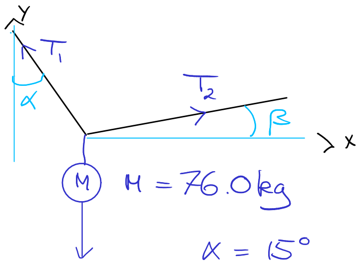
Problem 1: (1-6-30)



$M = 76.0\,kg$

$W = -gM$

$\alpha = 15°$

$\beta = 10°$

Equilibrium

$$y: \quad T_1 \cos\alpha + T_2 \sin\beta - gM = 0$$

$$x: \quad -T_1 \sin\alpha + T_2 \cos\beta = 0$$

$$x: \to \frac{T_1}{T_2} = \frac{\cos\beta}{\sin\alpha}$$

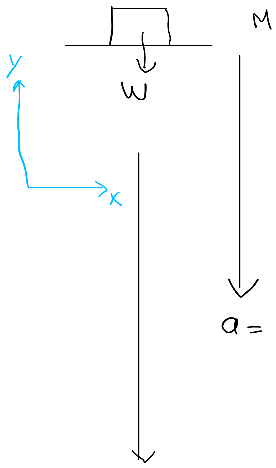
$$y: \to T_2\left\{\frac{\cos\beta}{\sin\alpha}\cos\alpha + \sin\beta\right\} = gM$$

$$\to T_2\left\{\cos\beta\cdot\cot\alpha + \sin\beta\right\} = gM$$

$$\to T_2 = \frac{gM}{\cos\beta\cot\alpha + \sin\beta} \simeq 194\,N$$

$$T_1 = \frac{gM}{\cos\beta\cot\alpha + \sin\beta}\cdot\frac{\cos\beta}{\sin\alpha} \simeq 7.4\cdot10^2\,N$$

Problem 2: (1-06-40)



$M = 10.0\,kg$

$a = -1.2\,m/s^2$

Find the force of M on the floor of the elevator during the trip down with acceleration a

$$F = -M\{g - a\}$$

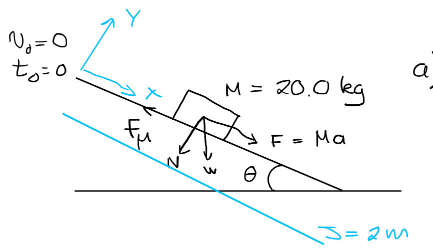
$$= -10.0\cdot\{9.81 - 1.2\}\,N$$

$$= -86\,N$$

The force is downwards --> negative

The force is reduced by the acceleration of the elevator

Problem 3: (1-06-64)



$$\theta = \frac{\pi}{6}, \quad \mu = 0{,}0300$$

a) Find a

$$F_\mu = \mu N = \mu g M \cos\theta$$

$$-F_\mu + gM\sin\theta = Ma$$

$$\to -\cos\theta\cdot\mu g M + gM\sin\theta = Ma$$

$$\to a = -\mu g\cos\theta + g\sin\theta = g\{\sin\theta - \mu\cos\theta\}$$

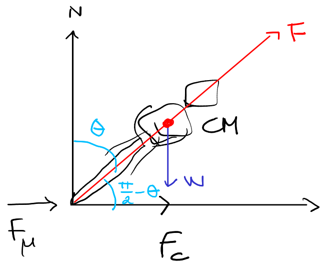
b) Find v at bottom

$$v = v_0 + at = at \to v = a\sqrt{\frac{2S}{a}} = \sqrt{2Sa}$$

$$S = \frac{1}{2}at^2 \to t^2 = \frac{2S}{a}$$

$$\to v = \sqrt{2Sg\{\sin\theta - \mu\cos\theta\}} \simeq 4{,}31\,m/s$$

Problem 4: (1-06-70)



$$F_c = M\frac{v^2}{r}$$

$\vec{F}$ has to pass through the CM to have equilibrium

$\vec{N}$ and $\vec{F_\mu}$ supply $\vec{F_i}$; $\vec{F_\mu}$ gives $\vec{F_c}$

$$\arctan\left(\frac{F_y}{F_x}\right) = \frac{\pi}{2} - \theta$$

$$\to \arctan\left(\frac{F_x}{F_y}\right) = \theta$$

$$F_x = M\frac{v^2}{r}$$

$$F_y = N = gM$$

$$\theta = \arctan\left(\frac{v^2}{rg}\right)$$

often this problem is solved using the torque of the forces around the touching point of the tire and the ground