12-1 Tangent Lines

Vocabulary

Review

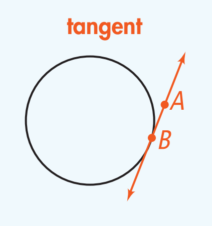
1. Cross out the word that does NOT apply to a *circle*.

arc	circumference	diameter	equilateral	radius

2. Circle the word for a segment with one endpoint at the center of a *circle* and the other endpoint on the *circle*.

arc	circumference	diameter	perimeter	radius

Vocabulary Builder



tangent (noun, adjective) TAN junt

Definition: A **tangent** to a circle is a line, ray, or segment in the plane of the circle that intersects the circle in exactly one point.

Other Word Form: tangency (noun)

Examples: In the diagram, $\overleftrightarrow{AB}$ is **tangent** to the circle at *B*. *B* is the *point of tangency*. $\overrightarrow{BA}$ is a **tangent** ray. $\overline{BA}$ is a **tangent** segment.

Other Usage: In a right triangle, the **tangent** is the ratio of the side opposite an acute angle to the side adjacent to the angle.

Use Your Vocabulary

3. Complete each statement with *always*, *sometimes*, or *never*.

A diameter is _?_ a *tangent*. ______

A *tangent* and a circle _?_ have exactly one point in common. ______

A radius can _?_ be drawn to the point of tangency. ______

A *tangent* _?_ passes through the center of a circle. ______

A *tangent* is _?_ a ray. ______

Theorems 12-1, 12-2, and 12-3

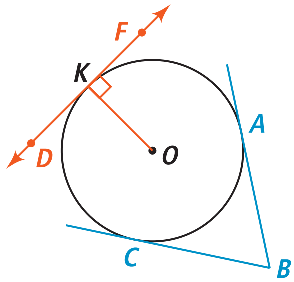
take note

Theorem 12-1 If a line is tangent to a circle, then the line is perpendicular to the radius at the point of tangency.

Theorem 12-2 If a line in the plane of a circle is perpendicular to a radius at its endpoint on the circle, then the line is tangent to the circle.

Theorem 12-3 If two tangent segments to a circle share a common endpoint outside the circle, then the two segments are congruent.

Use the diagram at the right for Exercises 4–6. Complete each statement.



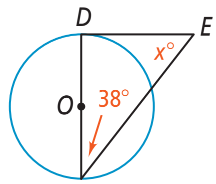
4. **Theorem 12-1** If $\overleftrightarrow{DF}$ is tangent to $\odot O$ at K, then ____ $\perp$ ____.

5. **Theorem 12-2** If $\overleftrightarrow{DF} \perp \overline{OK}$, then ____ is tangent to $\odot O$.

6. **Theorem 12-3** If $\overline{BA}$ and $\overline{BC}$ are tangent to $\odot O$, then ____ $\cong$ ____.

Problem 1 Finding Angle Measures

Got It? $\overline{ED}$ **is tangent to** $\odot O$**. What is the value of** x**?**



7. Circle the word that best describes $\overline{OD}$.

diameter	radius	tangent

8. What relationship does Theorem 12-1 support? Circle your answer.

$\overline{OD} \perp \overline{ED}$	$\overline{OD} \parallel \overline{ED}$	$\overline{OD} \cong \overline{ED}$

9. Circle the most accurate description of the triangle.

acute	isosceles	obtuse	right

10. Circle the theorem that you will use to solve for x.

Theorem 12-1	Triangle Angle-Sum Theorem

11. Complete the model below.

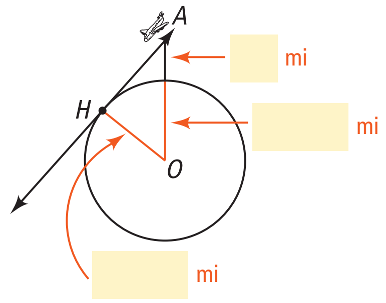
Relate	sum of angle measures in a triangle	is	38	plus	measure of $\angle D$	plus	measure of $\angle E$
Write	____	=	38	+	____	+	____

12. Solve for x.

13. The value of x is ____.

Problem 2 Finding Distance

Got It? **What is the distance to the horizon that a person can see on a clear day from an airplane 2 mi above Earth? Earth's radius is about 4000 mi.**



14. The diagram at the right shows the airplane at point A and the horizon at point H. Use the information in the problem to label the distances.

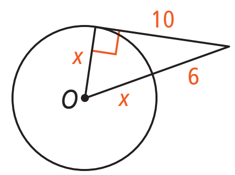
15. Use the justifications at the right to find the distance.

$\_\_\_ \perp \overline{AH}$	Theorem 12-1
$\_\_\_^2 + AH^2 = OA^2$	Pythagorean Theorem
$\_\_\_^2 + AH^2 = \_\_\_^2$	Substitute.
$\_\_\_ + AH^2 = \_\_\_$	Use a calculator.
$AH^2 = \_\_\_$	Subtract from each side.
$AH = \sqrt{\_\_\_}$	Take the positive square root.
$AH \approx \_\_\_$	Use a calculator.

16. A person can see about ___ miles to the horizon from an airplane 2 mi above Earth.

Problem 3 Finding a Radius

Got It? **What is the radius of $\odot O$?**



17. Write an algebraic or numerical expression for each side of the triangle.

___ ___ ___

18. Circle the longest side of the triangle. Underline the side that is opposite the right angle.

10 x $x + 6$

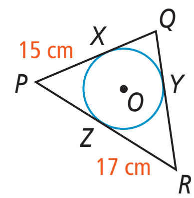
19. Use the Pythagorean Theorem to complete the equation.

$\_\_\_^2 + \_\_\_^2 = (\_\_\_)^2$

20. Solve the equation for x.

21. The radius is ___.

Problem 5 Circles Inscribed in Polygons



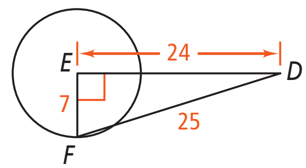
Got It? $\odot O$ is inscribed in $\triangle PQR$, which has a perimeter of 88 cm. What is the length of $\overline{QY}$?

22. By Theorem 12-3, $\overline{PX} \cong$ ____, $\overline{RZ} \cong$ ____, and $\overline{QX} \cong$ ____, so $PX =$ ____, $RZ =$ ____, and $QX =$ ____.

23. Perimeter $p = PQ + QR + RP$, so $p = PX +$ ____ $+ QY +$ ____ $+ RZ +$ ____ by the Segment Addition Postulate.

24. Use the values in the diagram and your answer to Exercise 23 to solve for QY.

Lesson Check • Do you UNDERSTAND?



Error Analysis A classmate insists that $\overline{DF}$ is a tangent to $\odot E$. Explain how to show that your classmate is wrong.

Underline the correct word or number to complete the sentence.

25. A tangent to a circle is parallel / perpendicular to a radius.

26. If $\overline{DF}$ is tangent to $\odot E$ at point F, then $m\angle EFD$ must be 30 / 90 / 180.

27. A triangle can have at most ____ right angle(s).

28. Explain why your classmate is wrong.

Math Success

Check off the vocabulary words that you understand.

☐ circle ☐ tangent to a circle ☐ point of tangency

Rate how well you can *use tangents to find missing lengths.*

Need to review | 0 2 4 6 8 10 | Now I get it!