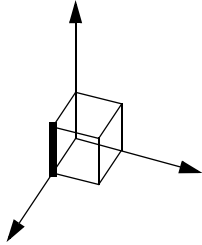


## Section 12.3

# Perimeter and Circumference

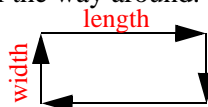
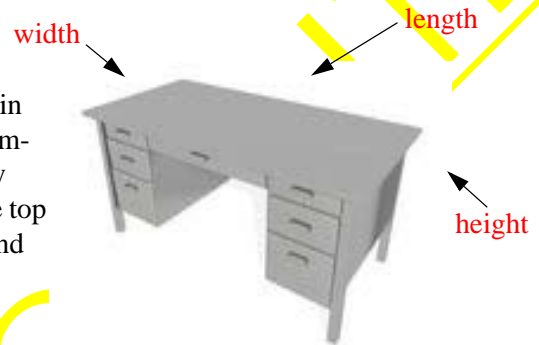
### DIMENSIONS AND SPACE

Every piece of matter has mass and takes space as a three-dimensional object, whether it is a person, rock or unobservable germ. Moreover, this mass can be measured in three different directions or axes. These axes are given many different names. For example, length, width, depth, height, thickness, altitude, and elevation. What they are called is a personal preference, but they will always be three.

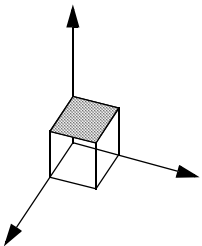


### Measuring dimensions

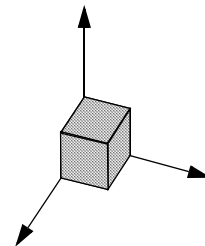
A *linear dimension* is measured in one direction only (see **bold** line in graph top-left). For example, *perimeter*. The perimeter of the desk shown is found by adding the desk's width and length twice. Twice because the top of the desk is a rectangle, has two widths and two lengths, and the perimeter must be measured all the way around.



*Surface* (two dimensions, see shaded portion in graph to the left) is the product (multiplication) of quantities measured in TWO directions: AREA. The area of the top of the desk shown is the product of the length  $\times$  width. Area measurements are given in *square units* (examples,  $\text{ft}^2$  or  $\text{m}^2$ ).



*Space* (three dimensions, see shaded portion in graph to the right) is the product of quantities measured in THREE directions: VOLUME. To find the volume of the box needed to pack the desk shown above, multiply the length  $\times$  width  $\times$  height of the desk. Volume measurements are given in cubic units (examples,  $\text{ft}^3$  or  $\text{m}^3$ ).



### CIRCUMFERENCE

The curved perimeter (distance around) of circles is called *circumference*, and it is calculated by multiplying the constant  $\pi \times \text{diameter}$  of the circle:

$$C = d\pi \quad \text{OR} \quad C = 2r\pi \quad \text{Where:}$$

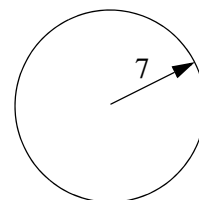
$d = \text{diameter}$

$r = \text{radius}$

$\pi = 3.14$

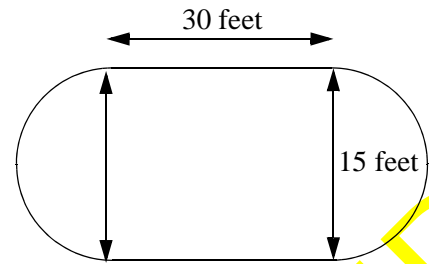
**Example:** Find the perimeter of a circle with radius of 7 inches.

$$C = 2(7)(3.14) = 43.96 \text{ inches.}$$



**Example:** Find the perimeter of the swimming pool shown.

The swimming pool is formed by two (top and bottom) straight lines of 30 feet each, and two half-circles (left and right) with a diameter of 15 feet each. (Notice that two half-circles make one whole circle.)

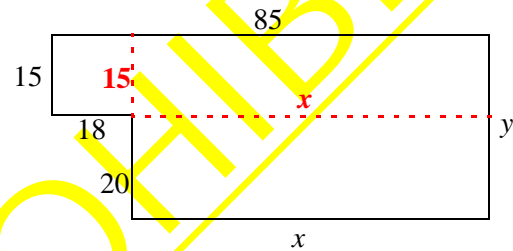


$$\text{Total perimeter} = 30 + 30 + \frac{\text{Circumference}}{2} + \frac{\text{Circumference}}{2} = 60 + C$$

$$C = d\pi = (15)(3.14) = 27.1$$

$$\text{Total perimeter} = 60 + 27.1 = 87.1 \text{ feet}$$

**Example:** Find the perimeter, in feet, of the floor plan shown.



To find the perimeter, all the sides of the irregular shape must be added; however, neither length  $x$  nor length  $y$  are shown.

Because 18 and  $x$  are horizontal lengths which add up to the top measure of 85, then  $x$  can be found by subtracting:

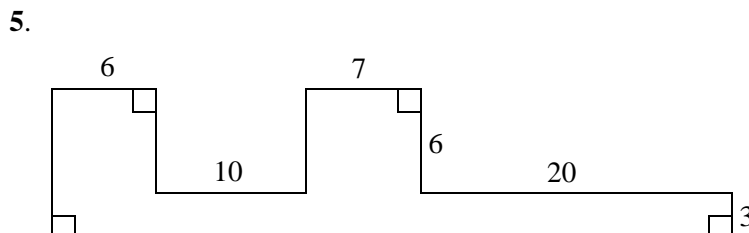
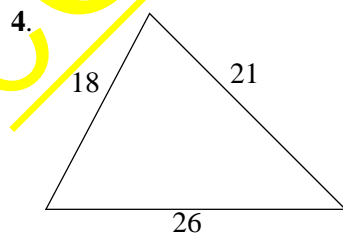
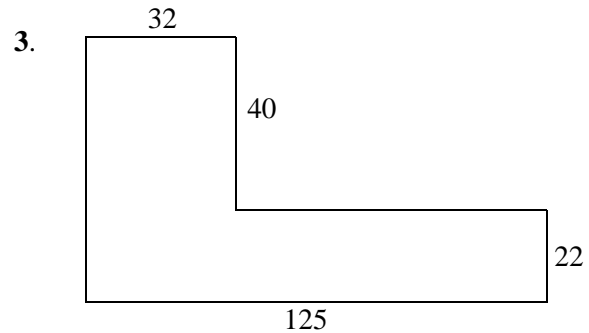
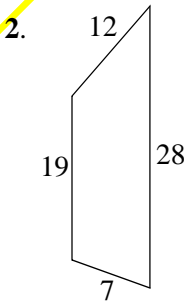
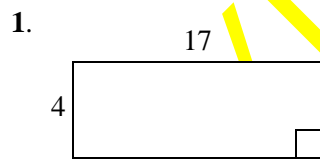
$$85 - 18 = x = 67$$

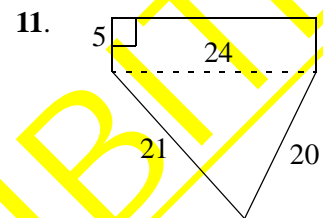
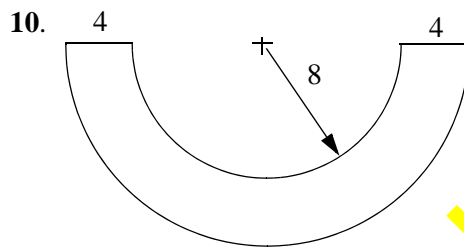
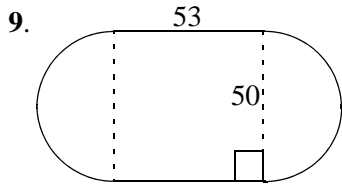
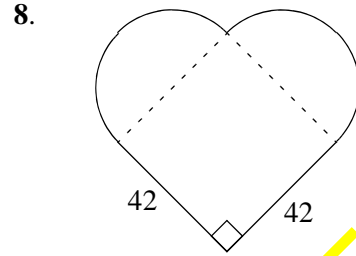
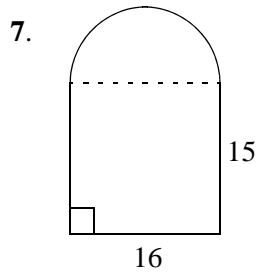
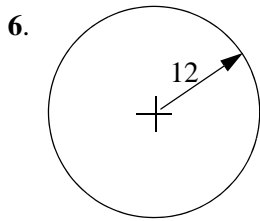
The width,  $y$ , is also the sum of the width 15 and 20 shown to the left of the plan. Therefore:  $y = 35$

and the perimeter of the floor plan is, clockwise:  $85 + 35 + 67 + 20 + 18 + 15 = 240$

**Practice:**

In exercises 1-11, find the perimeter.



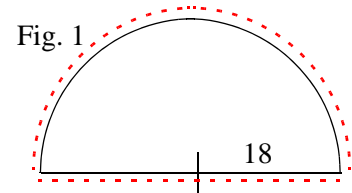


Solve.

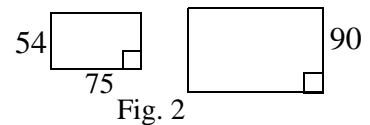
12. For a pig-pen, Sergio is building a rectangular fenced enclosure that measures 12 feet by 9 feet. How many linear feet of fence does he need to enclose the pigs?

13. Mimi needs to put rain gutters on her mobile home. If the mobile home measures 12 feet by 60 feet, how many feet of rain gutter must she buy?

14. A carpenter needs to place a dressing strip of wood around a semi-circle (figure 1). If the radius of the semi-circle is 18 inches, how long is the strip of dressing he needs?



15. The two parcels of land in figure 2 are similar. Find the length of the largest parcel and how many feet of fence must be bought to fence it.

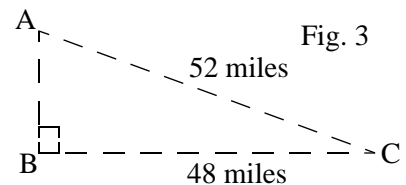


16. The perimeter of a round table cloth needs to be known to fasten trim all around. If the radius of the table cloth is 44 inches, how much trim is needed?

17. The fence Paul installed is broken. If the perimeter of the original fence is 80 feet and the broken portion measures 84 inches, how many feet long is the unbroken section?

18. A space alien is making crop circles on an Iowa farm. If it wants to make the circle with a 40-meter radius, how many meters must it walk on the edge of the circle to form it before getting caught?

19. An airplane must follow the triangular path shown in figure 3. Starting at A, it must fly south to B, east to C and then return to A again. How many miles did the plane fly?



20. A regular pentagon shaped building has dimensions as shown in figure 4. Find the perimeter of the building.

