Name: Key

$V = \omega (r)$

$\frac{m}{s} = \frac{rad}{s}\left(\frac{m}{rad}\right)$

Notes - 10.1 Angular Acceleration

1. What is the definition of angular speed ω? What are the units of ω?

$\omega = \frac{\Delta\theta}{\Delta t}$ units → rad/s

2. How are velocity and angular speed related?

$V = \omega r$

Where do the radians go? think of r as a ratio of meters per radian

3. What is the definition of angular acceleration α? What are the units of α?

$\alpha = \frac{\Delta\omega}{\Delta t}$ units → $\frac{rad}{s^2}$

4. Suppose a teenager puts her bicycle on its back and starts the rear wheel spinning from rest to a final angular velocity of 250 rpm in 5.00 s.

$\frac{250\ rev}{min}\left(\frac{2\pi\ rad}{rev}\right)\left(\frac{1\ min}{60\ sec}\right) = 26.2\ rad/s$

A. Calculate the angular acceleration in rad/s². Show your work.

$\alpha = \frac{\Delta\omega}{\Delta t} = \frac{26.2\ rad/s}{5s} = 5.24\ \frac{rad}{s^2}$

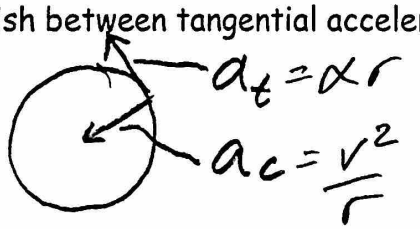
B. If she now slams on the brakes, causing an angular acceleration of -87.3 rad/s², how long does it take the wheel to stop? Show your work.

$\alpha = \frac{\Delta\omega}{\Delta t}$ $-87.3\ rad/s^2 = \frac{-26.2\ rad/s}{\Delta t}$ $\Rightarrow \Delta t = 0.3s$

5. How are tangential acceleration and angular acceleration related?

"linear accel." → $a_t = \alpha r$

6. Distinguish between tangential acceleration (a_t) and centripetal acceleration (a_c)?



7. A powerful motorcycle can accelerate from 0 to 30.0 m/s (about 108 km/h) in 4.20 s. What is the angular acceleration of its 0.320-m-radius wheels? Show your work.

$a_t = a = \frac{\Delta V}{\Delta t} = \frac{30\ m/s}{4.2s} = 7.14\ m/s^2$

$a = \alpha r \Rightarrow 7.14\ m/s^2 = \alpha (0.32\ m)$ $\frac{m}{rad}$

rad. of m per radian

$\alpha = 22.3\ rad/s^2$