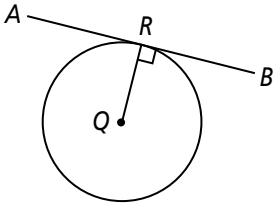
A tangent is a line that touches a circle at exactly one point. In the diagram, $\overline{AB}$ is tangent to $\odot Q$. You can apply theorems about tangents to solve problems.



Theorem 76

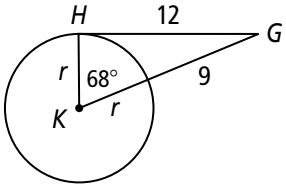
If a line is tangent to a circle, then that line forms a right angle with the radius at the point where the line touches the circle.

Theorem 77

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.

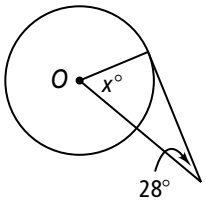
$$HK^2 + HG^2 = GK^2$$
$$r^2 + 12^2 = (9 + r)^2$$
$$r^2 + 144 = (9 + r)(9 + r)$$
$$r^2 + 144 = 81 + 18r + r^2$$
$$63 = 18r$$
$$3.5 = r$$

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.



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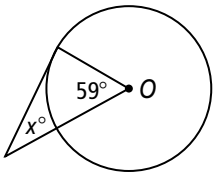

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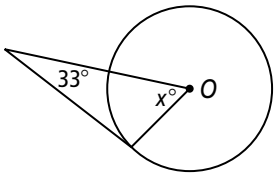

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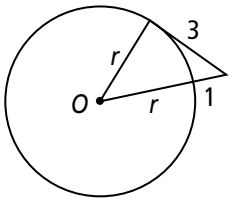
Reteaching (continued)

Tangent Lines

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

4.



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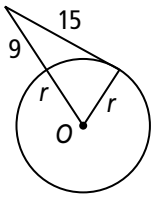

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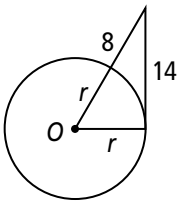
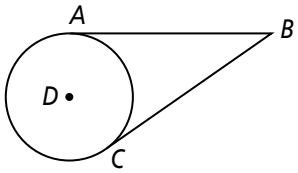


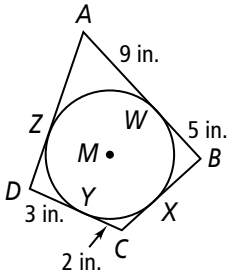
Theorem 78

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 78 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:

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

$CD = CY + YD = 2 + 3 = 5$ $\quad$ $DA = DZ + ZA = 3 + 9 = 12$

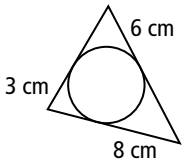
$14 + 7 + 5 + 12 = 38$

The perimeter is 38 in.

Exercises

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

7.



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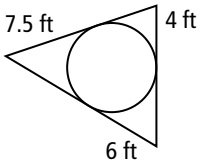

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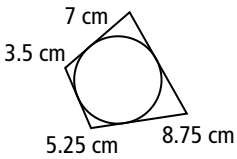

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Analytic Geometry

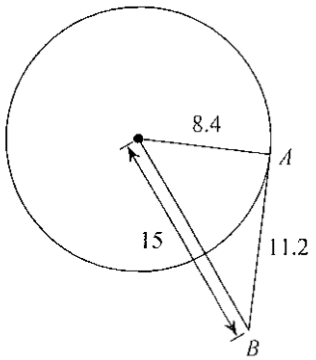
Name_____

Tangents & Party Hats

Date_____ Period____

Determine if line AB is tangent to the circle.

1)



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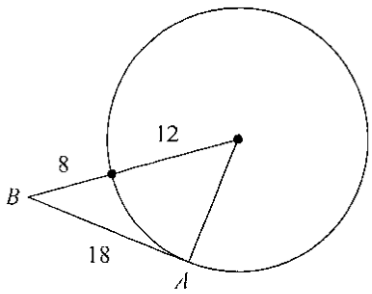

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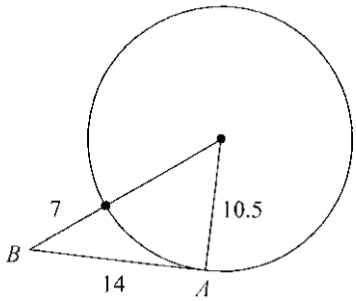

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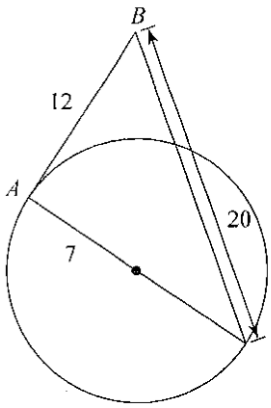
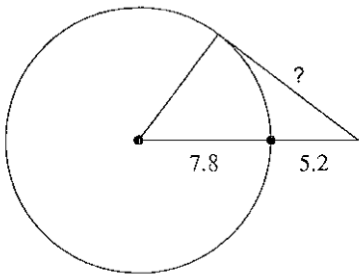


Find the segment length indicated. Assume that lines which appear to be tangent are tangent.

5)



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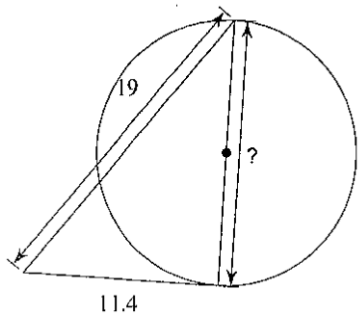

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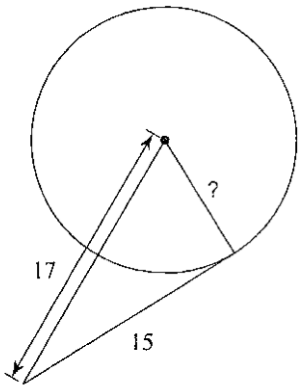

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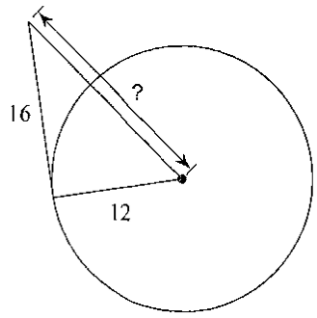

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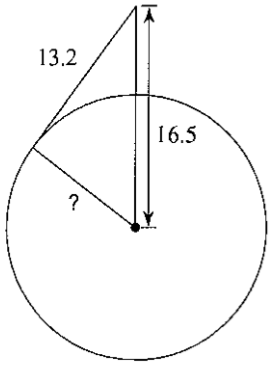

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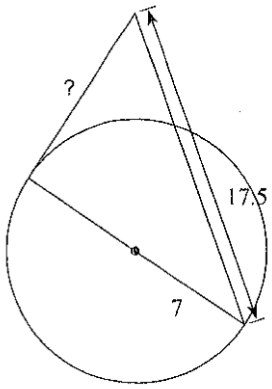
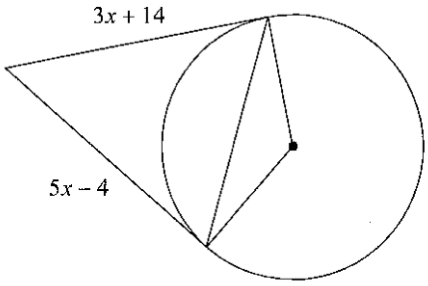


Solve for *x*. Assume that lines which appear to be tangent are tangent.

11)



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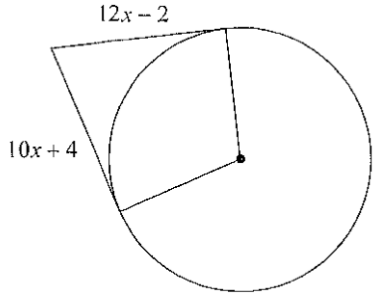

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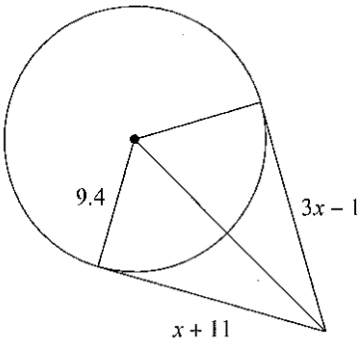

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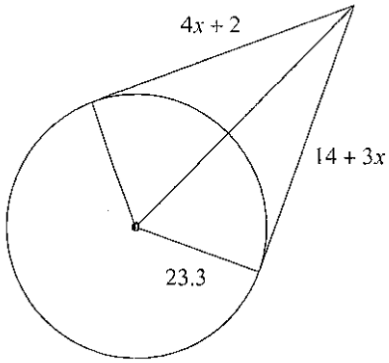

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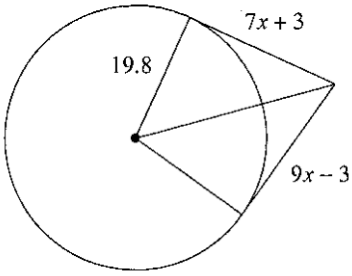

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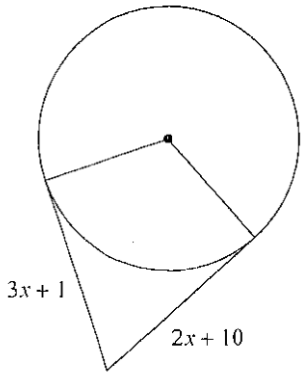
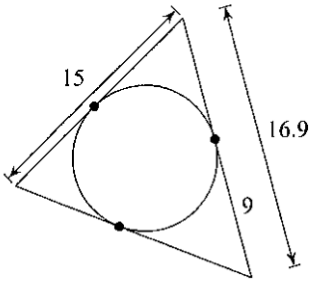
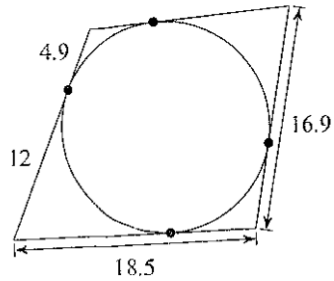


Find the perimeter of each polygon. Assume that lines which appear to be tangent are tangent.

17)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