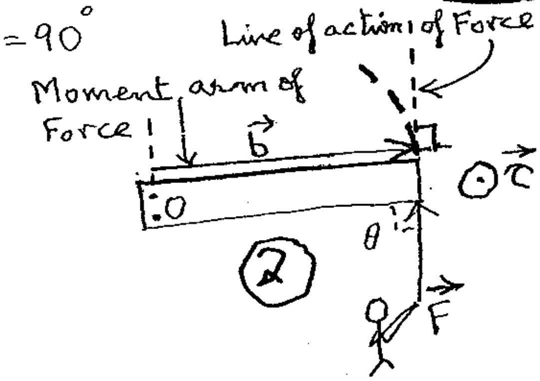
P-151/002 Random Graded HWK Total Pts = 75

{8-23} $F = 55\,N$, $b = 74\,cm\left(\frac{1\,m}{100\,cm}\right) = 0.74\,m$, $\theta = 90^\circ$



10 (a) $|\vec{\tau}| = |\vec{b} \times \vec{F}| = bF\sin\theta = bF = 0.74\,m \times 55\,N$

$\Rightarrow \tau = 40.7\,Nm$ (4)

(b) For $\theta = 45^\circ$

$\tau = 0.74\,m \times 55\,N\sin 45^\circ = \frac{40.7\,Nm}{\sqrt{2}}$

$\Rightarrow = 28.78\,Nm$ (4)

{8-53}

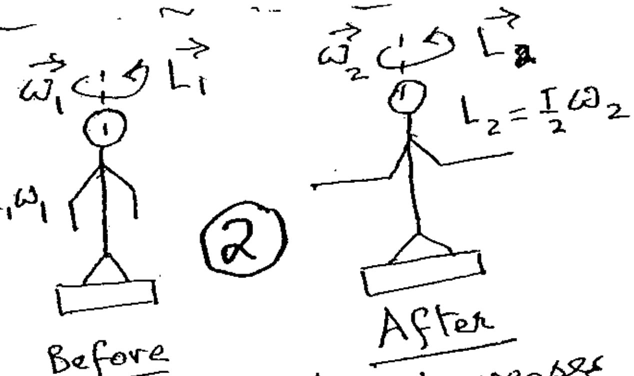
15

$\omega_1 = 1.3\,\frac{rev}{s}\left(\frac{2\pi\,rads}{1\,rev}\right)$

$\Rightarrow = 2.6\pi\,\frac{rads}{s}$ (2)

$\omega_2 = 0.8\,\frac{rev}{s}\left(\frac{2\pi\,rads}{rev}\right)$

$\Rightarrow = 1.6\pi\,\frac{rads}{s}$ (2)



(a) When arms are raised the moment of inertia increases $\Rightarrow I_2 > I_1$. However, angular momentum is conserved since no external torque is applied to the system $\Rightarrow L_2 = L_1 \Rightarrow I_2\omega_2 = I_1\omega_1$

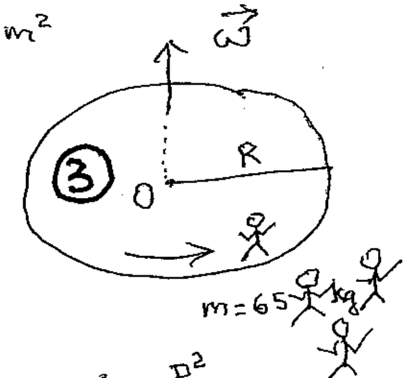
Since $I_2 > I_1$ we <u>must have</u> $\omega_2 < \omega_1$ (4)

(b) $\frac{I_2}{I_1} = \frac{\omega_1}{\omega_2} = \frac{2.6\pi\,rads/s}{1.6\pi\,rads/s}$

$\Rightarrow = 1.63$ (5)

P-151/002 Random Graded HWK

15 {8-62} $R = \frac{4.2\,m}{2} = 2.1\,m$, $\omega = 0.8\,\frac{rads}{s}$, $I_{mgr} = 1760\,kg\,m^2$



(3)

The angular momentum of merry-go-round plus people will be conserved since no external torque is applied to the system.

$L_f = L_i \Rightarrow I_i \omega_i = I_f \omega_f$ (2)

$\Rightarrow \omega_f = \frac{\omega_i I_i}{I_f} = \omega_i \frac{I_{mgr}}{I_{mgr} + I_{people}}$, where $I_{people} = 4 m R^2$

$= \frac{0.8 (\frac{rads}{s}) \times 1760\,kg\,m^2}{1760\,kg\,m^2 + 4(65\,kg)(2.1\,m)^2}$

$= \frac{1408\ rads/s}{1760 + 1146.6}$

$= \frac{1408}{2906.6}\,\frac{rads}{s}$

(a) $\omega_f = 0.48\,\frac{rads}{s}$ (5)

(b) If 4 people were on merry-go-round initially and they jump off radially outward from merry-go-round, they would exert no torque on the merry-go-round! So merry-go-round would continue to have an angular speed of $0.8\,\frac{rads}{s}$ (5)