NAME: Key DATE:

1. The wheel of radius r=.30 m spins at the rate of 900 rpm.
   a. What is the angular velocity of all points on the wheel?

- Convert rev to rad/s and min to sec

$\omega = 900 \frac{rev}{min} = \frac{2\pi\ rad}{1\ rev} \times \frac{1\ min}{60\ s} = 94.2\ rad/s$

   b. If the wheel slows uniformly to 60 rpm in 15 s, what angular acceleration does the wheel experience?

$\omega = 600 \frac{rev}{min} \times \frac{2\pi\ rad}{1\ rev} \times \frac{1\ min}{60\ s} = 6.28\ rad/s$

$\alpha = \frac{\omega - \omega_0}{t} = \frac{6.28\ rad/s - 94.2\ rad/s}{15\ s} = -5.9\ rad/s$

2. A small pully attached to the shaft of an electric motor has a radius of r=0.05 m and is turning with angular velocity of 5 rad/s and speed up to angular velocity of 8 rad/s in 2.5s.
   a. What acceleration does the pulley experience?

$\alpha = \frac{\omega - \omega_0}{t} = \frac{8\ rad/s - 5\ rad/s}{2.5\ s} = 1.2\ rad/s^2$

   b. What is the angular discplacement during this time peripd?

$\theta = \omega_0 t + \frac{1}{2}\alpha t^2 = \left(5 \frac{rad}{s}\right)(2.5\ s) + \frac{1}{2}\left(1.2 \frac{rad}{s^2}\right)(2.5\ s)^2 = 16.2\ rad$

   c. How many revolutions is this?

$n = 16.2\ rad \times \frac{1\ rev}{2\pi\ rad} = 2.6\ rev$

3. Compute the average angular acceleration and the angular displacement during the 2 seconds a rotating object speeds up from 0.5 rad/s to 0.7 rad/s.

$\alpha = \frac{\Delta\omega}{\Delta t} = \frac{0.7 - 0.5}{2} = 0.1\ rad/s^2$

$\Delta\theta = \omega_0 t + \frac{1}{2}\alpha t^2 = 0.5(2) + \frac{1}{2}(0.1)(2)^2 = 1 + 0.2 = 1.2\ rad$

4. A propeller, initially at rest, rotates about its midpoint with an angular acceleration of 12 rad/s2. How much time will it take to rotate through a 90 degree angle?

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

$\Delta\theta = 0\,t + \frac{1}{2}\alpha t^2$

$\Delta\theta = \frac{1}{2}\alpha t^2$

$\theta = \frac{\pi}{2}\ rad$

$t = \sqrt{\frac{2\Delta\theta}{\alpha}} = \sqrt{\frac{2\left(\frac{\pi}{2}\ rad\right)}{12\ rad/s^2}} = 0.51\ s$

5. A car tire is initially spinning with an angular speed of 150 rad/s. As the brakes are applied, the tire slows down at a rate of 25 rad/s2. How much time does it take the car to stop?

$\omega = \omega_0 + \alpha t$

$t = \frac{\omega - \omega_0}{\alpha} = \frac{0 - 150\ rad/s}{-25\ rad/s^2} = 6.0\ s$