

10.1

Use Properties of Tangents

Goal • Use properties of a tangent to a circle.

Your Notes

VOCABULARY

Circle A circle is the set of all points in a plane that are equidistant from a given point.

Center The center of a circle is the point from which all points of the circle are equidistant.

Radius A segment from the center of a circle to any point on the circle is a radius.

Chord A chord is a segment whose endpoints are on a circle.

Diameter A diameter is a chord that contains the center of the circle.

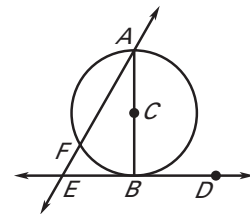
Secant A secant is a line that intersects a circle in two points.

Tangent A tangent is a line in the plane of a circle that intersects the circle in exactly one point.

Example 1 Identify special segments and lines

Tell whether the line, ray, or segment is best described as a *radius*, *chord*, *diameter*, *secant*, or *tangent* of $\odot C$.

- a. \overline{BC} b. \overleftrightarrow{EA} c. \overrightarrow{DE}



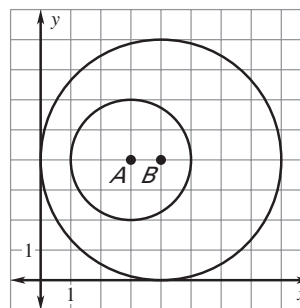
Solution

- a. \overline{BC} is a **radius** because C is the center and B is a point on the circle.
- b. \overleftrightarrow{EA} is a **secant** because it is a line that intersects the circle in two points.
- c. \overrightarrow{DE} is a **tangent** ray because it is contained in a line that intersects the circle at only one point.

Example 2 Find lengths in circles in a coordinate plane

Use the diagram to find the given lengths.

- a. Radius of $\odot A$
- b. Diameter of $\odot A$
- c. Radius of $\odot B$
- d. Diameter of $\odot B$



Solution

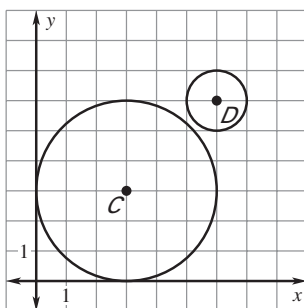
- a. The radius of $\odot A$ is 2 units.
- b. The diameter of $\odot A$ is 4 units.
- c. The radius of $\odot B$ is 4 units.
- d. The diameter of $\odot B$ is 8 units.

Checkpoint Complete the following exercises.

1. In Example 1, tell whether \overline{AB} is best described as a radius, chord, diameter, secant, or tangent. Explain.

\overline{AB} is a diameter because it is a chord that contains the center C .

2. Use the diagram to find (a) the radius of $\odot C$ and (b) the diameter of $\odot D$.

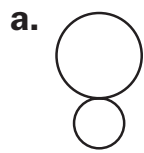


- (a) The radius of $\odot C$ is 3 units.
- (b) The diameter of $\odot D$ is 2 units.

Your Notes

Example 3 Draw common tangents

Tell how many common tangents the circles have and draw them.

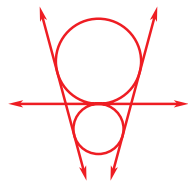


Solution

a. 3 common tangents

b. 2 common tangents

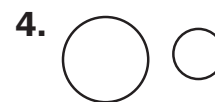
c. 1 common tangent



✔ **Checkpoint** Tell how many common tangents the circles have and draw them.



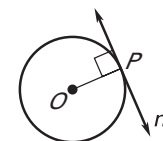
no common tangents




4 common tangents

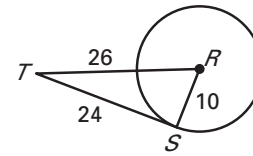
THEOREM 10.1

In a plane, a line is tangent to a circle if and only if the line is perpendicular to a radius of the circle at its endpoint on the circle.



Example 4 Verify a tangent to a circle

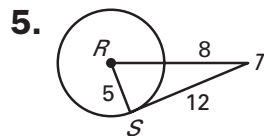
In the diagram, \overline{RS} is a radius of $\odot R$. Is \overline{ST} tangent to $\odot R$?



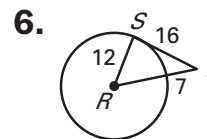
Solution

Use the Converse of the Pythagorean Theorem. Because $10^2 + 24^2 = 26^2$, $\triangle RST$ is a **right triangle** and $\overline{RS} \perp \overline{ST}$. So, \overline{ST} is perpendicular to a radius of $\odot R$ at its endpoint on $\odot R$. By **Theorem 10.1**, \overline{ST} is tangent to $\odot R$.

Checkpoint \overline{RS} is a radius of $\odot R$. Is \overline{ST} tangent to $\odot R$?



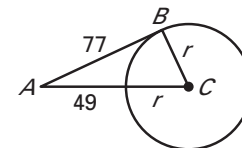
Yes



No

Example 5 Find the radius of a circle

In the diagram, B is a point of tangency. Find the radius r of $\odot C$.



Solution

You know from Theorem 10.1 that $\overline{AB} \perp \overline{BC}$, so $\triangle ABC$ is a **right triangle**. You can use the Pythagorean Theorem.

$$AC^2 = BC^2 + AB^2 \quad \text{Pythagorean Theorem}$$

$$(r + 49)^2 = r^2 + 77^2 \quad \text{Substitute.}$$

$$r^2 + \underline{98r} + \underline{2401} = r^2 + \underline{5929} \quad \text{Multiply.}$$

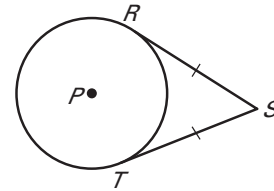
$$\underline{98r} = \underline{3528} \quad \text{Subtract from each side.}$$

$$r = \underline{36} \quad \text{Divide each side by 98.}$$

Your Notes

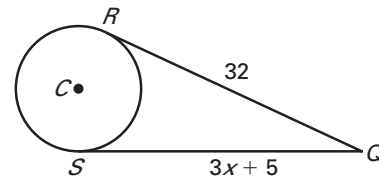
THEOREM 10.2

Tangent segments from a common external point are congruent.



Example 6 Use Theorem 10.2

\overline{QR} is tangent to $\odot C$ at R and \overline{QS} is tangent to $\odot C$ at S . Find the value of x .



Solution

$$QR = QS$$

Tangent segments from the same point are congruent.

$$32 = 3x + 5$$

Substitute.

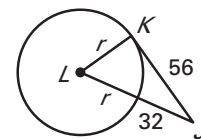
$$9 = x$$

Solve for x .

Checkpoint Complete the following exercises.

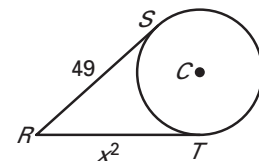
7. In the diagram, K is a point of tangency. Find the radius r of $\odot L$.

$$r = 33$$



8. \overline{RS} is tangent to $\odot C$ at S and \overline{RT} is tangent to $\odot C$ at T . Find the value(s) of x .

$$x = \pm 7$$



Homework