8

Circles

Circles are found all around us. The sun, Earth, and the planets are all round. Cross sections of many trees, plant stems, and flowers are circular. Many objects used in our daily lives are circular, such as wheels, coins, and CDs.

The circle is an important symbol in many cultures. The circle shows how everything in life is connected. It is used to show relationships between people and their world. In the First Nations culture, the circle can be seen in examples such as teepee circles, medicine wheels, ceremonial drums, beaded medallions, and talking circles.

What You Will Learn

- to construct and draw circles
- to estimate and calculate the circumference of a circle
- to estimate and calculate the area of a circle
- to solve problems using the area and the circumference of a circle
- to interpret and create circle graphs
- to use circle graphs to solve problems

Key Words

radius
diameter
circumference
pi
circle graph
sector
central angle

MATH LINK

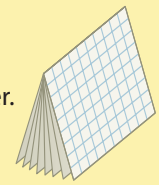
In many cultures, drums are used in ceremonies when people come together to share ideas. The drum is often considered a symbol of the heartbeat and of life.

Although drums come in many different shapes and sizes, often the top of the drum is in the shape of a circle. What math is involved in making a drum? What might you need to know to design and create your own drum?

FOLDABLES™
Study Tool

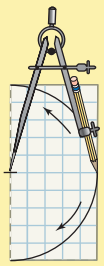
Make the following Foldable to organize what you learn in Chapter 8.

Step 1 Stack four sheets of grid paper, one on top of the other. Then fold them in half horizontally.

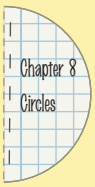


Step 2 Fold the stack in half again so that the left edge and right edge meet. Do not crease. Instead, pinch the top of the fold to locate the midpoint. Open back up.

Step 3 Place the tip of a compass at the midpoint of the top sheet. Draw a half circle on the top sheet.



Step 4 Staple the pages together. Then cut the pile of papers to make a half-circle foldable. Label the cover. When opened, the pages will be complete circles. Label the circles Key Words, 8.1, 8.2, 8.3, 8.4, 8.5 and What I Need to Work On.



Literacy Link

As you work through Chapter 8, take notes on the appropriate page. Include information about the key words, examples, and key ideas.

8.1 Construct Circles

Focus on...

After this lesson, you will be able to...

- draw a circle with a given radius or diameter
- determine the diameter of a circle given its radius
- determine the radius of a circle given its diameter

The Olympic rings are an easily recognized symbol of the Olympic Games. Canada has hosted the Olympic games in several cities including Calgary in 1988 and Vancouver in 2010. How could you draw the Olympic rings on a poster to advertise the Olympics?

Did You Know?

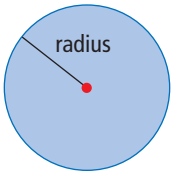
The colours of the Olympic rings were chosen because at least one of these colours is found in the flag of every nation. The five interlocking rings represent the union of the five major regions of the world—the Americas, Africa, Asia, Oceania, and Europe.

Explore the Math

How can you draw a circle with a given radius?

radius

- distance from the centre of the circle to the outside edge
- usually represented by the variable *r*



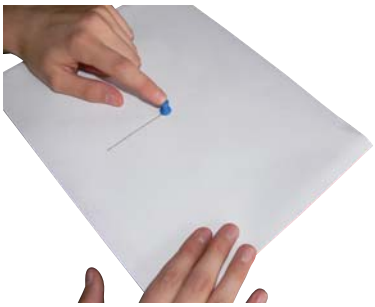
Example 1: Draw a Circle With a Given Radius Using String

Draw a circle with a **radius** the length of this line segment:

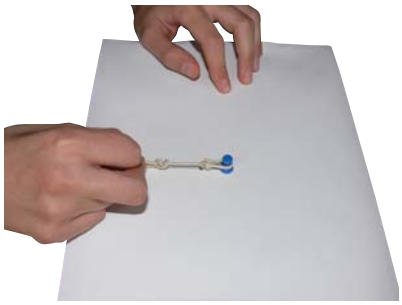
Solution

The length of the line segment shown is 6 cm.

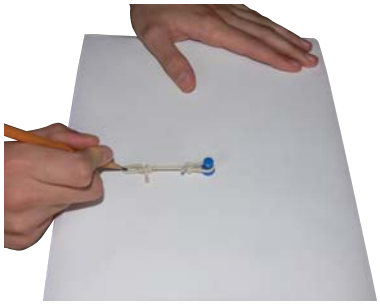
In the middle of your notebook page, draw a line segment 6 cm long.



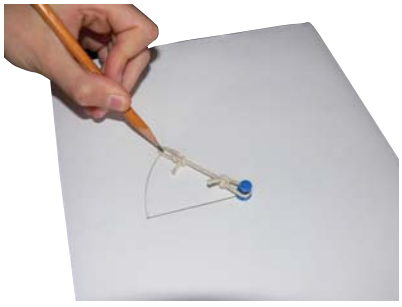
Put a push pin at one end of the line segment.



Tie two loops in a piece of string, so that the distance between the ends of the loops is the length of the line segment.



Put one loop over the push pin and put your pencil tip into the other loop.



Keep the string stretched tight as you move the pencil around the push pin to draw the circle.

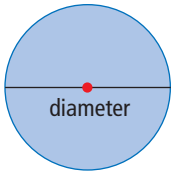
Example 2: Draw a Circle With a Given Radius Using a Compass

a) Draw a circle with a radius of 5 cm.

b) How does the **diameter** of the circle compare to the radius?

diameter

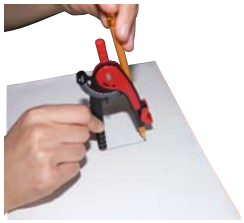
- distance across a circle through its centre
- usually represented by the variable *d*



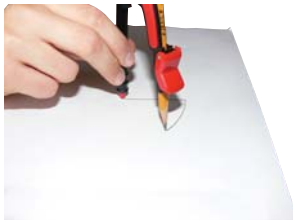
Solution

a)

In the middle of your notebook page, draw a line segment 5 cm long. This will be the radius of the circle.



Set the point of your compass at one end of the line segment. Set the point of your pencil at the other end of the line segment.

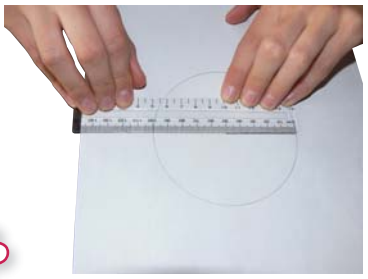


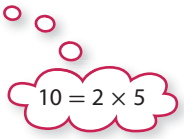
Hold the compass point at its end of the line segment as you rotate the compass to draw the circle.

Tech Link

You can use a Draw program to create circles on a computer.

b) Measure the diameter of the circle you drew in a). The diameter of the circle is 10 cm. The radius of the circle is 5 cm. The diameter of the circle is twice the radius of the circle. This relationship could be written as $d = 2 \times r$.





Show You Know

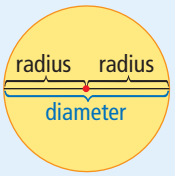
a) How could you find the radius of a circle with a diameter of 8 cm?

b) What is the radius of this circle?

c) Draw the circle.

Key Ideas

- The diameter of a circle is twice the radius.
- The radius of a circle is half the diameter.
- You can draw a circle using string and a pencil.



- You can draw a circle using a compass.

Communicate the Ideas

1. How can you find the diameter of a circle if you know the radius? Use words and diagrams to explain your answer.

2. Write a set of instructions to describe how to draw a circle with a diameter of 8 cm, using a compass. Give your instructions to a classmate or a relative and have them draw it. Is their drawing of the circle accurate?

3. How would you describe what a circle looks like to someone who cannot see?

Practise

For help with #4, refer to Example 1 on pages 268–269.

4. Using string, draw a circle with a radius the length of each line segment.

a) _____

b) _____

c) _____

For help with #5 to #8, refer to Example 2 on pages 269–270.

5. Use a compass to draw a circle with each radius.

a) 3 cm **b)** 5.5 cm **c)** 70 mm

6. What is the diameter of a circle with each radius?

a) 5 cm **b)** 8 cm **c)** 95 mm

7. What is the radius of a circle with each diameter?

a) 4 cm **b)** 7 cm **c)** 86 mm

8. Draw a circle with each diameter.

a) 15 cm **b)** 20 cm **c)** 110 mm

Apply

9. Plot the following coordinates on a grid. Draw a line connecting points A and B. Use a compass to draw a circle with centre A and passing through point B. What does the length of line segment AB represent?

a) A(5, 0) and B(8, 4)

b) A(−2, 1) and B(4, 5)

10. Without drawing the circles, determine which circle is bigger. How do you know?

Circle A with $r = 25$ cm
or
Circle B with $d = 45$ cm

11. Consider the following statement.

If the radius of a circle is doubled, the diameter is also doubled.

Which of the following best describes the statement? Use examples to support your answer.

A Always true

B Sometimes true

C Never true

12. Mandalas are used in many cultures. A mandala is thought to bring happiness and good luck to its owner. Draw a circle with a radius of 10 cm. Design your own mandala to hang in your room.

Did You Know?

The word *mandala* is Sanskrit for "circle." The mandala is an old and universal symbol that stands for peace. Many African cultures have used variations of the mandala in their art and culture to show the connections between people and their environment.

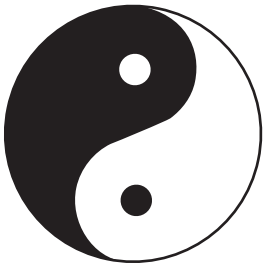
13. Draw a circle with a compass. Mark a point on this circle and use it as the centre to draw another circle with the same radius. Draw a line joining the centres of the two circles. Choose a point where the circles intersect. Connect this point to the centres of the two circles.

a) What shape have you made?

b) Why are all the sides of equal length?

Extend

14. In Chinese mythology, all things are divided into two principles, Yin and Yang. The symbol for Yin-Yang is shown. Use a compass to copy this symbol.



Did You Know?

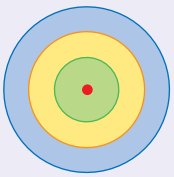
Yin represents dark and cold; Yang represents light and heat. The two principles combine to produce harmony in nature.

15. Is this a circle or a spiral? It is an optical illusion! It looks like a spiral, but it is really a set of concentric circles. The design draws your eye to the centre, creating the illusion that you are looking at a spiral.

Design your own optical illusion. Start by constructing a circle with a diameter of 15 cm. What concentric circles might you add? What design and colours might you use to draw attention to the centre?

Literacy Link

Concentric circles have the same centre but different diameters. One circle lies inside another.



MATH LINK

The face of an Aboriginal hand-painted drum often tells a story or shows a relationship that is important to a family or tribe. Construct a circle and create a design that is important to you. Try to include at least two other circles in your design.

8.2 Circumference of a Circle

Focus on...

After this lesson, you will be able to...

- estimate and calculate the circumference of a circle given its diameter or its radius
- solve problems involving the circumference of circles

The traditional Plains Indian powwow is an annual celebration. People gather together for storytelling, singing, dancing, and feasting. The powwow grounds are circles and the performers dance around the circle in a clockwise direction. How would you determine the distance a dancer travels in one complete trip around the circle?

Explore the Math

Materials

- circular objects (cans, glasses, Frisbees™, yo-yos, wheels, etc.)
- string
- metre stick
- ruler
- calculator

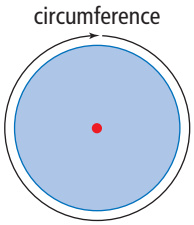
How does the circumference of a circle relate to its diameter?

1. Copy the following table into your notebook. Put ten rows under the column headings, so you can record data for ten objects.

Object	Circumference, C (cm)	Diameter, d (cm)	Circumference ÷ Diameter

circumference

- the distance around a circle
- usually represented by the variable C
- this is a linear measurement



2. Using classroom objects, or objects from around the school, choose two circular objects of different diameters and a length of string. Use the string to measure the **circumference** of each object. Record your data in the table.

3. Use a ruler or metre stick to measure and record the diameter of each object. This is the measurement across the widest part of the circle. Record your data in the table.

4. Share your data with four classmates and gather theirs so that you have a total of ten objects in your table.

a) Calculate the values of $C \div d$ in the last column of the table, to the nearest hundredth.

b) What do you notice about your calculated values?

c) What number is approximately equal to your calculated values?

d) Why do you think there are some differences in your calculated values?

Reflect on Your Findings

pi

- the ratio of the circumference of a circle to its diameter, $\frac{C}{d}$
- symbol for pi is π

Did You Know?

The value of pi is a non-repeating, non-terminating decimal. The most commonly used approximation for pi is 3.14.

5. a) What is the approximate ratio between C and d?

b) This ratio represents a constant value called **pi**. It is represented by the Greek symbol π. Press the π key on your calculator. What is the approximate value of π?

c) Write a formula that shows how to find the circumference of a circle if you know its diameter.

d) Write a formula that shows how to find the circumference of a circle if you know its radius.

e) Compare your formulas with those of your classmates. Make sure that everyone agrees on the formulas.

WWW Web Link

To learn more about pi, go to www.mathlinks7.ca and follow the links.

Example 1: Use Diameter to Find Circumference

Traffic circles, or roundabouts, are used in some neighbourhoods to slow down traffic. Vehicles enter the circle and drive around in a counterclockwise direction.

a) Estimate the circumference of this traffic circle.

b) What is the circumference of the traffic circle, to the nearest tenth of a metre?

c) Is your estimate reasonable?

Solution

Understand

You are given the diameter of the traffic circle. You need to find the circumference.

$C =$ ■, $d = 5.2$ m

Plan

Use the formula $C = \pi \times d$. Use an approximate value for π to estimate and calculate the circumference. Substitute the diameter into the formula.

Do It!

a) When estimating, use 3 as an approximate value for π.
The diameter of the traffic circle is about 5 m.

$C = \pi \times d$
$C \approx 3 \times 5$
$C \approx 15$

The circumference of the traffic circle is approximately 15 m.
The actual value should be higher because you estimated using numbers smaller than the actual numbers.

b) When calculating, use 3.14 as an approximate value for π.

$C = \pi \times d$
$C \approx 3.14 \times 5.2$
$C \approx 16.3$

C 3.14 × 5.2 = 16.328

The circumference of the traffic circle is approximately 16.3 m.

Check that you rounded your answer to the correct number of decimal places.

Remember to use the proper units in your final answer.

Tech Link

If your calculator has a π key, you can use the π key instead of the value 3.14.

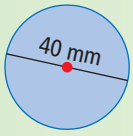
Look Back

c) The answer of 16.3 m is close to but a bit higher than the estimate of 15 m. The estimate of 15 m is reasonable.

Show You Know

Estimate and calculate the circumference of each circle, to the nearest tenth of a unit.

a)



b)

Example 2: Use Radius to Find Circumference

The carousel is a popular children's amusement park ride. The radius of a carousel is 6.1 m.

a) Estimate the circumference of the carousel. Should the actual value be higher or lower than the estimate?

b) What is the circumference of the carousel, to the nearest tenth of a metre?

c) Andrew sits on a horse on the inside of the carousel. The horse is 3.2 m from the centre of the carousel. How far does Andrew travel in one rotation of the carousel, to the nearest tenth of a metre?

Solution

Use the formula $C = 2 \times \pi \times r$.

Recall that $d = 2 \times r$.

a) When estimating, use 3 as an approximate value for π.
The radius of the carousel is about 6 m.

$C = 2 \times \pi \times r$
$C \approx 2 \times 3 \times 6$
$C \approx 36$

The circumference of the carousel is approximately 36 m.
The actual value should be higher because you estimated using numbers smaller than the actual numbers.

b) When calculating, use 3.14 as an approximate value for π.
$C =$ ■, $r = 6.1$ m
$C = 2 \times \pi \times r$
$C \approx 2 \times 3.14 \times 6.1$
$C \approx 38.3$

C 2 × 3.14 × 6.1 = 38.308

Round to the nearest tenth, which is one decimal place.

The circumference of the carousel is approximately 38.3 m.

c) $C =$ ■, $r = 3.2$ m
$C = 2 \times \pi \times r$
$C \approx 2 \times 3.14 \times 3.2$
$C \approx 20.1$

$2 \times 3 \times 3 = 18$

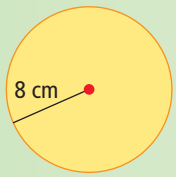
C 2 × 3.14 × 3.2 = 20.096

Andrew travels approximately 20.1 m in one rotation of the carousel.

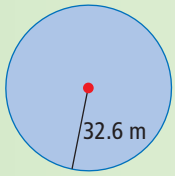
Show You Know

Estimate and calculate the circumference of each circle, to the nearest tenth of a unit.

a)

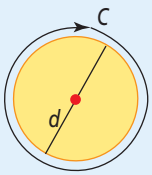


b)

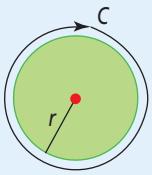


Key Ideas

- The circumference of a circle is approximately three times its diameter. Use this value to estimate the circumference before calculating it.
- The ratio of the circumference of a circle to its diameter is represented by the constant value called pi, often written as π. The value of π is approximately 3.14.
- The formula relating the circumference, C, of a circle to its diameter, d, is $C = \pi \times d$.

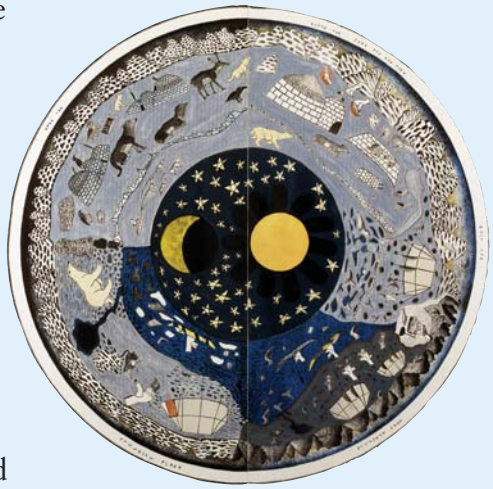


- The formula relating the circumference, C, of a circle to its radius, r, is $C = 2 \times \pi \times r$.



Communicate the Ideas

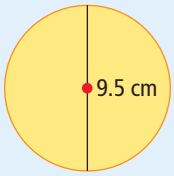
1. How would you determine the circumference of the circles in this Inuit artwork?



2. Dara attempts to solve the following question:

What is the circumference of the circle, to the nearest tenth of a centimetre?

Here is her solution:



$C = 2 \times \pi \times r$

$C \approx 2 \times 3.14 \times 9.5$

$C \approx 59.7$

The circumference is 59.7 cm.

Is her solution correct? If not, identify the error and write a correct solution.

Practise

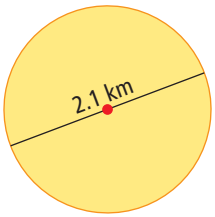
Use 3.14 for π in calculations.

Round all answers to the nearest tenth of a unit unless otherwise specified.

For help with #3 to #6, refer to Example 1 on page 275.

3. Estimate and then calculate the circumference of each circle.

a)



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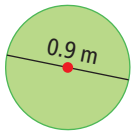


4. Estimate and then calculate the circumference of each circle.

a)

b)

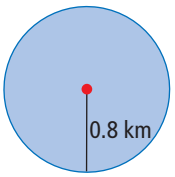
5. Suki is walking on a circular path around a park. If the circle has a diameter of 3 km, how far does she walk? Answer to the nearest kilometre.

6. The Deep Bay crater in Saskatchewan has a diameter of approximately 13 km. What is the circumference of the crater? Answer to the nearest kilometre.

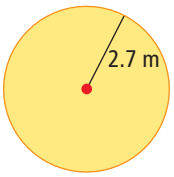
For help with #7 to #10, refer to Example 2 on page 276.

7. Estimate and then calculate the circumference of each circle.

a)



b)



8. Estimate and then calculate the circumference of each circle.

a)

b)

9. Ashley sits on a carousel horse that is 4.8 m from the centre of the carousel. How far does she travel in one rotation of the carousel?

10. The Medicine Wheel is an important symbol of the peaceful relationships among all living things. A number of stone Medicine Wheels can be found across southern Alberta. If the radius of a Medicine Wheel is 1.2 m, how far do you travel when you walk around the Medicine Wheel?

WWW Web Link

To learn more about Medicine Wheels, go to www.mathlinks7.ca and follow the links.

Apply

11. Todd is practising skating drills. He skates around the face-off circle of the ice rink. If the circle has a radius of 4.5 m, how far does he skate when he goes around the circle twice?

12. Van wants to decorate some circular picture frames by gluing fancy ribbons around the circumference of each frame. She has 3.8 m of ribbon. If each frame has a diameter of 0.12 m, how many frames can she decorate?

13. A Ferris wheel has a diameter of 45.9 m.

a) What is the circumference of the Ferris wheel?

b) The distance between cars on the Ferris wheel is approximately 6 m. How many cars are there on the Ferris wheel?

14. Consider the following statement.

If the radius of a circle is doubled, the circumference is also doubled.

Which of the following best describes the statement? Use examples to support your answer.

A Always true

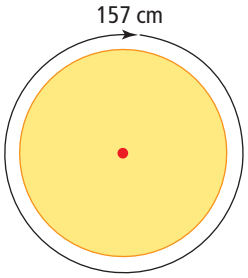
B Sometimes true

C Never true

15. A basketball hoop has a circumference of 1.6 m. If a basketball has a diameter of 0.24 m, can two basketballs fit through the hoop at the same time? Justify your answer.

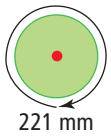
Extend

16. Describe how you could use the circumference formula to determine the diameter of this circle.

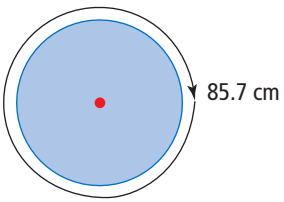


17. What is the diameter of each circle with the given circumference?

a)



b)



18. A gardener has 36 m of fencing to make a circular enclosure. What is the radius of the largest circle that she can make?

19. A BMX bike tire has a diameter of approximately 0.45 m. A mountain bike tire has a diameter of approximately 0.6 m. In a 400-m race, how many more times will the BMX bike tire have to turn than the mountain bike tire?

MATH LINK

The tabla is the most popular percussion instrument used in northern India. The frame for a tabla is made of wood. A single strip of wood is bent to form a circle. If a drum has a diameter of 38.5 cm, what length of wood is needed to make the frame?

8.3 Area of a Circle

Focus on...

After this lesson, you will be able to...

- ❑ explain how to determine the area of a circle
- ❑ estimate and calculate the area of a circle
- ❑ solve problems involving the area of a circle

When the City of Vancouver wanted new designs for their storm sewer covers, a design competition was held. The winning design was "Memory and Transformations," by Coast Salish artists Susan Point and Kelly Cannell. The circular design represents the circle of life for a frog. The eggs in the centre spin into tadpoles, and then turn into frogs. If the diameter of the circular cover is 65 cm, how could you determine the amount of area available for the design?

Explore the Math

Materials

- centimetre grid paper
- ruler
- compass
- calculator
- scissors

How can you determine the area of a circle?

Part 1: Estimate the Area of a Circle

1. Using centimetre grid paper, construct a circle with each radius listed in the table. Copy the table in your notebook.

Radius, *r*	Estimated Area, *A*
3 cm	
4 cm	
5 cm	
6 cm	

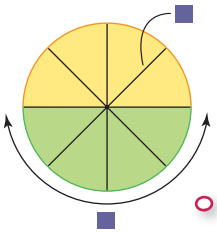
2. Count squares and estimate parts of squares to estimate the total area of each circle.

Reflect on Your Findings

3. How could you improve your estimate?

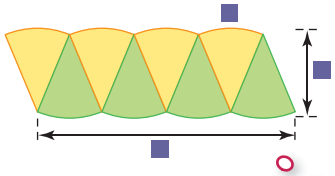
Part 2: Develop a Formula for the Area of a Circle

4. Draw a circle with a radius of 10 cm. Divide the circle into eight equal sections, like a pie, as shown. What are the missing dimensions? Explain your answer.



The formula for the circumference of a circle is $C = 2 \times \pi \times r$.

5. Cut the circle into eight wedges. Put the wedges together to make a shape like a parallelogram. Will this parallelogram have the same area as the circle? How do you know?



Look back at Chapter 3 for the area of a parallelogram.

6. a) What is the formula for the area of a parallelogram?

b) Use a ruler to measure the height of the parallelogram formed in #5.

c) Use a ruler to measure the approximate length of the base of the parallelogram.

d) Calculate the area of the parallelogram.

7. a) How is the height of the parallelogram related to the radius, r, of the circle?

b) The base of the parallelogram is approximately equal to the length of the outside edge of four of the wedges. How does this length compare with the dimensions you found in #4? Write an expression using the radius, r, for the length of the base of the parallelogram.

c) Use your answers to parts a) and b) to write an expression for the approximate area of the parallelogram.

d) How can you use the formula from part c) to find the area of the circle? What is the area of the circle?

e) How does the area of the circle compare with the area of the parallelogram in #6d)?

Reflect on Your Findings

8. a) Write a formula to calculate the area of a circle, A, if you know its radius, r.

b) Compare your formula with those of your classmates. Discuss any differences and make sure that everyone agrees on the formula.

Example 1: Calculate Area From a Given Radius

Mei Ling has a circular mirror in her bedroom.
The radius of the mirror is 20.5 cm.

a) Estimate the area of the mirror in square centimetres.

b) What is the area of the mirror in square centimetres?
Answer to the nearest tenth of a square centimetre.

c) The radius of the mirror expressed in metres is 0.205 m.
What is the area of the mirror in square metres?
Answer to the nearest hundredth of a square metre.

Solution

You are given the radius. You need to find the area.

Use the formula for the area of a circle $A = \pi \times r^2$.

a) Use 3 as an approximate value for π.
The radius of the mirror is about 20 cm.

$20 \times 20 = 400$
$3 \times 400 = 1200$
M E

$A = \pi \times r^2$
$A \approx 3 \times 20^2$
$A \approx 3 \times 20 \times 20$
$A \approx 1200$

r^2 is read as "r squared," which means $r \times r$.

Use cm^2 because $cm \times cm = cm^2$.

The area of the mirror is approximately 1200 cm^2.

b) Use 3.14 for π in calculations.
The radius is 20.5 cm.
$A = \pi \times r^2$
$A \approx 3.14 \times 20.5^2$
$A \approx 3.14 \times 20.5 \times 20.5$ C **3.14** × **20.5** × **20.5** = 1319.585
$A \approx 1319.6$

The area of the mirror is approximately 1319.6 cm^2.

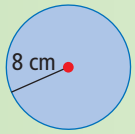
c) The radius is 0.205 m.
$A = \pi \times r^2$
$A \approx 3.14 \times 0.205^2$
$A \approx 3.14 \times 0.205 \times 0.205$ C **3.14** × **0.205** × **0.205** = 0.1319585
$A \approx 0.13$

The area of the mirror is approximately 0.13 m^2.

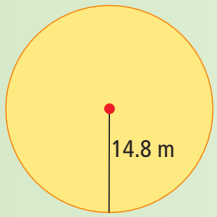
Show You Know

Estimate and calculate the area of each circle, to the nearest tenth of a square unit.

a)



b)



Example 2: Calculate Area From a Given Diameter

Jason is cutting a circular hole to go ice fishing. If the diameter of the circle is 25 cm, what is the area of the circle? Answer to the nearest tenth of a square centimetre.

Solution

You are given the diameter. You need to find the radius and then find the area.

$A =$ ■, $d = 25$ cm, $r =$ ■

The radius is half the diameter.

$r = 25 \div 2$

$r = 12.5$

The radius is 12.5 cm.

Use the formula $A = \pi \times r^2$.

$A = \pi \times r^2$

$A \approx 3.14 \times 12.5^2$

$A \approx 3.14 \times 12.5 \times 12.5$ C 3.14 × 12.5 × 12.5 = 490.625

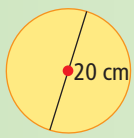
$A \approx 490.6$

The area of the circle is approximately 490.6 cm^2.

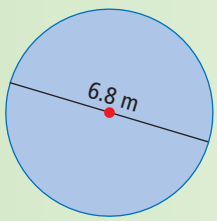
Show You Know

Estimate and calculate the area of each circle.

a)

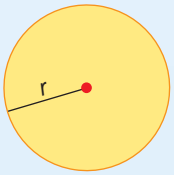


b)



Key Ideas

- The area of a circle is approximately three times the square of its radius. Use this value to estimate the area of a circle.
- The equation relating radius, r, and area of a circle, A, is $A = \pi \times r^2$. Use this formula to determine the area of a circle.
- Area is measured in square units, such as mm^2, cm^2, m^2, and km^2.



Communicate the Ideas

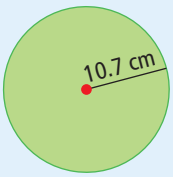
1. Describe how you would determine the area of this Aztec medallion.

2. Enrico made an error while attempting to solve the following question:

What is the area of the circle? Answer to the nearest tenth of a centimetre.

Here is his solution:

$A = \pi \times 10.7^2$
$A \approx 3.14 \times 10.7 \times 2$
$A \approx 67.196$
$A \approx 67.2$ cm



Identify his error and write a correct solution.

3. Taylor estimates that a circle with a radius of 4 cm has an area that is approximately 48 cm^2.

a) How did Taylor arrive at this estimate?

b) Discuss with a partner whether or not this is a good estimate of the area.

c) Is the answer that you will find on the calculator larger or smaller than 48 cm^2? Why?

Practise

Use 3.14 for π in calculations.

Round all answers to the nearest tenth of a unit unless otherwise specified.

For help with #4 to #7, refer to Example 1 on page 282.

4. Estimate and then calculate the area of each circle.

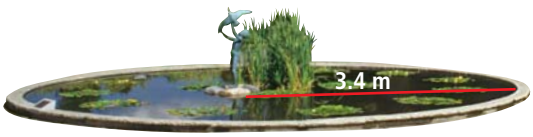
a)

b)

5. Estimate and then calculate the area of each circle.

a)

b)



6. A sprinkler shoots out a jet of water 6 m as it spins around. What is the area of lawn that can be watered by the sprinkler?

7. A circular porthole on a ship has a radius of 21 cm.

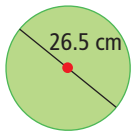
a) What is the area of the porthole to the nearest tenth of a square centimetre?

b) The radius of the porthole expressed in metres is 0.21 m. What is the area of the porthole to the nearest tenth of a square metre?

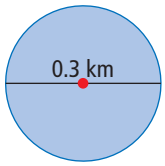
For help with #8 to #11, refer to Example 2 on page 283.

8. What is the area of each circle?

a)



b)



9. What is the area of each circle?

a)

b)

10. A circular outdoor ice rink has a diameter of 25.5 m. What is the area of the ice?

11. At an archery competition for entrants under the age of 16, the diameter of the circular target is 110 cm. What is the area of the target, to the nearest square centimetre?

Apply

12. A circular window has a diameter of 3 m. One square metre of glass costs $150. What is the cost of the glass for the window?

13. Charity has two circular tiles to paint. The radius of each tile is 22 cm. What is the total area to be painted?

14. Consider the following statement.
If the radius of a circle is doubled, the area is also doubled.
Which of the following best describes the statement? Use examples to support your answer.

A Always true **B** Sometimes true
C Never true

15. The outer ring on the Canadian toonie has an outside diameter of 28 mm and an inside diameter of 16 mm. What is the area of the outer ring to the nearest hundredth of a square millimetre?

16. At the 2006 Winter Olympics, the Canadian men's curling team won the gold medal. In curling, the house is a set of concentric circles, each with the following outside diameters:

Ring	Outside Diameter (cm)
White Button	30
Red	122
White	244
Blue	366

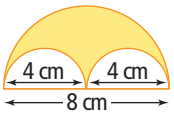
a) What is the area of each ring?
b) What is the total area of the house?

Extend

17. Can the area of a circle be the same numerical value as the circumference of a circle? Explain.

18. a) Construct two identical circles. Divide one circle into 8 equal wedges and the other into 16 equal wedges. For each circle, cut out the wedges and put them together to form a parallelogram.
b) Measure the length and height of each parallelogram. What is the area of each parallelogram?
c) What is the area of the circle? Use the formula for the area of a circle.
d) Compare the area of the circle from part c) with the area of each parallelogram. How do you predict the areas will compare as the circle is divided into even more wedges? Explain.

19. What is the area of the shaded region?



20. Forty-four metres of fencing is used to make a circular enclosure. What is the area of the circle? Answer to the nearest square metre.

MATH LINK

An African talking drum is a two-headed wooden drum with loose-fitting laces connecting the two heads. The player plays the drum with a stick and at the same time, squeezes the laces under his arm to create different sounds. The drum gets its name from these many varied sounds. If the diameter of an African talking drum is 20.4 cm, what is the combined area of the two playing surfaces of the drum?

8.4 Interpret Circle Graphs

Focus on...

After this lesson, you will be able to...

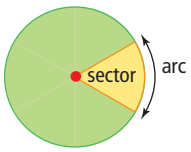
- ❑ read circle graphs
- ❑ use circle graphs to solve problems

circle graph

- a graph that represents data using sections of a circle

sector

- section of a circle formed by two radii and the arc of a circle connecting the radii



Staff at a community centre created a **circle graph** to show the number of people who enroll in their Native Arts programs.

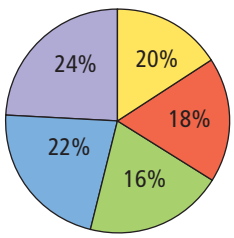
Which program do you think is most popular?

A circle graph shows how a category of data compares to the whole. The circle is divided into **sectors**. Each sector represents a category. Each category represents a specific percent of the whole. The area of the sector is the same percent of the area of the circle.

Circle graphs are easier to use when there are not too many categories Too many sectors make a circle graph difficult to read.

Circle graphs are easier to interpret when the percents are easily distinguishable. If the percents are too close in value, it is hard to see the differences in the sections.

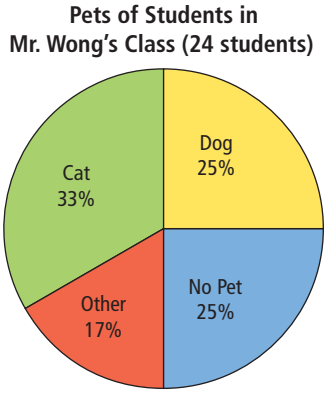
Native Arts Program Participation



Discuss the Math

How do you interpret a circle graph?

The following circle graph shows the types of pets of the 24 students in Mr. Wong's class.



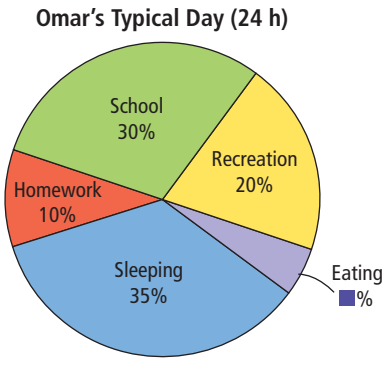
1. What is the title of the circle graph?
2. What are the different categories represented by the graph?
3. What percent of the class has a dog for a pet? How many students have a dog?
4. What percent of the class has a cat for a pet? How many students have a cat?
5. What percent of the circle is represented by all the sectors? Why does this make sense?
6. Would this circle graph make sense if the title or sector labels were missing? Explain why.

Reflect on Your Findings

7. How can a circle graph give you information about how parts of a whole are related? Discuss your answer with a classmate.

Example: Read and Interpret a Circle Graph

The circle graph shows how Omar spends a regular weekday.



a) What activity does Omar spend the most time on during a 24-h day? How many hours does he spend on this activity?

b) How many hours does Omar spend at school and doing homework?

c) What percent of his day is spent eating?

Solution

a) The largest section is labelled "Sleeping."
Calculate 35% of 24 h.

$35\% \text{ of } 24 = 0.35 \times 24$
$= 8.4$

Omar spends 8.4 h sleeping in a day.
That is the same as 8 h and 24 min.

There are 60 min in 1 h. To change part of an hour to minutes, multiply the decimal part by 60 min.
$0.4 \times 60 \text{ min} = 24 \text{ min}$

b) Omar spends 30% of his day at school and 10% doing homework.

School: $30\% \text{ of } 24 = 0.3 \times 24$
$= 7.2$

Homework: $10\% \text{ of } 24 = 0.1 \times 24$
$= 2.4$

10% of 24 is one tenth of 24 or 2.4.
30% is 10% + 10% + 10%.
30% of 24 is 2.4 + 2.4 + 2.4 or 7.2.

$$\begin{array}{r} 7.2 \\ +\ 2.4 \\ \hline 9.6 \end{array}$$

Omar spends a total of 9.6 h at school and doing homework. That is the same as 9 h and 36 min.

To find the minutes,
$0.6 \times 60 \text{ min} = 36 \text{ min}$

c) To find the percent of time spent eating, add up all the percents in the other categories.

$30\% + 10\% + 20\% + 35\% = 95\%$

The percents in the circle must add up to 100%, so subtract.

$100\% - 95\% = 5\%$

Omar spends 5% of his day eating.

Key Ideas

- A circle graph shows how each category of data compares to the whole using percents.
- The sum of all the percents in a circle graph is 100%.
- Circle graphs are easier to interpret when there are a small number of categories and when the percent values are not too close together.

Communicate the Ideas

1. Which set of data should not be represented by a circle graph? Why not?

Madison's Monthly Spending

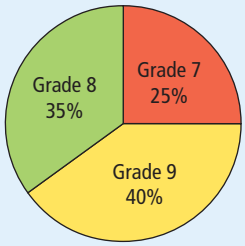
Lunches and snacks	40%
Entertainment	30%
Savings	20%
Other	10%

Eric's Math Test Results

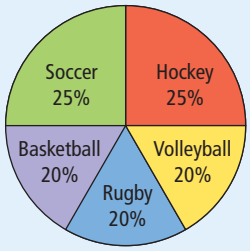
Chapter 1	75%
Chapter 2	77%
Chapter 3	80%
Chapter 4	80%

2. Is each circle graph correct as shown? If not, what needs to be changed?

a) **Students in a Club**



b) **Grade 7 Favourite Sports**

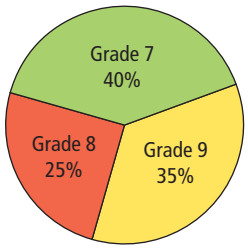


Practise

For help with #3 and #4, refer to the Example on pages 288–289.

3. The circle graph shows the grade levels of the students that attended a dance.

Students at the Dance



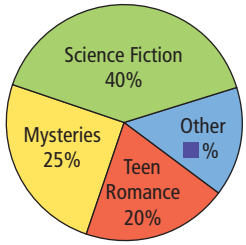
a) Which grade had the most students at the dance?

b) If there were 300 students at the dance, how many grade 7 students were there?

c) How many more grade 9 students came than grade 8 students?

4. The circle graph shows the types of books that were signed out of the library during the summer.

Books Signed Out in the Summer



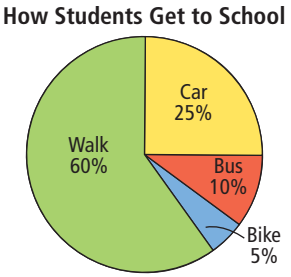
a) If there were 4000 books signed out of the library during the summer, how many were Teen Romance?

b) How many books were Science Fiction or Mysteries?

c) What percent of books are considered "Other"?

Apply

5. The circle graph shows how the 520 students in one school get to school.

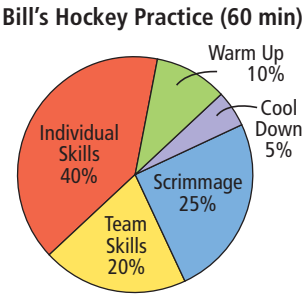


a) What is the most common way for students to get to school?

b) How many students ride their bikes to school?

c) How many students do not ride a bus to school?

6. Bill plays hockey with the Blizzard team. The circle graph shows how time is spent during one of his 60-min practices.

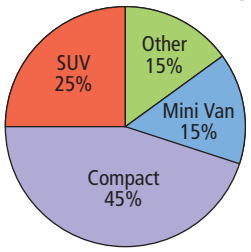


a) On what activity does Bill spend the most time during his hockey practice?

b) On what activities does Bill spend a total of 75% of his time? Give two possible answers.

c) If Bill's practice starts at 5:00 p.m., write a possible schedule for the practice.

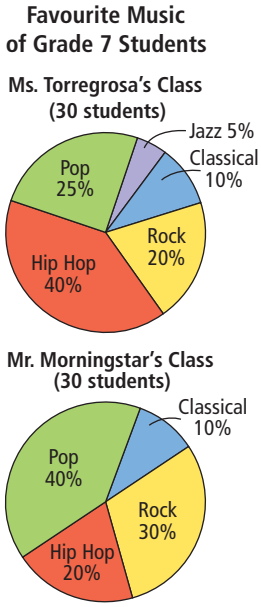
7. Eighty cars were sold at a dealership one week. The circle graph shows the types of cars that were sold.



a) What was the most popular car sold at this dealership?

b) How many more SUVs were sold than minivans?

8. Compare the data in these two circle graphs.



a) What is the most popular type of music in Mr. Morningstar's class?

b) In which class is hip hop more popular?

c) Which type of music is only popular in Ms. Torregrosa's class?

d) Which types of music are more popular in Mr. Morningstar's class than in Ms. Torregrosa's class?

9. Search various media, such as newspapers, magazines, and the Internet, for information that has been represented as a circle graph. Choose two graphs. Print or cut out each graph. Glue or tape each graph into your notebook. Analyse each graph according to the following criteria:

a) Is a title given? Does the title say what the graph is about?

b) Are sectors labelled or is a legend or key provided?

c) Do the percents add up to 100%?

d) Does the graph effectively get the reader's attention?

e) Are the data in the circle graph used to support an opinion?

f) Write and answer two questions about the data that can be answered by the graph.

8.5 Create Circle Graphs

Focus on...

After this lesson, you will be able to...

- ❑ **construct a circle graph with and without technology**

Number of People Entering During Angela's Shift

Age	Number of People
Children (under 6 years)	30
Youth (6–18)	80
Adults (19–59)	55
Seniors (60+)	25

Angela works at the local movie theatre on weekends. One of Angela's jobs is to record the number of people who enter during her shift. In one shift, she records the data shown in the table.

She wants to make a circle graph that will compare the age groups to each other, and to the total number of people who came in during her shift. How could she make the graph?

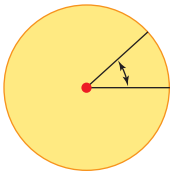
Explore the Math

Materials

- ruler
- compass
- protractor
- coloured pencils

central angle

- an angle formed by two radii of a circle
- the vertex of the angle is at the centre of the circle



How do you create a circle graph?

1. Construct a circle with a radius of 5 cm. Draw the diameter. With the centre of the circle as the vertex, measure the **central angle** formed by the diameter.
   a) How many degrees are in the top half of the circle?
   b) How many degrees are in the bottom half of the circle?
   c) What is the sum of the central angles of a circle?

2. Construct a circle graph to show how you would sort the students in your class by their number of siblings.
   a) Survey the class to find out the number of siblings each student has. Record this information in your notebook.
   b) Draw a circle to represent the whole class.
   c) Divide the circle into sectors to show how you sorted your classmates. How did you use the result of #1c) to decide on the size of each central angle?

Literacy Link

Siblings are brothers and sisters.

Reflect on Your Findings

3. Compare your circle graph with others in the class. How are they similar? How are they different? What might be reasons for any differences?

Did You Know?

Why does a circle have 360°?

The Babylonians saw that the sun took 365 days to complete a circle in the sky. By dividing this circle into 365 parts, the sun would move through one part each day. But 365 does not have many factors and is hard to work with as a fraction. The Babylonians decided that 360 was close enough and a much more convenient number. Discuss with a partner why 360 is more convenient than 365.

Example 1: Draw a Circle Graph Using a Protractor

Shannon surveyed her grade 7 class about the number of days they use the Internet in a typical week. The results are shown in the table.

Internet Use (Number of Days in a Week)	Number of Students
0	3
1–3	9
4 or more	18

Draw a circle graph to display the data.

Solution

Determine the total number of students in the class.

$3 + 9 + 18 = 30$

There are 30 students in the class.

Complete the following table.

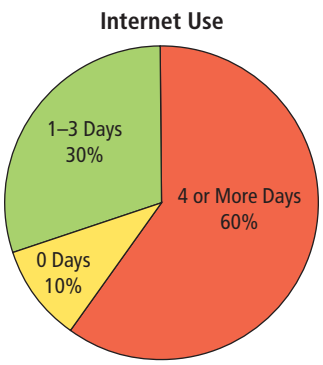
percent of total = (number of students ÷ total number of students) × 100%

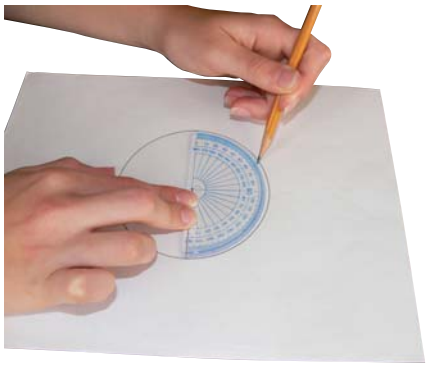
Internet Use (Number of Days in a Week)	Number of Students	Percent of Total	Decimal Value Equivalent	Central Angle
0	3	10%	0.10	$0.1 \times 360° = 36°$
1–3	9	30%	0.30	$0.3 \times 360° = 108°$
4 or more	18	60%	0.60	$0.6 \times 360° = 216°$
Totals	30	100%	1.00	360°

There are 360° in a circle.

To create a circle graph:

- Draw a circle.
- Use a protractor to measure and draw each central angle.
- Label each sector with its category and its percent.
- Colour or shade each sector.
- Add a title for the circle graph.





Example 2: Draw a Circle Graph Using Technology

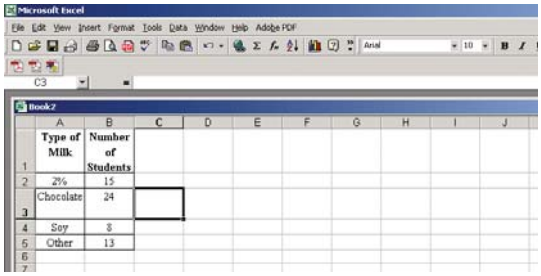
James surveyed all the students in his grade to find their favourite type of milk to drink. His results are shown in the table.

Type of Milk	Number of Students
2%	15
Chocolate	24
Soy	8
Other	13

Draw a circle graph to display the data.

Solution

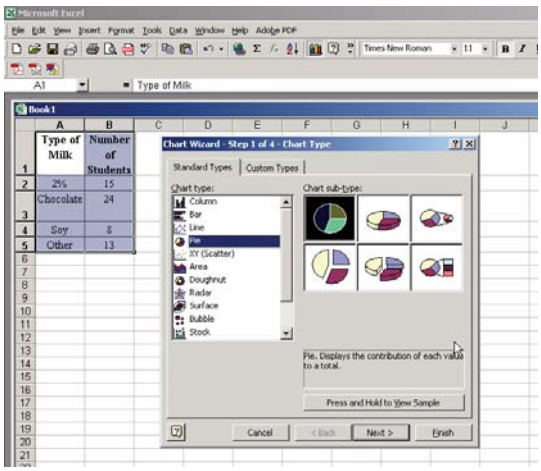
Enter the data from the table into two columns of a spreadsheet.



Select the **Chart Wizard**.

Select **Pie Chart**.

Pie chart is another name for a circle graph.

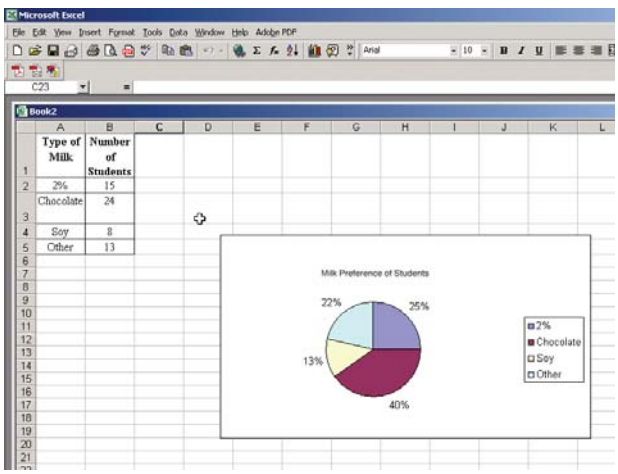


Follow the instructions in the **Chart Wizard**.

Enter a title for the graph.

Choose to display **Category Name** and **Percentage** from the **Data Labels** page.

Create a pie chart.



Tech Link

Use the spreadsheet software available on your computer to create the circle graph shown here.

Key Ideas

- The sum of the central angles of a circle is 360°.
- To create a circle graph using a protractor:
  - Express each category as a percent of the total.
  - Use the decimal value equivalent of the percent to calculate the measure of the central angle.

    central angle = decimal value equivalent of percent × 360°
  - Use a protractor to measure and draw each central angle.
  - Add sector labels and a title to the circle graph.
- To create a circle graph using a spreadsheet:
  - Enter the categories into one column and their corresponding amounts into the next column.
  - Use the **Chart Wizard** to make a pie chart.
  - Enter a title for the graph and choose labels for your sectors.

Communicate the Ideas

1. a) How do you know that the sum of the angles in a circle is 360°? Explain.

b) How is this value used to determine the size of each central angle in a circle graph?

2. a) Create a circle graph using data of your choice.

b) Write two questions related to your circle graph.

c) Give these questions to a classmate or friend. Is your classmate able to interpret your circle graph to answer your questions?

3. Fazila has completed the following table. Are there any errors in the calculations? If yes, identify the errors and correct them.

Cell Phone Calls Per Day	Number of People	Percent of Total	Decimal Value Equivalent	Central Angle
0	3	10%	0.1	36°
1–2	9	30%	0.3	108°
3–5	12	36%	0.36	130°
More than 5	6	20%	0.2	72°
Totals	30	100%	1.00	360°

Practise

For help with #4 to #6, refer to Example 1 on page 293.

4. Liam sorted and counted his hockey cards and decided to make a circle graph of the types of cards he had.

a) Copy and complete the following table.

Type	Number of Cards	Percent of Total	Decimal Value Equivalent	Central Angle
Forward	20			
Defense	16			
Goalie	4			
Totals				

b) Draw a circle graph to display the data.

5. All the grade 7s were surveyed to determine their favourite flavour of ice cream.

a) Copy and complete the following table.

Favourite Ice Cream	Number of Students	Percent of Total	Decimal Value Equivalent	Central Angle
Chocolate	24			
Strawberry	15			
Vanilla	12			
Other	9			
Totals				

b) Draw a circle graph to display the data.

6. Jordan surveyed her classmates to determine their favourite school subject. Make a circle graph to display the data.

Subject	Number of Students
Math	9
Art	6
P.E.	9
Other	6

For help with #7 to #9, refer to Example 2 on page 294.

7. Kian recorded the hours he spent on homework during a school week. Use a computer with spreadsheet software to make a circle graph displaying the data.

Day	Hours
Monday	1.75
Tuesday	1.25
Wednesday	2.5
Thursday	2.0
Friday	0.5

8. Angela recorded the following number of people entering the movie theatre during one busy holiday shift. Use a computer with spreadsheet software to create a circle graph to display the data.

Age	Number of People
Children (under 6 years)	60
Youth (6–18)	200
Adults (18–59)	100
Seniors (60+)	40

9. The school cafeteria records the number of lunch specials ordered over the week. Use a computer with spreadsheet software to create a circle graph to display the data.

Lunch Special	Number Ordered
Chicken strips	350
Fish and chips	225
Lasagna	175
Pizza	451
Macaroni and cheese	264

Apply

10. The table gives the total population for each of the three Canadian territories in 2001.

Territory Population in 2001

Territory	Population
Yukon Territory	28 520
Northwest Territories	37 100
Nunavut	26 665

a) Use a spreadsheet to create a circle graph to display the data.

b) Use the Internet to find the most recent population figures for the territories. Make a circle graph to display the data.

c) Discuss with a partner reasons for the population changes.

11. Select two different types of magazines, for example, sports, fashion, family, news.

a) Count the number of full pages of advertising in each magazine.

b) Count the number of full pages of articles.

c) Count the number of pages that contain both articles and advertising.

d) Make a circle graph for each magazine comparing the number of pages of advertising to the number of pages of articles.

e) Which type of magazine has the higher percent of advertising?

Extend

12. Use the Internet to find the most recent population figures for British Columbia, Alberta, Saskatchewan, and Manitoba. Also, record the population figures from approximately 20 years ago.

a) Make two circle graphs:
Graph A: using the most recent figures
Graph B: using the older set of data

b) How can you tell from the circle graphs which province showed the largest percent gain in total population, from Graph B to Graph A?

c) Write two questions that could be answered using the circle graphs you drew in part a).

13. Prepare a survey question that would give you data where a circle graph would be helpful.

a) How many different options does your question have? Is your question likely to have a different number of people responding to each option?

b) Ask the students in your class your survey question. Record the data in a chart.

c) Create a circle graph to display the data.

d) What conclusion(s) can you make based on your circle graph?

8 Chapter Review

Key Words

For #1 to #7, choose the letter representing the term that best matches each statement.

1. The distance from the centre of a circle to a point on the circle

2. Twice the radius of a circle

3. Approximately three times the diameter of the circle

4. The ratio $\frac{\text{circumference}}{\text{diameter}}$

5. An expression for the area of a circle

6. The sum of the central angles in a circle

7. A display that shows how categories of data compare to each other and to the whole

A circumference
B radius
C pi
D 360°
E $\pi \times r^2$
F diameter
G $2 \times \pi \times r$
H circle graph

8.1 Construct Circles, pages 268–272

8. Draw a circle with a radius that is the length of each line segment.

a) _____

b) _____

c) _____

9. Draw a circle with each diameter.

a) $d = 9$ cm

b) $d = 40$ mm

c) $d = 14$ cm

10. Using 1-cm grid paper, plot points A(−5, 3) and B(0, −1). Using point A as the centre, draw a circle of radius 6 cm. Does point B lie within the circle?

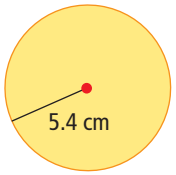
8.2 Circumference of a Circle, pages 273–279

Use 3.14 for π in calculations.

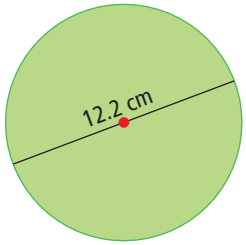
Answer to the nearest tenth of a unit, unless otherwise indicated.

11. What is the circumference of each circle?

a)



b)



12. What is the circumference of a circle with each given measurement?

a) $r = 3$ m

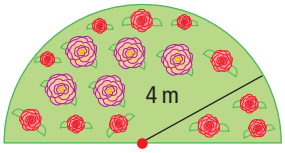
b) $r = 0.9$ km

c) $d = 1.4$ m

d) $d = 210$ cm

13. A circular window has a diameter of 1.2 m. What is the circumference of the window frame?

14. David wants to place a fence around a semi-circular flower garden. The garden has a radius of 4 m.



a) What length of fence does he need to buy?

b) If the fencing costs $7.25 per metre, how much does it cost to enclose the garden?

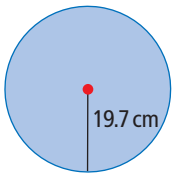
8.3 Area of a Circle, pages 280–286

Use 3.14 for π in calculations.

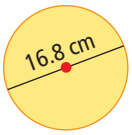
Answer to the nearest tenth of a square unit, unless otherwise indicated.

15. What is the area of each circle?

a)



b)

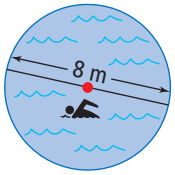


16. What is the area of a circle with each given measurement?

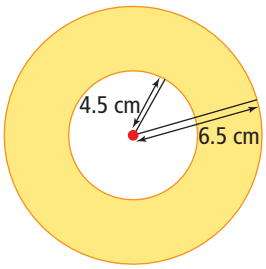
a) $r = 4.1$ m **b)** $r = 1.3$ km

c) $d = 15.7$ m **d)** $d = 25.6$ mm

17. Trevor is looking for a pool cover for his circular swimming pool. What is the area of the pool?

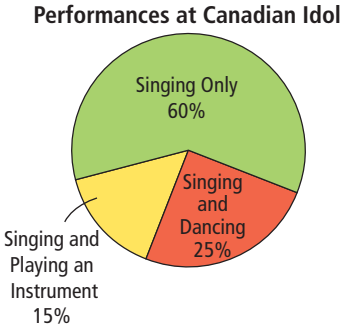


18. What is the area of the shaded region?

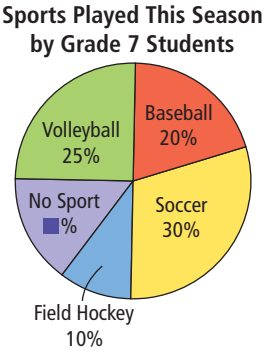


8.4 Interpret Circle Graphs, pages 287–291

19. The circle graph shows the types of performances at a recent tryout for Canadian Idol. If there were 2500 competitors, how many both sang and danced in their tryout?



20. Steven makes a circle graph of the favourite sports the students in grade 7 are playing this season.



a) If there are 60 students in grade 7, how many students prefer to play baseball?

b) What percent of the students prefer to play no sports this season?

c) What two sports do half of the students in grade 7 prefer to play?

8.5 Create Circle Graphs, pages 292–297

21. A radio station programs one hour of air time as shown in the table.

Type	Minutes
Music	30
News	12
Traffic	6
Commercials	12

Create a circle graph to display the data.

22. The 2001 Census recorded the following population numbers for the First Nations in four of the provinces or territories.

Area	Population
Yukon Territory	6 545
Nunavut	22 720
Saskatchewan	130 190
British Columbia	170 025

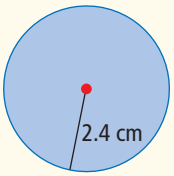
a) Create a circle graph to display the data.

b) Why do you think there are differences in the population numbers? Discuss with a partner.

8 Practice Test

For #1 to #4, select the best answer.

Use this diagram to answer #1 to #3.



1. What is the diameter of the circle?

A 0.6 cm **B** 1.2 cm

C 2.4 cm **D** 4.8 cm

2. What is the circumference of the circle?

B 4.8 cm **A** 7.5 cm

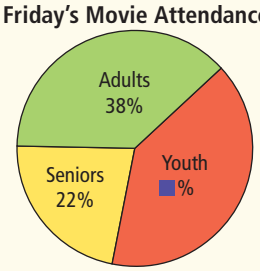
C 15.1 cm **D** 16.6 cm

3. What is the area of the circle?

A 15.1 cm^2 **B** 17.5 cm^2

C 18.1 cm^2 **D** 30.2 cm^2

4. The circle graph shows Friday's attendance at a movie theatre.



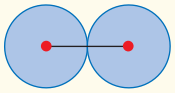
If 2450 tickets were sold that day, how many youth saw a movie?

A 539 **B** 817

C 931 **D** 980

For #5, write the correct numerical response.

5. Two identical circles are placed side by side. The length of the line segment joining the centres of the two circles is 12 cm. The length of the diameter of one of these circles is ■.



Short Answer

6. Draw a circle with a radius the length of the line segment shown.

_____

7. Construct a circle with a diameter of 9 cm.

8. Using 1-cm grid paper, plot points A(−1, 3) and B(2, 7). Draw a line segment to connect points A and B. Construct a circle with centre A and passing through point B.

a) What does the length of line segment AB represent?

b) What is the radius?

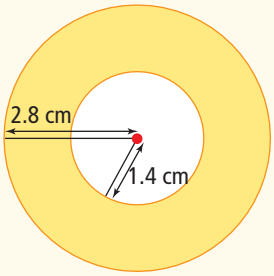
9. A circular mirror has a radius of 15.8 cm.

a) If trim for this mirror costs $5 per metre, how much will it cost to place trim around the mirror?

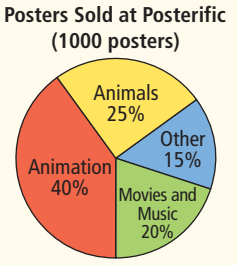
b) If glass costs $25 per square metre, how much will it cost for the glass in the mirror?

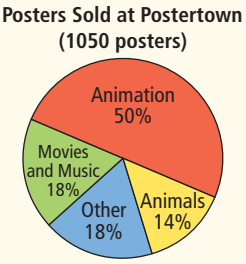
10. What circular area will this checker piece cover on a game board, to the nearest tenth of a square centimetre?

11. What is the area of the shaded region, to the nearest tenth of a square centimetre?



12. The circle graphs show the distribution of posters sold at two stores last month.





a) What was the most popular type of poster sold at each store?

b) At Postertown, what two types of posters were equal in sales? How many posters of each type were sold?

c) Which poster store sold more Movies and Music posters? How many more posters of that type were sold?

13. Sara surveys all the grade 7s to determine their favourite choice of activity for the year-end field trip. Her results are shown.

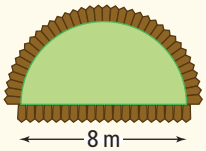
Activity	Number of Votes
Bowling	18
Beach picnic	36
Inline skating	12
Movie	6

a) Create a circle graph to display the data.

b) What two choices make up one third of the votes?

Extended Response

14. Ali is designing a semi-circular garden with a diameter of 8 m. He wants to enclose the garden with a small fence. Round all answers to the nearest hundredth.



a) What length of fence will he need to enclose the garden area?

b) If he uses the same length of fence but changes the shape of the garden to a circle, what will the diameter of the circular garden be?

c) What is the difference in area between the circular garden and the semi-circular garden?

15. Consider the following statement.

When the circumference of a circle is doubled, the area is doubled.

Do you agree with the statement? Use examples to support your answer.

WRAP IT UP!

Research drum designs from a culture of your choice and design your own drum.

- What is the diameter of the drum?
- How deep is the drum?
- How thick is the material used to make the drum?
- What is the radius and circumference of the top of the drum?
- What amount of material do you need to cover the top of the drum? Hint: Consider any overlap.
- Draw a design for your drum that includes a variety of circles.

Math Games

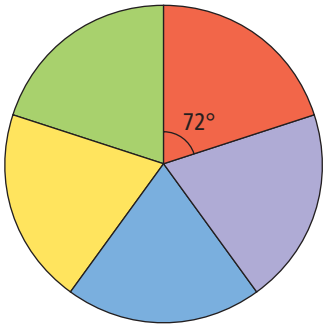
Make Spinner Games

Materials

- stiff paper or cardboard
- compass
- protractor
- scissors
- coloured pencils
- paper clip

You can make spinners using the skills you learned for drawing circle graphs. Suppose you want a spinner on which the probability of spinning each of five colours is $\frac{1}{5}$ or 0.2.

- Multiply 360° by 0.2 to find the central angle for each sector.
  $0.2 \times 360° = 72°$
- Draw a circle with a compass.
- Use a protractor to draw five 72° angles at the centre.
- Cut out the circle, and colour it.



1. a) Make a spinner with a radius of 5 cm, and so that the probability of spinning each of the numbers 0, 2, 3, and 4 is $\frac{1}{6}$, and the probability of spinning 1 is $\frac{1}{3}$.

b) Use your spinner and a partner's spinner, and take turns spinning them both. Multiply the numbers from both spinners to find your points for one turn. Keep a record of your total points. The first player to reach 30 points wins.

The sum of the probabilities is 1, because it is certain that you will spin one of the five numbers.

2. a) Work independently to make a spinner of your own using these rules:

- There must be at least two different whole numbers on the spinner.
- The sectors cannot all be the same size.
- You must be able to describe the probability of spinning each number.

Do not draw sectors with random sizes and unknown central angles.

b) With a partner, invent a spinner game that involves your two spinners and the multiplication of numbers. You will need to decide the total points that determine the winner. Use some trial rounds to check that your game works as you intended. Then play the game with your partner.

c) Exchange games with another pair of students in the class. Play the other pair's game. Suggest ways of improving their game.

Because you made your spinners independently, they will probably not be the same.

Challenge in Real Life

Winners' Circle

Your school is hosting the Math Olympics for the schools in your community. You are on the awards committee, which is creating the prizes for the winners.

You be the designer!

Design three medallions or rosettes.

- Provide three designs, one for each of first, second, and third place.
- Use a circular shape for each design.

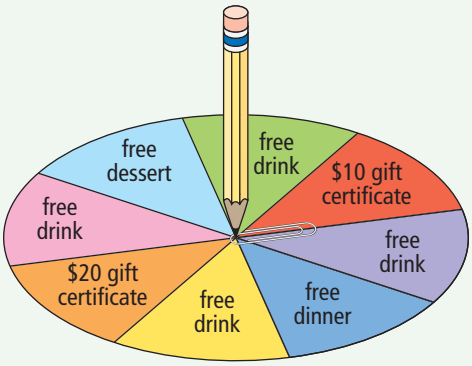
a) For each of the three designs:
- Use a compass to draw a circle the actual size of the medallion or rosette.
- Sketch the design for the face of the medallion or rosette.
- Label the diameter, circumference, and area on the drawing. Show all your calculations.

b) Prepare a presentation to make to the rest of the committee.
Describe and display your three designs. Explain why you think they are appropriate for the competition.

Chapters 5–8 Review

Chapter 5 Probability

1. It is Paul's birthday. The restaurant where he is having his party offers him a prize from the birthday spinner. All eight sections on the spinner are equal in size. Express the probability of each of the following events as a fraction, a ratio, and a percent.



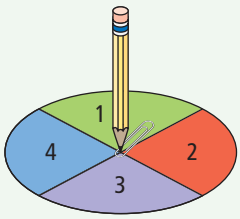
a) What is the probability of Paul winning a free drink?

b) What is the probability of him winning a gift certificate?

c) What is the probability of him winning a $50 gift certificate?

d) What is the probability of him winning a prize?

2. Use a tree diagram, table, or other graphic organizer to show the sample space for tossing a coin and spinning the spinner.



3. A camp guide is trying to read her list of names, but the last two letters of a student's name are smudged. She knows that both letters are vowels (a, e, i, o, or u).

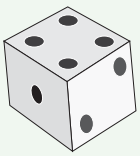
a) List the sample space for the last two letters.

b) What is the probability that the last two letters are ee?

c) What is P(e, e *or* o)?

d) What is the probability that at least one letter is e?

4. A six-sided die is rolled 30 times. The following tally chart shows the experimental outcomes.



Die Result	Experimental Results
1	𝍸 I
2	IIII
3	IIII
4	𝍸 I
5	𝍸
6	𝍸

a) From the tally chart, what is the experimental probability of rolling a 3?

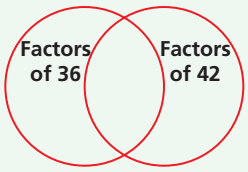
b) What is the theoretical probability of rolling a 3?

c) Compare the experimental probability and theoretical probability.

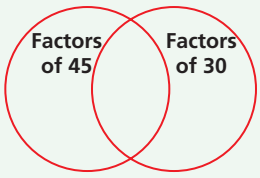
Chapter 6 Introduction to Fraction Operations

5. Use divisibility rules to determine the factors of each pair of numbers. Copy the Venn diagrams and use them to record your results.

a)



b)



6. Add. Write each answer in lowest terms.

a) $\frac{2}{5} + \frac{1}{5}$ **b)** $\frac{1}{14} + \frac{13}{14}$

c) $\frac{1}{8} + \frac{7}{8}$ **d)** $\frac{1}{12} + \frac{7}{12}$

7. Subtract. Write each answer in lowest terms.

a) $\frac{6}{7} - \frac{4}{7}$ **b)** $\frac{7}{15} - \frac{7}{15}$

c) $\frac{7}{8} - \frac{3}{8}$ **d)** $\frac{7}{10} - \frac{1}{10}$

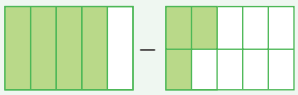
8. Jessie needs $\frac{7}{8}$ of a bag of nails to build a skateboard ramp. She has $\frac{5}{8}$ of a bag. André gives her another $\frac{1}{8}$ of a bag. Does she have enough? If not, how much more of a bag does she need?

Chapter 7 Add and Subtract Fractions

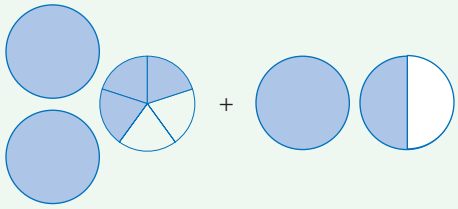
9. Write an expression to represent each diagram. Then add or subtract.

a)

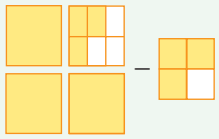
b)



c)



d)



10. Add or subtract. Write each answer in lowest terms.

a) $\frac{1}{3} + \frac{4}{9}$ **b)** $\frac{7}{10} - \frac{1}{4}$ **c)** $4\frac{5}{6} - 1\frac{1}{6}$

d) $2\frac{1}{4} + 1\frac{1}{4}$ **e)** $1\frac{2}{3} - \frac{1}{4}$ **f)** $2\frac{4}{5} + 5\frac{1}{2}$

11. David and Serena are selling cookies at the school bake sale. David has $3\frac{5}{12}$ trays left to sell. Serena has $2\frac{3}{4}$ trays left.

a) David sells another $1\frac{5}{6}$ trays. How much does he have left now?

b) Serena sells another $2\frac{3}{8}$ trays. How much does she have left?

c) Serena gives her remaining cookies to David to sell. How much in total does he now have to sell?

Chapter 8 Circles

Use 3.14 for π in calculations.

Answer to the nearest tenth of a unit, unless otherwise indicated.

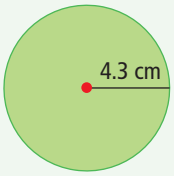
12. Using 1-cm grid paper, plot points A(2, −3) and B(−1, 4).

a) Using point A as the centre, construct a circle of radius 4 cm.

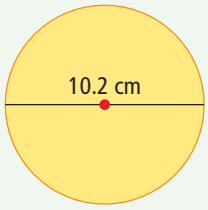
b) Does point B lie within the circle?

13. What is the circumference and area of each circle?

a)

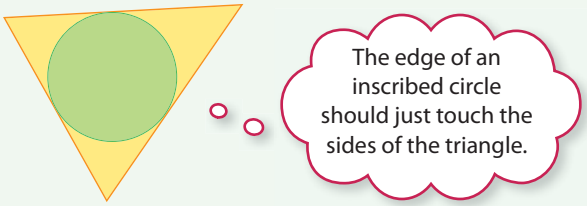


b)



14. A wheelchair wheel has a radius of 30 cm. It makes one complete rotation in a straight line on a flat surface. How far, horizontally, has the centre of the wheel travelled from where it started?

15. Construct an inscribed circle.



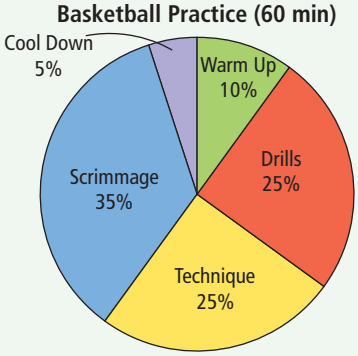
a) Draw a triangle with angles 50°, 70°, and 60°. Label it PQR.

b) Construct the bisectors of each angle. Label the point of intersection S.

c) With a compass, construct an inscribed circle using point S as the centre.

16. If the radius of a circle is doubled, what happens to the area of the new circle? Use examples to show how you know.

17. A basketball coach uses the following circle graph to plan his team's practices.



a) On what activity do team members spend the most time?

b) On what activities do team members spend a total of 70% of their time? Give two possible answers.

c) If practice starts at 4:00 p.m., write a possible schedule for the practice.

18. Some Grade 7 students were surveyed about their favourite weekend activities. Make a circle graph to display the data.

Weekend Activity	Number of Students
Go to a movie	3
Play a sport	9
Read a book	9
Play video games	3
Other	6

Task

Is This a Fair Game?

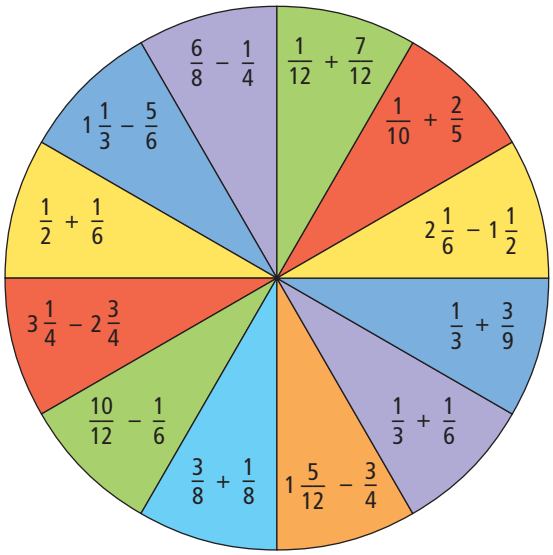
Materials

- compass or pin and string
- ruler
- pencil and paper clip (for spinner)

Here is a spinner.

Two players take turns spinning the spinner.

- Player A scores a point for landing on a section with an answer equivalent to $\frac{1}{2}$.
- Player B scores a point for landing on a section with an answer equivalent to $\frac{2}{3}$.
- Any player who lands on a line gets a second spin.
- The first player to score 10 points wins.



1. Play the game. Is this a fair game? Explain your answer.

2. Create your own spinner in the shape of a circle. Use fraction addition and subtraction questions. What changes could you make so that the probability of landing on an answer of $\frac{1}{2}$ is $\frac{1}{3}$, 1:3, or $33\frac{1}{3}\%$? Justify your new design.

3. Create a circular spinner with a 100% probability of landing on an answer of $\frac{1}{2}$. Justify your new design.