第二周

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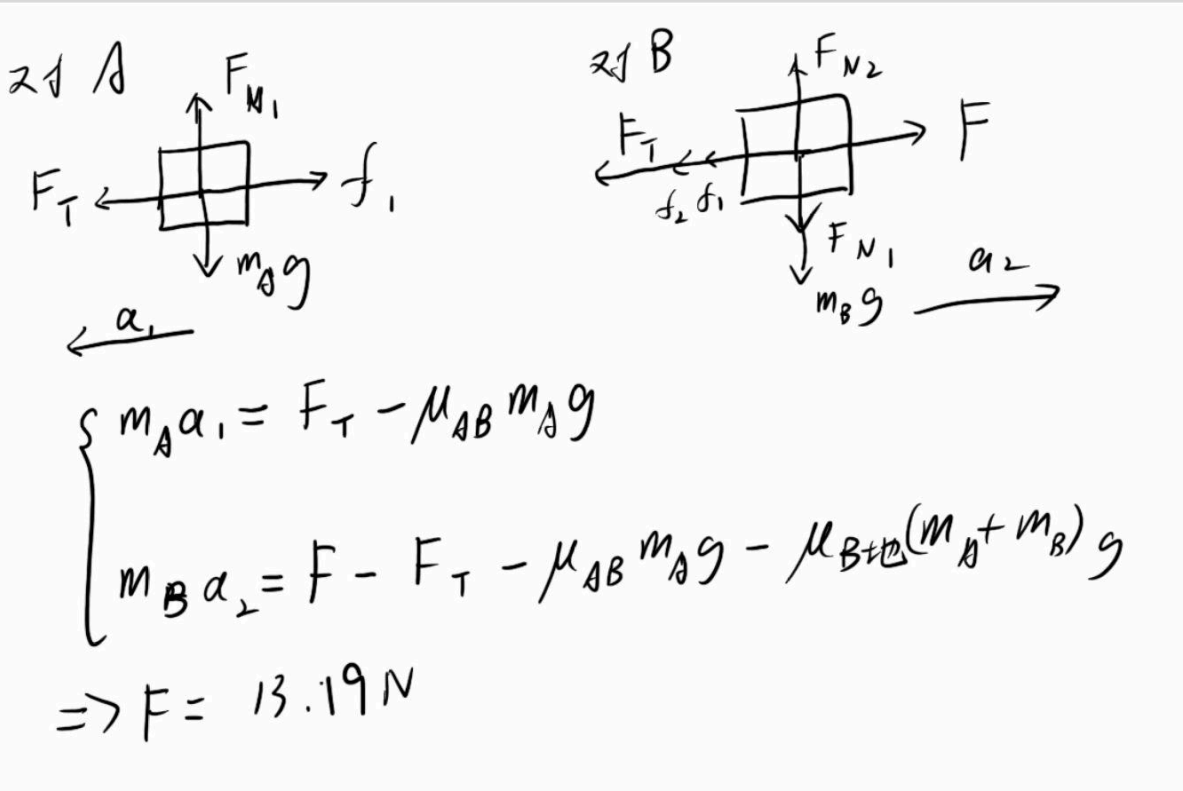
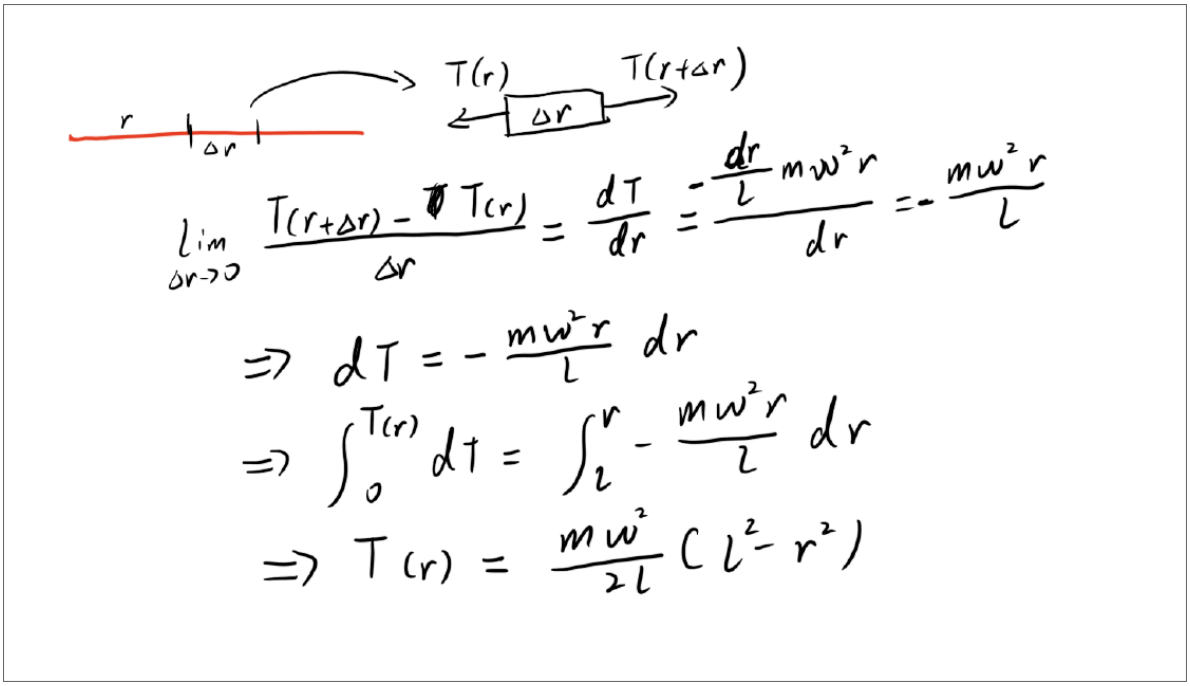
2.3



$$\begin{cases} m_A a_1 = F_T - \mu_{AB} m_A g \\ m_B a_2 = F - F_T - \mu_{AB} m_A g - \mu_{B地}(m_A + m_B) g \end{cases}$$

$$\Rightarrow F = 13.19\,N$$

2.18



$$\lim_{\Delta r \to 0} \frac{T(r+\Delta r) - T(r)}{\Delta r} = \frac{dT}{dr} = -\frac{\frac{dr}{l} m\omega^2 r}{dr} = -\frac{m\omega^2 r}{l}$$

$$\Rightarrow dT = -\frac{m\omega^2 r}{l} dr$$

$$\Rightarrow \int_0^{T(r)} dT = \int_l^r -\frac{m\omega^2 r}{l} dr$$

$$\Rightarrow T(r) = \frac{m\omega^2}{2l}(l^2 - r^2)$$

2.19

$\uparrow a_0$

(1) $F_{Ty} = m(a_0 + g) = 6.25\,N$

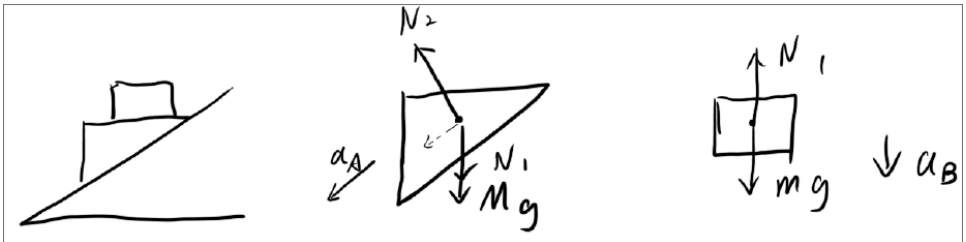
$F_T = \frac{F_{Ty}}{\cos 30^\circ} = 7.21\,N$

(2) $F_{Tx} = F_T \sin 30^\circ$

$m\omega^2 l \sin 30^\circ = F_{Tx}$

$\omega = \frac{7.21}{0.5 \cdot 0.25} = 7.59\,rad/s$

2.20



(1) $\begin{cases} Ma_A = (Mg + N_1)\sin\alpha \\ ma_B = (mg - N_1) \\ a_A \sin\alpha = a_B \end{cases}$

$\Rightarrow a_1 = a_A \cos\alpha = \frac{(M+m)g\sin\alpha\cos\alpha}{M + m\sin^2\alpha}$

(2) 显然 $a_2 = -a_1 = -\frac{(M+m)g\sin\alpha\cos\alpha}{M + m\sin^2\alpha}$

(3) $N_1 = m(g - a_B)$

$= m\left(g - \frac{(M+m)g\sin^2\alpha}{M + m\sin^2\alpha}\right)$

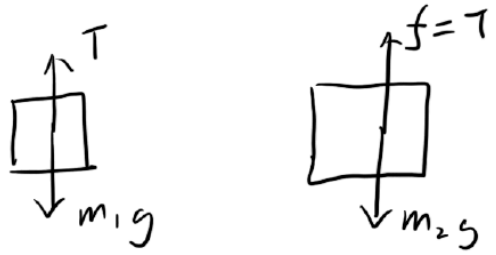
$= \frac{Mmg\cos^2\alpha}{M + m\sin^2\alpha}$

2.21

$$\begin{cases} m_1 a = m_1 g' - T \\ m_2 a = T - m_2 g' \\ g' = g - a_0 \end{cases} \Rightarrow a = \frac{(m_1 - m_2)(g - a_0)}{m_1 + m_2}$$

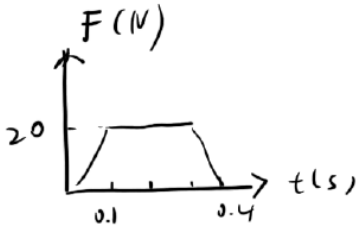
$$T = \frac{2 m_1 m_2 (g - a_0)}{m_1 + m_2}$$

2.28



$$\begin{cases} m_2 a_2 = m_2 g - f \\ m_1 a_1 = m_1 g - T \\ f = T \\ a = a_1 + a_2 \end{cases} \Rightarrow \begin{cases} a_1 = \frac{m_1 g + m_2 a - m_2 g}{m_1 + m_2} \\ a_2 = \frac{m_2 g + m_1 a - m_1 g}{m_1 + m_2} \\ f = \frac{m_1 m_2 (2g - a)}{m_1 + m_2} \end{cases}$$

2.30



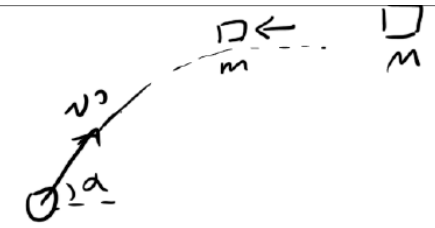
(1) $I = \Sigma F(t)\,\Delta t = 6\ N \cdot s$

$$\bar{F} = \frac{I}{\Delta t_{作}} = 15\ N$$

$$v - v_0) = I$$

$$v = 3\ m/s$$

2.44



$$\begin{cases}(m+M)v_0\cos\alpha = Mv_1 + mv_2 \\ v_2 - v_1 = u\end{cases}$$

$$\Rightarrow v_1 = \frac{(m+M)v_0\cos\alpha + mu}{m+M}$$

$$x = v_1 \cdot \frac{v_0\sin\alpha}{g} = \left(v_0\cos\alpha + \frac{mu}{m+M}\right)\frac{v_0\sin\alpha}{g}$$

z **2.48**

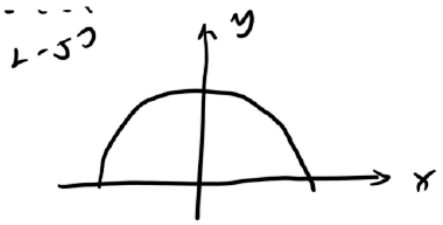
$$M\Delta V + m(0 - v_0) = 0$$

$$\Delta V = \frac{mv_0}{M}$$

$$m(-v) = mg\Delta t + Mg\Delta t - \bar{N}\Delta t$$

$$\bar{N} = (m+M)g + \frac{mv}{\Delta t}$$

2.50



显然 $x_c = 0$

$$y_c = \frac{\int y\,dm}{\int dm} = \frac{-\frac{1}{3}(R^2-y^2)^{\frac{3}{2}}\Big|_0^R \cdot 2\sigma}{\frac{1}{2}\pi R^2\sigma}$$

$$= \frac{4R}{3\pi}$$

$$dm = \sigma\, 2\sqrt{R^2-y^2}\,dy$$