NCERT Solutions Class 10 Maths
Chapter 10: Circles
Exercise 10.2

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Quick Summary: In NCERT Solutions Class 10 Maths Chapter 10 Exercise 10.2, students learn about the number of tangents from a point to a circle and their fundamental properties. This exercise covers the Tangent to a Circle Theorem and Length of Tangent Theorem, which are essential for understanding geometric relationships and solving CBSE board exam problems involving circles and tangent constructions.

Key Takeaways:

- Length of tangent from external point: If tangent length is l and distance from center is d, then l^2 = d^2 - r^2 where r is radius
- Two tangents from an external point are equal in length and the angle between them can be found using \angle PTQ = 180° - \angle POQ
- Tangent at any point on a circle is perpendicular to the radius at that point, making \angle OTP = 90°
- The perpendicular from the center to a tangent always passes through the point of contact, proving fundamental circle-tangent relationships

Complete Solutions

Question 1

QUESTION

From a point Q, the length of the tangent to a circle is 24 cm and the distance of Q from the centre is 25 cm. The radius of the circle is

SOLUTION

We are given the length of a tangent from a point Q to a circle and the distance of Q from the center of the circle. We need to find the radius of the circle.

Key concept: A tangent to a circle is perpendicular to the radius at the point of contact.

Step 1: Visualize the problem

Imagine a circle with center O. Let T be the point where the tangent from point Q touches the circle. Then OT is the radius, and QT is the tangent. We are given that QT = 24 cm and OQ = 25 cm. Also, because the radius is perpendicular to the tangent at the point of contact.

Step 2: Apply the Pythagorean theorem

Since is a right-angled triangle, we can use the Pythagorean theorem:

We want to find OT (the radius), so we rearrange the equation:

Step 3: Substitute the given values

We have OQ = 25 cm and QT = 24 cm. Substituting these values:

Step 4: Solve for OT

Taking the square root of both sides:

Therefore, the radius of the circle is 7 cm.

Answer: 7 cm

Why the other options are incorrect:

12 cm, 15 cm, and 24.5 cm do not satisfy the Pythagorean theorem with the given length of the tangent (24 cm) and the distance from the center (25 cm).

ANSWER

1

Question 2

QUESTION

In Fig. 10.11, if TP and TQ are two tangents to a circle with centre O so that ∠POQ = 110°, then ∠PTQ is equal to

SOLUTION

We are given a circle with center O, and two tangents TP and TQ drawn from an external point T. The angle ∠POQ is given as 110°, and we need to find the angle ∠PTQ.

Step 1: Identify the properties of tangents and radii

We know that the radius of a circle is perpendicular to the tangent at the point of contact. Therefore, OP is perpendicular to TP, and OQ is perpendicular to TQ.

This means:

Step 2: Recognize the quadrilateral

The points P, O, Q, and T form a quadrilateral OPTQ.

Step 3: Apply the angle sum property of a quadrilateral

The sum of the angles in a quadrilateral is 360°. Therefore:

Step 4: Substitute the known values

We know , , and . Substituting these values into the equation:

Step 5: Simplify and solve for ∠PTQ

Final Answer: The angle ∠PTQ is 70°.

Therefore, the correct option is 70°.

Option 1 (60°) is incorrect because the calculation leads to 70°.

Option 3 (80°) is incorrect because the calculation leads to 70°.

Option 4 (90°) is incorrect because the calculation leads to 70°.

ANSWER

2

Question 3

QUESTION

If tangents PA and PB from a point P to a circle with centre O are inclined to each other at an angle of 80°, then ∠POA is equal to

SOLUTION

This question tests the properties of tangents drawn from an external point to a circle and the angles formed by them at the center.

Step 1: Visualize the problem

Imagine a circle with center O. Let P be an external point. Draw two tangents PA and PB from P to the circle. The angle between the tangents, ∠APB, is given as 80°.

Step 2: Recall tangent properties

Tangents at any point on a circle are perpendicular to the radius through the point of contact. Therefore, OA is perpendicular to PA, and OB is perpendicular to PB. This means ∠OAP = 90° and ∠OBP = 90°.

Step 3: Consider quadrilateral OAPB

OAPB forms a quadrilateral. The sum of angles in a quadrilateral is 360°. Therefore,

Substituting the known values:

Step 4: Use the property of tangents from an external point

The line joining the center to the point P bisects the angle between the tangents, i.e., OP bisects ∠APB. Also, OP bisects ∠BOA. Therefore, ∠POA = (1/2) ∠BOA.

Step 5: Calculate ∠POA

Final Answer: The correct answer is 50°.

Option 1 (50°) is correct.

Option 2 (60°) is incorrect.

Option 3 (70°) is incorrect.

Option 4 (80°) is incorrect.

ANSWER

2

Question 4

QUESTION

Prove that the tangents drawn at the ends of a diameter of a circle are parallel.

SOLUTION

This question tests our understanding of the properties of tangents to a circle, specifically those drawn at the ends of a diameter. We need to prove that these tangents are parallel.

Step 1: Draw a diagram

Imagine a circle with center O. Draw a diameter AB. Draw a tangent PQ at point A and another tangent RS at point B.

Step 2: Recall the tangent-radius property

A tangent to a circle is perpendicular to the radius at the point of contact. This is a fundamental theorem.

Step 3: Apply the tangent-radius property to our diagram

Since PQ is a tangent at A, . Similarly, since RS is a tangent at B, .

Step 4: Analyze the angles

We have and . Notice that OA and OB are parts of the same diameter AB, and thus lie on the same straight line.

Step 5: Use properties of parallel lines

Consider the line AB as a transversal intersecting lines PQ and RS. The angles and are on the same side of the transversal and are equal to 90 degrees. Therefore, they can be considered as co-interior angles or consecutive interior angles.

Step 6: Apply the co-interior angles theorem

Since , the sum of these co-interior angles on the same side of the transversal AB is . If the sum of co-interior angles is 180 degrees, then the lines are parallel.

Step 7: Conclude

Therefore, PQ is parallel to RS. Hence, the tangents drawn at the ends of a diameter of a circle are parallel.

ANSWER

The tangents at the endpoints of a diameter are perpendicular to the radii at those points. Since the radii lie along a straight line, the tangents are parallel.

Question 5

QUESTION

Prove that the perpendicular at the point of contact to the tangent to a circle passes through the centre.

SOLUTION

This question requires us to prove a fundamental property of circles: that the perpendicular to a tangent at the point of contact always passes through the center of the circle.

Step 1: Draw a diagram and state the given information

Consider a circle with center O. Let AB be a tangent to the circle at point P. We are given that a line is drawn perpendicular to AB at point P. Our goal is to prove that this perpendicular line passes through the center O.

Step 2: Assume the contrary

Let's assume that the perpendicular at P does *not* pass through the center O. Instead, let it pass through another point, say O'.

Step 3: Use the theorem that the radius is perpendicular to the tangent at the point of contact

We know that the radius OP is perpendicular to the tangent AB at the point of contact P. This is a standard theorem. Therefore, .

Step 4: Consider our assumption

According to our assumption, O'P is perpendicular to AB. Therefore, .

Step 5: Analyze the implications

If both and are , it means that OP and O'P represent the same line. In other words, O' must lie on the line OP.

Step 6: Conclude

Since O' lies on the line OP, and OP passes through the center O, our assumption that the perpendicular at P does not pass through the center is incorrect. Therefore, the perpendicular at the point of contact to the tangent of a circle *must* pass through the center.

Therefore, the radius drawn to the point of contact is perpendicular to the tangent at that point. Hence this perpendicular must pass through the centre.

ANSWER

The radius drawn to the point of contact is perpendicular to the tangent at that point. Hence this perpendicular must pass through the centre.

Question 6

QUESTION

The length of a tangent from a point A at distance 5 cm from the centre of the circle is 4 cm. Find the radius of the circle.

SOLUTION

This question tests the understanding of the properties of tangents to a circle, specifically the relationship between the radius, the tangent, and the distance from the center of the circle to the point from which the tangent is drawn. We will use the Pythagorean theorem.

Step 1: Visualize the problem

Imagine a circle with center O. Let A be a point outside the circle, and let AP be a tangent drawn from A to the circle, where P is the point of contact on the circle. We are given that OA = 5 cm (distance from A to the center) and AP = 4 cm (length of the tangent).

Step 2: Recall the key property

The radius of a circle is perpendicular to the tangent at the point of contact. This means that OP is perpendicular to AP, forming a right-angled triangle OPA, with angle OPA = 90 degrees.

Step 3: Apply the Pythagorean theorem

In right-angled triangle OPA, we have:

Here, OA is the hypotenuse, OP is the radius (r), and AP is the tangent.

Step 4: Substitute the given values

We are given OA = 5 cm and AP = 4 cm. Substituting these values into the equation, we get:

Step 5: Solve for the radius (r)

Subtract 16 from both sides:

Take the square root of both sides:

Final Answer: The radius of the circle is 3 cm.

ANSWER

Using $AO^2 = AP^2 + r^2 \rightarrow 5^2 = 4^2 + r^2 \rightarrow r = 3$ cm.

Question 7

QUESTION

Two concentric circles are of radii 5 cm and 3 cm. Find the length of the chord of the larger circle which touches the smaller circle.

SOLUTION

This question involves finding the length of a chord of a larger circle that is tangent to a smaller, concentric circle. It tests the understanding of tangents, radii, and the Pythagorean theorem.

Step 1: Draw a diagram and label the parts

Draw two concentric circles (circles with the same center). Let the center be O. The larger circle has a radius of 5 cm, and the smaller circle has a radius of 3 cm. Draw a chord AB on the larger circle that touches the smaller circle at point P. OP is the radius of the smaller circle, and OA is the radius of the larger circle. Since AB is tangent to the smaller circle at P, OP is perpendicular to AB.

Step 2: Identify the right triangle

Triangle OPA is a right-angled triangle, with the right angle at P. We know that OA = 5 cm (radius of the larger circle) and OP = 3 cm (radius of the smaller circle).

Step 3: Apply the Pythagorean theorem

In right triangle OPA, by the Pythagorean theorem:

Substitute the known values:

Step 4: Use the property of the perpendicular from the center

Since OP is perpendicular to the chord AB, it bisects the chord. Therefore, AP = PB.

So, AB = 2 * AP

Step 5: Calculate the length of the chord

AB = 2 * 4 = 8 cm

Final Answer: The length of the chord is 8 cm.

This method works because the perpendicular from the center of a circle to a chord bisects the chord. Also, recognizing the right triangle and applying the Pythagorean theorem is key to solving this problem. A common mistake is forgetting to double the length of AP to find the full chord length AB.

ANSWER

Chord length = $2\sqrt{(5^2 - 3^2)} = 2\sqrt{16} = 8$ cm.

Question 8

QUESTION

A quadrilateral ABCD is drawn to circumscribe a circle. Prove that AB + CD = AD + BC.

SOLUTION

This question tests our understanding of the properties of tangents drawn from an external point to a circle. Specifically, it uses the fact that the lengths of tangents drawn from an external point to a circle are equal.

Step 1: Draw the diagram and label the points of contact

Draw a circle and a quadrilateral ABCD circumscribing it. Let the circle touch the sides AB, BC, CD, and DA at points P, Q, R, and S respectively.

Step 2: Apply the tangent property

Since tangents from an external point to a circle are equal in length, we have:

- AP = AS (Tangents from A)
- BP = BQ (Tangents from B)
- CR = CQ (Tangents from C)
- DR = DS (Tangents from D)

Step 3: Add the equations

Adding all the above equations, we get:

Step 4: Rearrange the terms to form the sides of the quadrilateral

We can rearrange the terms as follows:

Now, observe that:

- AP + BP = AB
- CR + DR = CD
- AS + DS = AD
- BQ + CQ = BC

Step 5: Substitute the side lengths

Substituting these into our equation, we get:

Final Answer:

Therefore, we have proven that .

Conclusion: This result holds true for any quadrilateral circumscribing a circle. The key is to remember that tangents from an external point are equal, and then carefully rearrange the terms to match the sides of the quadrilateral.

ANSWER

From tangents drawn from an external point, tangents to points of contact are equal. Adding pairs of equal tangents gives AB + CD = AD + BC.

Question 9

QUESTION

In Fig. 10.13, XY and X′Y′ are two parallel tangents to a circle and AB is another tangent intersecting XY at A and X′Y′ at B. Prove ∠AOB = 90°.

SOLUTION

This question involves proving that the angle formed by the intersection of tangents drawn from an external point to a circle is a right angle. It utilizes properties of tangents, parallel lines, and cyclic quadrilaterals.

Step 1: Draw radii OA and OB

Draw radii OA and OB to the points of tangency A and B respectively. Since the tangent at any point of a circle is perpendicular to the radius through the point of contact, we have and .

Step 2: Identify that and are straight angles

Since XY and X'Y' are straight lines, and . Also, XY || X'Y'.

Step 3: Relate angles using the property of parallel lines and a transversal

Let the point where AB intersects the circle be C. Let O be the center of the circle. Draw OC. Since OA and OC are radii, . Similarly, . Now, consider the angles formed at the center.

Step 4: Use the fact that the angle between tangents from an external point is supplementary to the angle subtended by the line segment joining the points of contact at the center.

Let and . Then, and .

Step 5: Apply angle sum property in triangle AOB

In triangle AOB, we have:

Step 6: Relate and

Since , and and (angle at the center is twice the angle at the circumference), we have:

Step 7: Conclude

Therefore, .

Thus, the angle AOB is a right angle.

ANSWER

Opposite tangents form supplementary angles; geometry of radii and symmetry gives ∠AOB = 90°.

Question 10

QUESTION

Prove that the angle between two tangents drawn from an external point to a circle is supplementary to the angle subtended by the line segment joining the points of contact at the centre.

SOLUTION

This question requires us to prove a relationship between the angle formed by two tangents drawn from an external point to a circle and the angle subtended by the line segment joining the points of contact at the center of the circle. Specifically, we need to show that these two angles are supplementary (add up to 180 degrees).

Step 1: Draw the diagram and label the points

Let O be the center of the circle. Let P be the external point from which two tangents PA and PB are drawn to the circle, where A and B are the points of contact on the circle. We need to prove that .

Step 2: Recall properties of tangents

We know that a tangent to a circle is perpendicular to the radius at the point of contact. Therefore, and .

Step 3: Consider the quadrilateral OAPB

OAPB is a quadrilateral. The sum of the angles in any quadrilateral is 360 degrees. Therefore, we have:

Step 4: Substitute known values

We know that and . Substituting these values into the equation, we get:

Step 5: Simplify the equation

Combining the constants, we have:

Step 6: Isolate the angles

Subtracting from both sides of the equation, we get:

Final Answer: The angle between the two tangents, , and the angle subtended by the line segment joining the points of contact at the center, , are supplementary, meaning they add up to 180 degrees. If is the angle at the center, then the angle between the tangents = .

ANSWER

If ∠AOB is at centre, then angle between tangents = 180° − ∠AOB.

Question 11

QUESTION

Prove that the parallelogram circumscribing a circle is a rhombus.

SOLUTION

This question requires us to prove that if a parallelogram circumscribes a circle, then it must be a rhombus. This means we need to show that all sides of the parallelogram are equal.

Step 1: Draw the diagram and label the points

Draw a circle and a parallelogram ABCD circumscribing it. Let the circle touch the sides AB, BC, CD, and DA at points P, Q, R, and S respectively.

Step 2: Use the property of tangents from a point

Tangents from an external point to a circle are equal in length. Therefore:

AP = AS

BP = BQ

CR = CQ

DR = DS

Step 3: Add the equations

Adding all the above equations, we get:

AP + BP + CR + DR = AS + BQ + CQ + DS

Step 4: Group the terms to form sides of the parallelogram

Rearranging the terms, we have:

(AP + BP) + (CR + DR) = (AS + DS) + (BQ + CQ)

AB + CD = AD + BC

Step 5: Use the property of a parallelogram

Since ABCD is a parallelogram, opposite sides are equal. Therefore, AB = CD and AD = BC. Substituting these into the equation above, we get:

AB + AB = AD + AD

2AB = 2AD

AB = AD

Step 6: Conclude that all sides are equal

Since AB = AD, and opposite sides of the parallelogram are equal, we have AB = CD = AD = BC. Therefore, all four sides of the parallelogram are equal.

Final Answer:

Since all sides of the parallelogram are equal, it is a rhombus.

Conclusion: By using the properties of tangents and parallelograms, we have shown that if a parallelogram circumscribes a circle, it must be a rhombus.

ANSWER

Opposite sides of a circumscribed quadrilateral sum equally; hence consecutive sides of parallelogram are equal → rhombus.

Question 12

QUESTION

A triangle ABC circumscribes a circle of radius 4 cm with BD = 8 cm and DC = 6 cm. Find AB and AC.

SOLUTION

This question involves using the properties of tangents drawn from an external point to a circle, and the area of a triangle to find the lengths of the sides AB and AC.

Step 1: Visualize and label

Imagine a triangle ABC circumscribing a circle. Let the circle touch BC at D, AC at E, and AB at F. We are given BD = 8 cm, DC = 6 cm, and the radius of the circle is 4 cm.

Step 2: Tangent properties

Tangents from an external point to a circle are equal in length. Therefore:

BD = BF = 8 cm

CD = CE = 6 cm

Let AE = AF = cm (since they are tangents from point A)

Step 3: Express side lengths in terms of x

AB = AF + FB = + 8

AC = AE + EC = + 6

BC = BD + DC = 8 + 6 = 14 cm

Step 4: Calculate the semi-perimeter (s)

The semi-perimeter is half the perimeter of the triangle:

Step 5: Area of triangle ABC using Heron's formula

Where a = BC = 14, b = AC = x+6, c = AB = x+8, and s = x+14

Step 6: Area of triangle ABC using radii

Area(ABC) = Area(OBC) + Area(OAC) + Area(OAB)

Area(ABC) =

Area(ABC) =

Area(ABC) =

Step 7: Equate the two area expressions

Squaring both sides:

Divide by 32:

Since x cannot be negative, x = 7

Step 8: Find AB and AC

AB = x + 8 = 7 + 8 = 15 cm

AC = x + 6 = 7 + 6 = 13 cm

Final Answer: AB = 15 cm, AC = 13 cm

ANSWER

Using tangent properties: AB = s − c = 12 cm, AC = s − b = 10 cm.

Question 13

QUESTION

Prove that opposite sides of a quadrilateral circumscribing a circle subtend supplementary angles at the centre.

SOLUTION

This question requires us to prove that in a quadrilateral circumscribing a circle, the angles subtended by the opposite sides at the center of the circle are supplementary (add up to 180 degrees).

Step 1: Draw the diagram and label the points

Consider a circle with center O. Let ABCD be the quadrilateral circumscribing the circle, touching the circle at points P, Q, R, and S respectively. We need to prove that and .

Step 2: Use the property of tangents from an external point

We know that tangents from an external point to a circle subtend equal angles at the center. Therefore:

, , , and .

Step 3: Express the sum of all angles around the center

The sum of all angles around the center O is 360 degrees. Thus:

Step 4: Simplify using the tangent property

Using the relations from Step 2, we can rewrite the equation as:

Dividing the entire equation by 2, we get:

Step 5: Relate the angles to the sides of the quadrilateral

We can rewrite the above equation as:

Notice that and . Therefore:

Step 6: Similarly prove for the other pair of opposite sides

In a similar way, it can be proved that .

Final Answer: The opposite sides of a quadrilateral circumscribing a circle subtend supplementary angles at the centre.

ANSWER

Tangent lengths imply opposite arcs sum to 180°, hence the angles subtended at the centre are supplementary.

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📐 Key Formulas

Important Formulas for Exercise 10.2

Formula / Concept	Description
Tangent to a Circle	A line that intersects the circle at exactly one point. This point is called the point of contact.
Theorem 10.1: Tangent-Radius Perpendicularity	The tangent at any point of a circle is perpendicular to the radius through the point of contact. If O is the center, P is the point of contact, and XY is the tangent, then OP \perp XY.
Pythagorean Theorem in Tangent Problems	In a right-angled triangle formed by the radius, tangent, and a line from the center to an external point, we can use the Pythagorean theorem: a^2 + b^2 = c^2. For a tangent from an external point P to a point of contact T on a circle with center O, OT^2 + PT^2 = OP^2.
Number of Tangents from a Point	• **Inside the circle:** No tangents can be drawn. • **On the circle:** Exactly one tangent can be drawn. • **Outside the circle:** Exactly two tangents can be drawn.
Theorem 10.2: Length of Tangents from an External Point	The lengths of tangents drawn from an external point to a circle are equal. If two tangents PA and PB are drawn from an external point P to a circle, then PA = PB.
Properties of Tangents from an External Point	If two tangents are drawn from an external point to a circle: • They subtend equal angles at the center. \anglePOA = \anglePOB • They are equally inclined to the line segment joining the center to that point. \angleAPO = \angleBPO

Formula / Concept	Description
Angle between Tangents and Angle at the Center	The angle between the two tangents drawn from an external point to a circle is supplementary to the angle subtended by the line-segment joining the points of contact at the center. If PA and PB are tangents from point P, then \angleAPB + \angleAOB = 180^\circ.

❓ Top FAQs

Q1. How many questions are in NCERT Solutions Class 10 Maths Chapter 10 Circles Exercise 10.2 for CBSE board exam 2025-26?

Exercise 10.2 of NCERT Solutions for Class 10 Maths Chapter 10 Circles contains exactly 13 questions based on the topic 'Number of Tangents from a Point on a Circle'. These questions are designed as per the CBSE syllabus 2025-26 and focus on the Tangent to a Circle Theorem and Length of Tangent Theorem with step by step solutions available for better understanding.

Q2. Where can I download free PDF of NCERT Solutions for Class 10 Maths Chapter 10 Circles Exercise 10.2 with step by step solutions?

You can download the free PDF of NCERT Solutions for Class 10 Maths Chapter 10 Circles Exercise 10.2 from the official NCERT website or various educational platforms that provide updated solutions for CBSE board exam 2025-26. These PDFs include detailed step by step solutions for all 13 questions covering tangent theorems and are available for offline study without any cost.

Q3. How many marks does Chapter 10 Circles carry in CBSE Class 10 Maths board exam 2025-26 and what is the weightage of Exercise 10.2?

Chapter 10 Circles carries approximately 5 marks in the CBSE Class 10 Maths board exam 2025-26 under Unit V - Geometry. Exercise 10.2 focusing on 'Number of Tangents from a Point' is an important part of this chapter, and questions from this exercise can appear in the form of short answer or long answer questions worth 2-4 marks each.

Q4. Which is the most difficult question in NCERT Solutions Class 10 Maths Chapter 10 Circles Exercise 10.2 for CBSE board preparation?

Questions 10, 11, and 13 in Exercise 10.2 of NCERT Solutions for Class 10 Maths Chapter 10 Circles are considered the most challenging as they involve complex applications of the Length of Tangent Theorem and require multiple steps to solve. These questions demand a thorough understanding of tangent properties and coordinate geometry concepts, making them important for CBSE board exam 2025-26 preparation with detailed step by step solutions.

Q5. What is Tangent to a Circle Theorem explained in NCERT Solutions for Class 10 Maths Chapter 10 Exercise 10.2?

The Tangent to a Circle Theorem in NCERT Class 10 Maths Chapter 10 Exercise 10.2 states that the tangent at any point of a circle is perpendicular to the radius through the point of contact. Additionally, the Length of Tangent Theorem proves that tangents drawn from an external point to a circle are equal in length, which is the foundation for solving all 13 questions in this exercise for CBSE board exam 2025-26.

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