Midterm #2, Engr 202. Spring 2015.

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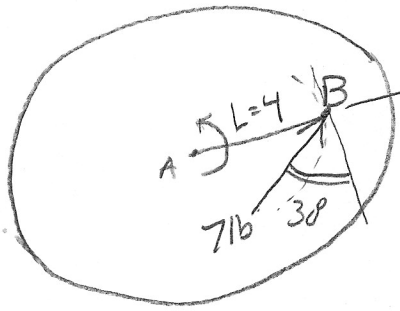
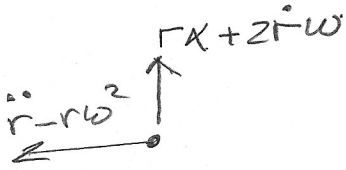
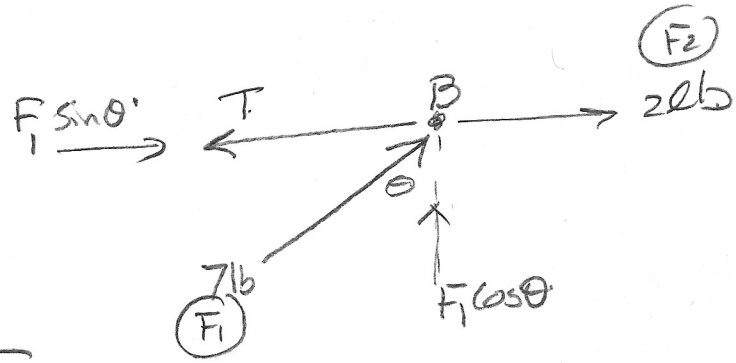
#3







using $\bar{h}_0 + \int_0^t \bar{M}dt = \bar{h}_{final}$.

but starting at rest. so $h_0 = 0$. and torque is

$$M = F_1 \cos\theta\, r$$

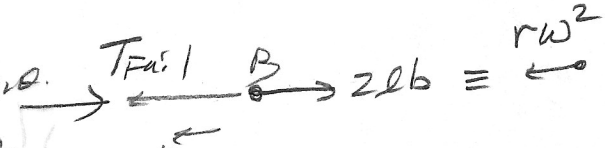
$$\Rightarrow \int_0^t F_1 \cos\theta\, r\, dt = I\omega_{final}$$

$$\Rightarrow F_1 \cos\theta\, r\, t_{final} = I\omega_{final} = mr^2\omega_{final}$$

(mass moment of inertia)

$$t_{final} = \frac{mr^2\omega_{final}}{F_1\cos\theta\, r} = \boxed{\frac{mr\omega_{final}}{F_1\cos\theta}} \quad (1)$$

to find ω_{final}. FBD



$$\Rightarrow -F_1\sin\theta + T_{Fail} - 2 = mr\omega^2_{final}$$

$$\omega^2_{final} = \frac{T_{Fail} - F_1\sin\theta - 2}{mr} = \frac{30 - 7\sin 30^\circ - 2}{\left(\frac{10}{32.2}\right)(4)} = 19.722$$

$$\boxed{\omega_{final} = 4.44 \text{ rad/sec}}$$

Plug into (1) $\Rightarrow t_{final} = \frac{\left(\frac{10}{32.2}\right)(4)(4.44)}{7\cos 30} = \boxed{0.91 \text{ seconds}}$

speed $= r\omega = \boxed{17.76 \text{ m/s}}$