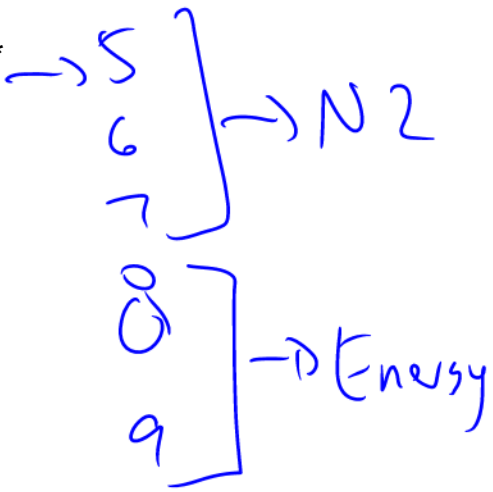
Announcements – 3 Oct 2013

1. **Exam 2 starts today!** 2 pm
   a. Exam ends Wed Oct 7 (late fee after Tues, 2 pm)
   b. Covers mainly Chapters 4 & 5, Homeworks 5-10*
   c. Format: just like last exam
   d. 30 problems
   e. Time estimate: 2 hours 15 mins on average
2. **TA Exam review**
   a. Tonight, 7:30 – 9 pm.
   b. Place: W112 BNSN



* There isn't really a HW 10

Experimental Problem

How much "horsepower" can a person generate?

Experiment: jumping from a stand-still → Volunteer needed!

Parameters:

mass (kg) = 86 kg

measured height jumped (m) = .63 m

measured "impulse time" (s) (time while legs are exerting force on ground)

= .47 sec

What was the work done by his/her body during the impulse time?

$W = mgh$

How much horsepower?

$P = \frac{W}{t} = \frac{mgh}{t} = \frac{(86)(9.8)(.63)}{(.47)} = 1130\ W = 1.51\ hp$

Clicker quiz

A car weighing 3000 N moves at a speed of 30 m/s on level ground. To do this, it pushes backwards on the road with a 5000 N force. What is the power output of the car engine?

a. 0 kW
b. 60 kW
c. 90 kW
d. 150 kW
e. 240 kW

$P = F_{\parallel} v$

from $P = \frac{W}{t} = F_{\parallel} \frac{\Delta x}{t} = F_{\parallel} v$

$= (5000\,N)(30\,m/s)$

$= 150{,}000\,W$

→ Where does this power go? If the car moves at constant speed, it's not used to accelerate the car.

From warmup

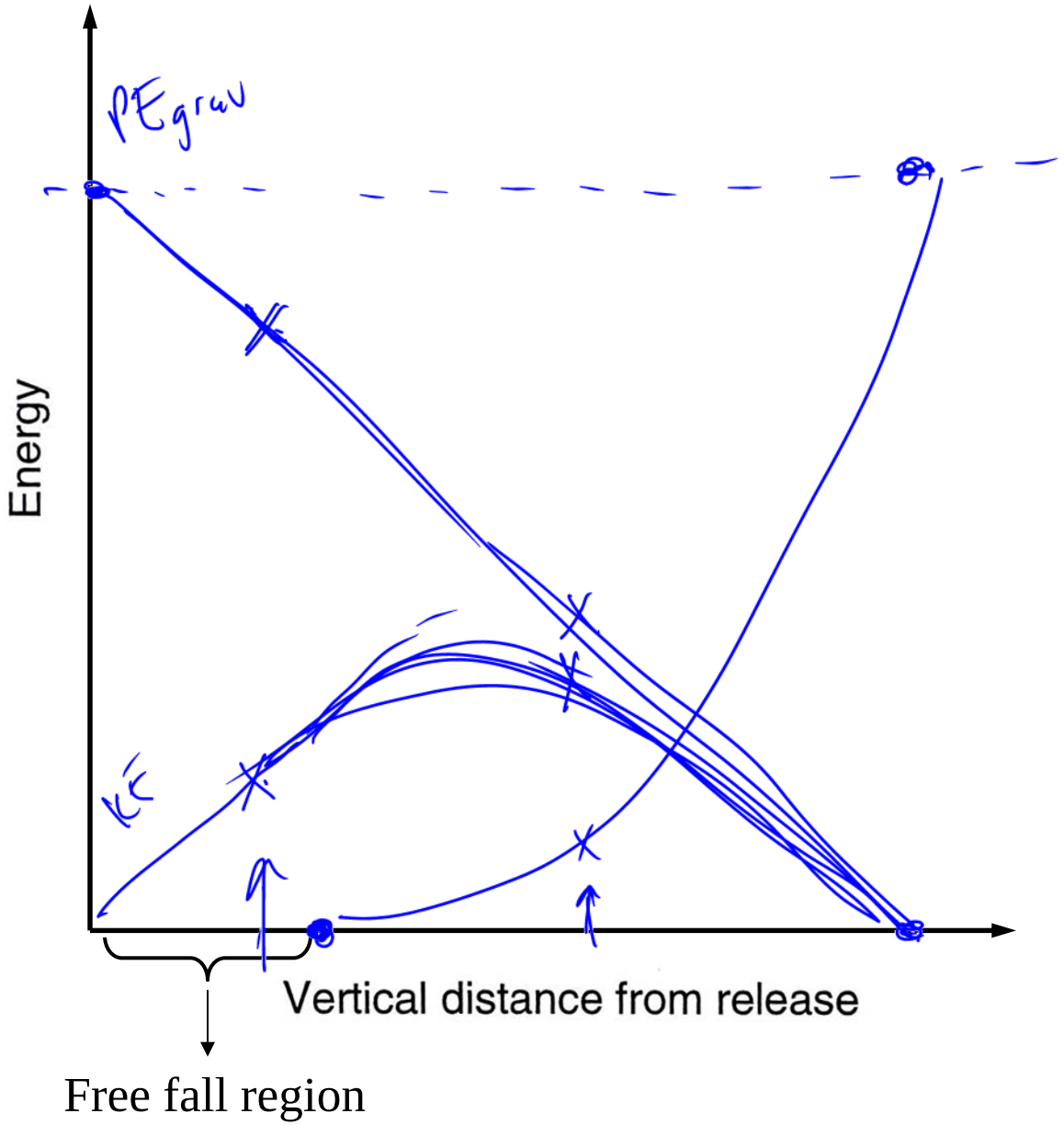
Ralph sees that his car's engine is rated at 100 hp. He thinks, "Cool, this means if I ever get in a tug of war with 90 horses, I will win!" Is he thinking about this correctly? What should you tell him?

"Pair share"–I am now ready to share my neighbor's answer if called on.

a. Yes

$PE_g = mgh$ $PE_{spring} = \frac{1}{2}kx^2$

Bungee jumping: types of energy



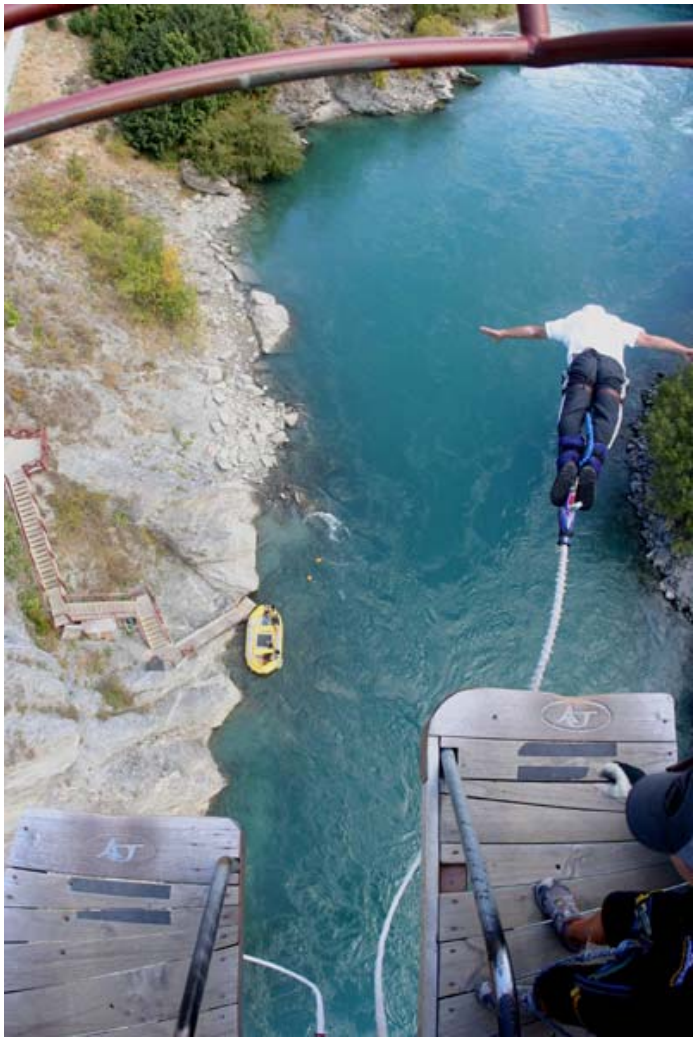
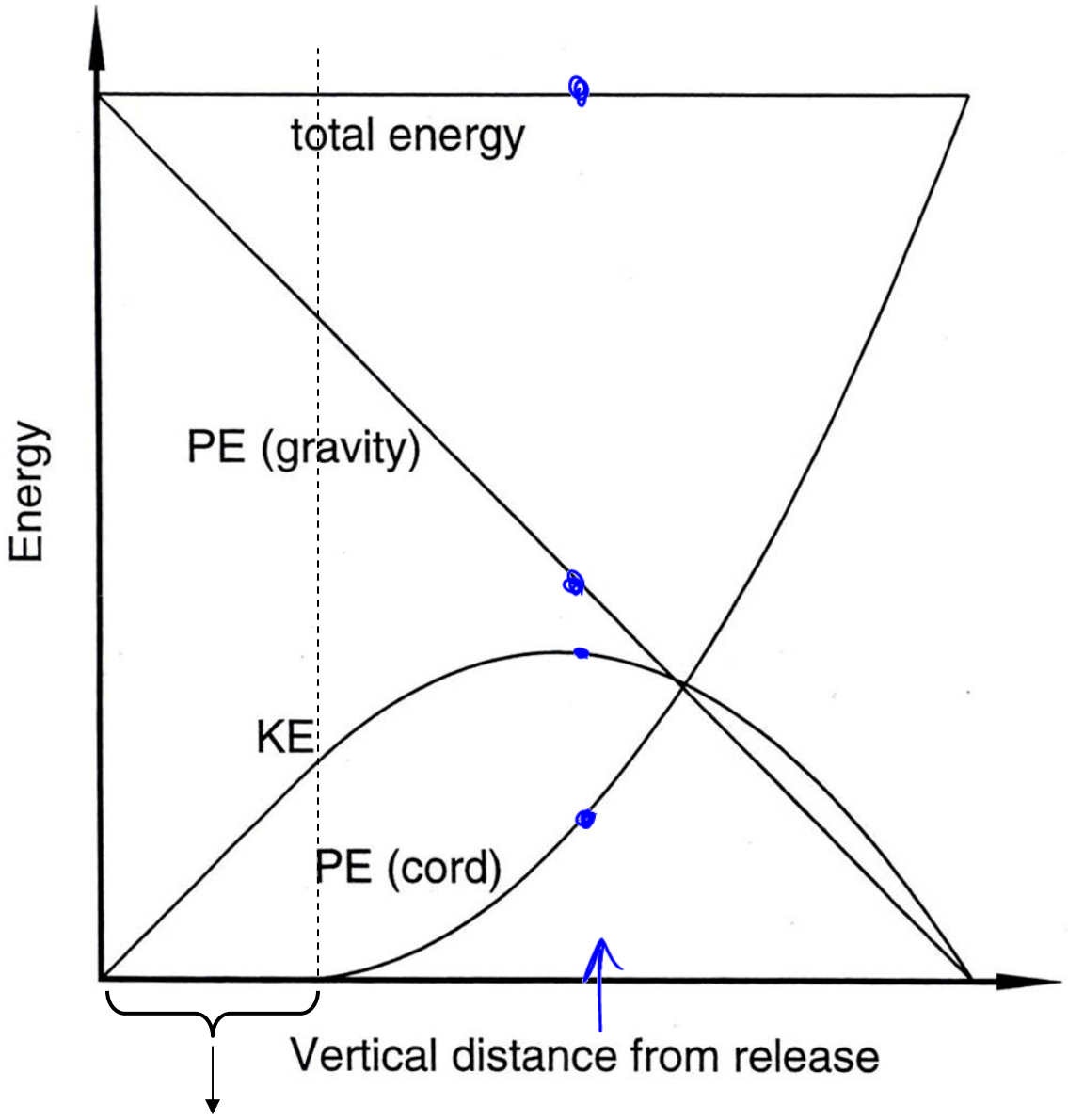


Image credit: Wikipedia


total energy
PE (gravity)
Energy
KE
PE (cord)
Vertical distance from release
Free fall region

More Exam Info

$\frac{1}{2}mv_0^2 + mgh = \frac{1}{2}mv_f^2$

Things to study like last time

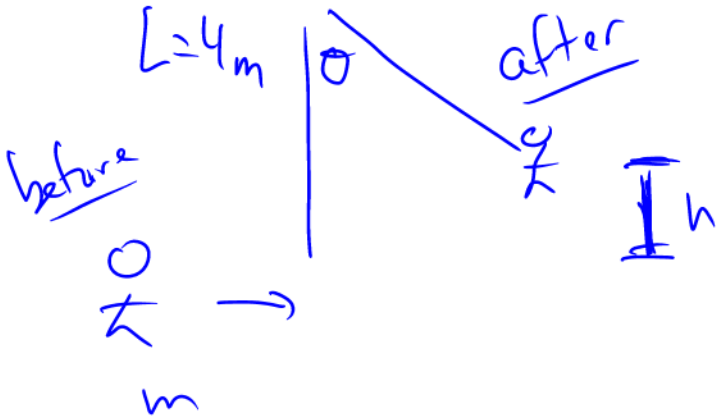
a. HW
b. Worked problems from class
c. Old midterms/final exams, posted to website
d. Conceptual questions from class (clicker quizzes, etc)
e. Warmup questions
f. Demo videos
g. Textbook, to fill in gaps of things you didn't get
h. Also: a couple of problems from last exam will return

Also, be sure to go over the "Chapter Summaries of Mathematical Relations" for these chapters, if you haven't been using it as you go along

Details of exam problems…

2007 #23

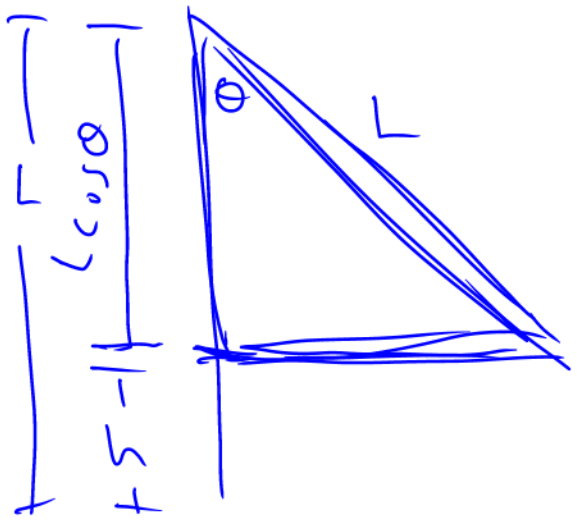
Requested Problems from Past Exams…



$m = .5\ kg$

$v_0 = 3\ m/s$

$\theta = ?$



$E_{bef} = E_{aft}$

$KE_i = PE_g$

$\frac{1}{2}mv_0^2 = mgh$ ←

$\frac{1}{2}v_0^2 = g(L - L\cos\theta)$

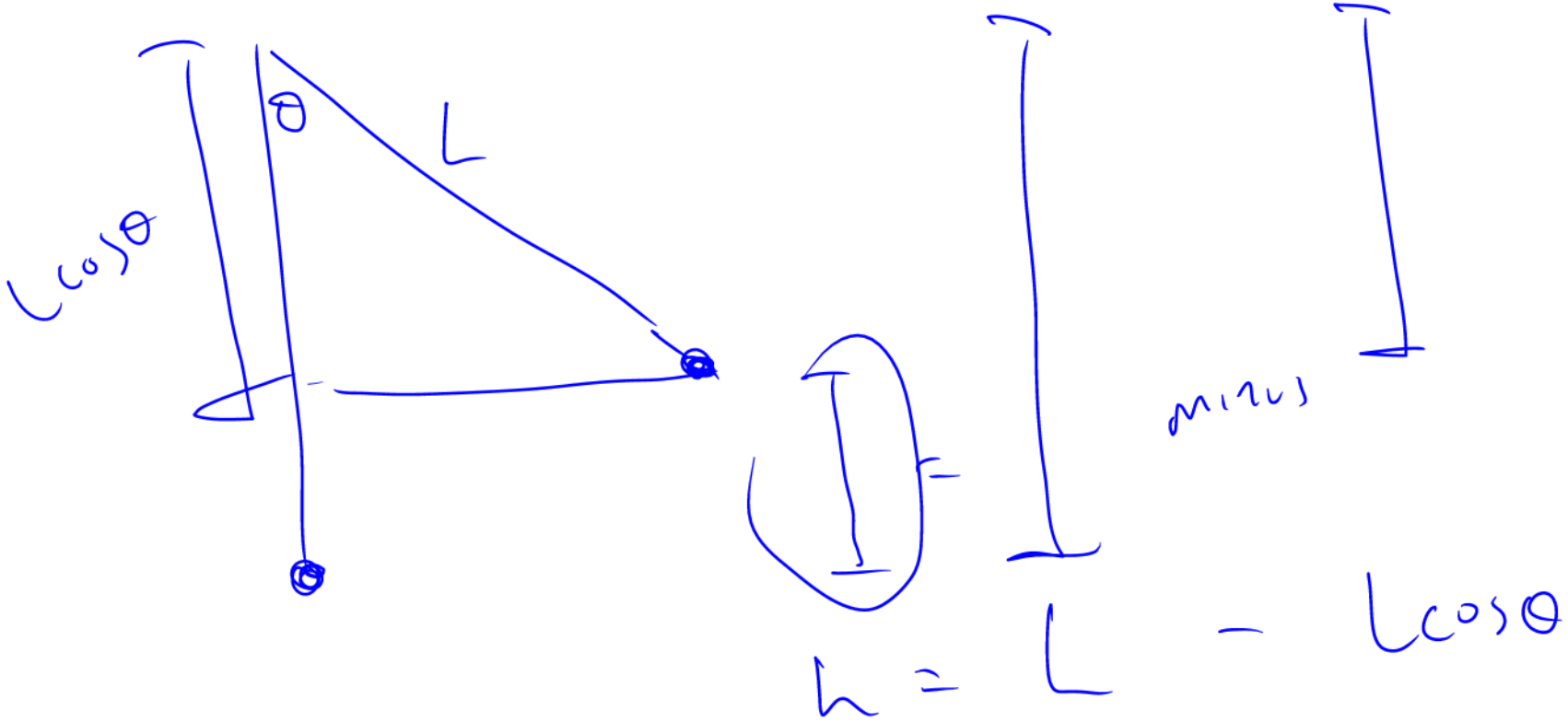
$gL\cos\theta = gL - \frac{1}{2}v_0^2$

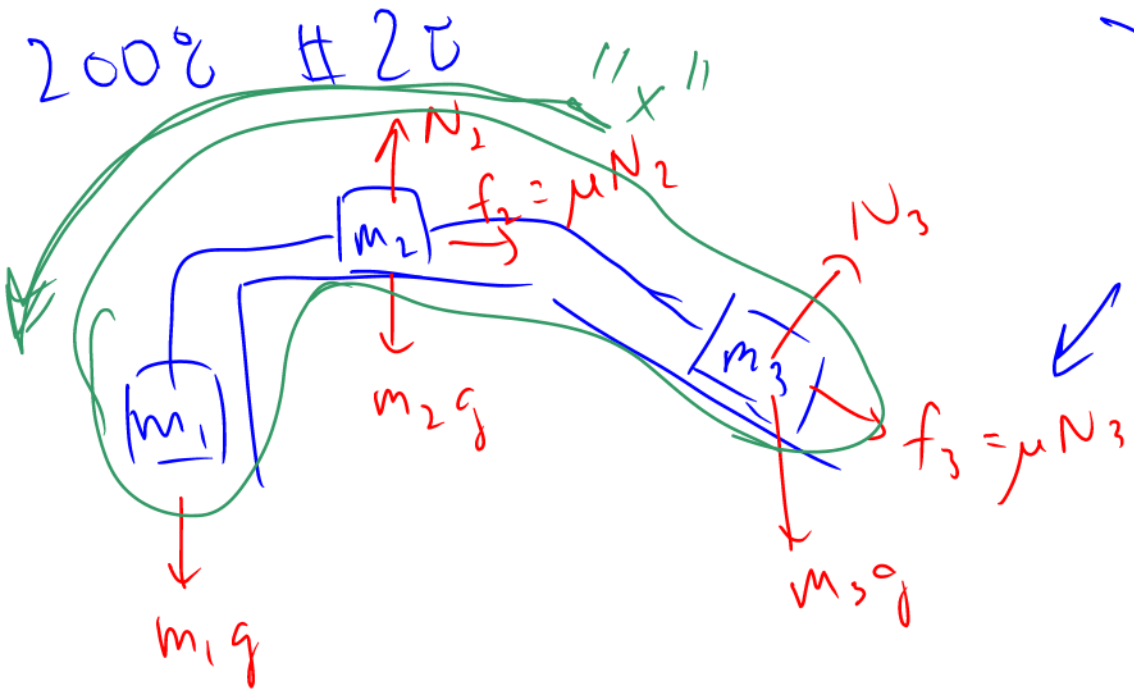
$\cos\theta = \frac{gL - \frac{1}{2}v_0^2}{gL}$

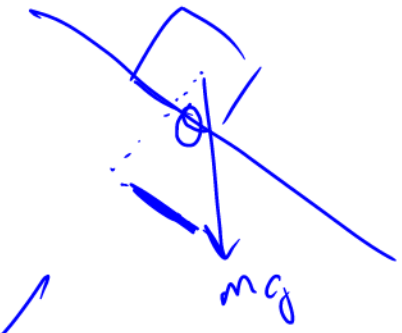
$\theta = \cos^{-1}\left(\frac{gL - \frac{1}{2}v_0^2}{gL}\right)$

$h = L - L\cos\theta$ ←

$\cos\theta = \frac{adj}{hyp}$


θ
L
L cos θ
minus
h = L − L cos θ





$m_1 = 10\ kg$

$m_2 = 5\ kg$

$m_3 = 3\ kg$

$a = 2.2\ \frac{m}{s^2}$

$\mu = ?$

$$\Sigma F_x = m a_x$$

$$m_1 g - f_2 - f_3 - m_3 g \sin\theta = (m_1 + m_2 + m_3)\, a$$

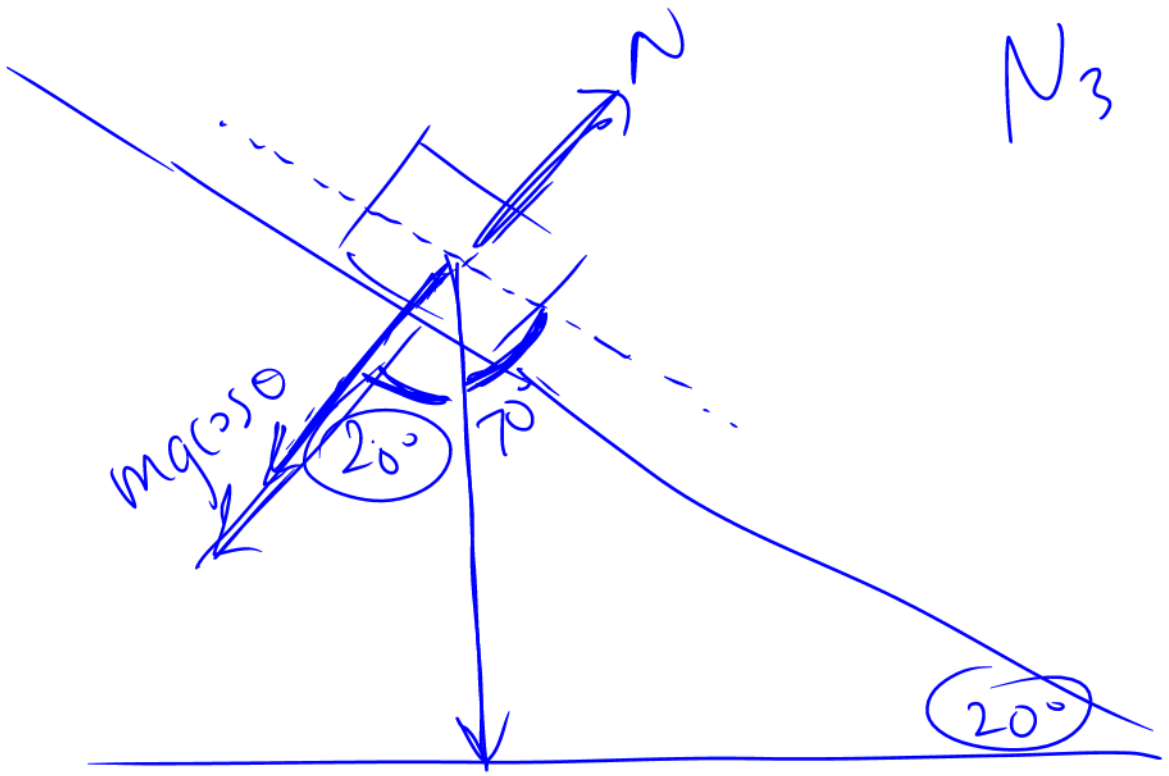
$f_2 \uparrow \mu N_2$ (where $N_2 \uparrow m_2 g$)

$f_3 \uparrow \mu N_3$ (where $N_3 \uparrow m_3 g \cos\theta$)

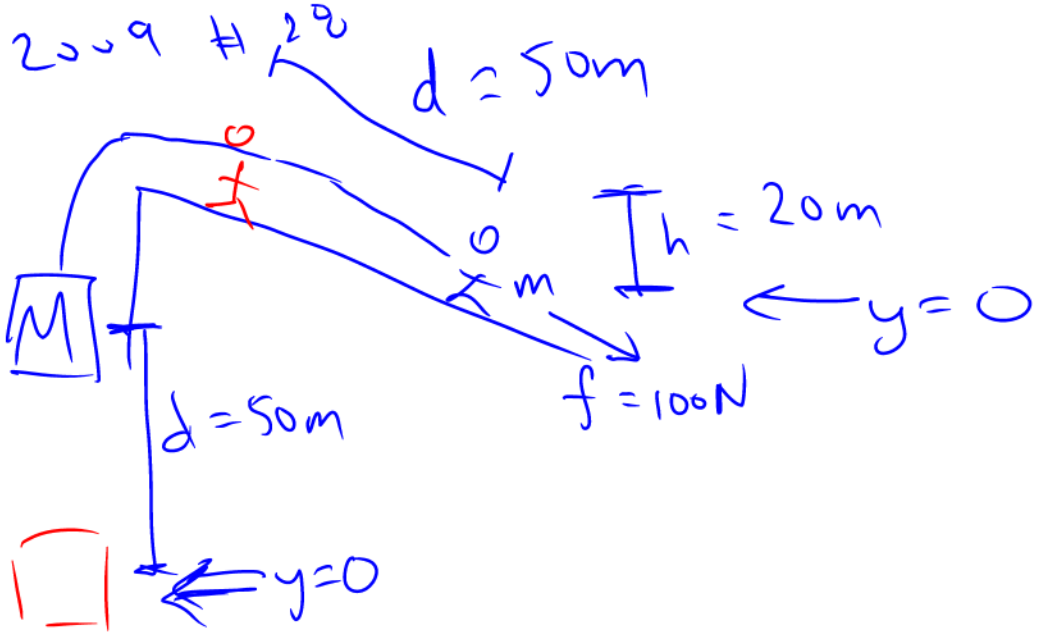
$$m_1 g - \mu m_2 g - \mu m_3 g \cos\theta - m_3 g \sin\theta = (m_1 + m_2 + m_3)\, a$$

$$\Sigma F_{y(\text{tilted})} = 0$$

$$N_3 = m_3 g \cos\theta$$



2009 #28



$M = 300\,kg$

$m = 100\,kg$

$$E_{ref} + W = E_{aft}$$

$$Mgd - fd = \tfrac{1}{2}(m+M)v_f^2 + mgh$$

$$300 \cdot 10 \cdot 50 - 100 \cdot 50 = \tfrac{1}{2}(400)v_f^2 + 100 \cdot 10 \cdot 20$$