

2.2.6: Perimeter and Circumference

You may use a calculator throughout this module if needed.

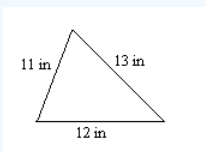
Perimeter

A polygon is a closed geometric figure with straight sides. Common polygons include triangles, squares, rectangles, parallelograms, trapezoids, pentagons, hexagons, octagons... The perimeter of a polygon is the distance around the outside. In general, to find the perimeter of a polygon, you can add up the lengths of all of its sides.

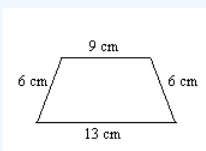
Also, if you haven't already, now is the time to get in the habit of including units in your answers.

? Exercises 2.2.6.1

- Find the perimeter of the triangle.



- Find the perimeter of the trapezoid.



Answer

- 36 in
- 34 cm

If we know that some of the sides of a polygon are equal, we can use a formula as an alternative to adding up all of the lengths individually. The first formula shown below uses the variable s for the side of a square. The rectangle formulas use l for length and w for width, or b for base and h for height; these terms are interchangeable.

Perimeter Formulas

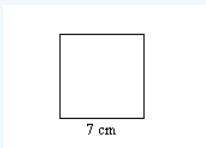
Square: $P = 4s$

Rectangle: $P = 2l + 2w$ or $P = 2b + 2h$

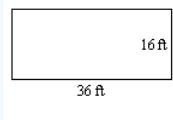
Rectangle: $P = 2(l + w)$ or $P = 2(b + h)$

? Exercises 2.2.6.1

- Find the perimeter of the square.



- Find the perimeter of the rectangle.



5. A storage area, which is a rectangle that is 45 feet long and 20 feet wide, needs to be fenced around all four sides. How many feet of fencing is required? (To keep it simple, ignore any gates or other complications.)
6. Giancarlo is putting crown molding around the edge of the ceiling of his living room. If the room is a 12-foot by 16-foot rectangle, how much crown molding does he need?

Answer

3. 28 cm

4. 104 ft

5. 130 ft

6. 56 ft

The sides of a regular polygon are all equal in length. Therefore, multiplying the length of a side by the number of sides will give us the perimeter.

Perimeter Formula

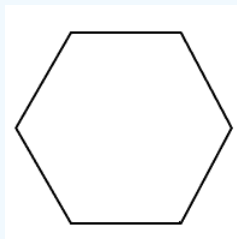
Regular Polygon with n sides of length s :

$$P = n \cdot s$$

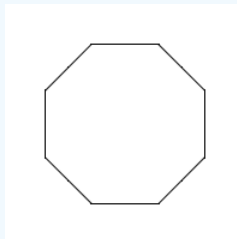
? Exercises 2.2.6.1

Find the perimeter of each regular polygon.

7. Each side of the hexagon is 4 inches long.



8. Each side of the octagon is 2.5 centimeters long.



Answer

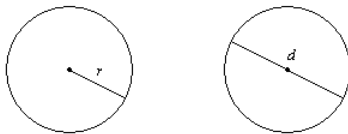
7. 24 in

8. 20 cm

Circumference

Instead of calling it the perimeter, the distance around the outside of circle is called the **circumference**. Let's review some circle vocabulary before moving on.

Every point on a circle is the same distance from its center. This distance from the center to the edge of the circle is called the **radius**. The distance from one edge to another, through the center of the circle, is called the **diameter**. As you can see, the diameter is twice the length of the radius.



Throughout history, different civilizations have discovered that the circumference of a circle is slightly more than 3 times the length of its diameter. By the year 2000 BCE, the Babylonians were using the value $3\frac{1}{8} = 3.125$ and the Egyptians were using the value $3\frac{13}{81} \approx 3.1605$.^[1] The value $3\frac{1}{7} \approx 3.1429$ is an even better approximation for the ratio of the circumference to the diameter. However, the actual value cannot be written as an exact fraction. It is the irrational number π , pronounced “pie”, which is approximately 3.14159

Circumference Formulas

$$C = \pi d$$

$$C = 2\pi r$$

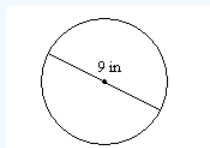
Any scientific calculator will have a π key; using this will give you the most accurate result, although you should be sure to round your answer appropriately. (See this module if you need a refresher on rounding with multiplying or dividing.) Many people use 3.14 as an approximation for π , but this can lead to round-off error; if you must use an approximation, 3.1416 is better than 3.14.

Sometimes we bend the rules in this textbook and ask you to round to a certain place value instead of rounding to a certain number of significant digits.

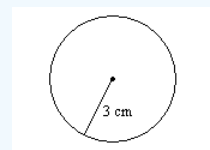
? Exercises 2.2.6.1

Calculate the circumference of each circle. Round to the nearest tenth.

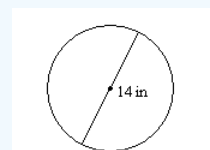
9.



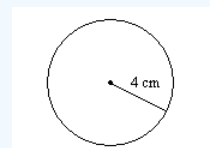
10.



11.



12.



Answer

- 9. 28.3in
- 10. 18.8cm
- 11. 44.0in
- 12. 25.1cm

1. This information comes from Chapter 1 of the book *A History of Pi* by Petr Beckmann. It is a surprisingly interesting read. ↩

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