Chapter 8 End of chapter problems 72-96 even

#72

$S = 1.50\,m$

$r = 2.50\,m$

$\theta = ?$

$S = r\theta$; $\theta = \frac{S}{r} = \frac{1.50}{2.50} = \underline{0.600\,rad}$

#74

$\theta = 128° \times \frac{\pi^R}{180°} = 2.23^R$

$r = 22\,cm = .22\,m$

$S = ?$

$S = r\theta$

$S = (.22)(2.23) = \underline{0.49\,m}$

#76

$\omega_o = 475 \frac{rev}{min} \times \frac{2\pi^R}{1\,rev} \times \frac{1\,min}{60\,sec} = 47.9\,rad/sec$

$\omega_f = 187 \frac{rev}{min} \times \frac{2\pi^R}{1\,rev} \times \frac{1\,min}{60\,sec} = 19.6\,rad/sec$

$t = 4.00\,sec$

$\alpha = \frac{\Delta\omega}{t} = \frac{\omega_f - \omega_o}{t} = \frac{19.6 - 47.9}{4.00} = -7.08\,rad/s^2$

* w/o rounding $\alpha = -7.54\,rad/s^2$

#78

$\omega_f = 542 \frac{rev}{min}$

$\omega_s = 328 \frac{rev}{min}$

$a_c = \frac{v^2}{r}$ and $v = r\omega$ so, $a_c = r\omega^2$

(a)

$a_{fast} = r(542)^2$

$a_{slow} = r(328)^2$

$\frac{a_{fast}}{a_{slow}} = \frac{r(542)^2}{r(328)^2} = 2.73$

(b)

$v_{fast} = r\omega_f = r(542)$

$v_{slow} = r\omega_s = r(328)$

$\frac{v_{fast}}{v_{slow}} = \frac{r(542)}{r(328)} = 1.65$

#80 $a_c = 0.35 \times 10^6 g = (0.35 \times 10^6)(9.80) = 3.53 \times 10^6 \, m/s^2$

$r = 2.50 \, cm = 2.50 \times 10^{-2} \, M$

$$a_c = \frac{v^2}{r} = \frac{(r\omega)^2}{r} = r\omega^2; \quad \sqrt{\frac{a_c}{r}} = \omega$$

$$\omega = \sqrt{\frac{3.53 \times 10^6}{2.50 \times 10^{-2}}} = 11879 \frac{rad}{sec} \times \frac{1 \, rev}{2\pi^R} \times \frac{60 \, sec}{1 \, min} = 1.13 \times 10^5 \frac{rev}{min}$$

#82

$F = 15 N$

$\theta = 90°$

$r = 25 cm = 25 \times 10^{-2} m$

$\tau = F_r \sin\theta = (15)(25 \times 10^{-2}) \sin 90°$

$\tau = 3.8 \, N\text{-}m$

#84 $r = 38 cm = 38 \times 10^{-2} M$

$\alpha = 2.67 \, rad/s^2$

$F = 0.35 N$

$\theta = 90°$

$\tau = I\alpha; \quad I = \frac{\tau}{\alpha} = \frac{F r \sin\theta}{\alpha}$

$$I = \frac{(0.35)(38 \times 10^{-2}) \sin 90°}{2.67} = 0.050 \, Kg\text{-}m^2$$

#86 $m = 12.5 \, kg$

$l = 4.00 m$

a) At the opposite end of the board, only $\frac{1}{2}$ of the board's mass will need to held up by Judi.

$F = \frac{1}{2} mg = (0.5)(12.5)(9.80) = 61.3 N$

b) At the board's center of mass, she will lift the entire mass.

$F = mg = (12.5)(9.80) = 122 N$

#88 53% on front tires

47% on rear tires

wheel base = 2.46 m

Let the center of mass be x from the front of the car. Let the weight of the car be F_W.

$$\tau_{front} = \tau_{back}$$

$$F_{front} r_{front} = F_{rear} r_{rear}$$

$$(.53 F_W)x = (.47)(2.46 - x)$$

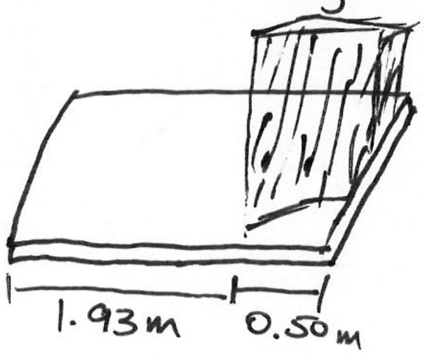
$$.53x = 1.1562 - .47x$$

$$.53x + .47x = 1.1562$$

$$1x = 1.1562\,m$$

Center of gravity of the car is 1.15 m from the front of the car

#90 10 bags of soil each weighing 175 N



$$F_{left} + F_{right} + F_{bags} = 0 \qquad \tau_{left} + \tau_{right} + \tau_{bags} = 0$$

Let F_{right} be axis of rotation; $\tau_{right} = 0$

$$\tau_{left} = -\tau_{bags}$$

$$F_{left} r_{left} = -F_{bags} r_{bags}; \quad F_{left} = \frac{-F_{bags} r_{bags}}{r_{left}}$$

$$F_{left} = \frac{-(10)(-175)(0.50)}{2.43} = 3.6 \times 10^2\,N$$

solve back for F_{right}; $F_{right} = -F_{left} - F_{bags}$

$$F_{right} = -3.6 \times 10^2 - (10)(-175)$$

$$F_{right} = 1.4 \times 10^2\,N$$

#92 $v_o = 2.5\,m/s$ $v_f = 0\,m/s$ a) $\alpha = \frac{a}{r}$

$r = \frac{0.241}{2} = 0.1205\,m$

$\Delta x = 12\,m$

$a = \frac{v_f^2 - v_o^2}{2\Delta x} = \frac{0^2 - 2.5^2}{2(12)}$

$a = {}^{-}0.26\,m/s^2$

$I = 5.8 \times 10^{-3}\,kg\text{-}m^2$

$\alpha = \frac{-0.26}{0.1205} = -2.16\,rad/s^2$

b) $\tau = I\alpha$

$\tau = (5.8 \times 10^{-3})(-2.16) = 1.25 \times 10^{-2}\,N\text{-}m$

#94

$\omega_f = 7200\,rpm \times \frac{2\pi R}{1\,rev} \times \frac{1\,min}{60\,s} = 754\,rad/sec$

$\omega_o = 0\,rpm = 0\,rad/sec$

$t = 1.5\,sec$

$\alpha = \frac{\Delta\omega}{\Delta t} = \frac{\omega_f - \omega_o}{\Delta t} = \frac{754 - 0}{1.5} = 5.03 \times 10^2\,rad/sec^2$

#96

$\mu = 0.35$
height $= 0.50\,m$
width $= 0.25\,m$

M = mass of the box ; center of mass = .25 m above the floor ($\frac{1}{2}$ way up the box)
The box tips when the torques equal.

$\tau_{rope} = \tau_{friction}$

$F_{rope} r_{rope} = F_{friction} r_{friction}$

$F_{rope} = \frac{F_{friction} r_{friction}}{r_{rope}} = \frac{\mu M g r_{friction}}{r_{rope}}$

$F_{rope} = \frac{(0.35)(M)(9.80)(0.25)}{h - 0.25} = \frac{0.86\,M}{h - 0.25}$