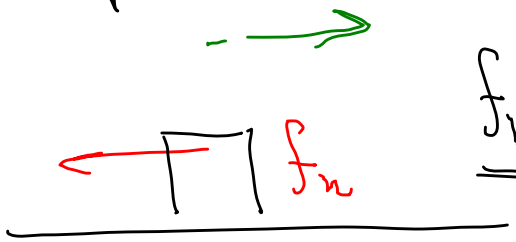
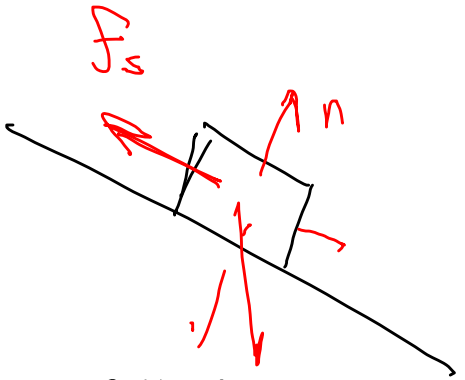
Phys 2110-4 2/17/12

Note Title 2/17/2012

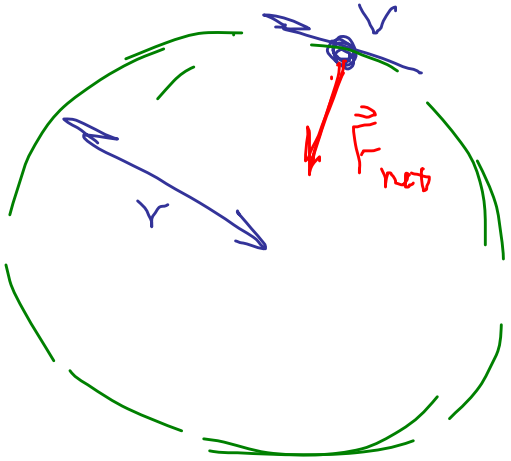
Chap 5: Friction:



$$f_k = \mu_k n$$



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

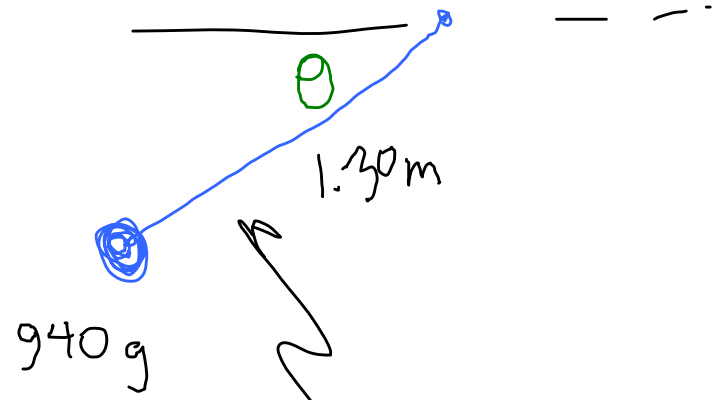


Uniform Circ Motion

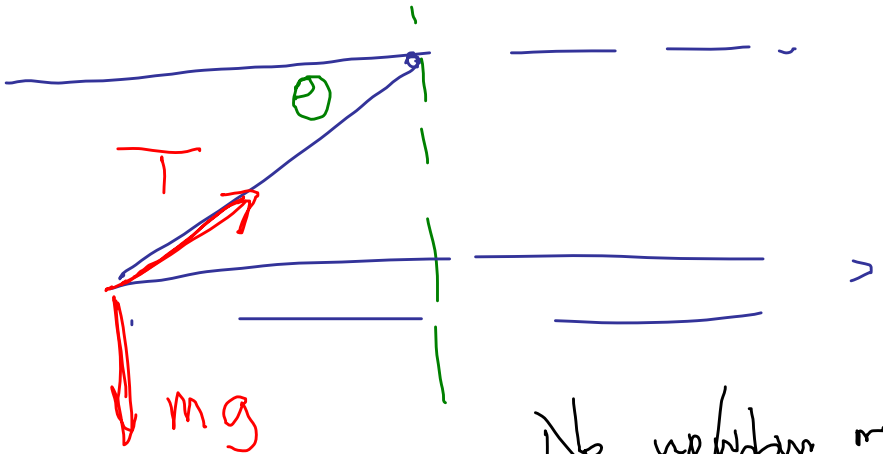
$$F_{net} = \frac{mv^2}{r}$$

5.24 a) Minimum θ

b) What is speed then?



Breaking strength is 120 N



No up/down motion

Vertical forces cancel

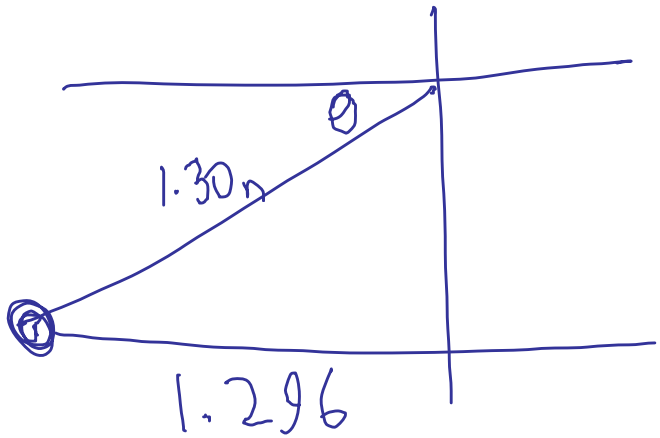
$+T\sin\theta - mg = 0$ (1201)

$T\sin\theta = mg$

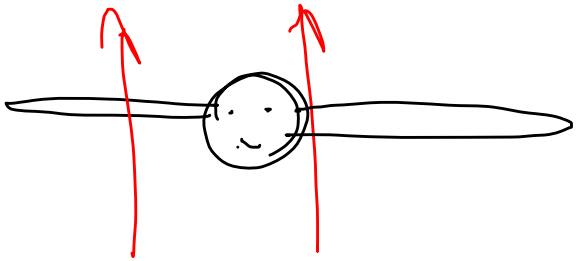
$\Rightarrow \quad \sin\theta = 0.9970 \qquad \theta = 85.6°$

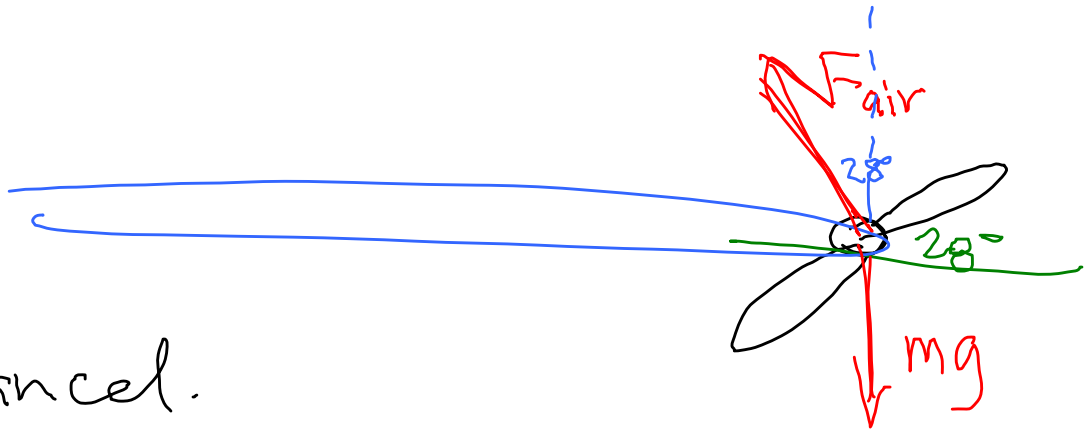
$$F_c = \frac{mv^2}{r} = T\cos\theta$$

$\Rightarrow 12.8 \frac{m}{s}$



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





Vertical forces cancel.

$$F_{air}\cos 28 - mg = 0$$

(1) $F_{air}\cos 28 = mg$

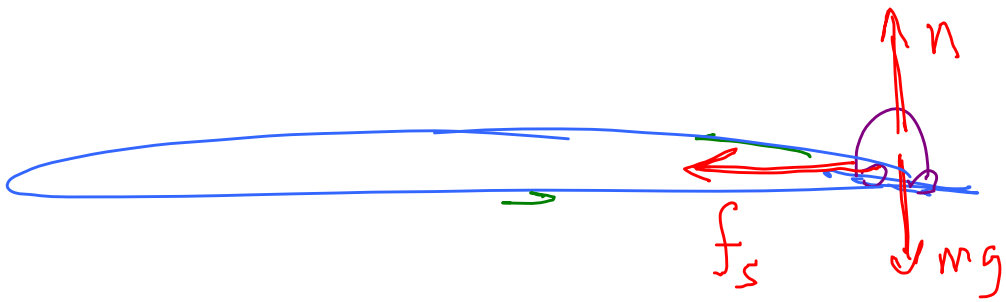
(2) $F_{air}\sin 28^\circ = \frac{mv^2}{r}$

Divide (2) by (1)

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

$$v = 137 \frac{m}{s}$$
$$= 490 \frac{km}{hr}$$

5.31 What frictional coefficient is needed to keep a car moving at $90 \frac{km}{hr}$ on a 120 m radius unbanked curved



$$f_s \leq f_s^{max} = \mu_s n$$

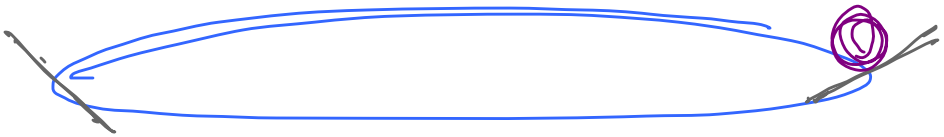
$$= \mu_s mg$$

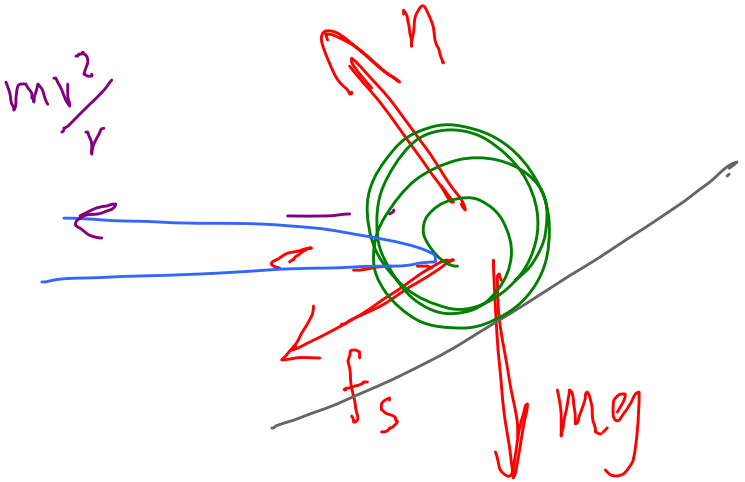
$$= m\frac{v^2}{r}$$

$$\mu = 0.531$$

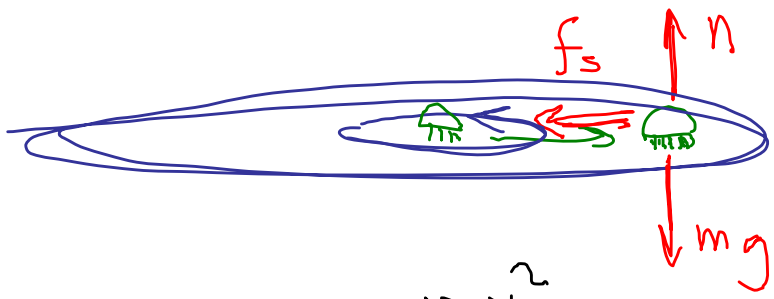
Banked curved

w/ friction.





5.48 A bug crawls outward from center of CD spinning at 200 rev/min. Coeff of static friction between bug & disc is 1.2. How far does bug get from center w/o slipping?



Time req'd 1 rev:

$$T = \frac{1\ \text{min}}{200\ \text{rev}} = 0.300\ \text{s}$$

$$n = mg \qquad \frac{mv^2}{r} = f_s = \mu_s n = \mu_s mg$$

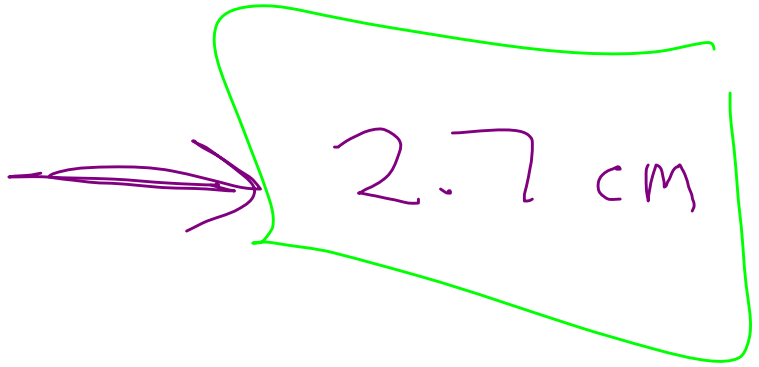
$$\frac{mv^2}{r} = \mu_s m g$$

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

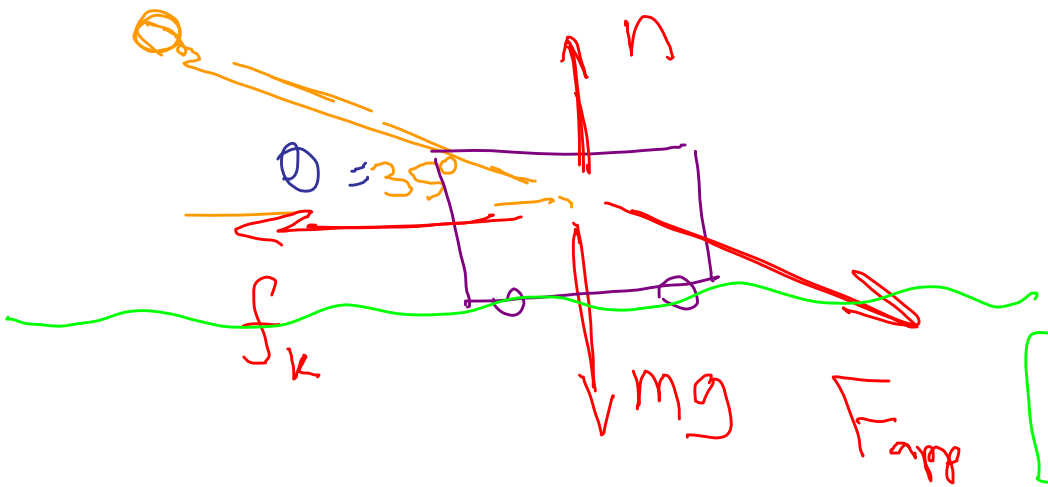
$$\frac{1}{r}\left(\frac{2\pi r}{T}\right)^2 = \mu_s g$$

$$\frac{4\pi^2 r}{T^2} = \mu_s g$$

$T =$



5.44 Handle of a 22-kg lawnmower makes angle 35° w/ horizontal Coeff of fric between mower & ground is 0.68. What magnitude force applied in dir of handle is req'd to make lawn mower move at constant velocity? Compare w/ mower's wt.



Vertical forces cancel

$$n - mg - F_{app}\sin 35^\circ = 0$$

$$n = mg + F_{app}\sin\theta$$

Horiz forces cancel:

$$f_k = F_{app}\cos\theta = \mu_k n = \mu_k (mg + F_{app}\sin\theta)$$

$$F_{app}\cos\theta = \mu_s(mg + F_{app}\sin\theta)$$

$$F_{app} = \frac{\mu_s mg}{(\cos\theta - \mu_k \sin\theta)} = 342\ N$$

$$= 1.6\ W$$

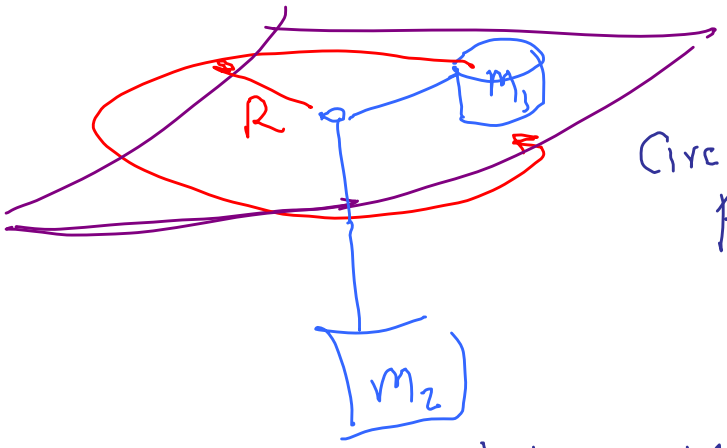
$$= 1.6\ mg$$

$$W = mg$$

5.37

$T = m_2 g$

$T = \frac{m_1 v^2}{R}$



Circ motion
R

stationary

Find T (tension)

Period = P

m's given

$V = \frac{2\pi R}{P}$ (R given)

$$T = m_2 g$$

$$T = \frac{m_1 v^2}{R} = \frac{m_1}{R}\left(\frac{2\pi R}{P}\right)^2 = \frac{4\pi^2 m_1 R}{P^2}$$

$$m_2 g = \frac{4\pi^2 m_1 R}{P^2}$$

$$P^2 = \frac{4\pi^2 m_1 R}{m_2 g} \qquad P = \sqrt{\frac{4\pi^2 m_1 R}{m_2 g}}$$