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**

\[ S = \text{arc length} \quad \text{we say the arc from A to B subtends the central angle, } \theta \]

**Def:** Radian measure of \( \theta \) is given by \( \theta = \frac{S}{r} \)

**Notes:** An angle that measures 1 radian is subtended by an arc length of 1 radius.

\[ \text{Arc Length Formula: } S = r \theta \]

**Ex.** Find the length of an arc with central angle 30 degrees and radius 12 cm.

\[
30^\circ \cdot \frac{\pi}{180^\circ} = \frac{\pi}{6}
\]
\[ s = r \theta \]
\[ = \frac{12}{\frac{\pi}{6}} \]
\[ = 2\pi \text{ cm} \]

2. Number of radians in 1 revolution is given by \(2\pi\).

3. \(2\pi\) radians = 360°
\[ \pi \text{ radians} = 180° \]
\[ \frac{\pi \text{ radians}}{180°} = 1 = \frac{180°}{\pi \text{ radians}} \]

\(\text{ex}\) convert to radians or degrees.

a) \(30°\)
a) \[
\frac{30^\circ}{1} \rightarrow \frac{\pi}{180^\circ} = \frac{\frac{30\pi}{180}}{6} = \frac{\pi}{6}
\]

b) \[27^\circ \quad \text{(approximate)}\]
\[
27^\circ \cdot \frac{\pi}{180^\circ} = \frac{27\pi}{180} = \frac{3\pi}{20}
\]
\[\approx 0.47
\]

c) \[\frac{4\pi}{3} \quad \text{(Assume to be radians when no units given)}\]
\[
\frac{4\pi}{3} \cdot \frac{180^\circ}{\pi} = 240^\circ
\]
Ex: Find the complement and supplement of $\frac{\pi}{5}$

Complement: $\pi - \frac{\pi}{5} = \frac{5\pi}{5} - \frac{\pi}{5} = \frac{4\pi}{5}$

Supplement: $\frac{\pi}{2} - \frac{\pi}{5} = \frac{5\pi}{10} - \frac{2\pi}{10} = \frac{3\pi}{10}$

Def: Angular Velocity (change in $\theta$ over time)

$\frac{\text{angular velocity}}{\text{time}} = \omega = \frac{\theta}{t}$

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

\[
\frac{200 \text{ rev}}{1 \text{ min}} \cdot \frac{2\pi \text{ rad}}{1 \text{ rev}} \cdot \frac{1 \text{ min}}{60 \text{ sec}} = \frac{400\pi \text{ rad}}{60 \text{ sec}}
\]

\[\approx 20.94 \text{ rad/ sec}\]

Ex. A truck has a tire of radius 45 cm rotating at 500 rpm. Find the speed of the truck in kilometers per hour.

\[C = 2\pi r\]

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