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

$t = ?$ for $v = 0$

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

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

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

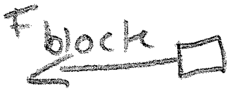
b) $a = ?$

$$v = v_0 + at$$

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

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

c) $F_{net} = ma$



$$F_{block} = (.002)(-6480)$$

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

(i.e. opposite the velocity)

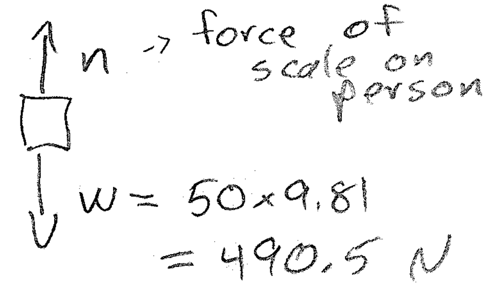
d) $F_{bullet \to block} = -F_{block \to bullet}$

$$F_{bullet \to block} = \underline{12.96\ N}$$

(ie same direction as velocity)

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

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

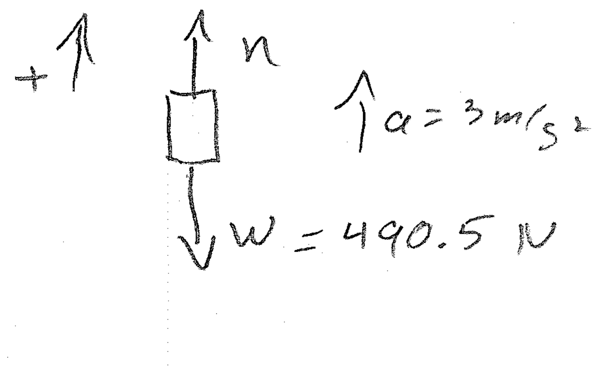


b) since $a = 0$, F_{net} is zero
again $n = \underline{490.5\ N}$

c) $F_{net} = ma$

$n - 490.5 = 50(3)$

$n = \underline{640.5\ N}$

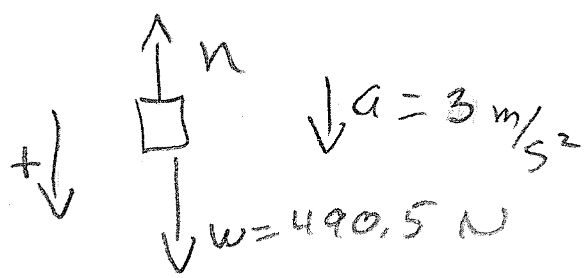


d) $F_{net} = ma$

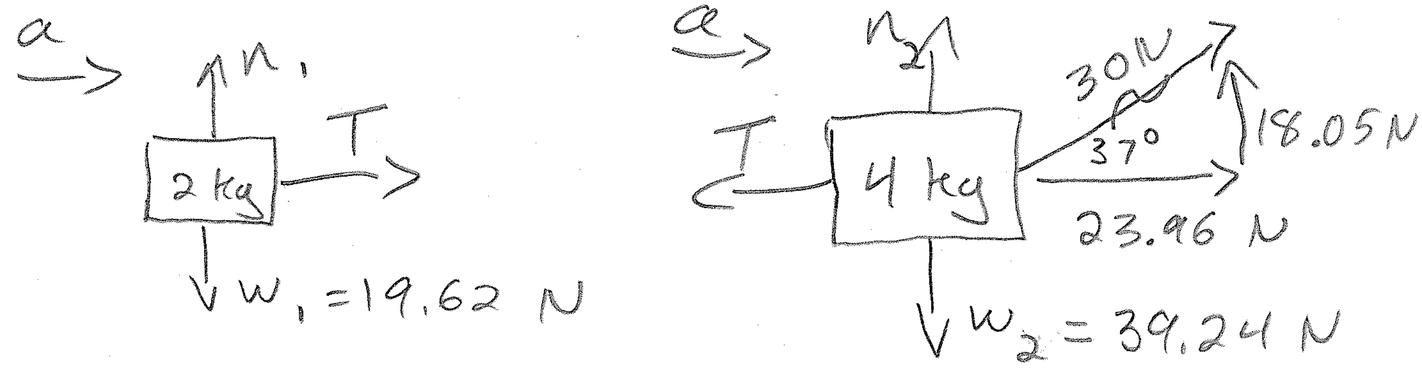
$490.5 - n = 50(3)$

$-n = -340.5$

$n = \underline{340.5\ N}$



3. a)



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

$$T = 2a \qquad\qquad 23.96 - T = 4a$$

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

$$23.96 = 6a$$

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

b)

$$T = 2a$$

$$= 2(3.99)$$

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

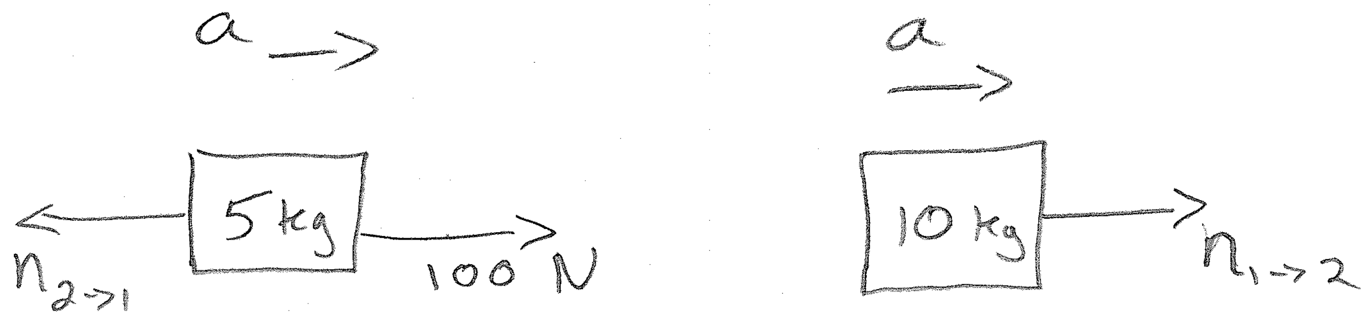
c)

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

$$n_2 + 18.05 = 39.24$$

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

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



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

$100 - n_{2\to1} = 5a$ $\qquad$ $n_{1\to2} = 10a$

but $n_{1\to2} = n_{2\to1}$

$100 - (10a) = 5a$

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

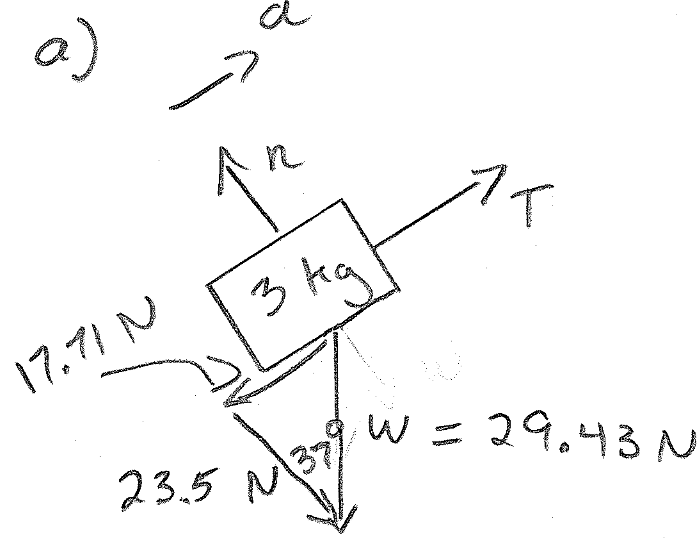
b) $n_{1\to2} = 10a$

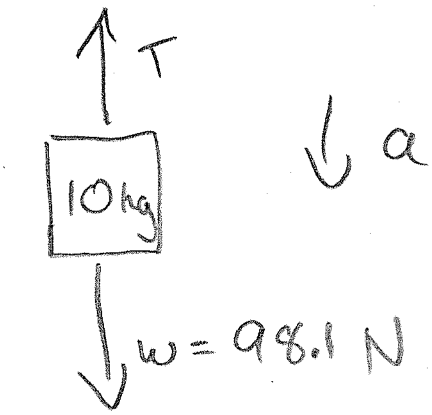
$= 10(6.67)$

$= \underline{\underline{66.7 \text{ N}}}$; same as $n_{1\to2}$

assume $\mu = 0$

5. a)





$F_{net} = ma$

$T - 17.71 = 3a$

$T = \underbrace{3a + 17.71}$

$F_{net} = ma$

$98.1 - T = 10a$

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

$80.39 = 13a$

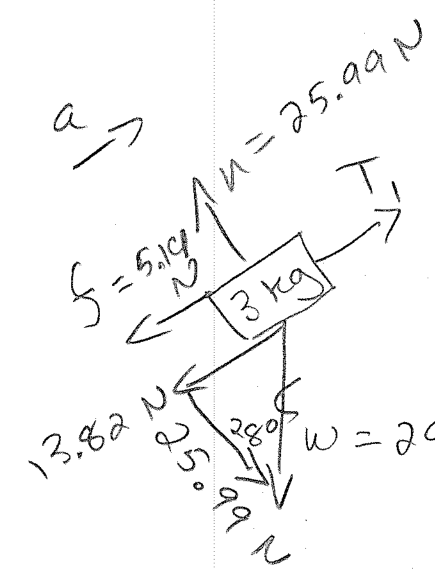
$\underline{\underline{a = 6.18 \, m/s^2}}$

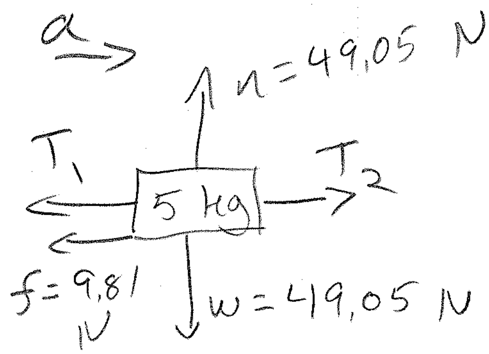
b) $v = v_0 + at$

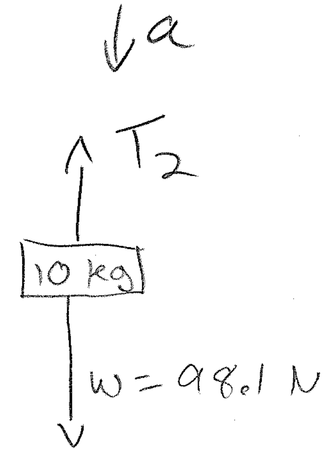
$0 = -3 + (6.18)t$

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

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







$F_{net} = ma$

$T_1 - 5.19 - 13.82 = 3a$

$T_1 - 19.01 = 3a$

$T_1 = 3a + 19.01$

$F_{net} = ma$

$T_2 - T_1 - 9.81 = 5a$

$F_{net} = ma$

$98.1 - T_2 = 10a$

$98.1 - 10a = T_2$

$$\underbrace{(98.1 - 10a)}_{T_2} - \underbrace{(3a + 19.01)}_{T_1} - 9.81 = 5a$$

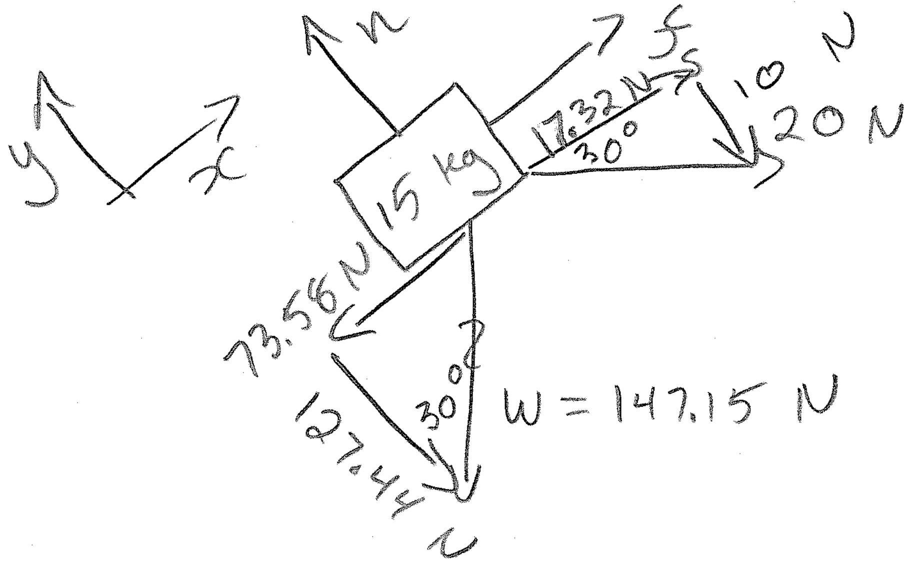
$69.28 = 18a$

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

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

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

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



$$\sum F_x = 0$$

$$f_s + 17.32 = 73.58$$

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

$$\sum F_y = 0$$

$$n = 10 + 127.44$$

$$= 137.44$$

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

$$56.26 = \mu_s (137.44)$$

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

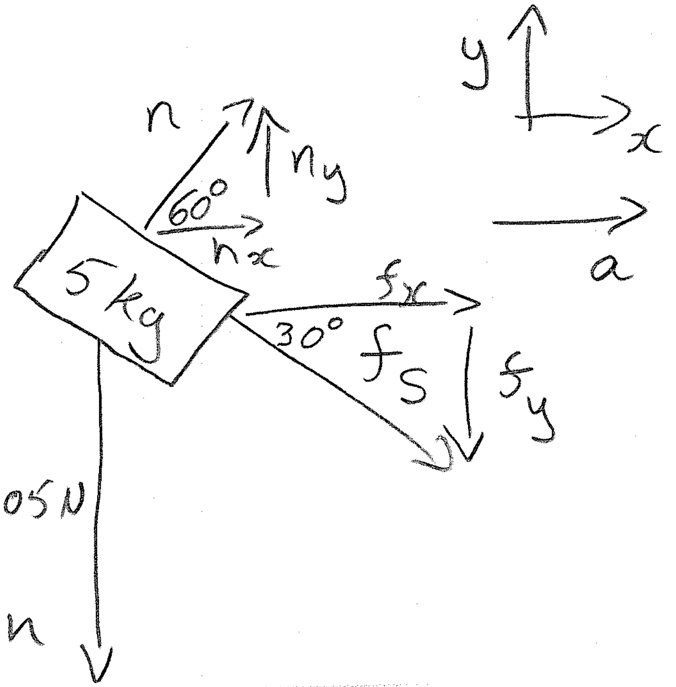
8. a) f_s pushes <u>down</u> the slope to stop it from sliding up

$n_y = 0.866\,n$

$n_x = 0.5\,n$

$f_x = 0.866\,f_s$

$f_y = 0.5\,f_s$



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

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

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

$0.616\,n = 49.05$

[part b)] $\underline{\underline{n = 79.6\,N}}$ so $f_s = 39.8\,N$

$\underline{\underline{x}}$ $F_{net} = ma$

$f_x + n_x = 5a$

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

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