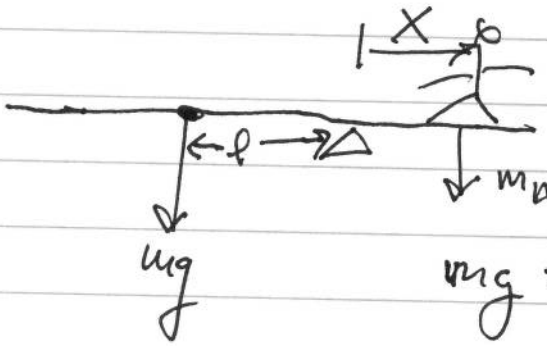
PLANK PROBLEM.

NO FORCE ON LEFT SUPPORT MEANS



$m_A g = 45 \cdot 10\ N$

$mg = 225 N$

$\ell = \frac{L}{2} - 1.1\ m = 1.4\ m$

BALANCE TORQUES:

$$mg\ell = m_A g X$$

$$X = (m/m_A)\ell$$

$$\boxed{x = 0.7\ m}$$

BOWLING BALL

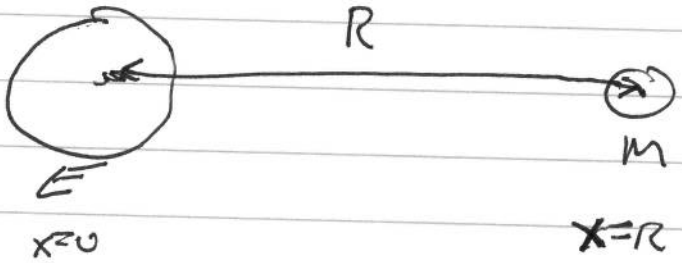
FOR ROLLING, $v_{CM} = \omega R$

BALL'S CM EVENTUALLY STOPS.
WHEN $v_{cm} = 0$, $\omega = 0$.

SINCE $KE_{ROT} = \frac{1}{2} I \omega^2$

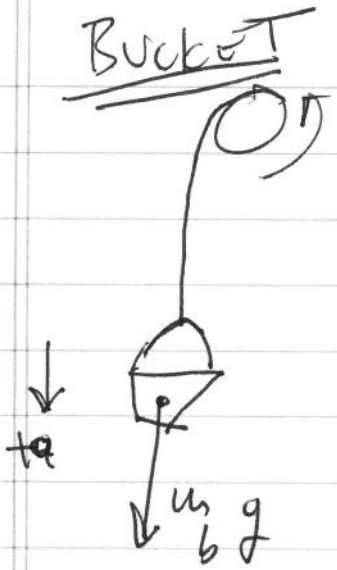
$KE_{ROT} = 0$ AT TOP

EARTH & MOON



$$x_{cm} = \frac{m_{MOON} \cdot R}{m_E + m_m}$$

$$x_{cm} = 4.66 \times 10^{6}\ m$$



$$F_N(\text{bucket}) = m_b g - T = m_b a$$

$$\text{Torque}_{\text{NET}}(\text{PULLEY}) = TR = I\alpha$$
$$= I(a/R)$$

SUB FROM FORCE INTO TORQUE

$$\underbrace{(m_b g - m_b a)}_{T} R = \underbrace{\tfrac{1}{2} M_p R^2}_{I_{\text{PULLEY}}} (a/R)$$

$$m_b(g-a) = \tfrac{1}{2} M_p a$$

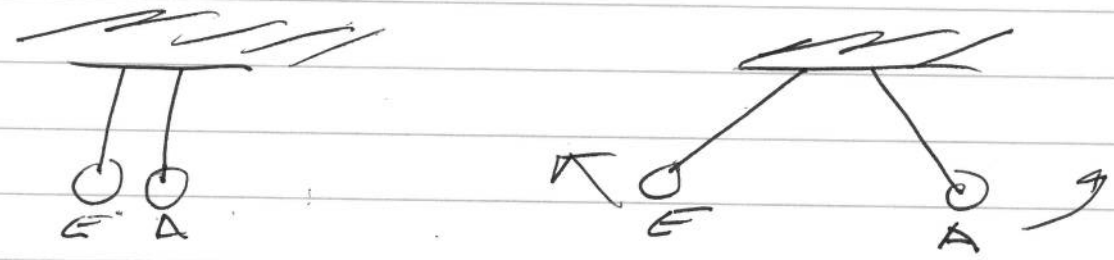
$$m_b g = a\left(m_b + M_p/2\right)$$

$$a = \frac{m_b}{m_b + M_p/2}$$

(a) $\boxed{a \simeq 5.4\ m/s^2}$

(b) $\boxed{\alpha = a/R = 9\ \text{RAD}/s^2}$

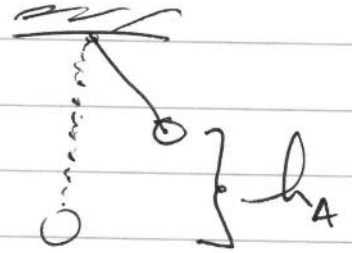
SWINGERS



THIS IS A KIND OF COLLISION.
AFTER PUSHING (JUST AFTER):

$$m_E v_E = m_A v_A$$

CONSIDER A:



CONS. OF E

$$\frac{1}{2} m v_A^2 = m_A g h_A$$

$$v_A = \sqrt{2 g h_A}$$

SO, $m_E \sqrt{2 g h_E} = m_A \sqrt{2 g h_A}$

$$m_E^2 \, 2 g h_E = m_A^2 \, 2 g h_A$$

$$h_E = \frac{m_A^2}{m_E^2} h_A = 1.33 \text{ m}$$