

Answers, Selected Even-Numbered Problems, Chapter 11

11.2

−9.53 cm .

The additional mass should be attached 9.53 cm to the left of the original center of gravity.

11.4

(a) 300 N . In this case the hinge exerts no force.

(b) 150 N . The hinges supply an upward force of 150 N .

11.6

The other person lifts with a force of 100 N at a point 2.40 m from the end where the other person lifts.

11.8

The tension in the left-hand wire is 25.0 N and the tension in the right-hand wire is 50.0 N .

11.10

(a) 360N .

(b) 170 N

(c) 2.7 m .

11.12

(a) The graphs are given in Figure 11.12.

(b) 6.25 m which is 1.25 m beyond point *B*.

(c) The distance that point *B* must be from the right end is 1.50 m .

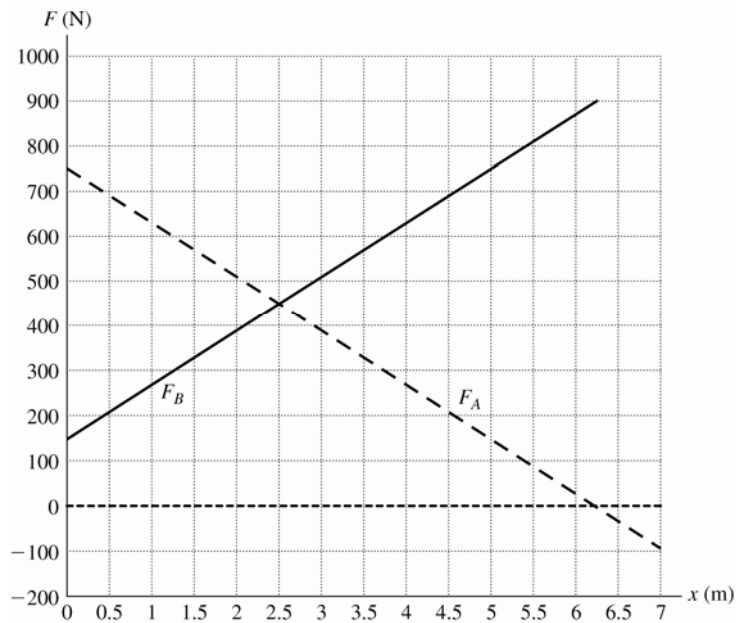


Figure 11.12

11.14

(a) 625 N .

(b) horizontal component: 500 N; vertical component: 75 N

11.16

(a) 1740 N .

(b) The extra force is applied by the ground pushing up on the wheel.

11.18

(a).

2.93×10^4 N .

(b) $F_h = 2.54 \times 10^4$ N . $F_v = 4.06 \times 10^4$ N .

11.20

$T = 7.40$ kN . The vertical component of the force exerted on the beam by the pivot
0.17 kN. The horizontal force is 3.13 kN.

11.42

9.84 m.

EVALUATE: Before Lancelot goes onto the bridge, the tension in the supporting cable is

$$T = \frac{(6.0 \text{ m})(200 \text{ kg})(9.80 \text{ m/s}^2)}{12.0 \text{ m}} = 9800 \text{ N} , \text{ well below the breaking strength of the}$$

cable. As he moves along the bridge, the increase in tension is proportional to x , the
distance he has moved along the bridge.

11.44

(a) 9,580 N

There is 9,580 N on the front wheels and 13,620 N on the rear wheels.

(b) 3.23×10^4 N .

11.46

$$x = 3L .$$

11.48 116 N.**11.50**

$$T_B = 292 \text{ N} . T_A = 66 \text{ N} .$$

11.52

- (a) $2.57 \times 10^5 \text{ N}$.
 (b) Horizontal: $1.97 \times 10^5 \text{ N}$ (to the right). Vertical: $2.46 \times 10^5 \text{ N}$ (upward).

11.54

- (a) 354 N.
 (b) the ladder exerts a downward force of 646 N on the pivot.
 (c) The results in parts (a) and (b) are independent of θ .

11.56

- (a) The free-body diagram for each rod is given in Figure 11.56.
 (b) $w_A = 3.0 \text{ N}$, $w_B = 15.0 \text{ N}$, $w_C = 8.0 \text{ N}$. Tensions: $S_1 = 32.0 \text{ N}$, $S_2 = 24.0 \text{ N}$, $S_3 = 9.0 \text{ N}$.
 (c) The center of gravity of the entire mobile must lie along a vertical line that passes through the point where S_1 is located.

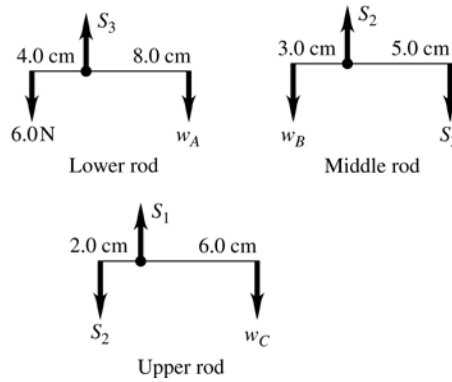


Figure 11.56

11.58

- (a) $1.19 \times 10^5 \text{ N}$
 (b) The hinge force has magnitude $1.27 \times 10^5 \text{ N}$ and is directed at 20.7° above the horizontal.

11.60

- (a) $w = 15.0 \text{ N}$.
 (b) the result would be the same.

11.62

$T_A = 0.353 \text{ N}$ $T_B = 0.588 \text{ N}$ $T_C = 0.470 \text{ N}$ $T_D = 0.353 \text{ N}$ $T_E = 0.833 \text{ N}$.
 $T_F = 0.931 \text{ N}$.

11.64

- (a) $1.3 \mu\text{m}$.
- (b) $3.1 \times 10^6 \text{ N}$.

11.66

- (a) 22° .
- (b) 30.2 cm .
- (c) 0.625 .

11.68

- (a) $F_B = 59.2 \text{ N}$.
- (b) $F_B = 754 \text{ N}$. The biceps force has a short lever arm, so it must be large to balance the torques.
- (c) $F_E = 659 \text{ N}$.

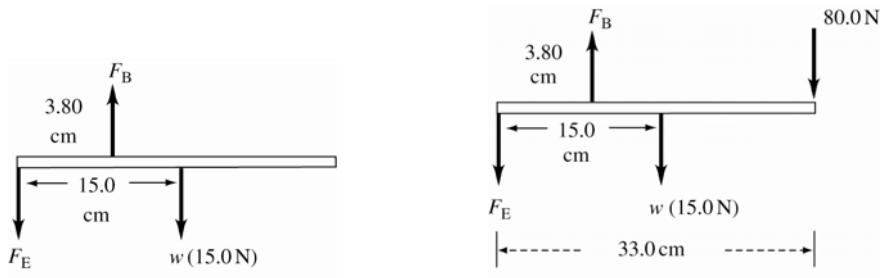


Figure 11.68a, b

11.70

Label the legs as shown in Figure 11.70a. Legs A and C are 3.6 m apart. Let the weight be placed closest to legs C and D . By symmetry, $A = B$ and $C = D$. Redraw the table as viewed from the AC side. The free-body diagram in this view is given in Figure 11.70b. $A = 130 \text{ N} = B$. $C = D = 670 \text{ N}$. By Newton's third law of motion, the forces A , B , C , and D on the table are the same magnitude as the forces the table exerts on the floor.

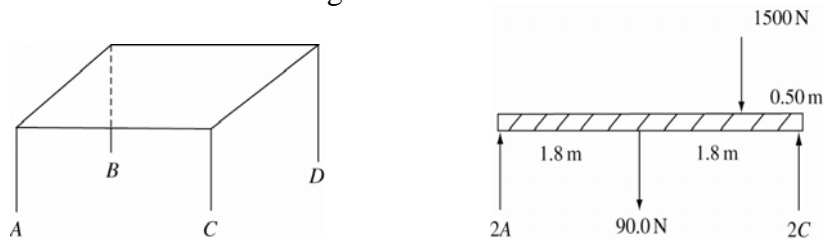


Figure 11.70a, b

11.72

(a)
$$F = mg \frac{\sqrt{2Rh - h^2}}{R - h}$$

(b) $\frac{mg\sqrt{2Rh - h^2}}{2R - h}$

(c) Less force is required when the force is applied at the top of the wheel, since in this case F has a larger moment arm.

11.74

(a) $3L/4$.

(b) $25L/24$.

(c) As the result of part (b) shows, with only four blocks, the overhang can be larger than the length of a single block.

The sequence of maximum overhangs is $\frac{18L}{24}$, $\frac{22L}{24}$, $\frac{25L}{24}$, The increase of overhang when one more block is added is decreasing.

11.76

(a) 130 N

(b) The crossbar is under compression.

(c) The hinge exerts a force 130 N horizontally to the left for the right-hand beam and 130 N to the right for the left-hand beam.

11.78

(a) 103 N

(b) $h = 0.36$ m.

11.82

(a) $W = 28.5$ N.

(b) $F = 84.5$ N.

11.96

(a) 400 N.

(b) 750 N

(c) 0.71.

11.98

(a) Taking $F_L = 391$ N. $F_R = 449$ N.

(b) $T = 322.1$ N $T(1.50 \text{ m}) = F_R(1.80 \text{ m}) - (360 \text{ N})(0.90 \text{ m})$ gives the same result.

(c) 334 N.

(d) 937 N.