

Chapter 8

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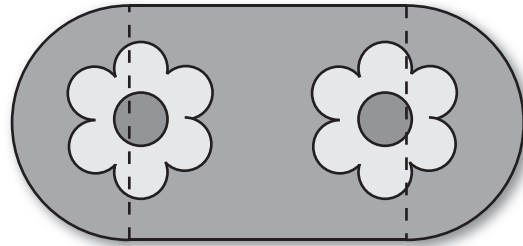
**Chapter
8****Circles and Area**

Dear Family,

Many families enjoy making crafts. Sewing, scrap-booking, landscaping, gardening, and doing woodwork are just a few activities that use mathematics to form pleasing shapes.

When you lay out a circular garden in a landscape, you cut the edging to match the circumference of the circle. Then you curve the edging around the circular plot to define the area. The area of the circle is used to figure out how much mulch, plants, and flowers you will need.

Similarly, basting the edge of a placemat involves figuring out the length of the edge. For a placemat with semicircles on each end, you use the circumference to find the lengths around the curve. You then add those lengths to the sides of the rectangular portion in the middle.



Find a craft to enjoy with your student. Ask your student to help with the following.

- Draw a plan of your project. You can use combinations of geometric shapes (like the rectangle and circle in the placement above) to help find the measurements.
- Find the parts of the project that use measurements around the perimeter and then make a list of the lengths of each edge. Use these lengths to plan for outlining and edging material.
- Find the parts of the project that fill in an area and make a list of the areas for each part. You will use these lengths to plan for interior material, such as the amount of fabric or wood.

As you work with your student, ask him or her whether to cut material exactly to the measurements or leave a little extra—different crafts have different needs. Work out strategies for changing your plans to match the materials you have readily available.

You and your student will have a lasting record of your work together—have fun showing it off to your friends and family!

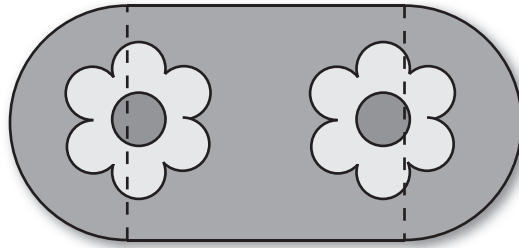
Capítulo
8**Círculos y área**

Estimada Familia:

Muchas familias disfrutan haciendo manualidades. Costura, álbumes de recortes, diseño de jardines, jardinería y trabajos en madera son solo algunas de las actividades que usan las matemáticas para hacer formas agradables.

Cuando se dispone un jardín circular en un diseño, se cortan los bordes para hacer coincidir la circunferencia del círculo. Luego se curvan los bordes alrededor del plano circular para definir el área. Se usa el área del círculo para averiguar cuánta composta, plantas y flores se necesitarán.

De forma similar, al hacer el hilván de un mantel individual se averigua el largo del borde. Para un individual con semicírculos en cada extremo, se puede usar la circunferencia para hallar los largos alrededor de la curva. Luego se pueden sumar esos largos a los lados de la porción rectangular en el medio.



Busque una manualidad que disfrute hacer con su estudiante. Pida a su estudiante ayuda con lo siguiente:

- Dibujen un plano de su proyecto. Pueden usar combinaciones de formas geométricas (como el rectángulo y círculo en la disposición anterior) para ayudar a encontrar las medidas.
- Encuentren las partes del proyecto que usan las medidas alrededor del perímetro y luego hagan una lista de los largos de cada borde. Usen estos largos para planear el delineado y el material del reborde.
- Encuentren las partes del proyecto que encajan en un área y hagan una lista de las áreas para cada parte. Usarán estos largos para planear el material interior, como por ejemplo la cantidad de tela o madera.

A medida que va trabajando con su estudiante, pregúntele si debe cortar el material exacto según las medidas o si debe dejar un poquito extra—las diversas manualidades tienen necesidades diferentes. Diseñen estrategias para cambiar sus planos y hacer que sus materiales se adapten a los materiales que ya tiene disponibles.

Usted y su estudiante tendrán un registro duradero de su trabajo juntos—diviértanse mostrándolo a sus amigos y familiares!

Activity
8.1**Start Thinking!**
For use before Activity 8.1

Pi, written π , is the ratio of a circle's circumference to its diameter. The digits of π do not repeat and continue on without end.

“Piems” are poems that can help you remember π to a certain number of digits. The length of each word in a “piem” represents a digit of π . For example:

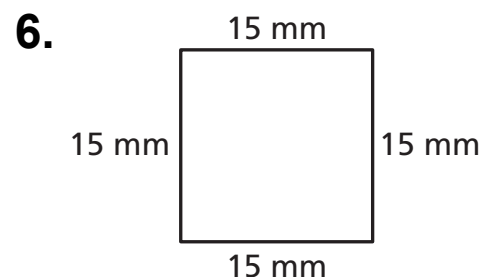
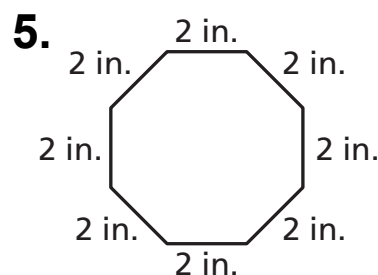
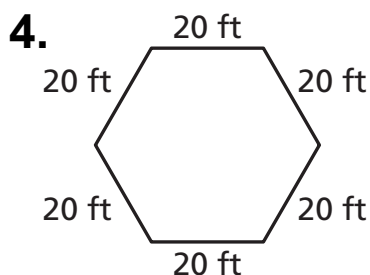
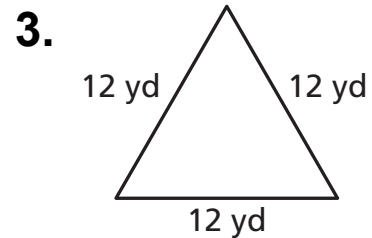
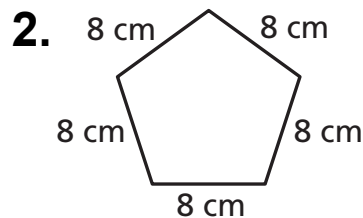
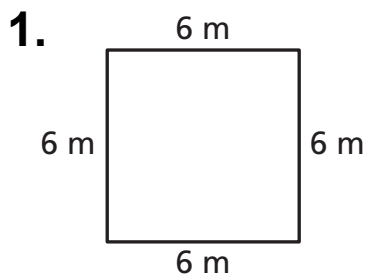
Piem: **Can I find a trick recalling pi easily?**

$$\pi \approx 3.1415926$$

Write your own “piem” to represent at least the first five digits of π (3.1415).

Activity
8.1**Warm Up**
For use before Activity 8.1

Find the perimeter of the polygon.



Lesson
8.1

Start Thinking!

For use before Lesson 8.1

Is it easier to measure the diameter or circumference of a tree trunk? Why?

Is it easier to measure the diameter or circumference of a quarter? Why?

In general, when is it easier to measure the diameter of a circular object? When is it easier to measure the circumference?

Lesson
8.1

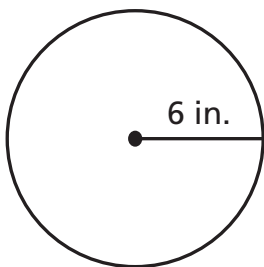
Warm Up

For use before Lesson 8.1

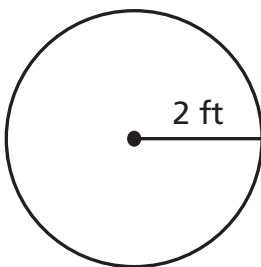
Find the circumference of the circle.

Use 3.14 or $\frac{22}{7}$ for π .

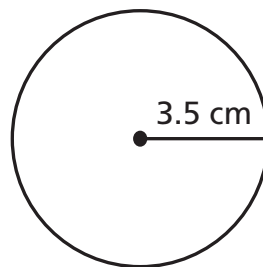
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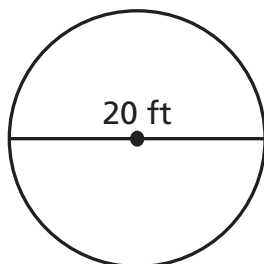
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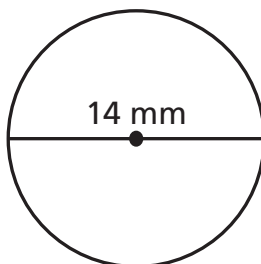
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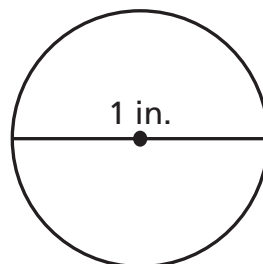
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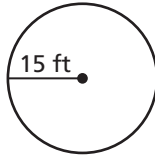
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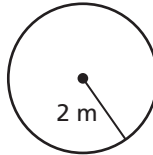
8.1 Practice A

Find the diameter of the circle.

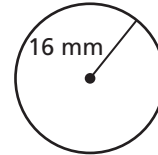
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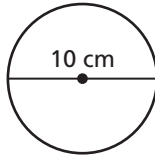


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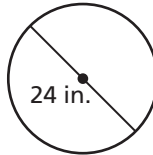


Find the radius of the circle.

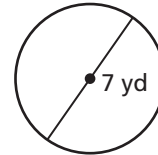
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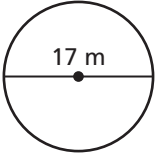


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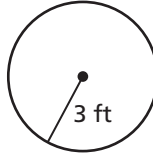


Find the circumference of the circle. Use 3.14 or $\frac{22}{7}$ for π .

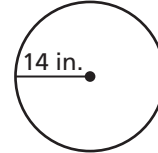
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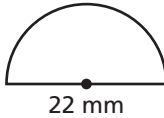


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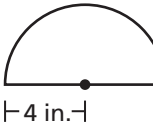


Find the perimeter of the semicircular region.

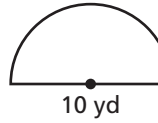
10.



11.



12.



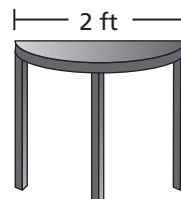
13. A circular ink spot has a circumference of 25.12 millimeters. A minute later, it has a circumference of 75.63 millimeters.

- Estimate the diameter of the ink spot each minute.
- How many times greater is the diameter of the ink spot compared to the previous minute?

14. You are enclosing a circular flower garden with a fence that costs \$2.99 per foot. The radius of the garden is 7 feet. How much will it cost to buy the fence?

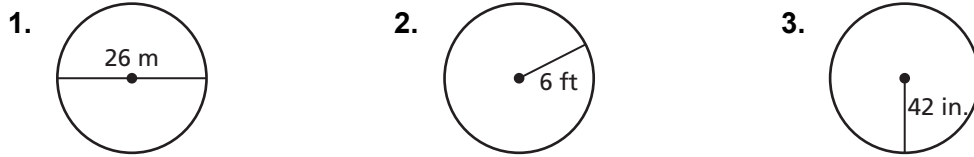
(Use $\frac{22}{7}$ for π .)

15. Find the perimeter of the semicircular tabletop shown at the right.

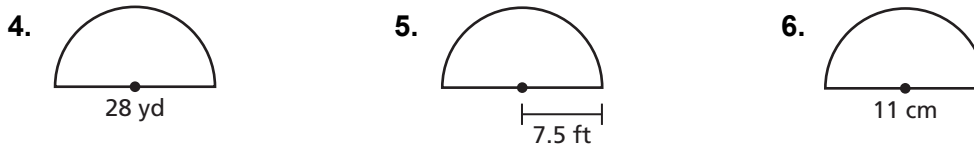


8.1 Practice B

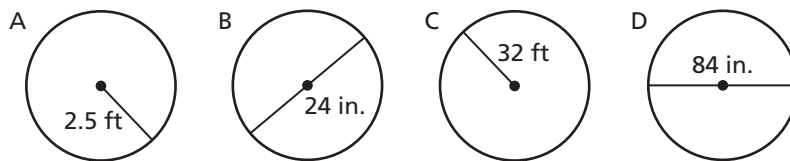
Find the circumference of the circle. Use 3.14 or $\frac{22}{7}$ for π .



Find the perimeter of the semicircular region.

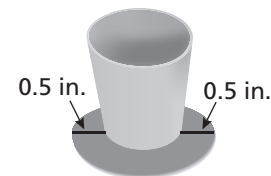


7. Copy and complete the table for Circles A, B, C, and D.

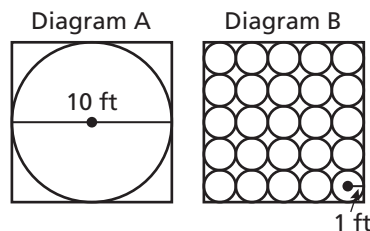


Circle	A	B	C	D
Radius	2.5 ft	? ft	32 ft	? ft
Diameter	? in.	24 in.	? in.	84 in.

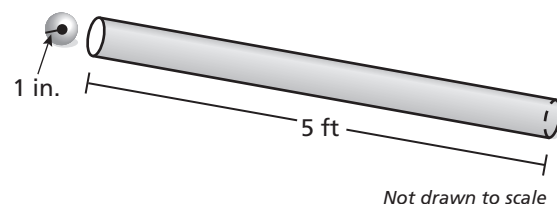
8. A coaster has a circumference of 12.56 inches. Suppose the same amount of coaster is visible around the bottom of a glass as shown. What is the circumference of the glass?



9. Are the side lengths of the squares in Diagram A and Diagram B equivalent? Explain your reasoning?



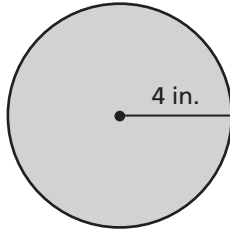
10. You release a ball with a radius of 1 inch into a pipe as shown. How many times will the ball rotate before it falls out of the other end of the pipe?



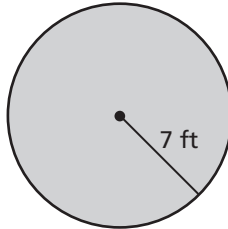
8.1 Enrichment and Extension**Changing Dimensions**

Find the circumference of the circle. Then find the circumference if the radius is multiplied by 2. Use 3.14 for π .

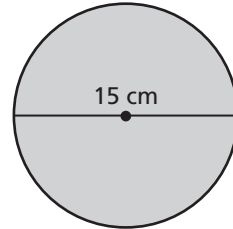
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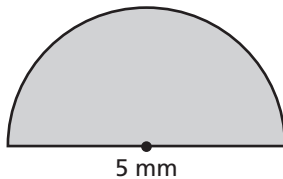
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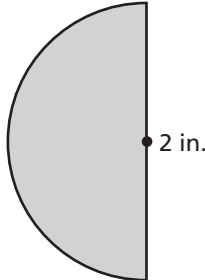
4. What happens to the circumference of a circle when its radius is multiplied by 2?
5. What happens to the circumference of a circle when its radius is multiplied by a positive number n ?

Find the perimeter of the semicircle. Then find the perimeter if the radius is multiplied by $\frac{1}{2}$. Use 3.14 for π .

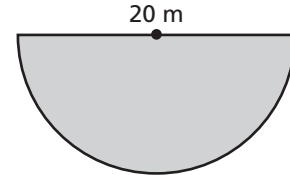
6.



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8.



9. What happens to the perimeter of a semicircle when its diameter is multiplied by $\frac{1}{2}$?
10. What happens to the perimeter of a semicircle when its radius is multiplied by a positive number n ?

8.1

Puzzle Time

Why Was The Gentleman Who Was Selling
Watches Unhappy?

A	B	C	D	E	F
G	H				

Complete each exercise. Find the answer in the answer column. Write the word under the answer in the box containing the exercise letter.

62.8 mm
MUCH

15 m
HE

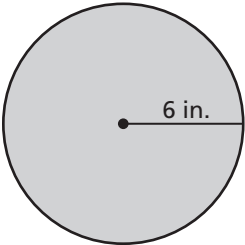
44 cm
TIME

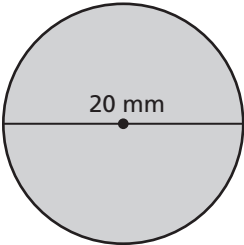
37.68 in.
TOO

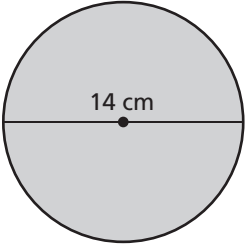
A. The diameter of a circle is 30 meters. Find the radius.

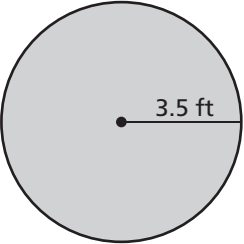
B. The radius of a circle is 11 millimeters. Find the diameter.

Find the circumference of the circle. Use 3.14 or $\frac{22}{7}$ for π .

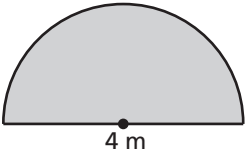
C.

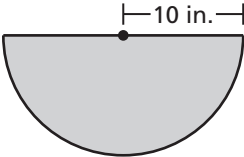
D.

E.

F.

Find the perimeter of the semicircle. Use 3.14 for π .

G.

H.

51.4 in.
HANDS

22 ft
ON

10.28 m
HIS

22 mm
HAD

258

Big Ideas Math Red
Resources by Chapter

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Activity
8.2**Start Thinking!**
For use before Activity 8.2

Have you ever used a map to find the distance you need to travel to get from one place to another?

How is using a map similar to finding the perimeter of an irregular shape?

Activity
8.2**Warm Up**
For use before Activity 8.2

Find the perimeter or circumference of the figure described.

1. square with side length 4 cm
2. rectangle with length 5 ft and width 3.5 ft
3. rectangle with length 19 in. and width 7 in.
4. triangle with side lengths 7 m, 8 m, and 10 m
5. circle with radius 9 in.
6. circle with diameter 20 ft

Lesson
8.2

Start Thinking!
For use before Lesson 8.2

Is a race track an example of a composite figure?
Why or why not?

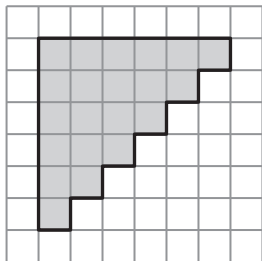
What are some other objects that are composite figures?

Lesson
8.2

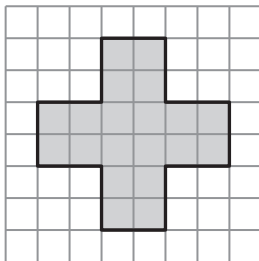
Warm Up
For use before Lesson 8.2

Estimate the perimeter of the figure.

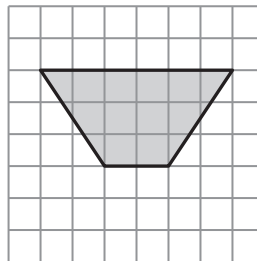
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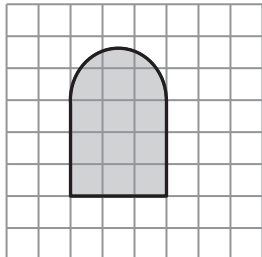
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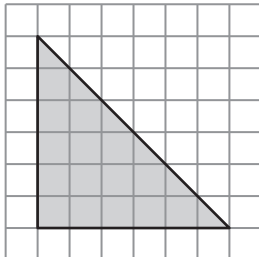
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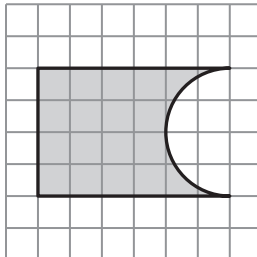
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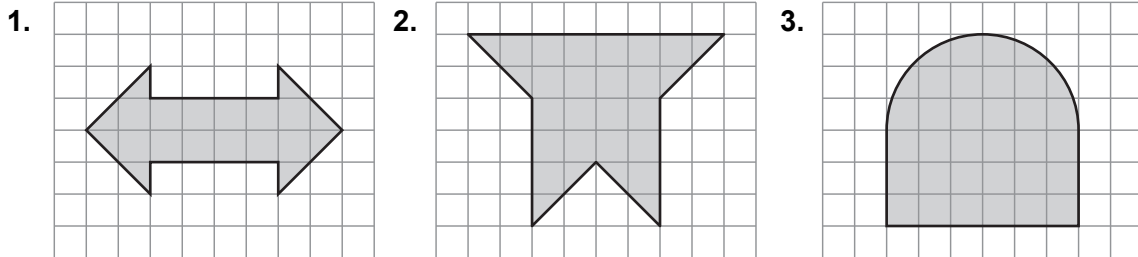


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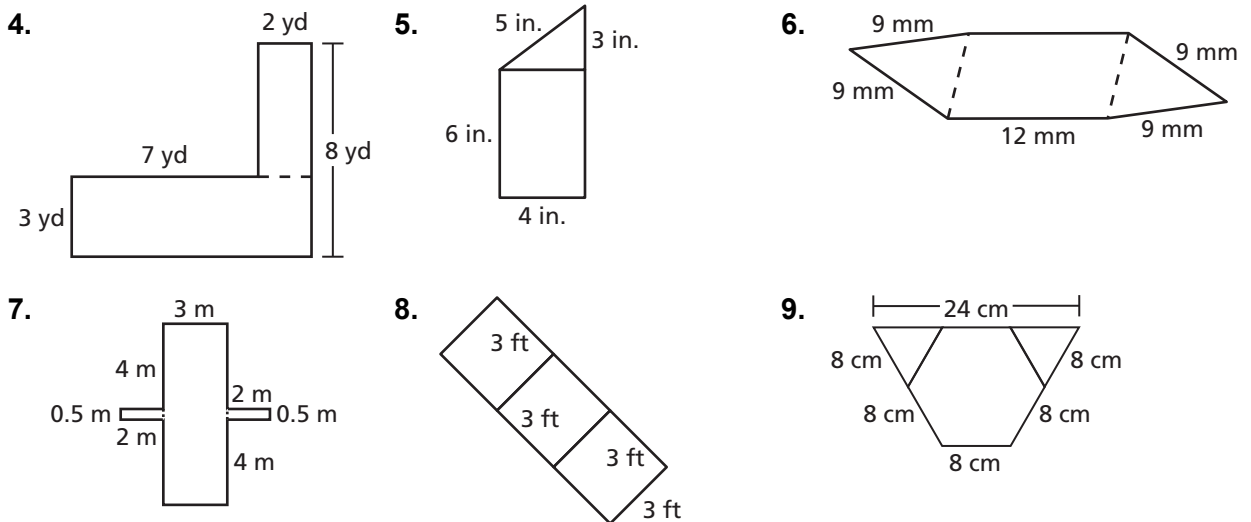


8.2 Practice A

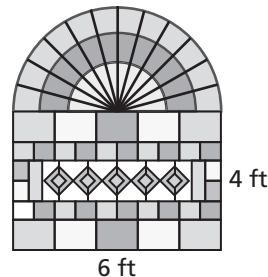
Estimate the perimeter of the figure.



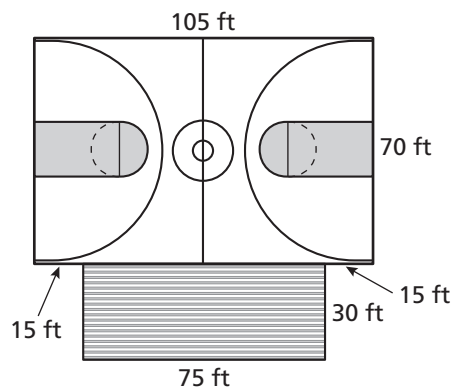
Find the perimeter of the figure.



10. A stained glass window has the dimensions shown. What is the perimeter of the hole that should be cut in the wall in order for the window to be installed?

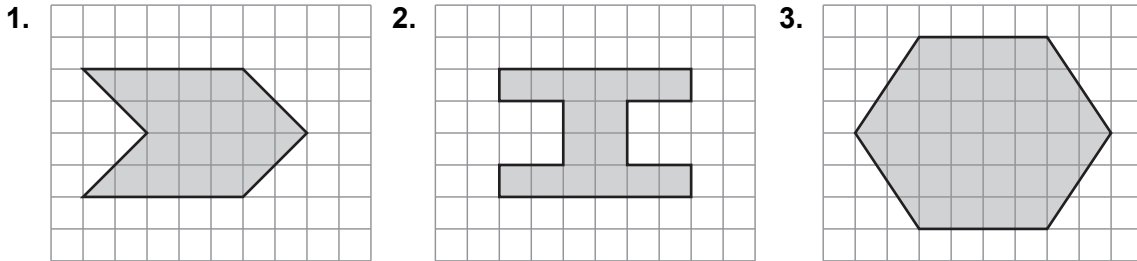


11. The dimensions of a new city park basketball court are shown at the right. A fence is to be built around the court and bleachers. The fence costs \$8.99 per foot. How much will it cost to install the fence?

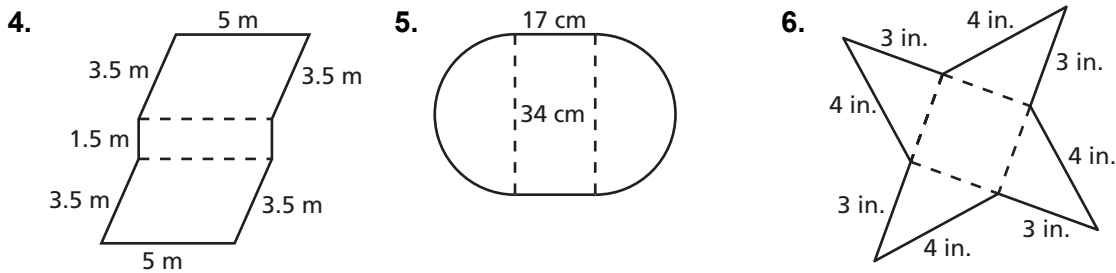


8.2 Practice B

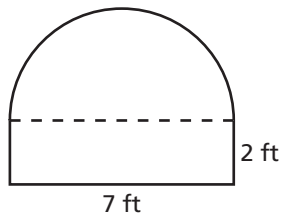
Estimate the perimeter of the figure.



Find the perimeter of the figure.

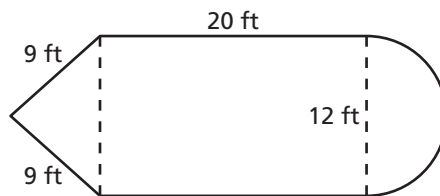


7. Describe and correct the error in finding the perimeter of the figure.

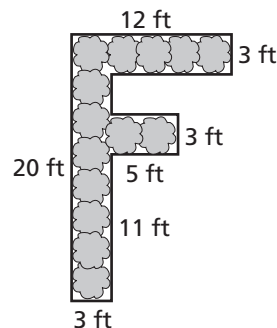


$$\begin{aligned} \times \quad \text{Perimeter} &\approx 2 + 7 + 2 + 21.98 \\ &= 32.98 \text{ ft} \end{aligned}$$

8. A school has a garden in the shape of a pencil. A fence is to be built around the garden. The fence costs \$2.75 per foot. How much will it cost to install the fence?



9. A shrub has been cut and trimmed into the shape of an "F." The owner has hired a landscaper to decrease the perimeter of the shrub by 10 feet. Draw a diagram of how the landscaper might do this. Is there more than one way? Explain.

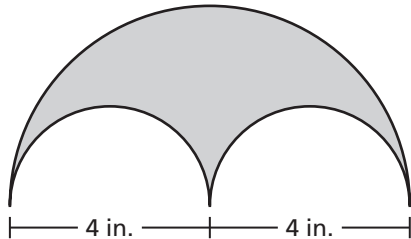


8.2 Enrichment and Extension

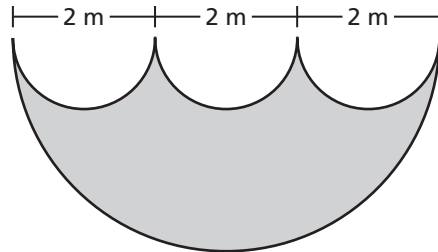
Geometry

Find the perimeter of the figure. Use 3.14 for π .

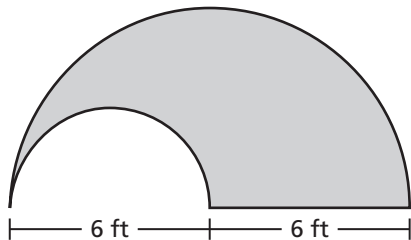
1.



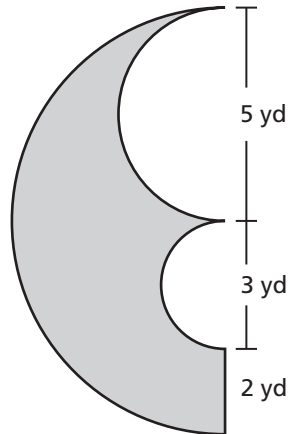
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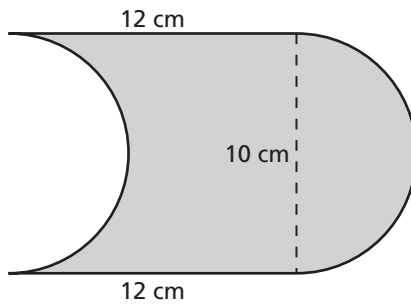
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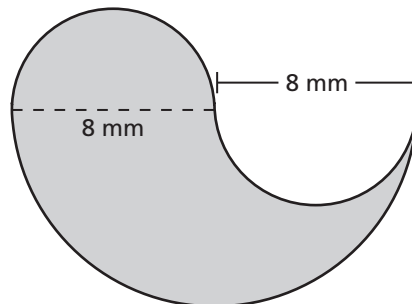
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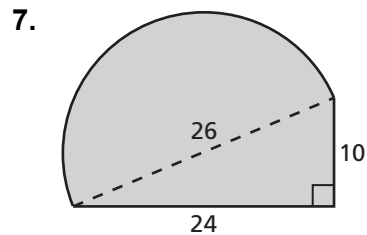
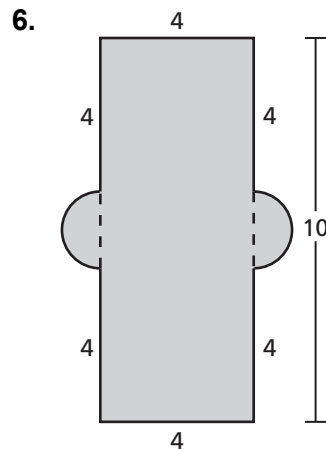
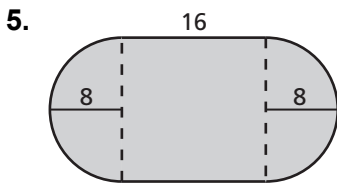
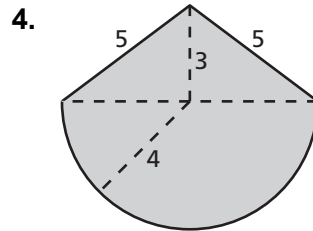
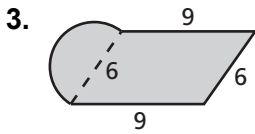
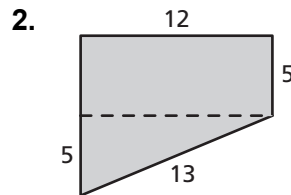
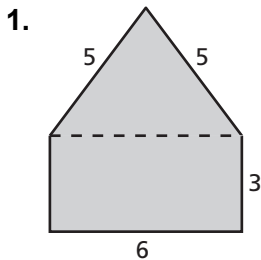


Puzzle Time

What Is The Building In Your City That Has The Most Stories?

Write the letter of each answer in the box containing the exercise number.

Find the perimeter of the figure.



Answers

R. 22.56

B. 40

I. 30.28

Y. 33.42

R. 82.24

L. 22

A. 74.82

1	6	2	5	7	4	3
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Activity
8.3**Start Thinking!**

For use before Activity 8.3

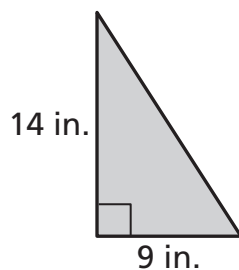
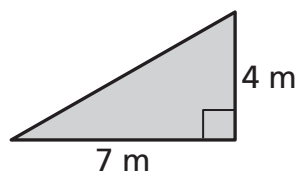
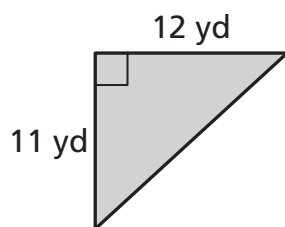
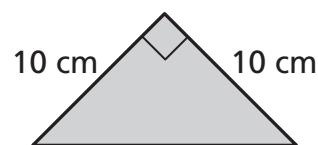
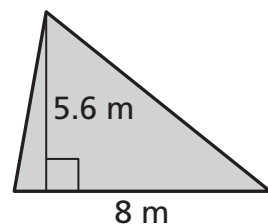
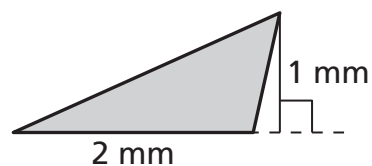
You know how to find the area of squares, rectangles, triangles, trapezoids, and parallelograms.

Describe three different methods you could use to estimate the area of a circle.

Activity
8.3**Warm Up**

For use before Activity 8.3

Find the area of the triangle.

1.**2.****3.****4.****5.****6.**

Lesson
8.3**Start Thinking!**

For use before Lesson 8.3

Two approximations for π are $\frac{22}{7}$ and 3.14.

In finding the area of a circle, when is it easier to use $\frac{22}{7}$? When is it easier to use 3.14?

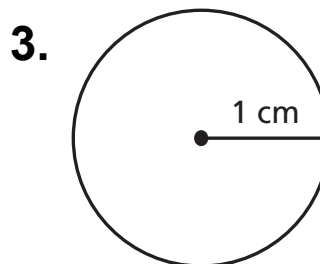
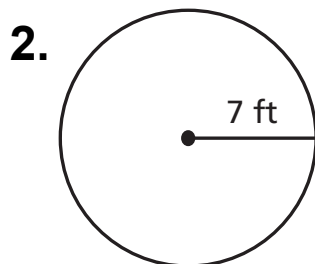
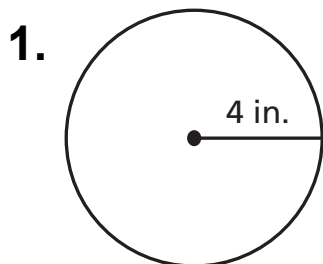
Write a word problem involving the area of a circular object. Exchange problems with a classmate and solve your classmate's problem.

Is it easier to use $\frac{22}{7}$ or 3.14 for π to solve your classmate's problem?

Lesson
8.3**Warm Up**

For use before Lesson 8.3

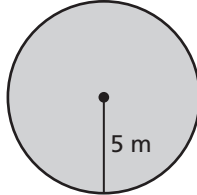
Find the area of the circle. Use 3.14 or $\frac{22}{7}$ for π .



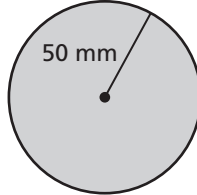
8.3 Practice A

Find the area of the circle. Use 3.14 or $\frac{22}{7}$ for π .

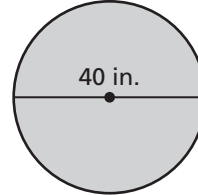
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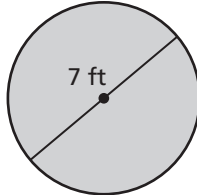
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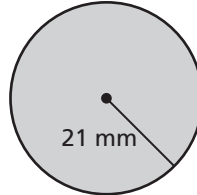
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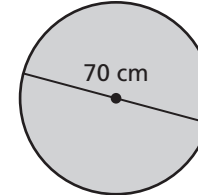
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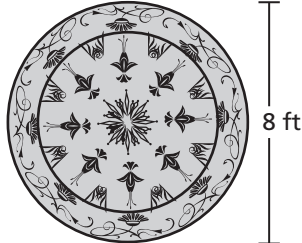


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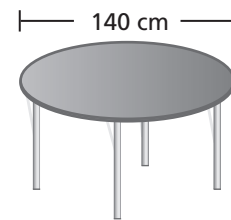


Find the area of the object.

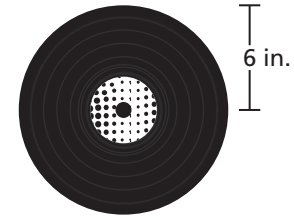
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9.



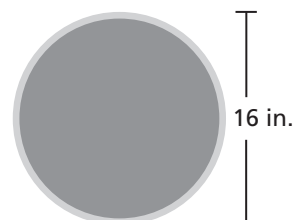
10. You use the compass to draw a circle. What will be the area of the circle?



11. What fraction of a square inch is the area of one side of a penny? Use $\frac{22}{7}$ for π . Write your answer in simplest form.



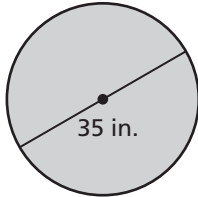
12. To make a pizza, you spread pizza sauce over all but a 1-inch area around the outside edge as shown. What area of the crust is covered with sauce?



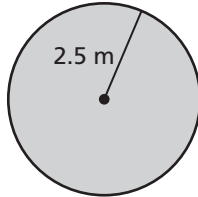
8.3 Practice B

Find the area of the circle. Use 3.14 or $\frac{22}{7}$ for π .

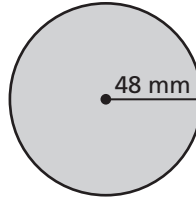
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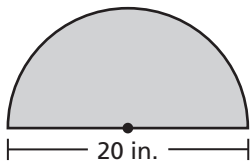


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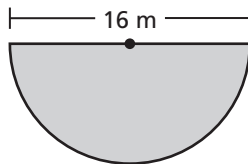


Find the area of the semicircle.

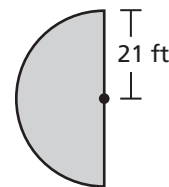
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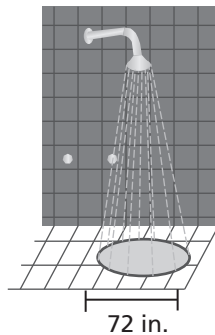
6.



7. The shadow of an object is roughly the same size as the object. What is the area of the circular shadow of the hot air balloon?



8. How many *square feet* of the ground are sprayed by the beach shower?

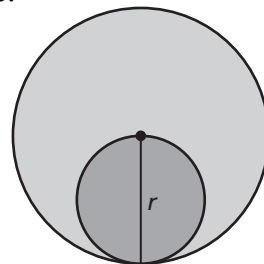


9. The radius of the small circle is half the radius of the large circle.

a. Use the radius r to write a formula for the area of the large circle.

b. Use the radius $\frac{r}{2}$ to write a formula for the area of the small circle.

c. How does the area of a circle compare to the area of another circle whose radius is twice as large? Explain your reasoning.



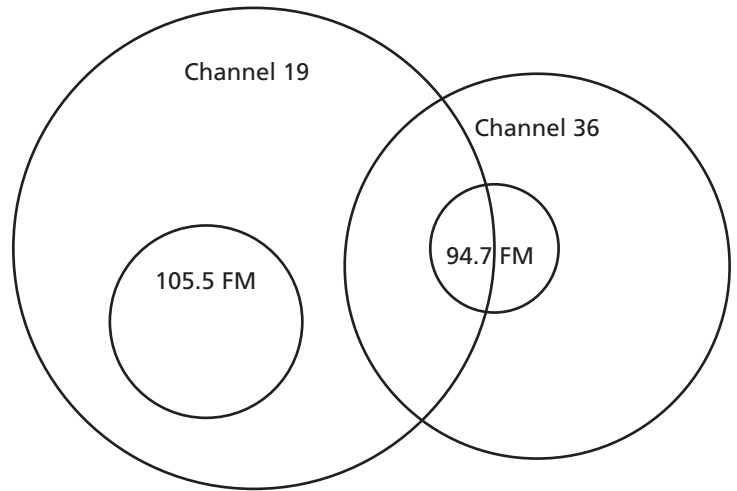
10. The number of square inches of a circle's area is equal to the number of inches of its circumference. What is the radius of the circle? Explain how you found your answer.

8.3 Enrichment and Extension

Where Are You Located?

The circular broadcast areas of two television stations and two radio stations are shown in the diagram. Use 3.14 for π .

	Broadcast radius (mi)
TV Channel 19	150
TV Channel 36	120
Radio 105.5 FM	60
Radio 94.7 FM	40



1. How many times larger is the broadcasting area of Channel 19 than the broadcasting area of Channel 36?
2. How many times larger is the broadcasting area of 105.5 FM than the broadcasting area of 94.7 FM?
3. What percent of the broadcast area of Channel 19 is also in the broadcast area of 105.5 FM?
4. What fraction of the broadcast area of Channel 36 is also in the broadcast area of 94.7 FM?
5. Half of the broadcast area of 94.7 FM can watch both television channels.
 - a. What percent of the broadcast area of Channel 19 can listen to 94.7 FM?
 - b. You can watch one of the television channels and can listen to one of the radio stations. Draw a diagram and shade the area where you may be located. What is the total area of the shaded region?
 - c. Your friend can watch Channel 19 but cannot listen to either of the radio stations. You do not know if your friend can watch Channel 36. Draw a diagram and shade the area where your friend may be located. What is the total area of the shaded region?

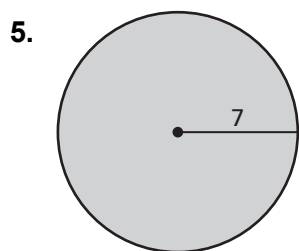
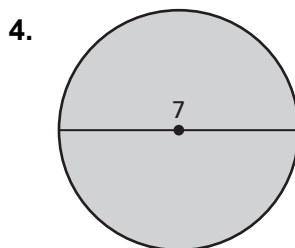
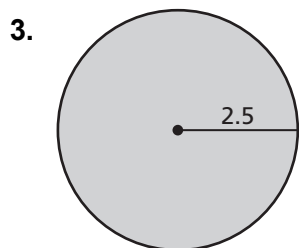
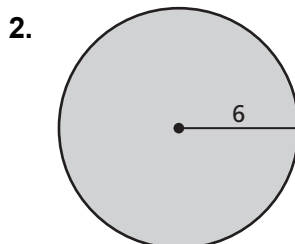
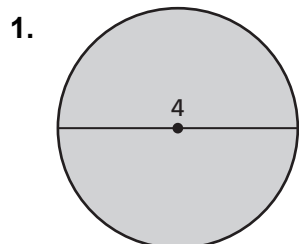


Puzzle Time

What Do Little Piggies Do As Soon As They Get Home From School?

Write the letter of each answer in the box containing the exercise number.

Find the area of the circle. Use 3.14 or $\frac{22}{7}$ for π .



Answers

K. 38.465 units²

H. 12.56 units²

M. 19.625 units²

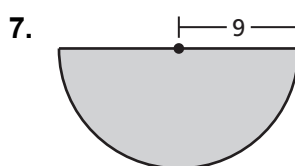
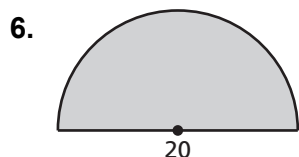
R. 127.17 units²

W. 154 units²

O. 113.04 units²

A. 157 units²

Find the area of the semicircle. Use 3.14 for π .



1	6	3	5	2	7	4
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Activity
8.4**Start Thinking!**

For use before Activity 8.4

When might it be useful to know how to find the area of a real-life composite figure?

Activity
8.4**Warm Up**

For use before Activity 8.4

Find the area of the figure described.

1. square with side length 10 ft
2. square with side length 16 in.
3. rectangle with length 15 m and width 10 m
4. triangle with base 5 cm and height 12 cm
5. circle with radius 10 ft
6. circle with diameter 100 yd

Lesson
8.4

Start Thinking!

For use before Lesson 8.4

Draw a picture of a house with a roof and a chimney.

How can you use a ruler and some calculations to find the area covered by your drawing?

Use a ruler and the method you described to estimate the area of the house.

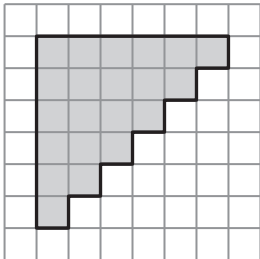
Lesson
8.4

Warm Up

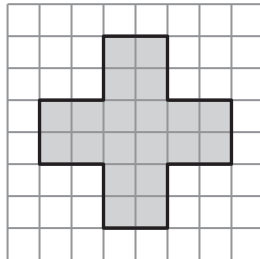
For use before Lesson 8.4

Find the area of the figure.

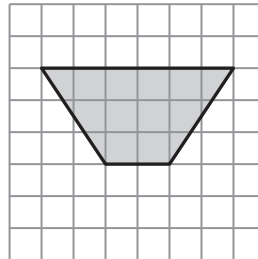
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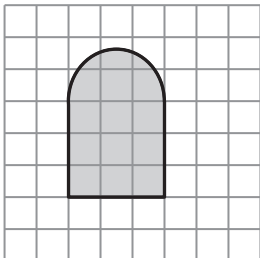
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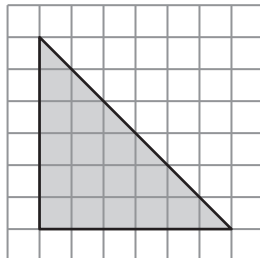
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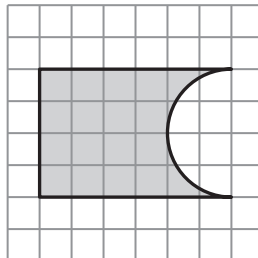
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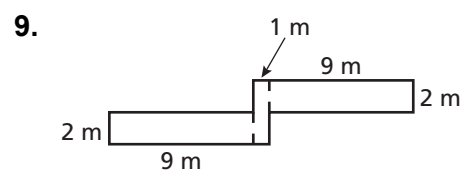
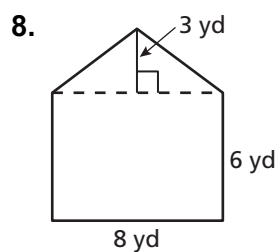
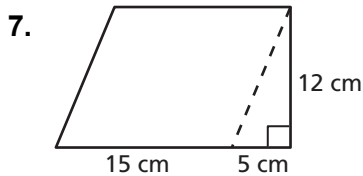
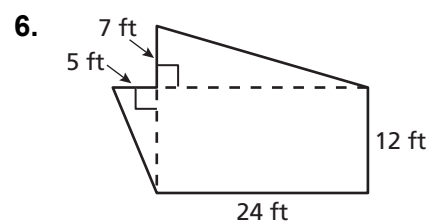
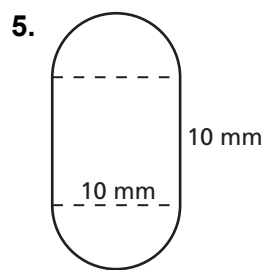
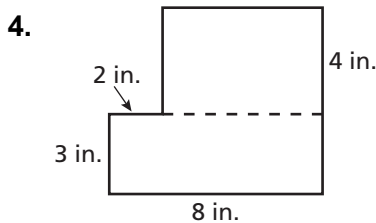
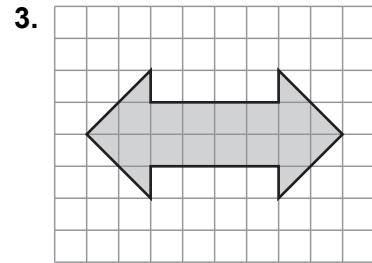
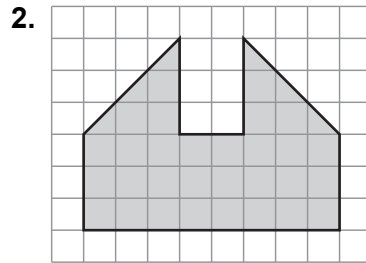
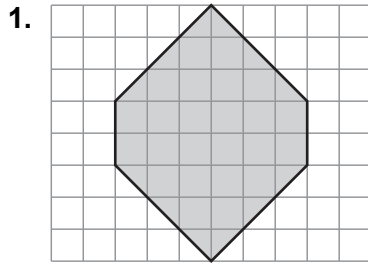


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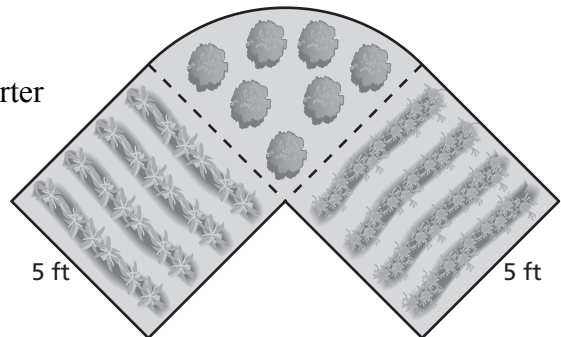


8.4 Practice A

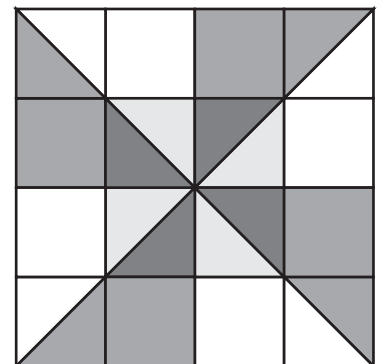
Find the area of the figure.



10. A garden is made up of two squares and a quarter circle. What are the perimeter and area of the garden?

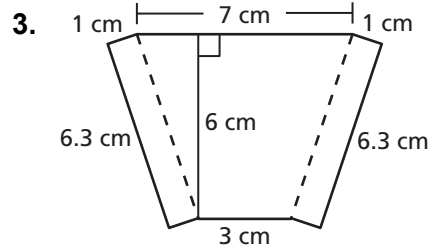
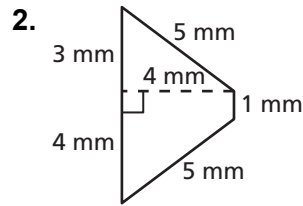
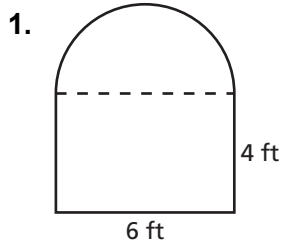


11. A pinwheel design for a quilt is shown at the right. Each square of the design has a side length of 3 inches.
- Find the total area of the design.
 - Find the total area of the four large shaded triangles.
 - The quilt will be made of 30 pinwheel designs. The material to make the large triangles costs \$0.08 per square inch. How much will it cost to purchase the material to make the triangles for the quilt?

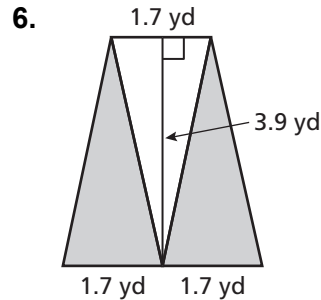
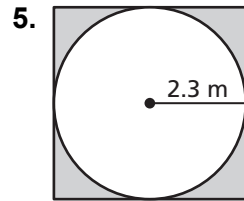
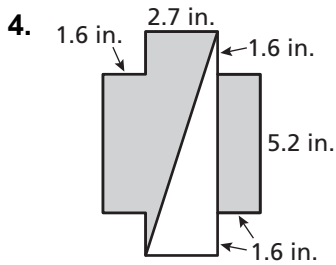


8.4 Practice B

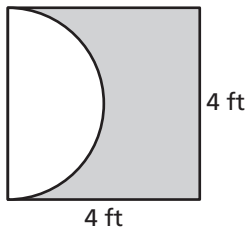
Find the perimeter and area of the figure.



Find the area of the shaded region of the figure.



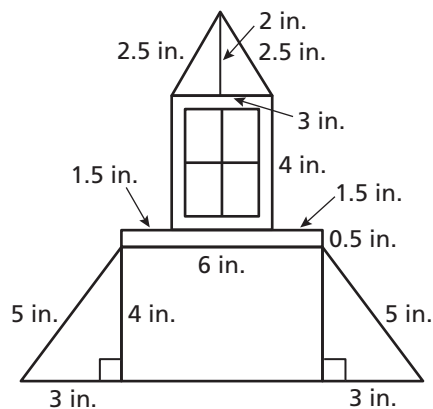
7. Describe and correct the error in finding the area of the shaded region of the figure.



$$\begin{aligned} \text{Shaded area} &\approx (4 \cdot 4) - (3.14 \cdot 2^2) \\ &= 16 - 12.56 \\ &= 3.44 \text{ ft}^2 \end{aligned}$$

8. Jackson Well Middle School's logo is shown at the right.

- Find the perimeter of the logo.
- Find the area of the logo.
- Will the logo fit on a notebook cover that is 11 inches long and 8.5 inches wide? Explain.

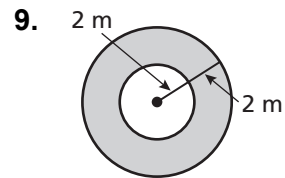
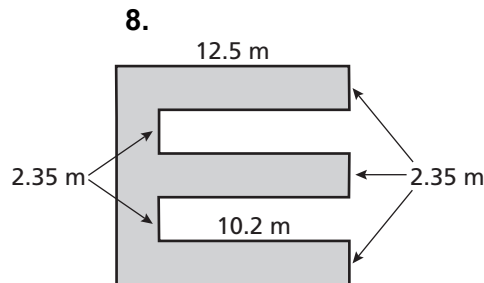
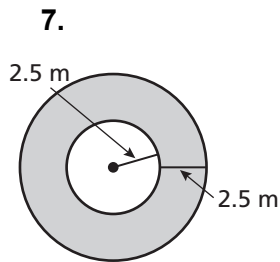
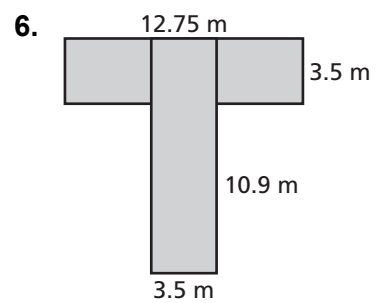
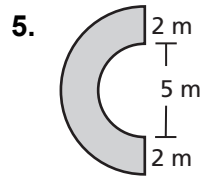
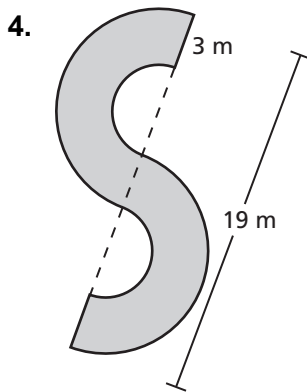
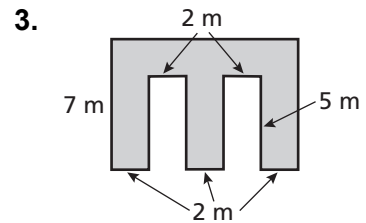
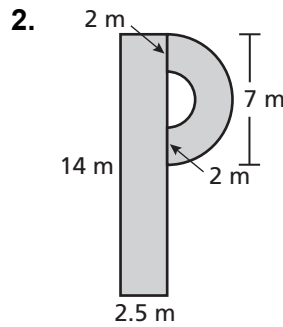
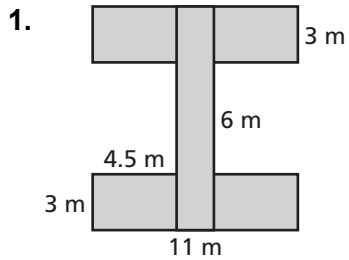


Jackson Well Middle School

8.4 Enrichment and Extension

Composite Letters

The letters consist of rectangles, semicircles, and circles. Find the area of the letter.



10. Order the letters from least to greatest area. What do they spell?

8.4

Puzzle Time

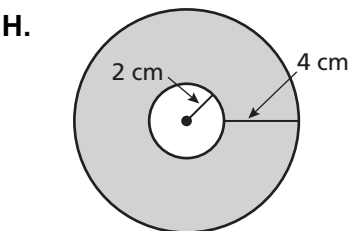
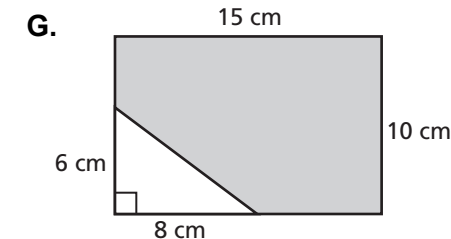
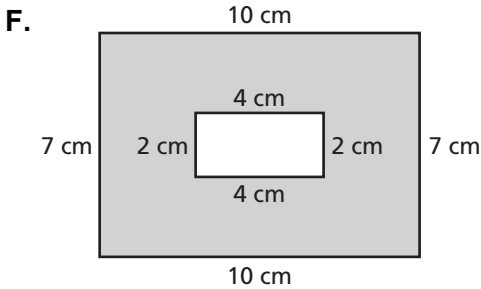
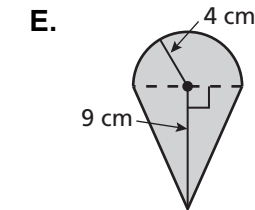
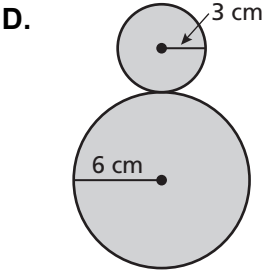
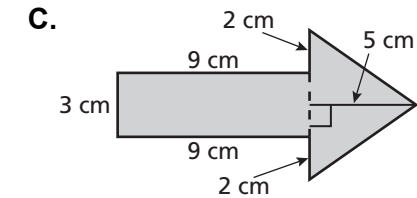
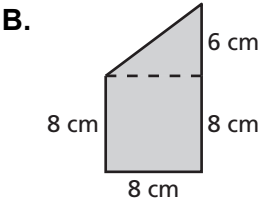
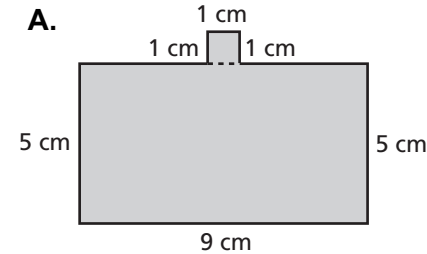
What Did One Flea Say To Another Flea?

A	B	C	D	E	F
G	H				

Complete each exercise. Find the answer in the answer column. Write the word under the answer in the box containing the exercise letter.

61.12 cm ² HOP
126 cm ² A
46 cm ² DO
100.48 cm ² DOG

Find the area of the shaded region of the figure.



44.5 cm ² WALK
141.3 cm ² OR
88 cm ² WE
62 cm ² ON

**Chapter
8****Technology Connection**

For use after Section 8.3

Choosing and Using Estimates for π

Pi—the ratio of a circle's circumference to its diameter—is a nonrepeating infinite decimal. To perform calculations using pi (π) you need to choose an approximation. A common decimal approximation of pi is $\pi \approx 3.14$.

A common fraction approximation of pi is $\pi \approx \frac{22}{7}$.

Some calculators have a button for π which will enter a decimal value for π that is more precise than 3.14. If your calculator has such a button you can find the value it is using by pressing the π button ($\boxed{\pi}$ or $\boxed{2nd} \boxed{[\pi]}$, depending on whether π has its own button or is a secondary function) and $\boxed{=}$ or \boxed{ENTER} .

A circle has a diameter of 83 centimeters.

1. Find the circumference using $\pi \approx 3.14$. Write down all the digits displayed on your calculator.
2. Find the circumference using $\pi \approx \frac{22}{7}$. Write down all the digits displayed on your calculator.
3. If your calculator has a button for π , find the circumference again using the button. Write down all the digits displayed on your calculator.
4. Compare your answers to Exercises 1–3. If you rounded your answers to the nearest hundredth, would the answers be the same?
5. To what place do you think you should round your answers when working with π ? Explain your reasoning.
6. Find the circumference of a circle with a diameter of 138 miles.