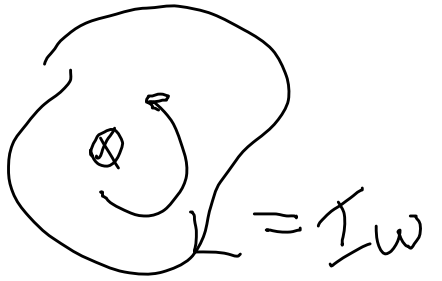
Phys 2110-4 4/2/12

Note Title 4/2/2012

Angular Momentum



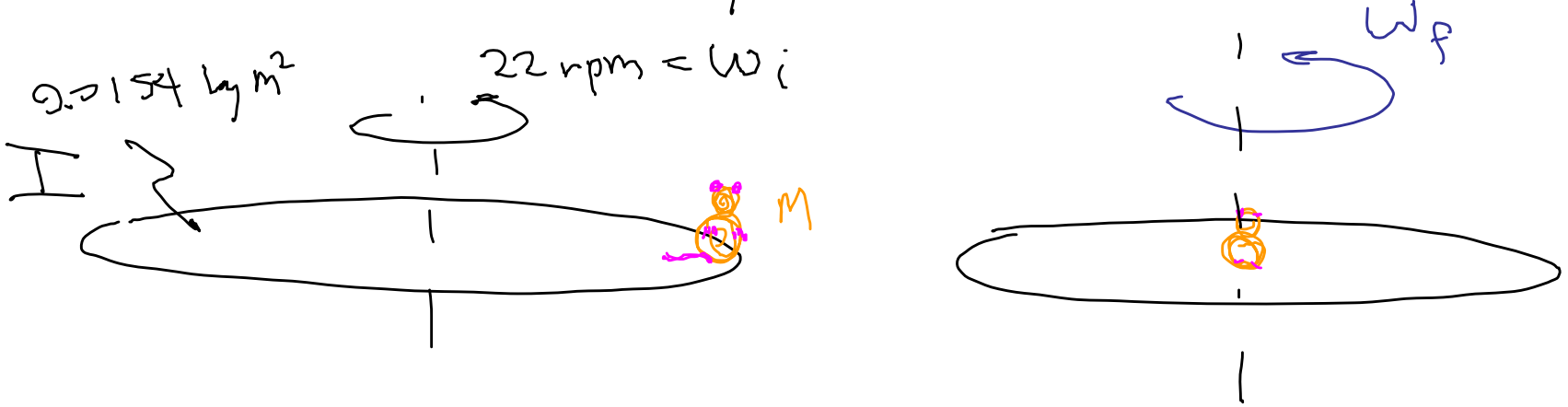
$L = I\omega$

$\left(\frac{kg\ m^2}{s}\right)$

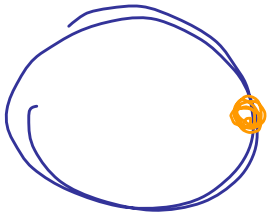
No (net) external torque

L_{total} is conserved.

11.38 A turntable of radium 25 cm & rot. inertia 0.0154 kg m² is spinning freely at 22 rpm about central axis with 19.5 g mouse at edge. Mouse walks from edge to center. Find new rotation rate & work done by mouse.



L_{total} is cons'd:



$$L_i = I_i \omega_i = \left(I_{disk} + mR^2\right)\omega_i$$

$$L_f = I_f \omega_f = \left(I_{disk}\right)\omega_f$$

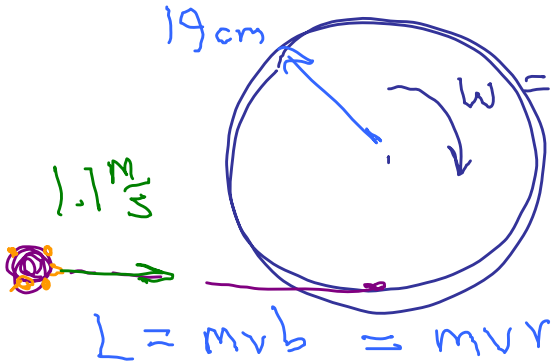
Equ:

a) $$\omega_f = \frac{\left(I_{disk} + mR^2\right)}{I_{disk}}\omega_i = 2.48\ \frac{rad}{s}$$

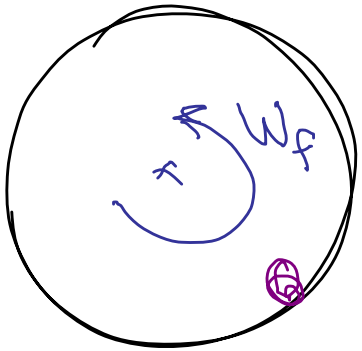
$$= 23.7\ \frac{rev}{min}$$

b) $$\Delta KE = \frac{1}{2}I_f\omega_f^2 - \frac{1}{2}I_i\omega_i^2 = 3.3\times10^{-3}\ J$$

11.43 A circular bird feeder 19 cm in radius has rotational inertia $0.12\ kg\ m^2$ spinning slowly at 5.6 rpm. 140 g bird lands on rim, comes in tangent at 1.1 m/s, opp feeder's rotation. What is rotn rate after bird lands.



$$L_i = (I_{feeder})(-5.6\ rpm) + (140\ g)(1.1\ m/s)(0.19\ m)$$



$$L_f = (I_{system})\,\omega_f$$

$$= (I_{feet} + mr^2)\,\omega_f$$

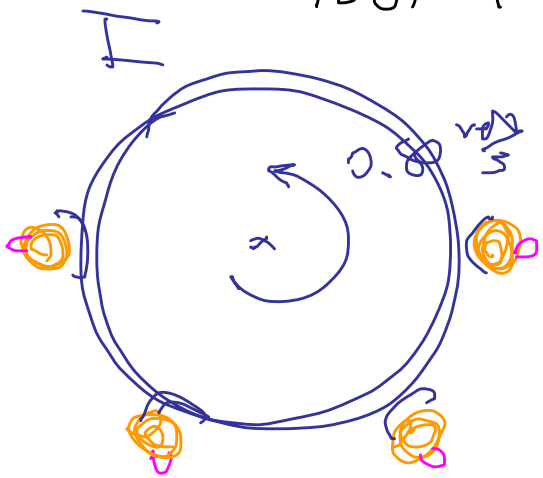
Equate them ω_f

11.26 3m – diam. merry-go-round

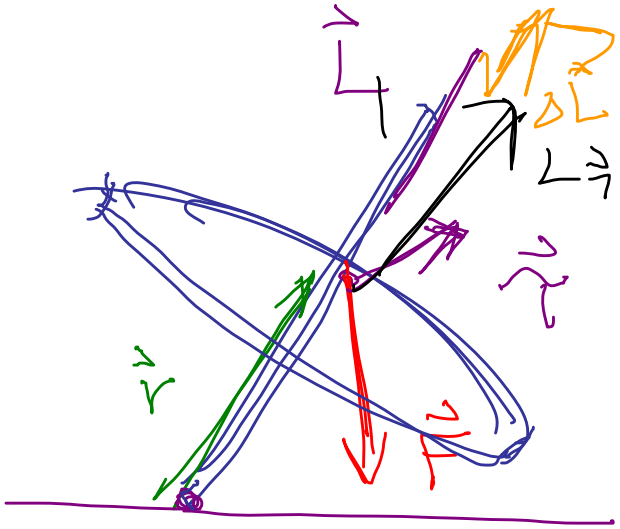
$I = 120\ kg\ m^2$ spins 0.50 rev/s

4 25 kg children sit suddenly on edge, find new angular speed, energy lost to friction

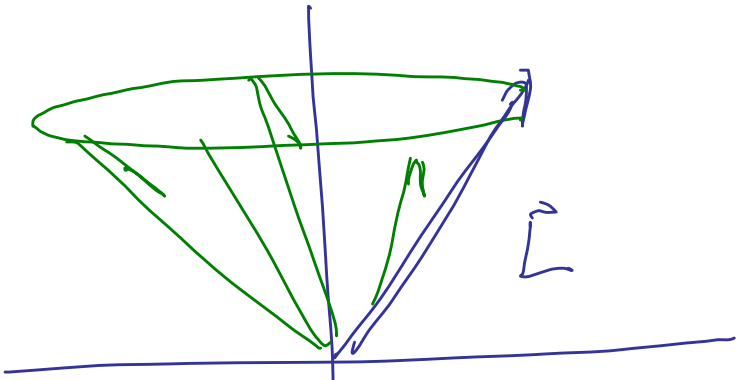
b) OK



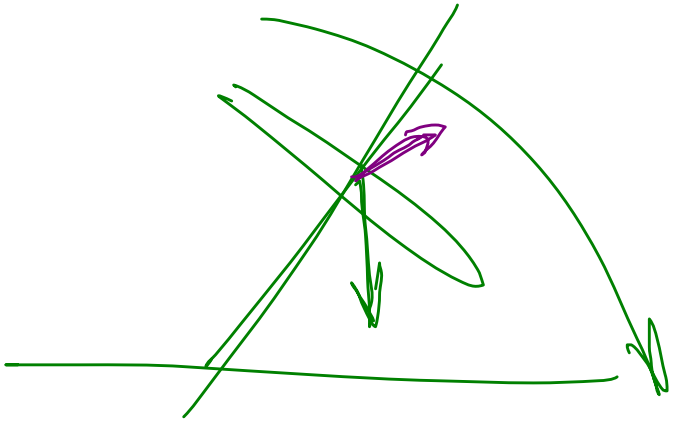
$$I_{disk}\omega_i = (I_{disk} + 4mr^2)\,\omega_f$$



$$\vec{\tau} = \frac{\Delta \vec{L}}{\Delta t}$$



Precession.

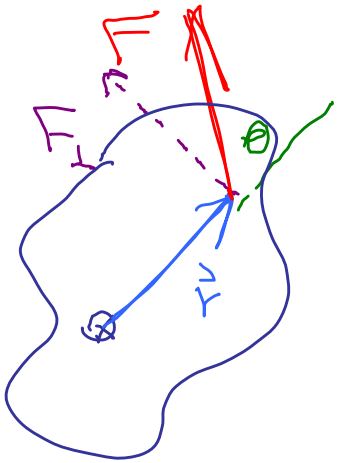


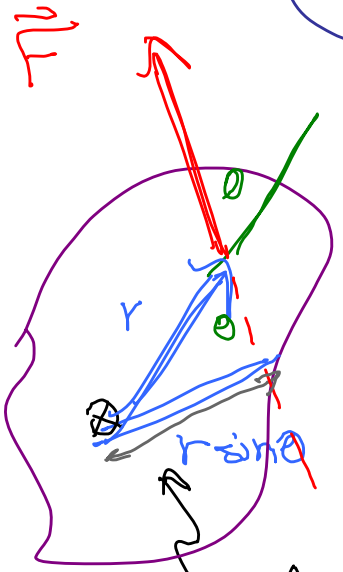
Chap: Vector nature.

$\vec{\tau} = \vec{r} \times \vec{F}$ $\quad \vec{L} = \vec{r} \times \vec{p}$

$L = Iw$ $\quad L$ is conserved.

Torque





l lever arm

$$\tau = rF\sin\theta$$

$$= r(F\sin\theta)$$

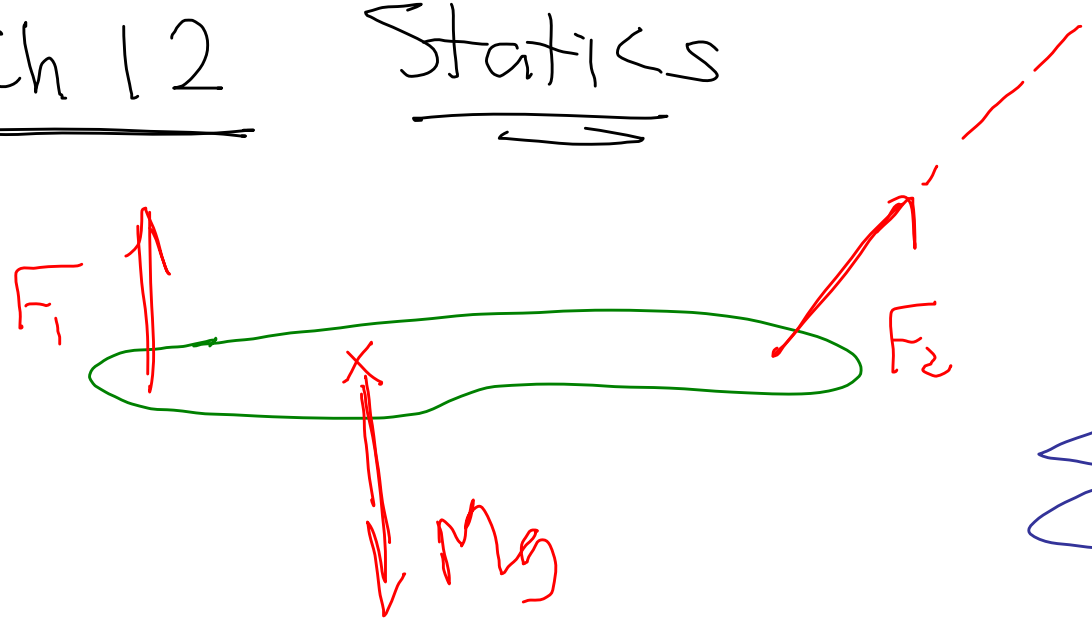
$$= rF_\perp$$

$$= (r\sin\theta)F$$

$$= r_\perp F$$

par/perp ($\tau = rF$)

Ch 12 Statics

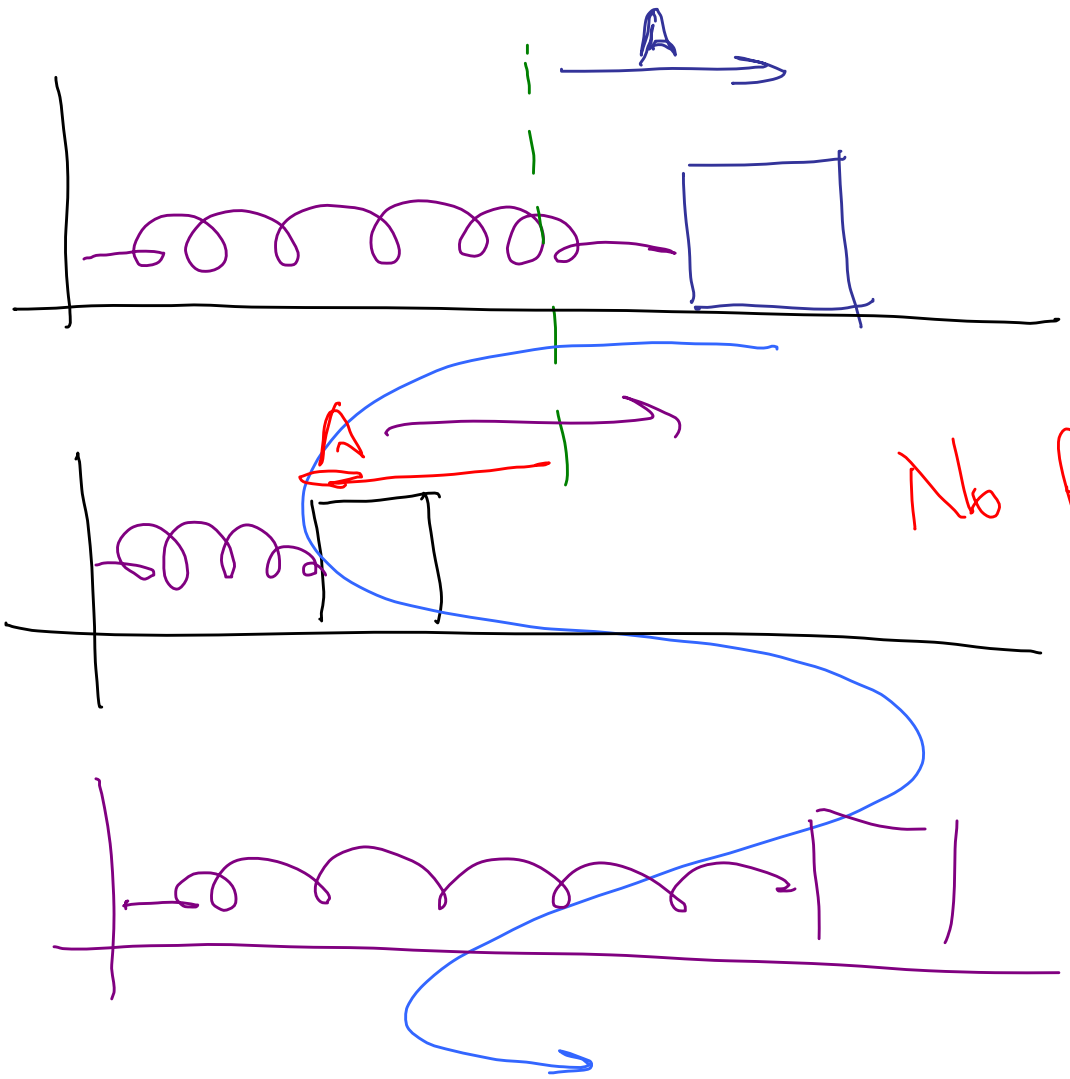


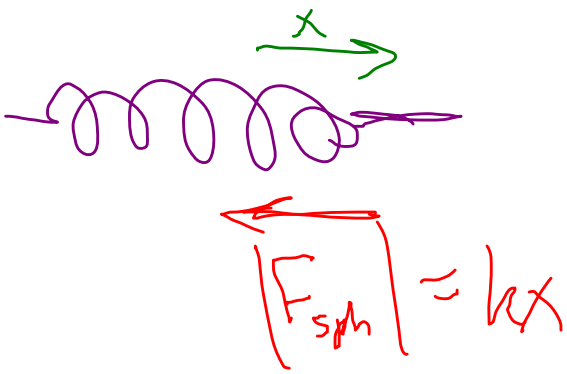
Not more.

$$\sum \vec{F} = 0$$

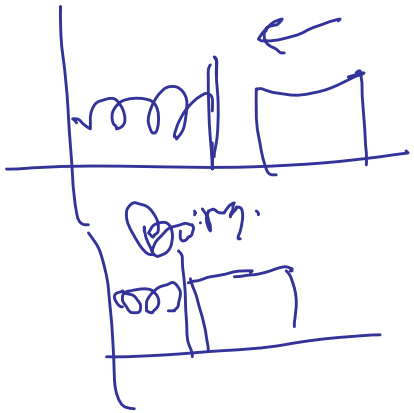
$$\sum \tau = 0$$

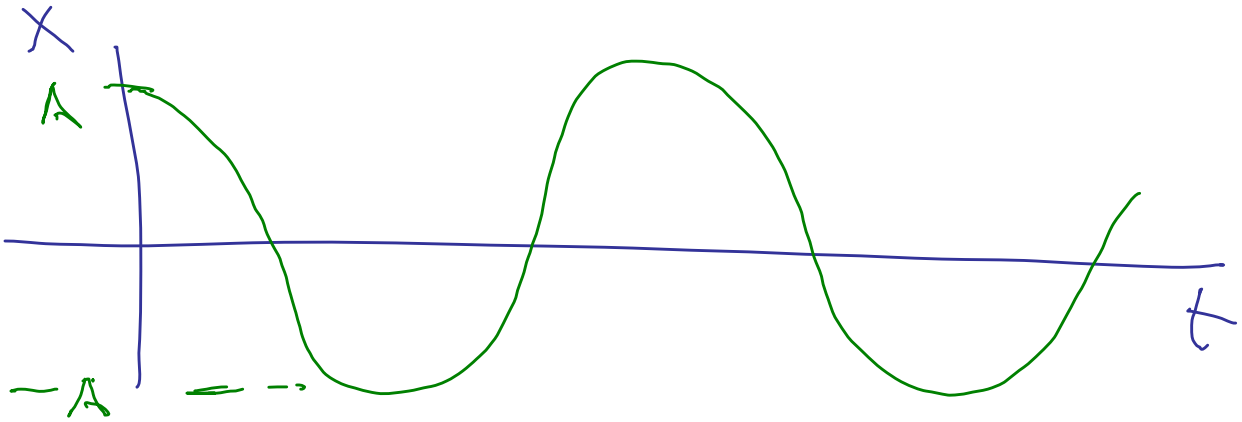
ME 202 Statics





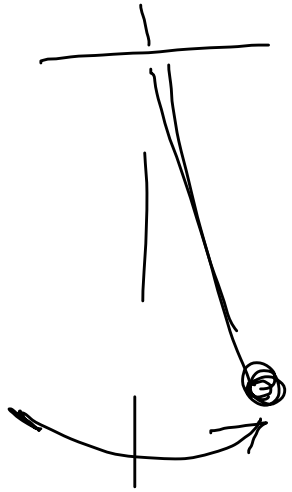
$F_x = -kx$





k, m

$A\cos(\omega t)$?



Oscillations

(Linear Restoring Force)

Simple Harmonic Motion

SHM, SHO.