# 12-2

## 1. Plan

### Objectives
1 To use congruent chords, arcs, and central angles
2 To recognize properties of lines through the center of a circle

### Examples
1 Using Theorem 12-4
2 Using Theorem 12-5
3 Using Diameters and Chords

Professional Development

### Math Background

Theorem 12-8 can be used to prove the theorem of analytic geometry that states that any three noncollinear points determine a unique circle. It also can be used to justify a method of constructing the circle. Construct the perpendicular bisectors of two of the three possible segments. Construct a circle whose center is the point of intersection of the perpendicular bisectors and whose radius is the distance from the center to any of the three points.

**More Math Background:** p. 660C

### Lesson Planning and Resources

See p. 660E for a list of the resources that support this lesson.

PowerPoint

### Bell Ringer Practice

**Check Skills You'll Need**
For intervention, direct students to:

**Using 45°-45°-90° Triangles**
Lesson 8-2: Example 2
Extra Skills, Word Problems, Proof Practice, Ch. 8

**Using 30°-60°-90° Triangles**
Lesson 8-2: Example 4
Extra Skills, Word Problems, Proof Practice, Ch. 8



# 12-2 Chords and Arcs

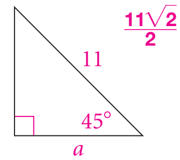
### What You'll Learn
- To use congruent chords, arcs, and central angles
- To recognize properties of lines through the center of a circle

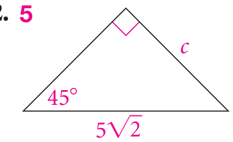
### . . . And Why
To see how an archaeologist finds the center and radius of the rim of a jar, as in Exercise 20

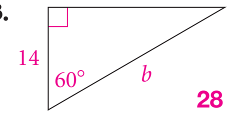
### Check Skills You'll Need

GO for Help Lesson 8-2

**Find the value of each variable. Leave your answer in simplest radical form.**

**1.** 

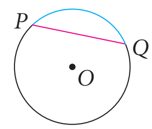

**2.** 


**3.** 


### New Vocabulary
- chord

## 1 Using Congruent Chords, Arcs, and Central Angles

A segment whose endpoints are on a circle is called a **chord.** The diagram shows the related chord and arc, $\overline{PQ}$ and $\overset{\frown}{PQ}$.



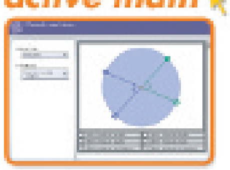

The following theorem is about related central angles, chords, and arcs. It says, for example, that if two central angles in a circle are congruent, then so are the two chords and two arcs that the angles intercept.

**Key Concepts**

**Theorem 12-4**

Within a circle or in congruent circles
(1) Congruent central angles have congruent chords.
(2) Congruent chords have congruent arcs.
(3) Congruent arcs have congruent central angles.

Online active math

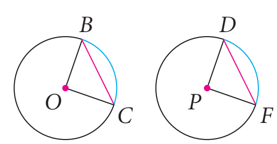


**For:** Chords and Arcs Activity
**Use:** Interactive Textbook, 12-2

You will prove Theorem 12-4 in Exercises 23, 24, and 35.

### 1 EXAMPLE Using Theorem 12-4

In the diagram, $\odot O \cong \odot P$. Given that $\overset{\frown}{BC} \cong \overset{\frown}{DF}$, what can you conclude?




By Theorem 12-4, $\angle O \cong \angle P$ and $\overline{BC} \cong \overline{DF}$.

**Quick Check**

1 If you are instead given that $\overline{BC} \cong \overline{DF}$, what can you conclude?
$\angle O \cong \angle P$; $\overset{\frown}{BC} \cong \overset{\frown}{DF}$



## Differentiated Instruction Solutions for All Learners

**Special Needs** L1
Review with students why *congruent arcs* must be in the same circle or in congruent circles. Also point out that a chord is related to the *minor arc* it intercepts.

learning style: verbal

**Below Level** L2
Have students draw diagrams for Theorems 12-6, 12-7, and 12-8 that accurately represent the given information.

learning style: visual

Theorem 12-5 shows a relationship between two chords and their distances from the center of a circle. You will prove part (2) in Exercise 38.

**Key Concepts**

**Theorem 12-5**

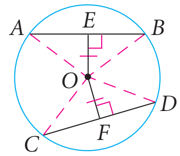
Within a circle or in congruent circles

(1) Chords equidistant from the center are congruent.

(2) Congruent chords are equidistant from the center.

**Proof**

### Proof of Theorem 12-5, Part (1)




**Given:** $\odot O, \overline{OE} \cong \overline{OF}$, $\overline{OE} \perp \overline{AB}, \overline{OF} \perp \overline{CD}$

**Prove:** $\overline{AB} \cong \overline{CD}$

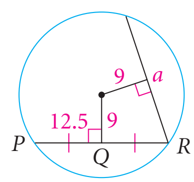
| Statements | Reasons |
|---|---|
| **1.** $\overline{OA} \cong \overline{OB} \cong \overline{OC} \cong \overline{OD}$ | **1.** Radii of a circle are congruent. |
| **2.** $\overline{OE} \cong \overline{OF}, \overline{OE} \perp \overline{AB}, \overline{OF} \perp \overline{CD}$ | **2.** Given |
| **3.** $\angle AEO$ and $\angle CFO$ are right angles. | **3.** Def. of perpendicular segments |
| **4.** $\triangle AEO \cong \triangle CFO$ | **4.** HL Theorem |
| **5.** $\angle A \cong \angle C$ | **5.** CPCTC |
| **6.** $\angle B \cong \angle A, \angle C \cong \angle D$ | **6.** Isosceles Triangle Theorem |
| **7.** $\angle B \cong \angle D$ | **7.** Transitive Property of Congruence |
| **8.** $\angle AOB \cong \angle COD$ | **8.** If two ⦞ of a △ are ≅ to two ⦞ of another △, then the third ⦞ are ≅. |
| **9.** $\overline{AB} \cong \overline{CD}$ | **9.** ≅ central angles have ≅ chords. |

**Real-World Connection**

Steel beams model congruent chords equidistant from the center to give the illusion of a circle.

You can use Theorem 12-5 to find missing lengths in circles.

## 2 EXAMPLE Using Theorem 12-5




**Multiple Choice** What is the value of $a$ in the circle at the right?

(A) 9 (B) 12.5 (C) 18 (D) 25

$PQ = QR = 12.5$ **Given**

$PQ + QR = PR$ **Segment Addition Postulate**

$25 = PR$ **Substitute.**

$a = PR$ **Chords equidistant from the center of a circle are congruent.**

$a = 25$ **Substitute.**

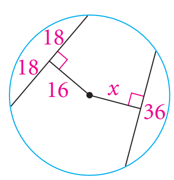
The correct answer is D.

**Test-Taking Tip**

In a circle, the length of the perpendicular segment from the center to a chord is the distance from the center to the chord.

**Quick Check**

**2** Find the value of $x$ in the circle at the right. **16**



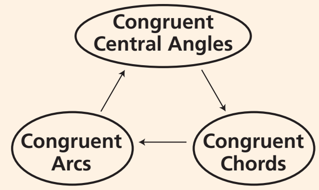



## 2. Teach

### Guided Instruction

**Visual Learners**

On the board, copy the diagram below that summarizes Theorem 12-4.




Ask: *Can you conclude that congruent chords have congruent central angles? If so, how?* **yes; by the Law of Syllogism**

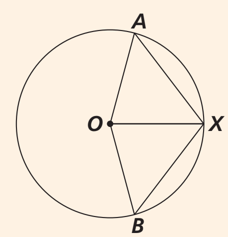
**Alternative Method**

An alternate proof of part 1 of Theorem 12-5 would use the HL Theorem to prove $\triangle AOE \cong \triangle BOE \cong \triangle COF \cong \triangle DOF$ and then use CPCTC and the Segment Addition Postulate. This method also could be used to prove Theorem 12

PowerPoint

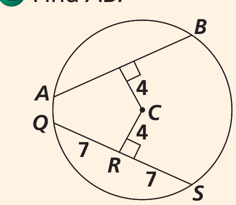
### Additional Examples

**1** In the diagram, radius $\overline{OX}$ bisects $\angle AOB$. What can you conclude?




**$\angle AOX \cong \angle BOX$; $\overline{AX} \cong \overline{BX}$; $\overset{\frown}{AX} \cong \overset{\frown}{BX}$**

**2** Find $AB$.




**14**

**Advanced Learners** L4

Have students write a paragraph to explain why the phrase *that is not a diameter* is necessary in Theorem 12-7.

learning style: verbal

**English Language Learners** ELL

Ask: *Is a diameter a chord? Explain.* **Yes; it is a segment with two endpoints on the circle.**
*Is a radius a chord? Explain.* **No; it has only 1 point on the circle.**

learning style: verbal

## Guided Instruction

**3 EXAMPLE** **Error Prevention**

Because the figures in parts a and b do not show diameters, some students may not understand why Theorems 12-6 and 12-7 apply. Have them reread the section above Theorem 12-6 to reinforce that the theorems apply to lines or segments that contain the center of the circle.

PowerPoint

## Additional Examples

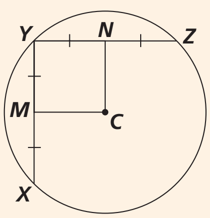
3 *P* and *Q* are points on ⊙*O*. The distance from *O* to $\overline{PQ}$ is 15 in., and *PQ* = 16 in. Find the radius of ⊙*O*. **17 in.**

**Resources**

- Daily Notetaking Guide 12-2 L3
- Daily Notetaking Guide 12-2—Adapted Instruction L1

## Closure

$\overline{XY}$ and $\overline{YZ}$ are perpendicular chords within ⊙*C* that are also equidistant from center *C*. What is the most precise name for quadrilateral *MYNC*? Explain.




**Square; congruent chords are equidistant from the center, and a diameter that bisects a chord is ⊥ to the chord.**

## 2 Lines Through the Center of a Circle

The Converse of the Perpendicular Bisector Theorem from Lesson 5-2 has special applications to a circle and its diameters, chords, and arcs.

### Key Concepts

**Theorem 12-6**

In a circle, a diameter that is perpendicular to a chord bisects the chord and its arcs.

**Theorem 12-7**

In a circle, a diameter that bisects a chord (that is not a diameter) is perpendicular to the chord.

**Theorem 12-8**

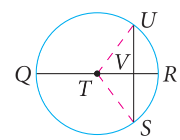
In a circle, the perpendicular bisector of a chord contains the center of the circle.

Proof

### Proof of Theorem 12-7

**Given:** ⊙*T* with diameter $\overline{QR}$ bisecting $\overline{SU}$ at *V*.

**Prove:** $\overline{QR} \perp \overline{SU}$




**Proof:** *TS* = *TU* because the radii of a circle are congruent. *VS* = *VU* by the definition of bisect. Thus, *T* and *V* are equidistant from *S* and *U*. By the Converse of the Perpendicular Bisector Theorem, *T* and *V* are on the perpendicular bisector of $\overline{SU}$. Since two points determine one line, $\overleftrightarrow{TV}$ is the perpendicular bisector of $\overline{SU}$. Another name for $\overleftrightarrow{TV}$ is $\overleftrightarrow{QR}$. Thus, $\overline{QR} \perp \overline{SU}$.

You will prove Theorems 12-6 and 12-8 in Exercises 25 and 36, respectively.

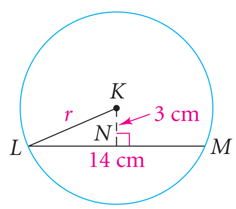
**Real-World Connection**

The center of the tire is located on the perpendicular bisector of the flat part.

### 3 EXAMPLE Using Diameters and Chords

**Algebra** Find each missing length to the nearest tenth.

**a.**

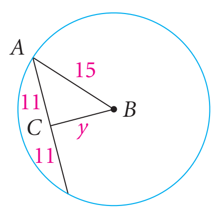



$LN = \frac{1}{2}(14) = 7$ **A diameter ⊥ to a chord bisects the chord.**

$r^2 = 3^2 + 7^2$ **Use the Pythagorean Theorem.**

$r \approx 7.6$ **Find the square root of each side.**

**b.**




$\overline{BC} \perp \overline{AC}$ **A diameter that bisects a chord that is not a diameter is ⊥ to the chord.**

$y^2 + 11^2 = 15^2$ **Use the Pythagorean Theorem.**

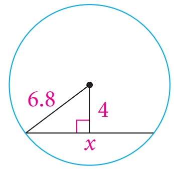
$y^2 = 104$ **Solve for $y^2$.**

$y \approx 10.2$ **Find the square root of each side.**

**Quick Check** 3 Use the circle at the right.

a. Find the length of the chord. **about 11**

b. Find the distance from the midpoint of the chord to the midpoint of its minor arc. **2.8**




# EXERCISES

For more exercises, see *Extra Skill, Word Problem, and Proof Practice.*

## Practice and Problem Solving

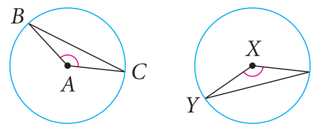
### A Practice by Example

GO for Help

**Example 1** (page 670)

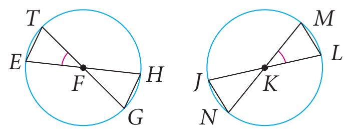
**In Exercises 1 and 2, the circles are congruent. What can you conclude?**

**1.**




**1–2. See left.**

**2.**



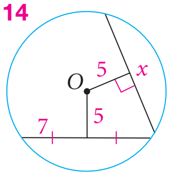

1. $\overset{\frown}{BC} \cong \overset{\frown}{YZ}$; $\overline{BC} \cong \overline{YZ}$

2. $\overset{\frown}{ET} \cong \overset{\frown}{GH} \cong \overset{\frown}{JN} \cong \overset{\frown}{ML}$; $\overline{ET} \cong \overline{GH} \cong \overline{JN} \cong \overline{ML}$; $\angle TFE \cong \angle HFG$; $\angle JKN \cong \angle MKL$

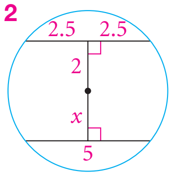
**Example 2** (page 671)

**Find the value of $x$.**

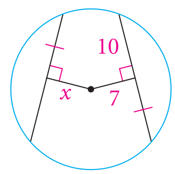
**3.** **14**



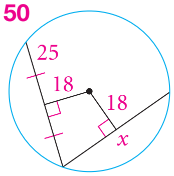

**4.** **2**



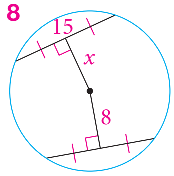

**5.** **7**



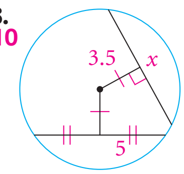

**6.** **50**




**7.** **8**




**8.** **10**

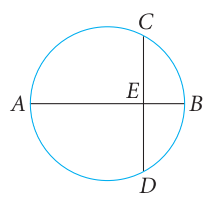



**Example 3** (page 672)

**Use the diagram at the right to complete Exercises 9 and 10.**

**9.** Given that $\overline{AB}$ is a diameter of the circle and $\overline{AB} \perp \overline{CD}$, then **a.** __?__ $\cong$ **b.** __?__ and **c.** __?__ $\cong$ **d.** __?__. **See left.**

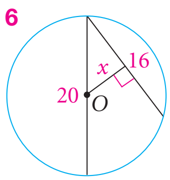
**10.** Given that $\overline{AB}$ is the perpendicular bisector of $\overline{CD}$, then $\overline{AB}$ contains __?__. **the center of the circle**



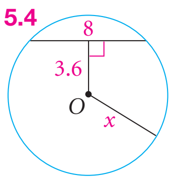

9. Answers may vary. Samples are given.
 a. $\overline{CE}$
 b. $\overline{DE}$
 c. $\angle CEB$
 d. $\angle DEA$

**Algebra** **Find the value of $x$ to the nearest tenth.**

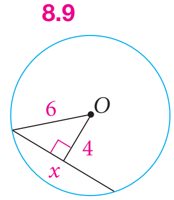
**11.** **6**



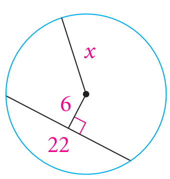

**12.** **5.4**



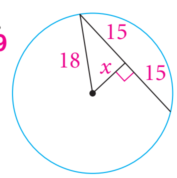

**13.** **8.9**



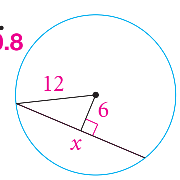

**14.** **12.5**




**15.** **9.9**




**16.** **20.8**






# 3. Practice

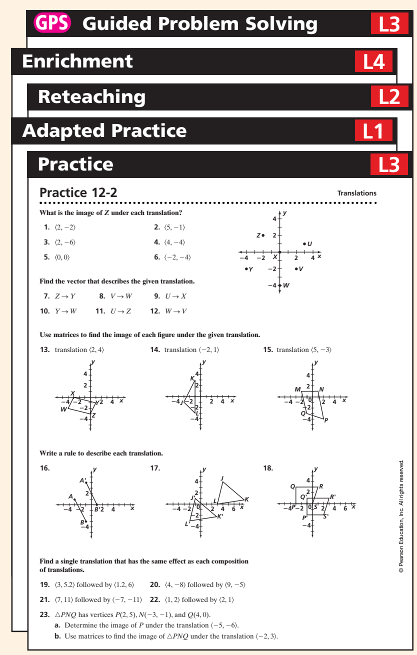
## Assignment Guide

| | | |
|---|---|---|
| 1 A B | 1-8, 17, 23, 24, 27, 29-32, 35 | |
| 2 A B | 9-16, 18-22, 25, 26, 28, 33, 34, 36, 37 | |
| C Challenge | 38-41 | |
| Test Prep | 42-48 | |
| Mixed Review | 49-52 | |

**Homework Quick Check**
To check students' understanding of key skills and concepts, go over Exercises 8, 12, 24, 29, 30.

**Exercises 12, 14** Students may find it helpful to draw and label the third side of the triangle, using the fact that all radii are congruent.

**Differentiated Instruction Resources**



## Error Prevention!

**Exercises 17–19** Students may confuse the measure of an arc with arc length. Remind them that the letter *m* signals the measure of the arc.

### Technology Tip

**Exercise 19** Review with students how to use the $\sin^{-1}$ calculator function key.

### Tactile Learners

**Exercise 20** Have students use a compass and straightedge and the concepts in this exercise to find the center of a circle circumscribed about three noncollinear points. This method also can be used in Exercise 30.

**Exercises 30–32** Discuss these exercises as a class. Have students suggest different solution methods, such as using the Pythagorean Theorem or showing that *ACBD* is a rhombus.

**Exercise 33** Show students how they can substitute $x = 2$ into $x^2 + y^2 = 25$ to find the positive and negative *y*-coordinates for the chord.

20. She can draw 2 chords, and their ⊥ bisectors, of the partial circle. The intersection pt. of the ⊥ bisectors will be the center and she can then measure the radius.

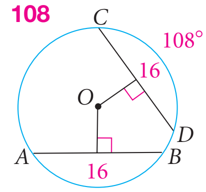
24. a. All radii of a circle are ≅.
 b. $\overline{AB} \cong \overline{CD}$
 c. Given
 d. SSS
 e. $\angle AEB \cong \angle CED$
 f. ≅ central ∡ have ≅ arcs.

36. *X* is equidist. from *W* and *Y*, since $\overline{XW}$ and $\overline{XY}$ are radii. So *X* is on the ⊥ bis. of $\overline{WY}$ by the Conv. of the ⊥ Bis. Thm. But ℓ is the ⊥ bis. of $\overline{WY}$, so ℓ contains *X*.

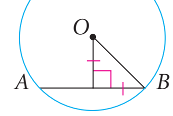
## B Apply Your Skills

Find $m\widehat{AB}$. (*Hint:* You will need to use trigonometry in Exercise 19.)

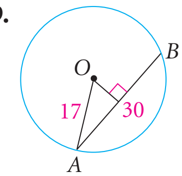
**17.** 108




**18.** 90




**19.** about 123.9

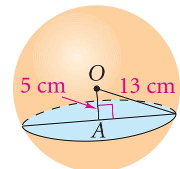



**Real-World Connection**

**Careers** Field archaeologists analyze artifacts to provide glimpses of life in the past.

**20. Archaeology** An archaeologist found several jar fragments including a large piece of the circular rim. How can she find the center and radius of the rim to help her reconstruct the jar? **See margin.**

**21. Geometry in 3 Dimensions** In the figure at the right, sphere *O* with radius 13 cm is intersected by a plane 5 cm from center *O*. Find the radius of cross section ⊙*A*. **12 cm**



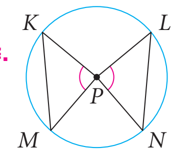

**22. Geometry in 3 Dimensions** A plane intersects a sphere that has radius 10 in. forming cross section ⊙*B* with radius 8 in. How far is the plane from the center of the sphere? **6 in.**

**23.** Complete this proof of Theorem 12-4, Part (1).

**Given:** ⊙*P* with $\angle KPM \cong \angle LPN$

**Prove:** $\overline{KM} \cong \overline{LN}$ **a–c. $\overline{PL}$; $\overline{PM}$; All radii of a circle are ≅.**

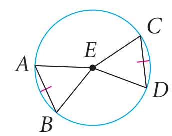
**Proof:** $\overline{KP} \cong$ **a.** ___?___ $\cong$ **b.** ___?___ $\cong \overline{NP}$ because **c.** ___?___. $\triangle KPM \cong$ **d.** ___?___ by **e.** ___?___. $\overline{KM} \cong \overline{LN}$ by **f.** ___?___.
**d–f. △*LPN*; SAS; CPCTC**




**24.** Complete this proof of Theorem 12-4, Part (2).

**Given:** ⊙*E* with congruent chords $\overline{AB}$ and $\overline{CD}$

**Prove:** $\widehat{AB} \cong \widehat{CD}$ **See margin.**




$\overline{EA} \cong \overline{EC} \cong \overline{ED} \cong \overline{EB}$ — **a.** ___?___
**b.** ___?___ — **c.** ___?___
→ $\triangle AEB \cong \triangle CED$ — **d.** ___?___
→ **e.** ___?___ — CPCTC
→ $\widehat{AB} \cong \widehat{CD}$ — **f.** ___?___

**Problem Solving Hint**

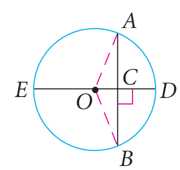
Recall that in a circle congruent central angles intercept congruent arcs.

Proof **25.** Prove Theorem 12-6. **See back of book.**

**Given:** ⊙*O* with diameter $\overline{ED} \perp \overline{AB}$ at *C*

**Prove:** $\overline{AC} \cong \overline{BC}$ and $\widehat{AD} \cong \widehat{BD}$

(*Hint*: Begin by drawing $\overline{OA}$ and $\overline{OB}$.)

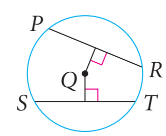



**GO for Help**

For a guide to solving Exercise 26, see p. 677.

**26.** Two concentric circles have radii of 4 cm and 8 cm. A segment tangent to the smaller circle is a chord of the larger circle. What is the length of the segment? **about 13.9 cm**

**27. Error Analysis** Scott looks at this figure and concludes that $\overline{ST} \cong \overline{PR}$. What is wrong with Scott's conclusion? **See left.**




27. He doesn't know that the chords are equidistant from the center.

**28. Open-Ended** Use a circular object such as a can or a saucer to draw a circle. Construct the center of the circle. **Check students' work.**

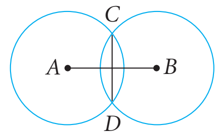
**29. Writing** Theorems 12-4 and 12-5 both begin with the phrase "Within a circle or in congruent circles." Explain why "congruent" is essential for both theorems.
**Circles can have ≅ chords or ≅ central ∡ without having both.**



38. All radii of ⊙*O* are ≅, so $\triangle AOB \cong \triangle COD$ by SSS. $\angle A \cong \angle C$ by CPCTC. Also, $\angle OEA \cong \angle OFC$ since both are rt. ∡. Thus, $\triangle OEA \cong \triangle OFC$ by AAS, and $\overline{OE} \cong \overline{OF}$ by CPCTC.

39. 1. ⊙*A* with $\overline{CE} \perp \overline{BD}$ (Given) 2. $\overline{CF} \cong \overline{CF}$ (Refl. Prop. of ≅) 3. $\overline{BF} \cong \overline{FD}$ (diameter ⊥ to a chord bisects the chord.) 4. $\angle CFB$ and $\angle CFD$ are rt. ∡ (Def. of ⊥). 5. $\triangle CFB \cong \triangle CFD$ (SAS) 6. $\overline{BC} \cong \overline{CD}$ (CPCTC) 7. $\widehat{BC} \cong \widehat{DC}$ (≅ chords have ≅ arcs.)

$\odot A$ and $\odot B$ are congruent. $\overline{CD}$ is a chord of both circles.




GPS **30.** $AB = 8$ in., $CD = 6$ in. How long is a radius? **5 in.**

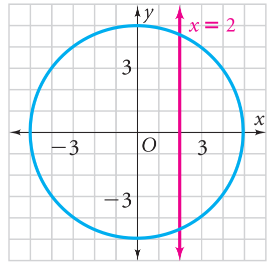
**31.** $AB = 24$ cm, radius $= 13$ cm. How long is $\overline{CD}$? **10 cm**

**32.** radius $= 13$ ft, $CD = 24$ ft. How long is $\overline{AB}$? **10 ft**

**Online Homework Help**
Visit: PHSchool.com
Web Code: aue-1202

**33. Multiple Choice** In the diagram at the right, the endpoints of the chord are the points where the line $x = 2$ intersects the circle $x^2 + y^2 = 25$. What is the length of the chord? **C**

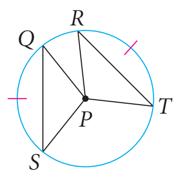
(A) 4.6
(B) 8.0
(C) 9.2
(D) 10.0



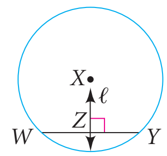

**34. Critical Thinking** The diameter of a circle is 20 cm. Two chords parallel to the diameter are 6 cm and 16 cm long. What are the possible distances between the chords to the nearest tenth of a centimeter? **3.5 cm, 15.5 cm**

**35. 1. $\odot P$ with $\overset{\frown}{QS} \cong \overset{\frown}{RT}$ (Given) 2. $m\overset{\frown}{QS} = m\angle QPS$ and $m\overset{\frown}{RT} = m\angle RPT$ (Arc measure = central $\angle$ measure.) 3. $m\overset{\frown}{QS} = m\overset{\frown}{RT}$ (Def. of $\cong$) 4. $\angle QPS \cong \angle RPT$ (Subst.)**

Proof **35.** Prove Theorem 12-4, Part (3).
**Given:** $\odot P$ with $\overset{\frown}{QS} \cong \overset{\frown}{RT}$
**Prove:** $\angle QPS \cong \angle RPT$ **See left.**



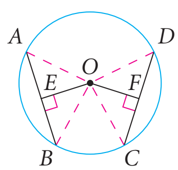

**36.** Prove Theorem 12-8.
**Given:** $\ell$ is the $\perp$ bisector of $\overline{WY}$.
**Prove:** $\ell$ contains the center of $\odot X$.
**See margin p. 674.**



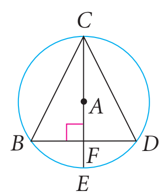

Proof **37.** $\overline{PQ}$ and $\overline{PR}$ are chords of $\odot C$. Prove that if $C$ is on the bisector of $\angle QPR$, then $PQ = PR$. **See back of book.**

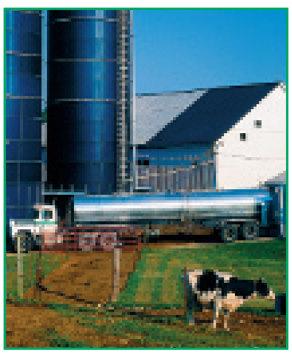
**C Challenge**

Proof **38.** Prove Theorem 12-5, Part (2).
**Given:** $\odot O$ with $\overline{AB} \cong \overline{CD}$
**Prove:** $\overline{OE} \cong \overline{OF}$ **38–39. See margin.**




**39. Given:** $\odot A$ with $\overline{CE} \perp \overline{BD}$
**Prove:** $\overset{\frown}{BC} \cong \overset{\frown}{DC}$

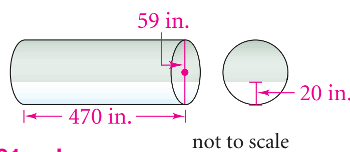


**Real-World Connection**

The cylinders used on milk tank trucks lie on the lateral surface and have a vertical base at each end.

**40. Dairy** The diameter of the base of a cylindrical milk tank is 59 in. The length of the tank is 470 in. You estimate that the depth of the milk in the tank is 20 in. Find the number of gallons of milk in the tank to the nearest gallon. (1 gal = 231 in.$^3$) **1661 gal**




Proof **41.** If two circles are concentric and a chord of the larger circle is tangent to the smaller circle, prove that the point of tangency is the midpoint of the chord. **See margin.**

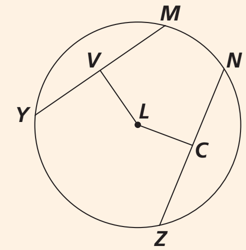


# 4. Assess & Reteach

PowerPoint

## Lesson Quiz

**For Exercises 1–5, use the diagram of $\odot L$ below.**




1. If $\overline{YM}$ and $\overline{ZN}$ are congruent chords, what can you conclude? **$\overline{YM} \cong \overline{ZN}$; $\angle YLM \cong \angle ZLN$**
2. If $\overline{YM}$ and $\overline{ZN}$ are congruent chords, explain why you cannot conclude that $LV = LC$. **You do not know whether $\overline{LV}$ and $\overline{LC}$ are perpendicular to the chords.**
3. Suppose that $\overline{YM}$ has length 12 in., and its distance from point $L$ is 5 in. Find the radius of $\odot L$ to the nearest tenth. **7.8 in.**

**For Exercises 4 and 5, suppose that $\overline{LV} \perp \overline{YM}$, $YV = 11$ cm, and $\odot L$ has a diameter of 26 cm.**

4. Find $YM$. **22 cm**
5. Find $LV$ to the nearest tenth. **6.9 cm**

## Alternative Assessment

Have students use only pictures and mathematical symbols to express each theorem in this lesson. Then have each student exchange their work with a partner who writes a paragraph below the picture evaluating the presentation for accuracy and clarity. Use the drawings and paragraphs to assess students' understanding.

**41. Let $O$ be the center of the circles, and $P$ be the pt. of tangency of the larger circle's chord to the smaller circle. Then $\overline{OP}$ is $\perp$ to the chord, and therefore bisects it. So $P$ is the midpt. of the chord.**

## Test Prep

**Resources**

For additional practice with a variety of test item formats:

- Standardized Test Prep, p. 711
- Test-Taking Strategies, p. 706
- Test-Taking Strategies with Transparencies

## Test Prep

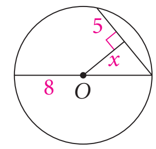
### Multiple Choice

**42.** The diameter of a circle is 25 cm and a chord of the same circle is 16 cm. To the nearest tenth, what is the distance of the chord from the center of the circle? **B**

**A.** 9.0 cm **B.** 9.6 cm **C.** 18.0 cm **D.** 19.2 cm

**43.** In the figure at the right, what is the value of $x$ to the nearest tenth? **G**

**F.** 3.0 **G.** 6.2
**H.** 6.8 **J.** 9.0




**44.** A 9-cm chord is 11 cm from the center of a circle. What is the radius of the circle? **B**

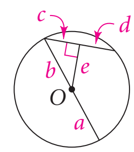
**A.** 9.0 cm **B.** 11.9 cm **C.** 13.0 cm **D.** 14.2 cm

**45.** The radius of a circle is 10.8 ft. The length of a chord is 12 ft. What is the approximate distance of the chord from the center of the circle? **H**

**F.** 1.2 ft **G.** 4.7 ft **H.** 9.0 ft **J.** 12.4 ft

**46.** What can you NOT conclude from the diagram at the right? **D**

**A.** $c = d$ **B.** $a = b$
**C.** $c^2 + e^2 = b^2$ **D.** $e = d$

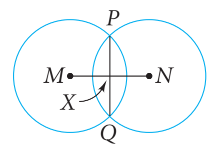



**47.** ⊙$A$ and ⊙$B$ intersect at points $C$ and $D$. Each circle has radius 6 in. and $AB = 8$ in. What is $CD$? **J**

**F.** 4.5 in. **G.** 6 in. **H.** 8 in. **J.** 8.9 in.

### Short Response

**48.** Circles $M$ and $N$ are congruent with radii measuring 13 cm. $\overline{PQ}$ is a chord of both circles and $PQ = 18$ cm. To the nearest tenth, find $MN$. Justify your answer. **See margin.**



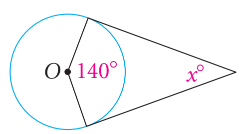

## Mixed Review

GO for Help

**Lesson 12-1**

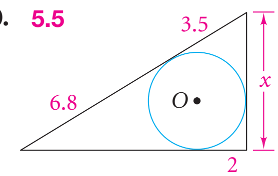
**Assume that lines that appear to be tangent are tangent. *O* is the center of each circle. Find the value of *x* to the nearest tenth.**

**49.**




**40**

**50.** **5.5**




**Lesson 8-5**

**51.** From the top of a building you look down at an object on the ground. If your eyes are 50 feet above the ground and the angle of depression is 50°, how far is the object on the ground from the base of the building? **about 42 ft**

**Lesson 7-5**

**52.** The legs of a right triangle are 10 in. and 24 in. long. Find the lengths, to the nearest tenth, of the segments into which the bisector of the right angle divides the hypotenuse. **18.4 in. and 7.6 in.**



**48. [2] $\overline{PN}$ is a radius of ⊙$N$. Thus, $PN = 13$ cm. $PX = \frac{1}{2}PQ = 9$, △$PNX$ is a rt. △, so $NX \approx 9.38$ cm. Thus, $MN = 18.8$ cm, to the nearest tenth.**

**[1] incorrect length OR incorrect explanation**