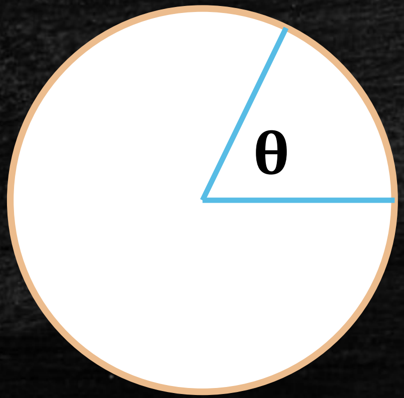
Introduction to rotation

Fundamental definition

- Rotation (for this class) will consider motion on a circular path where the speeds may be changing in time.
- Can measure angular position in three different units:

$$1 \text{ revolution} = 360° = 2\pi \text{ radians}$$

- Fundamental relationship for a circle:



$$s = \theta r$$

for $\theta = 2\pi$ we have:

$$s = 2\pi r = \text{circumference}$$

Kinematic variables

- Rotational kinematics is extremely similar to linear kinematics.
- In fact, we can use the old equation and change the names of the variables.

	linear motion	rotational motion
Distance:	**x**	**θ**
Velocity:	**v**	**ω**
Acceleration:	**a**	**α**

Linear to rotational conversions

- We can convert between linear and rotational quantities using the following definitions:

Distance & angle: $s = \theta r$

Velocity & angular velocity: $v = \omega r$

Acceleration & angular acceleration: $a = \alpha r$

Introduction

Linear equations

$$x = x_0 + v_0 t + \frac{1}{2}at^2$$

$$v = v_0 + at$$

$$x = x_0 + \frac{1}{2}(v_0 + v)$$

$$v^2 = v_0^2 + 2a(x - x_0)$$

Rotational equations

$$\theta = \theta_0 + \omega_0 t + \frac{1}{2}\alpha t^2$$

$$\omega = \omega_0 + \alpha t$$

$$\theta = \theta_0 + \frac{1}{2}(\omega_0 + \omega)$$

$$\omega^2 = \omega_0^2 + 2\alpha(\theta - \theta_0)$$

Part 1: conversions

- We are going to focus on unit conversions and measuring angles in terms of radians.

Part 2: linear and angular variables

- This part will focus on converting between linear and angular variables.

Part 3: kinematics

- A discus thrower wants to achieve a throw speed of 24.5 m/s. If the distance from the center of rotation to the discus is 1.20 m, what angular acceleration is needed to launch the discus after 1.5 revolutions?