Yathendi - assignment 11

4. $\circlearrowright \Sigma \tau = 0$

$(300\,N \cdot x) + (185\,N \cdot L/2) - (500\,N \cdot L\sin\theta) = 0$

$300x + 254.375\,m = 687.5\,m$

a) $\Rightarrow \boxed{x = 1.44\,m}$

$\rightarrow \Sigma F_x = 0$

$F_{hx} - T\cos\theta = 0$

b) $F_{hx} = 500 \cdot \frac{1}{2}\sqrt{3}\,N = \boxed{433\,N}\ (\rightarrow)$

$\uparrow \Sigma F_y = 0$

$F_{hy} - 185\,N - 300N + T\sin\theta = 0$

$F_{hy} = \boxed{235\,N}\ (\uparrow)$

10. $\circlearrowright \Sigma \tau = 0$

$T_1 \cdot \cos\theta \cdot x = T_2 \cdot \cos\phi \cdot (L - x) \quad \ldots(1)$

$\rightarrow \Sigma F_x = 0$

$T_1 \cdot \sin\theta = T_2 \cdot \sin\phi \quad \ldots(2)$

(2) $\mapsto$ (1):

$\frac{T_2 \cdot \sin\phi}{\sin\theta} \cdot \cos\theta \cdot x = T_2 \cos\phi\,(L - x)$

$\frac{\frac{1}{2}\sqrt{3}}{\frac{1}{2}} \cdot \frac{1}{2}\sqrt{3} \cdot x = \frac{1}{2} \cdot (9.50\,m - x)$

$\boxed{x = 2.375\,m}$

24. $\circlearrowright \Sigma \tau = 0$

$T\sin\phi \cdot l\cos\theta + T\cos\phi \cdot l\sin\theta - mg \cdot l\sin\theta = 0 \quad \ldots(1)$

$\rightarrow \Sigma F_x = 0$

$T\sin\phi - N = 0 \quad \ldots(2)$

$\uparrow \Sigma F_y = 0$

$T\cos\phi + f_s - mg = 0 \quad \ldots(3)$

(2) $\mapsto$ (3):

$\frac{N}{\sin\phi} \cdot \cos\phi + \mu_s \cdot N - mg = 0$

$N = \frac{mg}{\mu_s + \cot\phi}$

$\Rightarrow T = \frac{mg}{\mu_s \cdot \sin\phi + \cos\phi} \quad \ldots(4)$

(4) $\mapsto$ (1):

$\frac{mg \cdot \sin\phi \cdot l \cdot \cos\theta}{\mu_s \sin\phi + \cos\phi} + \frac{mg \cdot \cos\phi \cdot l \cdot \sin\theta}{\mu_s \cdot \sin\phi + \cos\phi} = mg\,l\sin\theta$

$\frac{\sin\phi\cos\theta + \cos\phi \cdot \sin\phi}{\sin\theta} = \mu_s \cdot \sin\phi + \cos\phi$

$\Rightarrow \mu_s = \left(\frac{\sin(\theta + \phi)}{\sin\theta} - \cos\phi\right)\frac{1}{\sin\phi} = \cot(\theta) = \boxed{1.28}$

25 $\Rightarrow \frac{F}{A} = E \cdot \frac{\Delta L}{L}$

$\frac{\Delta L}{L} = \frac{F}{AE}$

both cylinders have the same strain

$\Rightarrow \frac{F_A}{A_A E_A} = \frac{F_B}{A_B E_B}$

$\frac{F_A}{F_B} = \frac{A_A \cdot E_A}{A_B \cdot E_B} = 2.2^2 = 4.84$

a). $\frac{F_A}{F_A + F_B} = \frac{1}{1 + \frac{1}{4.84}} = \boxed{0.829}$.

b). $\frac{F_B}{F_A + F_B} = \frac{F_B}{F_A} \cdot \frac{F_A}{F_A + F_B} = \boxed{0.171}$.

c). $\Sigma \bar{\tau} = 0$.

$F_A d_A - F_B d_B = 0$

$\frac{d_A}{d_B} = \frac{F_B}{F_A} = \boxed{\frac{1}{4.84} = 0.207}$

38. $\Rightarrow \Sigma F_x = 0$

$f_s - F_{hx} = 0 \Rightarrow F_h \cdot \sin\theta = \mu_s \cdot N$ ...(1)

$\Rightarrow \Sigma F_y = 0$

$N + F_{hy} - W = 0 \Rightarrow N = W - F_h \cdot \cos\theta$ ...(2)

(2) $\rightarrow$ (1):

$\mu_s = \frac{F_h \sin\theta}{W - F_h \cdot \cos\theta}$ ...(3)

$\Rightarrow \Sigma \bar{\tau} = 0$

$F_h \cdot \left(\frac{h}{\sin\theta}\right) - W\left(\frac{L}{2} \cdot \cos\theta\right) = 0$ ...(4)

(4) $\rightarrow$ (3):

$\mu_s = \frac{\sin\theta}{\frac{2h}{L \sin\theta \cos\theta} - \cos\theta} = \boxed{0.641}$

40 a. $x_{com} = \frac{\Sigma x_i \cdot m_i}{\Sigma m_i} = \frac{1}{2} d = \boxed{2\,m}$.

b. $y_{com} = \frac{\Sigma y_i \cdot m_i}{\Sigma m_i} = d = \boxed{4\,m}$

c. $x_{cog} = \frac{\Sigma x_i \cdot m_i \cdot g_i}{\Sigma m_i \cdot g_i} = \left(\frac{m(7.4 + 2.6 + 7.8)}{m(\Sigma g_i)}\right) d = \frac{22.8}{46.2} d = \boxed{1.974\,m}$.

d. $y_{cog} = \frac{\Sigma y_i m_i g_i}{\Sigma m_i g_i} = \left(\frac{m(7.8 + 2.6 + 2.2.6 + 2.7.4)}{m(\Sigma g_i)}\right) d = \boxed{3.931\,m}$.