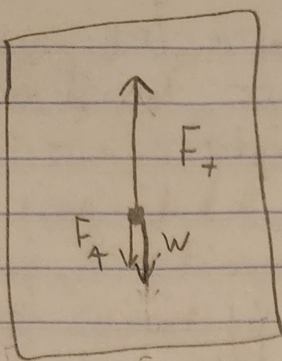
Score: 18/20, nice job!
Name: Dylan Leach

2

1) a)



F_T = Force of Thrusters
F_A = Force of Air resistance
W = Weigh; Force of Gravity

b) $\Sigma F = ma$

$F_T - (F_A + W) = m\,a$

$\boxed{6\ m/s^2}$

$W = mg$

$F_T - (F_A + mg) = m\,a$

$1.25 \times 10^7 - (9.5 \times 10^6 + 5 \times 10^5 (10)) = ma$

$3{,}000{,}000 = ma$

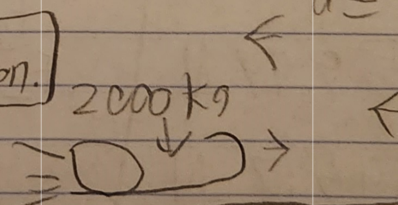
$\frac{3 \times 10^6}{5 \times 10^5} = \frac{5 \times 10^5 (a)}{5 \times 10^5}$

$a = 6\ m/s^2$

2) a) $\boxed{-700\ N}$

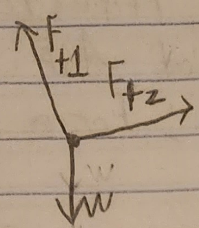
3) $\boxed{\text{a) The force of friction.}}$

$a = -200\ m/s^2$



I don't see the conclusion of exercise 3 ... (-1)

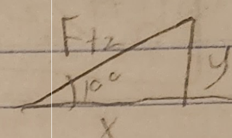
4) A)



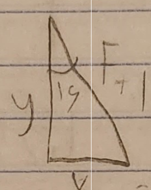
F_{t1} = Force Tension 1
F_{t2} = Force Tension 2
w = weight / Force Gravity

b) $\boxed{F_{net_x} = F_{t_2}\cos(10) - F_{t1}\sin(15)}$

$F_{t1} + F_{t2}$ ~~$W = mg$~~ not on x



$F_{t_2} - F_{t1}$



$\cos(10) = \frac{x}{F_{t2}}$

$F_{t_2}\cos(10) = x$

$\sin(15) = \frac{x}{F_{t1}}$

$F_{t1}\sin(15)$

C) $\boxed{F_{net_y} = F_{t_2}\sin(10) + F_{t1}\cos(15) - W}$

$\Sigma F = 0$

D) $\boxed{\begin{array}{l} F_{t1} = 739.97\ N \\ F_{t2} = 193.7\ N \end{array}}$

$F_1 \sin 15 = F_2 \cos(10)$

$F_1 \frac{\sin 15}{\cos 10} = F_2$

$F_{t1}\cos(15) + F_2(\sin(10)) = W$

$F1\cos(15) + F1(\frac{\sin 15}{\cos 10})(\sin(10)) = W$

$F1(\cos 15 + \frac{\sin 15}{\cos 10}(\sin 10)) = mg$

$F1(1.0127) = 76(9.8)$

$F1 = 735.97\ N$

Proof

$F_1\cos(15) + F_2\sin(10) = W$ $\quad F_1 = F_2\frac{\cos 10}{\sin 15}$

$739.97\cos(15) + 193.7\sin(10) = 749.56$ $\quad F2(\frac{\cos 10}{\sin 15}(\cos 15) + (\sin 10)) = W$

$716.89 + 33.64 \approx 749.56$ $\quad F2(3.849) = 745.96$

$F2 = 193.7$

Well done!

3

1) a) 588 N

b) The magnitude of acceleration will increase to about 1.97 m/s²

$F = ma$

$F_f = ma$

$589 - 588 = ma$

$589 = 120a$

$1 = \frac{120a}{120}$

$a = 0.008$ m/s

$588 - 352.8 = ma$

$a = 1.97$

2) $\boxed{a \approx 4.66 \ m/s^2}$

(-1) Math error?

$g\sin(25) - \mu g\cos(25) = a$

$\frac{mg\sin(25) - \mu mg\cos(25)}{m} = \frac{ma}{m}$

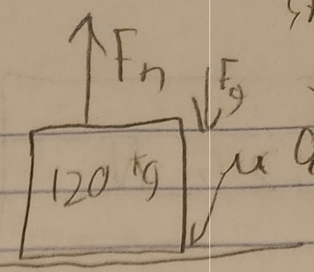
$f(x) = mg\sin(25)$

$w\sin 25 = \frac{f(x)}{w} \cdot w$

$f_f = \mu f_n$

$W_\perp = F_n$

$f_n = mg\cos 25$



static → μ 0.5 and 0.3 ← kinetic

$F_n = F_g$

$F_f = \mu F_n$

$F_f = 0.5 F_g$

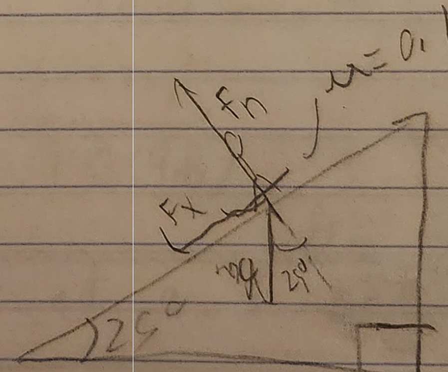
$F_f = 0.5mg$

$F_f = 0.5(120)(9.8)$

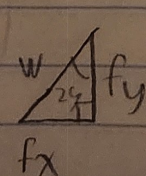
$F_f = 588$

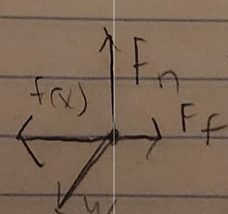
$F_f = 0.3mg$

$352.8 = 0.3(120)(9.8)$



$\Sigma F = ma$





$f(x) - f_f = ma$

$W_\perp - F_n = 0$

$w\cos(25) = \frac{f_y}{w} \cdot w$

3) $\boxed{F_D \approx 551.25 \text{ N}}$

$$F_D = \frac{1}{2} C_D A \rho v^2$$

$$F_D = \frac{1}{2}(0.79)(1.225)(0.79)(40)^2$$

$$F_D = 551.25$$

4) $\boxed{19{,}130 \text{ N/m}^2}$

$$\frac{F}{A} = Y\left(\frac{\Delta x}{L}\right)$$

$$\frac{2300\,(9.8)}{2\pi(.04)^2} = Y\left(\frac{0.003}{10}\right)$$

$$\frac{5.739}{0.0003} = Y\frac{(0.0003)}{0.0003}$$

$$19{,}130 = Y$$

(-1) The Young's modulus, according to the book, is usually in the range of 10^9 N/m^2 ...

4

1) $\boxed{288 \text{ rad}/s}$

(-1) 80 rad/sec

$V = r\omega$

$\frac{144}{0.5} = \frac{0.5\,\omega}{0.5}$

$\omega = 288$

2) $\boxed{\theta = 7.18 \text{ degrees}}$

well done!

120 km

120,000 meters ph

0.9 km

0900 m

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

$\frac{120{,}000 \text{ meters}}{\cancel{1hr}} \cdot \frac{\cancel{1hr}}{3600 \text{ seconds}} = 33.33 \, m/s$

$\tan\theta = \frac{(33.33)^2}{900(9.8)}$

$\tan\theta = 0.126$

$\theta = \tan^{-1}(0.126$

3) a) $\boxed{\text{Path 2 can be taken at a higher speed.}}$

B) $\boxed{\begin{array}{l}\text{Path 1: } V_{tan} = 62.6 \, m/s \\ \text{Path 2: } V_{tan} = 88.54 \, m/s\end{array}}$

yes!

$F_c = ma_c$

$a_c = \frac{v^2}{r}$

$F_c = F_f$

Path 1: $\sqrt{1(9.8)(400)} = 62.6 \, m/s$

$F_c = m\frac{v^2}{r}$

Path 2: $\sqrt{1(9.8)(800)} = 88.54 \, m/s$

$\mu g = \frac{v^2}{r} \cdot r$

$F_f = \mu F_n$

$\mu \cancel{m} g = \cancel{m}\frac{v^2}{r}$

$F_n = mg$

$\sqrt{\mu g r} = \sqrt{v^2}$

$\mu g r = v$

4) a) The acceleration due to gravity at Neptune due to Pluto is approximately $4.6\,1433086 \times 10^{-14}\ m/s^2$.

Force of Attract. on pluto due to on neptune

$$F_G = G\frac{m_1 m_2}{r^2}$$

$$G = 6.6743 \times 10^{-11}$$

$$F = m_2 a$$

$$\cancel{m_2} a = \frac{G m_1 \cancel{m_2}}{r^2}$$

$$a = \frac{G m_1}{r^2}$$

$$a = \frac{6.6743 \times 10^{-11}\ (1.4 \times 10^{22})}{(4.5 \times 10^{12})^2}$$

$$a = 4.6 \times 10^{-14}$$

b) The acceleration due to gravity at Neptune due to Uranus is approximately $9.20519456 \times 10^{-10}$. This means Uranus has much more of an effect on Neptune than Pluto does.

Uranus

$$a = \frac{G(m_1)}{r^2}$$

$$a = \frac{(6.6743 \times 10^{-11})(8.62 \times 10^{25}\ kg)}{(2.5 \times 10^{12})^2}$$

$$a \approx 9.20519456 \times 10^{-10}$$

(+2) Bonus!