**NCERT Solutions for Class 9**
**MATHS – Circles**

**1.** Fill in the blanks:

(i) The centre of a circle lies in ________ of the circle. (exterior/ interior)

(ii) A point, whose distance from the centre of a circle is greater than its radius lies in ________ of the circle. (exterior/ interior)

(iii) The longest chord of a circle is a ________ of the circle.

(iv) An arc is a ________ when its ends are the ends of a diameter.

(v) Segment of a circle is the region between an arc and ________ of the circle.

(vi) A circle divides the plane, on which it lies, in ________ parts.

**Sol.** (i) The centre of a circle lies in **interior** of the circle.

(ii) A point, whose distance from the centre of a circle is greater than its radius lies in **exterior** of the circle.

(iii) The longest chord of a circle is a **diameter** of the circle.

(iv) An arc is a **semi-circle** when its ends are the ends of a diameter.

(v) Segment of a circle is the region between an arc and **chord** of the circle.

(vi) A circle divides the plane, on which it lies, in **two** parts.

**2.** Write True or False: Give reasons for your answers.

(i) Line segment joining the centre to any point on the circle is a radius of the circle.

(ii) A circle has only finite number of equal chords.

(iii) If a circle is divided into three equal arcs, each is a major arc.

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

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

(vi) A circle is a plane figure.

**Sol.** **(i)** True

**(ii)** **False.** Because, there are infinite number of equal chords in a circle.

**(iii)** **False.** Because, each arc will make an angle of 120° at the centre. But major arc make angle greater than 180° at the centre.

**(iv)** True

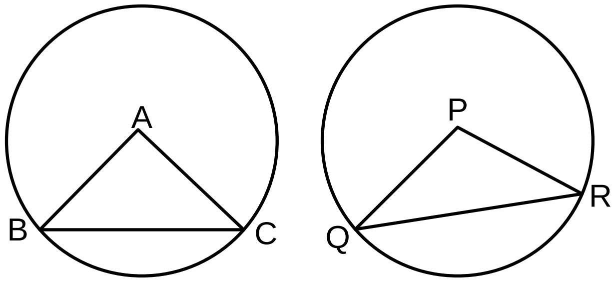
**(v)** **False.**Because, between chord and arc a segment is formed. Sector is the region which is formed between radii and arc.

**(vi)** True

**3.** Recall that two circles are congruent if they have the same radii. Prove that equal chords of congruent circles subtend equal angles at their centres.

**Sol.** **Given:** Circle C(A, r) and C(P, r) are two congruent circles such that BC = QR

**To prove:** $\angle BAC = \angle QPR$



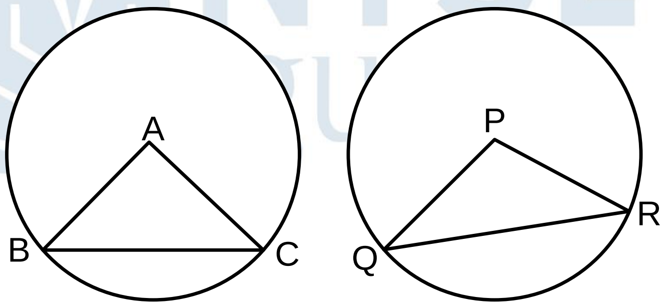

Proof: In $\Delta ABC$ and $\Delta PQR$,

| | |
|---|---|
| BC = QR | [$\because$ Given] |
| AB = PQ | [$\because$ Radii of congruent circles] |
| AC = PR | [$\because$ Radii of congruent circles] |
| Hence, $\Delta ABC \cong \Delta PQR$ | [$\because$ SSS congruency rule] |
| $\angle BAC = \angle QPR$ | [$\because$ CPCT] |

**4.** Prove that if chords of congruent circles subtend equal angles at their centres, then the chords are equal.

**Sol.** **Given:** Circle C(A, r) and C(P, r) are two congruent circles such that $\angle BAC = \angle QPR$.

**To prove:** BC = QR




| | |
|---|---|
| Proof: In $\Delta ABC$ and $\Delta PQR$, AB = PQ | [$\because$ Radii of congruent circles] |
| $\angle BAC = \angle QPR$ | [$\because$ Given] |
| $AC = PR$ | [$\because$ Radii of congruent circles] |
| Hence, $\Delta ABC \cong \Delta PQR$ | [$\because$ SAS Congruency rule] |
| BC = QR | [$\because$ CPCT] |

5. Draw different pairs of circles. How many points does each pair have in common? What is the maximum number of common points?

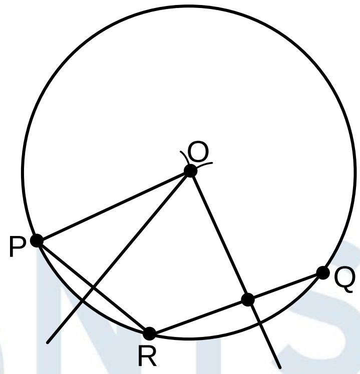
**Sol.**


In each pair either 0 or 1 or 2 points are common. The maximum number of common points is 2.

6. Suppose you are given a circle. Give a construction to find its centre.

**Sol.** **Given:** P, Q and R lies on circle C(O, r).

**Construction:**




- Join PR and QR.
- Draw the perpendicular bisectors of PR and QR which intersects at point O.
- Taking O as centre and OP as radius, draw a circle.
- This is the required circle.

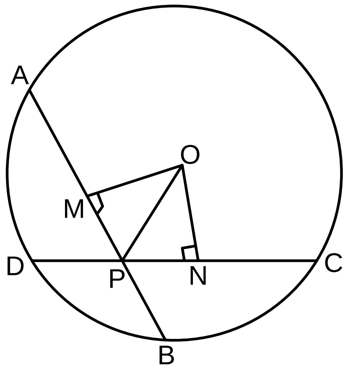
7. If two equal chords of a circle intersect within the circle, prove that the segments of one chord are equal to corresponding segments of the other chord.

**Sol.** **Given:** In circle C(0, r), equal chords AB and CD intersects at P.

**To prove:** AP = CP and BP = DP

**Construction:** Join OP. Draw $OM \perp AB$ on $ON \perp CD$.

**Proof:** In $\Delta OMP$ and $\Delta ONP$,




$\angle$OMP = $\angle$ONP [$\because$ Each $90^o$]

$OP = OP$ [$\because$ Common]

OM = ON [$\because$ Equal chords of a circle are equidistant from the centre]

Hence, $\Delta OMP \cong \Delta ONP$ [$\because$ RHS Congruency rule]

PM = PN …(1) [$\because$ CPCT]

and AB = CD …(2) [$\because$ Given]

$\Rightarrow \frac{1}{2}AB = \frac{1}{2}CD$

$\Rightarrow AM = CN$ …(3)

Adding the equations (1) and (3), we have

AM + PM = CN + PN

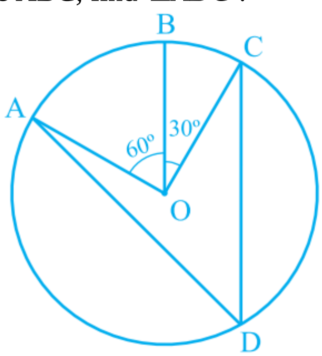
$\Rightarrow AP = CP$ …(4)

Subtracting equation (4) from (2), we have

$AB - AP = CD - CP$

$\Rightarrow PB = PD$

**8.** In Figure, A,B and C are three points on a circle with centre O such that $\angle BOC = 30^o$ and $\angle AOB = 60^o$ °. If D is a point on the circle other than the arc ABC, find $\angle ADC$ .



**Sol.** $\angle AOC = \angle AOB + \angle BOC = 60^o + 30^o = 90^o$

$\angle AOC = 2\angle ADC$

[$\because$ The angle subtended by an arc at the centre is double the angle subtended by it at any part of the circle.]

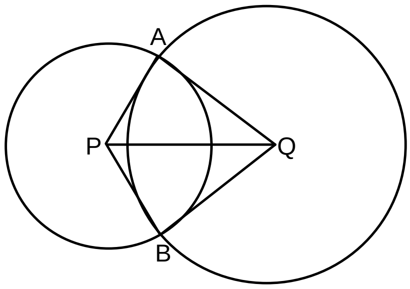
$\Rightarrow \angle ADC = \frac{1}{2}\angle AOC \quad \Rightarrow ADC = \frac{1}{2}\times 90^o = 45^o$

**9.** Prove that the line of centres of two intersecting circles subtends equal angles at the two points of intersection.

**Sol.** **Given:** Circle C(P, r) and Circle C(Q, r') intersects each other at A and B.

**To prove:** $\angle PAQ = \angle PBQ$

**Proof:** In $\Delta APQ$ and $\Delta BPQ$,




PQ = PQ [$\because$ Common]
PA = PB [$\because$ Radii of same circle]
QA = QB [$\because$ Radii of same circle]
Therefore, $\Delta APQ \cong \Delta BPQ$ [$\because$ SSS Congruency rule]
Hence, $\angle PAQ = \angle PBQ$ [$\because$ CPCT]

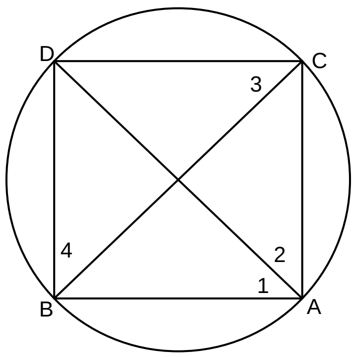
**10.** In any triangle ABC, if the angle bisector of $\angle A$ and perpendicular bisector of BC intersect, prove that they intersect on the circumcircle of the triangle ABC.

**Sol.** Given: In triangle ABC, bisector of $\angle A$ meet the circumcircle of triangle ABC at D.

To prove: D lies on perpendicular bisector of BC.

Construction: Join BD and DC.

Proof: $\angle 1$ and $\angle 3$ lies in the same segment. Therefore



$\angle 1 = \angle 3$ …(1) [$\because$ Angles in the same segment are equal]

Similarly $\angle 2 = \angle 4$ …(2)

And, $\angle 1 = \angle 2$ …(3) [$\because$ Given] [Angle bisector]

From the equation (1), (2) and (3), we have $\angle 3 = \angle 4$

Hence, $BD = DC$ [$\because$ In an isosceles triangle, angles opposite to equal sides are equal]

All the points lying perpendicular bisector of BC will be equidistant from B and C.

Hence, the point D also lies on perpendicular bisector of BC.