

energy conserved

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

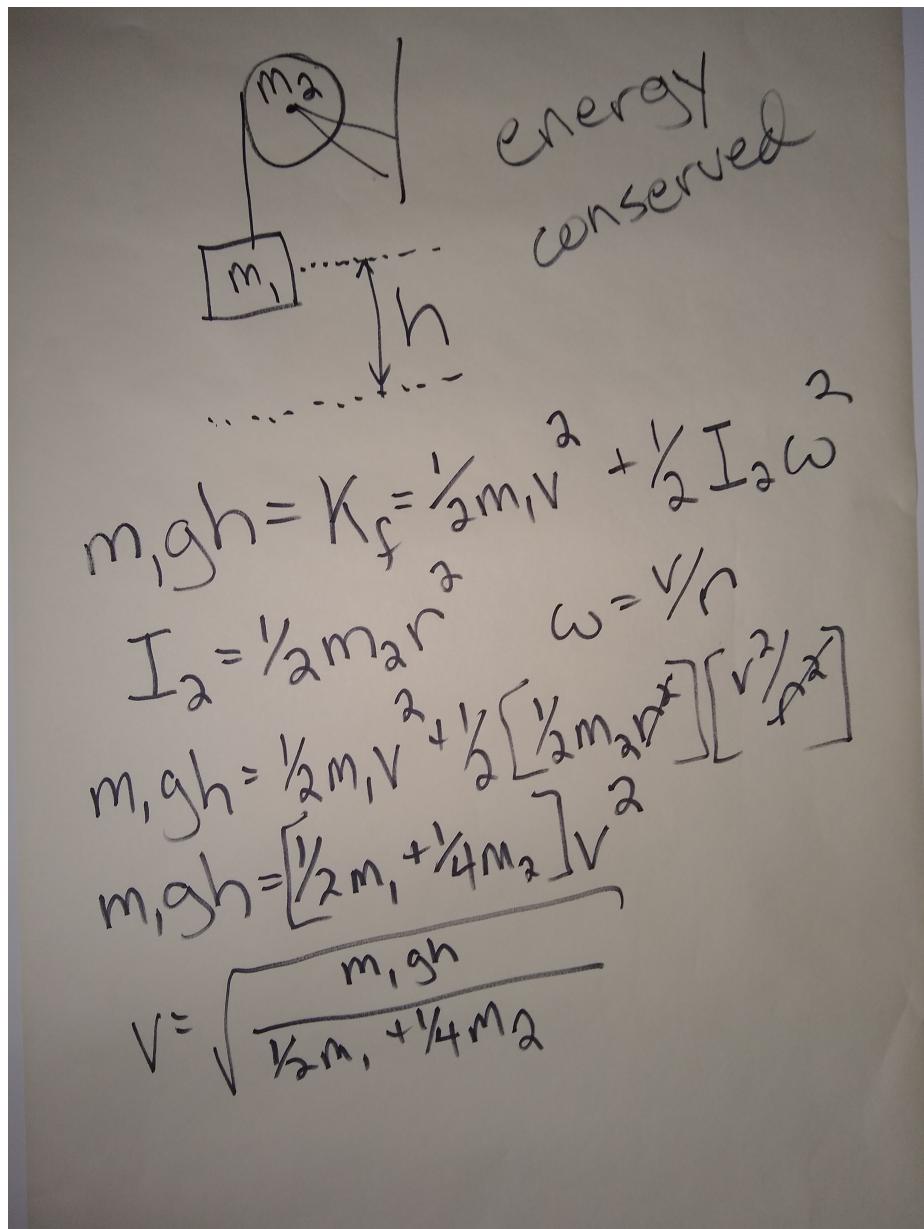
$$\text{disk: } I = \frac{1}{2}mr^2$$

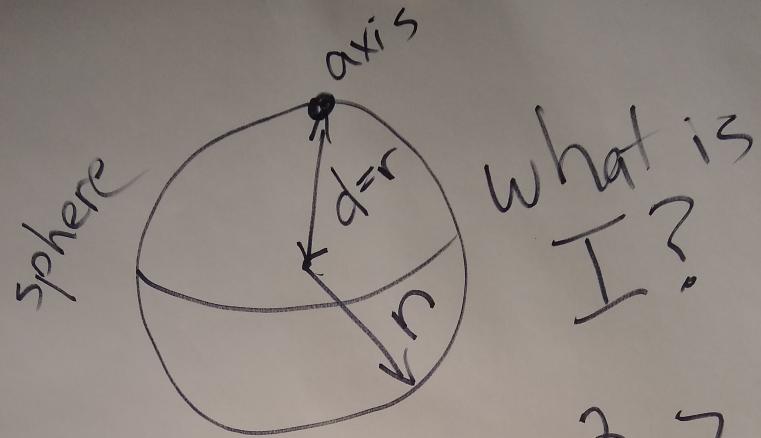
$$\text{rolling: } v = \omega r \text{ or } \omega = v/r$$

$$mgh = \frac{1}{2}mv^2 + \frac{1}{2} \left[\frac{1}{2}mr^2 \right] \left[\frac{v^2}{r^2} \right]$$

$$gh = \frac{1}{2}v^2 + \frac{1}{4}v^2 = \frac{3}{4}v^2$$

$$v = \sqrt{\frac{4gh}{3}}$$





$$I = \frac{2}{5}mr^2 + mr^2 = \frac{7}{5}mr^2$$

Parallel axis
d = r