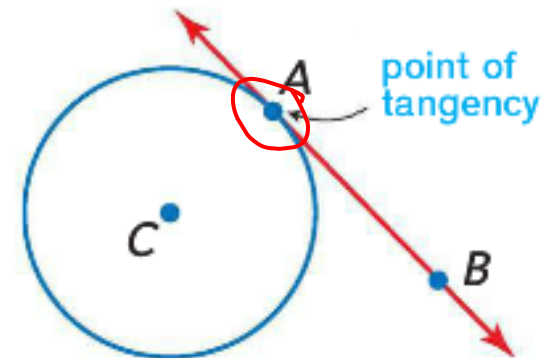


Tangents

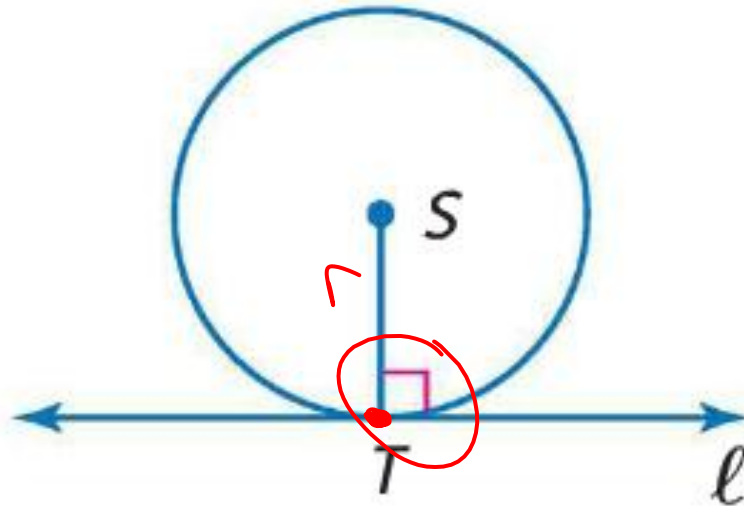
Tangent

- A tangent is a line in the same plane as a circle that intersects the circle in exactly one point, called the point of tangency.
- A common tangent is a line, ray, or segment that is tangent to two circles in the same plane.



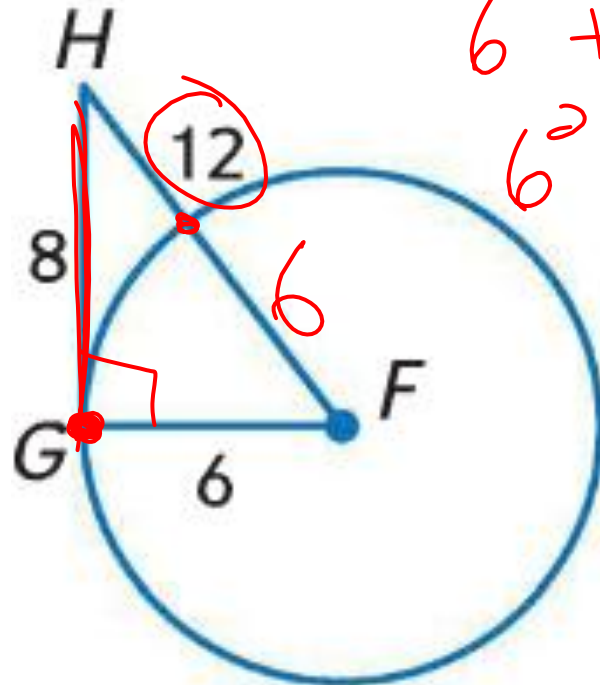
Tangent Theorem

- In a plane, a line is tangent to a circle if and only if it is perpendicular to a radius drawn to the point to tangency.



Examples

- Determine whether GH is ~~tangent~~ to $\odot F$. Justify your answer.



$$A^2 + B^2 = C^2$$

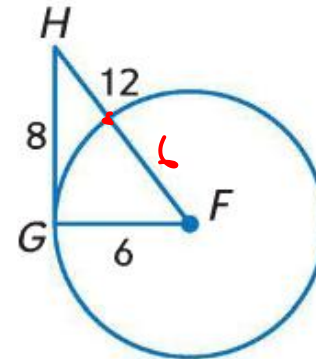
$$6^2 + 8^2 = C^2$$

$$6^2 + 8^2 \neq 10^2$$

Examples

- Determine whether \overline{GH} is tangent to $\odot F$. Justify your answer.

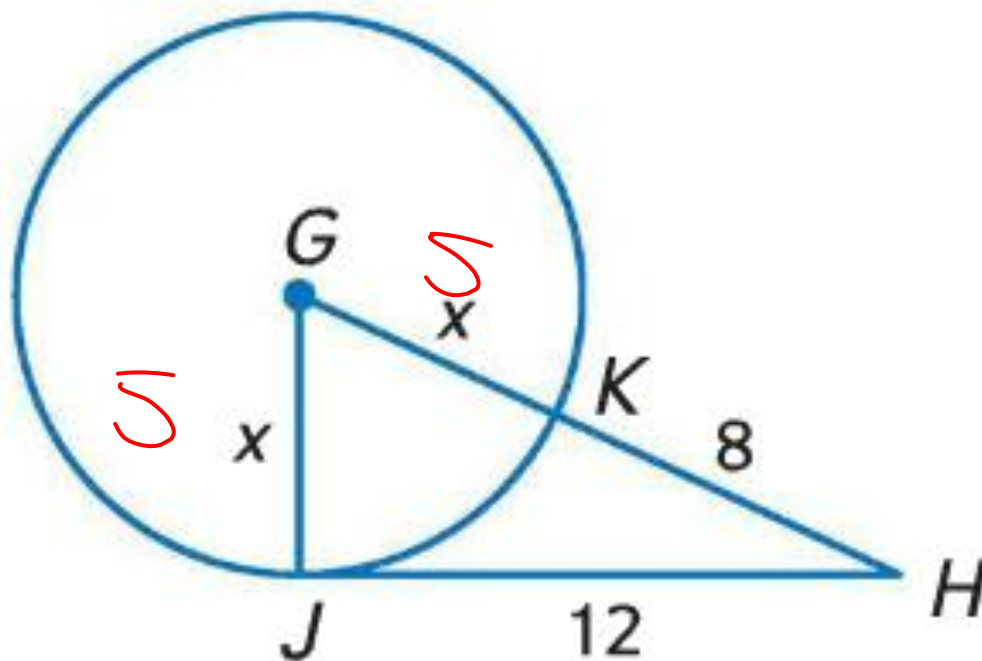
- $6^2 + 8^2 = (6 + 12)^2$
- $36 + 64 = 18^2$
- $100 = 324$
- Not tangent



$$x = 5$$

Examples

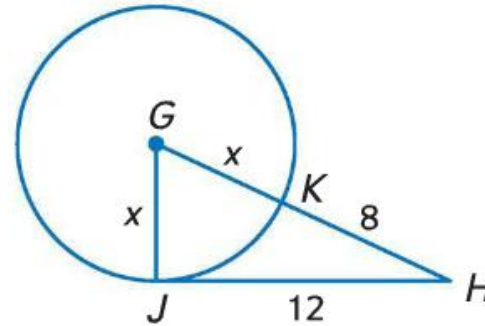
- JH is tangent to $\odot G$ at J . Find x .



Examples

- JH is tangent to $\odot G$ at J. Find x.

- $x^2 + 12^2 = (x + 8)^2$
- ~~$x^2 + 144 = x^2 + 16x + 64$~~
- $80 = 16x$
- $5 = x$
- 5, 12, 13 is a Pythagorean Triple
- Tangent



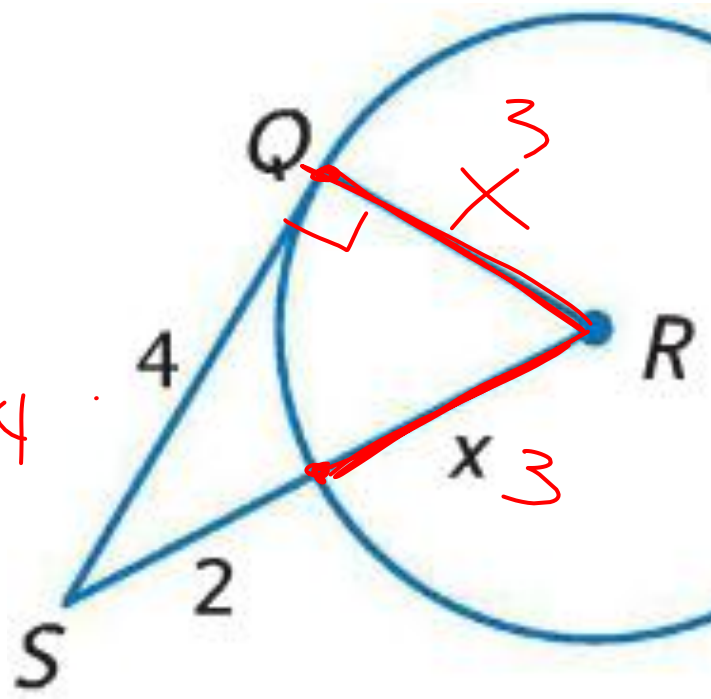
$$x = 3$$

Examples

- QS is tangent to $\odot R$ at Q. Find x.

$$x^2 + 4^2 = (x+2)^2$$
$$\cancel{x^2} + 16 = \cancel{x^2} + \underline{4x} + 4$$

$$(x+2)^2$$
$$(x+2)(x+2)$$
$$x^2 + 2x + 2x + 4$$

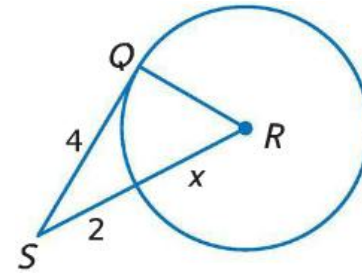


$$16 = 4x + 4$$
$$-4 \quad -4$$
$$\frac{12}{4} = \frac{4x}{4}$$
$$3 = x$$

Examples

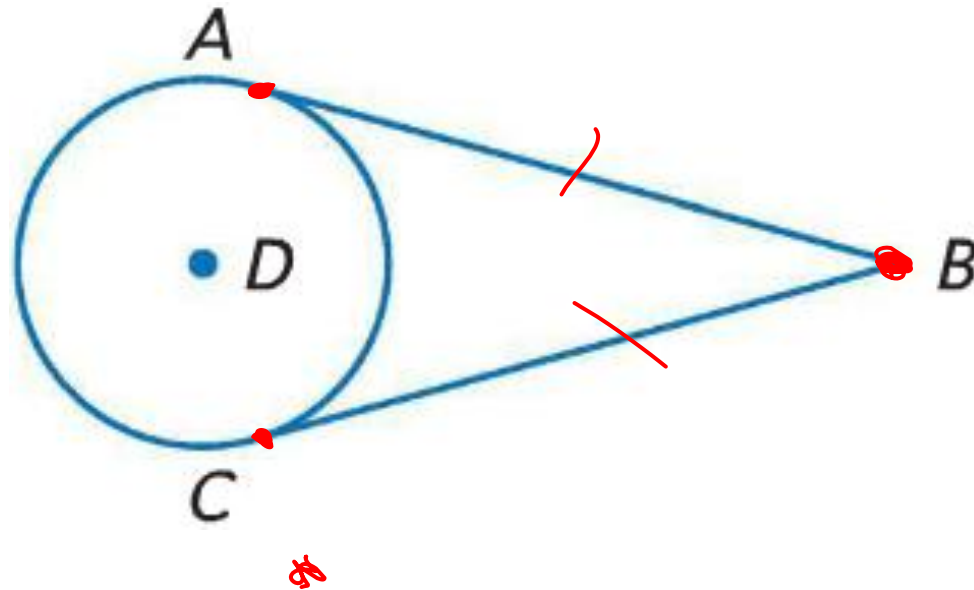
- QS is tangent to $\odot R$ at Q. Find x.

- $x^2 + 4^2 = (x + 2)^2$
- $x^2 + 16 = x^2 + 4x + 4$
- $16 = 4x + 4$
- $12 = 4x$
- $3 = x$



Congruent Tangents

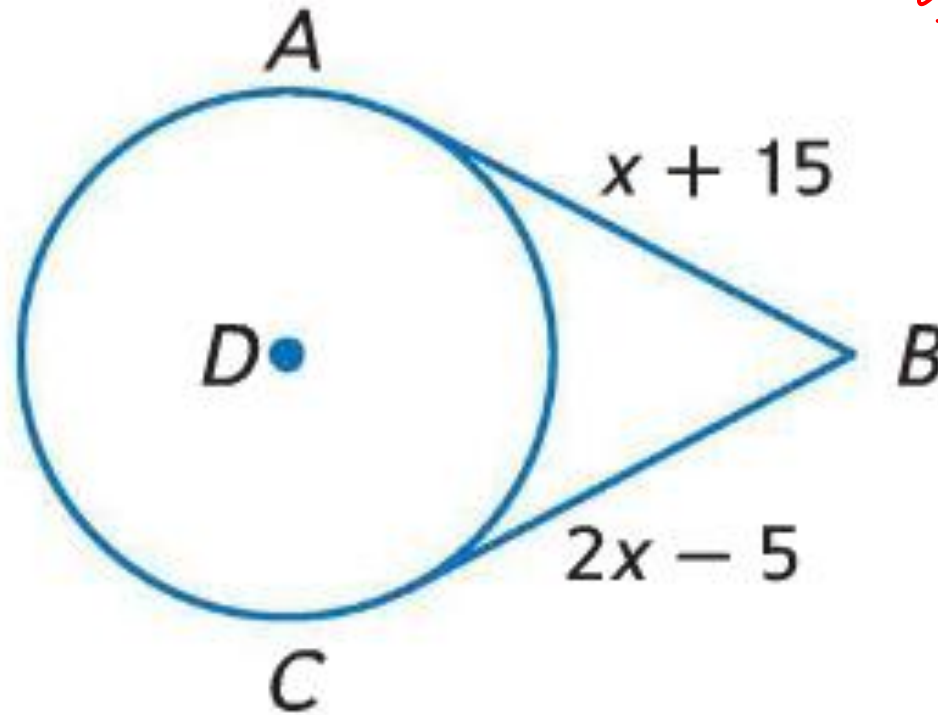
- If two segments from the same exterior point are tangent to a circle, then they are congruent.



$$x = 20$$

Examples

- AB and CB are tangent to $\odot D$. Find the value of x .



$$\begin{aligned} 2x - 5 &= x + 15 \\ 2x - x &= 5 + 15 \\ \boxed{x} &= \underline{\underline{20}} \end{aligned}$$

Examples

- AB and CB are tangent to $\odot D$. Find the value of x .

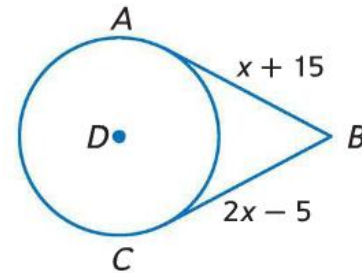
- $x + 15 = 2x - 5$

- $15 = x - 5$

- $20 = x$

Subtract x from both sides

Add 5 to both sides



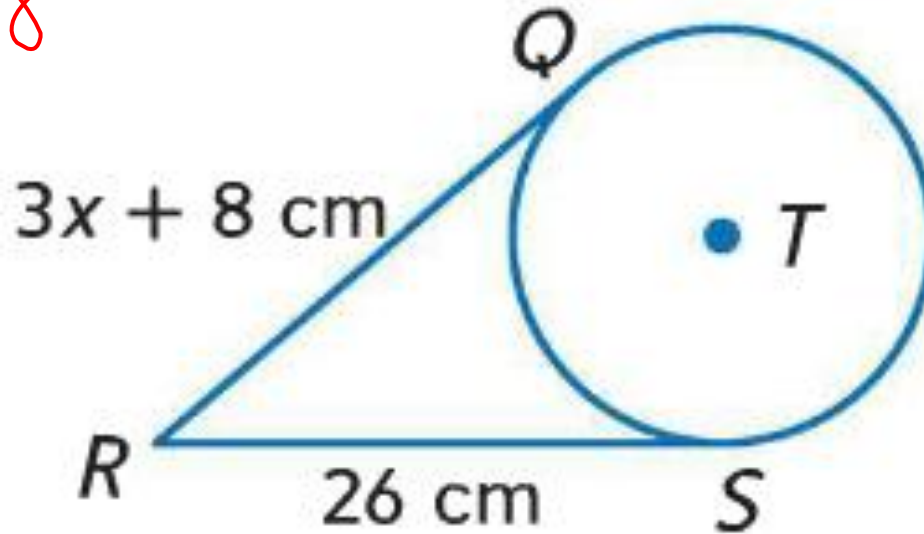
Examples

- Find the value of x . Assume that segments that appear to be tangent are tangent.

$$\begin{array}{r} 3x + 8 = 26 \\ +8 \quad -8 \end{array}$$

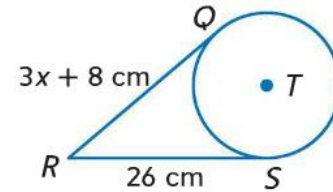
$$\begin{array}{r} 3x = 18 \\ \hline 3 \end{array}$$

$$\boxed{x = 6}$$



Examples

- Find the value of x . Assume that segments that appear to be tangent are tangent.



- $3x + 8 = 26$

- $3x = 18$

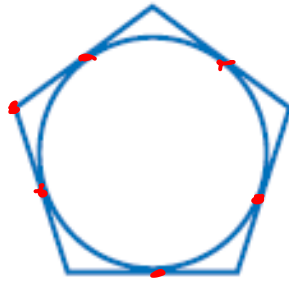
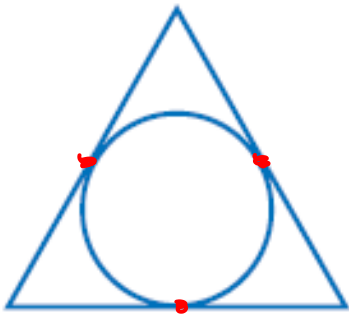
Subtract 8 from both sides

- $x = 6$

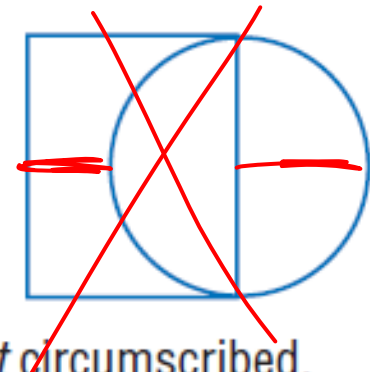
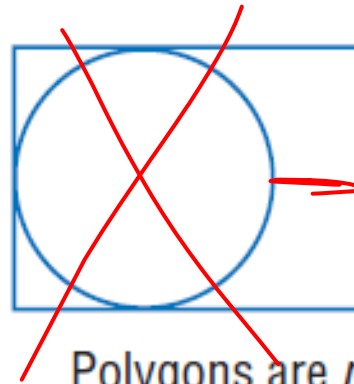
Divide by 3 on both sides

Circumscribed Polygons

- When a polygon is circumscribed about a circle, all of the sides of the polygon are tangent to the circle.



Polygons are circumscribed.

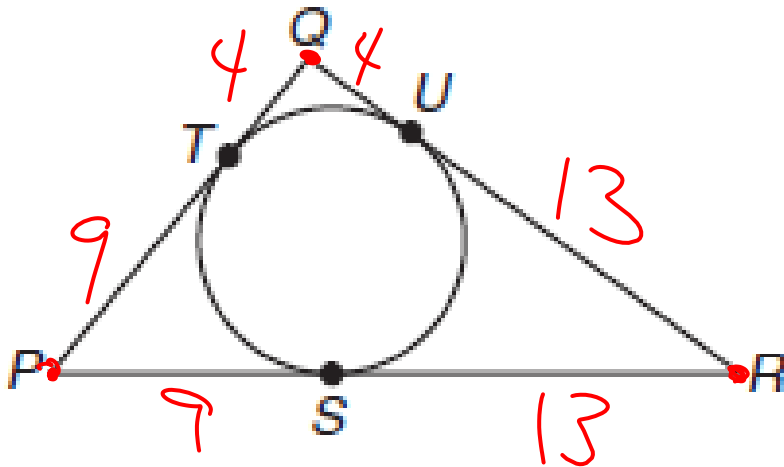


Polygons are *not* circumscribed.

Examples

- Find the perimeter of each polygon for the given information. Assume that segments that appear to be tangent are tangent.

- $QT = 4$, $PT = 9$, $SR = 13$



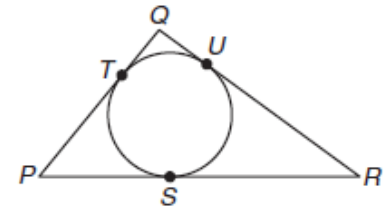
$$4 + 4 + 9 + 9 + 13 + 13$$

$$= 52$$

Examples

- Find the perimeter of each polygon for the given information. Assume that segments that appear to be tangent are tangent.

- $QT = 4$, $PT = 9$, $SR = 13$

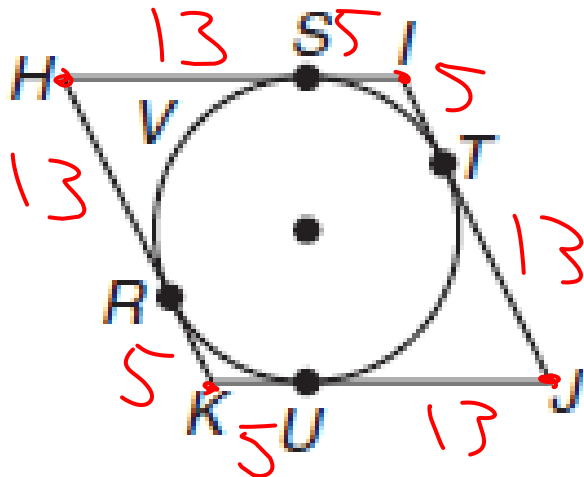


- $QT = 4$, $QU = 4$; $PT = 9$, $PS = 9$; $RS = 13$, $RU = 13$

- $\text{Perimeter} = 4 + 4 + 9 + 9 + 13 + 13 = 52$

Examples

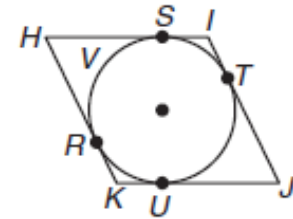
- Find the perimeter of each polygon for the given information. Assume that segments that appear to be tangent are tangent.
- $H I J K$ is a rhombus, $S I = 5$, $H R = 13$



$$18 + 18 + 18 + 18 = 72$$

Examples

- Find the perimeter of each polygon for the given information. Assume that segments that appear to be tangent are tangent.



- $HIJK$ is a rhombus, $SI = 5$, $HR = 13$
- $SI = 5$, $TI = 5$, $RK = 5$, $UK = 5$; $HR = 13$, $HS = 13$, $JU = 13$, $JT = 13$
- $\text{Perimeter} = 5 + 5 + 5 + 5 + 13 + 13 + 13 + 13 = 72$