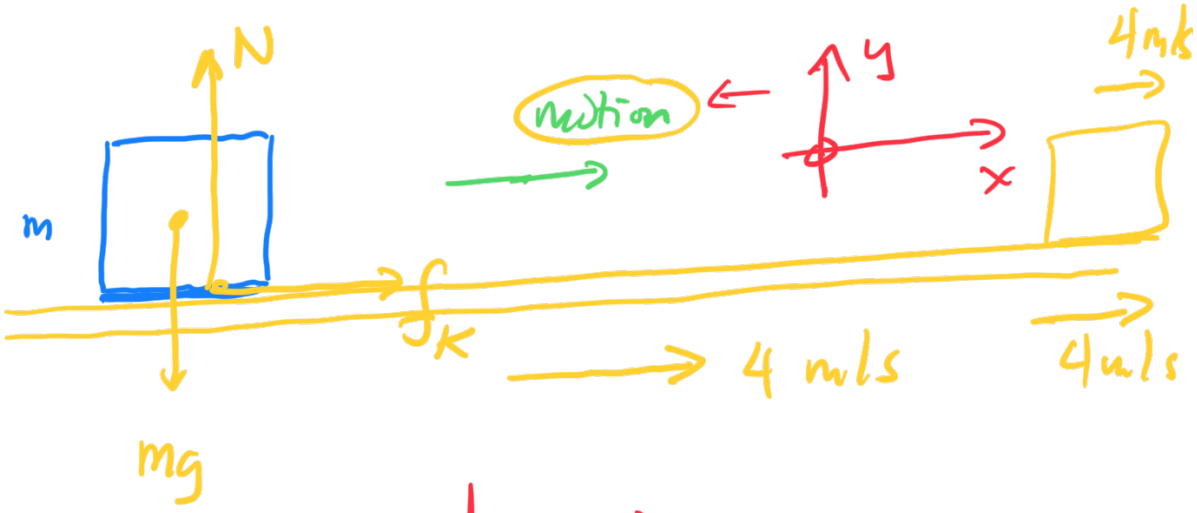
Physics 201 - Lecture 19

Hwk 5

6.



X	Y
$\Sigma F_x = ma_x$	$\Sigma F_y = ma_y = 0$
$f_K = ma_x$	$N - mg = 0$
	$N = mg$

$\mu_k mg = ma_x$ \ $f_k = \mu_k N$

$= \mu_k mg$

$a_x = \mu_k g$

① $\boxed{a_x = 3.43 \text{ m/s}^2}$ ←

② $v_{ix} = 0$

③ $v_{fx} = 4.0 \text{ m/s}$ ← stops skipping.

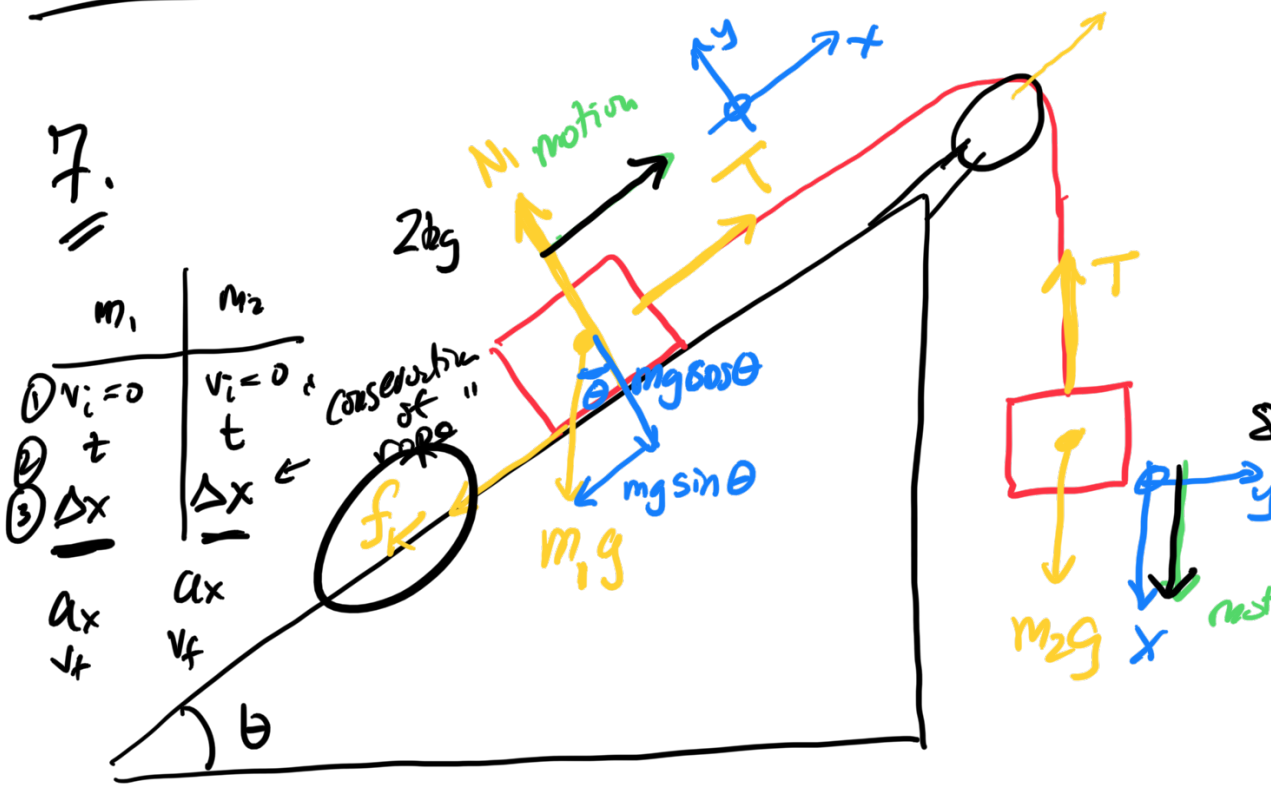
$t = ?$

$$v_{fx} = \cancel{v_{ix}}^{0} + a_x t$$

$$4 = 3.43\, t$$

$$t = \frac{4}{3.43} = \underline{\underline{1.17 \text{ s}}}$$

7.



← mass 1

X	Y
$\Sigma F_x = m_1 a_x$	$\Sigma F_y = m_1 a_y = 0$
$T - f_K$	$N_1 - mg\cos\theta = 0$
$-m_1 g \sin\theta$	$N_1 = m_1 g \cos\theta$
$= m_1 a_x$	$f_K = \mu_K N_1 = \mu_K m_1 g$

$$T - \mu_K m_1 g \cos\theta - m_1 g \sin\theta$$

$= m_1 a_x$

mass 1

Mass 2, X

$\Sigma F_x = m_2 a_x$

(2) $m_2 g - T = m_2 a_x$

mass 2

Trick: (1) + (2)

$m_2 g - \mu_K m_1 g \cos\theta = m_1 a_x + m_2 a_x$

$- m_1 g \sin\theta = (m_1 + m_2) a_x$

$$a_x = g \left(\frac{m_2 - \mu_K m_1 \cos\theta - m_1 \sin}{m_1 + m_2} \right)$$

always

$$a_x = 5.97\ m/s^2$$

consistent with our assumption.

---

① $K = \frac{1}{2}mv^2$

② $W_F = \vec{F} \cdot \Delta\vec{x}$

$= |\vec{F}||\Delta\vec{x}| \cos\theta$

③ $W_g = \pm mgh$

④ $U_g = mgy$

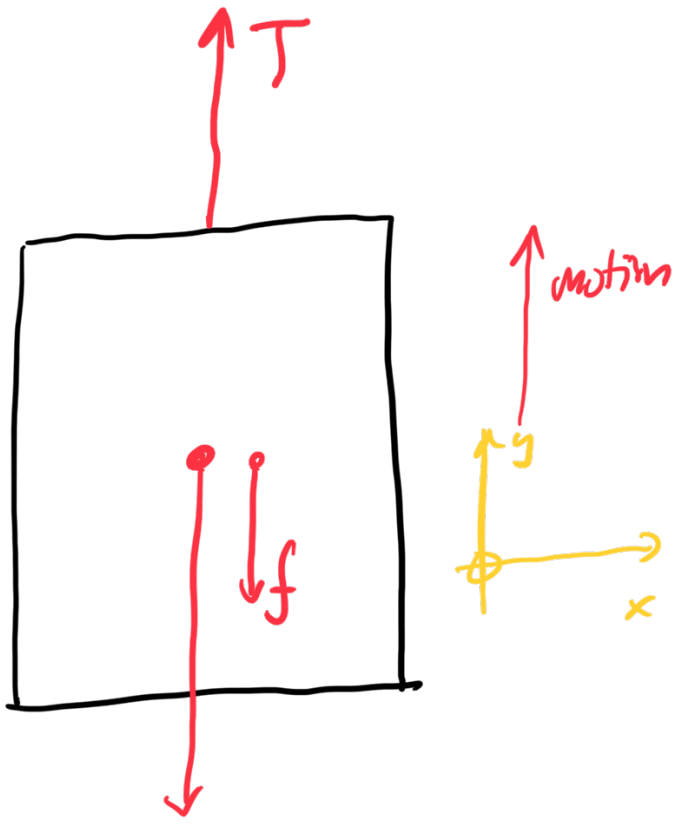
$W_g = -\Delta U_g$

⑤ $W_{\text{all forces}} = \Delta K$

⑥ $W_{\text{not gravity}} = \Delta K + \Delta U$

---

8 a)



$$\Sigma F_y = m a_y$$

$$T - f - mg = m a_y$$

y : ↑ ↑ ↑ $= 0$

"constant speed" $\rightarrow a_y = 0$

$$T = f + mg$$

$$= 140 + (1450)(9.8)$$

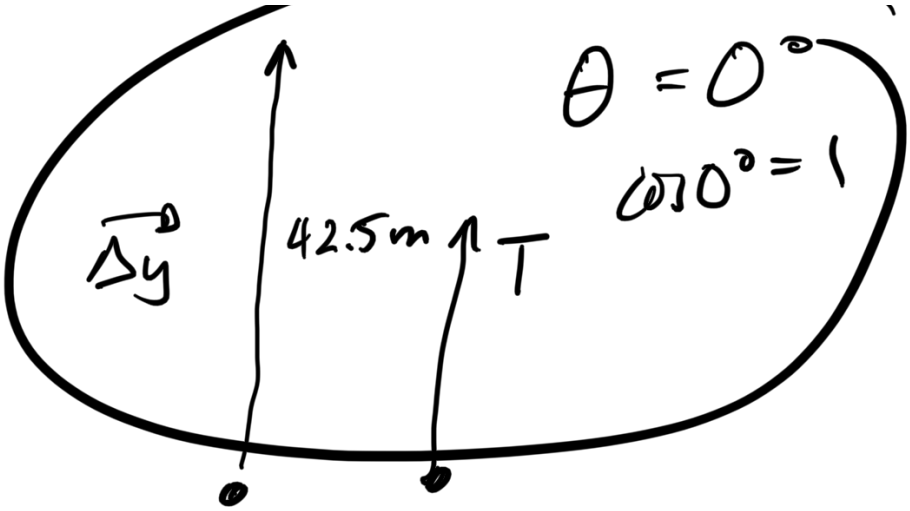
$$T = 14{,}350 \text{ N}$$

$$f = 140 \text{ N}$$

$$mg = 14{,}210 \text{ N}$$

$$W_{cable} = \vec{T} \cdot \Delta\vec{y}$$

$$= |\vec{T}||\Delta\vec{y}| \cos\theta$$



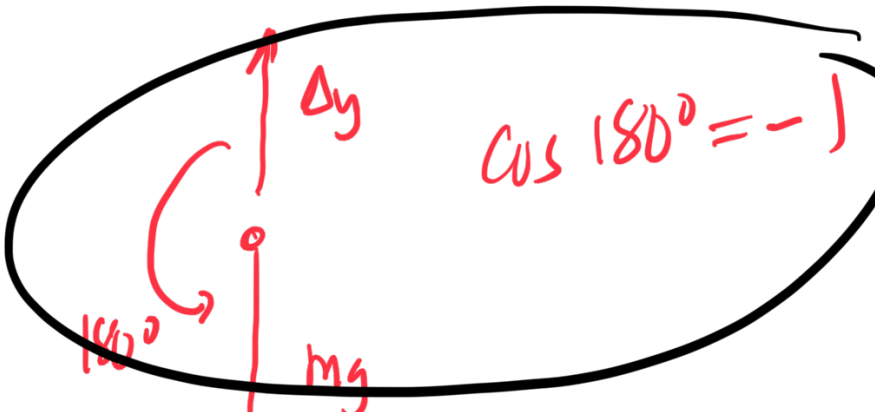
a) $W_{cable} = |\vec{T}||\vec{\Delta y}|$

$= (14350)(42.5)$

$= \boxed{609,875 \text{ J}}$

$= 6.10 \times 10^5 \text{ J}$

b) $W_{mg}^{added} = |\vec{F_g}||\vec{\Delta y}| \cos\theta$



$$W_{mg} = -|\vec{F_g}||\vec{\Delta y}|$$

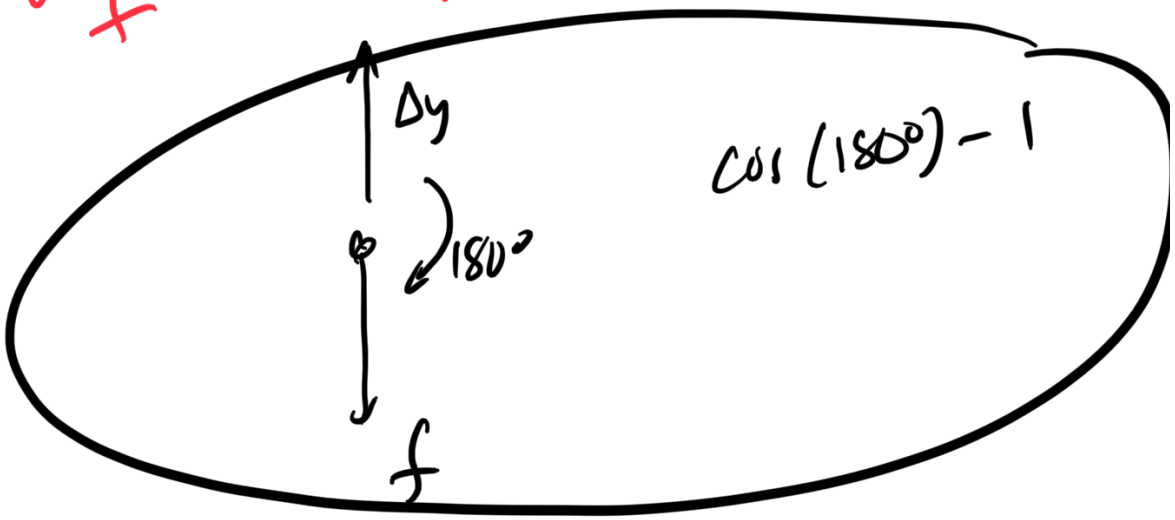
$$= -(14{,}210)(42.5)$$

$$= -6.04 \times 10^5 \text{ J}$$

$$\rightarrow 603{,}925$$

taken away

$$W_f = |\vec{f}||\vec{\Delta y}|\cos\theta$$



$$W_f = -(140)(42.5)$$

$= -5950$

take away

$W_{TOTAL} = W_T + W_{mg} + W_f$

$= 609875 - 603925 - 595$

$= 0$

W-E Theorm.

$$W_{TOTAL} = \Delta K = 0$$