12-1

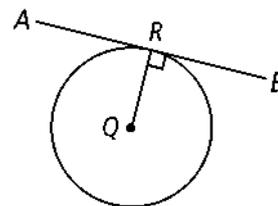## Reteaching

Tangent Lines

A tangent is a line that touches a circle at exactly one point. In the diagram, $\overline{AB}$ is tangent to $\odot Q$. You can apply theorems about tangents to solve problems.
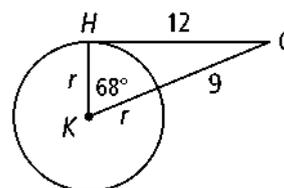
Theorem 12-1

If a line is tangent to a circle, then that line forms a right angle with the radius at the point where the line touches the circle.

Theorem 12-2

If a line in the same plane as a circle is perpendicular to a radius at its endpoint on the circle, then the line is tangent to the circle.

Problem

Use the diagram at the right to solve the problems below.

$\overline{GH}$ **is tangent to** $\odot K$.

What is the measure of $\angle G$?

Because $\overline{GH}$ is tangent to $\odot K$, it forms a right angle with the radius.

The sum of the angles of a triangle is always 180. Write an equation to find $m\angle G$.

$$m\angle G + m\angle H + m\angle K = 180$$
$$m\angle G + 90 + 68 = 180$$
$$m\angle G + 158 = 180$$
$$m\angle G = 22$$

What is the length of the radius? You can use the Pythagorean Theorem to find missing lengths.

$$HK^2 + HG^2 = GK^2$$
$$r^2 + 12^2 = (9 + r)^2$$
$$r^2 + 144 = (9 + r)(9 + r)$$
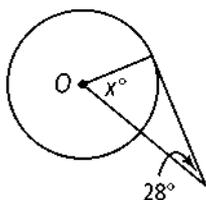$$r^2 + 144 = 81 + 18r + r^2$$
$$63 = 18r$$
$$3.5 = r$$

So, the measure of $\angle G$ is 22 and the length of the radius is 3.5 units.
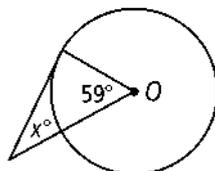
Exercises

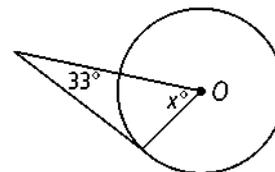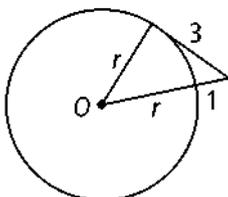**In each circle, what is the value of x?**
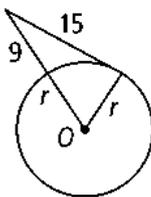
1.

2.

3.

12-1 | **Reteaching** (continued)

Tangent Lines

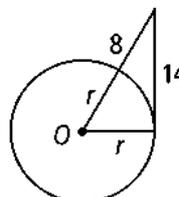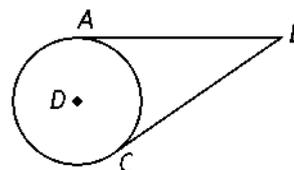**In each circle, what is the value of *r*?**

4.

5.

6.

Theorem 12-3

If two segments are tangent to a circle from the same point outside the circle, then the two segments are equal in length.

In the diagram, $\overline{AB}$ and $\overline{BC}$ are both tangent to $\odot D$. So, they are also congruent.

When circles are drawn inside a polygon so that the sides of the polygon are tangents, the circle is inscribed in the figure. You can apply Theorem 12-3 to find the perimeter, or distance around the polygon.
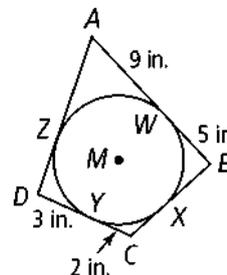
Problem

$\odot M$ is inscribed in quadrilateral *ABCD*.
What is the perimeter of *ABCD?*

$$ZA = AW = 9 \quad WB = BX = 5$$

$$CY = XC = 2 \quad YD = DZ = 3$$

Now add to find the length of each side:

$AB = AW + WB = 9 + 5 = 14$ $BC = BX + CX = 5 + 2 = 7$

$CD = CY + YD = 2 + 3 = 5$ $DA = DZ + ZA = 3 + 9 = 12$
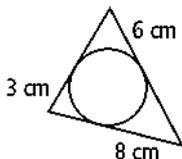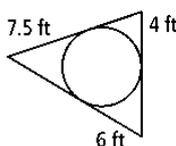
$14 + 7 + 5 + 12 = 38$

The perimeter is 38 in.

Exercises

Each polygon circumscribes a circle. What is the perimeter of each polygon?

7.

6 cm
3 cm
8 cm

8.

7.5 ft
4 ft
6 ft

9.

7 cm
3.5 cm
5.25 cm
8.75 cm