Z1) $m_1 = 2$ kg

$m_2 = 1.2$ kg

$\alpha = 50°$

$\mu = 1.2$

a) $F = 10$ N

$a = ?$

$N = m_2 g \cdot \cos \alpha + F_y$

$N = m_2 g \cdot \cos \alpha + F \cdot \sin \alpha$

$F = m_2 \cdot a$

$N = m_2 \cdot g \cdot \cos \alpha + F \cdot \sin \alpha$

$m_1 \cdot a = T - F_{tr} + F_x - F_{g2x}$

$\quad = T + F \cdot \cos \alpha - N \cdot \mu - m_2 g \cdot \sin \alpha$

$\quad = T + F \cos \alpha - \mu (m_2 \cdot g \cdot \cos \alpha + F \cdot \sin \alpha) - m_2 \cdot g \cdot \sin \alpha$

$m_1 \cdot a = F_{g1} - T$

$\quad = m_1 \cdot g - T$

$a(m_1 + m_2) = m_1 \cdot g + F \cdot \cos \alpha - \mu (m_2 \cdot g \cdot \cos \alpha + F \cdot \sin \alpha) -$

$\qquad m_2 \cdot g \cdot \sin \alpha$

$a = \dfrac{g(m_1 - m_2 \cdot \sin \alpha) + F \cdot \cos \alpha - \mu (m_2 \cdot g \cdot \cos \alpha + F \cdot \sin \alpha)}{m_1 + m_2}$

$a = -0.388 \quad$ m/s² $\qquad \vec{a} = ?$

$a = |m_1 = 5, m_2 = 1| = 5.2 \quad$ m/s²

b) $\vec{F'} = -\vec{F} = ?$
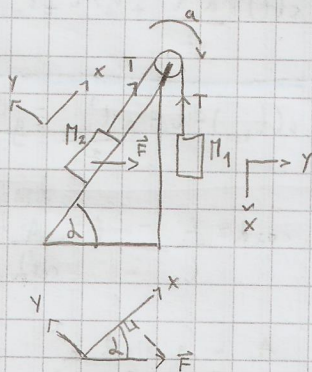
$F' \cdot \sin \alpha = m_2 \cdot g \cdot \cos \alpha$

$F' = \dfrac{m_2 \cdot g \cdot \cos \alpha}{\sin \alpha} \qquad\qquad F' = |m_1 = 5, m_2 = 1| = 8.23$

$F' = \dfrac{1.2 \cdot 1.81 \cdot \cos 50°}{\sin 50°} = 9.878$ N

Z2) $m_1 = 4$ kg

$m_2 = 8$ kg

$\alpha = 30°$

$\mu_1 = 0.1$

$\mu_2 = 0.2$

$T = ?$

$\left. \begin{array}{l} m_1 \cdot a = F_{g1x} - F_{tr1} - T \\ m_2 \cdot a = F_{g2x} - F_{tr2} + T \end{array} \right\} +$

$F_{gx} = m \cdot g \cdot \sin \alpha$

$F_{tr} = N \cdot \mu$

$N = m \cdot g \cdot \cos \alpha$

$m_1 \cdot a = m_1 \cdot g \cdot \sin \alpha - \mu_1 m_1 \cdot g \cdot \cos \alpha - T$

$m_2 \cdot a = m_2 \cdot g \cdot \sin \alpha - \mu_2 m_2 \cdot g \cdot \cos \alpha + T$

$\left. \begin{array}{l} m_1 \cdot a = m_1 \cdot g (\sin \alpha - \mu_1 \cos \alpha) - T \\ m_2 \cdot a = m_2 \cdot g \cdot (\sin \alpha - \mu_2 \cos \alpha) + T \end{array} \right\} +$

$a(m_1 + m_2) = g [m_1 (\sin \alpha - \mu_1 \cos \alpha) - m_2 (\sin \alpha - \mu_2 \cos \alpha)]$

$a = 9.81 \cdot \dfrac{[4 \cdot (\sin 30° - 0.1 \cdot \cos 30°) - 8 \cdot (\sin 30° - 0.2 \cdot \cos 30°)]}{4 + 8}$

$= 3.489$ m/s²

$T = m_2 \cdot a - m_2 \cdot g [\sin \alpha - \mu_2 \cdot \cos \alpha]$

$= 8 \cdot 3.489 - 8 \cdot 9.81 [\sin (30°) - 0.2 \cdot \cos (30°)]$

$T = 2.265$ N
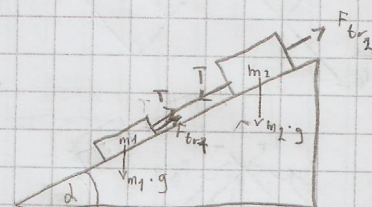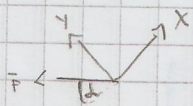
Z3) $\alpha (T_{min}) = ?$

$F_{tr} = N \cdot \mu$
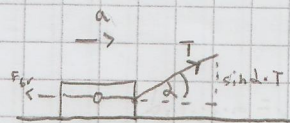
$$\frac{d\lambda}{dT} = 0 = \frac{dT}{d\lambda}$$

$$\cos\lambda = \frac{T_x}{T} \rightarrow T_x = T\cos\lambda$$

$$m \cdot a = T_x - F_{tr}$$

$$m \cdot a = T \cos\lambda - [\mu \cdot (m \cdot g - \sin\lambda \cdot T)]$$

$$ma + \mu mg = T\cos\lambda + T\mu\sin\lambda$$

$$T = \frac{m(a + \mu \cdot g)}{\mu\sin\lambda + \cos\lambda}$$

$$\frac{dT}{d\lambda} = \frac{m(a + \mu \cdot g)\cdot(\mu\cos\lambda - \sin\lambda)}{(\mu\sin\lambda + \cos\lambda)^2} = 0$$

$$\mu\cos\lambda - \sin\lambda = 0$$

$$\mu = tg\,\lambda$$

$$\lambda = arctg\,\mu$$

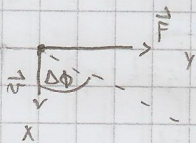$+$) $m = 10\,t = 10\,000\ kg$

$v = 1\,km/s = 1000\ m/s$

$F = 10\,kN = 10\,000\ N = F_{cp}$

$t\,(\Delta\phi = 60°) = ?$

$$\omega = \frac{d\phi}{dt} \rightarrow d\phi = \omega\,dt \quad /S$$

$$\Delta\phi = \omega \cdot t \rightarrow \omega = \frac{\Delta\phi}{t}$$

$$F_{cp} = \frac{m \cdot v^2}{R}$$

$$v = \omega \cdot R \rightarrow R = \frac{v}{\omega} = \frac{v \cdot t}{\Delta\phi}$$

$$F_{cp} = \frac{m \cdot v^2}{\frac{v \cdot t}{\Delta\phi}} = \frac{m \cdot v \cdot \Delta\phi}{t}$$

$$t = \frac{m \cdot v \cdot \Delta\phi}{F_{cp}}$$

$$= \frac{10\,000 \cdot 1000 \cdot \frac{\pi}{3}}{10\,000} = \frac{1000\,\pi}{3} = 1047.198\ s$$