

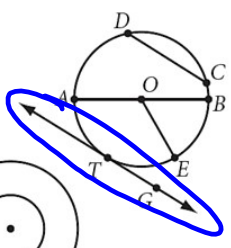
# Warm-Up

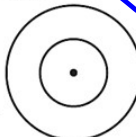
Match the figures in the second column with the terms in the left.

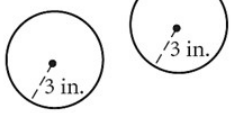
Please get a compass and protractor from the front.

1. Congruent circles
2. Concentric circles
3. Radius
4. Chord
5. Diameter
6. Tangent
7. Central angle
8. Minor arc
9. Major arc
10. Semicircle

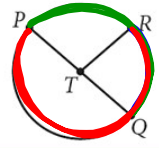
A.  $\overline{DC}$   
 B.  $\overline{TG}$   
 C.  $\overline{OE}$   
 D.  $\overline{AB}$



E. 

F. 

G.  $\widehat{RQ}$   
 H.  $\overline{PRQ}$   
 I.  $\overline{PQR}$   
 J.  $\angle PTR$



LESSON  
 9.1

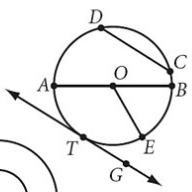
## Tangent Properties

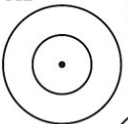
### Launch


Match the figures in the second column with the terms in the left.

1. Congruent circles
2. Concentric circles
3. Radius
4. Chord
5. Diameter
6. Tangent
7. Central angle
8. Minor arc
9. Major arc
10. Semicircle

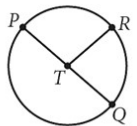
A.  $\overline{DC}$   
 B.  $\overline{TG}$   
 C.  $\overline{OE}$   
 D.  $\overline{AB}$



E. 

F. 

G.  $\widehat{RQ}$   
 H.  $\overline{PRQ}$   
 I.  $\overline{PQR}$   
 J.  $\angle PTR$



1. F
2. E
3. C
4. A
5. D
6. B
7. J
8. G
9. I
10. H

## 9.1 Tangent Properties

A. I can define properties of tangents of circles

B. I can use properties of tangent segments to solve problems

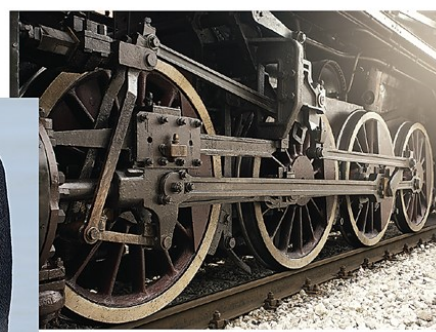
LESSON

9.1

## 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.

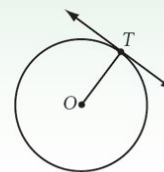


## INVESTIGATION 1

**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.

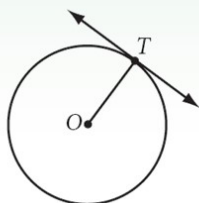
#### Tangent Conjecture

**C-74**

A tangent to a circle \_\_\_\_\_ the radius drawn to the point of tangency.



## 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.

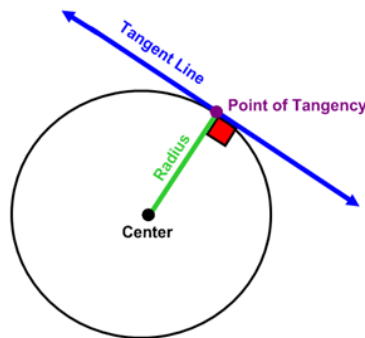
#### Tangent Conjecture

**C-74**

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

### Tangent Conjecture

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.

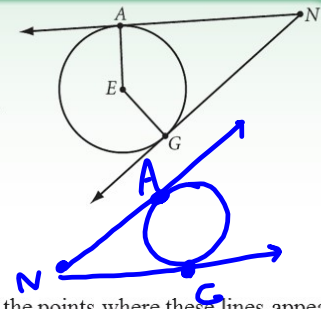
**Step 1** Construct a circle. Label the center  $E$ .

**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.



#### Tangent Segments Conjecture

C-75

Tangent segments to a circle from a point outside the circle are \_\_\_\_\_.

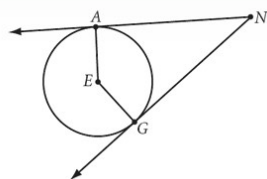


## INVESTIGATION 2

### 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.

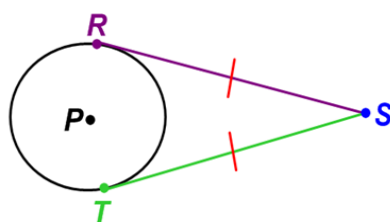
#### Tangent Segments Conjecture

C-75

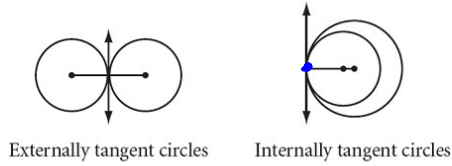
Tangent segments to a circle from a point outside the circle are **congruent**.

### Tangent Segments Conjecture

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



Tangent circles are two circles that are tangent to the same line at the same point. They can be **internally tangent** or **externally tangent**, as shown. What conjectures can you make about tangent circles? You will explore more about them in the exercise set.



Solve for x.

$$\begin{array}{|c|c|} \hline x & 8 \\ \hline x^2 & 8x \\ \hline 8x & 64 \\ \hline \end{array}$$

$\triangle PAB$  is a rt. triangle

$$(x+8)(x+8)$$

$$x^2 + 8x + 8x + 64$$

$$x^2 + 12^2 = (x+8)^2$$

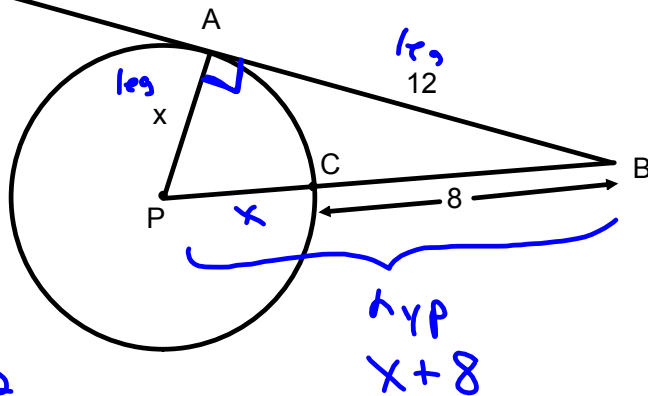
$$x^2 + 144 = x^2 + 16x + 64$$

$$-x^2 \quad -x^2$$

$$144 = 16x + 64$$

$$80 = 16x$$

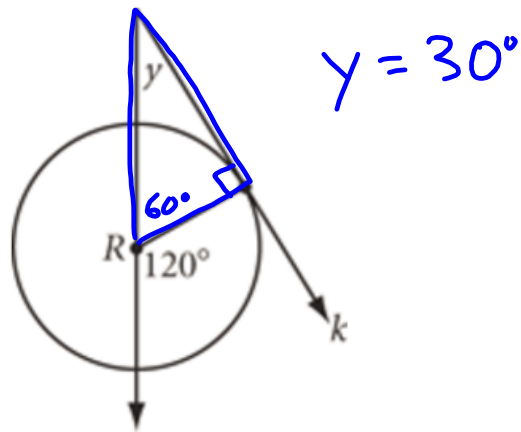
$$5 = x$$



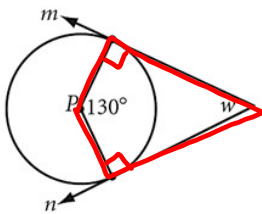
$$5^2 + 12^2 \stackrel{?}{=} 13^2$$

$$x = 5$$

4. Ray  $k$  is tangent to circle  $R$ . Find  $y$ .



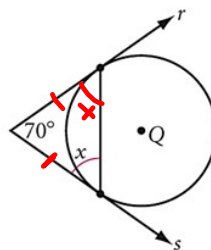
1. Rays  $m$  and  $n$  are tangent to circle  $P$ .  $w = ?$



$$360 - 90 - 90 - 130$$

$$w = 50^\circ$$

2. Rays  $r$  and  $s$  are tangent to circle  $Q$ .  $x = ?$  (h)

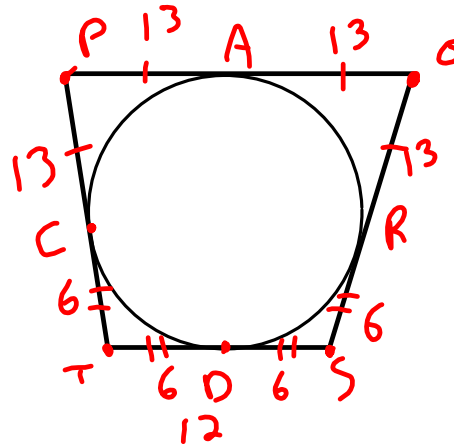
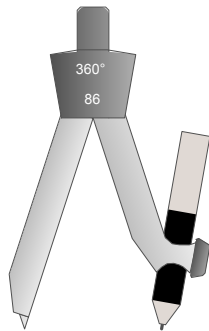
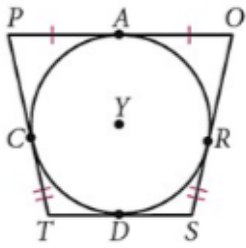


$$2x + 70 = 180$$

$$2x = 110$$

$$x = 55$$

5. Quadrilateral  $POST$  is circumscribed about circle  $Y$ .  
 $OR = 13$  in. and  $ST = 12$  in.  
 Find the perimeter of  $POST$ . (h)



Assignment: Workbook Page 65, #s 1-6