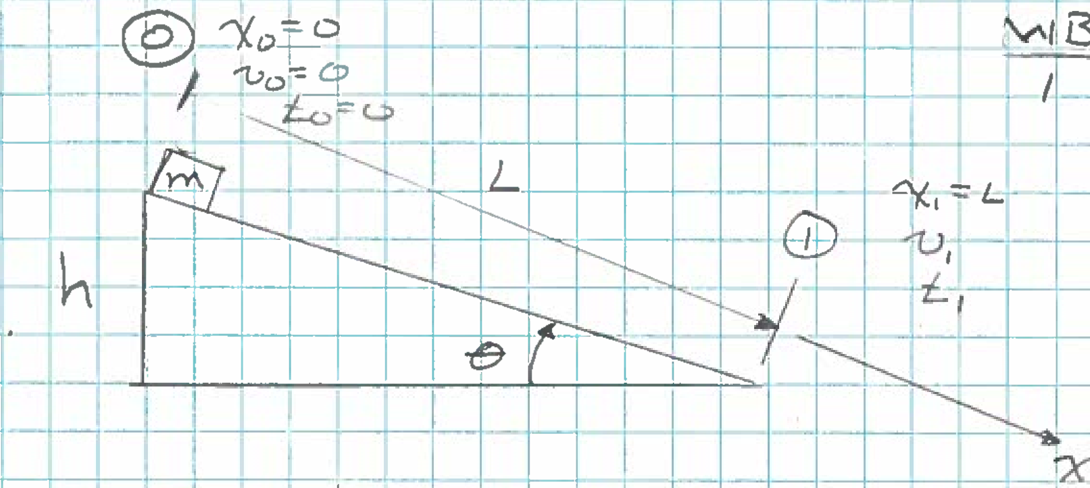
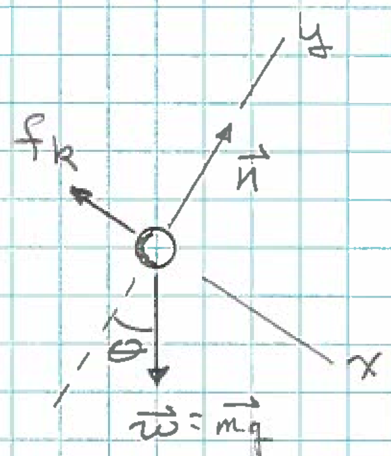


b.) FBD



find acceleration:

$$\Sigma F_x = -f_k + mg\sin\theta = ma_x$$

$$\Sigma F_y = n - mg\cos\theta = ma_y = 0 \quad \text{(stays on incline} \Rightarrow a_y = 0\text{)}$$

So, $n = mg\cos\theta$

and, $f_k = \mu_k n = \mu_k mg\cos\theta$

Now, subst. into x-eqn:

$$-\mu_k mg\cos\theta + mg\sin\theta = ma_x$$

So: $a_x = g(\sin\theta - \mu_k\cos\theta) = \text{constant}$

Now, kinematics from $0 \to 1$:

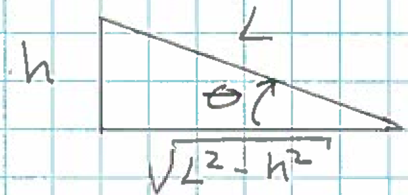
$$v_1^2 = \cancel{v_0^2} + 2a_x \Delta x \qquad \Delta x = x_1 - \cancel{x_0} = L$$

$$= 2g(\sin\theta - \mu_k \cos\theta)L$$

and

$$\boxed{v_1 = \sqrt{2g(\sin\theta - \mu_k\cos\theta)L}}$$

or, from the triangle to get in terms of h & L:



$$\sin\theta = h/L$$

$$\cos\theta = \frac{\sqrt{L^2-h^2}}{L}$$

So:

$$v_1 = \sqrt{2g\left(\frac{h}{L} - \mu_k \frac{\sqrt{L^2-h^2}}{L}\right)L}$$

or,

$$v_1 = \sqrt{2g\left(h - \mu_k\sqrt{L^2-h^2}\right)}$$

Does this make sense? It should agree with WB 6-6 when $\mu_k \to 0$.