

Assignment – 1

1. A welded connection is in equilibrium under the action of the four forces shown in Figure 1. Knowing that $F_A = 8 \text{ kN}$ and $F_B = 16 \text{ kN}$, determine the magnitudes of the other two forces. [Ans: $F_C = 6.40 \text{ kN}$, $F_D = 4.80 \text{ kN}$]
2. A sailor is being rescued using a boatswain's chair that is suspended from a pulley that can roll freely on the support cable ACB and is pulled at a constant speed by cable CD as shown in Figure 2. Knowing that $\alpha = 30^\circ$ and $\beta = 10^\circ$ and that the combined weight of the boatswain's chair and the sailor is 900 N , determine the tension (a) in the support cable ACB (b) in the traction cable CD. [Ans: (a) 1213 N , (b) 166.3 N]
3. A 600 N crate is supported by several rope-and-pulley arrangements as shown in Figure 3. Determine for each arrangement the tension in the rope. [Ans: (a) 300 N (b) 300 N (c) 200 N (d) 200 N (e) 150 N]
4. A horizontal circular plate is suspended as shown in Figure 4 from three wires that are attached to a support at D and form 30° angles with the vertical. Knowing that the x component of the force exerted by wire AD on the plate is 110.3 N , determine (i) the tension in wire AD (ii) the angles that the force exerted at A forms with the coordinate axes. [Ans: 288 N (b) 67.5° , 30° , 108.7°]
5. The ramp ABCD is supported by cables at corners C and D. The tension in each of the cables is 810 N . Determine the moment about A of the force exerted by (i) the cable at D, (ii) the cable at C.
6. Knowing that the tension in the cable AC is 1260 N , determine (i) the angle between cable AC and the boom AB, (ii) the projection on AB of the force exerted by cable AC at point A. [Ans: (a) 59° (b) 640 N]
7. A dirigible is tethered by a cable attached to its cabin at B. If the tension in the cable is 1040 N , replace the force exerted by the cable at B with an equivalent system formed by two parallel forces applied at A and C.
8. A 4-m -long beam is subjected to a variety of loadings. Replace each of the loading with an equivalent force-couple system at end A of the beam.
9. Two 150-mm -diameter pulleys are mounted on line shaft AD. The belts at B and C lie in vertical planes parallel to the yz plane. Replace the belt forces shown with an equivalent force-couple system at A. [Ans: $\mathbf{R} = (-420\mathbf{j} - 339\mathbf{k})\text{N}$; $\mathbf{M} = (1.125\mathbf{i} + 163.9\mathbf{j} - 109.9\mathbf{k})\text{N.m}$]
10. A 100-kg uniform rectangular plate is supported in the position shown by hinges A and B and by cable DCE that passes over a frictionless hook at C. Assuming that the tension is the same in both parts of the cable, determine (a) the tension in the cable, (b) the reactions at A and B. Assume that the hinge at B does not exert any axial thrust along x axis.

Figure 1

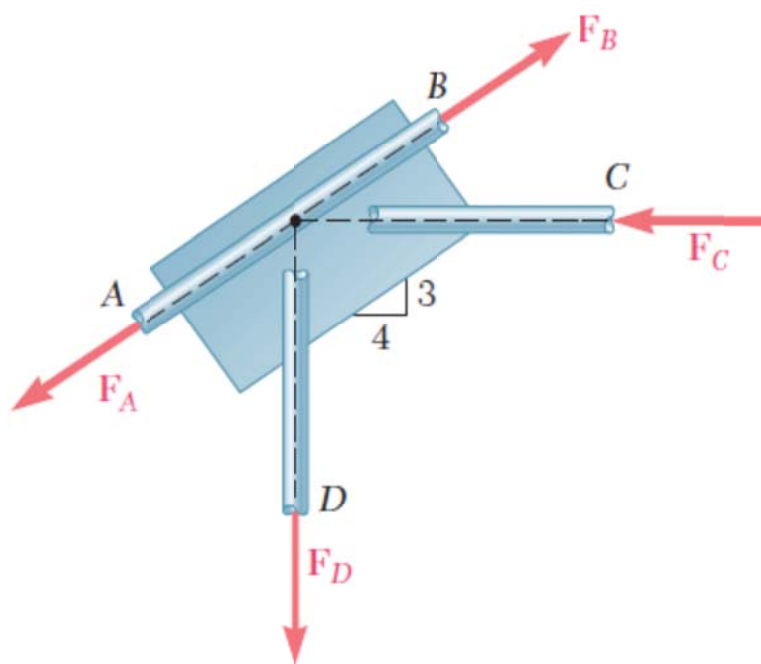


Figure 2

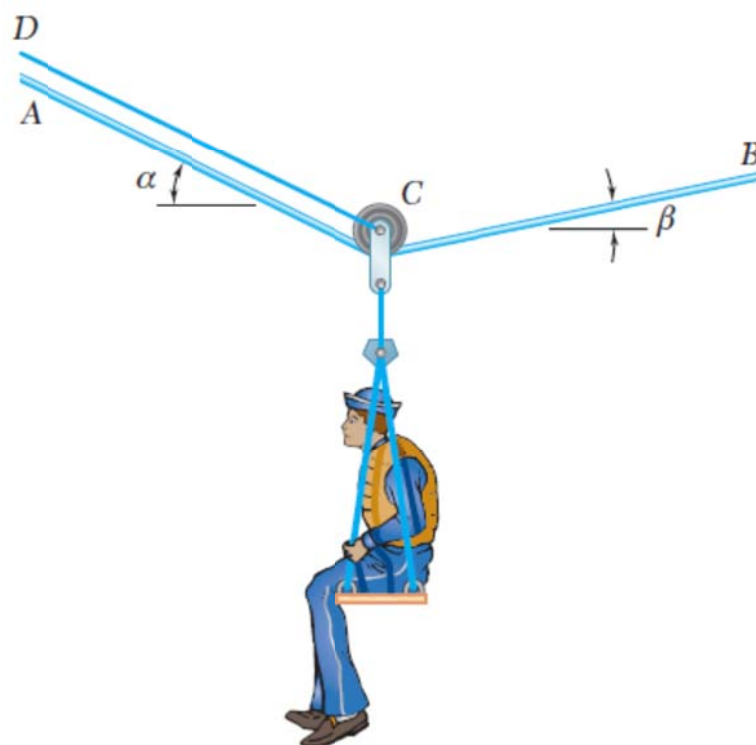


Figure 3

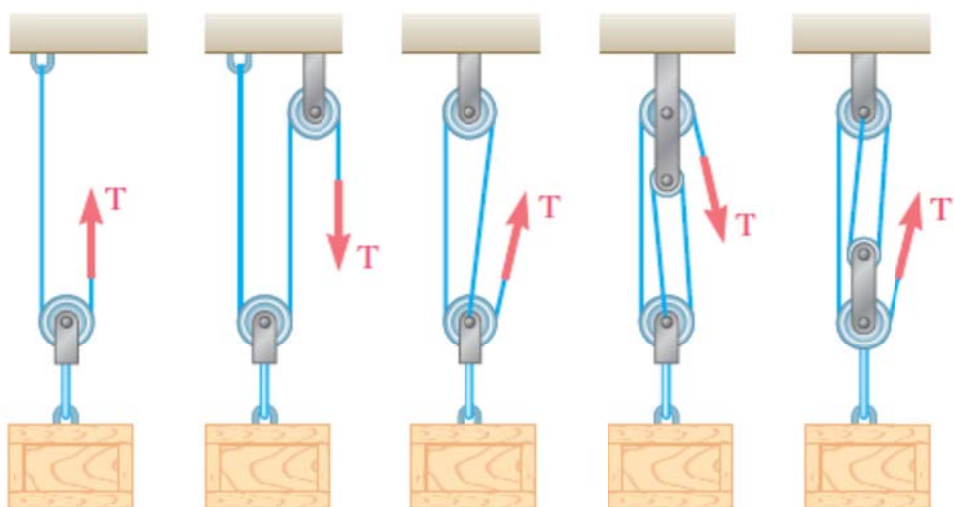


Figure 4

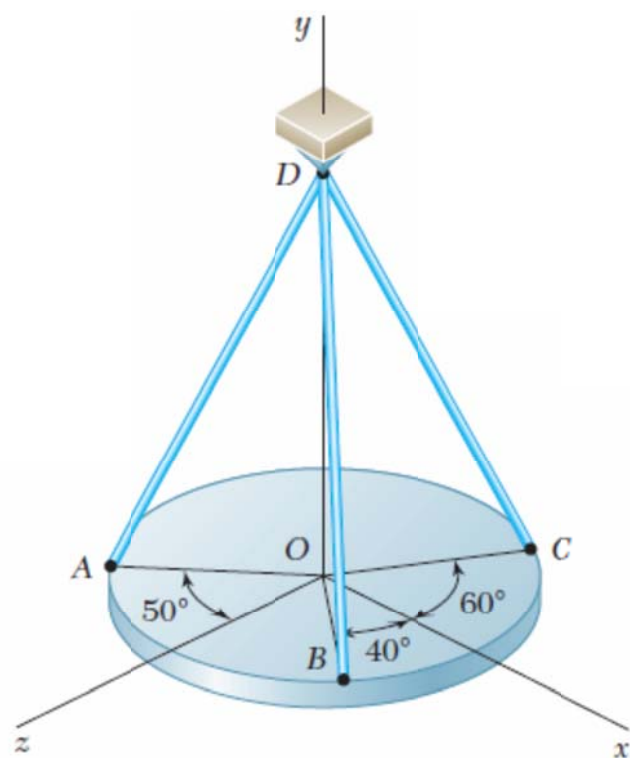


Figure 5

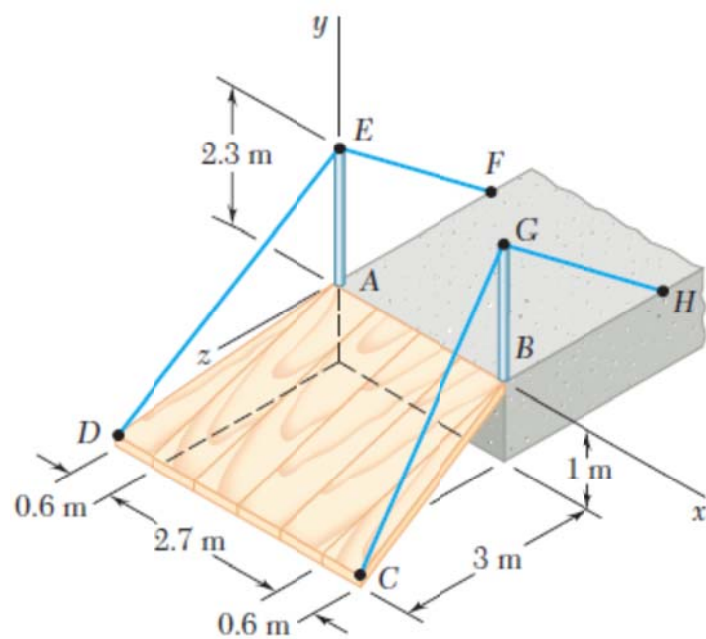


Figure 6

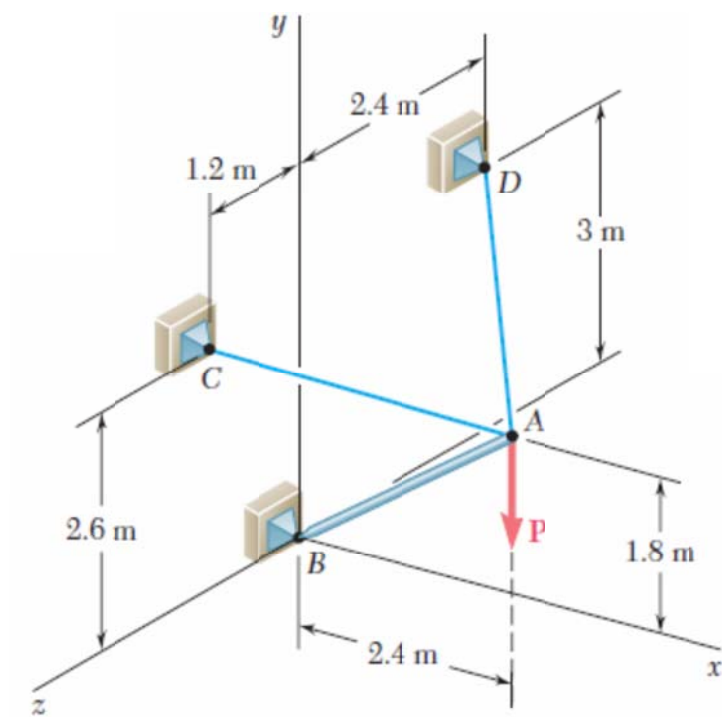


Figure 7

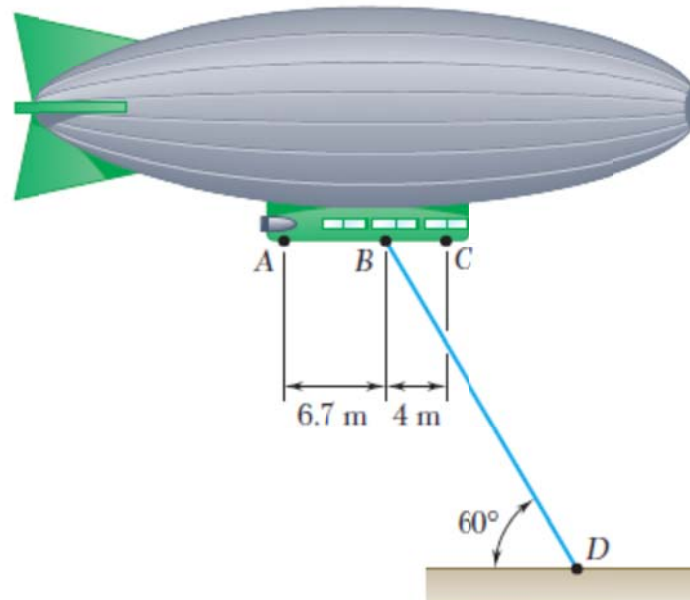


Figure 8

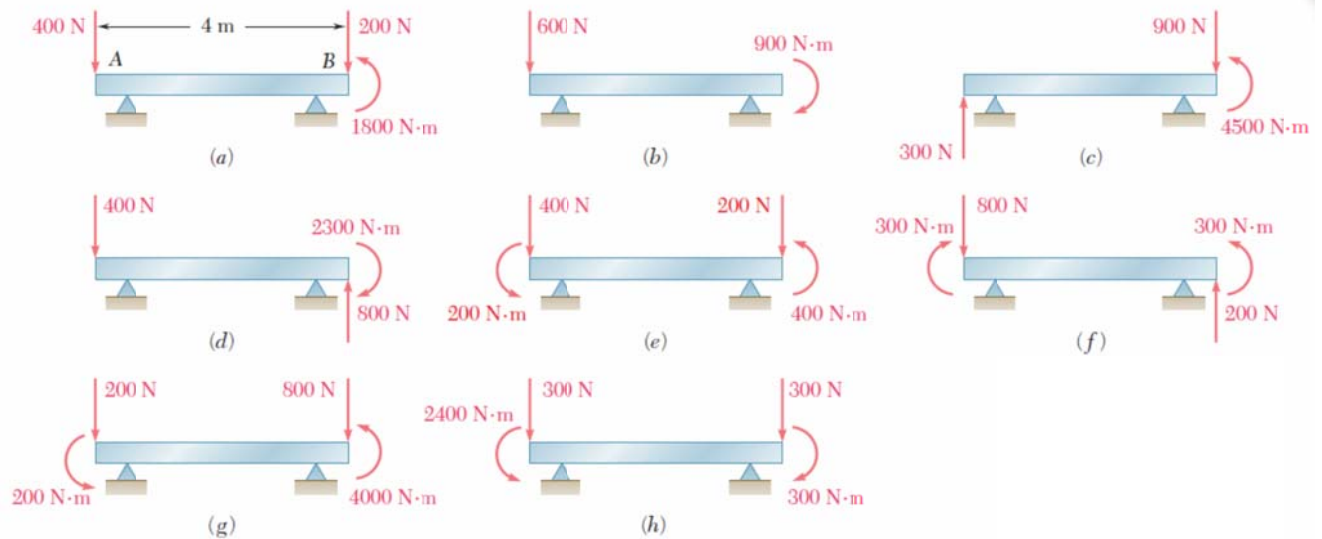


Figure 9

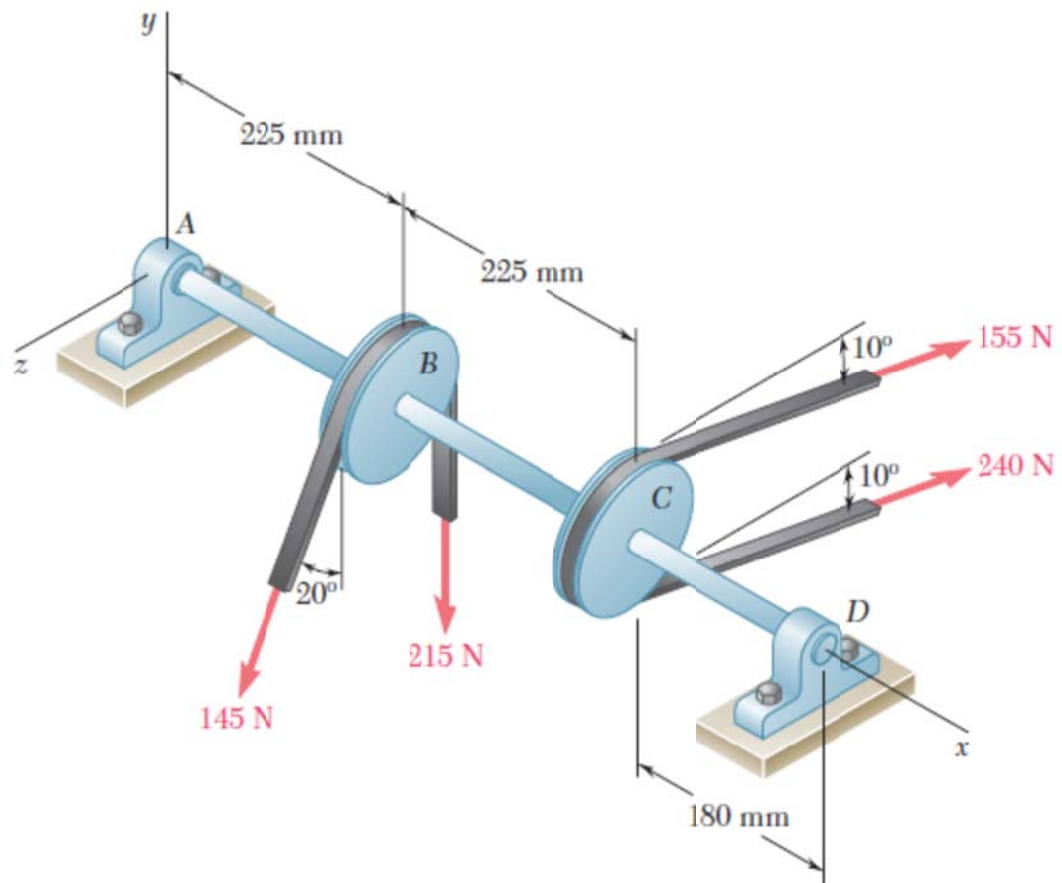


Figure 10

