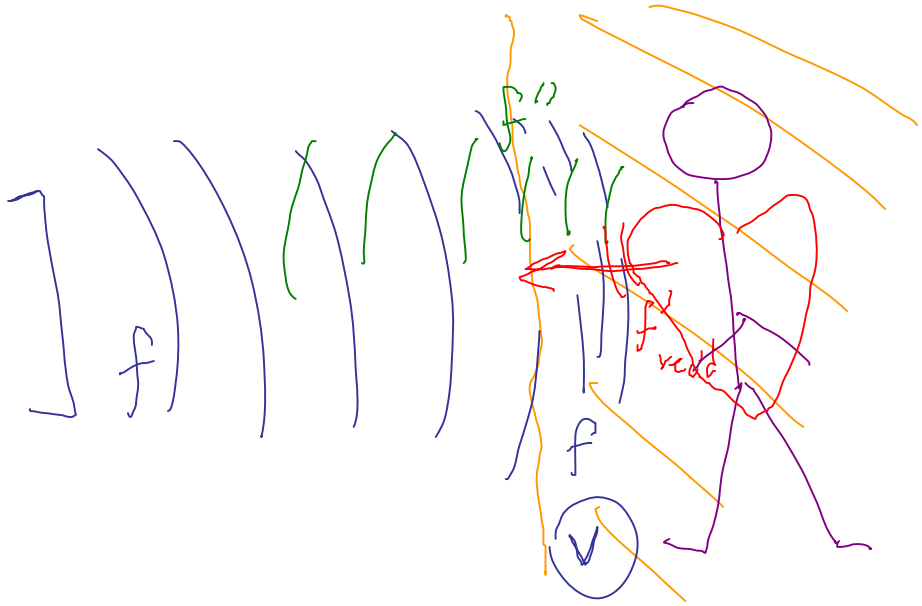
Phys 2110-4 4/27/12

Note Title 4/27/2012

14.78

$$f' = f\left(\frac{1+\frac{u}{v}}{1-\frac{u}{v}}\right)$$

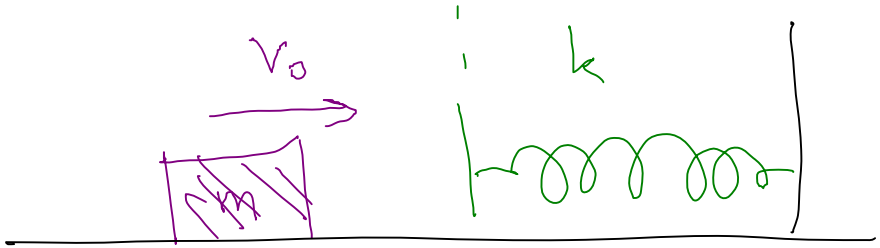


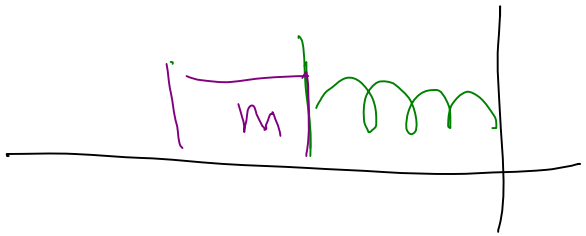
u = speed of u

$v = 1497 \frac{m}{s}$ (17)

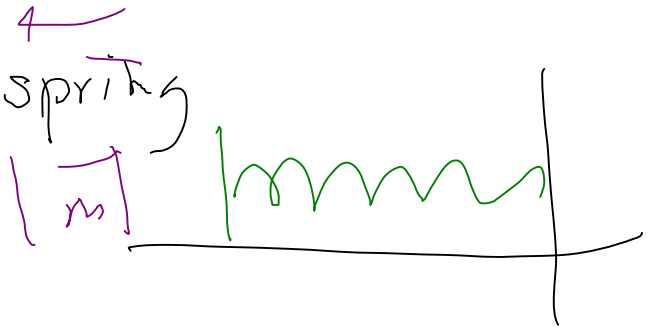
13.43

mass m
slides on horz
surf spring, k
Elastic encounter,
leads back in direction
it came from.





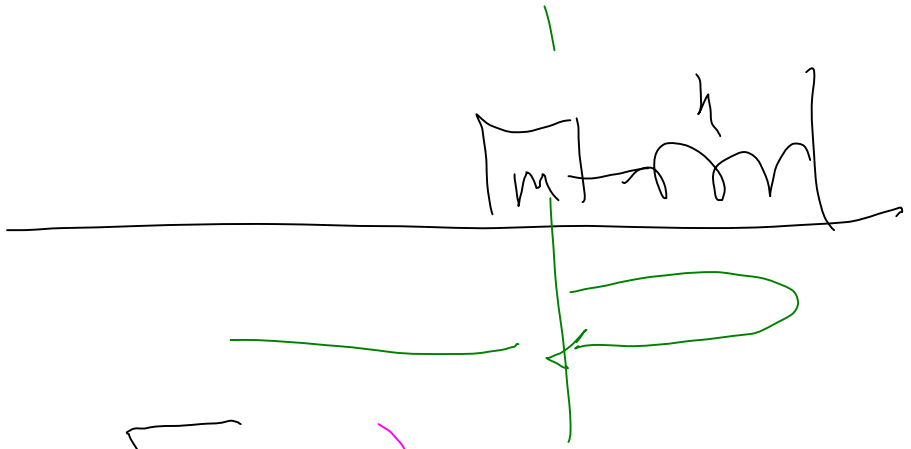
a) How long (time) mass in contact w/ spring
b) Spring's max compression.



Half period.

Perro 2

$$T = \frac{2\pi}{\omega} = 2\pi\sqrt{\frac{m}{k}}$$



$$\longrightarrow t_{contact} = \frac{T}{2} = \pi\sqrt{\frac{m}{k}}$$

b) Max compresion Energy Conservation.

$$\frac{1}{2}mv_0^2 = \frac{1}{2}kA^2 \qquad A^2 = \frac{mv_0^2}{k}$$

$$A = \sqrt{\frac{m}{k}}\,v_0$$

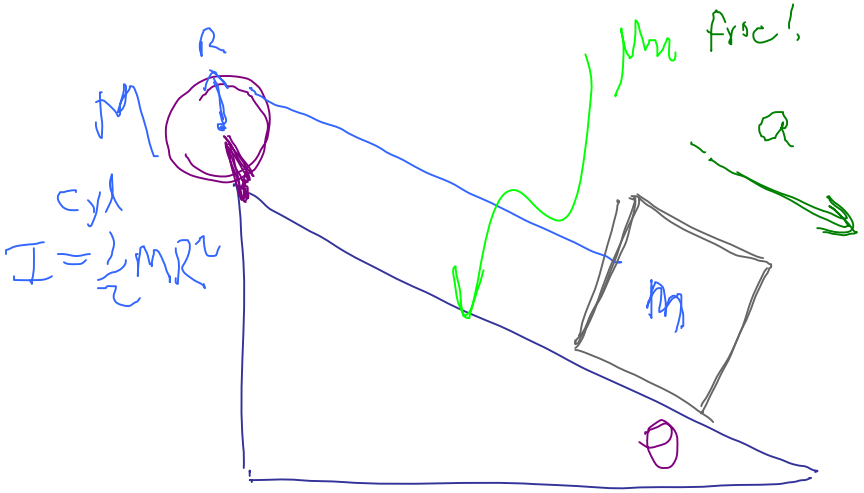
10.57

2.4 kg block

Drum $M = 0.85$ kg

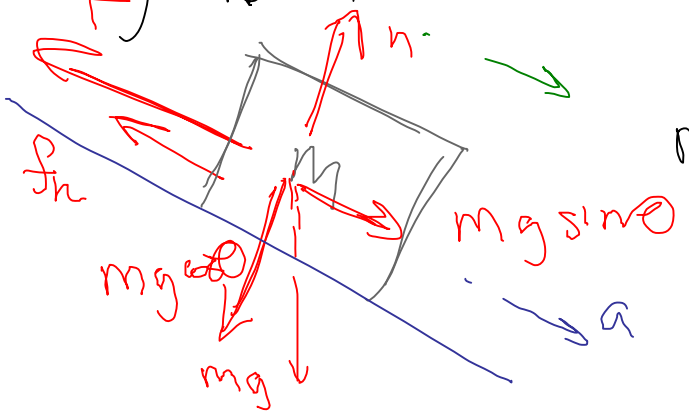
$R = 5.0$ cm

$a = 1.6 \frac{m}{s^2}$



$\theta = 30°$

Find μ_k for block & slope



$n = mg\cos\theta$

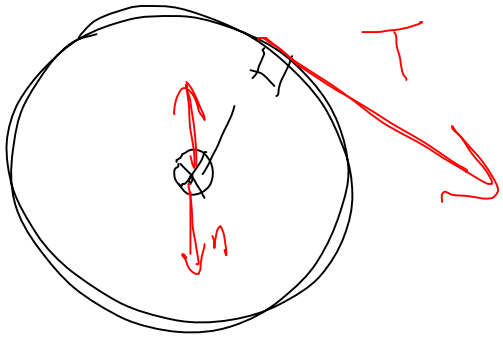
$mg\sin\theta - f_k - T = ma$

$f_k = \mu_k mg\cos\theta$

$$mg\sin\theta - \mu_k mg\cos\theta + T = ma$$

Torque eqn:

$$\tau = TR = I\alpha = I\frac{a}{R}$$



$$TR = \frac{1}{2}MR^2\frac{a}{R}$$

$$T = \frac{1}{2}Ma$$ Use this

$$mg\sin\theta - \mu_k mg\cos\theta - \frac{1}{2}Ma = ma$$

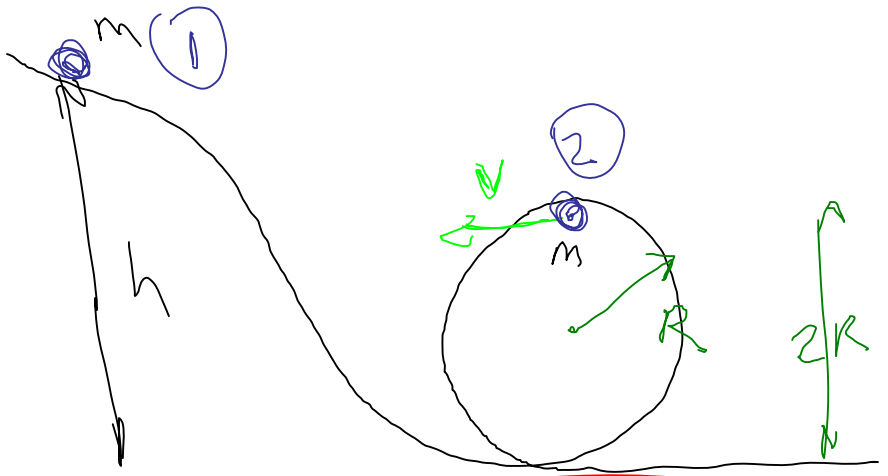
$a = R\alpha$

$\alpha = a/R$

Do it.

$\mu_k = 0.36$

10.68



Sliding mass

$h = \frac{5}{2}R$

Rolling object,

$I = \frac{2}{5}mr^2$

Conserv. of energy (1) (2)

$mgh = mg\,2(R-r) + \frac{1}{2}mv^2 + \frac{1}{2}\left(\frac{2}{5}mr^2\right)w^2$

$r << R$

$w = v/r$

What h needed for object to stay on track

$$mgh = mg(2R) + \frac{1}{2}mv^2 + \frac{1}{2}\cdot\frac{2}{5}mr^2\left(\frac{v}{r}\right)^2$$

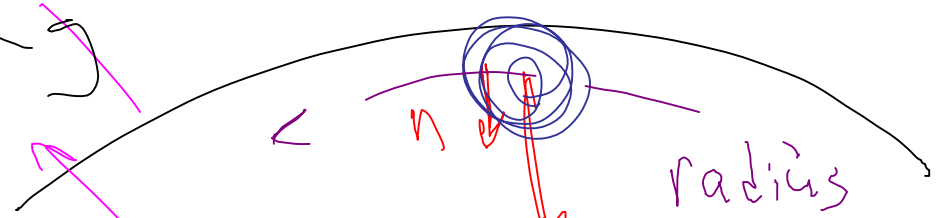
$$mgh = mg(2R) + \frac{7}{10}mv^2$$

sub

$$gh = g(2R) + \frac{7}{10}Rg$$

$$h = \left(2 + \frac{7}{10}\right)R$$

$$= (2.7)R$$



$$F_c = \frac{mv^2}{R} = n + mg$$

$$v^2 = Rg$$

Max ht.

$v_x = 0$

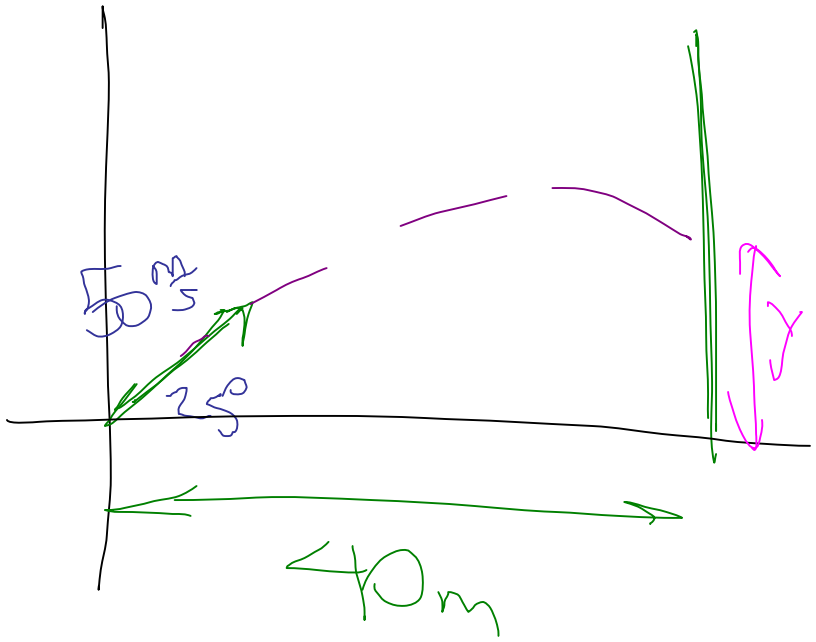
$v_{y_0} = 40\ m/s$

$y = y_0 + v_0 t + \frac{1}{2} a t^2$

$v = v_0 + at$

$v^2 = v_0^2 + 2a(x - x_0)$

$0 \qquad 40\ m/s \qquad -9.8\ m/s^2 = -g \qquad t$



t it hits

$V_0 \cos\theta$

$x = v_{ox} t$

$40m = (v_0 \cos\theta)\, t$

Get y... etc.