

# Precalculus: Trigonometric Functions

## 4.1: Angles and Their Measures

**Degrees**

**Radians**

Conversion:

Radians to degrees:  
 $\times \frac{180^\circ}{\pi \text{ radians}}$

Degrees to radians:  
 $\times \frac{\pi \text{ radians}}{180^\circ}$

$360^\circ = 2\pi \text{ radians}$

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

Example 1: Convert the radians to degrees and the degrees to radians.

- a)  $75^\circ \left( \frac{\pi \text{ radians}}{180} \right) = \frac{75\pi}{180} = \boxed{\frac{5\pi}{12}}$
- b)  $30^\circ \left( \frac{\pi}{180} \right) = \frac{30\pi}{180} = \boxed{\frac{\pi}{6}}$
- c)  $\frac{2\pi}{3} \cdot \left( \frac{180}{\pi} \right) = \frac{2 \cdot 180}{3} = \boxed{120^\circ}$
- d)  $\frac{11\pi}{6} \cdot \left( \frac{180}{\pi} \right) = \frac{11 \cdot 180}{6} = \boxed{330^\circ}$

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### DMS (degree-minute-second)

In the DMS system of angular measure, each degree is subdivided into 60 minutes (denoted by ') and each minute is subdivided into 60 seconds (denoted by '').

Example 2: Working with DMS Measure

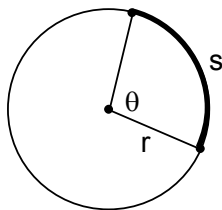
- a) Convert  $37.425^\circ$  to DMS
- b) Convert  $42^\circ 24' 36''$  to degrees

## Circular Arc Length

Arc Length Formula (Radian Measure)

$\theta$  is in radians

$$s = r\theta$$



$\theta$  is in degrees

$$s = \frac{2\pi r \theta}{360}$$

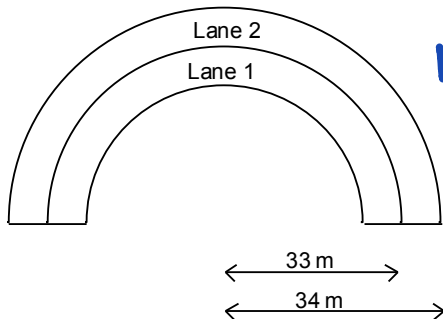
Example 3: Finding Arc Length. Find the exact answer and the approximate answer rounded to the nearest hundredth.

- a) Find the perimeter of a  $60^\circ$  slice of a large pizza.

crust:  $\frac{12\pi(60)}{360} = 2\pi$  in

perimeter:  $6 + 6 + 2\pi = 12 + 2\pi$  in  
 $\approx 18.28$  in

- b) The running lanes at the Emery Sears track at Bluffton College are 1 meter wide. The inside radius of lane 1 is 33 meters and the inside radius of lane 2 is 34 meters. How much longer is lane 2 than lane 1 around one turn?



lane 1:  $60\pi\left(\frac{180}{360}\right) = 33\pi$  meters

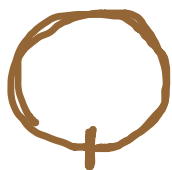
lane 2:  $68\pi\left(\frac{180}{360}\right) = 34\pi$  meters

Difference:  $34\pi - 33\pi$

$= \pi$  meters  
 $\approx 3.14$  meters

Example 4: Angular and Linear Motion

- a) Albert Juarez's truck has wheels 36 inches in diameter. If the wheels are rotating at 630 rpm (revolutions per minute), find the truck's speed in miles per hour.



1 revolution = Circumference

Circumference =  $36\pi$  in

$$\left(\frac{630 \cancel{\text{ rev}}}{1 \cancel{\text{ min}}}\right) \left(\frac{60 \cancel{\text{ min}}}{1 \text{ hour}}\right) \left(\frac{36\pi \cancel{\text{ in}}}{1 \cancel{\text{ rev}}}\right) \left(\frac{1 \cancel{\text{ ft}}}{12 \cancel{\text{ in}}}\right) \left(\frac{1 \text{ miles}}{5280 \cancel{\text{ ft}}}\right) = \frac{945\pi}{44} \text{ mph} \approx 67.47 \text{ mph}$$