HW4 p 269 P 32
p 311 P 22, 28, 31, 66
online (1) Sculpture in Equilibrium
(2) Axis of Rotation & I Rank

p269 - Problem

32) Two people hold hands on rollerblades
1m apart
$m_1 = 50kg$
$m_2 = 75kg$

a) Estimate center of mass? (from m_1)

$$X_{cm} = \frac{m_1 X_1 + m_2 X_2}{m_1 + m_2} = \frac{75kg\,(1m)}{50kg + 75kg}$$

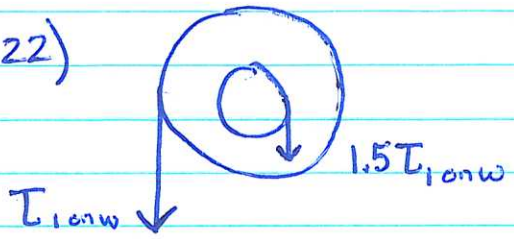
$X_{cm} = .60m$ from m_1

b) Push off + roll 4m apart. New CM?

X_{cm} stays same → no Fnet from external

p 311 – Problems

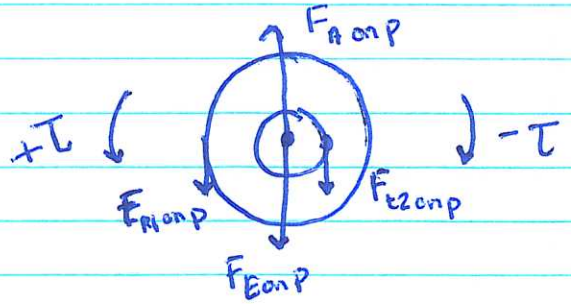
22)



• Solid 2 part pulley

$r_1 = 2.0a$ $r_2 = 1.5a$

a) Force diagram



b) $\Sigma\tau = \tau_1 - \tau_2 = F_1 r_1 - F_2 r_2$

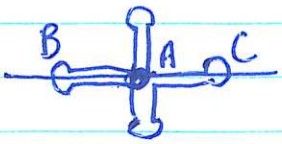
$= T_1(2a) - 1.5T_1(1.5a)$

$= 2T_1a - 2.25T_1a$

$= -.25T_1a$

c) sign ω? Initially +, will become –

d) sign α? Negative, will not change

28) 

$I = ?$

- massless rods
- axis $\perp$ to paper through point A

$$I = \Sigma mr^2 = 4(m)(1.0m)^2 = 4m$$

31) $\omega_0 = 0 rad/s$
$\omega_f = 1.5 rad/s$
$t = 8.0s$

merry go round mechanic (solid disk)

$\tau = ?$

$r = 5.0m$
$m = 25000kg$

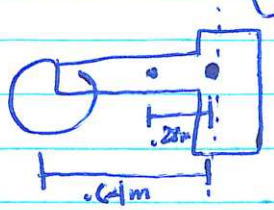
① $\alpha = \frac{\Delta\omega}{t} = \frac{1.5 rad/s}{8s} = .19 rad/s^2$

② $\tau = I\alpha = \frac{1}{2}mR^2\alpha$

$= \frac{1}{2}(25000kg)(5m)^2(.19 rad/s^2)$

$= 5.9 \times 10^4 Nm$

66) · Bowling ball throw



$l = .64m$ $\quad \alpha = ?$

$m_b = 2.7kg$

$I_{arm} = .48\ kgm^2$ $\quad \alpha = \frac{\Sigma \tau}{I}$

$m_{arm} = 3.5kg$

$r_{cm} = .28m$

(1) $\Sigma \tau = \tau_{ball} + \tau_{arm}$

$= m_b g r_{ball} + m_{arm} g r_{arm}$

$= (2.7kg)(9.81m/s^2)(.64m) + (3.5kg)(9.81m/s^2)(.28m)$

$= 26.6\ Nm$

(2) $I_{net} = I_{ball} + I_{arm}$

$= mr^2 + I_{arm}$

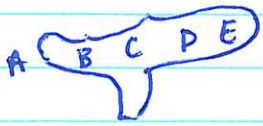
$= (2.7kg)(.64m)^2 + .48\ kgm^2$

$= 1.59\ kgm^2$

(3) $\alpha = \frac{\Sigma \tau}{I_{net}} = \frac{26.6\ Nm}{1.59\ kgm^2} = 16.7\ rad/s^2$

– Online

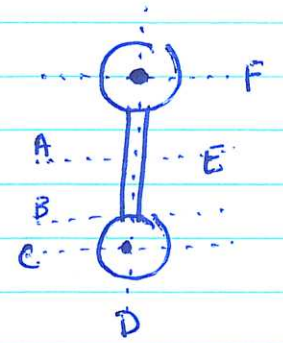
① Sculpture in Equilibrium



Where is center of mass?

C – right above support

② Axis of Rotation & I Rank



- Two identical uniform solid spheres attached by solid thin rod
- The rod lies on line connecting center of mass of 2 spheres
- ABCD plane of the page
- EF ⊥ to plane

Rank I about the axes indicated (large to sm)

C B A D
F E

A: $mr^2 + mr^2 = 2mr^2$ E same as A
C: $m(2r)^2 = 4mr^2$ F same as C