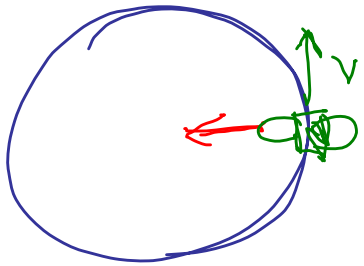
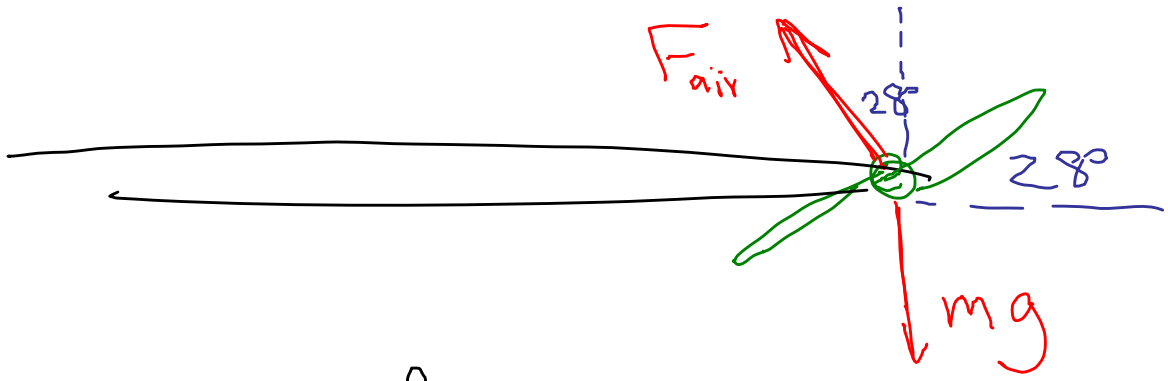
Phys 2110-4 10/3/11

Note Title 10/3/2011

Solve force problems! Chap 5

5.27 Airplane goes into turn 3.6 km in radius. Banking angle req'd is 28°. What plane's speed?





Vertical forces: (cancel)

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

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

$$\tan 28^\circ = \frac{mv^2/r}{mg} = \frac{v^2}{gr}$$

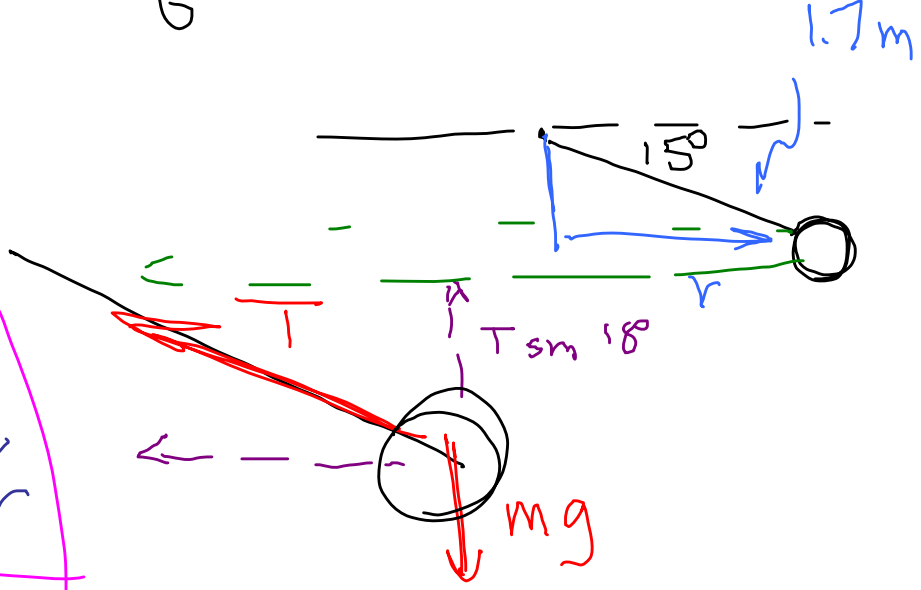
Divide (2) by (1)

$$v^2 = gr\tan 28$$

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

526 A tetherball on a 1.7m rope is struck so that it goes into circular motion in horiz. plane with rope making 15° angle to horizontal What is speed of ball?

$r = 1.7\text{m} \cos 15°$



Vert forces

$$T \sin 15° = mg$$

$$T \cos 15° = mv^2/r$$

Divide

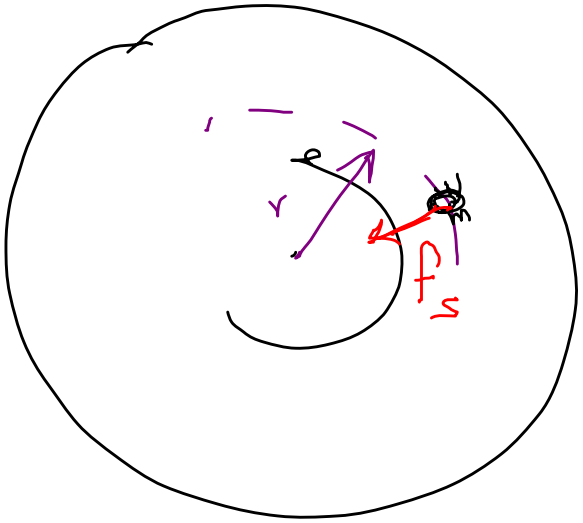
$$\tan 15^\circ = \frac{gr}{v^2}$$

Do it.

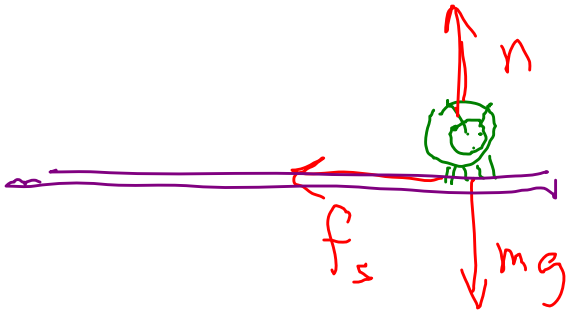
$$v = 59 \frac{m^2}{s^2}$$

$$v = 7.74 \frac{m}{s}$$

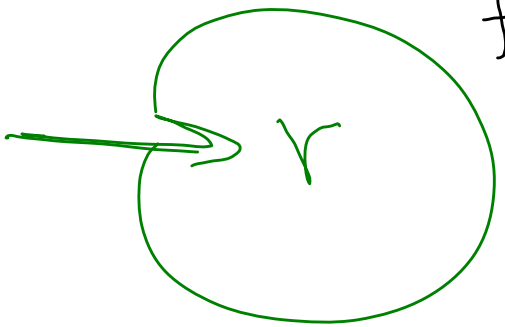
5.48 Bug crawls outward from center of CD spinning at 200 revolutions/min Coeff of friction is 1.2 How far does he get before he slips?



Find period, T (time)



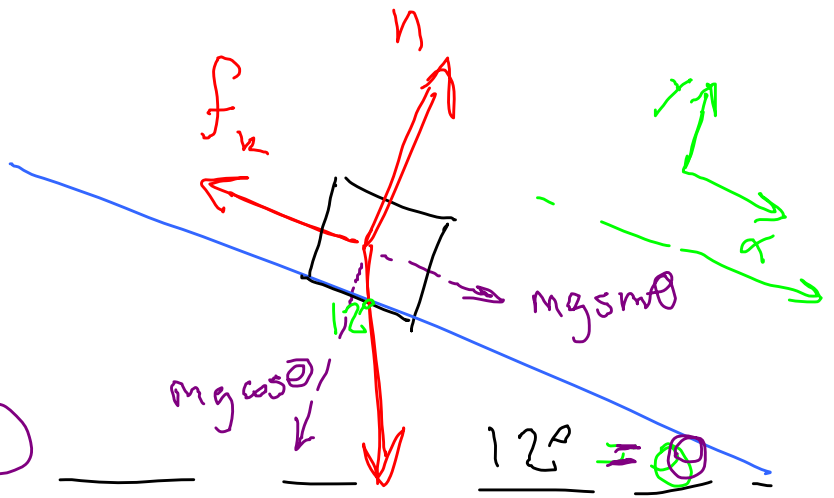
$n = mg$



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

$$= \frac{mv^2}{r} = \frac{m}{r}\left(\frac{2\pi r}{T}\right)^2 = \frac{m 4\pi^2 r}{T^2}$$

5.43 A child sleds down a 12° slope at constant speed. What's the frictional coeff. between slope and sled?



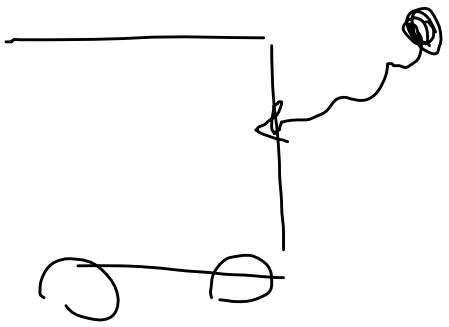
$n = mg\cos\theta$

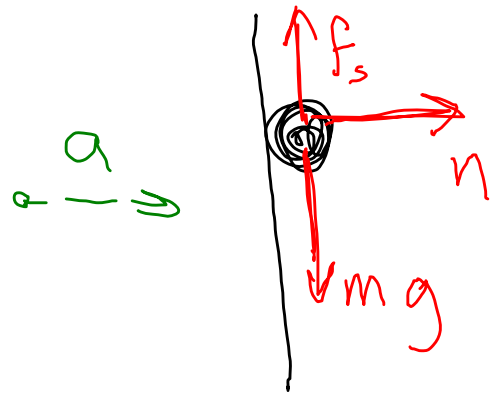
$mg\sin\theta = f_k = \mu_k n$

$= \mu_k mg\cos\theta$

$\tan\theta = \mu_k$

5.46 A bat crashes into vertical front of accelerating subway train. Fric coeff between bat & train is 0.86. Minimum acceleration of train so that bat stays in place.





$f_s = mg$

$n = ma$

$f_s = mg = \mu_s n \Rightarrow \mu_s ma$

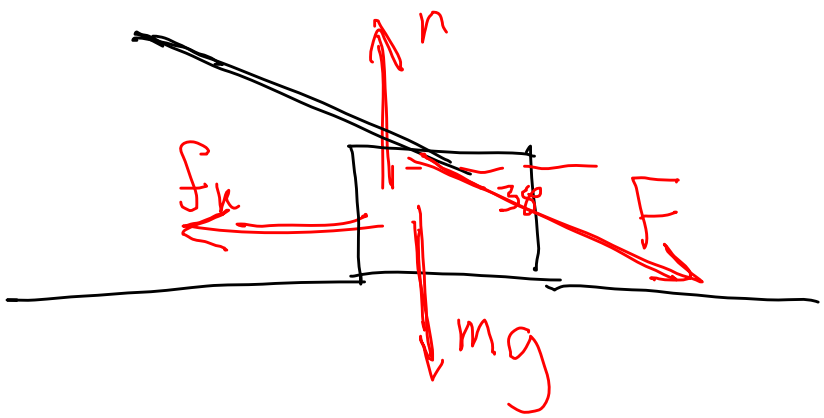
$n = ma$

equ

$a = g/\mu_s$ $\qquad g = \mu_s a$

$= \frac{9.8\ m/s^2}{0.86} = 11\ m/s^2$

5.44 What is F so that lawn mower moves at constant



$$n = mg + F \sin 35^\circ$$