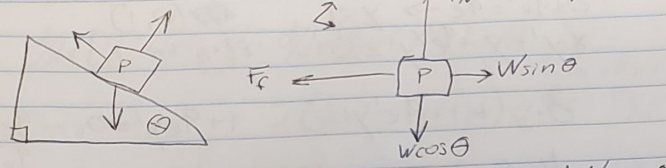
HW#7

1.

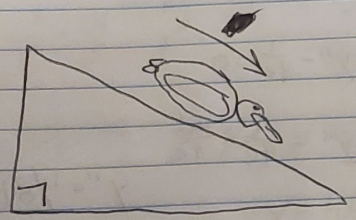


$F_N = W\cos\theta$ $\quad F_f = \mu \cdot F_N = W\sin\theta$

$F_f = \mu W\cos\theta = W\sin\theta$ $\quad F_f = \mu = \frac{\sin\theta}{\cos\theta} = \tan\theta$

$F_f \div \mu = \tan\theta \tan^{-1}$ $\quad \boxed{\theta = \cot\mu}$

2.

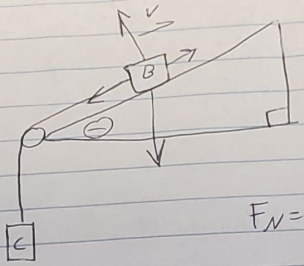


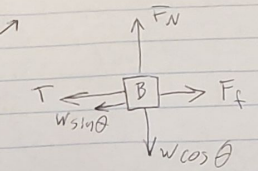
3.

$\mu = \tan\theta$ $\quad \tan 30 = 0.58$ $\quad \tan 45 = 1$

Yes, these seem reasonable the more inclinedd surface would need a higher coefficient of friction to not move

4.





$\Sigma F_x = 0$

$F_N = W\cos\theta$ $\quad F_f = \mu F_N = \frac{T + W\sin\theta}{a}$?

$T = 4.9N$ $\quad \theta = 20°$ $\quad a = \frac{T + W\sin\theta}{\mu W\cos\theta}$

$W = 9.8N$ $\quad \mu = 0.6$

$a = \frac{4.9 + 9.8\sin 20}{0.6(9.8\cos 20)} = \frac{8.25}{5.53} = 1.49\ m/s^2$

$t = V_f - V_i / a$ $\quad V_f = 0$ $\quad V_i = 3$ $\quad a = -1.49$

$\boxed{t = 2.01 \text{ seconds}}$

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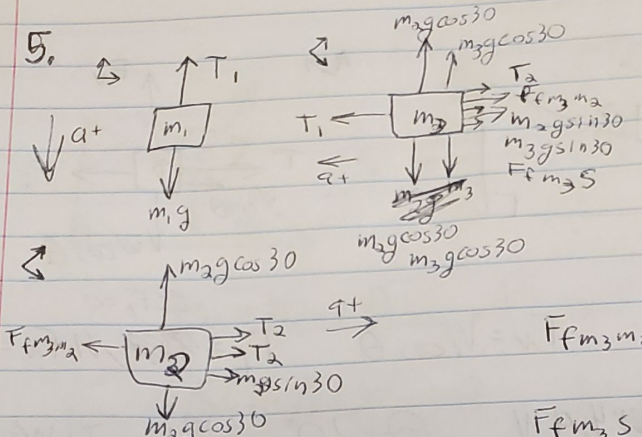
5.



$m_1 = 10\,kg$ $\quad \mu = 0.3$

$m_2 = 2\,kg$

$m_3 = 3\,kg$

$F_{fm_3m_2} = (m_2 g\cos 30)\cdot 0.3$

$F_{fm_3 S} = (m_2 g\cos 30 + m_3 g\cos 30)\cdot 0.3$

$\Sigma F_{y_1} = m_1 g - T_1 = m_1 a_1$

$98 - T_1 = 10a_1 \rightarrow a_1 = 9.8 - T_1/10 \rightarrow a_1 - 9.8 = -T_1/10$

$-10(a_1 - 9.8) = T_1$

$98 - 10a_1 = T_1$

$\Sigma F_{y_2} = m_2 g\cos 30 - m_2 g\cos 30 = 0$

$16.97 - 16.97 = 0$

$\Sigma F_{x_2} = T_2 + T_2 + m_2 g\sin 30 - (m_2 g\cos 30)\cdot 0.3 = m_2 a_2$

$2T_2 + 9.8 - 5.09 = 2a_2 \rightarrow a_2 = T_2 + 2.36 \rightarrow a_2 - 2.36 = T_2$

$\Sigma F_{y_3} = m_2 g\cos 30 + m_3 g\cos 30 - m_2 g\cos 30 - m_3 g\cos 30 = 0$

$16.97 + 25.46 - 16.97 + 25.46 = 0$

$\Sigma F_{x_3} = T_1 - T_2 - 0.3(m_2 g\cos 30) - 0.3(m_2 g\cos 30 + m_3 g\cos 30) -$

$m_2 g\sin 30 - m_3 g\sin 30 = m_3 a_3$

$T_1 - T_2 - 5.09 - 12.73 - 9.8 - 14.7 = 3a_3 \rightarrow$

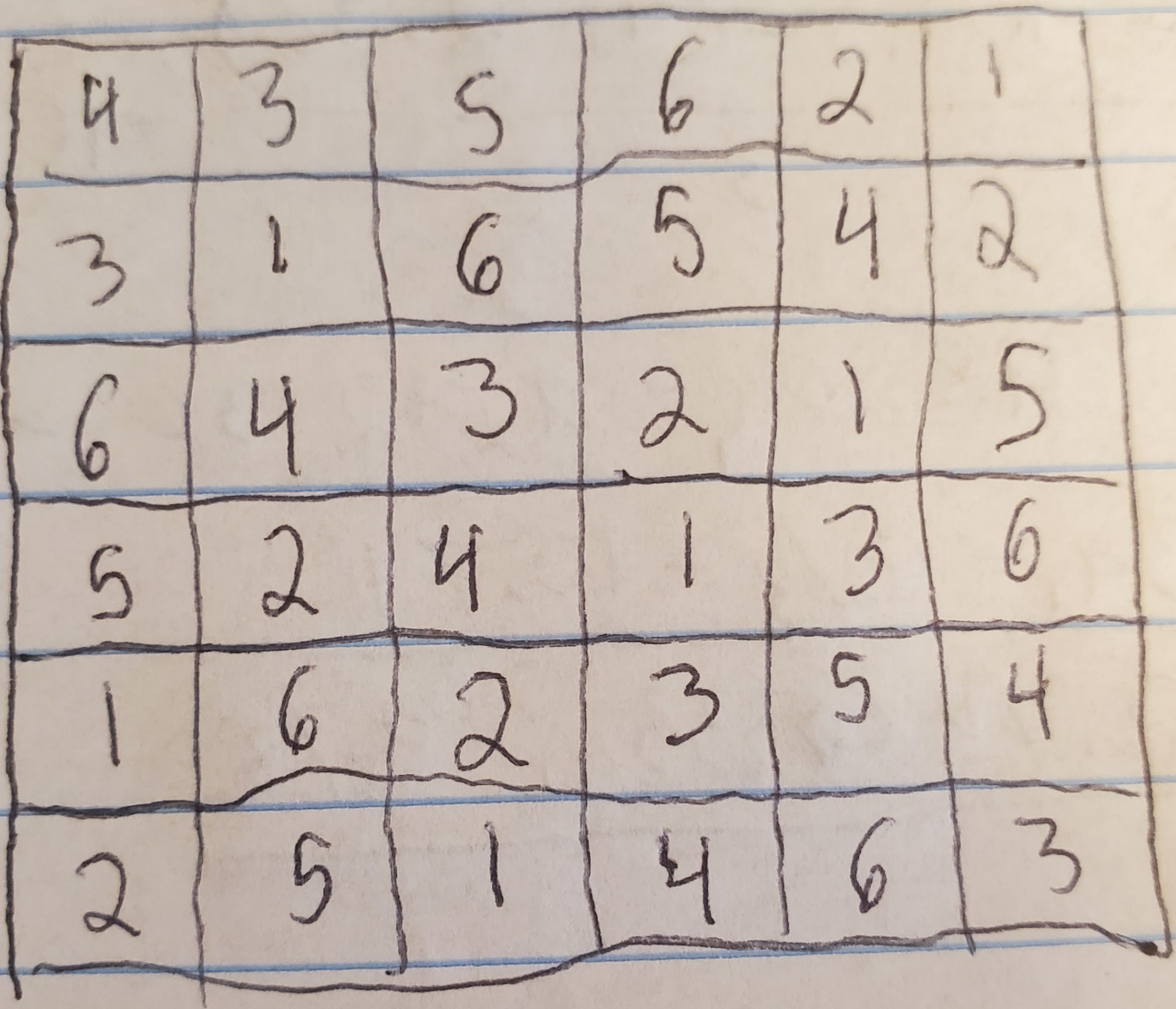
$a_3 = \frac{T_1 - T_2}{3} - 10.71$

$a_3 = \frac{(98 - 10a_1) - (a_2 - 2.36)}{3} - 10.71$

$98 - 10a_1 - a_2 + 2.36 \rightarrow \frac{100.36 - 10a_1 - a_2}{3}$

$33.45 - 3.33a_1 - a_2/3 - 10.71$

a. $\boxed{a_3 = 22.74 - 3.33a_1 - a_2/3}$


4 3 5 6 2 1
3 1 6 5 4 2
6 4 3 2 1 5
5 2 4 1 3 6
1 6 2 3 5 4
2 5 1 4 6 3