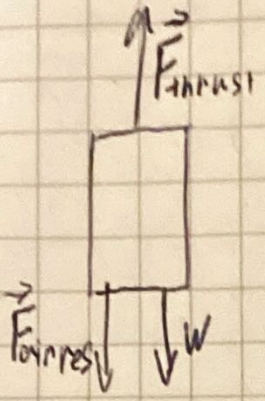
Midterm 2

Name: Golubev
Score: 22/20 ... Flawless victory

II

1) a)



b) $F_{tot} = 1.25 \cdot 10^7 - (4.5 \cdot 10^6 + (5 \cdot 10^5 \cdot 9.8))$

$F_{tot} = 3.1 \cdot 10^6$

$3.1 \cdot 10^6 = 5 \cdot 10^5 \cdot a$

$\boxed{a = 6.2\ m/s^2}$

2) a) ~~$F_1 = F_2$~~ $\vec{F}_{AB} = -\vec{F}_{BA}$

$700 = -700$

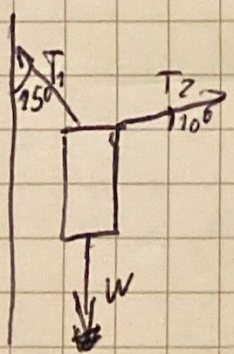
$\boxed{\vec{F}_{BA} = -700\ N}$

3) $\vec{F} = ma = 2000 \cdot (-200) = -400000\ N$

$-400000 = -1000 + X$

$\boxed{X = -399000\ N}$

4) a)



b) $\vec{F}_{tot,x} = -\vec{T}_1 \cos(75°) + \vec{T}_2 \cos(10°)$

c) $\vec{F}_{tot,y} = \vec{T}_1 \sin(75°) + \vec{T}_2 \sin(10°) - 745$

d) $T_2 \cos(10) - T_1 \cos(75) = 0$

$T_1 \sin(75°) + T_2 \sin(10) - 745 = 0$

$T_1 = \frac{T_2 \cos(10)}{\cos(75}$ $\quad \frac{T_2 \cos(10)}{\cos(75)} \cdot \sin(75) + T_2 \sin(10) - 745 = 0$

$\boxed{T_2 = 184\ N \quad T_1 = 738\ N}$

III

1) $N = -W = mg = 1.180\,N$

$f_s \leq 0.5(1180)$

$\boxed{f_s \leq 590\,N}$

b) $f_k = 0.3 \cdot 1180$

$f_k = 354\,N$

$590 - 354 = 120 \cdot a$

$\boxed{a = 1.97\,m/s^2}$

2) $W_x = W\sin(25)$ $\quad N = -W_y$

$W_y = -W\cos(25)$

$f_k = 0.1 \cdot (W\cos(25))$

$W\sin(25) - 0.1(W\cos(25)) = m a_x$

$W(\sin(25) - 0.1(\cos(25))) = m a_x$

$g(\sin(25) - 0.1\cos(25)) = a_x$

$\boxed{a_x = 3.25\,m/s^2}$

3) $F_D = \frac{1}{2} C_p A V^2$

$F_D = \frac{1}{2} \cdot 0.75 \cdot 1.225 \cdot 0.75 \cdot 40^2$

$\boxed{F_D = 551.25\,N}$

4) $\frac{F}{A} = Y(\Delta x / L)$

Excellent!

$\frac{2540}{0.005} = Y\left(\frac{0.003}{70}\right)$

$\boxed{Y = 15026666666.\bar{6}}$

IV

1) $V = r\omega$

~~$44 = 0.5$~~ $40 = 0.5 \cdot \omega$

$\omega = 80$ r/s

2) $\tan\theta = \frac{v^2}{rg}$

$\tan\theta = \frac{33.3^2}{800 \cdot 9.8} = 0.126$

$\theta = 7.18^\circ$

3) a) path 2 b) $V_{T1} = 400$ w

$V_{T2} = 800$ w

4) a) $a_c = \frac{Gm}{r^2}$

$a_c = \frac{6.673 \cdot 10^{-11} \cdot 1.4 \cdot 10^{22}}{(4.5 \cdot 10^{12})^2} = \boxed{4.61 \cdot 10^{-14}\ m/s^2}$

b) $a_c = \frac{6.673 \cdot 10^{-11} \cdot 8.62 \cdot 10^{25}}{(2.5 \cdot 10^{12})^2} = \boxed{9.2 \cdot 10^{-10}\ m/s^2}$

~~$9.2 \cdot 10^{-10}$~~ ~~$4.61 \cdot$~~

$\frac{9.2 \cdot 10^{-10}}{4.61 \cdot 10^{-14}} = 20000$

(+2) Bonus!