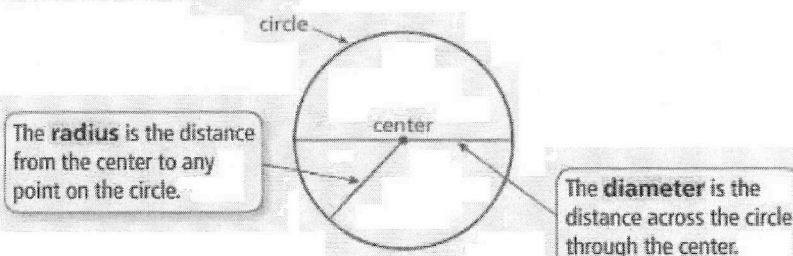


8.1 Lesson

Key Vocabulary

circle, p. 318
center, p. 318
radius, p. 318
diameter, p. 318
circumference, p. 319
pi, p. 319
semicircle, p. 320

A **circle** is the set of all points in a plane that are the same distance from a point called the **center**.



Key Idea

Radius and Diameter

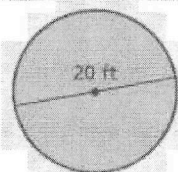
Words The diameter d of a circle is twice the radius r . The radius r of a circle is one-half the diameter d .

Algebra Diameter: $d = 2r$

Radius: $r = \frac{d}{2}$

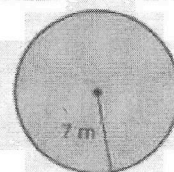
EXAMPLE 1 Finding a Radius and a Diameter

- a. The diameter of a circle is 20 feet. Find the radius.



$$\begin{aligned} r &= \frac{d}{2} \\ &= \frac{20}{2} \\ &= 10 \text{ ft.} \end{aligned}$$

- b. The radius of a circle is 7 meters. Find the diameter.



$$\begin{aligned} d &= 2r \\ &= 2(7) \\ &= 14 \text{ m.} \end{aligned}$$

The distance around a circle is called the **circumference**. The ratio $\frac{\text{circumference}}{\text{diameter}}$ is the same for *every* circle and is represented by the Greek letter π , called **pi**. The value of π can be approximated as 3.14 or $\frac{22}{7}$.

Study Tip

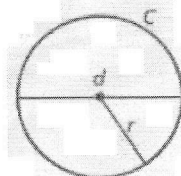
When the radius or diameter is a multiple of 7, it is easier to use $\frac{22}{7}$ as the estimate of π .

Key Idea

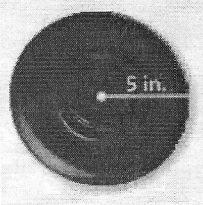
Circumference of a Circle

Words The circumference C of a circle is equal to π times the diameter d or π times twice the radius r .

Algebra $C = \pi d$ or $C = 2\pi r$

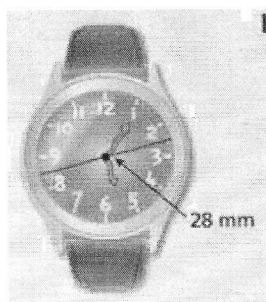


EXAMPLE 2 Finding Circumferences of Circles



- a. Find the circumference of the flying disc. Use 3.14 for π .

$$\begin{aligned} C &= 2\pi r \\ &= 2\pi(5) \\ &= 10\pi \\ &\approx 31.4 \text{ in.} \end{aligned}$$



- b. Find the circumference of the watch face. Use $\frac{22}{7}$ for π .

$$\begin{aligned} C &= \pi d \\ &= 28\pi \\ &\approx \frac{28}{1} \left(\frac{22}{7} \right) \\ &\approx 88 \text{ mm} \end{aligned}$$

EXAMPLE 3 Estimating a Diameter

The circumference of the roll of caution tape decreases 10.5 inches after a construction worker uses some of the tape. Which is the best estimate of the diameter of the roll after the decrease?

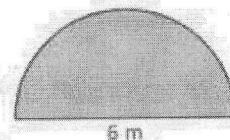
- (A) 5 inches (B) 7 inches (C) 10 inches (D) 12 inches

$$\begin{aligned}
 31.4 - 10.5 &= 20.9 \text{ in} \\
 C &= \pi d \\
 20.9 &\approx 3.14 d \\
 \frac{20.9}{3.14} &= \frac{3.14 d}{3.14} \\
 7 &\approx d
 \end{aligned}$$

EXAMPLE 4 Finding the Perimeter of a Semicircular Region

A semicircle is one-half of a circle. Find the perimeter of the semicircular region.

The straight side is 6 meters long. The distance around the curved part is one-half the circumference of a circle with a diameter of 6 meters.



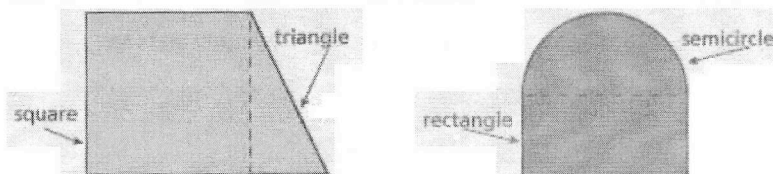
$$\begin{aligned}
 \text{Semi} &= \frac{\pi d}{2} + d && \text{(half the distance around the circle plus the straight side)} \\
 &= \frac{6\pi}{2} + 6 \\
 &= 3\pi + 6 \\
 &\approx 3(3.14) + 6 \\
 &\approx 9.42 + 6 \\
 &\approx 15.42 \text{ m}
 \end{aligned}$$

8.2 Lesson

Key Vocabulary

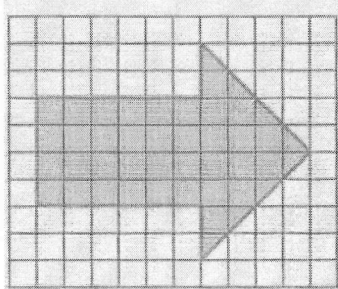
composite figure,
p. 326

A **composite figure** is made up of triangles, squares, rectangles, semicircles, and other two-dimensional figures. Here are two examples.



To find the perimeter of a composite figure, find the distance around the figure.

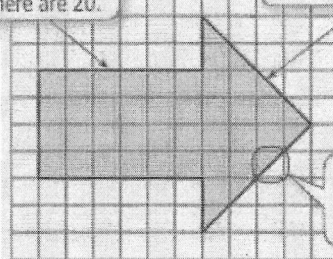
EXAMPLE 1 Estimating a Perimeter Using Grid Paper



Estimate the perimeter of the arrow.

Count the number of grid square lengths around the arrow. There are 20.

Count the number of diagonal lengths around the arrow. There are 8.



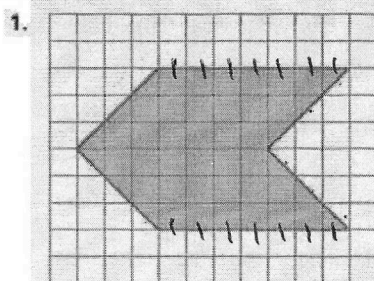
Estimate the diagonal length to be 1.5 units.

$$20 + 8(1.5) = 20 + 12 = 32 \text{ units}$$

On Your Own

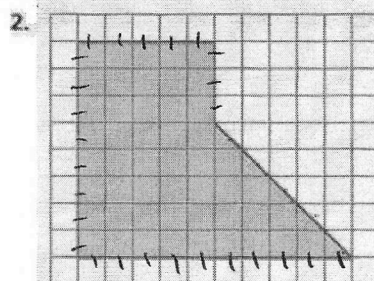
Now You're Ready
Exercises 3–8

Estimate the perimeter of the figure.



$$14 + 12(1.5)$$

$$32$$



$$26 + 5(1.5)$$

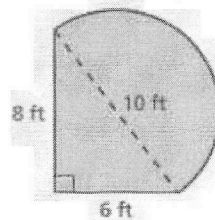
$$33.5$$

EXAMPLE 2 Finding a Perimeter

The figure is made up of a semicircle and a triangle. Find the perimeter.

$$\text{Semi} = \frac{\pi d}{2} = \frac{10\pi}{2} = 5\pi \approx 15.7$$

$$6 + 8 + 15.7 = 29.7 \text{ ft}$$

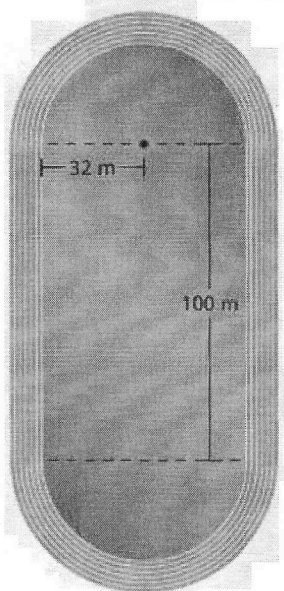


EXAMPLE 3 Finding a Perimeter

The running track is made up of a rectangle and two semicircles. Find the perimeter.

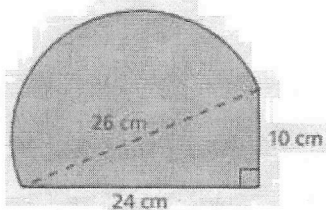
$$C = 2\pi r = 2(\pi)(32) = 64\pi \approx 200.96$$

$$100 + 100 + 200.96 = 400.96 \text{ m}$$

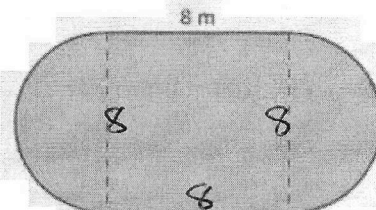


On Your Own

3. The figure is made up of a semicircle and a triangle. Find the perimeter.



4. The figure is made up of a square and two semicircles. Find the perimeter.



Now You're Ready
Exercises 9–11

$$\text{Semi} = \frac{\pi d}{2} = \frac{26\pi}{2} = 13\pi$$

$$13\pi + 24 + 10 = 47\pi \approx 147.58$$

8.3 Lesson

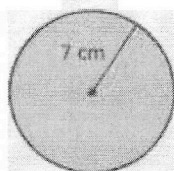
Key Idea

Area of a Circle

Words The area A of a circle is the product of π and the square of the radius.

Algebra $A = \pi r^2$

EXAMPLE 1 Finding Areas of Circles

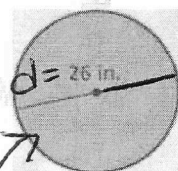


- a. Find the area of the circle. Use $\frac{22}{7}$ for π .

$$A = \pi r^2 = \pi \times r \times r$$

$$= \frac{22}{7} \left(\frac{7}{1}\right) \left(\frac{7}{1}\right) = \frac{1078}{7} = 154 \text{ cm}^2$$

Area is always
"squared"
units



- b. Find the area of the circle. Use 3.14 for π .

$$A = \pi r^2 = \pi \times r \times r$$

$$= 3.14(13)(13)$$

$$= 530.66 \text{ in}^2$$

$$d = 2r$$

or

$$r = \frac{d}{2}$$

$$r = 13$$

EXAMPLE 2 Describing a Distance

You want to find the distance the monster truck travels when the tires make one 360-degree rotation. Which best describes this distance?

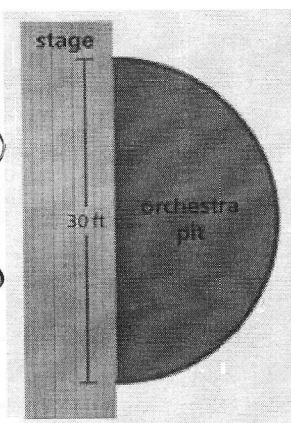
- (A) the radius of the tire (B) the diameter of the tire
 (C) the circumference of the tire (D) the area of the tire

The distance the truck travels after one rotation is the same as the distance **AROUND** the tire.

EXAMPLE 3 Finding the Area of a Semicircle

Find the area of the semicircular orchestra pit.

$$\begin{aligned} d &= 30 \\ \text{so} \\ r &= 15 \end{aligned}$$



$$\text{Semi} = \frac{\pi r^2}{2}$$

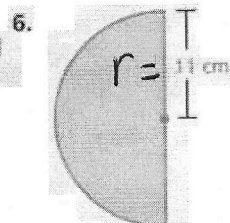
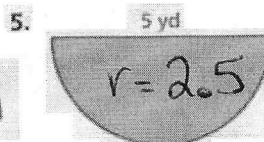
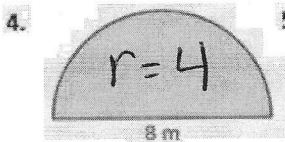
$$\approx \frac{3.14 \times 15 \times 15}{2}$$

$$\approx 353.25 \text{ ft}^2$$

On Your Own

Find the area of the semicircle.

Now You're Ready.
Exercises 13–15



$$\begin{aligned} A &= \frac{\pi r^2}{2} \\ &= \frac{\pi \times 4 \times 4}{2} \\ &= \frac{16\pi}{2} = 8\pi \\ &= 25.12 \text{ m}^2 \end{aligned}$$

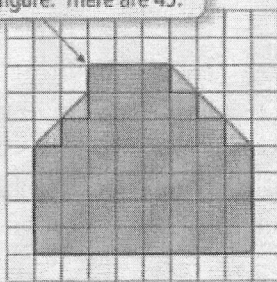
8.4 Lesson

To find the area of a composite figure, separate it into figures with areas you know how to find. Then find the sum of the areas of those figures.

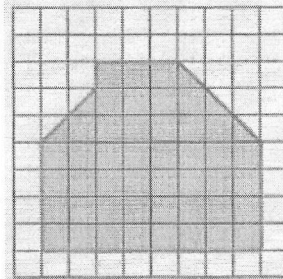
EXAMPLE 1 Finding an Area Using Grid Paper

Find the area of the yellow figure.

Count the number of squares that lie entirely in the figure. There are 45.



Count the number of half squares in the figure. There are 5.



divide by 2

$$45 + \frac{5}{2}$$

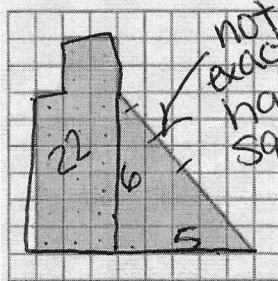
$$45 + 2.5 = 47.5 \text{ square units}$$

On Your Own

Now You're Ready
Exercises 3–8

Find the area of the shaded figure.

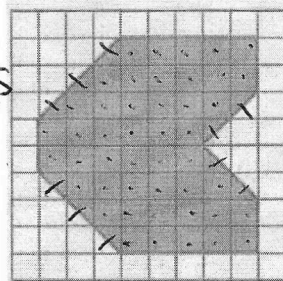
1.



not exactly 2 half squares

$$22 + 15 = 37$$

square units



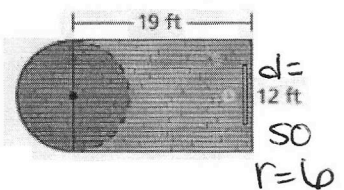
$$\frac{10}{2} = 5$$

$$46 + 5 = 51 \text{ square units}$$

EXAMPLE 2 Finding an Area

Find the area of the portion of the basketball court shown.

The figure is made up of a rectangle and a semicircle. Find the area of each figure.



Rectangle + Semi

$$A = bh + A = \frac{\pi r^2}{2}$$

$$= 19(12) + \frac{\pi(6)^2}{2}$$

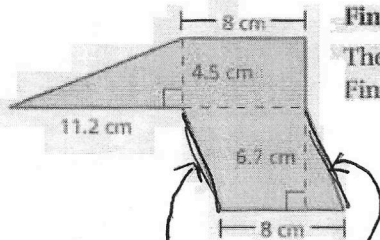
$$= 228 + \frac{36\pi}{2} = 228 + 18(3.14)$$

$$= 228 + 56.52 = 284.52 \text{ ft}^2$$

EXAMPLE 3 Finding an Area

Find the area of the figure.

The figure is made up of a triangle, a rectangle, and a parallelogram. Find the area of each figure.



slants
are
never
heights

Triangle Rectangle Parallelogram

$$\frac{bh}{2} + bh + bh$$

$$\frac{(4.5)(11.2)}{2} + 4.5(8) + 8(6.7)$$

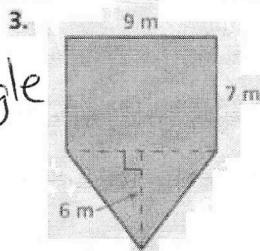
$$25.2 + 36 + 53.6$$

$$= 114.8 \text{ cm}^2$$

On Your Own

Find the area of the figure.

Now You're Ready
Exercises 9 and 10



rectangle + triangle

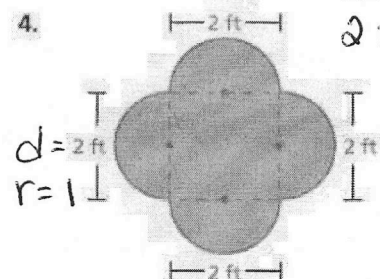
$$bh + \frac{bh}{2}$$

$$9(7) + \frac{9(6)}{2}$$

$$63 + \frac{54}{2}$$

$$63 + 27 = 90 \text{ m}^2$$

4.



2 circles + square

$$2\pi r^2 + bh$$

$$2\pi(1)^2 + 2(2)$$

$$2\pi + 4$$

$$2(3.14) + 4$$

$$6.28 + 4$$

$$10.28 \text{ ft}^2$$