Key

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10 Anticipation Guide

Circles and Circumference

Step 1 *Before you begin Chapter 10*

- Read each statement.
- Decide whether you Agree (A) or Disagree (D) with the statement.
- Write A or D in the first column OR if you are not sure whether you agree or disagree, write NS (Not Sure).

STEP 1 A, D, or NS	Statement	STEP 2 A or D
	1. The distance from any point on a circle to the center of the circle is called the diameter.	D
	2. A chord of a circle is any segment with endpoints that are on the circle.	A
	3. The formula for the circumference of a circle is $C = \pi r^2$.	D
	4. The vertex of a central angle of a circle is at the center of the circle.	A
	5. If two arcs from two different circles have the same measure then the arcs are congruent.	D
	6. In a circle, two minor arcs are congruent if their corresponding chords are congruent.	A
	7. In a circle, two chords that are equidistant from the center are congruent.	A
	8. The measure of an inscribed angle equals the measure of its intercepted arc.	D
	9. A line is tangent to a circle only if it contains a chord of the circle.	D
	10. Two secant lines of a circle can intersect in the interior or the exterior of the circle.	A
	11. If two chords intersect inside a circle then the two chords are congruent.	D
	12. The center of a circle represented by the equation $(x + 3)^2 + (y + 5)^2 = 9$ is located at (3, 5).	D

Step 2 *After you complete Chapter 10*

- Reread each statement and complete the last column by entering an A or a D.
- Did any of your opinions about the statements change from the first column?
- For those statements that you mark with a D, use a piece of paper to write an example of why you disagree.

10-1 Lesson Reading Guide

Circles and Circumference

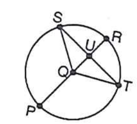
Get Ready for the Lesson

Read the introduction to Lesson 10-1 in your textbook.

How could you measure the approximate distance around the circular carousel using everyday measuring devices? **Sample answer: Place a piece of string along the rim of the carousel. Cut off a length of string that covers the perimeter of the circle. Straighten the string and measure it with a yardstick.**

Read the Lesson

1. Refer to the figure.



   a. Name the circle. $\odot Q$
   b. Name four radii of the circle. $\overline{QP}$, $\overline{QR}$, $\overline{QS}$, and $\overline{QT}$
   c. Name a diameter of the circle. $\overline{PR}$
   d. Name two chords of the circle. $\overline{PR}$ and $\overline{ST}$

2. Match each description from the first column with the best term from the second column. (Some terms in the second column may be used more than once or not at all.)

   a. a segment other than the diameter endpoints on a circle iii
   b. the set of all points in a plane that are the same distance from a given point iv
   c. the distance between the center of a circle and any point on the circle i
   d. a chord that passes through the center of a circle ii
   e. a segment whose endpoints are the center and any point on a circle i
   f. a chord made up of two collinear radii ii
   g. the distance around a circle v

   i. radius
   ii. diameter
   iii. chord
   iv. circle
   v. circumference

3. Which equations correctly express a relationship in a circle? A, D, G

   A. $d = 2r$ B. $C = \pi r$ C. $C = 2d$ D. $d = \frac{C}{\pi}$
   E. $r = \frac{d}{\pi}$ F. $C = r^2$ G. $C = 2\pi r$ H. $d = \frac{1}{2}r$

Remember What You Learned

4. A good way to remember a new geometric term is to relate the word or its parts to geometric terms you already know. Look up the origins of the two parts of the word *diameter* in your dictionary. Explain the meaning of each part and give a term you already know that shares the origin of that part. **Sample answer: The first part comes from *dia*, which means *across* or *through*, as in *diagonal*. The second part comes from *metron*, which means *measure*, as in *geometry*.**

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10-2 Lesson Reading Guide

Measuring Angles and Arcs

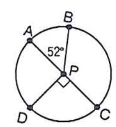
Get Ready for the Lesson

Read the introduction to Lesson 10-2 in your textbook.

- What is the measure of the angle formed by the hour hand and the minute hand of the clock at 5:00? 150
- What is the measure of the angle formed by the hour hand and the minute hand at 10:30? (Hint: How has each hand moved since 10:00?) 135

Read the Lesson

1. Refer to $\odot P$. $\overline{AC}$ is a diameter. Indicate whether each statement is *true* or *false*.



   a. $\widehat{DAB}$ is a major arc. false
   b. $\widehat{ADC}$ is a semicircle. true
   c. $\widehat{AD} \cong \widehat{CD}$ true
   d. $\widehat{DA}$ and $\widehat{AB}$ are adjacent arcs. true
   e. $\angle BPC$ is an acute central angle. false
   f. $\angle DPA$ and $\angle BPA$ are supplementary central angles. false

2. Refer to the figure in Exercise 1. Give each of the following arc measures.
   a. $m\widehat{AB}$ 52 b. $m\widehat{CD}$ 90
   c. $m\widehat{BC}$ 128 d. $m\widehat{ADC}$ 180
   e. $m\widehat{DAB}$ 142 f. $m\widehat{DCB}$ 218
   g. $m\widehat{DAC}$ 270 h. $m\widehat{BDA}$ 308

3. Underline the correct word or number to form a true statement.
   a. The arc measure of a semicircle is (90/180/360).
   b. Arcs of a circle that have exactly one point in common are (congruent/opposite/adjacent) arcs.
   c. The measure of a major arc is greater than (0/90/180) and less than (90/180/360).
   d. Suppose a set of central angles of a circle have interiors that do not overlap. If the angles and their interiors contain all points of the circle, then the sum of the measures of the central angles is (90/270/360).
   e. The measure of an arc formed by two adjacent arcs is the (sum/difference/product) of the measures of the two arcs.
   f. The measure of a minor arc is greater than (0/90/180) and less than (90/180/360).

Remember What You Learned

4. A good way to remember something is to explain it to someone else. Suppose your classmate Luis does not like to work with proportions. What is a way that he can find the length of a minor arc of a circle without solving a proportion? Sample answer: Divide the measure of the central angle of the arc by 360 to form a fraction. Multiply this fraction by the circumference of the circle to find the length of the arc.

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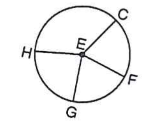
10-2 Study Guide and Intervention

Measuring Angles and Arcs

Angles and Arcs A **central angle** is an angle whose vertex is at the center of a circle and whose sides are radii. A central angle separates a circle into two arcs, a **major arc** and a **minor arc**.



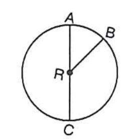
$\widehat{GF}$ is a minor arc.
$\widehat{CHG}$ is a major arc.
$\angle GEF$ is a central angle.

Here are some properties of central angles and arcs.

- The sum of the measures of the central angles of a circle with no interior points in common is 360. — $m\angle HEC + m\angle CEF + m\angle FEG + m\angle GEH = 360$
- The measure of a minor arc equals the measure of its central angle. — $m\widehat{CF} = m\angle CEF$
- The measure of a major arc is 360 minus the measure of the minor arc. — $m\widehat{CGF} = 360 - m\widehat{CF}$
- Two arcs are congruent if and only if their corresponding central angles are congruent. — $\widehat{CF} \cong \widehat{FG}$ if and only if $\angle CEF \cong \angle FEG$.
- The measure of an arc formed by two adjacent arcs is the sum of the measures of the two arcs. **(Arc Addition Postulate)** — $m\widehat{CF} + m\widehat{FG} = m\widehat{CG}$

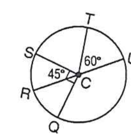
Example **In $\odot R$, $m\angle ARB = 42$ and $\overline{AC}$ is a diameter. Find $m\widehat{AB}$ and $m\widehat{ACB}$.**

$\angle ARB$ is a central angle and $m\angle ARB = 42$, so $m\widehat{AB} = 42$.
Thus $m\widehat{ACB} = 360 - 42$ or 318.



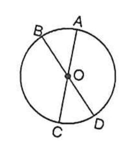
Exercises

Find each measure.



1. $m\angle SCT$ 75 2. $m\angle SCU$ 135
3. $m\angle SCQ$ 90 4. $m\angle QCT$ 165

In $\odot O$, $m\angle BOA = 44$. Find each measure.



5. $m\widehat{BA}$ 44 6. $m\widehat{BC}$ 136
7. $m\widehat{CD}$ 44 8. $m\widehat{ACB}$ 316
9. $m\widehat{BCD}$ 180 10. $m\widehat{AD}$ 136

Lesson 10-2

Answers *(Lesson 10–2)*

Answers

Answers (Lesson 10–2 and 10–3)

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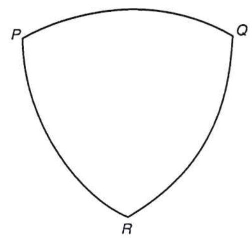
10-2 Enrichment

Curves of Constant Width

A circle is called a curve of constant width because no matter how you turn it, the greatest distance across it is always the same. However, the circle is not the only figure with this property.

The figure at the right is called a Reuleaux triangle.



1. Use a metric ruler to find the distance from P to any point on the opposite side. **4.6 cm**
2. Find the distance from Q to the opposite side. **4.6 cm**
3. What is the distance from R to the opposite side? **4.6 cm**

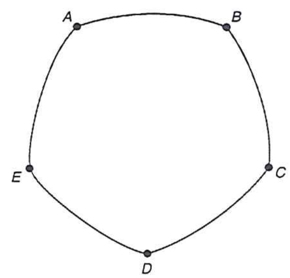
The Reuleaux triangle is made of three arcs. In the example shown, $\overparen{PQ}$ has center R, $\overparen{QR}$ has center P, and $\overparen{PR}$ has center Q.

4. Trace the Reuleaux triangle above on a piece of paper and cut it out. Make a square with sides the length you found in Exercise 1. Show that you can turn the triangle inside the square while keeping its sides in contact with the sides of the square. **See students' work.**
5. Make a different curve of constant width by starting with the five points below and following the steps given.

Step 1: Place the point of your compass on D with opening DA. Make an arc with endpoints A and B.

Step 2: Make another arc from B to C that has center E.

Step 3: Continue this process until you have five arcs drawn.



Some countries use shapes like this for coins. They are useful because they can be distinguished by touch, yet they will work in vending machines because of their constant width.

6. Measure the width of the figure you made in Exercise 5. Draw two parallel lines with the distance between them equal to the width you found. On a piece of paper, trace the five-sided figure and cut it out. Show that it will roll between the lines drawn. **5.3 cm**

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10-3 Lesson Reading Guide

Arcs and Chords

Get Ready for the Lesson

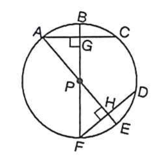
Read the introduction to Lesson 10-3 in your textbook.

What do you observe about any two of the grooves in the waffle iron shown in the picture in your textbook? **They are either parallel or perpendicular.**

Read the Lesson

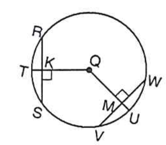
1. Supply the missing words or phrases to form true statements.
   a. In a circle, if a radius is **perpendicular** to a chord, then it bisects the chord and its **arc**.
   b. In a circle or in **congruent** circles, two **minor arcs** are congruent if and only if their corresponding chords are congruent.
   c. In a circle or in **congruent** circles, two chords are congruent if they are **equidistant** from the center.
   d. A polygon is inscribed in a circle if all of its **vertices** lie on the circle.
   e. All of the sides of an inscribed polygon are **chords** of the circle.

2. If $\odot P$ has a diameter 40 centimeters long, and $AC = FD = 24$ centimeters, find each measure.



   a. PA **20 cm** b. AG **12 cm**
   c. PE **20 cm** d. PH **16 cm**
   e. HE **4 cm** f. FG **36 cm**

3. In $\odot Q$, $RS = VW$ and $m\overparen{RS} = 70$. Find each measure.



   a. $m\overparen{RT}$ **35** b. $m\overparen{ST}$ **35**
   c. $m\overparen{VW}$ **70** d. $m\overparen{VU}$ **35**

4. Find the measure of each arc of a circle that is circumscribed about the polygon.
   a. an equilateral triangle **120** b. a regular pentagon **72**
   c. a regular hexagon **60** d. a regular decagon **36**
   e. a regular dodecagon **30** f. a regular n-gon $\frac{360}{n}$

Remember What You Learned

5. Some students have trouble distinguishing between *inscribed* and *circumscribed* figures. What is an easy way to remember which is which? **Sample answer: The *in*scribed figure is *in*side the circle.**

Lesson 10-3

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10-4 Lesson Reading Guide

Inscribed Angles

Get Ready for the Lesson

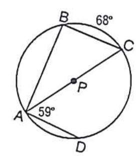
Read the introduction to Lesson 10-4 in your textbook.

- Why do you think regular hexagons are used rather than squares for the "hole" in a socket? Sample answer: If a square were used, the points might be too sharp for the tool to work smoothly.
- Why do you think regular hexagons are used rather than regular polygons with more sides? Sample answer: If there are too many sides, the polygon would be too close to a circle, so the wrench might slip.

Read the Lesson

1. Underline the correct word or phrase to form a true statement.
   - a. An angle whose vertex is on a circle and whose sides contain chords of the circle is called a(n) (central/inscribed/circumscribed) angle.
   - b. Every inscribed angle that intercepts a semicircle is a(n) (acute/right/obtuse) angle.
   - c. The opposite angles of an inscribed quadrilateral are (congruent/complementary/supplementary).
   - d. An inscribed angle that intercepts a major arc is a(n) (acute/right/obtuse) angle.
   - e. Two inscribed angles of a circle that intercept the same arc are (congruent/complementary/supplementary).
   - f. If a triangle is inscribed in a circle and one of the sides of the triangle is a diameter of the circle, the diameter is (the longest side of an acute triangle/a leg of an isosceles triangle/the hypotenuse of a right triangle).

2. Refer to the figure. Find each measure.



   - a. $m\angle ABC$ 90
   - b. $m\overset{\frown}{CD}$ 118
   - c. $m\overset{\frown}{AD}$ 62
   - d. $m\angle BAC$ 34
   - e. $m\angle BCA$ 56
   - f. $m\overset{\frown}{AB}$ 112
   - g. $m\overset{\frown}{BCD}$ 186
   - h. $m\overset{\frown}{BDA}$ 248

Remember What You Learned

3. A good way to remember a geometric relationship is to visualize it. Describe how you could make a sketch that would help you remember the relationship between the measure of an inscribed angle and the measure of its intercepted arc. Sample answer: Draw a diameter of the circle to divide it into two semicircles. Inscribe an angle in one of the semicircles; this angle will intercept the other semicircle. From your sketch, you can see that the inscribed angle is a right angle. The measure of the semicircle arc is 180, so the measure of the inscribed angle is half the measure of its intercepted arc.

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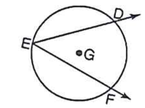
10-4 Study Guide and Intervention

Inscribed Angles

Inscribed Angles An **inscribed angle** is an angle whose vertex is on a circle and whose sides contain chords of the circle. In $\odot G$, inscribed $\angle DEF$ **intercepts** $\overset{\frown}{DF}$.



$m\angle DEF = \frac{1}{2}m\overset{\frown}{DF}$

Inscribed Angle Theorem	If an angle is inscribed in a circle, then the measure of the angle equals one-half the measure of its intercepted arc.

Example **In $\odot G$ above, $m\overset{\frown}{DF} = 90$. Find $m\angle DEF$.**

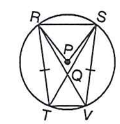
$\angle DEF$ is an inscribed angle so its measure is half of the intercepted arc.

$m\angle DEF = \frac{1}{2}m\overset{\frown}{DF}$

$= \frac{1}{2}(90)$ or 45

Exercises

Use $\odot P$ for Exercises 1–10. In $\odot P$, $\overline{RS} \parallel \overline{TV}$ and $\overline{RT} \cong \overline{SV}$.



1. Name the intercepted arc for $\angle RTS$. $\overset{\frown}{RS}$
2. Name an inscribed angle that intercepts $\overset{\frown}{SV}$. $\angle SRV$ or $\angle STV$

In $\odot P$, $m\overset{\frown}{SV} = 120$ and $m\angle RPS = 76$. Find each measure.

3. $m\angle PRS$ 52
4. $m\overset{\frown}{RSV}$ 196
5. $m\overset{\frown}{RT}$ 120
6. $m\angle RVT$ 60
7. $m\angle QRS$ 60
8. $m\angle STV$ 60
9. $m\overset{\frown}{TV}$ 44
10. $m\angle SVT$ 98