Announcements – Oct 29, 2013

1. **Exam 3 starts today!**
   a. Exam ends Mon Oct 4, 2 pm. Late fee after Saturday, 2 pm)
   b. 30 multiple choice questions
   c. Time estimate: 2 hours 15 mins on average
   d. Covers mainly Chapters 6, 7, & 8, Homeworks 11-17*
      i. Momentum (mainly collisions)
      ii. Rotation motion (tangential, angular, and centripetal acceleration; also includes Newton's law of gravity)
      iii. Torques (equilibrium, rotational KE, N2 for torques, angular momentum)
   e. **Read my chapter summaries in the syllabus**

2. **TA Exam review tonight, 6:30 – 8 pm**
   a. Place: TBA Same place as last time

3. **Quick self-quiz:** Write down all the blueprint equations for this exam you can think of.

* There isn't really a HW 17

Blueprint Equations

$\Sigma p_{bef} = \Sigma p_{aft}$ if no ext. forces

$\Sigma \tau = I\alpha$

$\Sigma \tau = 0$ } if equilibrium
$\Sigma \vec{F} = 0$ }

$\Sigma L_{bef} = \Sigma L_{aft}$ if no external torques

$\Rightarrow \Sigma F = ma_c = \frac{mv^2}{r}$ if circular motion

$\Rightarrow E_{bef} + W = E_{aft}$

$(v_1 - v_2)_{bef} = (v_2 - v_1)_{aft}$ if elastic

Details of the exam problems…

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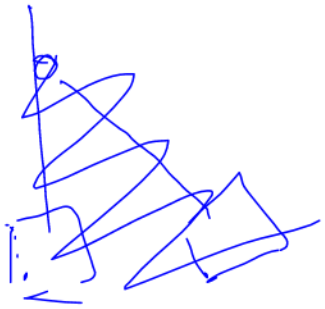
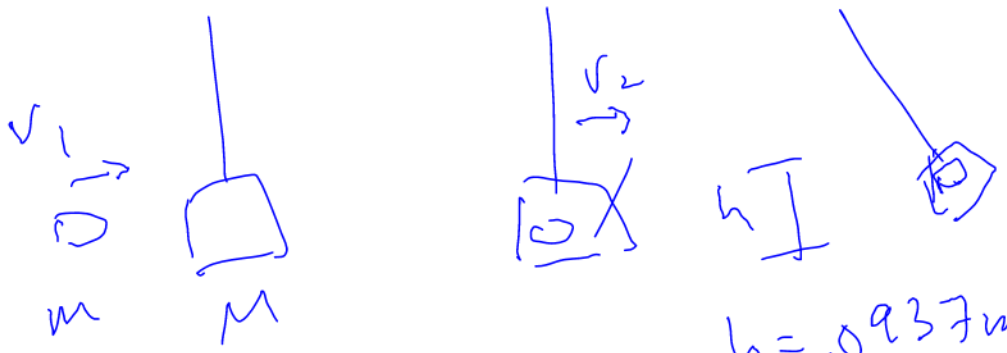
Momentum | energy

2007 #11

$m = .005\ kg$

$M = .175\ kg$





$h = .0937m$

$\Sigma p_{bef} = \Sigma p_{aft}$

$E_{bef} + \cancel{U} = E_{aft}$

$m v_1 = (m+M) v_2$

$\frac{1}{2}(\cancel{m+M}) v_2^2 = (\cancel{m+M}) g h$

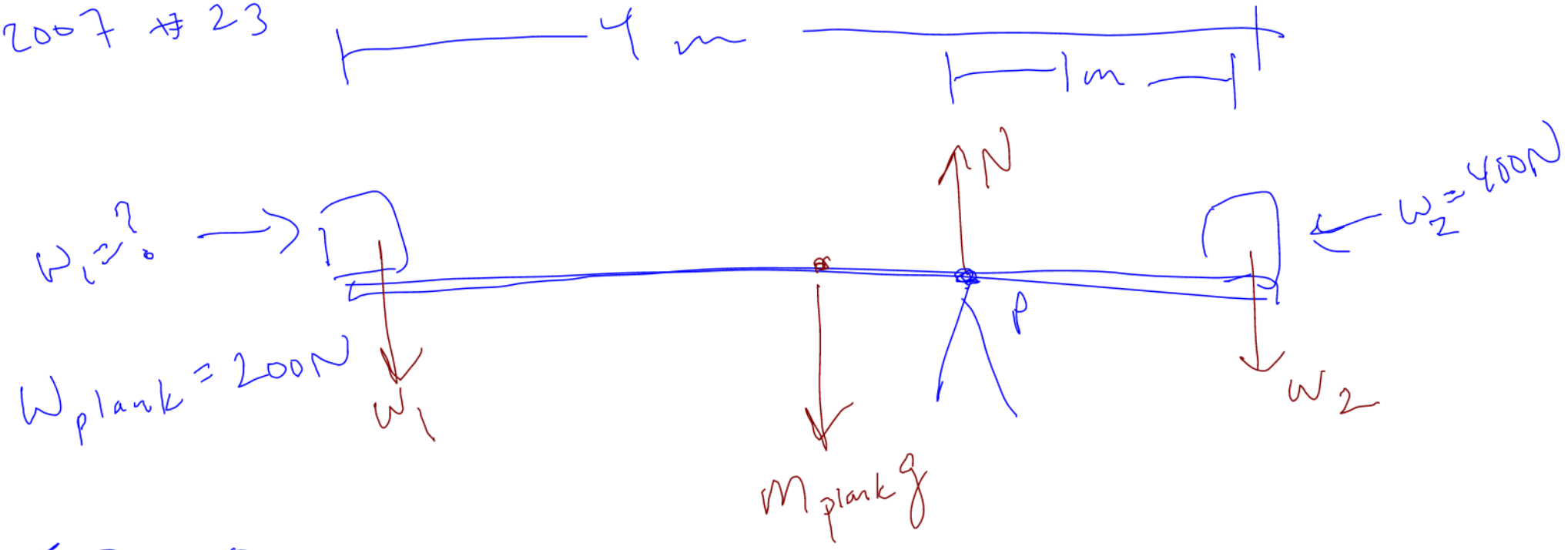
$\frac{1}{2} v_2^2 = g h$

$v_2 = \sqrt{2gh}$

$v_1 = \left(\frac{m+M}{m}\right)\left(\sqrt{2gh}\right)$

$= \underline{\text{number}}$

2007 #23



$$\sum F_y = 0$$

$$N - W_1 - W_{plank} - W_2 = 0$$

$$\sum \tau_P = 0$$

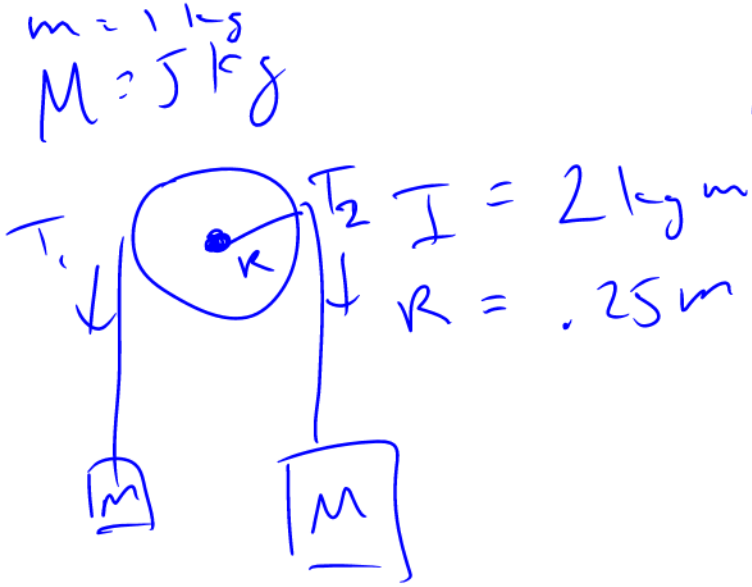
$$(W_1)(3m) + (W_{plank})(1m) - (W_2)(1m) = 0$$

✓ ✓ ✓ ✓ ✓

→ $W_1 =$ (solve)

Requested Problems from Past Exams…

2007 #29, 30



$\Sigma \tau = I\alpha$

$T_2 R - T_1 R = I\alpha$

$(T_2)(.25) - (T_1)(.25) = (2)\left(\frac{a}{.25}\right)$

$\Sigma F = ma$ $\quad T_2 - T_1 = 32a$

$T_1 - mg = ma$

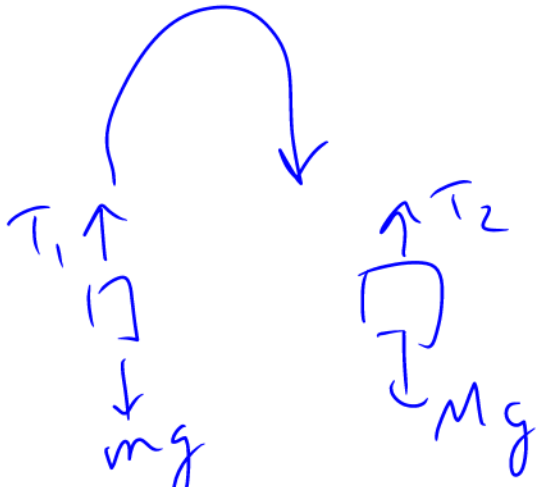
$T_1 - (1)(9.8) = (1)a$

$T_1 - 9.8 = a$

$\Sigma F = Ma$

$Mg - T_2 = Ma$

$(5)(9.8) - T_2 = 5a$



$T_2 - T_1 + T_1 - 9.8 + 5 \cdot 9.8 - T_2 = 32a + a + 5a$

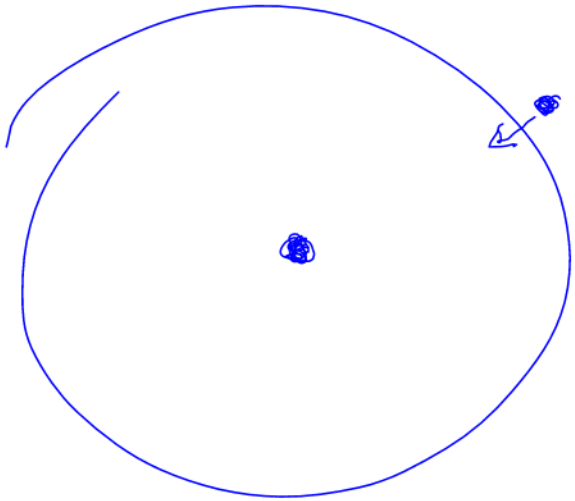
$= 38a$

2006 # 18

$M = .0225\ M_{earth} = 1.345 \cdot 10^{23}$ kg

$R = .404\ R_{earth} = 2{,}576{,}000$ m

$a = ?$



$$\Sigma F = ma$$

$$\frac{GMm}{R^2} = ma$$

$$a = \frac{(6.67 \cdot 10^{-11})(1.345 \cdot 10^{23})}{(2576000)^2}$$

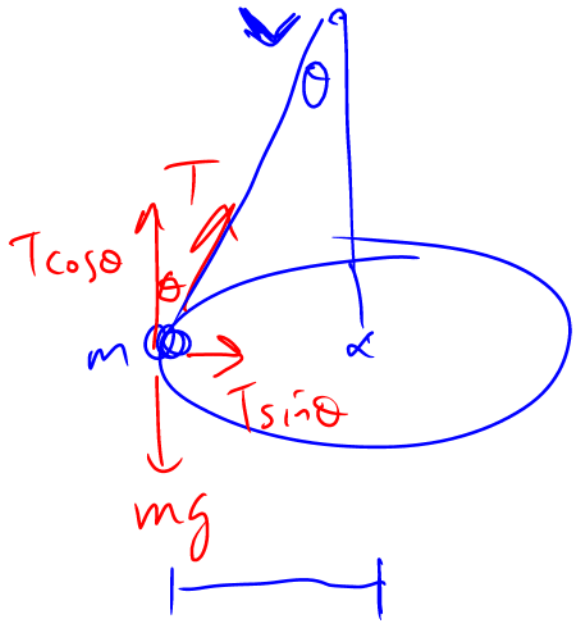
$$= \text{number}$$

2008 # 25 and 29

$m = .5\,kg$

$L = .8\,m$

$\theta = 35°$



$\Sigma F_x = ma_c$

$T\sin\theta = m\frac{v^2}{r}$

$\Sigma F_y = 0$

$T\cos\theta = mg$

$T = \frac{(.5)(9.8)}{\cos 35°}$

$= \underline{\text{(number)}}$

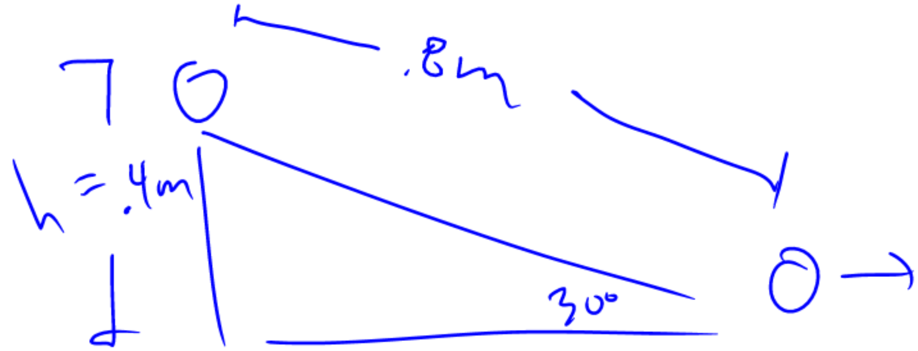
$r = L\sin\theta$

$v = \sqrt{\frac{r}{m} T\sin\theta}$

$= \underline{\text{the answer}}$

Loop B
26

What is a?



$\omega = \frac{v}{r}$

$E_{bef} + \cancel{W} = E_{aft}$

$mgh = \frac{1}{2}mv^2 + \frac{1}{2}I\omega^2$

$\cancel{m}gh = \frac{1}{2}\cancel{m}v^2 + \frac{1}{2}\left(\frac{2}{5}\cancel{m}\cancel{r^2}\right)\left(\frac{v^2}{\cancel{r^2}}\right)$

$gh = v^2\left(\frac{1}{2} + \frac{1}{5}\right)$

$\sqrt{\frac{(9.8)(.4)}{.7}} = v^2 \cancel{(.7)} = \underline{\text{some number}}$

$v_f^2 = \cancel{v_0^2} + 2a\Delta x \longrightarrow a = \boxed{\frac{v_f^2}{2(.8m)}}$

2008 # 27

$m_{bear} = 100\ kg$

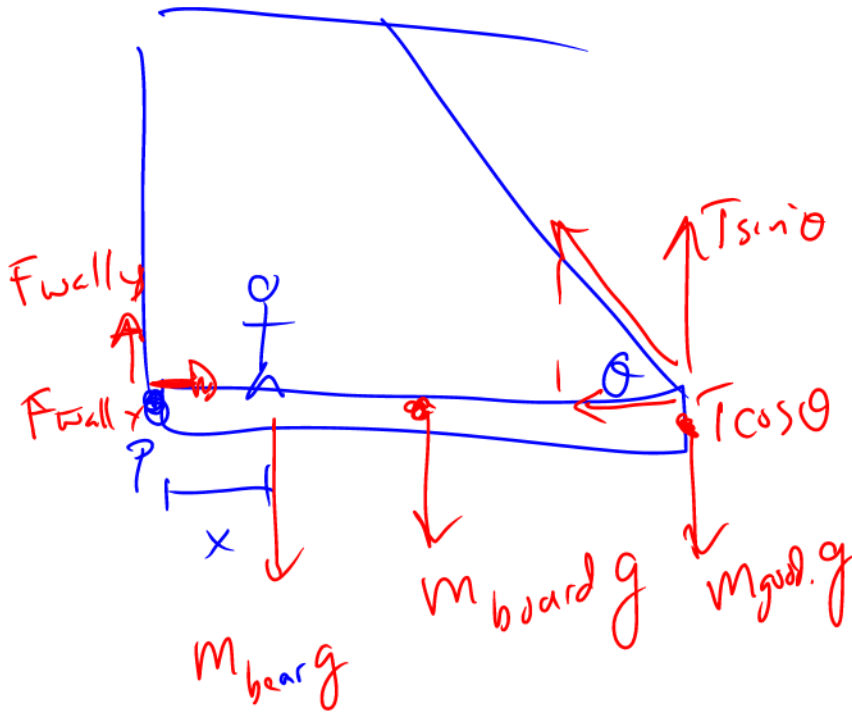
$m_{beam} = 20\ kg$

$L = 5\ m$

$m_{goodies} = 9\ kg$

$\theta = 60°$

$T = 1100\ N$



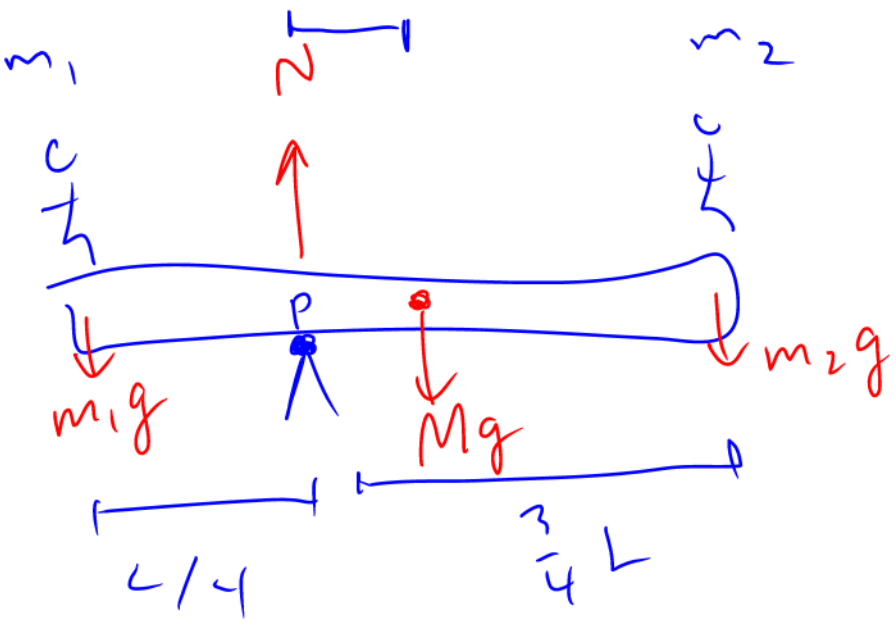
$\Sigma F_x = 0$ $\quad F_{wall_x} = T\cos\theta$

$\Sigma F_y = 0$ $\quad F_{wall_y} + T\sin\theta = m_{bear}g + m_{board}g + m_{goodies}g$

$\Sigma \tau_p = 0$ $\quad -(m_{bear}g)x - (m_{board}g)(2.5m) - (m_{good.}g)(5m) + (T\sin\theta)(5) = 0$

✓ ✓ ? ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓

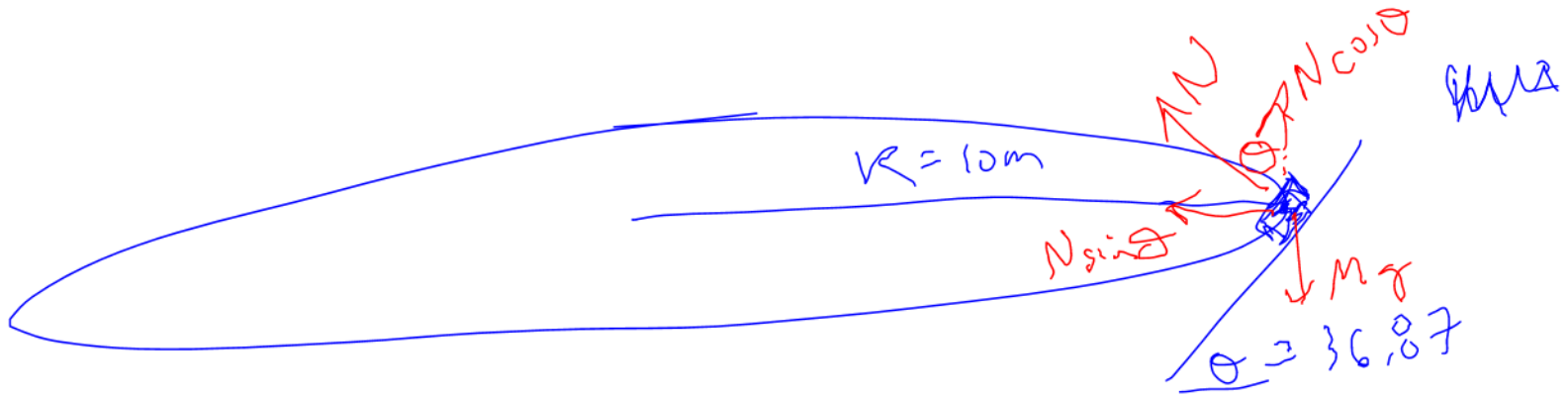
→ Solve for x !



$$\sum \tau_P = 0$$

$$(m_1 g)\left(\frac{L}{4}\right) + 0 - (Mg)\left(\frac{L}{4}\right) - (m_2 g)\left(\frac{3}{4}L\right) = 0$$

2059 #26



$\sum F = ma_c$

$N \sin\theta = m\frac{v^2}{R}$

$\sum F_y = 0$

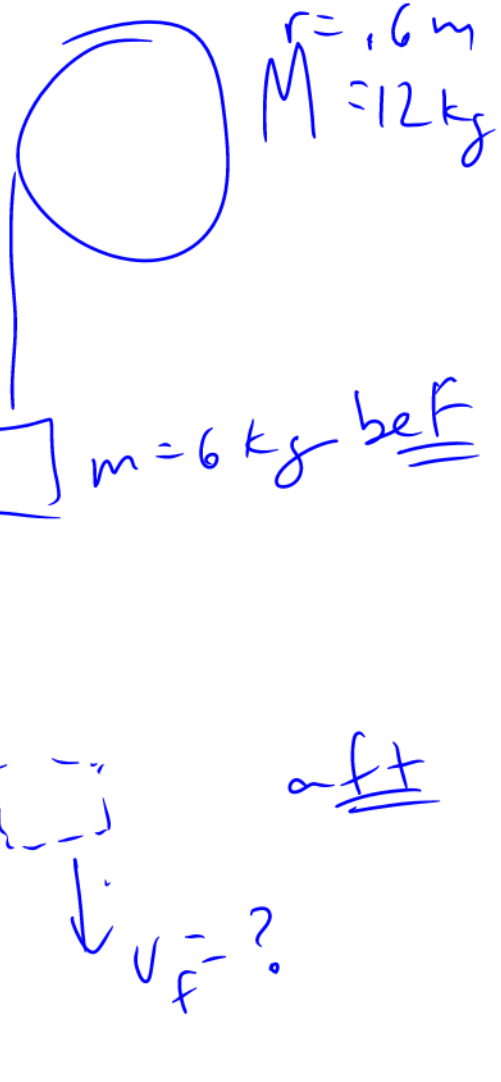
$N\cos\theta = mg$

$N = \frac{mg}{\cos\theta}$

$\left(\frac{mg}{\cos\theta}\right)\sin\theta = \frac{mv^2}{R}$

$v = \sqrt{gR\frac{\sin\theta}{\cos\theta}} = \underline{\quad\text{number}\quad}$

Book #27



$E_{bef} + \cancel{W} = E_{aft}$

$mgh = \frac{1}{2}mv^2 + \frac{1}{2}Iw^2$

$I = \frac{1}{2}Mr^2$ $\quad w^2 = \frac{v^2}{r^2}$

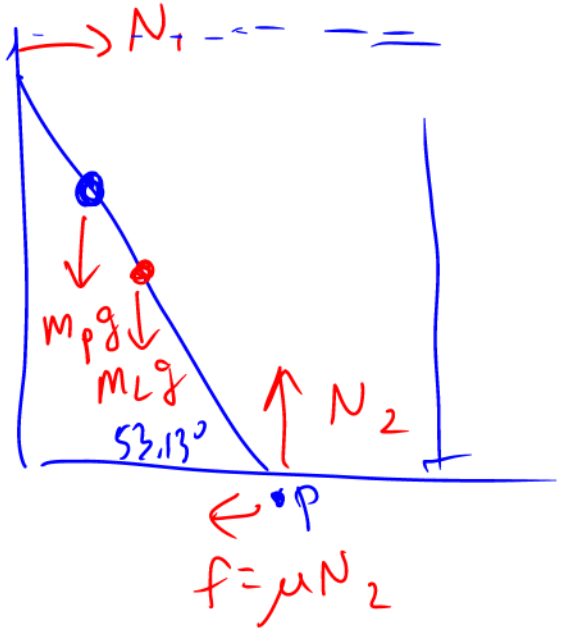
$$mgh = \frac{1}{2}mv^2 + \frac{1}{4}Mv^2$$

$mgh = v^2\left(\frac{1}{2}m + \frac{1}{4}M\right)$

$$v = \sqrt{\frac{mgh}{\frac{1}{2}m + \frac{1}{4}M}}$$

← plug in numbers

2009 #28



$m_{ladder} = 10\,kg$

$L = 10\,m$

$\mu = .5$

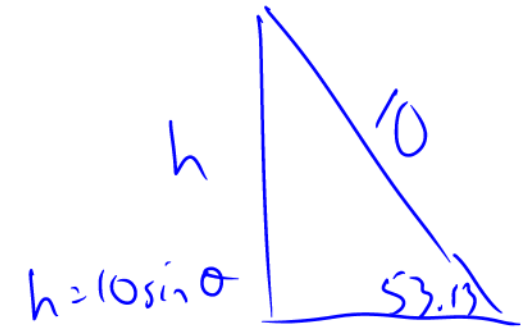
$m_p = 50\,kg$

$\Sigma F_x = 0$

$N_1 = \mu N_2$

$\Sigma F_y = 0$

$m_p g + m_L g = N_2$



$\Sigma \tau_p = 0$

$-(N_1)(10\sin\theta) + (m_p g)(d\cos\theta) + (m_L g)(5\cos\theta) = 0$

? ?

$N_1 = \mu N_2 = \mu(m_p g + m_L g)$

Solve for d