Reminder:

Free Body Diagrams

\[ \Sigma F_x = ma_x \quad \Sigma F_y = ma_y \]
Rotational and Linear motion

**Knowns:**
- $v_0 = 0 \text{ m/s}$
- $w_0 = 0 \text{ rad/s}$
- $v = 2 \text{ m/s}$
- $w = ?$
- $t = 10 \text{ s}$

**Wheel spin**

Linear quantities: $t, v_0, v \Rightarrow$ use together to get $a_t$

Angular quantities: $t, w_0, (w, \alpha) \Rightarrow$ use $v = rw$

**Translational motion**

$V = rw$

$w = \frac{v}{r} = \frac{2 \text{ m/s}}{0.2 \text{ m}} = 10 \text{ rad/s}$

$t, w_0, w \Rightarrow$ get $\alpha$

$w = w_0 + \alpha t$

$10 = \alpha \times 10$

$\alpha = 1 \text{ rad/s}^2$
\[ \Sigma F_c = \text{net radial force} \]

\[ \Sigma F_c = ma_c = mR\omega^2 \]
Stationary case

\[ F_{\text{track}} = n \]
\[ F_y = m a_y \]
\[ a_y = 0 \]
\[ F_{\text{track}} - F_g = (m)(0) \]
\[ F_{\text{track}} - F_g = 0 \]
\[ F_{\text{track}} = F_g = m g \]

Moving along curve

\[ F_{\text{track}} \]
\[ F_y = m a_y \]
\[ a_c = \frac{v^2}{r} \]
\[ F_{\text{track}} - F_g = m \frac{v^2}{r} \]
\[ F_{\text{track}} = m \frac{v^2}{r} + F_g \]
\[ \text{Feels heavier} \]
SIDE (P)
\[ \sum F_c = m a_c \]
\[ F_{track} = \frac{m v^2}{r} \] only centripet. accel felt

\[ F_{track} = F_g + \frac{m v^2}{r} \]
Feel centripet. accel PLUS gravity

TOP (Q)
\[ \sum F_c = m a_c \]
\[ F_{track} + F_g = \frac{m v^2}{r} \]

\[ F_{track} = \frac{m v^2}{r} - F_g \]
Feel LESS than centripet. accel.
Centripetal Bucket!

Net force, centripetal: \[ \sum F_c = Ma_c \] \[ (a_c = rw^2) \]

\[ + F_b + F_g = mrw^2 \]
\[ 0 + mg = mrw \]
\[ + g = rw^2 \]
\[ w^2 = \frac{g}{r} \]
\[ w = \sqrt{\frac{g}{r}} \]
\[ w = \sqrt{\frac{9.8 \text{m/s}^2}{1 \text{m}}} \]
\[ w = 3.13 \text{rad/s} \times \frac{1 \text{rev}}{2 \pi \text{rad}} \]
\[ \omega = 0.5 \text{rev/s} \]

\[ \frac{1}{\omega} = 2 \text{s/1 full circle} \]