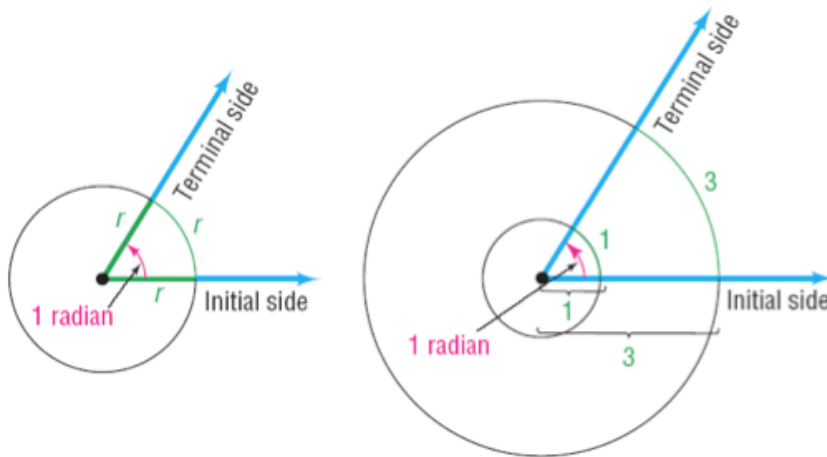


# Chapter 6 Trigonometric Functions

## 6.1 Angles and Their Measures Day 2

### Radians



## 2 Find the Length of an Arc of a Circle

### THEOREM

#### Arc Length

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

$$s = r\theta$$

**EXAMPLE** Finding the Length of an Arc of a Circle

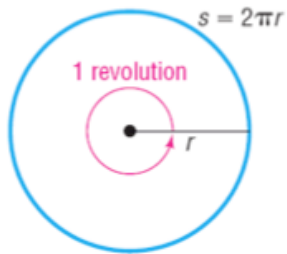
Find the length of the arc of a circle of radius 4 meters subtended by a central angle of 0.5 radian.

$$s = r\theta$$

$$s = 4(.5)$$

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

### 3 Convert from Degrees to Radians and from Radians to Degrees



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

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

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

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

$30^\circ$

4.76

**EXAMPLE** Converting from Degrees to Radians

Convert each angle in degrees to radians.

- (a)
- $30^\circ$
- (b)
- $120^\circ$
- (c)
- $-60^\circ$
- (d)
- $270^\circ$
- (e)
- $104^\circ$

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

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

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

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

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

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

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

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

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

$$1.82$$

**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

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

$$60^\circ$$

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

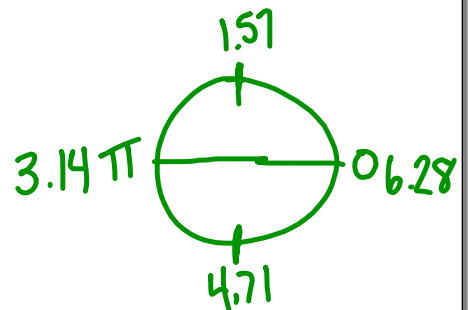
$$-90$$

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

$$150^\circ$$

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

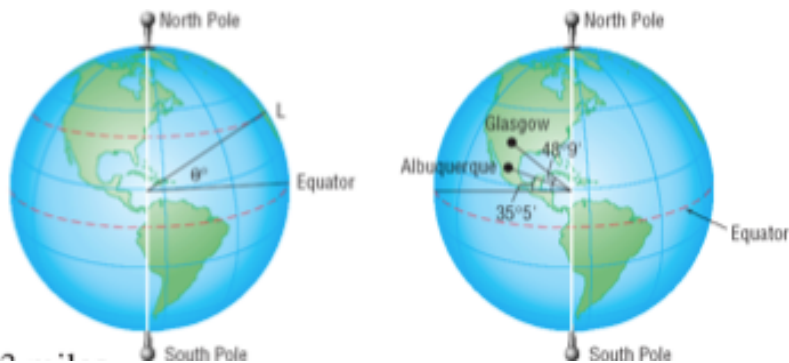
$$286.48^\circ$$



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

**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.



$$s = r\theta$$

$$s = 3960(\theta)$$

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

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

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

$$.8404$$

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

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

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

$$- .6123$$