Section 3.2

Applications of Radian Measure

In section 3.1, we defined radian measure using the following:

$$\frac{s}{r} = \theta$$

Rearrange to put s by itself on one side, $s = r\theta$, and now we have a formula to find s which represents arclength.

Arclength

The length s of the arc intercepted on a circle of radius r by a central angle of measure θ radians is given by the product of the radius and the radian measure of the angle.

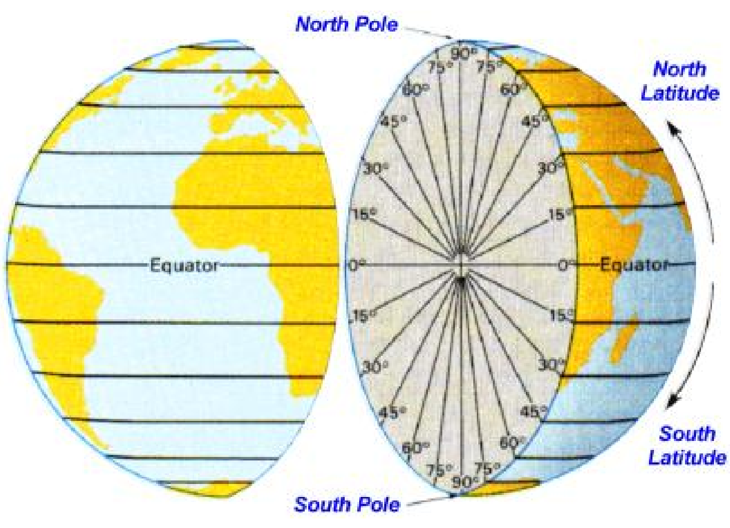
$\boldsymbol{s = r\theta}$, where θ must be in radians and NOT degrees.

Example 1: A circle has radius 25.60 cm. Find the length of the arc intercepted by a central angle having each of the following measures. Round to the nearest 2 decimal places.

a) $\dfrac{7\pi}{8}$

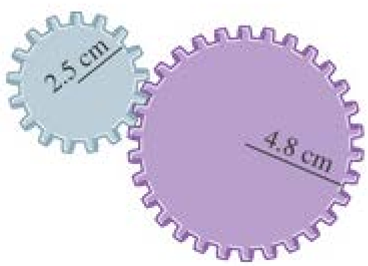
b) $210°$

Latitude gives the measure of a central angle with vertex at Earth's center whose initial side goes through the equator and whose terminal side goes through the given location.

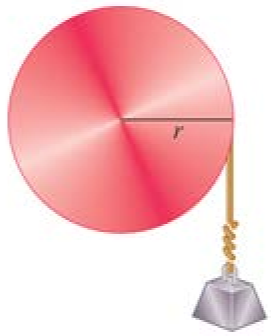


Example 2: Erie, Pennsylvania, is approximately due north of Columbia, South Carolina. The latitude of Erie is 42°N and that of Columbia is 34°N. The radius of Earth is 6400 km. Find the north-south distance between the two cities.

Example 3: Two gears are adjusted so that the smaller gear drives the larger one. If the smaller gear rotates through an angle of 225°, through how many degrees will the larger gear rotate?



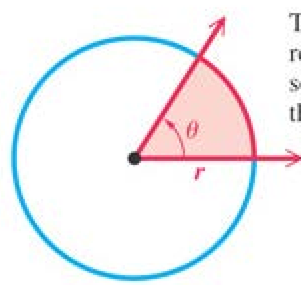
Pulley raising a weight



Example 4: Find the radius of the pulley if a rotation of 51.6° raises the weight 11.4 cm. Round to the nearest tenth.

Area of a sector of a circle

A = $\boldsymbol{\frac{1}{2}r^2\theta}$ **, where** $\boldsymbol{\theta}$ **is measured in radians**



Example 5: Find the area of a sector of a circle having radius $r = 59.8\ km$ and central angle $\theta = \frac{2\pi}{3}$. Express answers to the nearest tenth.

Surveying: A frequent problem is surveying city lots and rural lands adjacent to curves of highways and railways is that of finding the area when one or more of the boundary lines is the arc of a circle.

Example 6: Find the area of the lot shown in the figure. Round to the nearest hundred square yards.