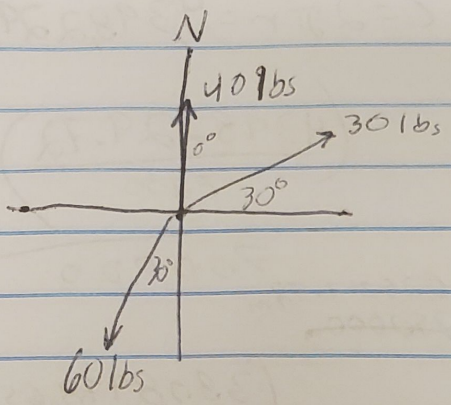
PHYS 407

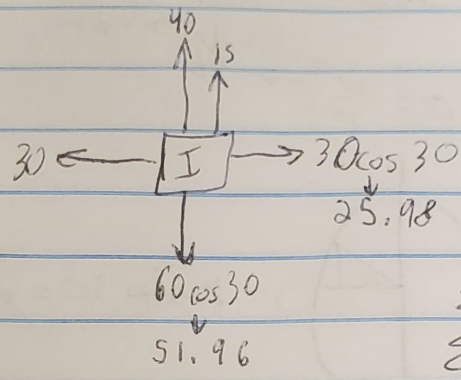
Exam #2

1.

B

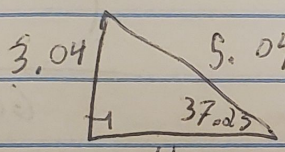
2.





$\Sigma F_y = 40 + 15 - 51.96$

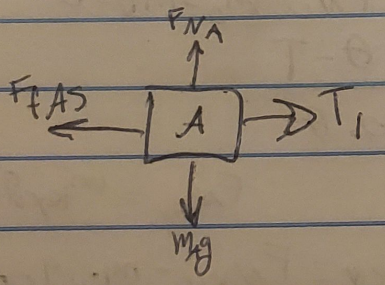
$\Sigma F_x = 30 - 25.98$



Isaac is being pulled by 20.16N 37.23° north of west

3.

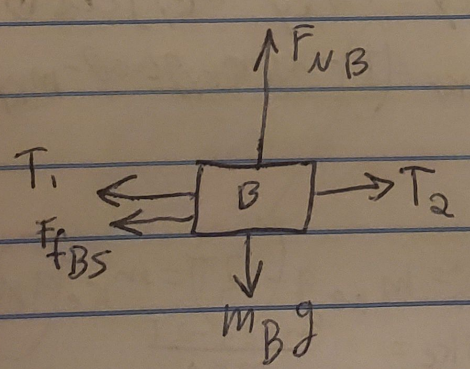
$m_A = 100kg \quad m_B = 80kg \quad T_{1,max} = 400N \quad \mu_K = 0.3$



$\Sigma F_{yA} = F_{NA} - m_A g = 0 \quad F_{NA} = m_A g$

$\Sigma F_{xA} = T_1 - \mu_K F_{NA} = m_A a$

$\frac{T_1 - \mu m_A g}{m_A} = a \quad \frac{(400) - (0.3)(100)(9.8)}{100} = 1.06 m/s^2$



$\Sigma F_{yB} = F_{NB} - m_B g = 0 \quad F_{NB} = m_B g$

$\Sigma F_{xB} = T_2 - T_1 - \mu_K F_{NB} = m_B a$

$T_2 = m_B a + T_1 + \mu_K m_B g$

$714.8N = (80)(1.06) + 400 + (0.3)(80)(9.8)$

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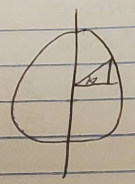
4. $m_K = 9E^{21}$ kg $r = 700{,}000$ m $m_A = 0.1$ kg

$$\frac{G((9E^{21})(0.1))}{(700{,}000)^2} = \boxed{0.12\ m/s^2}$$

$T = 7200$ seconds $C = 2\pi r = 4{,}398{,}229.72$ m

$a = \frac{v^2}{r} \rightarrow \frac{d/t \rightarrow 2\pi r}{}$

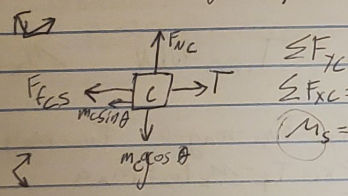
$$\frac{\left(\frac{4398229.72}{7200}\right)^2}{700000} = \boxed{0.53\ m/s^2}$$



$r \cos 30 = 606217.78$ m

$$\frac{\left(\frac{3808978.65}{7200}\right)^2}{606217.78} = \boxed{0.46\ m/s^2}$$

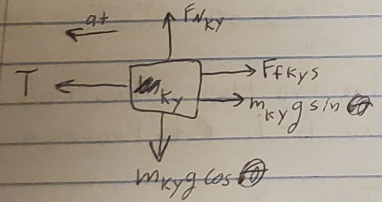
5. $m_C = 46$ kg $m_{Ky} = 30$ kg $m_{Ke} = 150$ kg $\mu_k = 0.3$



$\Sigma F_{YC} = F_{NC} - m_C g\cos\theta = 0$ $F_{NC} = m_C g\cos\theta$

$\Sigma F_{XC} = T - \mu_S F_{NC} - m_C \sin\theta = 0$

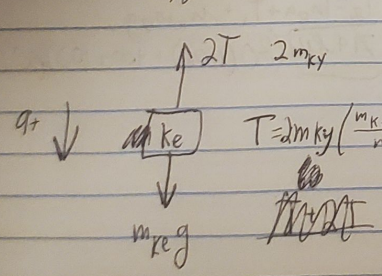
$\mu_S = \frac{m_C g \sin\theta - T}{m_C g \cos\theta}$



$F_{NKy} = m_{Ky} g\cos\theta$

$\Sigma F_{yKy} = F_{NKy} - m_{Ky} g\cos\theta = 0$

$\Sigma F_{xKy} = T - \mu_k m_{Ky} g\cos\theta - m_{Ky} g\sin\theta = m_{Ky} a_{Ky}$



$\Sigma F_{yKe} = m_{Ke} g - 2T = m_{Ke} a_{Ke}$

$a_{Ke} = \frac{m_{Ke} g - 2T}{m_{Ke}}$

$a_{Ky} = 2 a_{Ke}$

$T = 2m_{Ky}\left(\frac{m_{Ke} g - 2T}{m_{Ke}}\right) + \mu_k m_{Ky} g\cos\theta + m_{Ky} g\sin\theta$

$T m_{Ke} + 2T = \sim\sim$

$T(m_{Ke} + 2) = \sim\sim$

$\frac{T(m_{Ke}+2)}{(m_{Ke}+2)}$

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$T = 60\left(\frac{1470 - 2T}{150}\right) + 259.11$ $T - 259.11 = \frac{60(1470 - 2T)}{150}$

$5(T - 259.11) = 2(1470 - 2T)$

$5T - 1295.55 = 2940 - 4T$

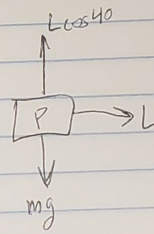
$+4T \quad +1295.55 \quad +1295.55 \quad +4T$

$\frac{9T}{9} = \frac{4235.55}{9}$ $T = 470.62$ N

$\mu_S = \frac{m_C g \sin 30 - T}{m_C g \cos 30} = -0.63$ $\boxed{\mu_S = 0.63}$

6.

$600{,}000/60/60 \rightarrow 166.67$ m/s



$\Sigma F_y = L\cos\theta - mg = 0$

$\Sigma F_x = L\sin\theta = ma$ $a = \frac{v^2}{r}$

$L\cos\theta = mg \rightarrow L = \frac{mg}{\cos\theta}$

$L\sin\theta = m\left(\frac{v^2}{r}\right)$

$\frac{r}{L\sin\theta}\left(\frac{L\sin\theta}{m}\right) = \frac{v^2}{r}\cdot r$

$\frac{v^2}{1} \times \frac{L\sin\theta}{m} \rightarrow \frac{v^2}{r} \times \frac{m}{L\sin\theta}$

$r = \frac{mv^2}{L\sin\theta}$

$\frac{mv^2}{\frac{mg}{\cos\theta} \cdot \frac{\sin\theta}{1}}$ $\frac{mv^2}{mg\tan\theta}$

$r = \frac{v^2}{g\tan\theta}$ $\frac{27777.78}{9.8\tan 40} = 3379.29$

$\boxed{r = 3379.29\ Km}$