2. Bleepo the Clown is shot out of a cannon into a net which is 10 m above the cannon and a horizontal distance of 40 m away. His angle to the horizontal as he leaves the cannon barrel, screaming pitifully, is 60 degrees. He lands in the net, which sadly was filled with razor wire by his estranged wife.

a) What is his speed as he leaves the cannon barrel?

$$t = \frac{40m}{V_0 \cos\theta_0} = \frac{80m}{V_0}$$

$$Y - Y_0 = 10m = (V_0 \sin\theta_0)t - \frac{1}{2}gt^2$$

$$= 69.3m - (4.9 m/s^2)\frac{(80m)^2}{V_0^2}$$

$$-59.3m = -\frac{31360 m^3/s^2}{V_0^2}$$

$$V_0 = 23 m/s$$

b) What is his speed as he lands in the net and is sliced to bits?

$$V_{fx} = V_{0x} = (23 m/s)\cos(60^\circ) = 11.5 m/s$$

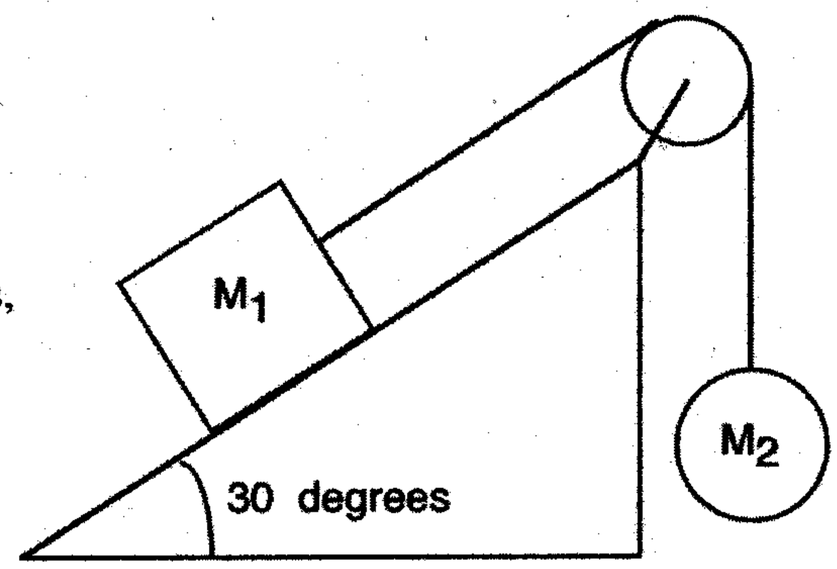
$$t = 80m/V_0 = 3.49s$$

$Y - Y_0 = 10m$ but who cares at this point?

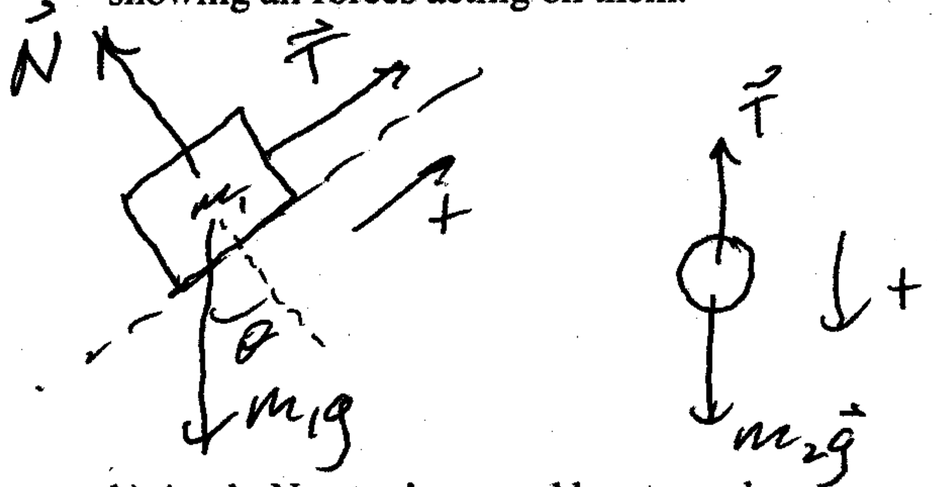
$$V_{fy} = V_{0y} - gt = V_0 \sin\theta_0 - gt = -14.3 m/s$$

$$V_f = \sqrt{V_{fx}^2 + V_{fy}^2} = 18.3 m/s$$

3. Masses M1 = 3.0 kg and M2 = 2.0 kg are tied together with a massless, inextensible string which goes over a massless, frictionless pulley (perhaps made of frozen neutrinos). Gravity acts down, as it so often does.



a) Draw a free body diagram for each of the masses, showing all forces acting on them.



b) Apply Newton's second law to each mass.

$$T - m_1 g \sin 30^\circ = m_1 a$$

$$m_2 g - T = m_2 a$$

c) Solve the result of b) for the acceleration of the blocks and the tension in the string

add $(m_2 - m_1 \sin 30^\circ)g = (m_1 + m_2)a$ $\quad a = \frac{m_2 - m_1 \sin 30^\circ}{m_1 + m_2} g = 0.98 \frac{m}{s^2}$

From second equation

$$T = m_2 g - m_2 a = (2.0 kg)(9.8 m/s^2 - 0.98 m/s^2)$$

$$T = 18N$$