, $\angle BCD = 25°$, given)

Now, $\angle ADC = \angle PAD + \angle APD$

(ext. angle of a Δ = sum of two internal opposite angles)

$\angle ADC = 25° + 35° = 60°$

35. In the given figure, $OE \perp CD$, $OF \perp AB$, $AB || CD$, $AB = 48$ cm, $CD = 20$ cm, radius $OA = 26$ cm. The length of EF is



(a) 6 cm (b) 8 cm
(c) 14 cm (d) 16 cm

Ans : (c) 14 cm

E is mid point of CD and F is the mid point of AB

Now, in ΔOAF, $AF^2 = OA^2 - OF^2$

$$\left(\frac{48}{2}\right)^2 = 26^2 - OF^2$$

$$OF^2 = 676 - 576$$

$$OF = 10 \text{ cm}$$

In ΔOCE, $OE^2 = OC^2 - CE^2$

$$OE^2 = 26^2 - \left(\frac{20}{2}\right)^2$$

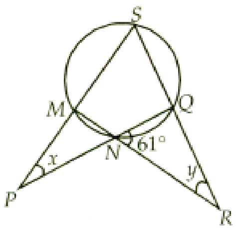
$$OE^2 = 676 - 100$$

$$OE = 24 \text{ cm}$$

Hence, $EF = OE - OF = (24 - 10)$ cm

$= 14$ cm

36. In the given figure, $MNQS$ is a cyclic quadrilateral in which $\angle QNR = 61°$ and $x:y$ is 2 :1. The values of x and y respectively are



(a) $18\frac{1}{4}°, 37\frac{3}{4}°$ (b) $38\frac{2}{3}°, 19\frac{1}{3}°$
(c) $21\frac{1}{3}°, 33\frac{2}{3}°$ (d) $19\frac{1}{4}°, 38\frac{1}{4}°$

Ans : (b) $38\frac{2}{3}°, 19\frac{1}{3}°$

In ΔQNR, $\angle SQN = y + 61°$,

$\angle MNP = \angle QNR = 61°$

$\angle SMN = x + \angle MNP$

$= x + 61°$

Now, $\angle SQN + \angle SMN = 180°$

or $(y + 61°) + (x + 61°) = 180°$

$x + y = 58°$ but $x = 2y$

Thus, $y = \left(\frac{58}{3}\right)° = 19\frac{1}{3}°$

and $x = \left(\frac{116}{3}\right)° = 38\frac{2}{3}°$

2. FILL IN THE BLANK

DIRECTION : Complete the following statements with an appropriate word/term to be filled in the blank space(s).

1. The longest chord of a circle is a .... of the circle.

Ans : diameter

2. Segment of a circle is the region between an arc and

the related .... of the circle.
Ans : chord

3. The chords of a circle which are .... from the centre are equal.
Ans : equidistant

4. A radius of a circle is a line segment with one end point at the .... and the other end on the ....
Ans : centre, circle

5. The .... bisectors of two chords to a circle intersect at the centre.
Ans : perpendicular

6. A diameter of a circle is a chord that passes through the .... of the circle.
Ans : centre

7. Angles in the same segment of a circle are ....
Ans : equal

8. The centre of a circle lies in the .... of the circle.
Ans : interior

9. A point, whose distance from the centre of a circle is greater than its radius, lies on the .... of the circle.
Ans : exterior

10. An arc is a .... when its ends are the ends of a diameter.
Ans : semicircle

11. The sum of either pair of opposite angles of a cyclic quadrilateral is ....
Ans : 180°

3. TRUE/FALSE

DIRECTION : Read the following statements and write your answer as true or false.

1. Sector is the region between the chord and its corresponding arc.
Ans : False

2. A cyclic trapezium is always isoscele.
Ans : True

3. Diameter is the longest chord of the circle.
Ans : True

4. Chords of congruent circles which are equidistant from the corresponding centres are equal.
Ans : True

5. A diameter of a circle divides the circular region into two parts. Each part is called a semi-circular region.
Ans : True

6. Equal chords subtend equal angles at the centre.
Ans : True

7. Every circle has a unique centre and it lies inside the circle.
Ans : True

8. A chord of a circle which is twice as long as its radius is a diameter of the circle.
Ans : True

9. Line segment joining the centre to any point on the circle is a radius of the circle.
Ans : True

10. A circle has only a finite number of equal chords.
Ans : False

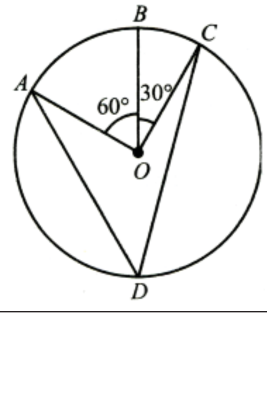
11. A circle is a plane figure.
Ans : True

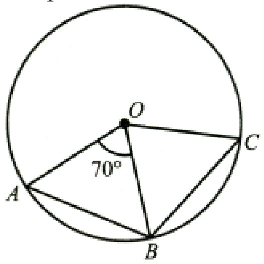
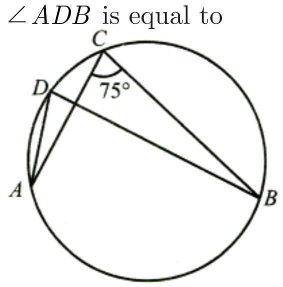
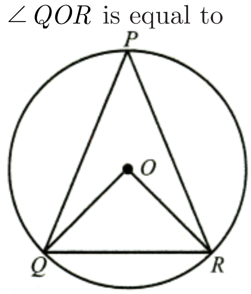
12. If a circle is divided into three equal arcs, each is a major arc.
Ans : False

4. MATCHING QUESTIONS

DIRECTION : Each question contains statements given in two columns which have to be matched. Statements (P, Q, R, S, T) in Column-I have to be matched with statements (1, 2, 3, 4, 5) in Column-II.

1. Math the following

	Column-I		**Column-II**
(P)	In the given figure, $\angle ADC =$ 	(1)	120°

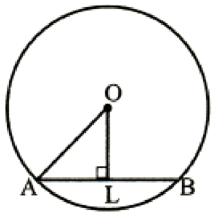
(Q)	Distance of a chord AB of a circle from the centre is 12 cm and length of the chord is 10 cm. The diameter of the circle is .... cm.	(2)	75°
(R)	In the figure given below, O is the centre of the circle. If $AB = BC$ and $\angle AOB = 70^\circ$ then $\angle OBC$ is equal to 	(3)	45°
(S)	In the given figure, the points A, B, C and D lie on a circle. If $\angle ACB = 75^\circ$, then $\angle ADB$ is equal to 	(4)	55°
(T)	If an equilateral triangle PQR is inscribed in a circle with centre O, then $\angle QOR$ is equal to 	(5)	26°

Ans : P–3, Q–5, R–4, S–2, T–1

(P) $\angle ADC = \frac{1}{2}\angle AOC = \frac{1}{2} \times 90^\circ = 45^\circ$

(Since, angle subtended by an arc at the centre is double the angle formed by it on the remaining part of the circle)
(Q) The perpendicular from the centre to the chord bisects the chord.

$$AL = 5\,\text{cm and } OL = 12\,\text{cm}$$
$$AO = \sqrt{(12)^2 + (5)^2}$$
$$= \sqrt{169} = 13\,\text{cm}$$
$$\text{Radius} = 13\,\text{cm}$$
$$\text{Diameter} = 26\,\text{cm}$$



(R) $\angle BOC = 70^\circ$
(Since, equal chords of a circle subtend equal angles at the centre).

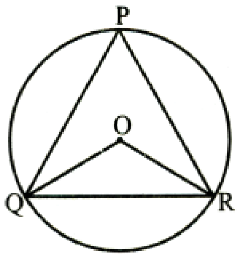
$$\angle OBC + \angle OCB = 180^\circ - 70^\circ = 110^\circ$$

Hence, $\angle OBC = 55^\circ$
(Since $OB = OC \Rightarrow \angle OBC = \angle OCB$)
(S) Since angles in the same segment of a circle are equal

Hence, $\angle ADB = \angle ACB = 75^\circ$
(T) Since PQR is an equilateral triangle inscribed in a circle,

Hence, $\angle QPR = 60^\circ$

Hence, $\angle QOR = 2 \times \angle QPR = 120^\circ$



2. Match the following :

Column-I		Column-II	
(P)	The radius of circle is 8 cm and the length of one of its chords is 12 cm. The distance of the chord from the centre is	(1)	23 cm
(Q)	Two parallel chords of lengths 30 cm and 16 cm are drawn on the opposite sides of the centre of a circle of radius 17 cm. The distance between the chords is	(2)	5.196 cm
(R)	The length of a chord which is at a distance of 4 cm from the centre of the circle of radius 6 cm is	(3)	5.291 cm
(S)	An equilateral triangle of side 9 cm is inscribed in a circle. The radius of the circle is	(4)	8.94 cm

	P	Q	R	S
(a)	3	1	4	2
(b)	3	4	1	2
(c)	1	2	3	4
(d)	1	3	2	4

Ans : (a) P–3, Q–1, R–4, S–2

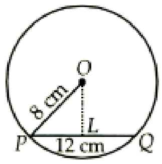
(P) Let PQ be the chord of a circle with centre O and radius 8 cm such that $PQ = 12$ cm. From O, draw $OL \perp PQ$. Join OP. Since the perpendicular from the centre of a circle to chord bisects the chord.

$$PL = LQ = \frac{1}{2}PQ = 6\text{cm}$$

In right angled triangle OLP, we have

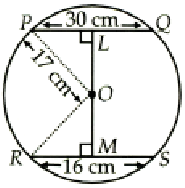
$$OP^2 = OL^2 + PL^2$$
$$8^2 = OL^2 + 6^2$$
$$OL^2 = 8^2 - 6^2 = 64 - 36 = 28$$
$$OL = \sqrt{28} = 5.291\text{cm}$$

Hence, the distance of the chord from the centre is 5.291 cm.



(Q) We know that the perpendicular from the centre of a circle to a chord bisects the chord.

$$PL = \frac{1}{2}PQ = 15\text{cm}$$
$$RM = \frac{1}{2}RS = 8\text{cm}$$
$$OP = OR = 17\text{cm}$$



From the right angled $\triangle OLP$, we have

$$OL^2 = OP^2 - PL^2$$
$$OL^2 = 17^2 - 15^2 = 64$$
$$OL = 8\text{cm}$$

From the right angled $\triangle ORM$, we have

$$OM^2 = OR^2 - RM^2 = 17^2 - 8^2 = 225$$
$$OM = 15\text{cm}$$

Since $OL \perp PQ$, $OM \perp RS$ and $PQ || RS$, the points L, O, M are collinear.

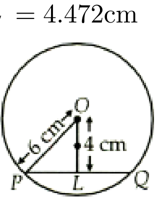
$$LM = LO + OM = 8 + 15 = 23\text{cm}$$

(R) Let PQ be a chord of a circle with centre O and radius 6cm. Draw $OL \perp PQ$. Join OP.

Then $OL = 4\text{cm}$ and $OP = 6\text{cm}$.

From the right angled $\triangle OPL$, we have

$$OP^2 = OL^2 + PL^2$$
$$PL^2 = OP^2 - OL^2$$
$$PL^2 = 6^2 - 4^2$$
$$= 36 - 16 = 20$$
$$PL = 4.472\text{cm}$$

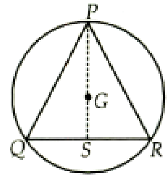


Since the perpendicular from the centre of the circle to a chord bisects the chord, we have

$$PQ = 2 \times PL$$
$$= 2 \times 4.472 = 8.94\text{cm}$$

(S) Let $\triangle PQR$ be an equilateral triangle of side 9 cm. Let PS be one of its median. Then $PS \perp QR$ and $QS = \frac{9}{2}$cm

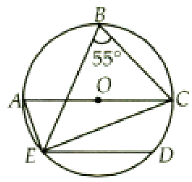
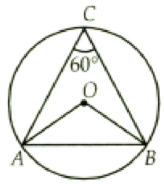
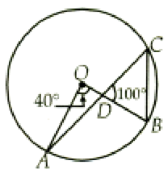
$$PS = \sqrt{PQ^2 - QS^2}$$
$$= \sqrt{9^2 - \left(\frac{9}{2}\right)^2}\text{ cm} = \frac{9\sqrt{3}}{2}\text{cm}$$



In an equilateral triangle, the centroid and circum centre coincide and

$$PG : PS = 2 : 3$$
$$\text{Radius} = PG = \frac{2}{3}PS = \frac{2}{3} \times \frac{9\sqrt{3}}{2}$$
$$= 3\sqrt{3} = 5.196\text{cm}$$

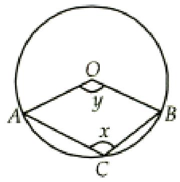
3. Match the following:

Column-I		**Column-II**	
(P)	C is a point on the minor arc AB of the circle with centre O. If $\angle ACB = x$ calculate x, if $ACBO$ is a parallelogram.	(1)	60°
(Q)	Chord ED is parallel to the diameter AC of the circle. If $\angle CBE = 55°$, then $\angle DEC$ is 	(2)	120°
(R)	In the given figure, O is the centre of the circle. If $\angle ACB = 60°$, find $\angle OAB$. 	(3)	35°
(S)	In the given figure, O is the centre of a circle, $\angle AOB = 40°$ and $\angle BDC = 100°$. Find $\angle OBC$. 	(4)	30°

	P	Q	R	S
(a)	2	4	3	1
(b)	2	3	4	1
(c)	1	2	3	4
(d)	1	3	2	4

Ans : (b) P–2, Q–3, R–4, S–1

(P) Clearly, major arc BA subtends x angle at a point on the remaining part of the circle.



Reflex, $\angle AOB = 2x$

$360° - y = 2x$

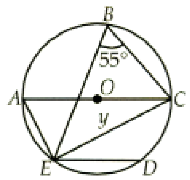
$y = 360° - 2x$

Since, $ACBO$ is a parallelogram.

$x = y \Rightarrow x = 360° - 2x$

$3x = 360° \Rightarrow x = 120°$

(Q) Since, $\angle CBE$ and $\angle CAE$ are the angles in the same segment of arc CDE.



$\angle CAE = \angle CBE$

$\angle CAE = 55°$ $[\angle CBE = 55°]$

Since, AC is the diameter of the circle and the angle in semi-circle is a right angle $\angle AEC = 90°$ Now, in $\triangle ACE$,

$\angle ACE + \angle AEC + \angle CAE = 180°$

$\angle ACE = 35°$

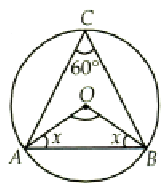
But, $\angle DEC$ and $\angle ACE$ are alternate angles, because

$AC \parallel DE$.

$\angle DEC = \angle ACE = 35°$

(R) $\angle AOB = 120°$

(The angle subtended by an arc of a circle at the centre is double the angle subtended by it at any point on the remaining part of the circle)



$OA = OB$ (Radius of the circle)

$x + x + 120° = 180°$

$2x = 60°$

$x = 30°$

(S) $\angle AOB = 2 \times \angle ACB$

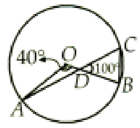
$\angle ACB = \frac{1}{2} \times \angle AOB$

$= \frac{1}{2} \times 40° = 20°$

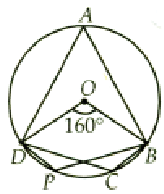
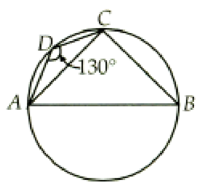
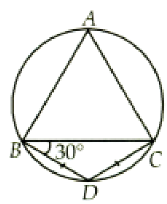
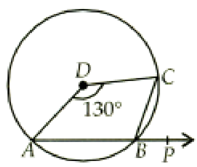
In $\triangle BDC, \angle DBC + \angle BDC + \angle DCB = 180°$

$\angle OBC + 100° + 20° = 180°$

$\angle OBC = 180° - 120° = 60°$



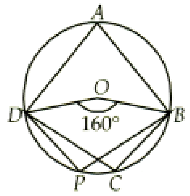
4. Match the following:

	Column-I		Column-II
(P)	In the given figure, $ABCD$ is a cyclic quadrilateral, O is the centre of the circle. If $\angle BOD = 160°$, find the measure of $\angle BPD$. 	(1)	60°
(Q)	In given figure, $ABCD$ is a cyclic quadrilateral whose side AB is a diameter of the circle through A, B, C, D. If $\angle ADC = 130°$, find $\angle BAC$. 	(2)	65°
(R)	In the given figure, $BD = DC$ and $\angle CBD = 30°$, find $\angle BAC$. 	(3)	40°
(S)	In the given figure, D is the centre of the circle and arc ABC subtends an angle of $130°$ at the centre. If AB is extended to P, find $\angle PBC$. 	(4)	100°

	P	Q	R	S
(a)	1	2	3	4
(b)	4	1	3	2
(c)	4	3	1	2
(d)	1	4	2	3

Ans : (c) P-4, Q-3, R-1, S-2

(P) Consider the arc BCD of the circle. This arc makes $\angle BOD = 160^\circ$ at the centre of the circle and $\angle BAD$ at a point A on the circumference.

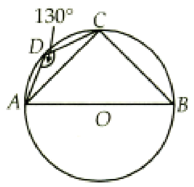


$$\angle BAD = \frac{1}{2}\angle BOD = 80^\circ$$

Now, $ABPD$ is a cyclic quadrilateral.

$$\angle BAD + \angle BPD = 180^\circ$$
$$80^\circ + \angle BPD = 180^\circ$$
$$\angle BPD = 100^\circ$$

(Q) Since $ABCD$ is a cyclic quadrilateral



$$\angle ADC + \angle ABC = 180^\circ$$
$$130^\circ + \angle ABC = 180^\circ$$
$$\angle ABC = 50^\circ$$

Since $\angle ACB = 90^\circ$

Now, in $\triangle ABC$, we have

$$\angle BAC + \angle ACB + \angle ABC = 180^\circ$$
$$\angle BAC + 90^\circ + 50^\circ = 180^\circ$$
$$\angle BAC = 40^\circ$$

(R) $BD = DC$

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

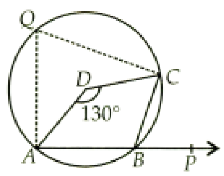
So, $\angle BDC = 180^\circ - 30^\circ - 30^\circ$

$$= 120^\circ$$

As $ABCD$ is cyclic quadrilateral

$$\angle BAC = 180^\circ - 120^\circ = 60^\circ$$

(S) Let Q be a point on circumference.



Join QA and QC.

Now, $ABCQ$ is a cyclic quadrilateral

$$\angle AQC = \frac{1}{2}\angle ADC = 65^\circ$$

$\angle PBC = 65^\circ$ (If one side of a cyclic quadrilateral is produced, then the exterior angle is equal to the interior opposite angle)

5. ASSERTION AND REASON

DIRECTION : In each of the following questions, a statement of Assertion is given followed by a corresponding statement of Reason just below it. Of the statements, mark the correct answer as

(a) Both assertion and reason are true and reason is the correct explanation of assertion.

(b) Both assertion and reason are true but reason is not the correct explanation of assertion.

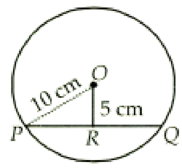
(c) Assertion is true but reason is false.

(d) Assertion is false but reason is true.

1. Assertion : The length of a chord which is at a distance of 5 cm from the centre of a circle of radius 10 cm is 17.32 cm.

Reason : The perpendicular from the centre of a circle to a chord bisects the chord.

Ans : (a) Both assertion and reason are true and reason is the correct explanation of assertion.



Let, PQ be a chord of a circle with centre O and radius 10cm. Draw $OR \perp PQ$.

Now, $OP = 10\text{cm}$ and $OR = 5\text{cm}$

In right triangle ORP, we get

$$OP^2 = PR^2 + OR^2$$
$$PR^2 = OP^2 - OR^2$$
$$PR^2 = 10^2 - 5^2 = 75$$
$$PR = \sqrt{75} = 8.66$$

Since, the perpendicular from the centre to a chord bisects the chord.

Therefore, $PQ = 2 \times PR$

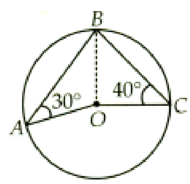
$$= 2 \times 8.66 = 17.32\text{cm}$$

2. Assertion : The circumference of a circle must be a positive real number.

Reason : If $r(> 0)$ is the radius of the circle, then its circumference $2\pi r$ is a positive real number.

Ans : (a) Both Assertion and Reason are correct and Reason is the correct explanation of Assertion.

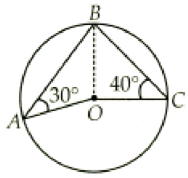
3. Assertion : The measure of $\angle AOC = 60^\circ$



Reason : Angle subtended by an arc of a circle at the centre of the circle is double the angle subtended by arc on the circumference.

Ans : (d) Assertion is false but reason is true.

Join BO.



In $\Delta\, AOB$, we have

$$OA = OB \qquad \text{[radius]}$$

$$\angle OBA = \angle OAB$$

[Angle opposite to equal sides of a triangle are equal]

$$\angle OBA = 30^\circ \qquad ...(1)$$

Similarly, in $\Delta\, BOC$, we get $OB = OC$

$$\angle OCB = \angle OBC$$

$$\angle OBC = 40^\circ \qquad ...(2)$$

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

$$= 30^\circ + 40^\circ = 70^\circ$$

[Using (1) and (2)]

Since angle subtended by an arc of a circle at the centre of the circle is double the angle subtended by the arc on the circumference.

$$\angle AOC = 2 \times \angle ABC$$

$$= 2 \times 70^\circ = 140^\circ$$

4. **Assertion :** Given a circle of radius r and with centre O. A point P lies in a plane such that $OP > r$ then point P lies on the exterior of the circle.

Reason : The region between an arc and the two radii, joining the centre of the end points of the arc, is called a sector.

Ans : (b) Both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.

5. **Assertion :** In a cyclic quadrilateral $ABCD$, $\angle A - \angle C = 60^\circ$, then the smaller of two is 60°.

Reason : Opposite angles of cyclic quadrilateral are supplementary.

Ans : (a) Both assertion and reason are true and reason is the correct explanation of assertion.

Since $ABCD$ is a cyclic quadrilateral, so, its opposite angles are supplementary

$$\angle A + \angle C = 180^\circ \qquad ...(1)$$

Also, $\angle A - \angle C = 60^\circ \qquad ...(2)$

On solving (i) and (ii), we get

$$\angle A = 120^\circ, \angle C = 60^\circ$$

6. **Assertion :** If P and Q are any two points on a circle, then the line segment PQ is called a chord of the circle.

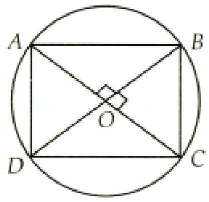
Reason : Equal chords of a circle subtend equal angles at the centre.

Ans : (b) Both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.

7. **Assertion :** Two diameters of a circle intersect each other at right angles. Then the quadrilateral formed by joining their end-points is a square.

Reason : Equal chords subtend equal angles at the centre.

Ans : (a) Both assertion and reason are true and reason is the correct explanation of assertion.



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

Now, $\angle ABC = 90^\circ$

[Angle in semicircle is a right angle]

Similarly $\angle ACD = \angle ADC$

$$= \angle BAD = 90^\circ \qquad ...(1)$$

In $\Delta\, AOB$ and $\Delta\, AOD$, we have

$$AO = AO \qquad \text{(Common)}$$

$$\angle AOB = \angle AOD \qquad \text{(Each } 90^\circ\text{, given)}$$

$$BO = OD \qquad \text{(Radii of circle)}$$

$$\Delta\, AOB \cong \angle AOD \text{(By SAS congruence)}$$

$$AB = AD \qquad \text{(By C.P.C.T.)}$$

Similarly, we have,

$$AD = DC,\ DC = BC; BC = AB$$

Hence, $AB = BC = CD = DA \qquad ...(2)$

Also, it is given that diagonals of $ABCD$ intersect at 90° ...(3)

By (1), (2) and (3) $ABCD$ is a square.

8. **Assertion :** The sum of either pair of opposite angles of a cyclic quadrilateral is 180°.

Reason : Two or more circles are called concentric circles if and only if they have different centre and radii.

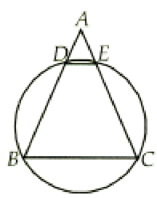
Ans : (c) Assertion is correct but Reason is incorrect.

Two or more circles are called concentric circles if and only if they have same centre but different radii.

9. **Assertion :** In an isosceles triangles ABC with $AB = AC$, a circle is passing through B and C intersects the sides AB and AC at D and E respectively. Then $DE \,||\, BC$.

Reason : Exterior angle of a cyclic quadrilateral is equal to interior opposite angle of that quadrilateral.

Ans : (a) Both assertion and reason are true and reason is the correct explanation of assertion.



To prove $DE \parallel BC$

i.e., $\angle B \angle ADE$.

In ΔABC, we have

$$AB = AC$$

$$\angle B = \angle C \quad ...(1)$$

In the cyclic quadrilateral $CBDE$,
side BD is produced to A. We know that an exterior angle of cyclic quadrilateral is equal to interior opposite angle of cyclic quadrilateral.

$$\angle ADE = \angle C \quad ...(2)$$

From (1) and (2), we get

$$\angle B = \angle ADE.$$

Hence, $DE \parallel BC$

10. Assertion : A diameter of a circle is the longest chord of the circle and all diameters have equal length.
Reason : Length of a diameter = radius.

Ans : (c) Assertion is correct but Reason is incorrect.