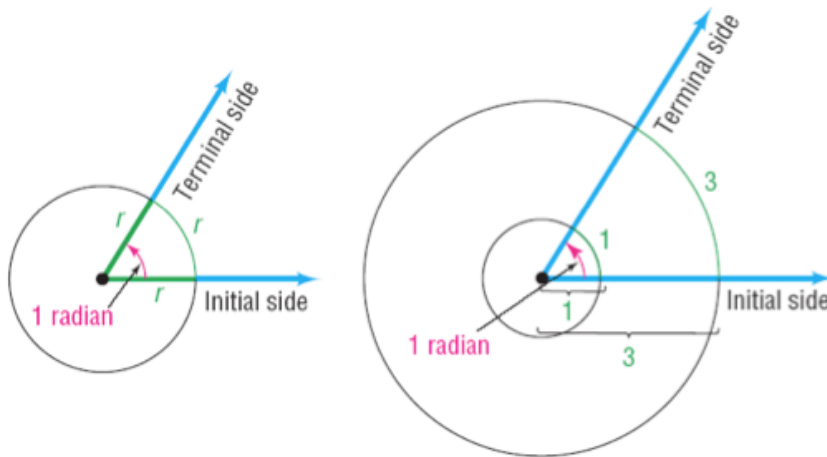


Chapter 6 Trigonometric Functions

6.1 Angles and Their Measures Day 2

Radians



2 Find the Length of an Arc of a Circle

$$\frac{45}{360} \cdot 2\pi r$$

THEOREM**Arc Length**

For a circle of radius r , a central angle of θ radians subtends an arc whose length s is

$$s = r\theta$$

EXAMPLE Finding the Length of an Arc of a Circle

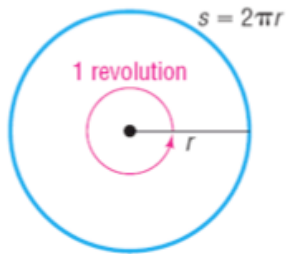
Find the length of the arc of a circle of radius 4 meters subtended by a central angle of 0.5 radian.

$$s = r\theta$$

$$s = 4(.5)$$

$$s = 2 \text{ m}$$

3 Convert from Degrees to Radians and from Radians to Degrees



$$1 \text{ revolution} = 2\pi \text{ radians}$$

$$180^\circ = \pi \text{ radians}$$

$$1 \text{ degree} = \frac{\pi}{180} \text{ radian} \quad 1 \text{ radian} = \frac{180}{\pi} \text{ degrees}$$

$$\cancel{180} \cdot \frac{\pi}{\cancel{180}}$$

30°

4.76

EXAMPLE Converting from Degrees to Radians

Convert each angle in degrees to radians.

- (a)
- 30°
- (b)
- 120°
- (c)
- -60°
- (d)
- 270°
- (e)
- 104°

$$30^\circ \cdot \frac{\pi}{180^\circ}$$

$$\frac{\pi}{6}$$

$$120^\circ \cdot \frac{\pi}{180^\circ}$$

$$\frac{2\pi}{3}$$

$$-60^\circ \cdot \frac{\pi}{180^\circ}$$

$$-\frac{\pi}{3}$$

$$270^\circ \cdot \frac{\pi}{180^\circ}$$

$$\frac{3\pi}{2}$$

$$104^\circ \cdot \frac{\pi}{180^\circ}$$

$$1.82$$

EXAMPLE**Converting from Degrees to Radians**

Convert each angle in radians to degrees.

- (a) $\frac{\pi}{3}$ radian (b) $-\frac{\pi}{2}$ radian (c) $\frac{5\pi}{6}$ radians (d) 5 radians

$$\frac{\pi}{3} \cdot \frac{180^\circ}{\pi}$$

$$60^\circ$$

$$-\frac{\pi}{2} \cdot \frac{180^\circ}{\pi}$$

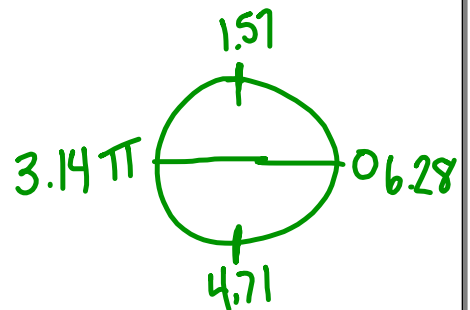
$$-90$$

$$\frac{5\pi}{6} \cdot \frac{180^\circ}{\pi}$$

$$150^\circ$$

$$5 \cdot \frac{180}{\pi}$$

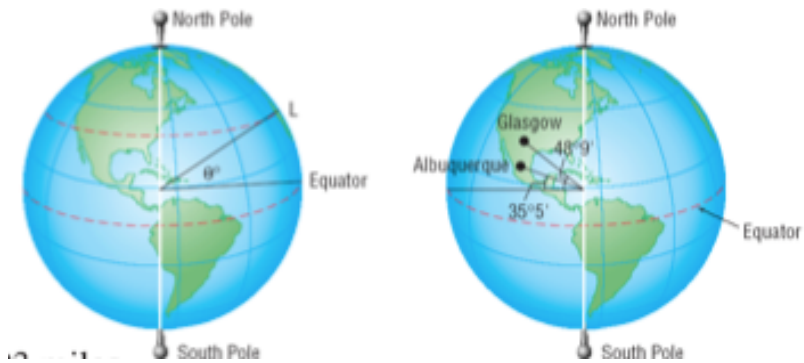
$$286.48^\circ$$



Degrees	0°	30°	45°	60°	90°	120°	135°	150°	180°
Radians	0	$\frac{\pi}{6}$	$\frac{\pi}{4}$	$\frac{\pi}{3}$	$\frac{\pi}{2}$	$\frac{2\pi}{3}$	$\frac{3\pi}{4}$	$\frac{5\pi}{6}$	π
Degrees		210°	225°	240°	270°	300°	315°	330°	360°
Radians		$\frac{7\pi}{6}$	$\frac{5\pi}{4}$	$\frac{4\pi}{3}$	$\frac{3\pi}{2}$	$\frac{5\pi}{3}$	$\frac{7\pi}{4}$	$\frac{11\pi}{6}$	2π

EXAMPLE Finding the Distance between Two Cities

See Figure 13(a). The latitude of a location L is the angle formed by a ray drawn from the center of Earth to the Equator and a ray drawn from the center of Earth to L . See Figure 13(b). Glasgow, Montana, is due north of Albuquerque, New Mexico. Find the distance between Glasgow ($48^{\circ}9'$ north latitude) and Albuquerque ($35^{\circ}5'$ north latitude). Assume that the radius of Earth is 3960 miles.



$$s = r\theta$$

$$s = 3960(.2281)$$

$$s = 903.3 \text{ miles}$$

$$48^{\circ}9'$$

$$48 + 9\left(\frac{1}{60}\right)$$

$$48.15^{\circ} \cdot \frac{\pi}{180^{\circ}}$$

$$.8404$$

$$35^{\circ}5'$$

$$35 + 5\left(\frac{1}{60}\right)$$

$$35.08^{\circ} \cdot \frac{\pi}{180}$$

$$.6123 = .2281 = \theta$$