

9.1 Tangent Properties

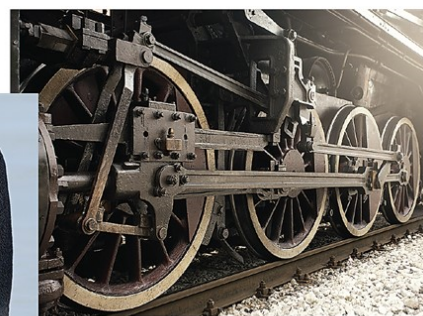
- I can determine and apply the relationship between a radius and a tangent line at the point of tangency.
- I can determine and apply the relationship between two tangent segments with a common endpoint outside the circle.



Tangent Properties

In this lesson you will investigate the relationship between a tangent line to a circle and the radius of the circle, and between two tangent segments to a common point outside the circle.

Rails act as tangent lines to the wheels of a train. Each wheel of a train theoretically touches only one point on the rail. The point where the rail and the wheel meet is a point of tangency. Why can't a train wheel touch more than one point at a time on the rail? How is the radius of the wheel to the point of tangency related to the rail? Let's investigate.



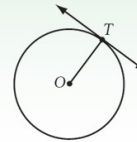
The rail is tangent to the wheels of the train.
The adult penguins' heads are tangent to each other.

INVESTIGATION 1

YOU WILL NEED:
compass,
straightedge

Going Off on a Tangent

In this investigation you will discover the relationship between a tangent line and the radius drawn to the point of tangency.



Step 1 Construct a large circle. Label the center O .

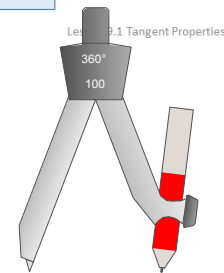
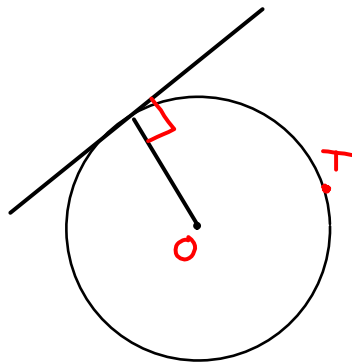
Step 2 Using your straightedge, draw a line that appears to touch the circle at only one point. Label the point T . Construct \overline{OT} .

Step 3 Use your protractor to measure the angles at T . What can you conclude about the radius \overline{OT} and the tangent line at T ?

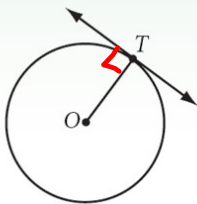
Step 4 Share your results with your group. Then copy and complete the conjecture.

Tangent Conjecture **C-74**
A tangent to a circle _____ the radius drawn to the point of tangency.

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INVESTIGATION 1 SOLUTION



Step 1 Construct a large circle. Label the center O .

Step 2 Using your straightedge, draw a line that appears to touch the circle at only one point. Label the point T . Construct \overline{OT} .

Step 3 Use your protractor to measure the angles at T . What can you conclude about the radius \overline{OT} and the tangent line at T ?

Step 4 Share your results with your group. Then copy and complete the conjecture.

Tangent Conjecture **C-74**
A tangent to a circle **is perpendicular to** the radius drawn to the point of tangency.

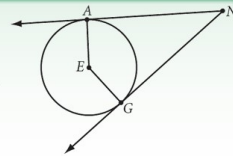


INVESTIGATION 2

YOU WILL NEED:
compass,
straightedge

Tangent Segments

In this investigation you will discover something about the lengths of segments tangent to a circle from a point outside the circle.



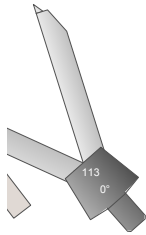
Step 1 Construct a circle. Label the center E .

Step 2 Choose a point outside the circle and label it N .

Step 3 Draw two rays from point N tangent to the circle. Mark the points where these lines appear to touch the circle and label them A and G .

Step 4 Use your compass to compare segments NA and NG . Segments such as these are called **tangent segments**.

Step 5 Share your results with your group. Copy and complete the conjecture.



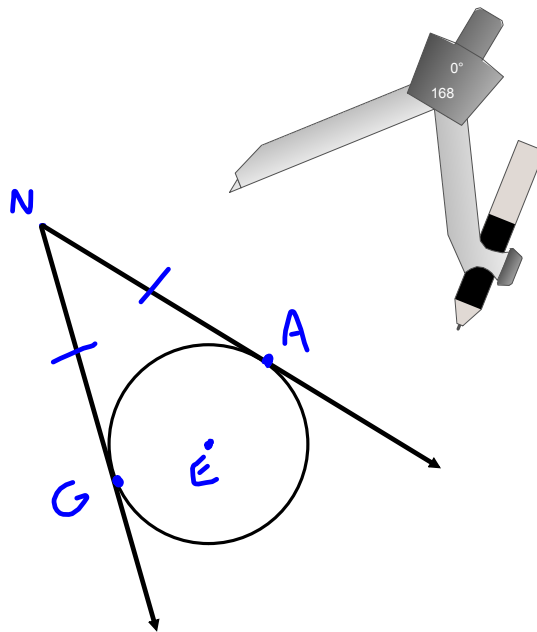
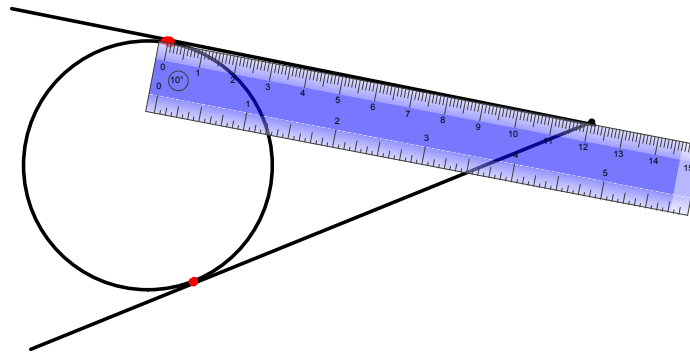
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Tangent Segments Conjecture

C-75

Tangent segments to a circle from a point outside the circle are _____.

Lesson 9.1 Tangent Properties

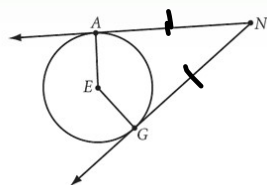




INVESTIGATION 2 SOLUTION

Step 1 Construct a circle. Label the center E .

Step 2 Choose a point outside the circle and label it N .



Step 3 Draw two rays from point N tangent to the circle. Mark the points where these lines appear to touch the circle and label them A and G .

Step 4 Use your compass to compare segments NA and NG . Segments such as these are called **tangent segments**.

Step 5 Share your results with your group. Copy and complete the conjecture.

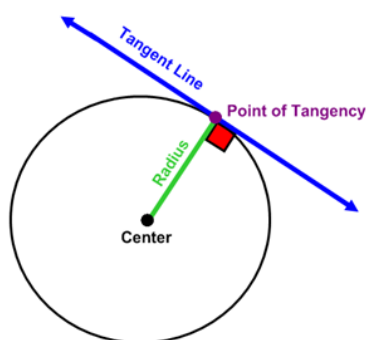
Tangent Segments Conjecture

C-75

Tangent segments to a circle from a point outside the circle are **congruent**.

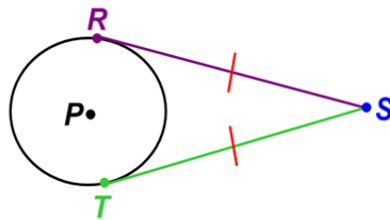
Tangent Conjecture

A tangent to a circle is perpendicular to the radius drawn to the point of tangency.



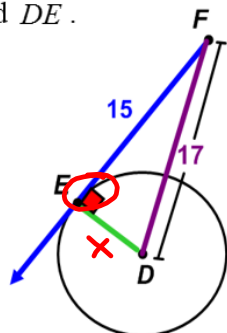
Tangent Segments Conjecture

Tangent segments to a circle from a point outside the circle are congruent.



Examples

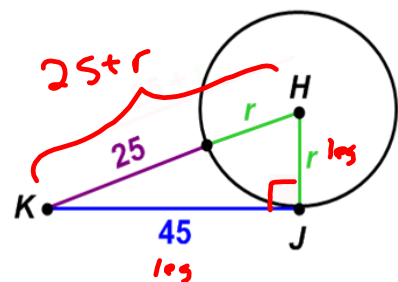
1. \overline{FE} is tangent to circle D at point E.
Find \overline{DE} .



~~$x^2 + 17^2 = 15^2$~~
 ~~$15^2 + 17^2 = x^2$~~

$x^2 + 15^2 = 17^2$
 $x^2 + 225 = 289$
 $x^2 = 64$
 $x = 8$

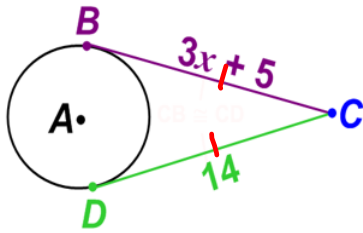
2. \overline{KJ} is tangent to circle H at point J.
Find the radius of circle H.



$45^2 + r^2 = (25+r)^2$
 $2025 + r^2 = (25+r)(25+r)$
 $2025 + r^2 = 625 + 25r + 25r + r^2$
 $-r^2$ $-r^2$
 $2025 = 625 + 50r$
 $1400 = 50r$
 $28 = r$

Solve for the value of x .

3.

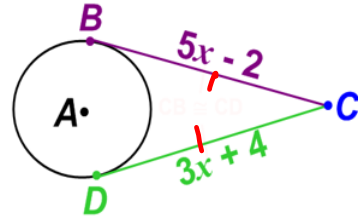


$$3x + 5 = 14$$

$$3x = 9$$

$$x = 3$$

4.



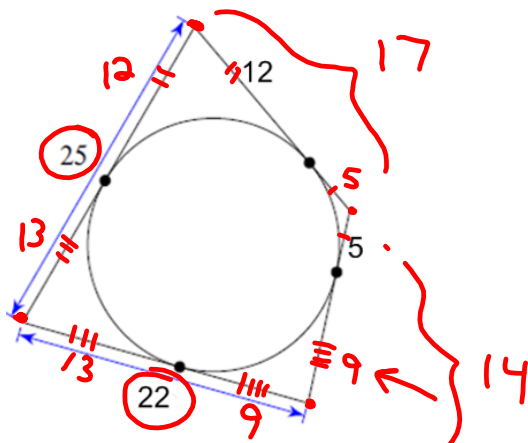
$$5x - 2 = 3x + 4$$

$$2x - 2 = 4$$

$$2x = 6$$

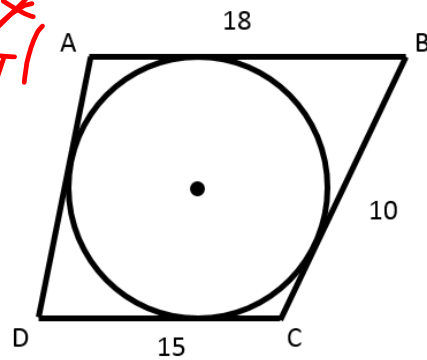
$$x = 3$$

5. Find the perimeter of the polygon below.



$$22 + 25 + 17 + 14 = 78$$

6. Given $AB = 18$, $BC = 10$, and $CD = 15$. Find AD .



$$15 - (-8 + x)$$

$$x + 23 - x = 10 - (18 - x)$$

$$23 = 10 - 18 + x$$

$$23 = -8 + x$$

$$x = 31$$

Assignment: 9.1 Tangent Properties Practice