Q1 Conservation of Momentum!!

$I_i = (50\ kg)(0.8\ m)^2$

$\omega_i = 2\ rad/s$

$I_f = (50\ kg)(0.2\ m)^2$

$\omega_f = ?$

There is no external force, and by the angular momentum of inertia, $\vec{\tau} = \frac{d\vec{L}}{dt}$

$$\frac{d\vec{L}}{dt} = 0 \iff \vec{L_f} = \vec{L_i}$$

Therefore,

$$\vec{L_i} = I_i \omega_i = (50\ kg)(0.8\ m)^2 \cdot (2\ rad/s)$$

$$\vec{L_f} = I_f \omega_f = (50\ kg)(0.2\ m)^2 \cdot (X\ rad/s)$$

Thus,

$$X\ rad/s = \frac{(0.8\ m)^2 (2\ rad/s)}{(0.2\ m)^2} = 32\ rad/s.$$

$$\therefore \omega_f = 32\ rad/s$$