Problems
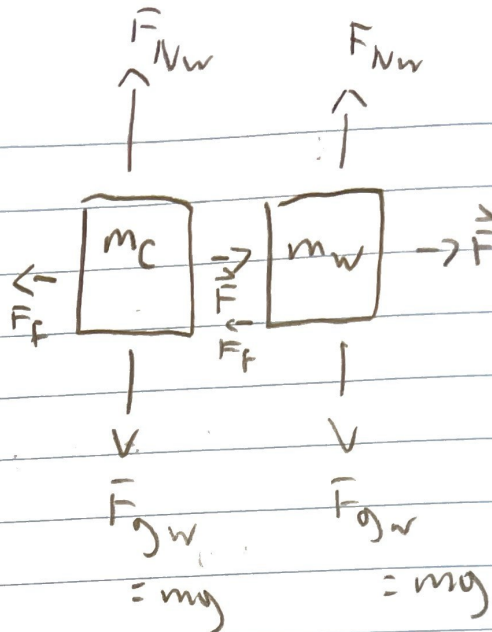
20)

$$m_c + m_w = 4.0 \, kg$$

$$F_f = F_{fc} + F_{fw}$$

$$F_f = 2.0 + 4.0$$

$$F_f = 6.0 N$$

N2

$$\Sigma F_x = F - F_f = ma$$

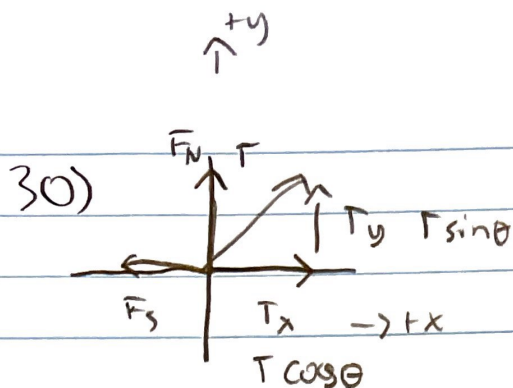$$a = \frac{F - F_f}{m} = \frac{12N - 6N}{4N} = 1.5 \, m/s^2$$

$$F'_{cow} = m_w a + F_f$$

$\underset{\smile}{}$ cheerios on wheaties

$$F_{cow} = 3.0 \, (1.5) + 4.0$$

$$\Rightarrow \boxed{8.5 N}$$

30)

$$\cos\theta = \frac{T_x}{T}$$

a)

N2 $\sum F_y = ma_y$

$\cancel{m a \cos \theta}$

$$F_N + T\sin\theta - mg = 0$$
$$F_N = mg - T\sin\theta$$

$$\sum F_x = ma_x$$

$\cancel{m a \cos \theta}$

$$\mu_s F_N - T\cos\theta$$

$$T\cos\theta - \mu_s(mg - T\sin\theta) = 0$$

$$T\cos\theta - \mu_s mg + \mu_s T\sin\theta$$

$$T\cos\theta + T\mu_s\sin\theta = mg\mu_s$$

$$T = \frac{\mu_s mg}{\cos\theta + \mu_s\sin\theta}$$

$$\frac{0.42(180N)}{\cos(42) + 0.42\sin(42)} = \boxed{74N}$$

b) $T = \dfrac{75.6}{\cos\theta + 0.42\sin\theta} =$

c) $\dfrac{dT}{d\theta} = \dfrac{(\cos\theta + 0.42\sin\theta)(0) - 75.6(-\sin\theta + 0.42\cos\theta)}{(\cos\theta + 0.42\sin\theta)^2}$

$$= 0$$

$-75.6(-\sin\theta + 0.42\cos\theta = 0$

$$0.42\cos\theta = \sin\theta$$

$$\dfrac{\sin c}{\cos\theta} = 0.42$$

$$\tan\theta = 0.42 \quad \tan^{-1}$$

$$= \boxed{23^\circ}$$

d)

$$F = \dfrac{75.6}{\cos(23^\circ) + 0.42\sin(23^\circ}$$

$$= \boxed{69.58\,N}$$