10 CHAPTER REVIEW

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• Multi-Language Glossary
• Vocabulary practice

REVIEW KEY VOCABULARY

For a list of postulates and theorems, see pp. 926–931.

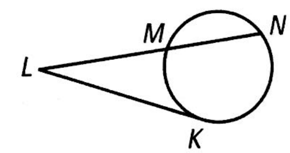
- circle, *p. 651*
  center, radius, diameter
- chord, *p. 651*
- secant, *p. 651*
- tangent, *p. 651*
- central angle, *p. 659*
- minor arc, *p. 659*
- major arc, *p. 659*
- semicircle, *p. 659*
- measure of a minor arc, *p. 659*
- measure of a major arc, *p. 659*
- congruent circles, *p. 660*
- congruent arcs, *p. 660*
- inscribed angle, *p. 672*
- intercepted arc, *p. 672*
- inscribed polygon, *p. 674*
- circumscribed circle, *p. 674*
- segments of a chord, *p. 689*
- secant segment, *p. 690*
- external segment, *p. 690*
- standard equation of a circle, *p. 699*

VOCABULARY EXERCISES

1. Copy and complete: If a chord passes through the center of a circle, then it is called a(n) __?__.
2. Draw and *describe* an inscribed angle and an intercepted arc.
3. **WRITING** *Describe* how the measure of a central angle of a circle relates to the measure of the minor arc and the measure of the major arc created by the angle.

In Exercises 4–6, match the term with the appropriate segment.

4. Tangent segment — **A.** $\overline{LM}$
5. Secant segment — **B.** $\overline{KL}$
6. External segment — **C.** $\overline{LN}$



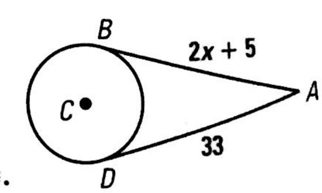
REVIEW EXAMPLES AND EXERCISES

Use the review examples and exercises below to check your understanding of the concepts you have learned in each lesson of Chapter 10.

10.1 Use Properties of Tangents *pp. 651–658*

EXAMPLE

In the diagram, *B* and *D* are points of tangency on ⊙*C*. Find the value of *x*.



Use Theorem 10.2 to find x.

$AB = AD$	**Tangent segments from the same point are ≅.**
$2x + 5 = 33$	**Substitute.**
$x = 14$	**Solve for *x*.**

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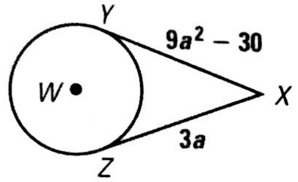
EXERCISES

EXAMPLES 5 and 6 on p. 654 for Exs. 7–9

Find the value of the variable. *Y* and *Z* are points of tangency on ⊙*W*.

7.



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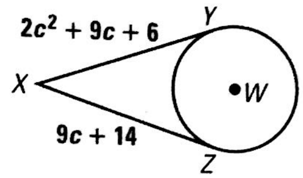

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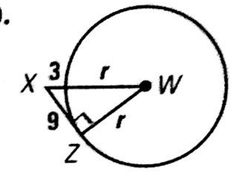
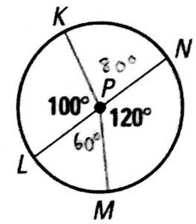


10.2 Find Arc Measures

pp. 659–663

EXAMPLE

Find the measure of the arc of ⊙*P*. In the diagram, $\overline{LN}$ is a diameter.



a. $\widehat{MN}$ **b.** $\widehat{NLM}$ **c.** $\widehat{NML}$

a. $\widehat{MN}$ is a minor arc, so $m\widehat{MN} = m\angle MPN = 120°$.

b. $\widehat{NLM}$ is a major arc, so $m\widehat{NLM} = 360° - 120° = 240°$.

c. $\widehat{NML}$ is a semicircle, so $m\widehat{NML} = 180°$.

EXERCISES

EXAMPLES 1 and 2 on pp. 659–660 for Exs. 10–13

Use the diagram above to find the measure of the indicated arc.

10. $\widehat{KL}$ **11.** $\widehat{LM}$ **12.** $\widehat{KM}$ **13.** $\widehat{KN}$

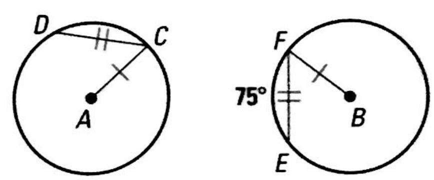
10.3 Apply Properties of Chords

pp. 664–670

EXAMPLE

In the diagram, ⊙*A* ≅ ⊙*B*, $\overline{CD} \cong \overline{FE}$, and $m\widehat{FE} = 75°$. Find $m\widehat{CD}$.

By Theorem 10.3, $\overline{CD}$ and $\overline{FE}$ are congruent chords in congruent circles, so the corresponding minor arcs $\widehat{FE}$ and $\widehat{CD}$ are congruent. So, $m\widehat{CD} = m\widehat{FE} = 75°$.

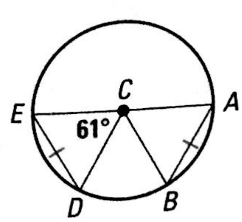


EXERCISES

EXAMPLES 1, 3, and 4 on pp. 664, 666 for Exs. 14–16

Find the measure of $\widehat{AB}$.

14.



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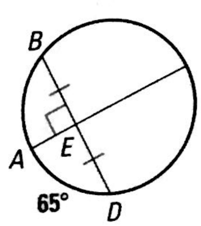

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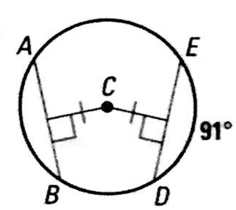


10 CHAPTER REVIEW

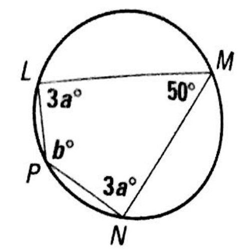
10.4 Use Inscribed Angles and Polygons

pp. 672–679

EXAMPLE

Find the value of each variable.

LMNP is inscribed in a circle, so by Theorem 10.10, opposite angles are supplementary.



$$m\angle L + m\angle N = 180^\circ \qquad m\angle P + m\angle M = 180^\circ$$

$$3a^\circ + 3a^\circ = 180^\circ \qquad b^\circ + 50^\circ = 180^\circ$$

$$6a = 180 \qquad b = 130$$

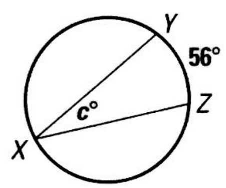
$$a = 30$$

EXERCISES

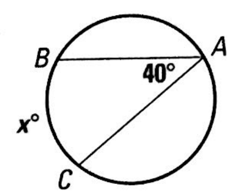
EXAMPLES 1, 2, and 5 on pp. 672–675 for Exs. 17–19

Find the value(s) of the variable(s).

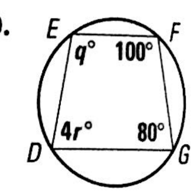
17.



18.



19.



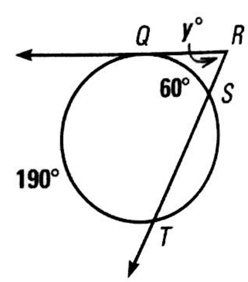
10.5 Apply Other Angle Relationships in Circles

pp. 680–686

EXAMPLE

Find the value of *y*.

The tangent $\overrightarrow{RQ}$ and secant $\overrightarrow{RT}$ intersect outside the circle, so you can use Theorem 10.13 to find the value of *y*.



$y^\circ = \frac{1}{2}\left(m\widehat{QT} - m\widehat{SQ}\right)$ **Use Theorem 10.13.**

$y^\circ = \frac{1}{2}(190^\circ - 60^\circ)$ **Substitute.**

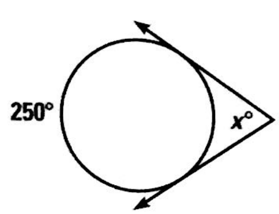
$y = 65$ **Simplify.**

EXERCISES

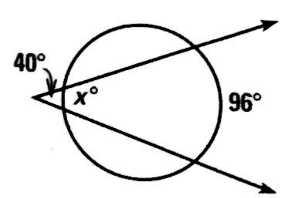
EXAMPLES 2 and 3 on pp. 681–682 for Exs. 20–22

Find the value of *x*.

20.



21.



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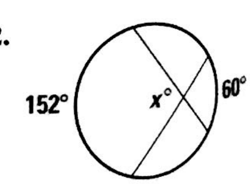


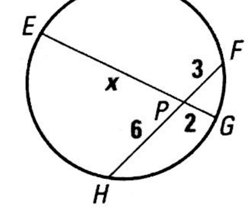
10.6 Find Segment Lengths in Circles

pp. 689–695

EXAMPLE

Find the value of x.

The chords $\overline{EG}$ and $\overline{FH}$ intersect inside the circle, so you can use Theorem 10.14 to find the value of x.

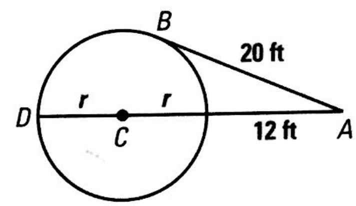


$EP \cdot PG = FP \cdot PH$	**Use Theorem 10.14.**
$x \cdot 2 = 3 \cdot 6$	**Substitute.**
$x = 9$	**Solve for *x*.**

EXERCISE

EXAMPLE 4 on p. 692 for Ex. 23

23. SKATING RINK A local park has a circular ice skating rink. You are standing at point A, about 12 feet from the edge of the rink. The distance from you to a point of tangency on the rink is about 20 feet. Estimate the radius of the rink.



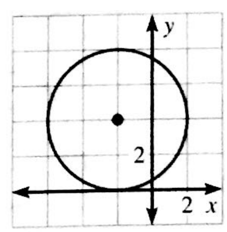
10.7 Write and Graph Equations of Circles

pp. 699–705

EXAMPLE

Write an equation of the circle shown.

The radius is 4 and the center is at $(-2, 4)$.



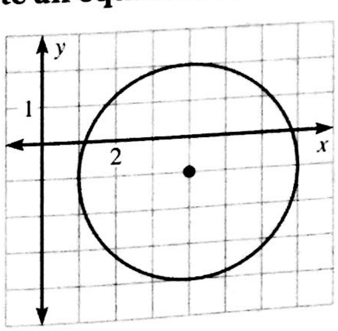
$(x - h)^2 + (y - k)^2 = r^2$	**Standard equation of a circle**
$(x - (-2))^2 + (y - 4)^2 = 4^2$	**Substitute.**
$(x + 2)^2 + (y - 4)^2 = 16$	**Simplify.**

EXERCISES

EXAMPLES 1, 2, and 3 on pp. 699–700 for Exs. 24–32

Write an equation of the circle shown.

24.



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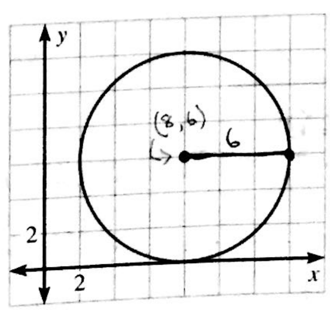
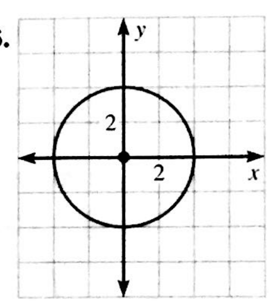


26.



Write the standard equation of the circle with the given center and radius.

27. Center (0, 0), radius 9

28. Center (−5, 2), radius 1.3

29. Center (6, 21), radius 4

30. Center (−3, 2), radius 16

31. Center (10, 7), radius 3.5

32. Center (0, 0), radius 5.2

11 CHAPTER SUMMARY

BIG IDEAS

For Your Notebook

Big Idea 1

Using Area Formulas for Polygons

Polygon	Formula	
Triangle	$A = \frac{1}{2}bh,$	with base b and height h
Parallelogram	$A = bh,$	with base b and height h
Trapezoid	$A = \frac{1}{2}h(b_1 + b_2),$	with bases b_1 and b_2 and height h
Rhombus	$A = \frac{1}{2}d_1d_2,$	with diagonals d_1 and d_2
Kite	$A = \frac{1}{2}d_1d_2,$	with diagonals d_1 and d_2
Regular polygon	$A = \frac{1}{2}a \cdot ns,$	with apothem a, n sides, and side length s

Sometimes you need to use the Pythagorean Theorem, special right triangles, or trigonometry to find a length in a polygon before you can find its area.

Big Idea 2

Relating Length, Perimeter, and Area Ratios in Similar Polygons

You can use ratios of corresponding measures to find other ratios of measures. You can solve proportions to find unknown lengths or areas.

If two figures are similar and ...	then ...
the ratio of side lengths is $a:b$	• the ratio of perimeters is also $a:b$. • the ratio of areas is $a^2:b^2$.
the ratio of perimeters is $c:d$	• the ratio of side lengths is also $c:d$. • the ratio of areas is $c^2:d^2$.
the ratio of areas is $e:f$	• the ratio of side lengths is $\sqrt{e}:\sqrt{f}$. • the ratio of perimeters is $\sqrt{e}:\sqrt{f}$.

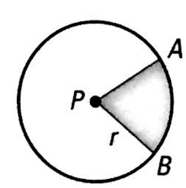
Big Idea 3

Comparing Measures for Parts of Circles and the Whole Circle

Given $\odot P$ with radius r, you can use proportional reasoning to find measures of parts of the circle.

Arc length $\quad \dfrac{\text{Arc length of } \overset{\frown}{AB}}{2\pi r} = \dfrac{m\overset{\frown}{AB}}{360^\circ}$ ← Part / ← Whole

Area of sector $\quad \dfrac{\text{Area of sector } APB}{\pi r^2} = \dfrac{m\overset{\frown}{AB}}{360^\circ}$ ← Part / ← Whole



11 CHAPTER REVIEW

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REVIEW KEY VOCABULARY

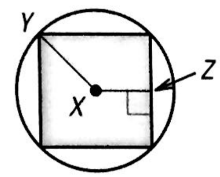
For a list of postulates and theorems, see pp. 926–931.

- bases of a parallelogram, *p. 720*
- height of a parallelogram, *p. 720*
- height of a trapezoid, *p. 730*
- circumference, *p. 746*
- arc length, *p. 747*
- sector of a circle, *p. 756*
- center of a polygon, *p. 762*
- radius of a polygon, *p. 762*
- apothem of a polygon, *p. 762*
- central angle of a regular polygon, *p. 762*
- probability, *p. 771*
- geometric probability, *p. 771*

VOCABULARY EXERCISES

1. Copy and complete: A *sector of a circle* is the region bounded by __?__.
2. **WRITING** *Explain* the relationship between the height of a parallelogram and the bases of a parallelogram.

The diagram shows a square inscribed in a circle. Name an example of the given segment.



3. An apothem of the square
4. A radius of the square

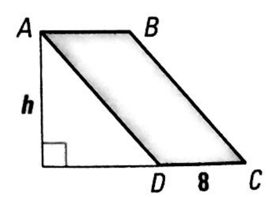
REVIEW EXAMPLES AND EXERCISES

Use the review examples and exercises below to check your understanding of the concepts you have learned in each lesson of Chapter 11.

11.1 Areas of Triangles and Parallelograms *pp. 720–726*

EXAMPLE

The area of ▱*ABCD* is 96 square units. Find its height *h*.



$A = bh$ **Formula for area of a parallelogram**

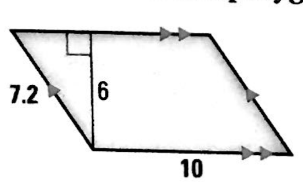
$96 = 8h$ **Substitute 96 for *A* and 8 for *b*.**

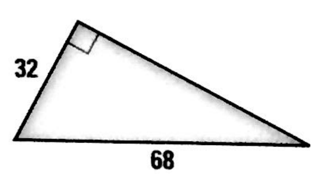
$h = 12$ **Solve.**

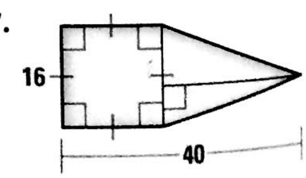
EXERCISES

EXAMPLES 1, 2, and 3 on pp. 721–722 for Exs. 5–8

Find the area of the polygon.

5. 

6. 

7. 

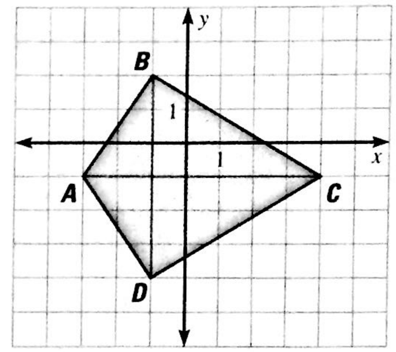
8. The area of a triangle is 147 square inches and its height is 1.5 times its base. Find the base and the height of the triangle.

11.2 Areas of Trapezoids, Rhombuses, and Kites

pp. 730–736

EXAMPLE

Find the area of the kite.



Find the lengths of the diagonals of the kite.

$d_1 = BD = |2 - (-4)| = 6$

$d_2 = AC = |4 - (-3)| = 7$

Find the area of *ABCD*.

$A = \frac{1}{2}d_1d_2$ **Formula for area of a kite**

$= \frac{1}{2}(6)(7) = 21$ **Substitute and simplify.**

▶ The area of the kite is 21 square units.

EXERCISES

EXAMPLE 4 on p. 732 for Exs. 9–11

Graph the polygon with the given vertices and find its area.

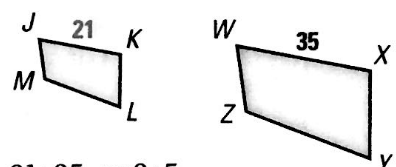
9. $L(2, 2)$, $M(6, 2)$, $N(8, 4)$, $P(4, 4)$
10. $Q(-3, 0)$, $R(-2, 3)$, $S(-1, 0)$, $T(-2, -2)$
11. $D(-1, 4)$, $E(5, 4)$, $F(3, -2)$, $G(1, -2)$

11.3 Perimeter and Area of Similar Figures

pp. 737–743

EXAMPLE

Quadrilaterals *JKLM* and *WXYZ* are similar. Find the ratios (red to blue) of the perimeters and of the areas.



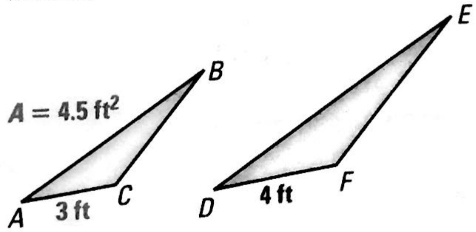
The ratio of the lengths of the corresponding sides is 21 : 35, or 3 : 5. Using Theorem 6.1, the ratio of the perimeters is 3 : 5. Using Theorem 11.7, the ratio of the areas is $3^2 : 5^2$, or 9 : 25.

EXERCISES

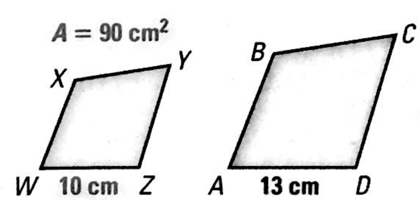
EXAMPLES 1, 2, and 3 on pp. 737–738 for Exs. 12–14

The polygons are similar. Find the ratio (red to blue) of the perimeters and of the areas. Then find the unknown area.

12. $\triangle ABC \sim \triangle DEF$



13. $WXYZ \sim ABCD$



14. The ratio of the areas of two similar figures is 144 : 49. Write the ratio of the lengths of corresponding sides.

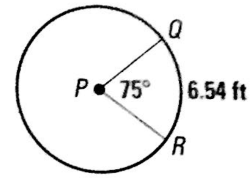
11 CHAPTER REVIEW

11.4 Circumference and Arc Length

pp. 746–752

EXAMPLE

The arc length of $\overset{\frown}{QR}$ is 6.54 feet. Find the radius of $\odot P$.



$$\frac{\text{Arc length of } \overset{\frown}{QR}}{2\pi r} = \frac{m\overset{\frown}{QR}}{360°}$$ **Arc Length Corollary**

$$\frac{6.54}{2\pi r} = \frac{75°}{360°}$$ **Substitute.**

$$6.54(360°) = 75°(2\pi r)$$ **Cross Products Property**

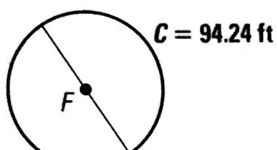
$$r \approx 5.00 \text{ ft}$$ **Solve.**

EXERCISES

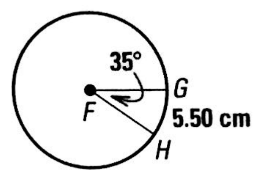
EXAMPLES 1, 3, and 4 on pp. 746, 748 for Exs. 15–17

Find the indicated measure.

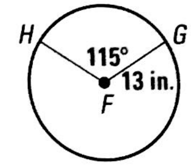
15. Diameter of $\odot F$



16. Circumference of $\odot F$



17. Length of $\overset{\frown}{GH}$

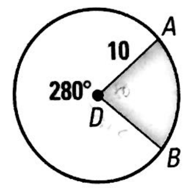


11.5 Areas of Circles and Sectors

pp. 755–761

EXAMPLE

Find the area of sector *ADB*.



First find the measure of the minor arc.

$m\angle ADB = 360° - 280° = 80°$, so $m\overset{\frown}{AB} = 80°$.

$$\text{Area of sector } ADB = \frac{m\overset{\frown}{AB}}{360°} \cdot \pi r^2$$ **Formula for area of a sector**

$$= \frac{80°}{360°} \cdot \pi \cdot 10^2$$ **Substitute.**

$$\approx 69.81 \text{ units}^2$$ **Use a calculator.**

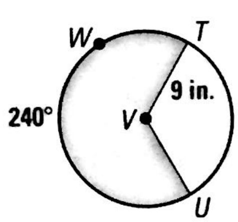
▶ The area of the small sector is about 69.81 square units.

EXERCISES

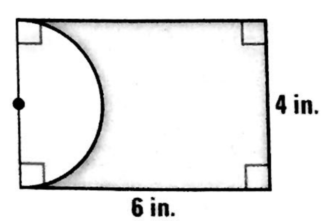
EXAMPLES 2, 3, and 4 on pp. 756–757 for Exs. 18–20

Find the area of the blue shaded region.

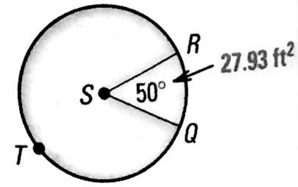
18.



19.

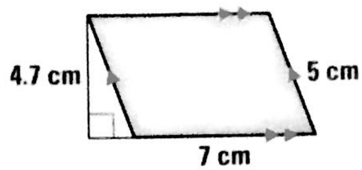


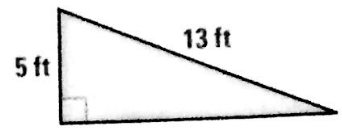
20.

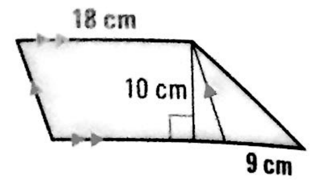


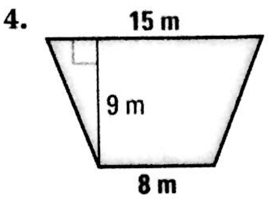
11 CHAPTER TEST

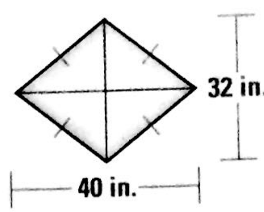
In Exercises 1–6, find the area of the shaded polygon.

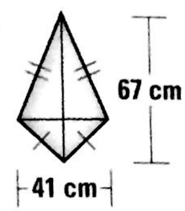
1.


2.


3.


4.


5.


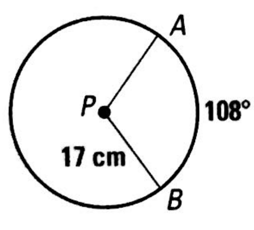
6.


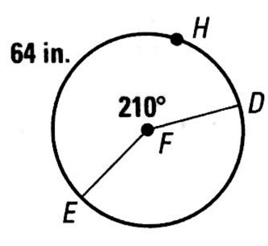
7. The base of a parallelogram is 3 times its height. The area of the parallelogram is 108 square inches. Find the base and the height.

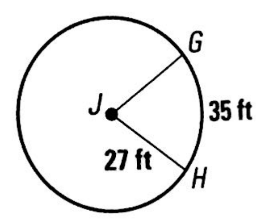
Quadrilaterals *ABCD* and *EFGH* are similar. The perimeter of *ABCD* is 40 inches and the perimeter of *EFGH* is 16 inches.

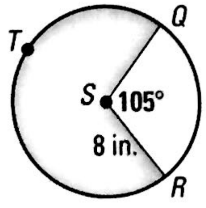
8. Find the ratio of the perimeters of *ABCD* to *EFGH*.
9. Find the ratio of the corresponding side lengths of *ABCD* to *EFGH*.
10. Find the ratio of the areas of *ABCD* to *EFGH*.

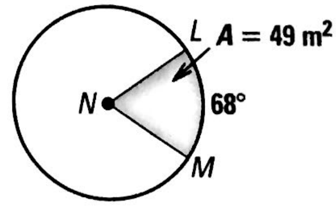
Find the indicated measure for the circle shown.

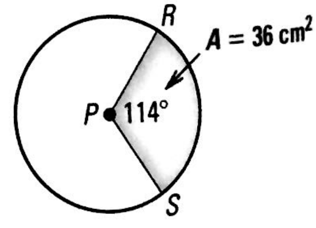
11. Length of $\widehat{AB}$


12. Circumference of ⊙*F*


13. $m\widehat{GH}$


14. Area of shaded sector


15. Area of ⊙*N*


16. Radius of ⊙*P*


12 CHAPTER SUMMARY

BIG IDEAS — For Your Notebook

Big Idea 1

Exploring Solids and Their Properties

Euler's Theorem is useful when finding the number of faces, edges, or vertices on a polyhedron, especially when one of those quantities is difficult to count by hand.

For example, suppose you want to find the number of edges on a regular icosahedron, which has 20 faces. You count 12 vertices on the solid. To calculate the number of edges, use Euler's Theorem:

$F + V = E + 2$	**Write Euler's Theorem.**
$20 + 12 = E + 2$	**Substitute known values.**
$30 = E$	**Solve for *E*.**

Big Idea 2

Solving Problems Using Surface Area and Volume

Figure	Surface Area	Volume
Right prism	$S = 2B + Ph$	$V = Bh$
Right cylinder	$S = 2B + Ch$	$V = Bh$
Regular pyramid	$S = B + \frac{1}{2}P\ell$	$V = \frac{1}{3}Bh$
Right cone	$S = B + \frac{1}{2}C\ell$	$V = \frac{1}{3}Bh$
Sphere	$S = 4\pi r^2$	$V = \frac{4}{3}\pi r^3$

The volume formulas for prisms, cylinders, pyramids, and cones can be used for oblique solids.

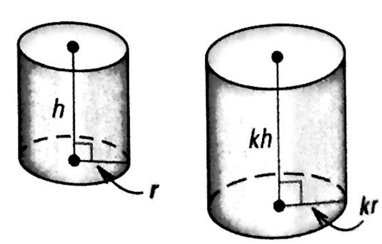
While many of the above formulas can be written in terms of more detailed variables, it is more important to remember the more general formulas for a greater understanding of why they are true.

Big Idea 3

Connecting Similarity to Solids

The similarity concepts learned in Chapter 6 can be extended to 3-dimensional figures as well.

Suppose you have a right cylindrical can whose surface area and volume are known. You are then given a new can whose linear dimensions are k times the dimensions of the original can. If the surface area of the original can is S and the volume of the original can is V, then the surface area and volume of the new can can be expressed as k^2S and k^3V, respectively.



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- Multi-Language Glossary
- Vocabulary practice

REVIEW KEY VOCABULARY

For a list of postulates and theorems, see pp. 926–931.

- polyhedron, *p. 794*
  face, edge, vertex, base
- regular polyhedron, *p. 796*
- convex polyhedron, *p. 796*
- Platonic solids, *p. 796*
- tetrahedron, *p. 796*
- cube, *p. 796*
- octahedron, *p. 796*
- dodecahedron, *p. 796*
- icosahedron, *p. 796*
- cross section, *p. 797*
- prism, *p. 803*
  lateral faces, lateral edges
- surface area, *p. 803*
- lateral area, *p. 803*
- net, *p. 803*
- right prism, *p. 804*
- oblique prism, *p. 804*
- cylinder, *p. 805*
- right cylinder, *p. 805*
- pyramid, *p. 810*
- vertex of a pyramid, *p. 810*
- regular pyramid, *p. 810*
- slant height, *p. 810*
- cone, *p. 812*
- vertex of a cone, *p. 812*
- right cone, *p. 812*
- lateral surface, *p. 812*
- volume, *p. 819*
- sphere, *p. 838*
  center, radius, chord, diameter
- great circle, *p. 839*
- hemisphere, *p. 839*
- similar solids, *p. 847*

VOCABULARY EXERCISES

1. Copy and complete: A _?_ is the set of all points in space equidistant from a given point.
2. **WRITING** Sketch a right rectangular prism and an oblique rectangular prism. *Compare* the prisms.

REVIEW EXAMPLES AND EXERCISES

Use the review examples and exercises below to check your understanding of the concepts you have learned in each lesson of Chapter 12.

12.1 Explore Solids

pp. 794–801

EXAMPLE

A polyhedron has 16 vertices and 24 edges. How many faces does the polyhedron have?

$F + V = E + 2$	**Euler's Theorem**
$F + 16 = 24 + 2$	**Substitute known values.**
$F = 10$	**Solve for *F*.**

▶ The polyhedron has 10 faces.

EXERCISES

EXAMPLES 2 and 3 on pp. 796–797 for Exs. 3–5

Use Euler's Theorem to find the value of *n*.

3. Faces: 20
   Vertices: n
   Edges: 30
4. Faces: n
   Vertices: 6
   Edges: 12
5. Faces: 14
   Vertices: 24
   Edges: n