Note: The solutions are not as detailed as usual, but hopefully you can get any help needed!

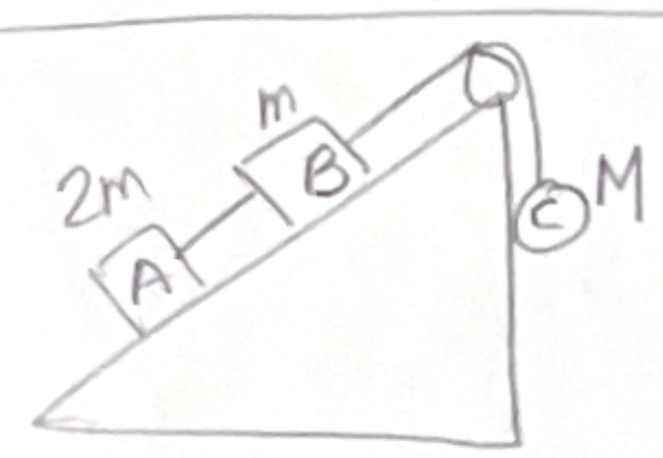
Analysis Problem 6

(c) (i) Decrease to zero b/c the M is no longer keeping it taut.

(ii) up

(iii) down

(d)

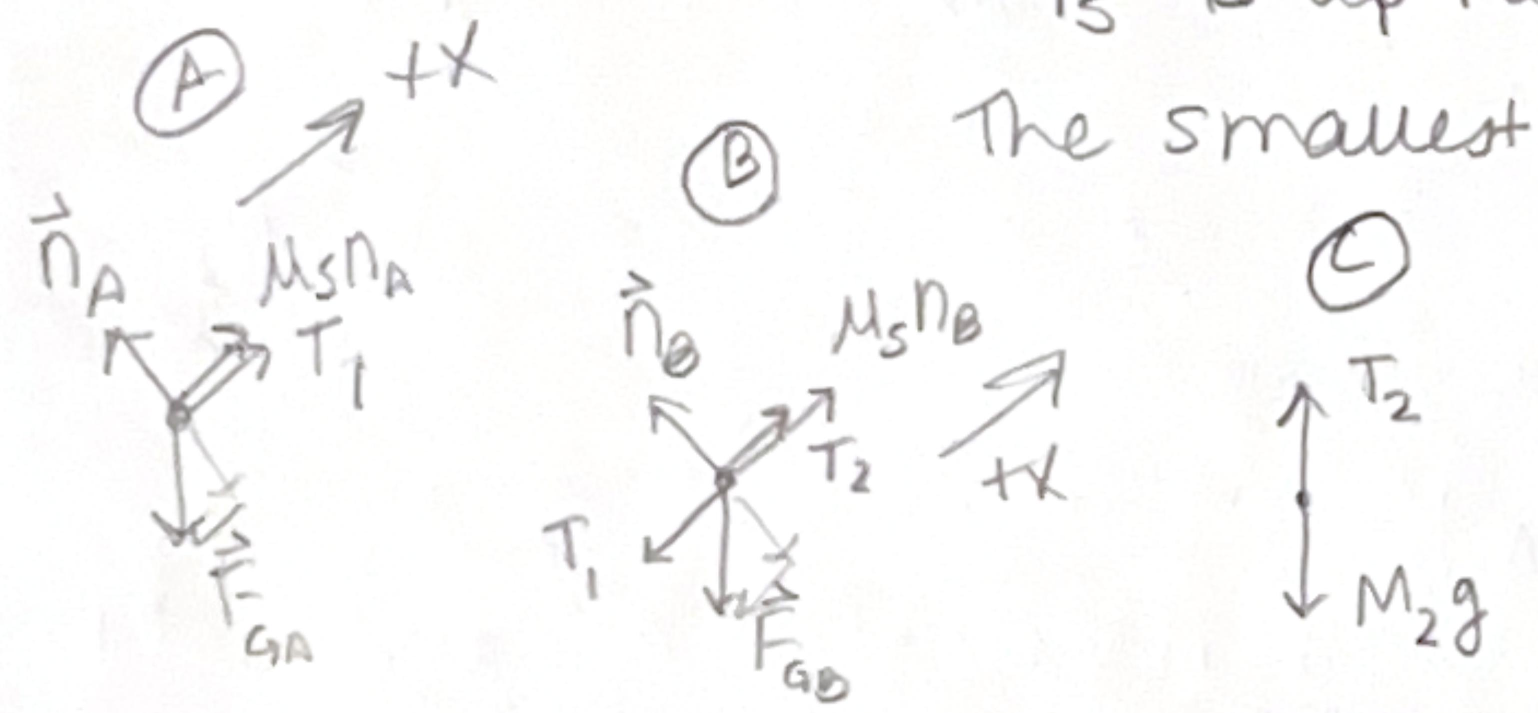


μ_s Find smallest M for blocks to not slide down.

So, tendency to slide is down ramp.

f_s is up ramp

The smallest M is when static friction is a max.



(A) $a_{Ax} = \frac{\Sigma F_x}{m_A}$

$0 = \mu_s n_A + T_1 - m_A g \sin\theta$

(B) $a_{Bx} = \frac{\Sigma F_x}{m_B}$

$0 = \mu_s n_B + T_2 - T_1 - m_B g \sin\theta$

(C) $a_{cy} = \frac{\Sigma F_y}{m_C}$

$0 = M_2 g - T_2$

Add equations:

$$0 = \mu_s n_A + \cancel{T_1} - m_A g \sin\theta$$

$$+ \quad 0 = \mu_s n_B + \cancel{T_2} - \cancel{T_1} - m_B g \sin\theta$$

$$+ \quad 0 = M_2 g - \cancel{T_2}$$

$$0 = \mu_s n_A - m_A g \sin\theta + \mu_s n_B - m_B g \sin\theta + M_2 g$$

$$-\mu_s m_A g \cos\theta + m_A g \sin\theta - \mu_s m_B g \cos\theta + m_B g \sin\theta = +M_2 g$$

$$(m_A + m_B)\sin\theta - \mu_s \cos\theta (m_A + m_B) = M_2$$

Put in masses that are given: $\longrightarrow$

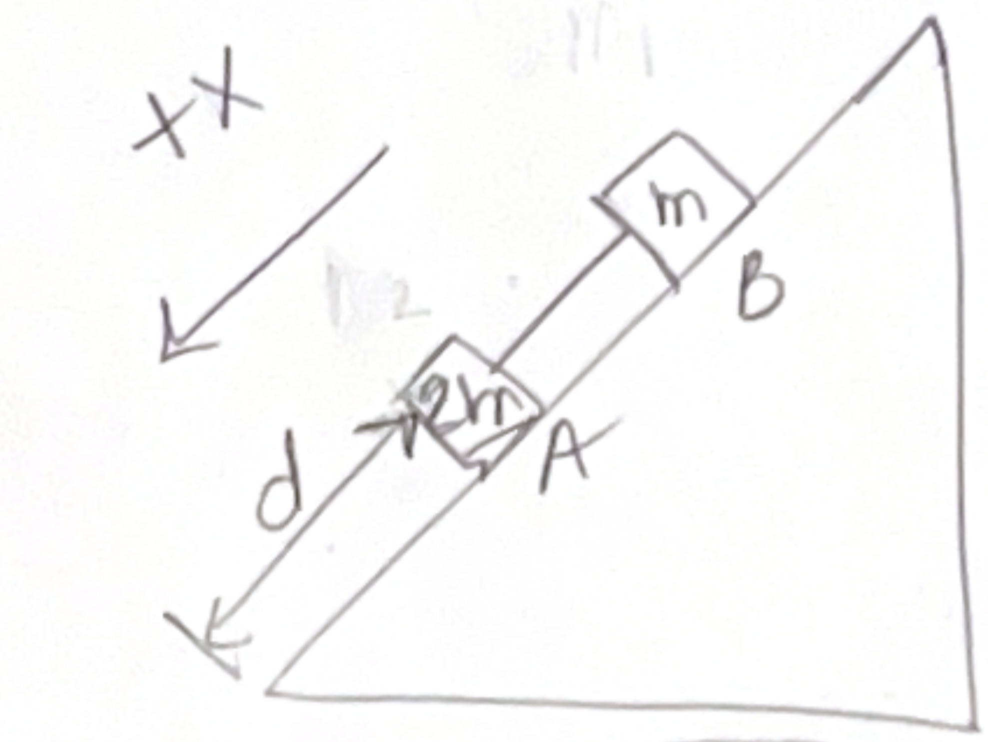
$$3m \sin\theta - \mu_s \cos\theta (3m) = M_2$$

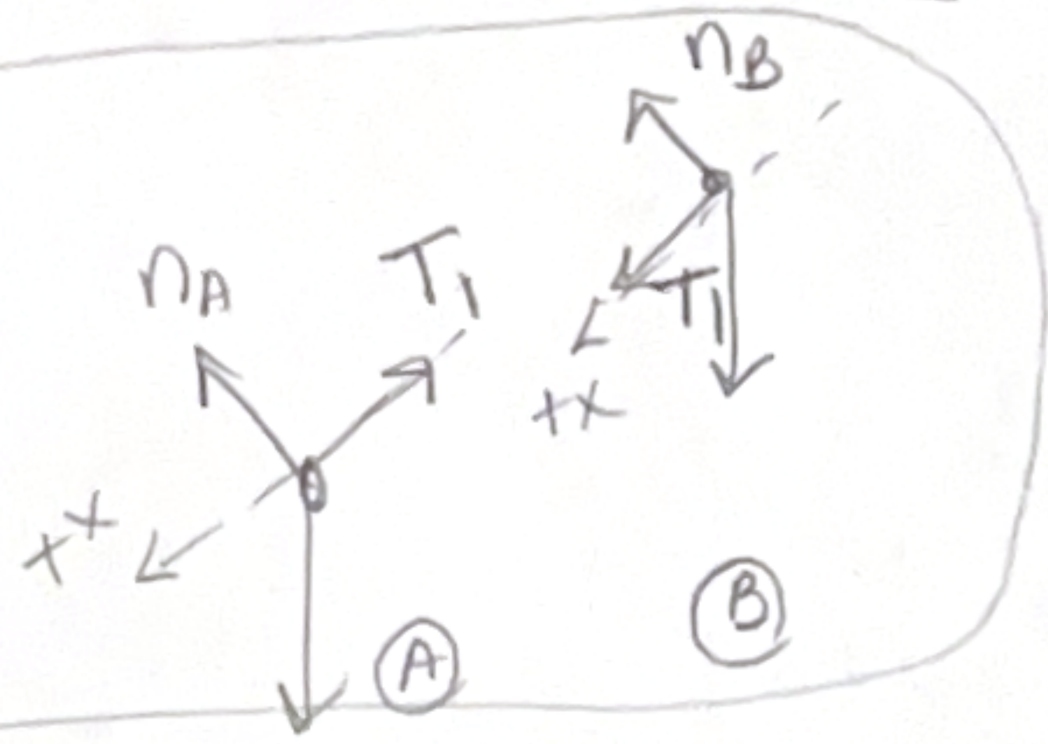
$$3m(\sin\theta - \mu_s \cos\theta) = M_2$$

(e)

This could also be solved using energy

Find speed at bottom





$$a_{Ax} = \frac{\Sigma F_x}{m_A}$$

$$a_{Ax} = \frac{m_A g \sin\theta - T_1 - \mu_k m_A g \cos\theta}{m_A}$$

$$a_{Bx} = \frac{\Sigma F_x}{m_B}$$

$$a_{Bx} = \frac{T_1 + m_B g \sin\theta - \mu_k m_B g \cos\theta}{m_B}$$

$$a_{Ax} = a_{Bx} = a$$

Put in common variable "a" and add equations

$$(m_A + m_B) a = m_A g \sin\theta - \mu_k m_A g \cos\theta + m_B g \sin\theta - \mu_k m_B g \cos\theta$$

$$(m_A + m_B) a = \frac{3mg\sin\theta - 3mg\cos\theta\,\mu_k}{3m}$$

$$a = g\sin\theta - g\mu_k\cos\theta$$

$$a = g(\sin\theta - \mu_k\cos\theta)$$

Then $v_{fx}^2 = v_{ix}^2 + 2a_x \Delta x \Rightarrow v_f = \sqrt{2g(\sin\theta - \mu_k\cos\theta)d}$