RECITATION 4

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••7 SSM There are two forces on the 2.00 kg box in the overhead view of Fig. 5-31, but only one is shown. For $F_1 = 20.0$ N, $a = 12.0$ m/s^2, and $\theta = 30.0°$, find the second force (a) in unit-vector notation and as (b) a magnitude and (c) an angle relative to the positive direction of the x axis.

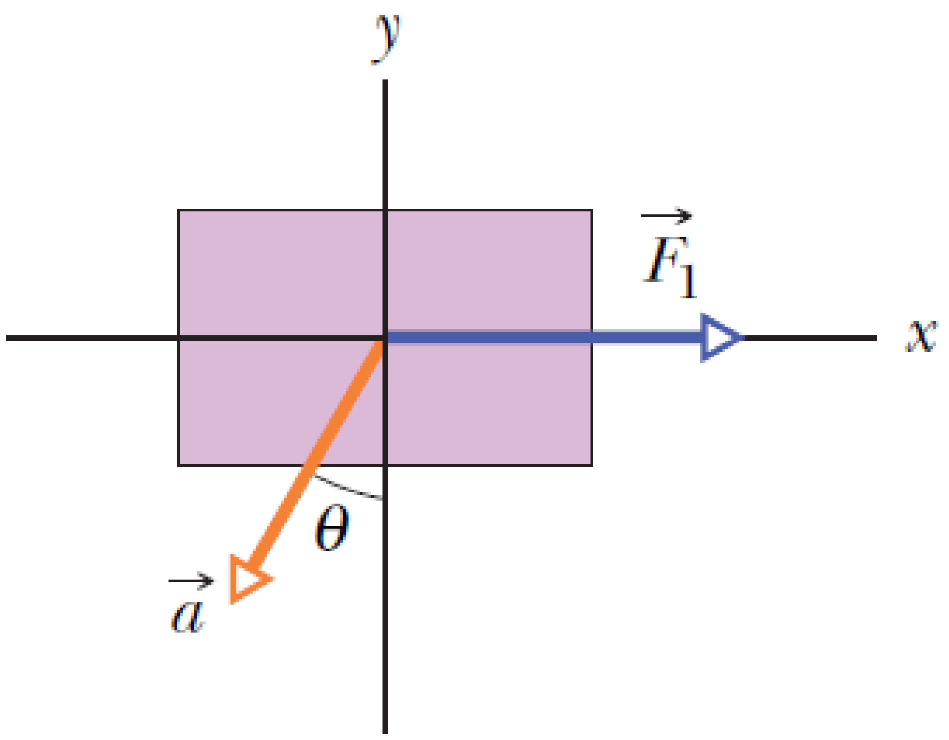


Fig. 5-31 Problem 7.

$$\vec{F}_1 + \vec{F}_2 = m\vec{a}$$

$$\vec{F}_2 = m\vec{a} - \vec{F}_1$$

a)

$$F_{2,x} = ma_x - F_{1,x} = (2.00)(12.0\cos 240°) - 20.0\cos 0° = -32.0\ \text{N}.$$

$$F_{2,y} = ma_y - F_{1,y} = (2.00)(12.0\sin 240°) - 20.0\sin 0° = -20.8\ \text{N}.$$

b)

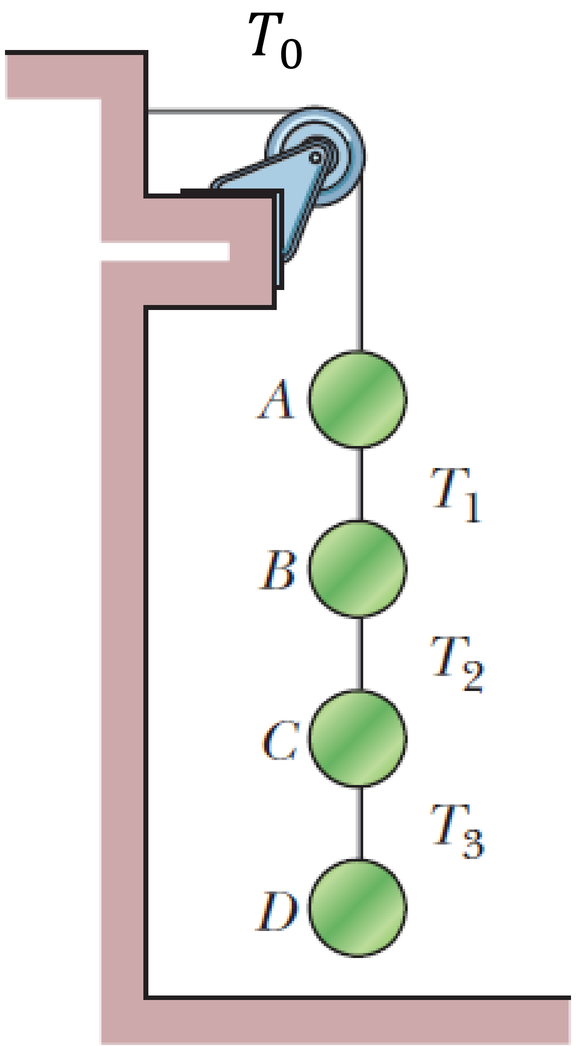
$$F_2 = \sqrt{(-32.0)^2 + (-20.8)^2} = 38.2\ \text{N}.$$

c)

$$\phi = \tan^{-1}\frac{F_{2,y}}{F_{2,x}} = \tan^{-1}\frac{-20.8}{-32.0} = 33.0° + 180° = 213°.$$

sec. 5-7 Some Particular Forces

•13 Figure 5-33 shows an arrangement in which four disks are suspended by cords. The longer, top cord loops over a frictionless pulley and pulls with a force of magnitude 98 N on the wall to which it is attached. The tensions in the three shorter cords are $T_1 = 58.8$ N, $T_2 = 49.0$ N, and $T_3 = 9.8$ N. What are the masses of (a) disk A, (b) disk B, (c) disk C, and (d) disk D?



a)

$$T_0 - T_1 - m_A g = m_A(0)$$

$$m_A = \frac{T_0 - T_1}{g} = \frac{98\text{ N} - 58.8\text{ N}}{9.8\text{ m/s}^2} = 4.0\text{ kg}.$$

b)

$$T_1 - T_2 - m_B g = m_B(0)$$

$$m_B = \frac{T_1 - T_2}{g} = \frac{58.8 \text{ N} - 49.0 \text{ N}}{9.8 \text{ m/s}^2} = 1.0 \text{ kg}.$$

c)

$$T_2 - T_3 - m_C g = m_C(0)$$

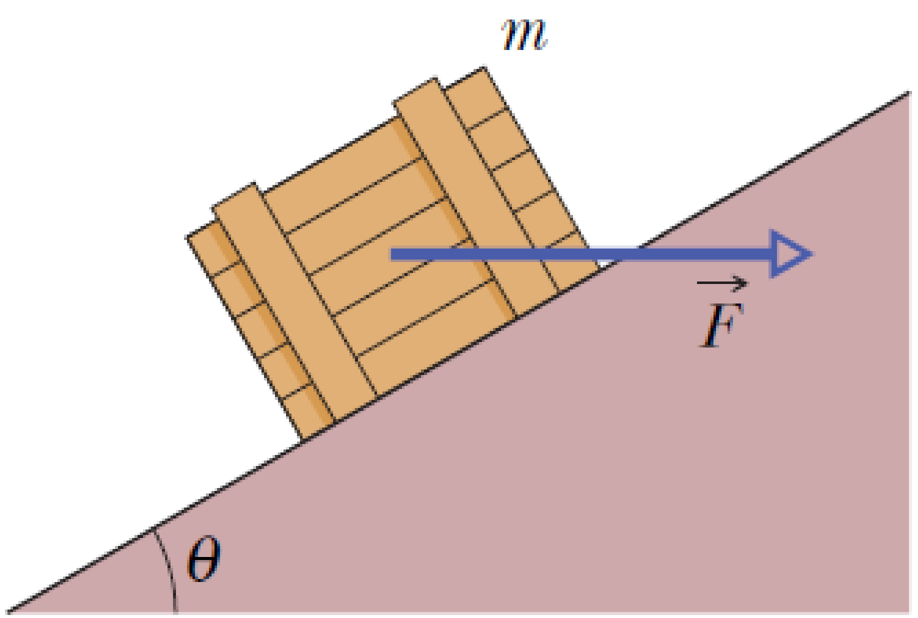
$$m_C = \frac{T_2 - T_3}{g} = \frac{49.0 \text{ N} - 9.8 \text{ N}}{9.8 \text{ m/s}^2} = 4.0 \text{ kg}.$$

d)

$$T_3 - m_D g = m_D(0)$$

$$m_D = \frac{T_3}{g} = \frac{9.8 \text{ N}}{9.8 \text{ m/s}^2} = 1.0 \text{ kg}.$$

••34 GO In Fig. 5-40, a crate of mass $m = 100$ kg is pushed at constant speed up a frictionless ramp ($\theta = 30.0°$) by a horizontal force $\vec{F}$. What are the magnitudes of (a) $\vec{F}$ and (b) the force on the crate from the ramp?



We take the x-axis to be along the ramp's surface.

a) For the x-axis

$$F\cos(\theta) - mg\sin\theta = m(0)$$

$$F = mg\tan\theta = (100)(9.81)\tan 30.0° = 566\text{ N}.$$

b)

$$F_N - mg\cos\theta - F\sin(\theta) = m(0)$$

$$F_N = mg\cos\theta + F\sin\theta = (100)(9.81)\cos 30.0° + (566\ N)\sin 30.0°$$

$$= 1.13 \times 10^3\text{N}.$$

••57 ILW A block of mass $m_1 = 3.70$ kg on a frictionless plane inclined at angle $\theta = 30.0°$ is connected by a cord over a massless, frictionless pulley to a second block of mass $m_2 = 2.30$ kg (Fig. 5-52). What are (a) the magnitude of the acceleration of each block, (b) the direction of the acceleration of the hanging block, and (c) the tension in the cord?

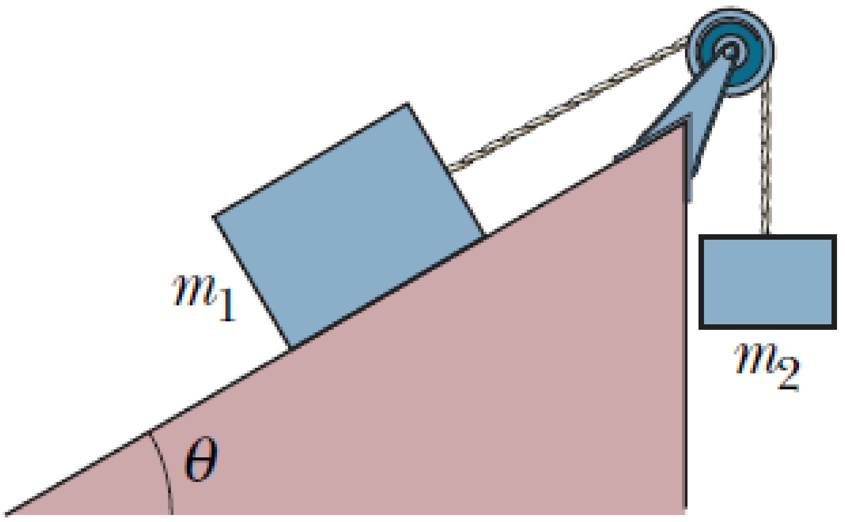


Fig. 5-52 Problem 57.

••42 GO In earlier days, horses pulled barges down canals in the manner shown in Fig. 5-42. Suppose the horse pulls on the rope with a force of 7900 N at an angle of $\theta = 18°$ to the direction of motion of the barge, which is headed straight along the positive direction of an x axis. The mass of the barge is 9500 kg, and the magnitude of its acceleration is 0.12 m/s^2. What are the (a) magnitude and (b) direction (relative to positive x) of the force on the barge from the water?