Goals:

1. To convert between radian and degrees.
2. To compute arc length of a sector of a circle
3. To solve apps.
4. To evaluate a trig function of any real number.

Radian Measure

we say the arc from A to B subtends the central angle, \( \theta \)

Radian measure of \( \theta \) is given by \( \theta = \frac{s}{r} \).

Notes:

1. An angle that measures 1 radian is subtended by an arc length of 1 radius.
2. # of radians in 1 revolution is given by \( \theta = \frac{s}{r} = \frac{C}{r} = \frac{2\pi r}{r} = (2\pi) \) radians.
3) \[ 360^\circ = 2\pi \text{ radians} \]

\[ 180^\circ = \pi \text{ radians} \]

![Diagram of trigonometric functions]

**Example**

Convert to radians or degrees.

a) \[-270^\circ \]

\[ -270^\circ \cdot \frac{\pi}{180^\circ} = \frac{-270\pi}{180} = \frac{-3\pi}{2} \]

b) \[130^\circ \ (\text{approximate})\]

\[ 130^\circ \cdot \frac{\pi}{180^\circ} = \frac{130\pi}{180} = \frac{13\pi}{18} \]

\[ \approx 2.27 \]

c) \[\frac{\pi}{2} \ (\text{Assume to be radians when necessary})\]
\[
\frac{\pi}{3} \cdot \frac{180^\circ}{\pi \times 180^\circ} = \frac{180^\circ}{3} = 60^\circ
\]

**Ex**  
*Arc length formula:*  
\[S = r \cdot \Theta\]

\[r = 5 \text{ ft} \quad \Theta = \frac{\pi}{6}\]

\[\text{crust} = S = 5 \left(\frac{\pi}{6}\right) = \frac{5\pi}{6} \text{ ft}\]

**Ex**  
Find the complement of \(\frac{\pi}{3}\)

\[
\text{complement: } \frac{\pi}{2} - \frac{\pi}{3} = \frac{3}{6} - \frac{2}{6} = \frac{1}{6} \text{ and } \frac{3\pi}{6} - \frac{2\pi}{6} = \frac{\pi}{6}
\]

\[
\text{supplement: } \pi - \frac{\pi}{3} = \frac{3\pi}{3} - \frac{\pi}{3} = \frac{2\pi}{3}
\]

**Def:** Angular Velocity (change in \(\Theta\) over time)
\[
(\text{angular velocity}) = \omega = \frac{\theta}{t}
\]

"omega"

**Ex.** A wheel is rotating at 200 rpm. Find the angular velocity in radians per second.

\[
\frac{200 \text{ rev}}{1 \text{ min}} \cdot \frac{2\pi \text{ rad}}{1 \text{ rev}} \cdot \frac{1 \text{ min}}{60 \text{ sec}} = 20.94 \frac{\text{rad}}{\text{sec}}
\]

**Ex.** A truck has a tire of radius 45 cm rotating at 500 rpm. Find the speed of the truck.

\[
\frac{500 \text{ rev}}{1 \text{ min}} \cdot \frac{2\pi (45) \text{ cm}}{1 \text{ rev}} \cdot \frac{1 \text{ km}}{100 000 \text{ cm}} \cdot \frac{60 \text{ min}}{1 \text{ hr}} = \frac{84.8 \text{ km}}{\text{hr}}
\]