

1 a) $m = 0.002 \text{ kg}$ $v_0 = 36 \text{ m/s}$ $\Delta x = 0.1 \text{ m}$

$t = ?$ for $v = 0$

$$\Delta x = \left(\frac{v_0 + v}{2} \right) t$$

$$0.1 = \frac{(36 + 0)}{2} t$$

$$\rightarrow \underline{\underline{t = 5.56 \times 10^{-3} \text{ s}}}$$

b) $a = ?$ $v = v_0 + at$

$$0 = 36 + a(5.56 \times 10^{-3})$$

$$\underline{\underline{a = -6480 \text{ m/s}^2}}$$

c) $F_{\text{net}} = ma$



$$F_{\text{block}} = (0.002)(-6480)$$

$$F_{\text{block}} = \underline{\underline{-12.96 \text{ N}}}$$

(i.e. opposite the velocity)

d)

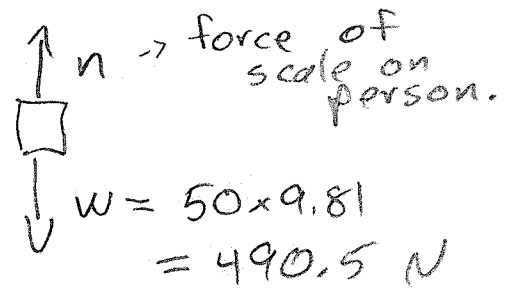
$$F_{\text{bullet} \rightarrow \text{block}} = -F_{\text{block} \rightarrow \text{bullet}}$$

$$F_{\text{bullet} \rightarrow \text{block}} = \underline{\underline{12.96 \text{ N}}}$$

(i.e. same direction as velocity)

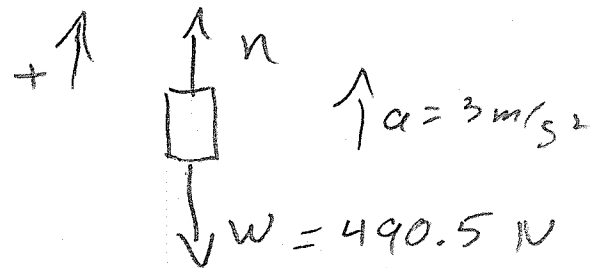
2. a) since $a = 0$,
 $F_{\text{net}} = 0$

$$n = w = \underline{490.5 \text{ N}}$$

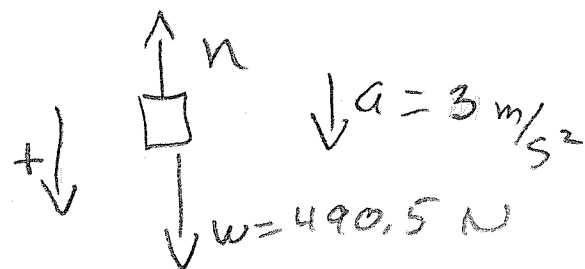


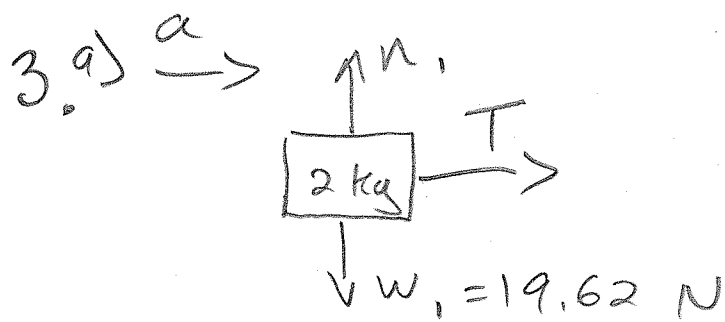
b) since $a = 0$, F_{net} is zero
 again $n = \underline{490.5 \text{ N}}$

c) $F_{\text{net}} = ma$
 $n - 490.5 = 50(3)$
 $n = \underline{640.5 \text{ N}}$



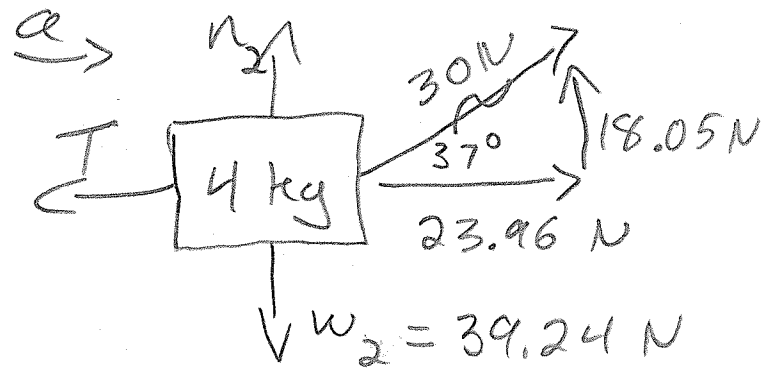
d) $F_{\text{net}} = ma$
 $490.5 - n = 50(3)$
 $-n = -340.5$
 $n = \underline{340.5 \text{ N}}$





$$F_{\text{net}} = ma$$

$$T = 2a$$



$$F_{\text{net}} = ma$$

$$23.96 - T = 4a$$

$$23.96 - (2a) = 4a$$

$$23.96 = 6a$$

$$\underline{a = 3.99 \text{ m/s}^2}$$

b)

$$T = 2a$$

$$= 2(3.99)$$

$$= \underline{\underline{7.99 \text{ N}}}$$

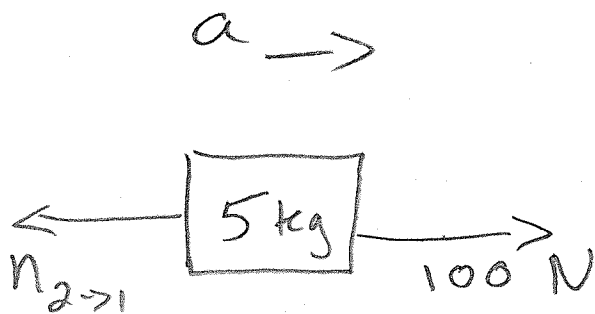
c)

$$n_1 = w_1 = \underline{\underline{19.62 \text{ N}}}$$

$$n_2 + 18.05 = 39.24$$

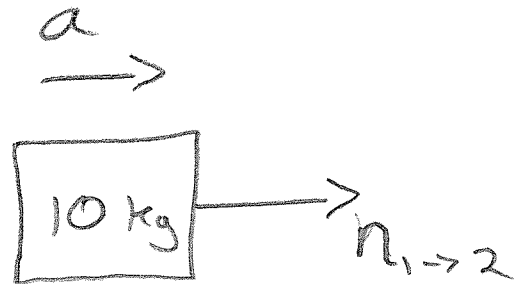
$$n_2 = \underline{\underline{21.19 \text{ N}}}$$

4. a) In order for both to accelerate, the force must push on m_1



$$F_{\text{net}} = ma$$

$$100 - n_{2 \rightarrow 1} = 5a$$



$$F_{\text{net}} = ma$$

$$n_{1 \rightarrow 2} = 10a$$

$$\text{but } n_{1 \rightarrow 2} = n_{2 \rightarrow 1}$$

$$100 - (10a) = 5a$$

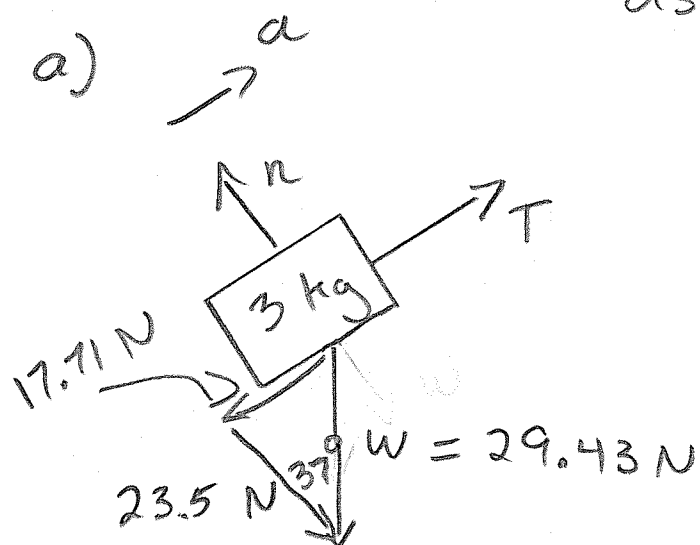
$$\underline{\underline{a = 6.67 \text{ m/s}^2}}$$

$$\begin{aligned} \text{b) } n_{1 \rightarrow 2} &= 10a \\ &= 10(6.67) \end{aligned}$$

$$\underline{\underline{= 66.7 \text{ N}}}; \text{ same as } n_{1 \rightarrow 2}$$

assume $\mu = 0$

5. a)



$$F_{\text{net}} = ma$$

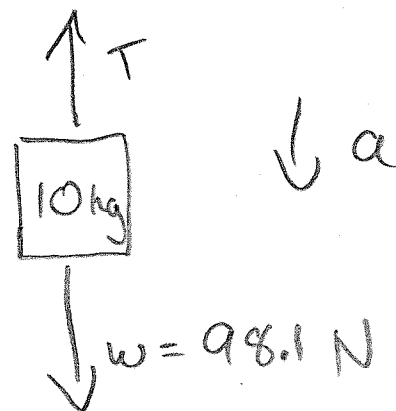
$$T - 17.71 = 3a$$

$$T = 3a + 17.71$$

$$98.1 - (3a + 17.71) = 10a$$

$$80.39 = 13a$$

$$\underline{\underline{a = 6.18 \text{ m/s}^2}}$$



$$F_{\text{net}} = ma$$

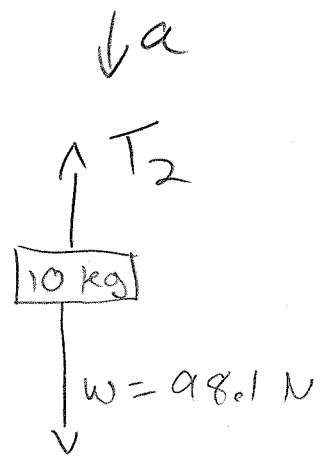
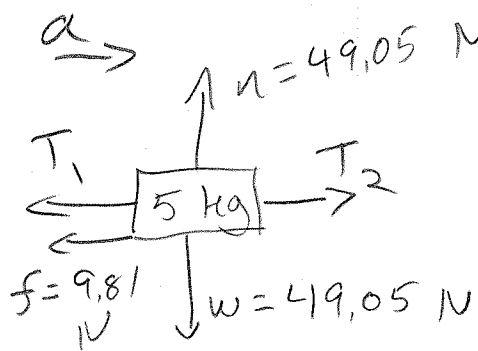
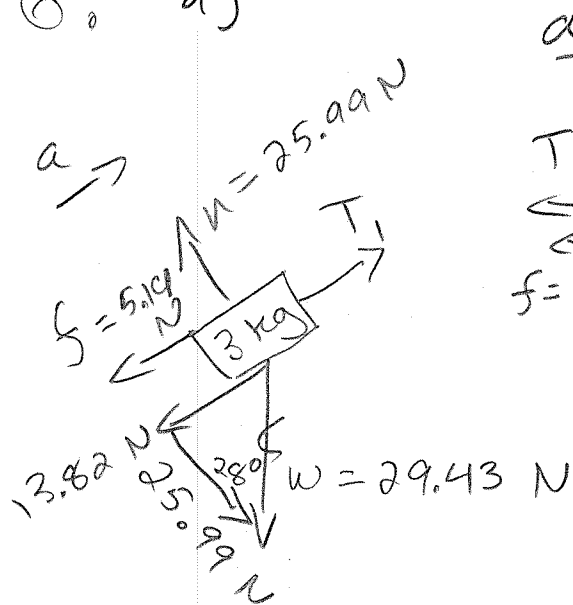
$$98.1 - T = 10a$$

b) $v = v_0 + at$

$$0 = -3 + (6.18)t$$

$$\underline{\underline{t = 0.485 \text{ s}}}$$

6. a) For m_2 and m_3 , $f = \mu n$



$$F_{\text{net}} = ma$$

$$T_1 - 5.19 - 13.82 = 3a$$

$$T_1 - 19.01 = 3a$$

$$T_1 = 3a + 19.01$$

$$F_{\text{net}} = ma$$

$$T_2 - T_1 - 9.81 = 5a$$



$$(98.1 - 10a) - (3a + 19.01) - 9.81 = 5a$$

$$69.28 = 18a$$

$$a = 3.85 \text{ m/s}^2$$

$$F_{\text{net}} = ma$$

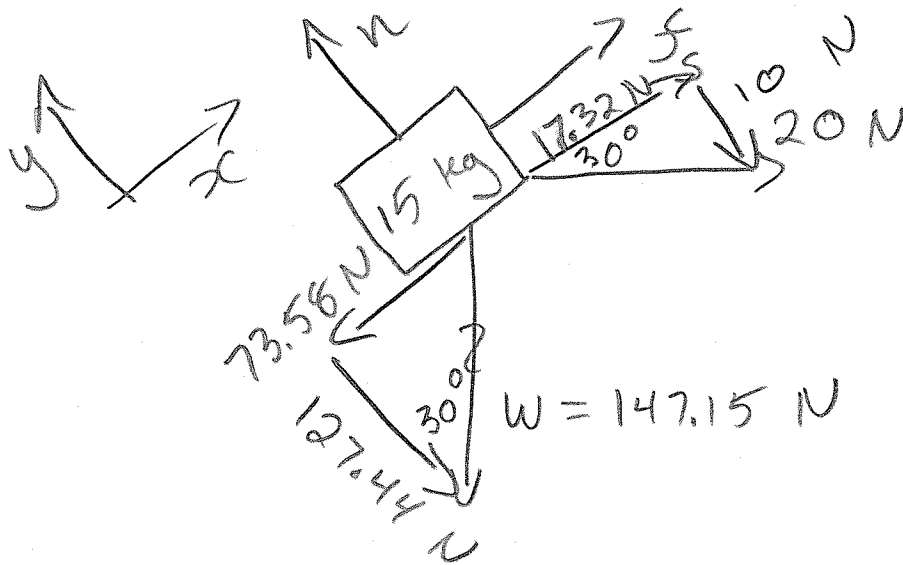
$$98.1 - T_2 = 10a$$

$$98.1 - 10a = T_2$$

$$b) T_1 = 3(3.85) + 19.01 = \underline{\underline{30.6 \text{ N}}}$$

$$T_2 = 98.1 - 10(3.85) = \underline{\underline{59.6 \text{ N}}}$$

7. We must maintain equilibrium with f_s pushing up the incline. (to stop it from sliding down)



$$\sum F_{xc} = 0$$

$$f_s + 17.32 = 73.58$$

$$f_s = 56.26 \text{ N}$$

$$\sum F_y = 0$$

$$n = 10 + 127.44$$

$$= 137.44$$

but $f_s = \mu_s n$ when it is almost slipping

$$56.26 = \mu_s (137.44)$$

$$\underline{\underline{\mu_s = 0.409}}$$

8. a) f_s pushes down the slope to stop it from sliding up

$$n_y = 0.866n$$

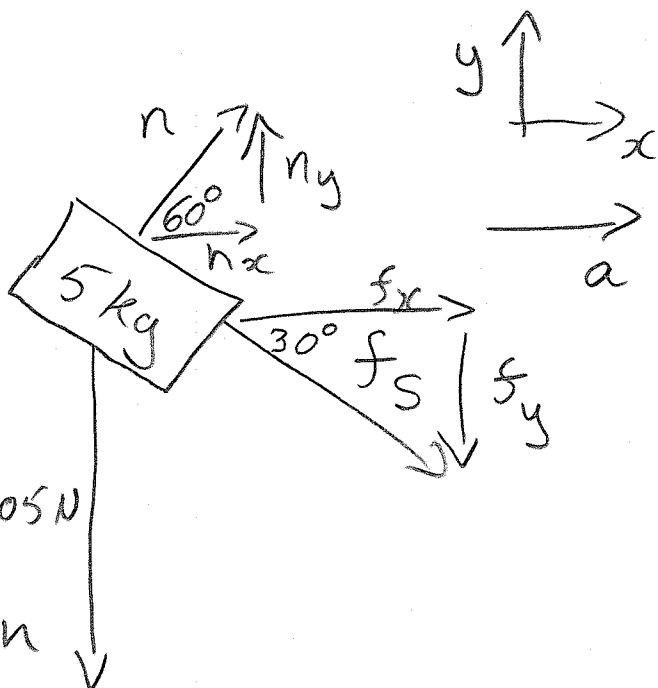
$$n_x = 0.5n$$

$$f_x = 0.866f_s$$

$$f_y = 0.5f_s$$

$$W = 49.05 \text{ N}$$

$$f_s = \mu n = 0.5n$$



$$\sum F_y = 0: n_y = f_y + 49.05$$

$$0.866n = 0.5(0.5n) + 49.05$$

$$0.616n = 49.05$$

$$[\text{part b)}] \quad \underline{\underline{n = 79.6 \text{ N}}}$$

$$\text{so } f_s = 39.8 \text{ N}$$

x

$$F_{\text{net}} = ma$$

$$f_x + n_x = 5a$$

$$0.866(39.8) + 0.5(79.6) = 5a$$

$$[\text{part a)}] \quad \underline{\underline{a = 14.8 \text{ m/s}^2}}$$