

# Lesson 11-1

Objective - To solve problems involving circles.  
 Circle - The locus of points equidistant from a center point.

$O$  - Center  
 $\overline{OA}$  - Radius - Segment or distance from center to circle.  
 $\overline{XM}$  - Chord - Segment whose endpoints lie on the circle.  
 $\overline{XY}$  - Diameter - Chord that passes through the center.  
 $\overline{MY}$  - Secant - Line that intersects the circle at two points.  
 $\overline{PA}$  - Tangent - Line that intersects the circle at exactly one point and is perpendicular to radius.

$\widehat{XA}$  - Arc  
 - Piece of a circle.  
 $\widehat{XMY}$  - Semicircle  
 - Half of a circle.

Draw the following in order.

- 1) circle A
- 2) radius  $\overline{AB}$
- 3) diameter  $\overline{XY}$
- 4) chord  $\overline{MY}$
- 5) secant  $\overline{MX}$
- 6) tangent  $\overline{PQ}$  which is tangent to circle A at point B.

Pairs of Circles

Concentric Circles      Tangent Circles

-Two coplanar circles with the same center

-Internally tangent

-Externally tangent

Identify the line of tangency for each pair of circles.

- 1) Circles that are internally tangent.  
 $x = 1$
- 2) Circles that are externally tangent.  
 $y = -2$

Common Tangents

-External Tangents      -Internal Tangents

(True or False) The external tangents of two circles have the same points of tangency as the internal tangents.

False

Construction

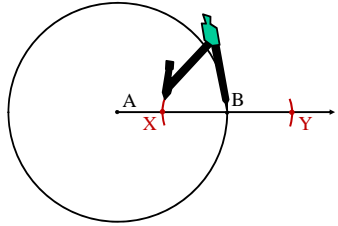
Construct a tangent line to a point on the circle.

- 1) Given Point B on circle A, draw  $\overline{AB}$
- 2) Construct 2 equally distant points from B on  $\overline{AB}$ .

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Construction

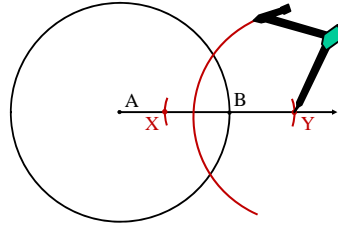
Construct a tangent line to a point on the circle.



- 1) Given Point B on circle A, draw  $\overline{AB}$
- 2) Construct 2 equally distant points from B on  $\overline{AB}$ .
- 3) Label these points X and Y.

Construction

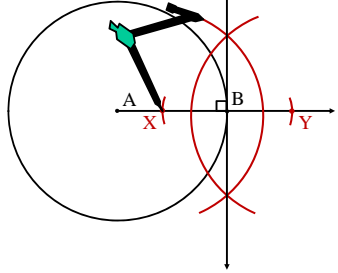
Construct a tangent line to a point on the circle.



- 1) Given Point B on circle A, draw  $\overline{AB}$
- 2) Construct 2 equally distant points from B on  $\overline{AB}$ .
- 3) Label these points X and Y.
- 4) Construct  $\perp$  bisector of  $\overline{XY}$ .

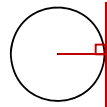
Construction

Construct a tangent line to a point on the circle.



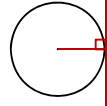
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Tangent Theorem



If a line is tangent to a circle, then it is perpendicular to the radius at that point.  
(Tangent line  $\rightarrow \perp$  to radius)

Converse of the Tangent Theorem

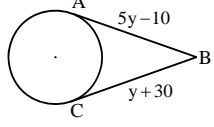


If a line is perpendicular to the radius at a point on the circle, then it is tangent to the circle.  
( $\perp$  to radius  $\rightarrow$  tangent line)

Two Tangent Lines Theorem

If two segments are tangent to a circle from the same external point, then they are congruent.  
(Two tangent lines from same ext. pt. are  $\cong$ )

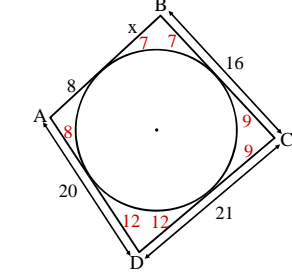
Find the length of the tangent lines.



$$\begin{array}{r} 5y - 10 = y + 30 \\ -y \quad -y \\ \hline 4y - 10 = 30 \\ +10 \quad +10 \\ \hline 4y = 40 \\ y = 10 \end{array}$$

$\overline{AB} = 5(10) - 10$   
 $\overline{AB} = 40 \quad \overline{BC} = 40$

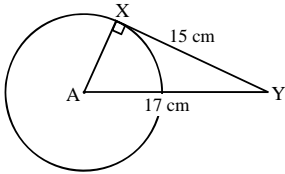
Find the length of x.



$x = 7$

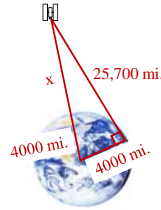
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Find the length of the diameter for circle A.



$$\begin{aligned}
 a^2 + b^2 &= c^2 \\
 AX^2 + 15^2 &= 17^2 \\
 AX^2 + 225 &= 289 \\
 \underline{-225 \quad -225} & \\
 AX^2 &= 64 \\
 AX &= \sqrt{64} \\
 \text{radius } AX &= 8 \\
 \text{diameter} &= 16 \text{ cm}
 \end{aligned}$$

A satellite in geosynchronous orbit is 25,700 miles from the horizon of the Earth. If the Earth has a radius of 4000 miles, what is the height of the satellite above the Earth?



Let  $x$  = height above Earth  
(in thousands)

$$\begin{aligned}
 a^2 + b^2 &= c^2 \\
 4^2 + 25.7^2 &= (x + 4)^2 && \begin{array}{l} 1 \times 60 \\ 2 \times 30 \\ 3 \times 20 \\ 4 \times 15 \\ 5 \times 12 \\ 6 \times 10 \\ 10 \times 6 \\ 11 \times 60 \\ 12 \times 55 \\ 15 \times 44 \\ 20 \times 33 \\ 22 \times 30 \end{array} \\
 0 &= x^2 + 8x - 660 \\
 0 &= (x + 30)(x - 22) \\
 x &= -30 \text{ or } 22 \\
 \text{22,000 miles} &
 \end{aligned}$$