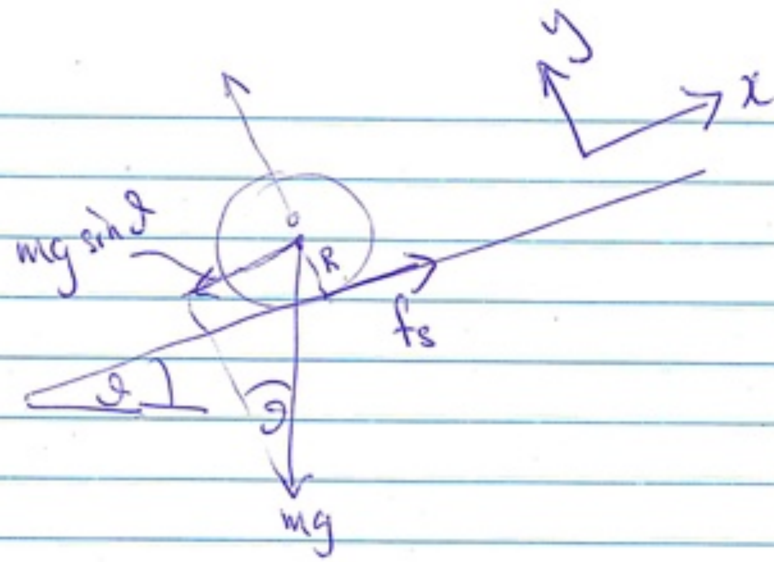
<u>Example 1</u>



Along ramp (x-direction):

$$\sum F_x = f_s - mg\sin\theta = ma_x \quad (1)$$

$$\sum \tau_o = f_s R = I\alpha \quad (2)$$

$$f_s = \frac{I\alpha}{R} \qquad\qquad a = -\alpha R$$

$$\therefore \alpha = -\frac{a}{R}$$

$$= -\frac{I}{R^2}a$$

$$= -\beta m a \qquad (I = \beta m R^2)$$

Put into (1):

$$-\beta m a - mg\sin\theta = m a$$

$$\cancel{m}a(1+\beta) = -\cancel{m}g\sin\theta$$

$$\boxed{\therefore a = -\frac{g}{1+\beta}\sin\theta}$$

To calculate velocity

$$v^2 = 2a\,\Delta x$$

$$\Delta x = -L$$

$$\therefore v^2 = 2\left(\frac{-g\sin\theta}{1+\beta}\right)(-L)$$

$$= \frac{2g}{1+\beta} L\sin\theta$$

$$= \frac{2g}{1+\beta} \cdot H \qquad (H = L\sin\theta)$$

(b) Using conservation of energy:

$$\Delta E = 0 \qquad \therefore \Delta K = -\Delta U$$

$$\Delta K = \frac{1}{2}mv^2(1+\beta)$$

$$\Delta U = mg\,\Delta y \qquad (\Delta y = -H)$$

$$= -mgH$$

$$\therefore \frac{1}{2}\cancel{m}v^2(1+\beta) = \cancel{m}gH$$

$$\therefore v^2 = \frac{2gH}{1+\beta}$$