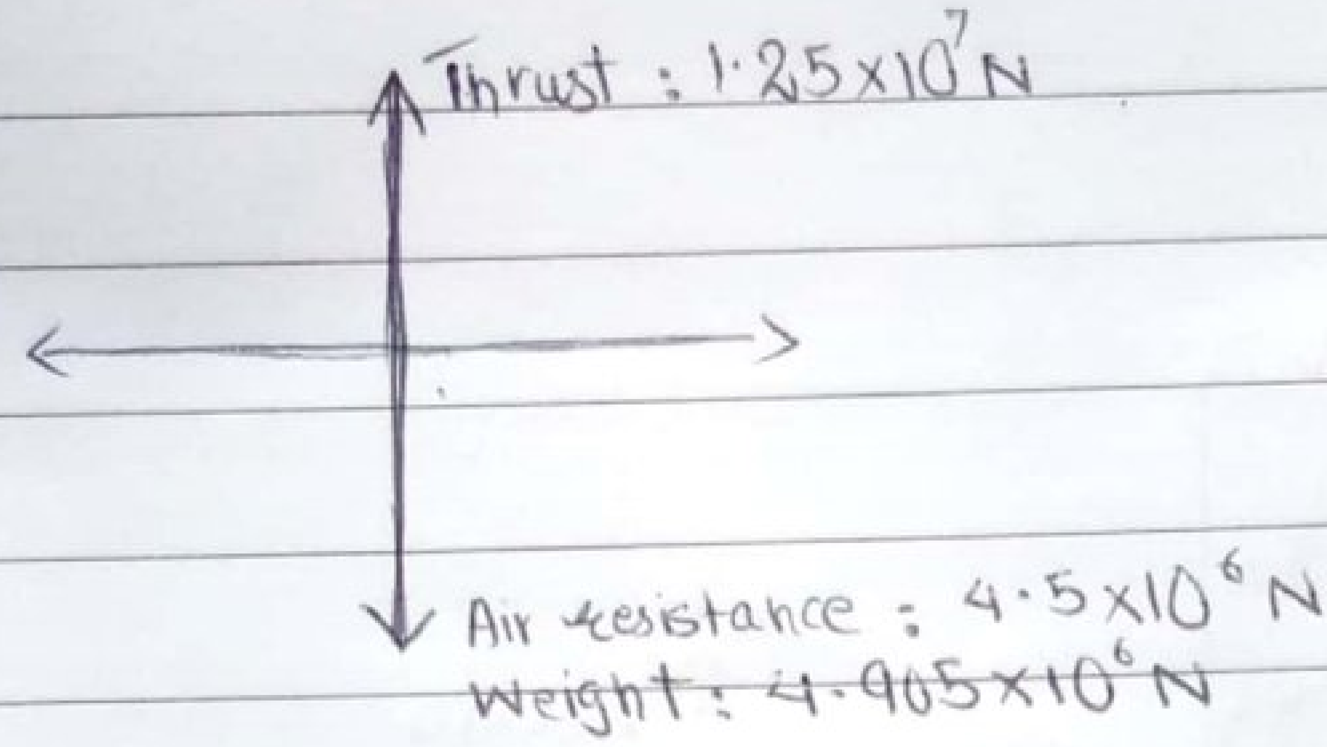
Name : AIMAS WASEEM [MID-TERM 2] Date

Ch-4

1-> (a)



$W = mg$
$W = 5 \times 10^5 \times 9.81 = 4.905 \times 10^6$ N

(b)

Forward force − Backward force = $m \times a$

$(1.25 \times 10^7) - [(4.5 \times 10^6) + (4.905 \times 10^6)] = 5 \times 10^5 \times a$

rocket's acceleration = a = $6.19 \, m/s^2$

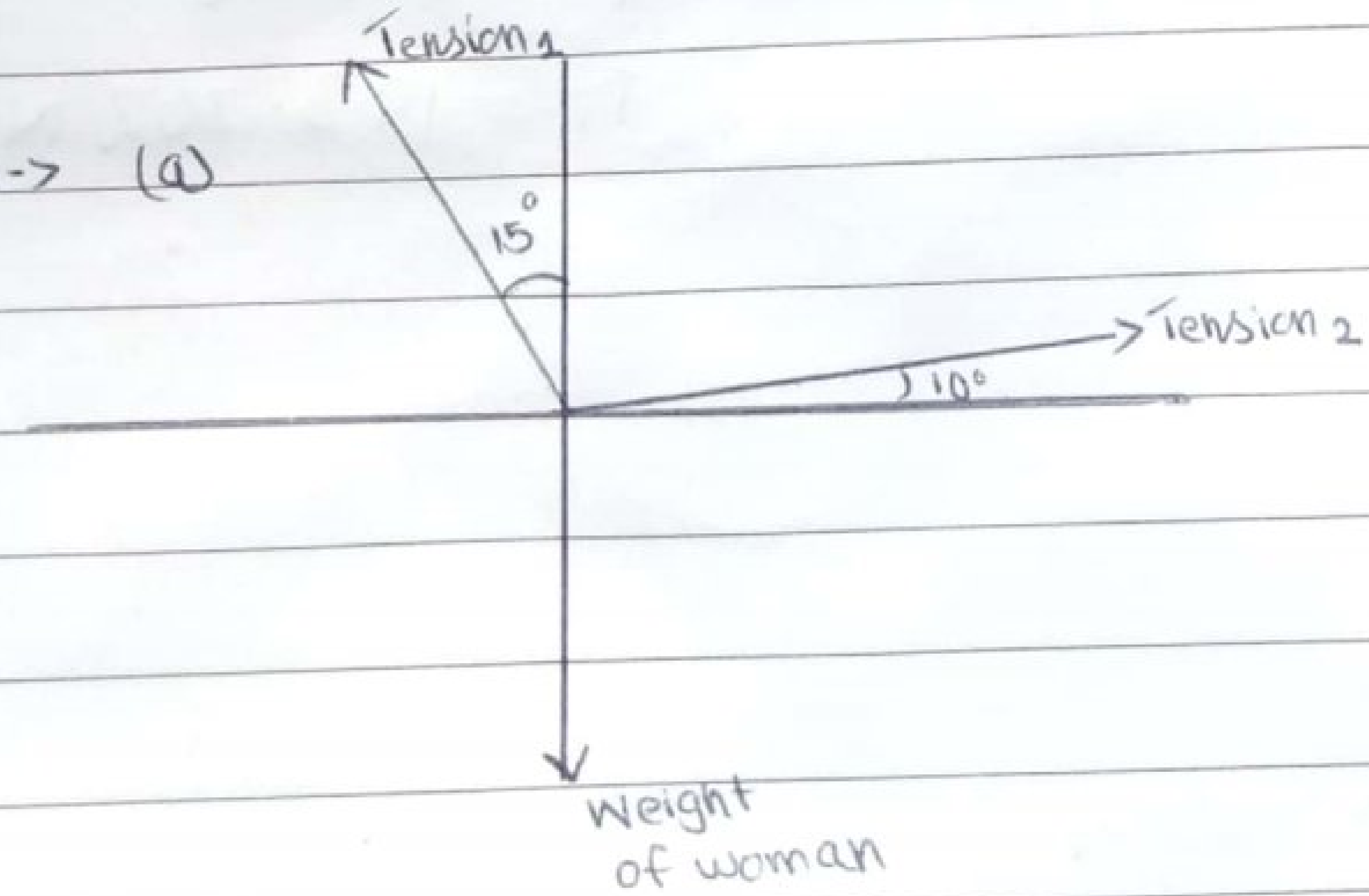
2-> 700 N

3-> $F = ma$

$F = 2000 \times (\cancel{-}200)$

$F = \cancel{-} 4 \times 10^5$ N

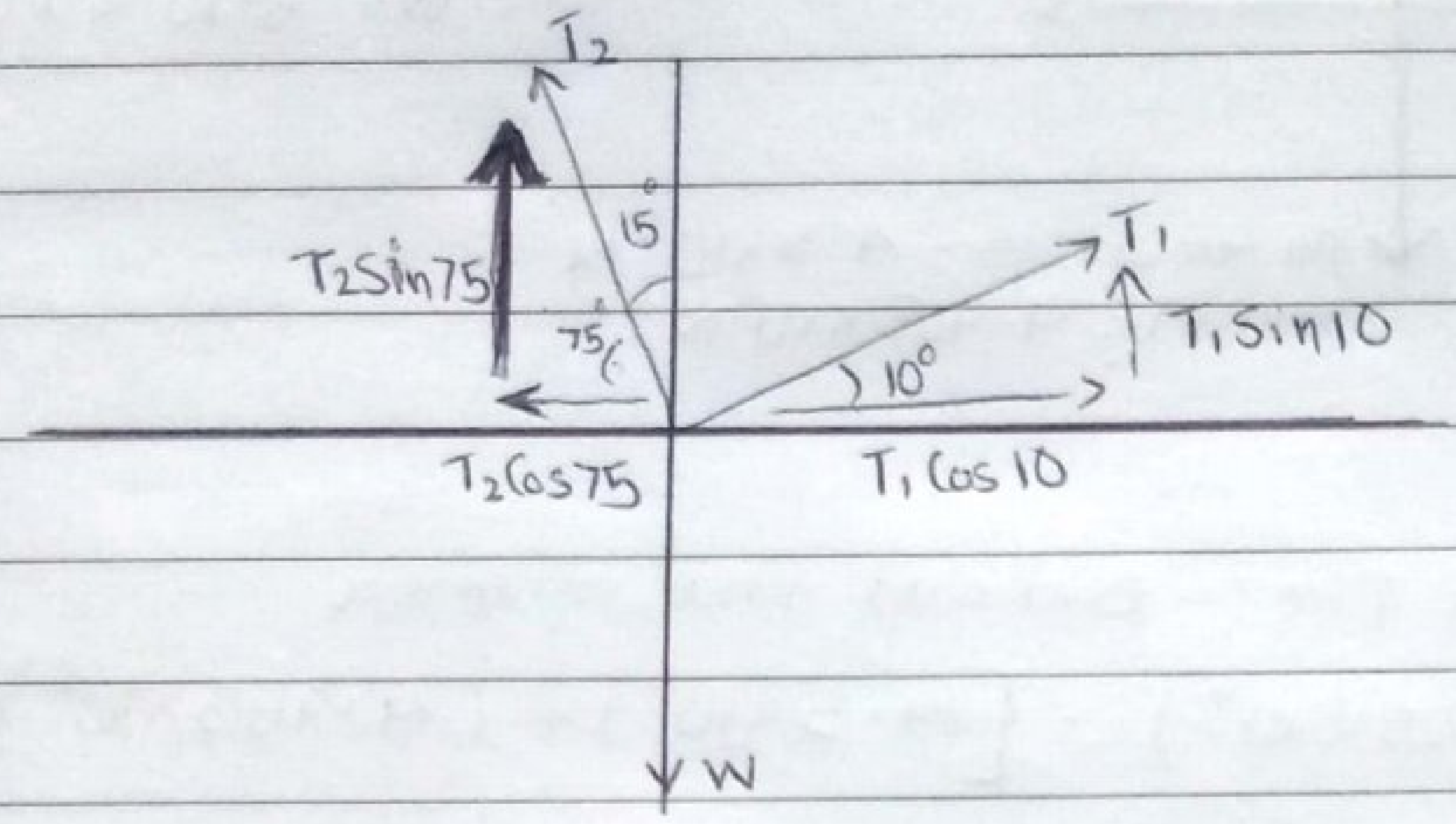
4-> (a)



(b) $F_{net,x} = ma_x$

(C) $F_{net,y} = ma_y$

(d)



⇒ As the system is motionless it is in "equilibrium."

$\cancel{T_1 \sin 10 = T_2 \sin 75}$

$\cancel{T_1 = \frac{T_2 \sin 75}{\sin 10}}$

$w = mg$

$w = 76 \times 9.81 = 745.56\,N$

eq① $T_2 \cos 75 = T_1 \cos 10$

$T_2 = \frac{T_1 \cos 10}{\cos 75}$

plug in second eq

eq②

$T_2 \sin 75 + T_1 \sin 10 = w$

$(T_1 \, 3.805) \sin 75 + T_1 \sin 10 = 745.56$

$T_1 \, 3.6759 + T_1 \, 0.1736 = 745.56$

$3.849 \; T_1 = 745.56$

$T_1 = 193.702\,N$

Now finding T_2

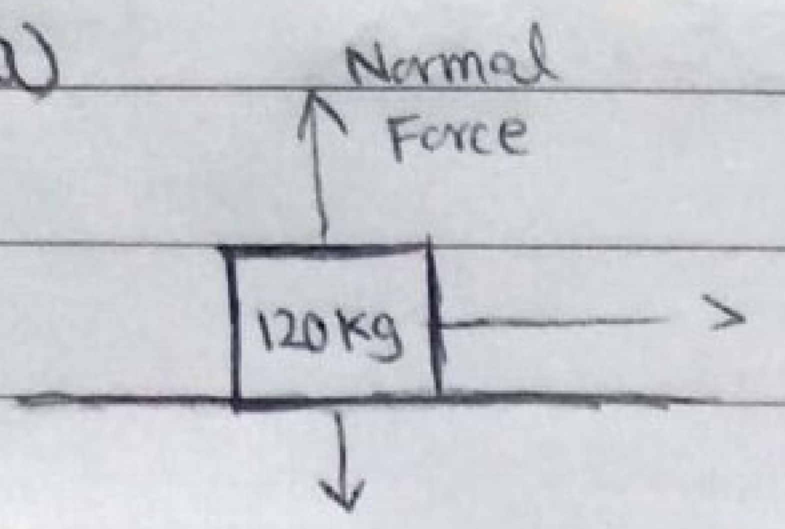
$T_2 = T_1 \frac{\cos 10}{\cos 75}$

$T_2 = 193.702 \times \frac{\cos 10}{\cos 75}$

$T_2 = 737.029\,N$

Ch-5

1-> (a)



$w = 120 \times 9.81$
$= 1177.2$

$F_N + W = 0$

$\therefore F_N - 1177.2 = 0$

$F_N = 1177.2\,N$

$F_N = W$

$F_s \leq \mu N$

$F_s = 0.5 \times 1177.2$

$F_s = 588.2\,N$

(b) $F_k = \mu_k N$

$F_k = 0.3 \times 1177.2$

$F_k = 353.16\,N$

$F_{net} = ma$

$a = \frac{F_{net}}{m} = \frac{588.2 - 353.16}{120} = 1.958\,m/s^2$

2-> • $\sin 25 = \frac{w_{\parallel}}{w}$

$\cos 25 = \frac{w_{\perp}}{w}$

• $N = W_T = w \cos 25$

$F_k = 0.1\, w \cos 25$

$F_{net} = ma$

$w\,(\sin 25 - 0.1 (\cos 25)) = ma$

$a = g \times 0.3319$

$a = 3.2567\,m/s^2$

3-> $F_D = \frac{1}{2} C \rho A r^2$

$F_D = \frac{1}{2} \times 0.75 \times 1.225 \times 0.75 \times (40)^2 = 551.25 N$

4->

$F = mg$

$= 2300 \times 9.81$

$= 22563$

$A = \pi r^2$

$A = \pi \times (4 \times 10^{-2})^2$

$A = 5 \times 10^{-3} m^2$

Young's modulus $= \frac{FL}{A \Delta x} = \frac{22540 \times 10}{5 \times 10^{-3} \times 3 \times 10^{-3}} = 1.5\,267 \times 10^{10}$ N/m^2

Ch-6

1-> $\omega = \frac{v}{r} = \frac{144 \times 1000}{3600 \times 0.5} = 80$ rad/s

$\left(\frac{120}{3600} \times 1000\right)$

2-> $\tan\theta = \frac{v^2}{rg} = \frac{(33.3)^2}{0.9 \times 1000 \times 9.81} = 0.125$

$\theta = \tan^{-1}(0.125) = 7.2^\circ$

3-> $F_c = F_N$

$\frac{mv^2}{R} = \mu_x F_N$

$\frac{\cancel{m} v^2}{R} = \mu_x \cancel{m} g$

$v^2 = \mu_x g R$

$v = \sqrt{\mu_x g R}$

$v_1 = \sqrt{1 \times 400 \times 9.81}$

$v_1 = 62.641839$ m/s

$v_2 = \sqrt{1 \times 800 \times 9.81}$

$v_2 = 88.588$ m/s

4-> [redacted]

(a) $a = \frac{Gm}{R^2} = \frac{6.67 \times 10^{-11} \times 1.4 \times 10^{22}}{(4.5 \times 10^{12})^2}$

$a = 4.6 \times 10^{-14} \ m/s^2$

(b) $a = \frac{Gm}{R^2} = \frac{6.67 \times 10^{-11} \times 8.62 \times 10^{25}}{(2.5 \times 10^{12})^2}$

$\Rightarrow 9.199 \times 10^{-10} \ m/s^2$

(c) $\cancel{\frac{1^{st}\ a}{2^{nd}\ a}} \cancel{=} \frac{2^{nd}\ a}{1^{st}\ a} = \frac{9.199 \times 10^{-10}}{4.6 \times 10^{-14}} = 1.99 \times 10^{4}$

$\Rightarrow$ acc due to gravity is 1.99×10^{4} greater