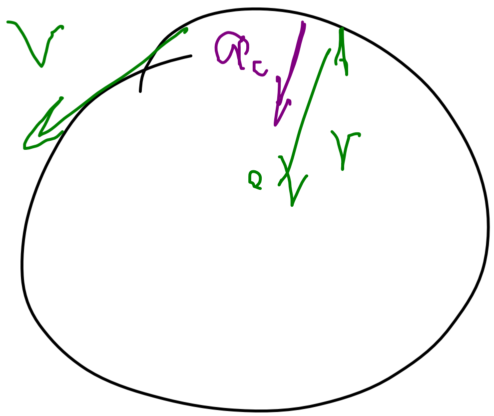
Phys 2110-4 2/22/13

Note Title 2/22/2013

Force problems



$$a_c = \frac{v^2}{r}$$

$$F_c = \frac{mv^2}{r}$$

(net)

Kinetic fric

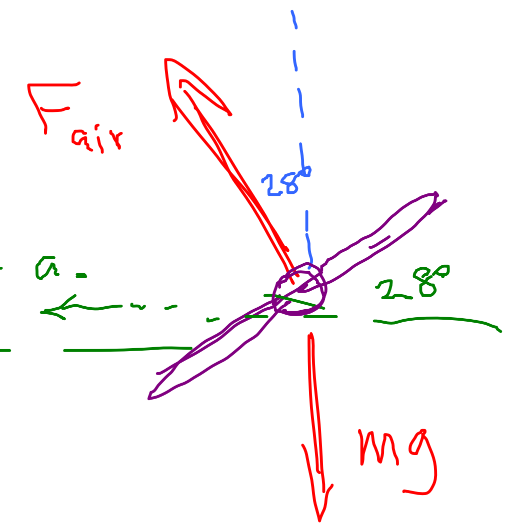
$$f_k = \mu_k n$$

Static fric

$$f_s^{(max)} = \mu_s n$$

5.27 An airplane goes into a turn 3.6 km in radius. If banking angle required is 28° from horizontal, whats the plane's speed ?

(Net) force toward center $\frac{mv^2}{r}$



No net force up/down

up/down $\quad F_{air} \cos 28° - mg = 0$

Centripetal

$$\cancel{F_{air}} \sin 28 = \frac{\cancel{m}v^2}{r}$$

$$\cancel{F_{air}} \cos 28 = \cancel{m}g$$

Divide the eqns

$$\tan 28 = \frac{v^2}{gr}$$

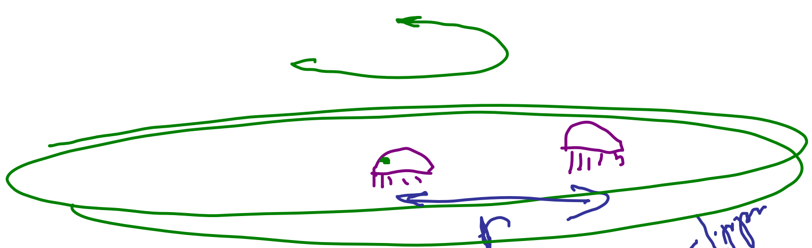
$$v = \sqrt{gr \tan 28}$$

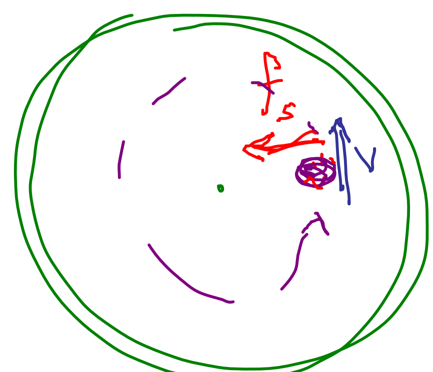
$r = 3600$ m

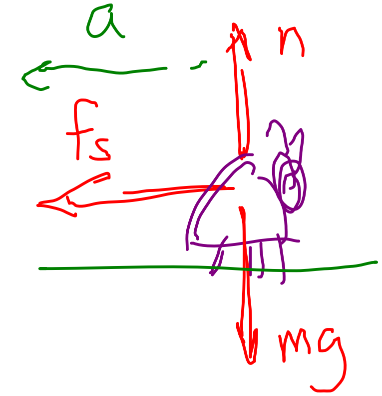
$\longrightarrow 137 \frac{m}{s}$

$= 490 \frac{km}{hr}$

5.48 A bug crawls outward from center of a CD spinning at 200 rev/min. The coefficient of static fric between bug's feet & disc is 1.2. How far does bug get before slipping?







at slipping

$$f_s = \frac{mv^2}{r} = f_s^{(max)} = \mu_s n = \mu_s mg$$

True

No slipping

$$f_s = f_s^{max} = \frac{\cancel{m}v^2}{r} = \mu \cancel{m} g$$

$$r = \frac{v^2}{\mu g}$$

$$v = \frac{2\pi r}{T}$$ use this

$$r = \frac{1}{\mu g}\left(\frac{2\pi r}{T}\right)^2$$

Algebra
get r

Get $r = 2.7$ cm.

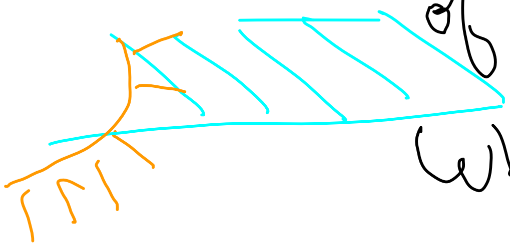
$200 \frac{rev}{min}$

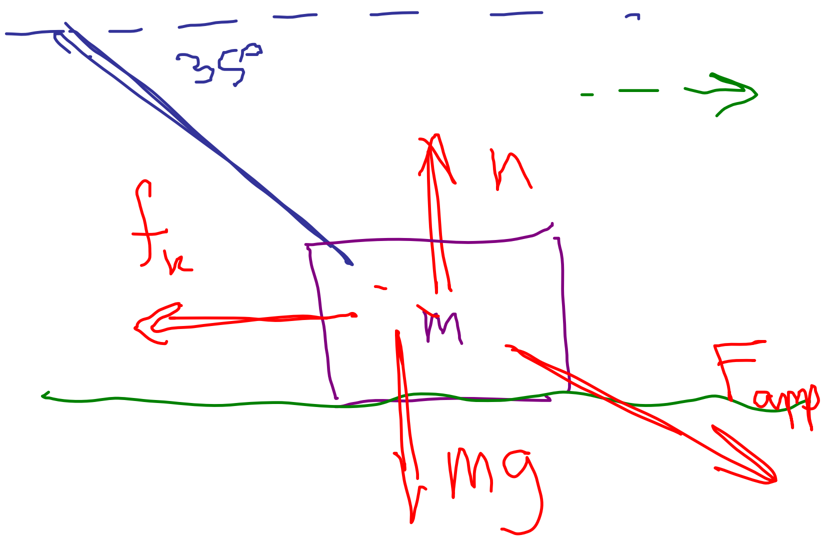
How long for CD to turn once

$$T = \underset{rot}{\text{Period of}} = \frac{1 \text{ min}}{200 \text{ rev}}$$

$$= \frac{60 \text{ sec}}{200 \text{ rev}} = 0.30 \text{ s}$$

5.44 Handle of 22 kg lawnmower makes 35° angle w/ horizontal. If coefficient of friction between mower/ground is 0.68 What mag of force exerted on handle is nec. to move mower at constant speed?





$\vec{a} = 0$

$\sum F_y = 0$

$\sum F_x = 0$

Vert:

$n - mg - F_{app} \sin 35° = 0$

$n = mg + F_{app} \sin 35°$

Horiz forces

$$-f_k + F_{app}\cos 35^\circ = 0 = m\cancel{a_x}$$

F_{app}

$$f_k = \mu_k n$$

$$= \mu_k(mg + F_{app}\sin 35)$$

$$F_{app}\cos 35^\circ = f_k = \mu_k(mg + F_{app}\sin 35^\circ)$$

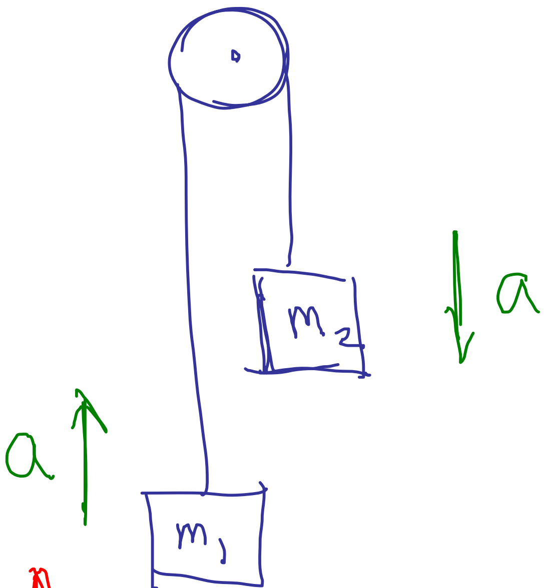
$\longrightarrow F_{app}$ Algebra etc.

Classic problem:

Attwood machine

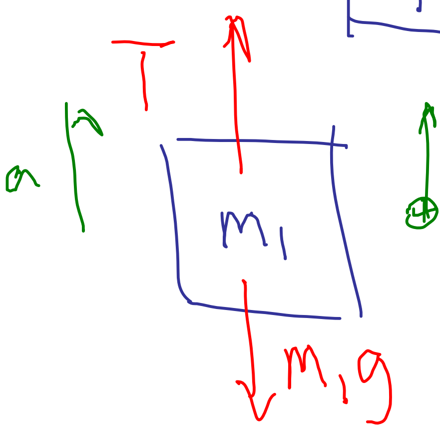
Ideal pulley, string att'd to m_1, m_2

<u>Find accel</u> of masses, when released



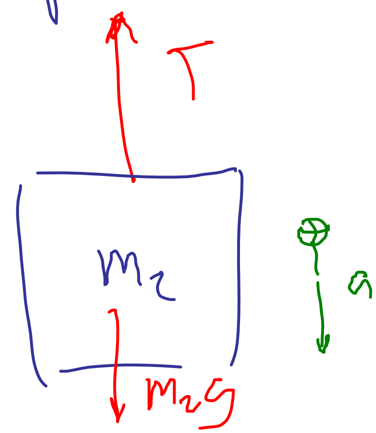
Assume $m_2 > m_1$

m_2 falls m_1 goes up.



$$\boxed{\begin{aligned} T - m_1 g &= m_1 a \\ m_2 g - T &= m_2 a \end{aligned}}$$

2 eqns 2 unk's T, a



Add together

$$m_2 g - m_1 g = m_1 a + m_2 a$$

Find a:

$$(m_2 - m_1) g = (m_1 + m_2) a$$

$$a = \frac{(m_2 - m_1)}{(m_1 + m_2)} g$$

Makes sense?

$m_2 = m_1 \Longrightarrow a = 0$

$m_2 = m \quad m_1 = 0$

$$\frac{m}{m} g = g$$

$m_2 = 0 \quad m_1 = m \quad -\frac{m}{m} g = -g$

Chap 6, 7

Energy

8

Normal

9

Momentum ...

Still based on $\vec{F} = m\vec{a}$

Derive new "laws" to help solve problems