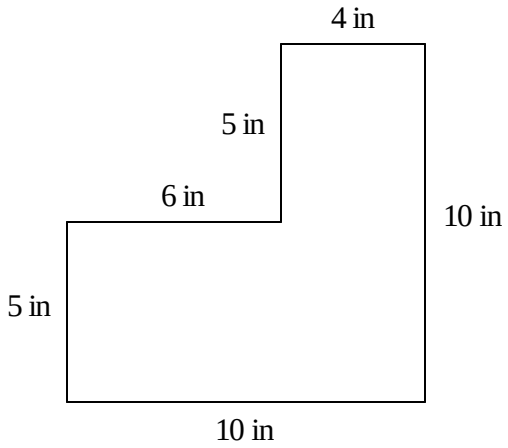
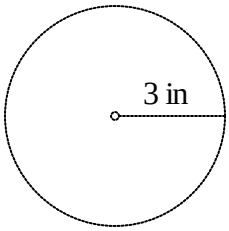
TOPIC 14: Perimeter and Area

The ***perimeter*** of a closed plane (two-dimensional) figure is the total distance around it. Perimeter is measured in units of length, such as inches or centimeters. For example, to find the perimeter P of the figure below we add the lengths of its sides:



$P = 10 + 10 + 4 + 5 + 6 + 5 = 40$ inches

The distance around a circle is its ***circumference***. The circumference C of a circle of radius r is given by the formula $C = 2pr$. The circumference of a circle of



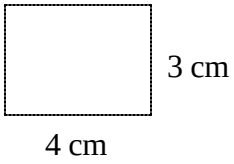
radius 3 inches shown above is:

$$C = 2pr$$
$$C = 2p(3)$$
$$C = 6p \text{ inches}$$

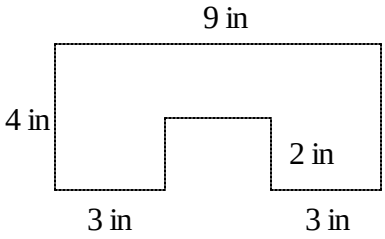
If we use the approximation $p = 3.14$, then the circumference $C \approx 6 \cdot 3.14 = 18.84$ in.

For exercises 1-4, find the perimeter or circumference.

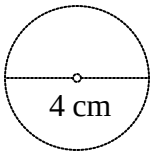
1.



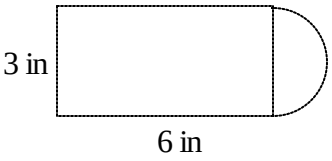
2.



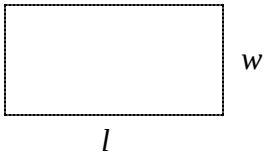
3.



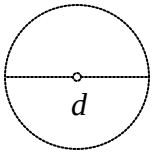
4.



5. Find a formula for the perimeter P of the rectangle with length l and width w shown below:



6. The diameter d of a circle is a line segment with endpoints on the circle that goes through the center of the circle. Find a formula for the circumference C that uses the diameter.

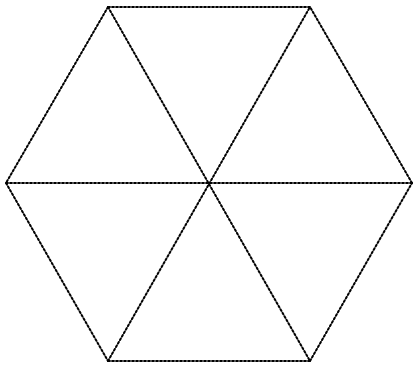


7. The length of a rectangular garden is 3 m longer than its width. If the perimeter of the garden is 26 m, what are the length and width?

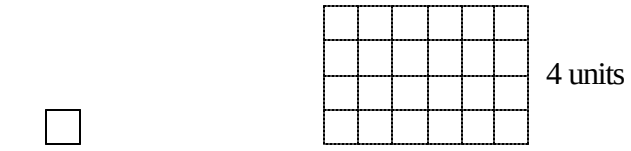
8. If the diameter of a circular disk is 6 ft, what is the circumference of the inner tube?

9. A circular pool has a circumference of $10p$ ft. If there is a sidewalk surrounding the pool that is 2 ft wide, what is the perimeter of the outside of the sidewalk?

10. A regular hexagon is formed from 6 equilateral triangles as shown below. If each triangle has a perimeter of 6 yd, what is the perimeter of the hexagon?



The ***area*** of a closed plane figure is a measure of the size of the enclosed region. Area is measured in square units, such as square feet (ft^2) or square meters (m^2). We can think of area as the number of unit squares that fit *inside* the figure. For example, a rectangle of length 6 units and width 4 units has an area of $6 \cdot 4 = 24$ square units:



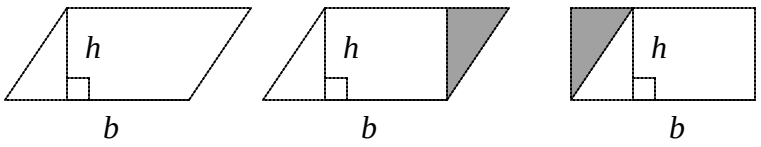
In general, the formula for the area A of a rectangle of length l and width w is $A = lw$.

Recall that the area A of a circle of radius r is $A = \pi r^2$.

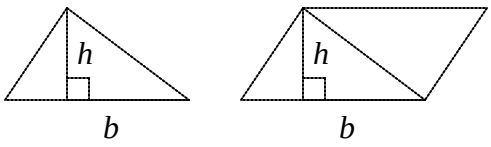
---

11. A ***square*** is a rectangle in which all sides are the same length. What is the formula for the area A of a square with sides of length s? Why?

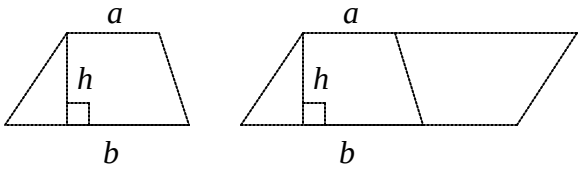
12. Start with a ***parallelogram*** with base b and height h. Imagine cutting off the shaded triangle and attaching it to the opposite end of the parallelogram as shown below. What is the formula for the area A of a parallelogram with base b and height h? Why?



13. Start with a ***triangle*** with base b and height h. Imagine making an exact copy of the triangle and attaching it to the original triangle as shown below. What is the formula for the area A of a triangle with base b and height h? Why?

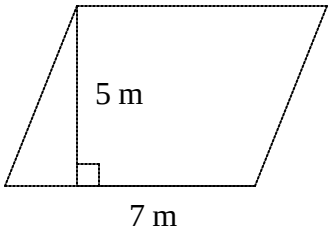


14. Start with a ***trapezoid*** with bases a and b, and height h. Imagine making an exact copy of the trapezoid and attaching it to the original trapezoid as shown below. What is the formula for the area A of a trapezoid with bases a and b, and height h? Why?

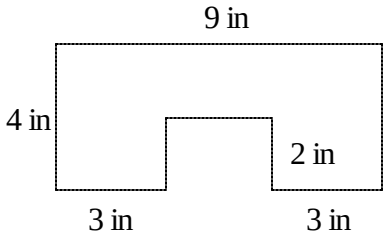


For exercises 15-18, find the area.

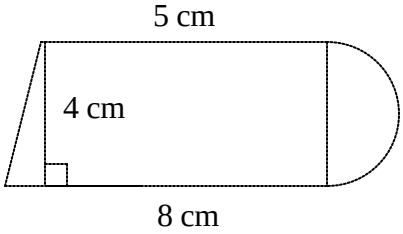
15.



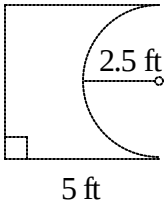
16.



17.



18.



19. If rectangle that is 4 in by 16 in has the same area as a square, what is the length of a side of the square?

20. What is the area of the base of a circular fountain which has a circumference of $6p$ cm?

21. A rectangular pool is 20 m by 30 m. There is a 3 m sidewalk surrounding the pool What is the area of the sidewalk?

22. Find the area of the regular hexagon in exercise 10 above.

23. A college dormitory is 100 ft wide and 140 ft long. On the fifth floor there are staircases, rest rooms, and a hall that together account for 5000 ft^2. The remainder of the fifth floor consists of 30 rooms of equal size. What is the size (floor space) of each room?