CHAPTER 10

Chapter Summary

WHAT did you learn?	*WHY did you learn it?*
Identify segments and lines related to circles. **(10.1)**	Lay the foundation for work with circles.
Use properties of tangents of circles. **(10.1)**	Find real-life distances, such as the radius of a silo. **(p. 597)**
Use properties of arcs and chords of circles. **(10.2)**	Solve real-life problems such as analyzing a procedure used to locate an avalanche rescue beacon. **(p. 609)**
Use properties of inscribed angles and inscribed polygons of circles. **(10.3)**	Reach conclusions about angles in real-life objects, such as your viewing angle at the movies. **(p. 614)**
Use angles formed by tangents, chords, and secants. **(10.4)**	Estimate distances, such as the maximum distance at which fireworks can be seen. **(p. 625)**
Find the lengths of segments of tangents, chords, and lines that intersect a circle. **(10.5)**	Find real-life distances, such as the distance a satellite transmits a signal. **(p. 634)**
Find and graph the equation of a circle. **(10.6)**	Solve real-life problems, such as determining cellular phone coverage. **(p. 639)**
Draw loci in a plane that satisfy one or more conditions. **(10.7)**	Make conclusions based on real-life constraints, such as using seismograph readings to locate the epicenter of an earthquake. **(p. 644)**

How does Chapter 10 fit into the BIGGER PICTURE of geometry?

In this chapter, you learned that circles have many connections with other geometric figures. For instance, you learned that a quadrilateral can be inscribed in a circle if and only if its opposite angles are supplementary. Circles also occur in natural settings, such as the ripples in a pond, and in manufactured structures, such as a cross section of a storage tank. The properties of circles that you studied in this chapter will help you solve problems related to mathematics and the real world.

STUDY STRATEGY

Did you answer your questions?

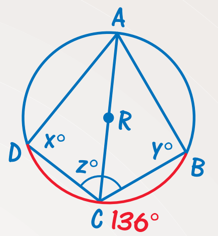
Your record of questions about difficult exercises, following the study strategy on page 594, may resemble this one.

Questions to Answer

Exercise 18, p. 617

Is there enough information to find x and y?

Oh, $\overline{AC}$ is a diameter, so $x = 90$ and $y = 90$.



CHAPTER 10

Chapter Review

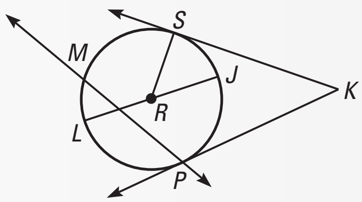
VOCABULARY

- circle, p. 595
- center of circle, p. 595
- radius of circle, p. 595
- congruent circles, p. 595
- diameter of circle, p. 595
- chord, secant, tangent, p. 595
- tangent circles, p. 596
- concentric circles, p. 596
- common tangent, p. 596
- interior of a circle, p. 596
- exterior of a circle, p. 596
- point of tangency, p. 597
- central angle, p. 603
- minor arc and its measure, p. 603
- major arc and its measure, p. 603
- semicircle, p. 603
- congruent arcs, p. 604
- inscribed angle, p. 613
- intercepted arc, p. 613
- inscribed polygon, p. 615
- circumscribed circle, p. 615
- tangent segment, p. 630
- secant segment, p. 630
- external segment, p. 630
- standard equation of a circle, p. 636
- locus, p. 642

10.1 Tangents to Circles

Examples on pp. 595–598

EXAMPLES In $\odot R$, R is the center. $\overline{RJ}$ is a radius, and $\overline{JL}$ is a diameter. $\overline{MP}$ is a chord, and $\overleftrightarrow{MP}$ is a secant. $\overleftrightarrow{KS}$ is a tangent and so it is perpendicular to the radius $\overline{RS}$. $\overline{KS} \cong \overline{KP}$ because they are two tangents from the same exterior point.



Name a point, segment, line, or circle that represents the phrase.

1. Diameter of $\odot P$

2. Point of tangency of $\odot Q$

3. Chord of $\odot P$

4. Center of larger circle

5. Radius of $\odot Q$

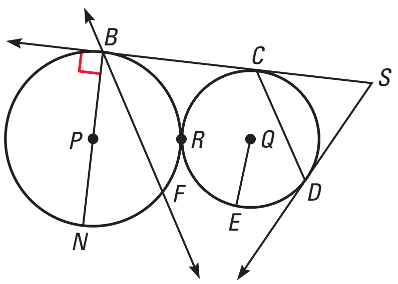
6. Common tangent

7. Secant

8. Point of tangency of $\odot P$ and $\odot Q$

9. Is $\angle PBC$ a right angle? Explain.

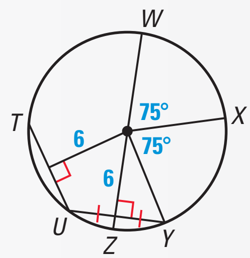
10. Show that $\triangle SCD$ is isosceles.



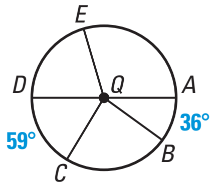
10.2 Arcs and Chords

Examples on pp. 603–606

EXAMPLES $\overset{\frown}{WX}$ and $\overset{\frown}{XY}$ are congruent minor arcs with measure 75°. $\overset{\frown}{WYX}$ is a major arc, and $m\overset{\frown}{WYX} = 360° - 75° = 285°$. Chords $\overline{TU}$ and $\overline{UY}$ are congruent because they are equidistant from the center of the circle. $\overset{\frown}{TU} \cong \overset{\frown}{UY}$ because $\overline{TU} \cong \overline{UY}$. Chord $\overline{WZ}$ is a perpendicular bisector of chord $\overline{UY}$, so $\overline{WZ}$ is a diameter.



Use ⊙*Q* in the diagram to find the measure of the indicated arc. $\overline{AD}$ is a diameter, and $m\overset{\frown}{CE} = 121°$.



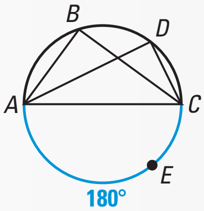
11. $\overset{\frown}{DE}$ **12.** $\overset{\frown}{AE}$ **13.** $\overset{\frown}{AEC}$

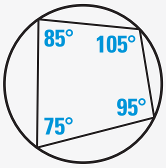
14. $\overset{\frown}{BC}$ **15.** $\overset{\frown}{BDC}$ **16.** $\overset{\frown}{BDA}$

10.3 Inscribed Angles

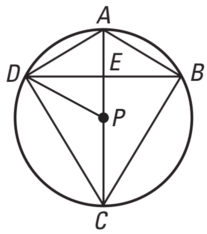
Examples on pp. 613–616

EXAMPLES $\angle ABC$ and $\angle ADC$ are congruent inscribed angles, each with measure $\frac{1}{2} \cdot m\overset{\frown}{AEC} = 90°$. Because $\triangle ADC$ is an inscribed right triangle, $\overline{AC}$ is a diameter. The quadrilateral can be inscribed in a circle because its opposite angles are supplementary.





Kite *ABCD* is inscribed in ⊙*P*. Decide whether the statement is *true* or *false*. Explain your reasoning.



17. $\angle ABC$ and $\angle ADC$ are right angles.

18. $m\angle ACD = \frac{1}{2} \cdot m\angle AED$

19. $m\angle DAB + m\angle BCD = 180°$

10.4 Other Angle Relationships in Circles

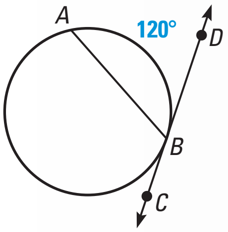
Examples on pp. 621–623

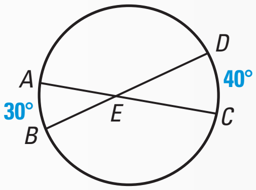
EXAMPLES

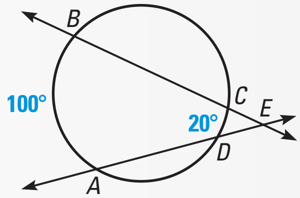
$m\angle ABD = \frac{1}{2} \cdot 120°$
$= 60°$

$m\angle CED = \frac{1}{2}(30° + 40°)$
$= 35°$

$m\angle CED = \frac{1}{2}(100° - 20°)$
$= 40°$

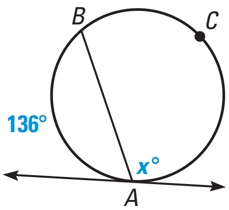






Find the value of *x*.

20.



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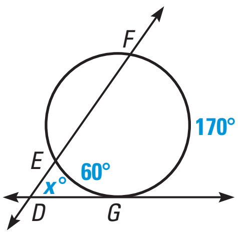

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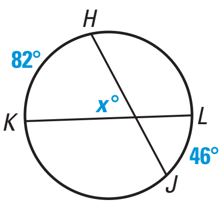

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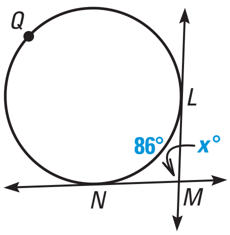


10.5 Segment Lengths in Circles

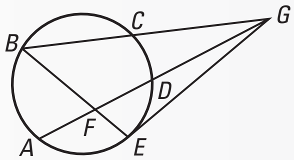
Examples on pp. 629–631

EXAMPLES $\overline{GE}$ is a tangent segment.

$BF \cdot FE = AF \cdot FD$

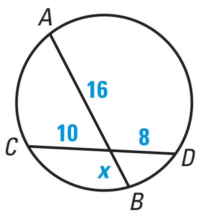
$GC \cdot GB = GD \cdot GA$

$(GE)^2 = GD \cdot GA$

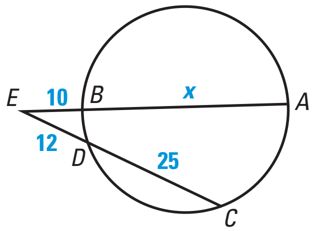


Find the value of *x*.

24.



25.



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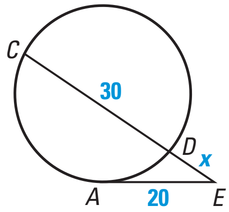
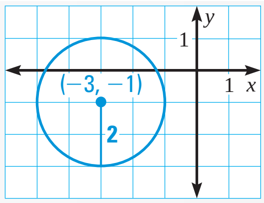


10.6 Equations of Circles

Examples on pp. 636–637

EXAMPLE $\odot C$ has center $(-3, -1)$ and radius 2. Its standard equation is

$$[x - (-3)]^2 + [y - (-1)]^2 = 2^2, \text{ or } (x + 3)^2 + (y + 1)^2 = 4.$$



Write the standard equation of the circle. Then graph the equation.

27. Center (2, 5), radius 9

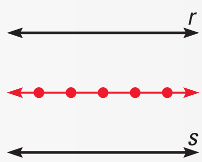
28. Center $(-4, -1)$, radius 4

29. Center $(-6, 0)$, radius $\sqrt{10}$

10.7 Locus

Examples on pp. 642–644

EXAMPLE To find the locus of points equidistant from two parallel lines, *r* and *s*, draw 2 parallel lines, *r* and *s*. Locate several points that are equidistant from *r* and *s*. Identify the pattern. The locus is a line parallel to *r* and *s* and halfway between them.



Draw the figure. Then sketch and describe the locus of points on the paper that satisfy the given condition(s).

30. $\triangle RST$, the locus of points that are equidistant from *R* and *S*

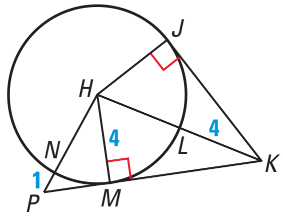
31. Line ℓ, the locus of points that are no more than 4 inches from ℓ

32. $\overline{AB}$ with length 4 cm, the locus of points 3 cm from *A* and 4 cm from *B*

CHAPTER 10

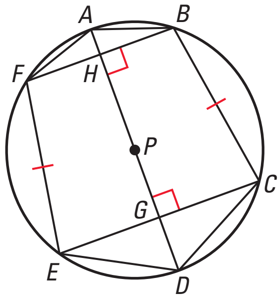
Chapter Test

Use the diagram at the right.



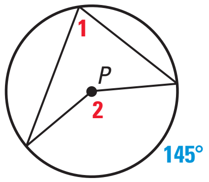
1. Which theorems allow you to conclude that $\overline{JK} \cong \overline{MK}$?
2. Find the lengths of $\overline{JK}$, $\overline{MP}$, and $\overline{PK}$.
3. Show that $\overset{\frown}{JL} \cong \overset{\frown}{LM}$.
4. Find the measures of $\overset{\frown}{JM}$ and $\overset{\frown}{JN}$.

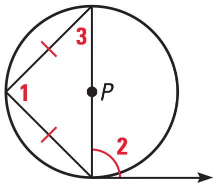
Use the diagram at the right.

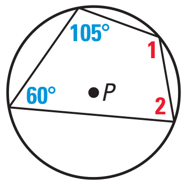


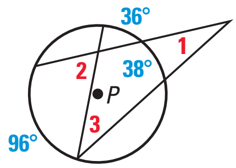
5. Show that $\overset{\frown}{AF} \cong \overset{\frown}{AB}$ and $\overline{FH} \cong \overline{BH}$.
6. Show that $\overset{\frown}{FE} \cong \overset{\frown}{BC}$.
7. Suppose you were given that $PH = PG$. What could you conclude?

Find the measure of each numbered angle in ⊙*P*.

8. 

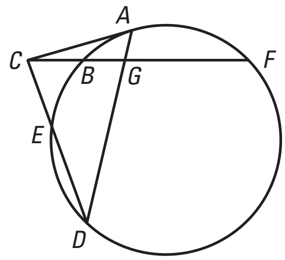
9. 

10. 

11. 

12. Sketch a pentagon *ABCDE* inscribed in a circle. Describe the relationship between (a) $\angle CDE$ and $\angle CAE$ and (b) $\angle CBE$ and $\angle CAE$.

In the diagram at the right $\overline{CA}$ is tangent to the circle at *A*.



13. If $AG = 2$, $GD = 9$, and $BG = 3$, find GF.
14. If $CF = 12$, $CB = 3$, and $CD = 9$, find CE.
15. If $BF = 9$ and $CB = 3$, find CA.
16. Graph the circle with equation $(x - 4)^2 + (y + 6)^2 = 64$.
17. Sketch and describe the locus of points in the coordinate plane that are equidistant from (0, 3) and (3, 0) and 4 units from the point (4, 0).
18. **ROCK CIRCLE** This circle of rock is in the Ténéré desert in the African country of Niger. The circle is about 60 feet in diameter. About a mile away to the north, south, east, and west, stone arrows point away from the circle. It's not known who created the circle or why. Suppose the center of the circle is at (30, 30) on a grid measured in units of feet. Write an equation for the circle.

19. **DOG RUN** A dog on a leash is able to move freely along a cable that is attached to the ground. The leash allows the dog to move anywhere within 3.5 feet from any point on the 10-foot straight cable. Draw and describe the locus of points that the dog can reach.