

1. Calculate the tensions  $\vec{F}_A$  and  $\vec{F}_B$  in the two cords that are connected to the vertical cord supporting the 200 kg chandelier of Fig. 1.
2. A board of mass  $M = 2$  kg serves as a seesaw for two children. Child A has a mass of 30 kg and sits 2.5 m from the pivot point P (his CM gravity is 2.5 m from the pivot). At what distance  $x$  from the pivot must child B of mass 25 kg, place herself to balance the seesaw? Assume the board is uniform and centered over the pivot.
3. A traffic light hangs from a pole as shown in Fig. 1. The uniform aluminum pole AB is 7.5 m long and has a mass of 12 kg. The mass of the traffic light is 21.5 kg. Determine (a) the tension in the horizontal massless cable CD, and (b) the vertical and horizontal components of the force exerted by the pivot A on the aluminum pole.
4. A 50-story building is being planned. It is to be 200 m high with a base of 40 m by 70 m. Its total mass will be about  $1.8 \times 10^7$  kg, and its weight therefore  $1.8 \times 10^8$  N. Suppose a 200 km/h wind exerts a force of  $950 \text{ N/m}^2$  over the 70 m-wide face. Calculate the torque about the potential pivot point, the rear edge of the building (where  $\vec{F}_E$  acts in) and determine whether the building will topple. Assume the total force of the wind acts at the midpoint of the building's face, and that the building is not anchored in bedrock. (See Fig. 2.)
5. Consider the right-hand (northernmost) section of the Golden Gate bridge, which has a length  $d_1 = 343$  m. Assume the CG of this span halfway between the tower and anchor. Determine  $F_{T1}$  and  $F_{T2}$  (which act on the northernmost cable) in terms of  $mg$ , the weight of the northernmost span, and calculate the height  $h$  needed for the equilibrium. Assume the roadway is supported only by the suspension cables, and neglect the mass of the cables and vertical wires. (See Fig. 2.)
6. The forces acting on a 67,000 kg aircraft flying at constant velocity are shown in Fig. 3. The engine thrust,  $F_T = 5 \times 10^5$  N, acts on a line 1.6 m below the CM. Determine the drag force  $F_D$  and the distance above the CM that it acts. Assume  $\vec{F}_D$  and  $\vec{F}_T$  are horizontal.
7. A uniform flexible steel cable of weight  $mg$  is suspended between two points at the same elevation as shown in Fig. 3, where  $\theta = 60^\circ$ . Determine the tension in the cable (a) at its lowest point, and (b) at the points of attachment. (c) What is the direction of the tension force in each case.
8. 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  $0.3 \text{ m}^2$  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 m of snow. Show that the person may escape serious injury.
9. Consider a ladder with a painter climbing up it. If the mass of the ladder is 12 kg, the mass of the painter is 55 kg, and the ladder begins to slip at its base when her feet are 70% of the way up the length of the ladder, what is the coefficient of static friction between the ladder and the floor? Assume the wall is frictionless. (See Fig. 4.)
10. A person wants to push a lamp (mass 7.2 kg) across the floor, for which the coefficient of friction is 0.2. Calculate the maximum height  $x$  above the floor at which the person can push the lamp so that it slides rather than tips. (see Fig.4.)

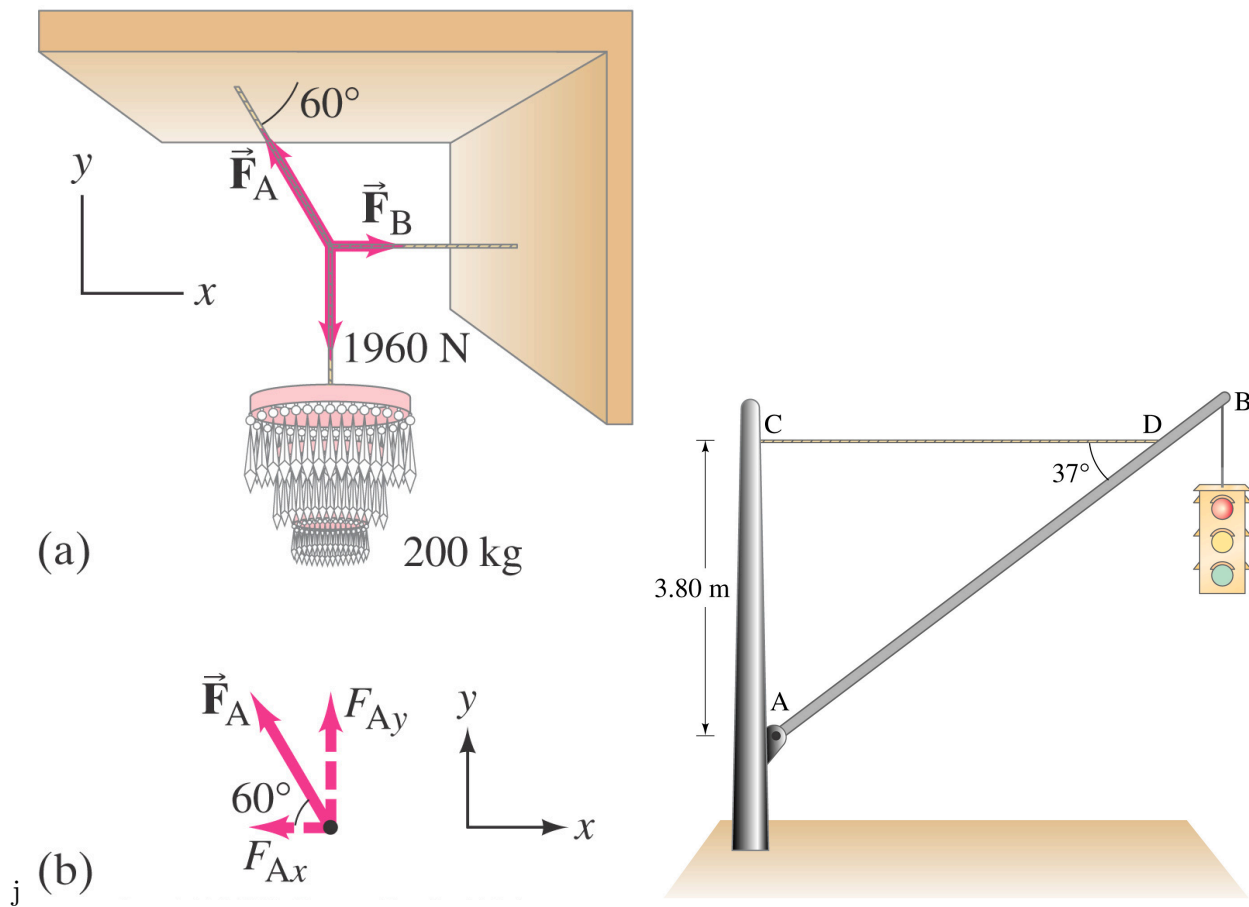


Figure 1: The situations in problem 1 (left) and problem 3 (right).

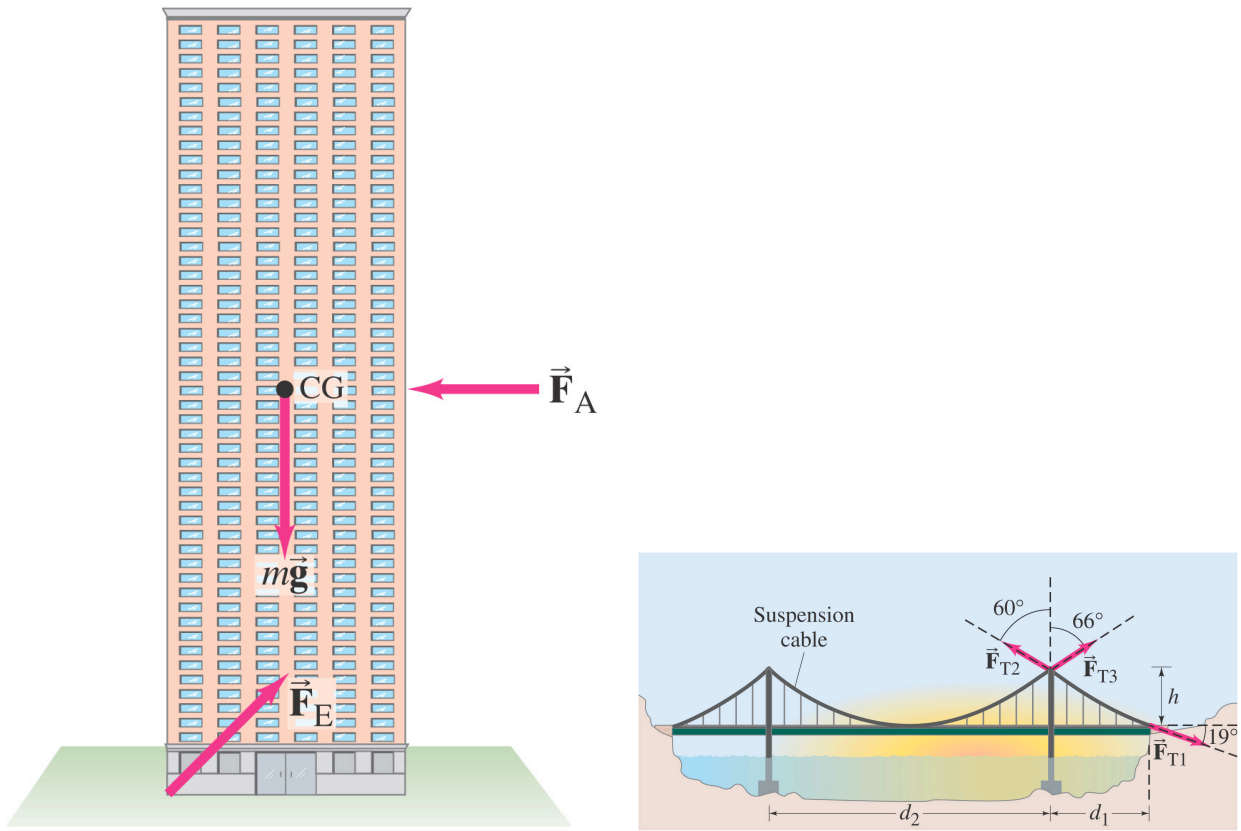


Figure 2: The situations in problem 4 (left) and 5 (right).

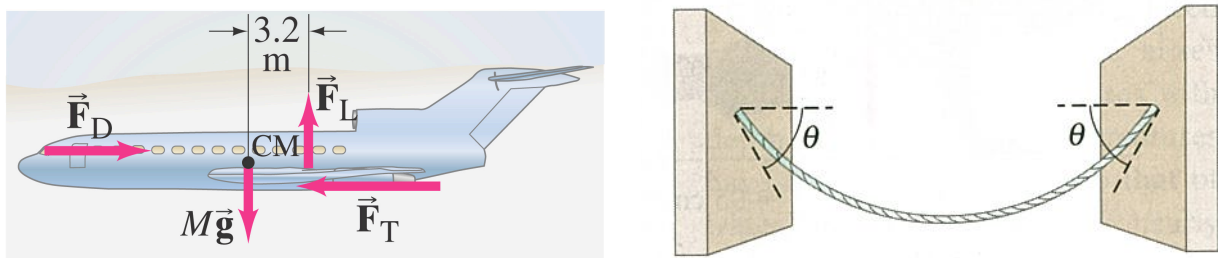


Figure 3: The situations in problem 6 (left) and problem 7 (right).

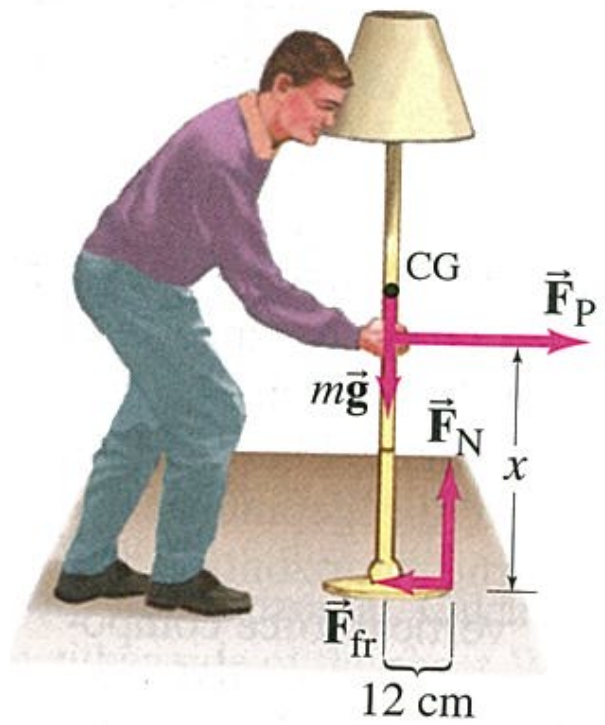
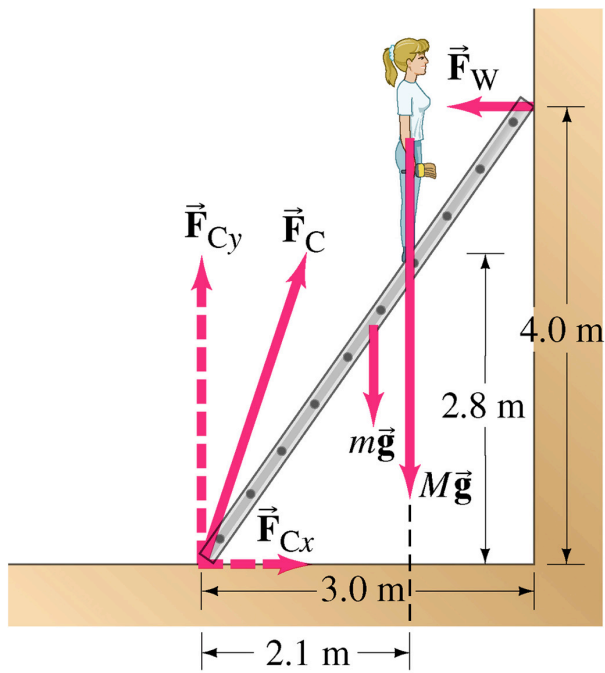


Figure 4: The situations on problem 9 (left) and 10 (right).