PROBLEM 1

C.O.L.M IN y DIR ↑

$$\frac{d}{dt}(\mathbb{P}_{y,sys}) = \sum F_y + \underbrace{\sum \dot{m}_{in} V_y}_{0} - \underbrace{\sum \dot{m}_{out} V_y}_{0}$$

$$\frac{d}{dt}\left(M_B \underbrace{V_{B,y}}_{\text{NO } y\ V_B}\right) = -P\sin\theta - mg + N$$

$$N = \overset{?}{P}\sin\theta + mg$$

C.O.L.M. IN x DIR →

$$\frac{d}{dt}(\mathbb{P}_{sys,x}) = \sum F_x + 0 \quad 0$$

CLOSED

$$\frac{d}{dt}\left[m V_G\right] = P\cos\theta - \mu_k N$$

$$m\frac{dV_G}{dt} = P\cos\theta - \mu_k N$$

$$m\, a_G = \overset{?}{P}\cos\theta - \mu_k\left[\overset{?}{P}\sin\theta + mg\right]$$

... SOLVE FOR P...

PROBLEM 2

C.O.L.M y-DIR FOR PULLEY C ↑

$$\frac{d}{dt}\left(P_{y,sys}\right) = \sum F_y \underbrace{+ 0 - 0}_{\text{CLOSED}}$$

$$\frac{d}{dt}\underbrace{\left(\cancel{m} V\right)}_{0 \text{ (MASSLESS)}} = 2T_A - T_B \qquad \boxed{\overset{?}{T_B} = 2\overset{?}{T_A}} \quad (1)$$

C.O.L.M y-DIR BLOCK B ↑

$$\frac{d}{dt}\left(P_{sys,y}\right) = \sum F_y \underbrace{+ 0 - 0}_{\text{CLOSED}}$$

$$\frac{d}{dt}\left(m_B[-V_B]\right) = T_B - m_B g$$

$$-m_B \frac{dV_B}{dt} = T_B - m_B g \qquad \boxed{-m_B \overset{?}{a_B} = T_B - m_B g} \quad (2)$$

C.O.L.M X-DIR BLOCK A +→

$$\frac{d}{dt}\left(P_{x,sys}\right) = \sum F_x \underbrace{+ 0 - 0}_{\text{CLOSED}}$$

$$\frac{d}{dt}\left[m_A V_A\right] = T_A$$

$$m_A \frac{dV_A}{dt} = T_A \qquad \boxed{m_A \overset{?}{a_A} = T_A} \quad (3)$$

KINEMATICS

$$\boxed{a_b = \frac{1}{2} a_A} \quad (4)$$

FOUR EQNS & 4 UNKS
(1 → 4) $\quad (T_A, T_B, a_A, a_B)$

... SOLVE

C.O.L.M BLOCK A X– DIR $+\longrightarrow$

$$\frac{d}{dt}(\mathbb{P}_{x,sys}) = \sum F_x + \cancel{\not{\;}}_0 - \cancel{\not{\;}}_0$$

CLOSED

$$\frac{d}{dt}(m_A V_A) = N_B \sin\theta$$

$$m_A \frac{dV_A}{dt} = N_B \sin\theta \Longrightarrow m_A \overset{?}{a_A} = \overset{?}{N_B} \sin\theta \quad (1)$$

y–DIR $\uparrow +$

$$\frac{d}{dt}(\mathbb{P}_{y,sys}) = \sum F_y$$

$$\frac{d}{dt}(m_A \cancel{V_{A,y}}) = N_A - m_A g - m_A g\cos\theta$$

$$0 = \overset{?}{N_A} - m_A g - m_A g\cos\theta$$

$\hookrightarrow$ CAN SOLVE FOR N_A ...

C.O.L.M BLOCK B X $\swarrow +$ DIR $\longrightarrow$

$$\frac{d}{dt}(\mathbb{P}_{x,sys}) = \sum F_x + \cancel{\not{\;}}_0 - \cancel{\not{\;}}_0 \quad (2)$$

$$\frac{d}{dt}\left[m_B V_{B,x}\right] = m_B g\sin\theta$$

? ABSOLUTE!!

$\nwarrow +$ y-DIR

$$\frac{d}{dt}(\mathbb{P}_{y,sys}) = \sum F_y + \cancel{\not{\;}}_0 - \cancel{\not{\;}}_0$$

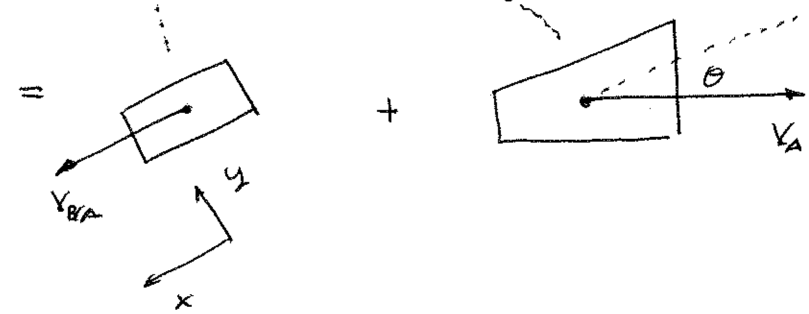
ABSOLUTE!!

$$\frac{d}{dt}(m_B V_{B,y}) = N_B - m_B g\cos\theta \quad (3)$$

?

NEED RELATIVE VELOCITIES

$$\vec{V}_B = \vec{V}_{B/A} + \vec{V}_A$$



IN x

$$V_{B,x} = V_{B/A} - V_A \cos\theta$$

IN y

$$V_{B,y} = 0 - V_A \sin\theta$$

(NO $V_{B/A}$ IN y)

2 BECOMES:

$$\frac{d}{dt}\left[m_B\left(V_{B/A} - V_A\cos\theta\right)\right] = m_B g \sin\theta$$

$$m_B \frac{dV_{B/A}}{dt} - m_B \cos\theta \frac{dV_A}{dt} = m_B g \sin\theta$$

$$m_B \overset{?}{a_{B/A}} - m_B \cos\theta\, a_A = m_B g \sin\theta \qquad (4)$$

3 BECOMES

$$\frac{d}{dt}\left(m_B(-V_A \sin\theta)\right) = N_B - m_B g \cos\theta$$

$$-m_B \sin\theta \frac{dV_A}{dt} = N_B - m_B g \cos\theta$$

$$-m_B \sin\theta\, a_A = N_B - m_B g \cos\theta \qquad (5)$$

3 EQNS (1, 4, 5), 3 UNKNOWNS (N_B, a_A, $a_{B/A}$) ...