**72.** A man doing push-ups pauses in the position shown in Fig. 9–84. His mass $m = 75\,\text{kg}$. Determine the normal force exerted by the floor (*a*) on each hand; (*b*) on each foot.

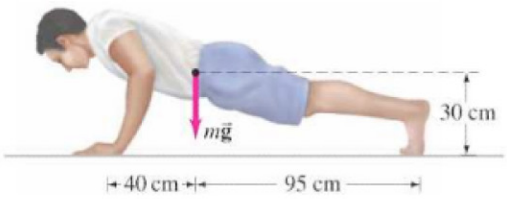


**FIGURE 9–84** Problem 72.

**73.** A 20-kg sphere rests between two smooth planes as shown in Fig. 9–85. Determine the magnitude of the force acting on the sphere exerted by each plane.

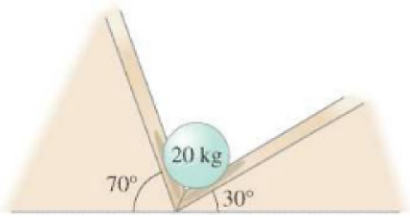


**FIGURE 9–85** Problem 73.

**74.** A 2200-kg trailer is attached to a stationary truck at point B, Fig. 9–86. Determine the normal force exerted by the road on the rear tires at A, and the vertical force exerted on the trailer by the support B.

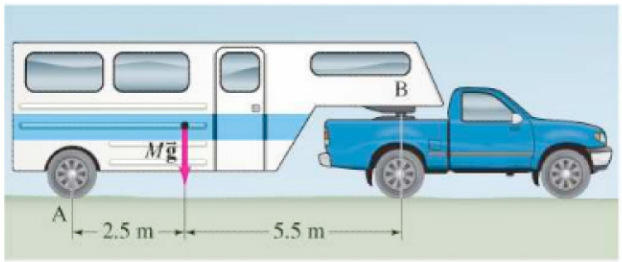


**FIGURE 9–86** Problem 74.

*** 75.** Parachutists whose chutes have failed to open have been known to survive if they land in deep snow. Assume that a 75-kg parachutist hits the ground with an area of impact of $0.30\,\text{m}^2$ at a velocity of 60 m/s, and that the ultimate strength of body tissue is $5 \times 10^5\,\text{N/m}^2$. Assume that the person is brought to rest in 1.0 m of snow. Show that the person may escape serious injury.

*** 76.** A steel wire 2.0 mm in diameter stretches by 0.030% when a mass is suspended from it. How large is the mass?

*** 77.** In Example 7–6 in Chapter 7, we calculated the impulse and average force on the leg of a person who jumps 3.0 m down to the ground. If the legs are not bent upon landing, so that the body moves a distance $d$ of only 1.0 cm during collision, determine (*a*) the stress in the tibia (a lower leg bone of area $= 3.0 \times 10^{-4}\,\text{m}^2$), and (*b*) whether or not the bone will break. (*c*) Repeat for a bent-knees landing ($d = 50.0\,\text{cm}$).

*** 78.** The roof over a 7.0-m × 10.0-m room in a school has a total mass of 12,600 kg. The roof is to be supported by vertical "2 × 4s" (actually about 4.0 cm × 9.0 cm) along the 10.0-m sides. How many supports are required on each side, and how far apart must they be? Consider only compression, and assume a safety factor of 12.

*** 79.** A 25-kg object is being lifted by pulling on the ends of a 1.00-mm-diameter nylon string that goes over two 3.00-m-high poles that are 4.0 m apart, as shown in Fig. 9–87. How high above the floor will the object be when the string breaks?


**FIGURE 9–87** Problem 79.

*** 80.** There is a maximum height of a uniform vertical column made of any material that can support itself without buckling, and it is independent of the cross-sectional area (why?). Calculate this height for (*a*) steel (density = mass/volume $= 7.8 \times 10^3\,\text{kg/m}^3$), and (*b*) granite (density $= 2.7 \times 10^3\,\text{kg/m}^3$).

## Answers to Exercises

**A:** $F_A$ also has a component to balance the sideways force $F_B$.
**B:** Yes: $\sin\theta$ appears on both sides and cancels out.
**C:** $F_N = m_A g + m_B g + Mg = 560\,\text{N}$.
**D:** Static friction at the cement floor ($= F_{Cx}$) is crucial, or else the ladder would slip. At the top, the ladder can move and adjust, so we wouldn't expect a strong static friction force there.