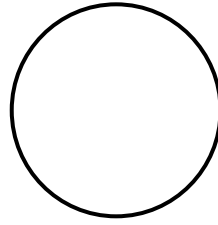
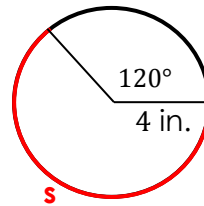


Arc Length:



**Example 1:** A circle has a radius of 4 inches. Find the length of the arc intercepted by a central angle of  $240^\circ$ .

**Example 2:** Find  $s$



**Example 3:** Find the central angle (in radians and degrees) that is formed by a radius of 12 ft and an arc length of 31 ft

**Example 4:** Find the **distance between the cities**. Assume that the Earth is a sphere of radius 3960 miles and the cities are on the same longitude (one city is due north of the other).

Johannesburg, South Africa	$26^\circ$ S
Jerusalem, Israel	$31^\circ$ N

**Write a formula relating distance, rate and time:**

**Linear Speed:**

**Angular Speed:**

**Equivalent ratios:**

**Equivalent ratios:**  $2\pi$  radians =  $360^\circ$  = 1 revolution = circumference [ $2\pi r$  "units"]

**Example 5:** The second hand of a clock is 10.2 cm long. Find the linear speed of the tip of the second hand in cm/s.

**Example 6:** A 15-inch diameter tire on a car makes 9.3 revolutions per second.

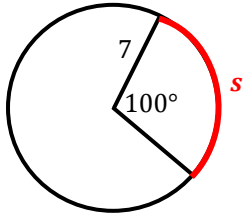
- a. Find the angular speed of the tire in rad/sec      b. Find the linear speed of the car in in/sec

**Example 7:** The circular blade on a saw has a diameter of 7.25 inches and rotates at 4800 revolutions per minute.

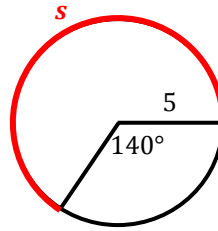
- a. Find the angular speed of the blade in rad/sec      b. Find the linear speed of the saw teeth (in ft/sec) as they contact the wood being cut.

**Example 8:** A woman is riding a bicycle whose wheels are 30 inches in diameter. If the wheels rotate at 150 rpm, find the speed at which she is traveling in **mi/hr**.

1. Find the length of the arc  $s$  in the figure.



2. Find the length of arc  $s$  in the figure.



3. Find the length of an arc that subtends [forms] a central angle of  $45^\circ$  in a circle of radius 10 m.
4. Find the length of an arc that subtends [forms] a central angle of 2 rad in a circle of radius 2 mi.
5. An arc of length 100 m subtends [forms] a central angle  $\theta$  in a circle of radius 50 m. Find the measure of  $\theta$  in radians and degrees.
6. Find the radius of the circle if an arc of length 6 m on the circle subtends [forms] a central angle of  $\frac{\pi}{6}$  rad.
7. Memphis, TN and New Orleans, LA lie approximately on the same meridian (longitude line). Memphis has a latitude  $35^\circ\text{N}$  and New Orleans has a latitude  $30^\circ\text{N}$ . Find the distance between these cities if the radius of the earth is 3960 mi.
8. A radial saw has a blade with a 6-in radius. Suppose the blade spins at 1000 rpm.
- a) Find the angular speed of the blade in rad/min.
- b) Find the linear speed of the saw teeth in ft/sec.

9. The wheels of a car have a diameter of 22 in and are rotating at 600 rpm. Find the speed of the car in mi/hr.
10. The earth rotates about its axis once every 23 h 56 min 4 s, and the radius of the earth is 3960 mi. Find the linear speed of a point on the equator in mi/hr.
11. A wind machine used to generate electricity has blades that are 10 ft in length. The propeller is rotating at 4 revolutions per second. Find the linear speed of the tips of the blades in ft/min.
12. The carousel at the county fair makes 3 revolutions per minute.
- a) Find the linear speed in ft/sec of a person riding a horse that is 22.5 ft from the center.
- b) The linear speed of the person on the inside of the carousel is 3.1 ft/sec. How far is this person from the center?
- c) How much faster is the rider on the outside going than the rider on the inside?

**Answers:**

1. 12.22 units      2. 19.20 units      3. 7.85 m      4. 4 mi      5.  $\theta = 2$  rad or  $\theta = 114.6^\circ$
6.  $r = \frac{36}{\pi}$  m or  $r = 11.46$  m      7. 345.6 mi      8a.  $2000\pi$  rad/min or 6283.19 rad/min      8b. 52.36 ft/sec
9. 39.27 mph      10. 1039.6 mph      11. 15079.64 ft/min      12a. 7.07 ft/sec      12b. 9.87 ft      12c. 3.97 ft/sec