

Physics 201 Examples 8

Feb 20, 2013

1. A hiker, who weighs 985 newtons, is strolling through the woods and crosses a small horizontal bridge. The bridge is uniform, weighs 3610 newtons, and rests on two concrete supports, one at each end. He stops one-fifth of the way along the bridge. What is the magnitude of the force that a concrete support exerts on the bridge (a) at the near end and (b) at the far end?

- (a) 2590 N
(b) 2010 N

2. A square, 0.40 m on a side, is mounted so that it can rotate about an axis that passes through the center of the square. The axis is perpendicular to the plane of the square. A force of 15 N lies in this plane and is applied to the square. What is the magnitude of the maximum torque that such a force could produce?

4.2 N·m

3. You are installing a new spark plug in your car, and the manual specifies that it be tightened to a torque that has a magnitude of 45 newton-meters. Using the data in Figure ??, determine the magnitude of the force that you must exert on the wrench.

210 newtons

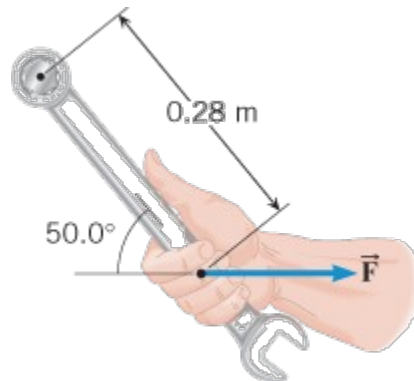


Figure 1: Problem 9.3

4. Workers have loaded a delivery truck in such a way that its center of gravity is only slightly forward of the rear axle, as shown in Figure 2. The mass of the truck and its contents is 7460 kilograms. Find the magnitudes of the forces exerted by the ground on (a) the front wheels and (b) the rear wheels of the truck.

- (a) 15,700 newtons
(b) 57,400 newtons

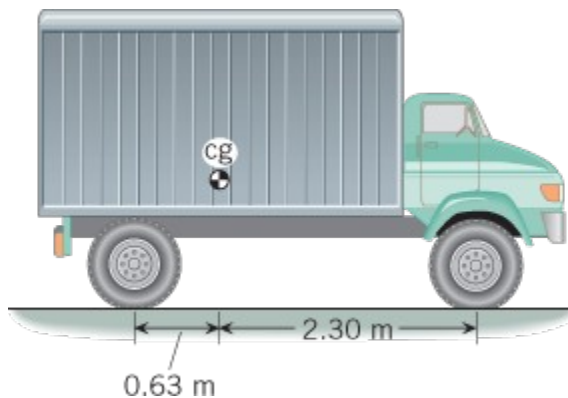


Figure 2: Problem 9.14

5. A 1220 newton uniform beam is attached to a vertical wall at one end and is supported by a cable at the other end. A 1960 newton crate hangs from the far end of the beam. Using the data shown in Figure 3, find (a) the magnitude of

- (a) 2260 newtons
(b) 1450 newtons
(c) 1450 newtons

the tension in the wire and (b) the magnitude of the horizontal and (c) vertical components of the force that the wall exerts on the left end of the beam.

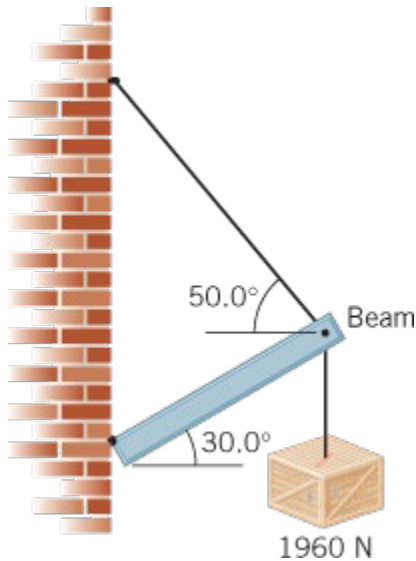


Figure 3: Problem 9.25

6. A wrecking ball (weight = 4800 newtons) is supported by a boom, which may be assumed to be uniform and has a weight of 3600 newtons. As Figure 4 shows, a support cable runs from the top of the boom to the tractor. The angle between the support cable and the horizontal is 32°, and the angle between the boom and the horizontal is 48°. Find (a) the tension in the support cable and (b) the magnitude of the force exerted on the lower end of the boom by the hinge at point *P*.

- (a) 16,000 newtons
- (b) 22,000 newtons

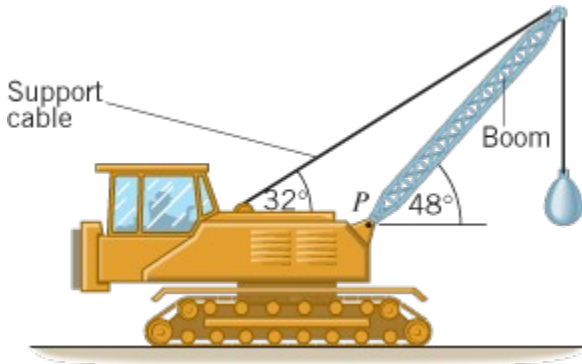


Figure 4: Problem 9.27

7. A uniform plank of length 5.0 meters and weight 225 newtons rests horizontally on two supports, with 1.1 meters of the plank hanging over the right support (see Figure 5). To what distance can a person who weighs 450 newtons walk on the overhanging part of the plank before it just begins to tip?

0.70 meters

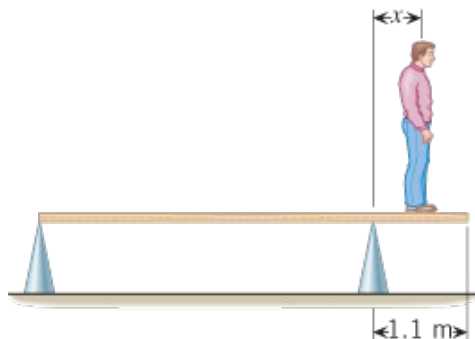


Figure 5: Problem 9.72

8. Figure 6 shows an outstretched arm (0.61 meters in length) that is parallel to the floor. The arm is pulling downward against the ring attached to the pulley system, in order to hold the 98 newton weight stationary. To pull the arm downward, the latissimus dorsi muscle applies the force \vec{M} in the drawing, at a point that is 0.069 meters from the shoulder joint and oriented at an angle of 29° . The arm has a weight of 47 newtons and a center of gravity that is located 0.28 meters from the shoulder joint. Find the magnitude of \vec{M} .

1400 newtons

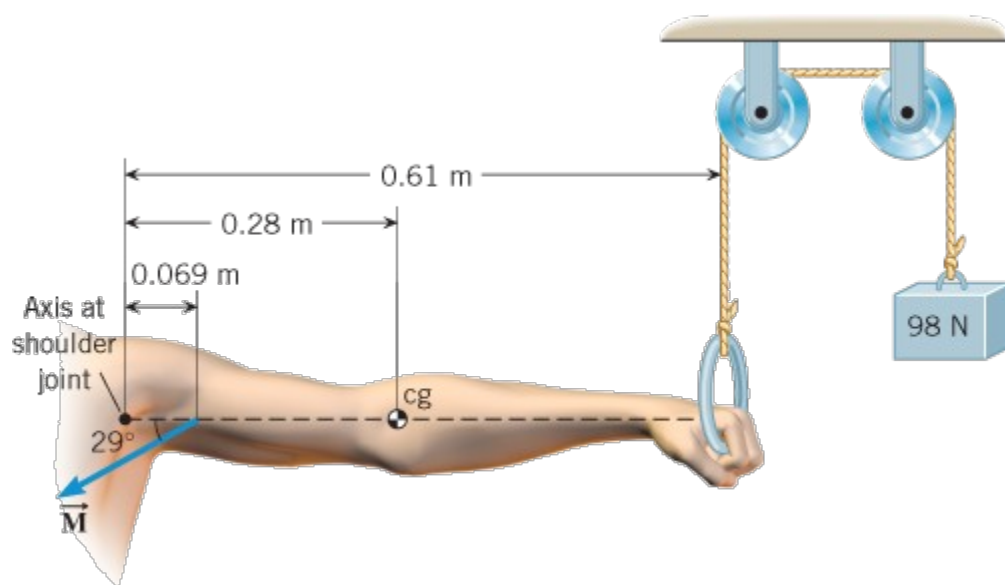


Figure 6: Problem 9.75

9. An inverted "V" is made of uniform boards and weighs 356 newtons. Each side has the same length and makes a 30.0° angle with the vertical, as Figure 7 shows. Find the magnitude of the static frictional force that acts on the lower end of each leg of the "V".

51.4 newtons



Figure 7: Problem 9.79

10. A sign of 2.0 meters long and 1.5 meters high hangs perpendicular to the wall of a building to the right. The top corner closest is pinned to the wall and the far top corner is attached to a wire which is also attached to the building 1.0 meter up. If the mass of the sign is 10 kg, what is the tension in the wire?

110 N

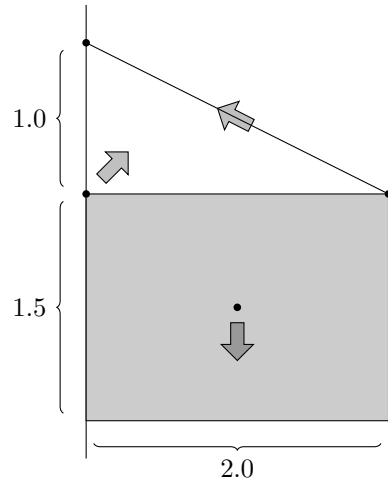


Figure 8: Forces on a hanging sign

11. A table has a 100 kg mass on it. The 50 kg table is 2.0 m long and the mass is 0.10 m from the left edge. What are the support forces in the four legs?

- (a) On the left: 1200 N
- (b) On the right: 290 N