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NCERT Solutions for 9th Class Maths : Chapter 10 Circles

NCERT Solutions for 9th Class Maths : Chapter 10 Circles

Class 9: Maths Chapter 10 solutions. Complete Class 9 Maths Chapter 10 Notes.

NCERT Solutions for 9th Class Maths : Chapter 10 Circles

NCERT 9th Maths Chapter 10, class 9 Maths Chapter 10 solutions

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Exercise 10.1

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.

Answer

(i) The centre of a circle lies in interior

of the circle. (exterior/interior)

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

of the circle. (exterior/interior)

(iii) The longest chord of a circle is a diameter

of the circle.

(iv) An arc is a semicircle

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 three

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.

Answer

(i) True.

All the line segment from the centre to the circle is of equal length.

(ii) False.

We can draw infinite numbers of equal chords.

(iii) False.

We get major and minor arcs for unequal arcs. So, for equal arcs on circle we can't say it is major arc or minor arc.

(iv) True.

A chord which is twice as long as radius must pass through the centre of the circle and is diameter to the circle.

(v) False.

Sector is the region between the arc and the two radii of the circle.

(vi) True.

A circle can be drawn on the plane.

Exercise 10.2

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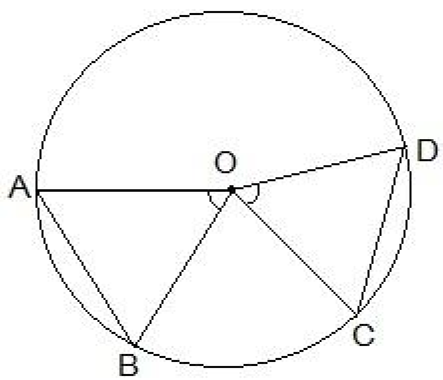
1. Recall that two circles are congruent if they have the same radii. Prove that equal chords of congruent circles subtend equal angles at their centres.

Answer

A circle is a collection of points whose every every point is equidistant from the centre. Thus, two circles can only be congruent when they the distance of every point of the both circle is equal from the centre.



Given,

AB = CD (Equal chords)

To prove,

∠AOB = ∠COD

Proof,

In ΔAOB and ΔCOD,

OA = OC (Radii)

OB = OD (Radii)

AB = CD (Given)

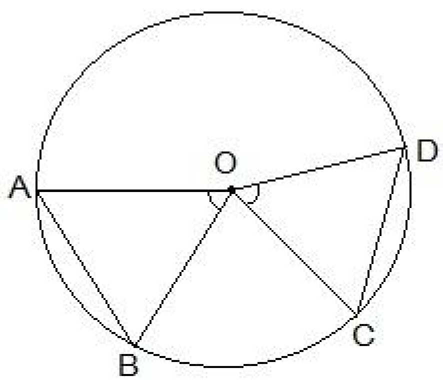
∴ ΔAOB ≅ ΔCOD (SSS congruence condition)

Thus, ∠AOB = ∠COD by CPCT.

Equal chords of congruent circles subtend equal angles at their centres.

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

Answer



Given,

∠AOB = ∠COD (Equal angles)

To prove,

AB = CD

Proof,

In ΔAOB and ΔCOD,

OA = OC (Radii)

∠AOB = ∠COD (Given)

OB = OD (Radii)

∴ ΔAOB ≅ ΔCOD (SAS congruence condition)

Thus, AB = CD by CPCT.

If chords of congruent circles subtend equal angles at their centres, then the chords are equal.

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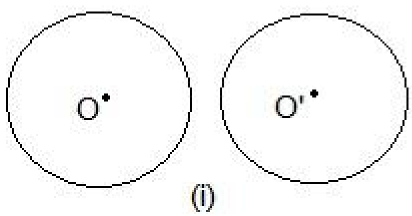
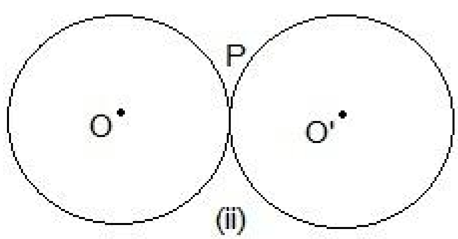
Exercise 10.3

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

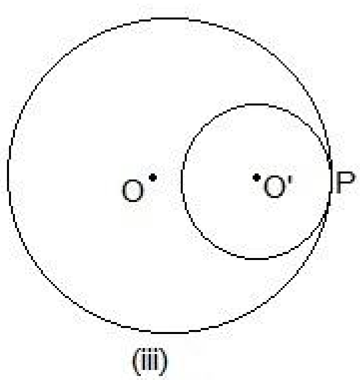
Answer



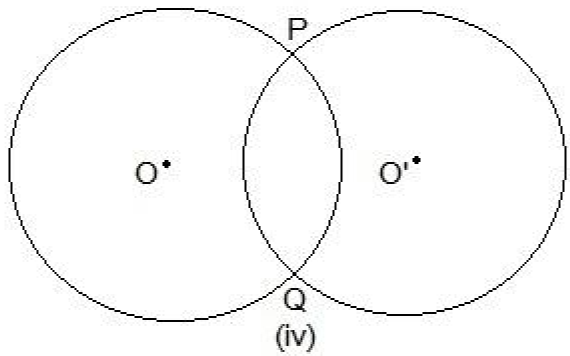
No point is common.



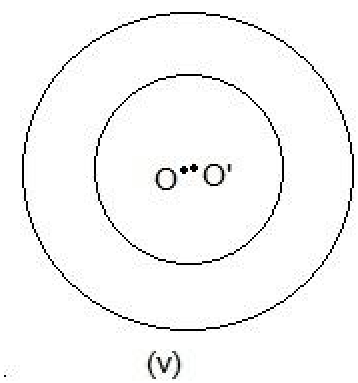
One point P is common.



One point P is common.



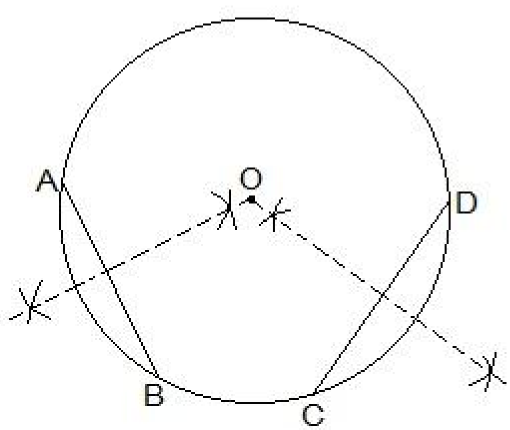
Two points P and Q are common.



No point is common.

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

Answer



Steps of construction:

Step I: A circle is drawn.

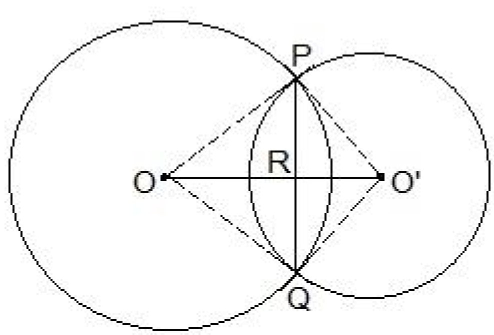
Step II: Two chords AB and CD are drawn.

Step III: Perpendicular bisector of the chords AB and CD are drawn.

Step IV: Let these two perpendicular bisector meet at a point. The point of intersection of these two perpendicular bisector is the centre of the circle.

3. If two circles intersect at two points, prove that their centres lie on the perpendicular bisector of the common chord.

Answer



Given,

Two circles which intersect each other at P and Q.

To prove,

OO' is perpendicular bisector of PQ.

Proof,

In ΔPOO' and ΔQOO',

OP = OQ (Radii)

OO' = OO' (Common)

O'P = OQ (Radii)

∴ ΔPOO' ≅ ΔQOO' (SSS congruence condition)

Thus,

∠POO' = ∠QOO' --- (i)

In ΔPOR and ΔQOR,

OP = OQ (Radii)

∠POR = ∠QOR (from i)

OR = OR (Common)

∴ ΔPOR ≅ ΔQOR (SAS congruence condition)

Thus,

∠PRO = ∠QRO

also,

∠PRO + ∠QRO = 180°

⇒ ∠PRO = ∠QRO = 180°/2 = 90°

Hence,

OO' is perpendicular bisector of PQ.

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Exercise 10.4

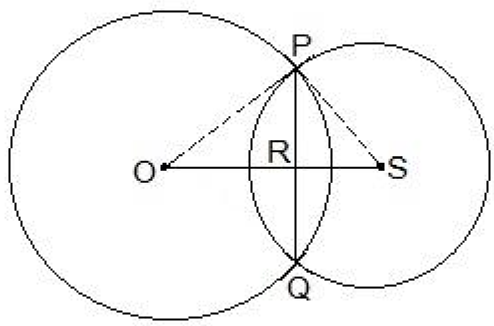
1. Two circles of radii 5 cm and 3 cm intersect at two points and the distance between their centres is 4 cm. Find the length of the common chord.

Answer

OP = 5cm, PS = 3cm and OS = 4cm.

also, PQ = 2PR

Let RS be x.



In ΔPOR,

$OP^2 = OR^2 + PR^2$

⇒ $5^2 = (4-x)^2 + PR^2$

⇒ $25 = 16 + x^2 - 8x + PR^2$

⇒ $PR^2 = 9 - x^2 + 8x$ --- (i)

In ΔPRS,

$PS^2 = PR^2 + RS^2$

⇒ $3^2 = PR^2 + x^2$

⇒ $PR^2 = 9 - x^2$ --- (ii)

Equating (i) and (ii),

$9 - x^2 + 8x = 9 - x^2$

⇒ $8x = 0$

⇒ $x = 0$

Putting the value of x in (i) we get,

$PR^2 = 9 - 0^2$

⇒ PR = 3cm

Length of the cord PQ = 2PR = 2×3 = 6cm

2. 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.

Answer

Given,

AB and CD are chords intersecting at E.

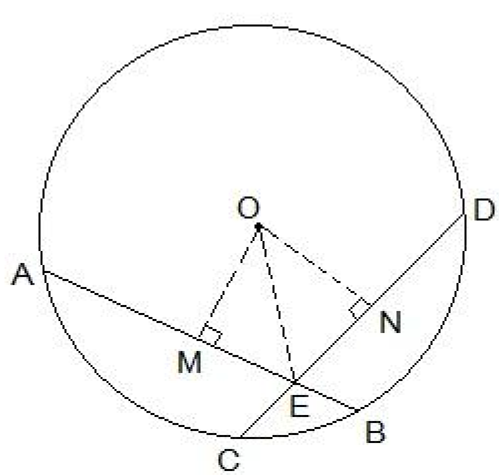
AB = CD

To prove,

AE = DE and CE = BE

Construction,

OM ⊥ AB and ON ⊥ CD. OE is joined.



Proof,

OM bisects AB (OM ⊥ AB)

ON bisects CD (ON ⊥ CD)

As AB = CD thus,

AM = ND --- (i)

and MB = CN --- (ii)

In ΔOME and ΔONE,

∠OME = ∠ONE (Perpendiculars)

OE = OE (Common)

OM = ON (AB = CD and thus equidistant from the centre)

ΔOME ≅ ΔONE by RHS congruence condition.

ME = EN by CPCT --- (iii)

From (i) and (ii) we get,

AM + ME = ND + EN

⇒ AE = ED

From (ii) and (iii) we get,

MB - ME = CN - EN

⇒ EB = CE

3. If two equal chords of a circle intersect within the circle, prove that the line joining the point of intersection to the centre makes equal angles with the chords.

Answer

Given,

AB and CD are chords intersecting at E.

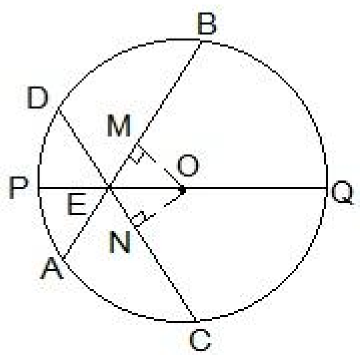
AB = CD, PQ is the diameter.

To prove,

∠BEQ = ∠CEQ

Construction,

OM ⊥ AB and ON ⊥ CD. OE is joined.



In ΔOEM and ΔOEN,

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

OE = OE (Common)

∠OME = ∠ONE (Perpendicular)

ΔOEM ≅ ΔOEN by RHS congruence condition.

Thus,

∠MEO = ∠NEO by CPCT

⇒ ∠BEQ = ∠CEQ

4. If a line intersects two concentric circles (circles with the same centre) with centre O at A, B, C and D, prove that AB = CD (see Fig. 10.25).

Answer

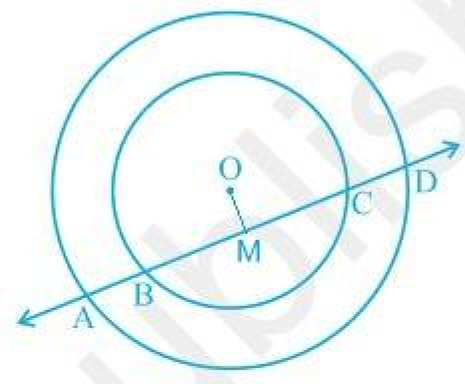


Fig. 10.25

OM ⊥ AD is drawn from O.

OM bisects AD as OM ⊥ AD.

⇒ AM = MD --- (i)

also, OM bisects BC as OM ⊥ BC.

⇒ BM = MC --- (ii)

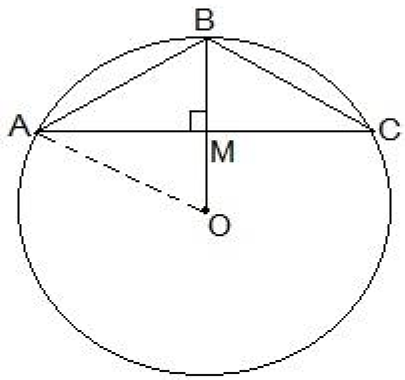
From (i) and (ii),

AM - BM = MD - MC

⇒ AB = CD

5. Three girls Reshma, Salma and Mandip are playing a game by standing on a circle of radius 5m drawn in a park. Reshma throws a ball to Salma, Salma to Mandip, Mandip to Reshma. If the distance between Reshma and Salma and between Salma and Mandip is 6m each, what is the distance between Reshma and Mandip?

Answer



Let A, B and C represent the positions of Reshma, Salma and Mandip respectively.

AB = 6cm and BC = 6cm.

Radius OA = 5cm

BM ⊥ AC is drawn.

ABC is an isosceles triangle as AB = BC, M is mid-point of AC. BM is perpendicular bisector of AC and thus it passes through the centre of the circle.

Let AM = y and OM = x then BM = (5-x).

Applying Pythagoras theorem in ΔOAM,

$OA^2 = OM^2 + AM^2$

⇒ $5^2 = x^2 + y^2$ --- (i)Applying Pythagoras theorem in ΔAMB,

$AB^2 = BM^2 + AM^2$

⇒ $6^2 = (5-x)^2 + y^2$ --- (ii)Subtracting (i) from (ii), we get

$36 - 25 = (5-x)^2 - x^2$ -

⇒ 11 = 25 - 10x

⇒ 10x = 14 ⇒ x= 7/5

Substituting the value of x in (i), we get

$y^2 + 49/25 = 25$

⇒ $y^2 = 25 - 49/25$

⇒ $y^2 = (625 - 49)/25$

⇒ $y^2 = 576/25$

⇒ $y = 24/5$

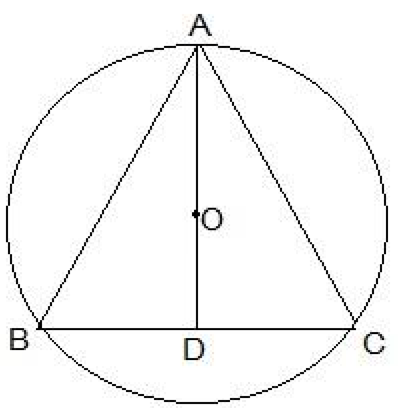
Thus,

AC = 2×AM = 2×y = 2×(24/5) m = 48/5 m = 9.6 m

Distance between Reshma and Mandip is 9.6 m.

6. A circular park of radius 20m is situated in a colony. Three boys Ankur, Syed and David are sitting at equal distance on its boundary each having a toy telephone in his hands to talk each other. Find the length of the string of each phone.

Answer



Let A, B and C represent the positions of Ankur, Syed and David respectively. All three boys at equal distances thus ABC is an equilateral triangle.

AD ⊥ BC is drawn. Now, AD is median of ΔABC and it passes through the centre O.

Also, O is the centroid of the ΔABC. OA is the radius of the triangle.

OA = 2/3 AD

Let the side of a triangle a metres then BD = a/2 m.

Applying Pythagoras theorem in ΔABD,

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

$\Rightarrow AD^2 = AB^2 - BD^2$

$\Rightarrow AD^2 = a^2 - (a/2)^2$

$\Rightarrow AD^2 = 3a^2/4$

$\Rightarrow AD = \sqrt{3}a/2$

$OA = 2/3\ AD \Rightarrow 20\ m = 2/3 \times \sqrt{3}a/2$

$\Rightarrow a = 20\sqrt{3}\ m$

Length of the string is $20\sqrt{3}$ m.

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Exercise 10.5

1. In Fig. 10.36, A,B and C are three points on a circle with centre O such that ∠BOC = 30° and ∠AOB = 60°. If D is a point on the circle other than the arc ABC, find ∠ADC.

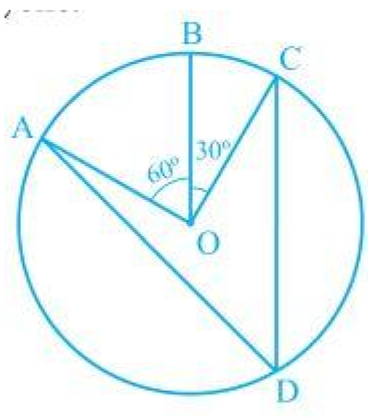

Fig. 10.36

Answer

Here,

∠AOC = ∠AOB +

∠BOC

⇒ ∠AOC = 60° + 30°

⇒ ∠AOC = 90°

We know that angle subtended by an arc at centre is double the angle subtended by it any point on the remaining part of the circle.

∠ADC = 1/2∠AOC = 1/2 × 90° = 45°

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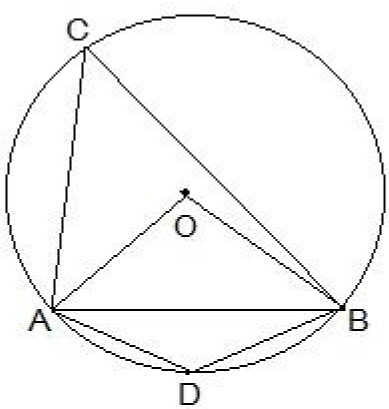
2. A chord of a circle is equal to the radius of the circle. Find the angle subtended by the chord at a point on the minor arc and also at a point on the major arc.

Answer



Given,

AB is equal to the radius of the circle.

In ΔOAB,

OA = OB = AB = radius of the circle.

Thus, ΔOAB is an equilateral triangle.

∠AOC = 60°

also,

∠ACB = 1/2 ∠AOB = 1/2 × 60° = 30°

ACBD is a cyclic quadrilateral,

∠ACB +

∠ADB = 180° (Opposite angles of cyclic quadrilateral)

⇒ ∠ADB = 180° - 30° = 150°

Thus, angle subtend by the chord at a point on the minor arc and also at a point on the major arc are 150° and 30° respectively.

3. In Fig. 10.37, ∠PQR = 100°, where P, Q and R are points on a circle with centre O. Find ∠OPR.

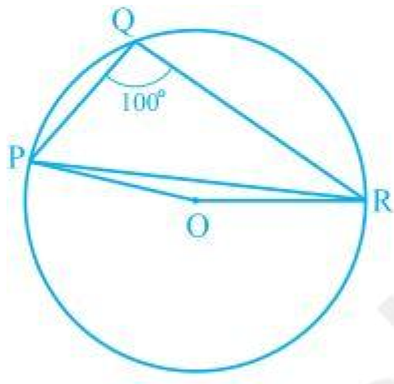


Fig. 10.37

Answer

Reflex ∠POR = 2 × ∠PQR = 2 × 100° = 200°

∴ ∠POR = 360° - 200° = 160°

In ΔOPR,

OP = OR (radii of the circle)

∠OPR = ∠ORP

Now,

∠OPR +

∠ORP +

∠POR = 180° (Sum of the angles in a triangle)

⇒ ∠OPR +

∠OPR + 160° = 180°

⇒ 2∠OPR = 180° - 160°

⇒ ∠OPR = 10°

4. In Fig. 10.38, ∠ABC = 69°, ∠ ACB = 31°, find ∠BDC.

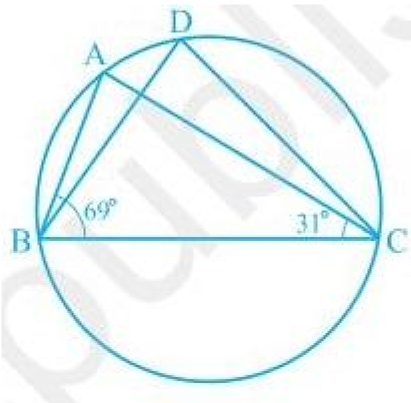


Fig. 10.38

Answer

∠BAC = ∠BDC (Angles in the segment of the circle)

In ΔABC,

∠BAC +

∠ABC +

∠ACB = 180° (Sum of the angles in a triangle)

⇒ ∠BAC + 69° + 31° = 180°

⇒ ∠BAC = 180° - 100°

⇒ ∠BAC = 80°

Thus, ∠BDC = 80°

5. In Fig. 10.39, A, B, C and D are four points on a circle. AC and BD intersect at a point E such that ∠BEC = 130° and ∠ECD = 20°. Find ∠ BAC.

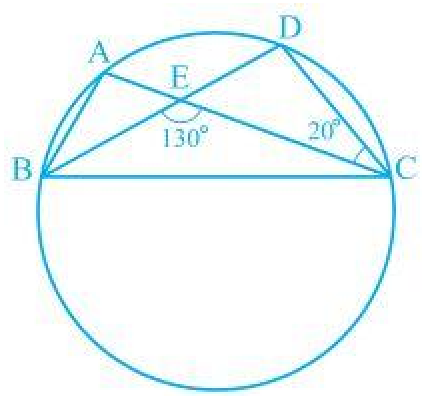


Fig. 10.39

Answer

∠BAC = ∠CDE (Angles in the segment of the circle)

In ΔCDE,

∠CEB = ∠CDE + ∠DCE (Exterior angles of the triangle)

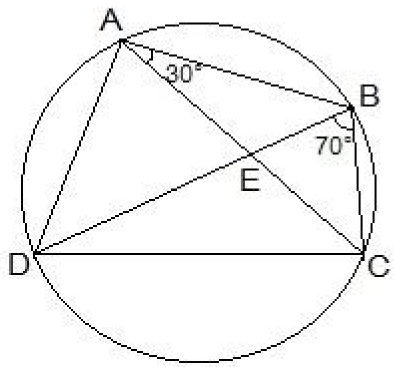
⇒ 130° = ∠CDE + 20°

⇒ ∠CDE = 110°

Thus, ∠BAC = 110°

6. ABCD is a cyclic quadrilateral whose diagonals intersect at a point E. If ∠DBC = 70°, ∠BAC is 30°, find ∠BCD. Further, if AB = BC, find ∠ECD.

Answer



For chord CD,

∠CBD = ∠CAD (Angles in same segment)

∠CAD = 70°

∠BAD = ∠BAC + ∠CAD = 30° + 70° = 100°

∠BCD + ∠BAD = 180° (Opposite angles of a cyclic quadrilateral)

⇒ ∠BCD + 100° = 180°

⇒ ∠BCD = 80°

In ΔABC

AB = BC (given)

∠BCA = ∠CAB (Angles opposite to equal sides of a triangle)

∠BCA = 30°

also, ∠BCD = 80°

∠BCA + ∠ACD = 80°

⇒ 30° + ∠ACD = 80°

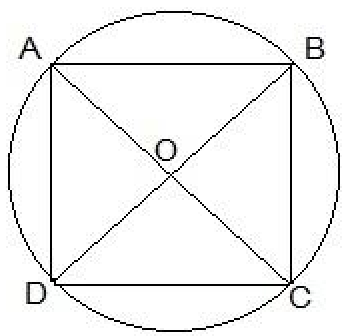
∠ACD = 50°

$\angle ECD = 50°$

7. If diagonals of a cyclic quadrilateral are diameters of the circle through the vertices of the quadrilateral, prove that it is a rectangle.

Answer

Let ABCD be a cyclic quadrilateral and its diagonal AC and BD are the diameters of the circle through the vertices of the quadrilateral.



$\angle ABC = \angle BCD = \angle CDA = \angle DAB = 90°$ (Angles in the semi-circle)

Thus, ABCD is a rectangle as each internal angle is 90°.

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8. If the non-parallel sides of a trapezium are equal, prove that it is cyclic.

Answer

Given,

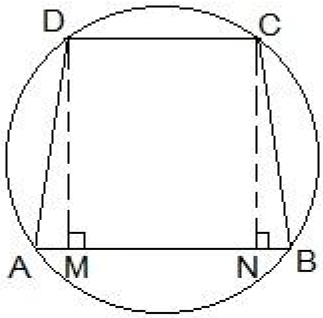
ABCD is a trapezium where non-parallel sides AD and BC are equal.

Construction,

DM and CN are perpendicular drawn on AB from D and C respectively.

To prove,

ABCD is cyclic trapezium.



Proof:

In ΔDAM and ΔCBN,

AD = BC (Given)

∠AMD = ∠BNC (Right angles)

DM = CN (Distance between the parallel lines)

ΔDAM ≅ ΔCBN by RHS congruence condition.

Now,

∠A = ∠B by CPCT

also, ∠B +

∠C = 180° (sum of the co-interior angles)

⇒ ∠A + ∠C = 180°

Thus, ABCD is a cyclic quadrilateral as sum of the pair of opposite angles is 180°.

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9. Two circles intersect at two points B and C. Through B, two line segments ABD and PBQ are drawn to intersect the circles at A, D and P, Q respectively (see Fig. 10.40). Prove that ∠ACP = ∠QCD.

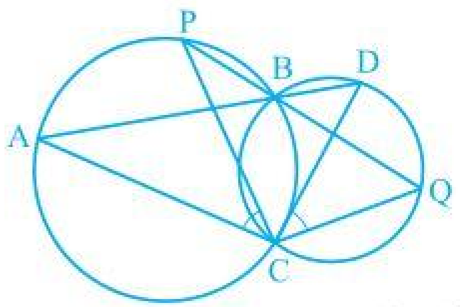

Fig. 10.40

Answer

Chords AP and DQ are joined.

For chord AP,

∠PBA = ∠ACP (Angles in the same segment) --- (i)

For chord DQ,

∠DBQ = ∠QCD (Angles in same segment) --- (ii)

ABD and PBQ are line segments intersecting at B.

∠PBA = ∠DBQ (Vertically opposite angles) --- (iii)

By the equations (i), (ii) and (iii),

∠ACP = ∠QCD

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10. If circles are drawn taking two sides of a triangle as diameters, prove that the point of intersection of these circles lie on the third side.

Answer

Given,

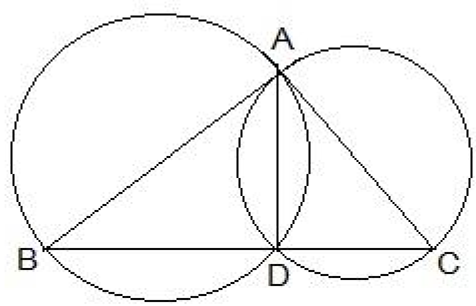
Two circles are drawn on the sides AB and AC of the triangle ΔABC as diameters. The circles intersected at D.

Construction,

AD is joined.

To prove,

D lies on BC. We have to prove that BDC is a straight line.



Proof:

∠ADB = ∠ADC = 90° (Angle in the semi circle)

Now,

∠ADB + ∠ADC = 180°

⇒ ∠BDC is straight line.

Thus, D lies on the BC.

11. ABC and ADC are two right triangles with common hypotenuse AC. Prove that ∠CAD = ∠CBD.

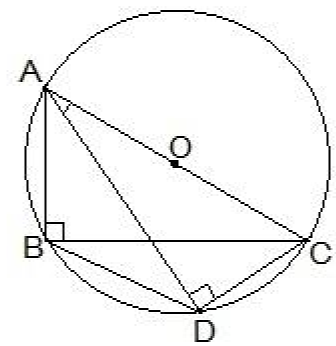
Answer

Given,

AC is the common hypotenuse. ∠B = ∠D = 90°.

To prove,

∠CAD = ∠CBD



Proof:

Since, ∠ABC and ∠ADC are 90°. These angles are in the semi circle. Thus, both the triangles are lying in the semi circle and AC is the diameter of the circle.

⇒ Points A, B, C and D are concyclic.

Thus, CD is the chord.

⇒ ∠CAD = ∠CBD (Angles in the same segment of the circle)

12. Prove that a cyclic parallelogram is a rectangle.

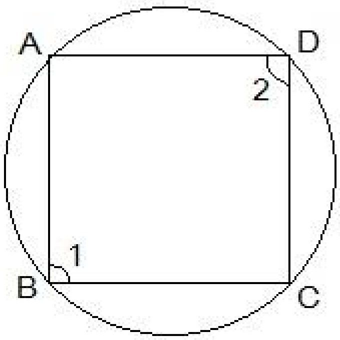
Answer

Given,

ABCD is a cyclic parallelogram.

To prove,

ABCD is rectangle.



Proof:

∠1 +

∠2 = 180° (Opposite angles of a cyclic parallelogram)

also, Opposite angles of a cyclic parallelogram are equal.

Thus,

∠1 = ∠2

⇒ ∠1 + ∠1 = 180°

⇒ ∠1 = 90°

One of the interior angle of the paralleogram is right angled. Thus, ABCD is a rectangle.

Chapter 10 Circles NCERT Solutions will help you in understanding about circles, other related terms and some properties of a circle. NCERT Textbooks for Class 9 are prepared in such a way that students can understand topics in an interesting way.

• Circles and Its Related Terms: A Review: The collection of all the points in a plane, which are at a fixed distance from a fixed point in the plane, is called a circle. The fixed point is called the centre of the circle and the fixed distance is called the radius of the circle. A piece of a circle between two points is called an arc. The length of the complete circle is called its circumference. The region between a chord and either of its arcs is called a segment of the circle. When two arcs are equal, that is, each is a semicircle, then both segments and both sectors become the same and each is known as a semicircular region.

• Angle Subtended by a Chord at a Point: Equal chords of a circle subtend equal angles at the centre. If the angles subtended by the chords of a circle at the centre are equal, then the chords are equal.

• Perpendicular from the Centre to a Chord: The perpendicular from the centre of a circle to a chord bisects the chord. The line drawn through the centre of a circle to bisect a chord is perpendicular to the chord.

• Circle through Three Points: There is one and only one circle passing through three given non-collinear points.

• Equal Chords and Their Distances from the Centre: The length of the perpendicular from a point to a line is the distance of the line from the point.

(i) Equal chords of a circle (or of congruent circles) are equidistant from the centre (or centres).

(ii) Chords equidistant from the centre of a circle are equal in length.

• Angle Subtended by an Arc of a Circle: If two chords of a circle are equal, then their corresponding arcs are congruent and conversely, if two arcs are congruent, then their corresponding chords are equal.

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

(ii) Angles in the same segment of a circle are equal.

(iii) If a line segment joining two points subtends equal angles at two other points lying on the same side of the line containing the line segment, the four points lie on a circle (i.e. they are concyclic).

• Cyclic Quadrilaterals: A quadrilateral ABCD is called cyclic if all the four vertices of it lie on a circle. The sum of either pair of opposite angles of a cyclic quadrilateral is 180º. If the sum of a pair of opposite angles of a quadrilateral is 180º, the quadrilateral is cyclic.

There are total six exercises in the **Chapter 10 Class 9 NCERT Solutions** which can be used to complete homework and understand the concepts behind the questions. You can find exercisewise Class 9 Maths NCERT Solutions from the links given below.

These NCERT Solutions prepared by Indcareer Schools experts have taken every care so students can easily understand and clear their doubts. These solutions are prerequisites before going for supplementary Maths Books.

NCERT Solutions for Class 9 Maths Chapters:

FAQ on Chapter 10 Circles

How many exercises in Chapter 10 Circles?

Chapter 10 Circles Class 9 NCERT Solutions for Maths contains total six exercises in which the last one if optional. You will get detailed and accurate NCERT Solutions of every question so you can always find them whenever any difficulty occur.

The diameter of circle is 3.8 cm. Find the length of its radius.

Since, the diameter of circle is double its radius.

∴ Diameter = 2 x Radius

⇒ (1/2)x Diameter = Radius

⇒ Radius = (1/2) x 3.8 cm

= 1/2 x 38/10 cm

= 19/10 = 1.9 cm.

What is an arc?

The length of the complete circle is called its circumference, whereas a piece of a circle between two points is called an arc. If the length of an arc is less than the semicircle, then it is a minor arc, otherwise, it is a major arc.

What is a diameter?

A chord, passing through the centre is called a diameter of the circle.

NCERT 9th Maths Chapter 10, class 9 Maths Chapter 10 solutions

Chapterwise NCERT Solutions for Class 9 Maths :

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