Indian Institute of Information Technology Design and Manufacturing, Kancheepuram

Department of Mechanical Engineering

Engineering Mechanics

Assignment – 3

1. Determine the force in each member of the Pratt roof truss shown in Figure 1. State whether each member is in tension or compression [Ans:

$$F_{AB} = 47.2 \text{ kN } C;\ F_{AC} = 44.6 \text{ kN } T;\ F_{BC} = 10.50 \text{ kN } C;$$
$$F_{BD} = 47.2 \text{ kN } C;\ F_{CD} = 17.50 \text{ kN } T;\ F_{CE} = 30.6 \text{ kN } T;$$
$$F_{DE} = 0.$$

2. The portion of truss shown in Figure 2 represents the upper part of a power transmission line tower. For the given loading, determine the force in each of the members located above HJ. State whether each member is in tension or compression. [Ans:

$$F_{AB} = F_{DF} = 2.29 \text{ kN } T;\ F_{AC} = F_{EF} = 2.29 \text{ kN } C;$$
$$F_{BC} = F_{DE} = 0.600 \text{ kN } C;\ F_{BD} = 2.21 \text{ kN } T;\ F_{BE} = F_{EH} = 0;$$
$$F_{CE} = 2.21 \text{ kN } C;\ F_{CH} = F_{EJ} = 1.200 \text{ kN } C.$$

3. A Pratt roof truss is loaded as shown in Figure 3. Determine the force in members CE, DE, and DF. [Ans: F_{CE} = 8 kN (T), F_{DE} = 4.5 kN (C), F_{DF} = 10 kN (C)]

4. A stadium roof truss is loaded as shown Figure 4. Determine the force in members AB, AG, and FG. [Ans: F_{AB} = 36.5 kN (T), F_{AG} = 20 kN (T), F_{FG} = 51.6 kN (C)]

5. Locate the centroid of the plane area shown in Figure 5. [Ans: x = 92 mm, y = 23.3 mm] [Ans: x = 0 mm, y = 6.45 inches]

6. The horizontal *x* axis is drawn through the centroid C of the area shown in Figure 6, and it divides the area into two component areas A_1 and A_2. Determine the first moment of each component area with respect to the *x* axis, and explain the results obtained.

7. Determine the centroid of the area shown in Figure 7 by direct integration method in terms of '*a*' and '*h*'. [Ans: $x = a/2$, $y = 2h/5$]

8. Locate the '*x*' and '*z*' coordinates of the centre of gravity for the machine element shown in Figure 8. [Ans: x = 46.8 mm, z = 26.2 mm]

9. Find the moment of inertia by direct integration method for the area shown in Figure 9 with respect to *y* and *x* axes. [Ans: $2a^3b/15$, $2ab^3/7$]

10. Determine the moments of inertia of area shown in Figure 10 with respect to centroidal axes respectively parallel and perpendicular to side AB. [Ans: 48900 mm^4, 8350 mm^4]

11. Find the mass moment of inertia and radius of gyration of the steel machine element shown in Figure 11 w.r.t. the x axis. (The density of steel is 7850 kg/m^3) [Ans: 0.038 $kg.m^2$, k_x = 110.7mm]

Figure 1

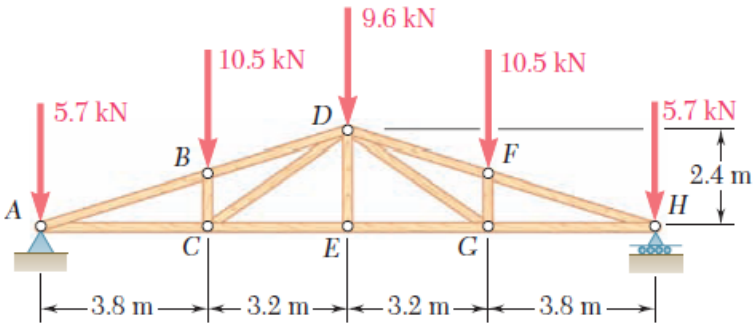


Figure 2

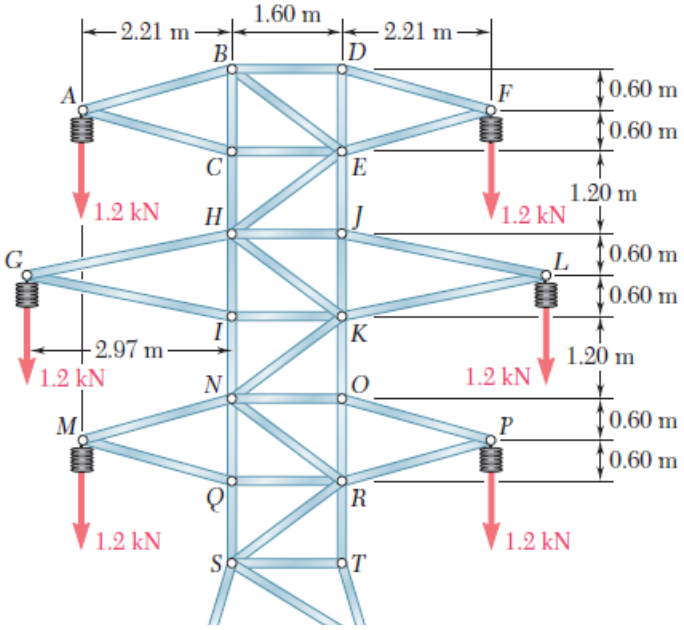


Figure 3

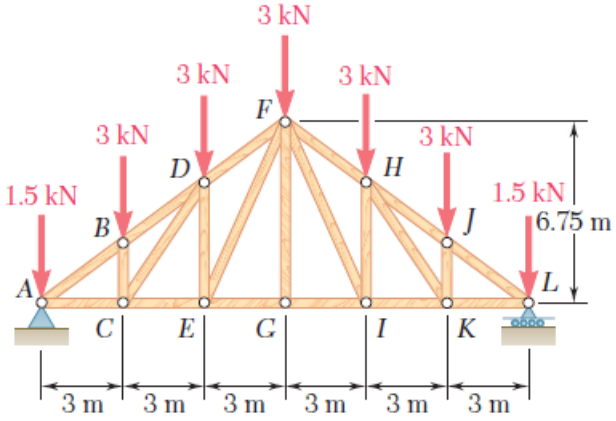
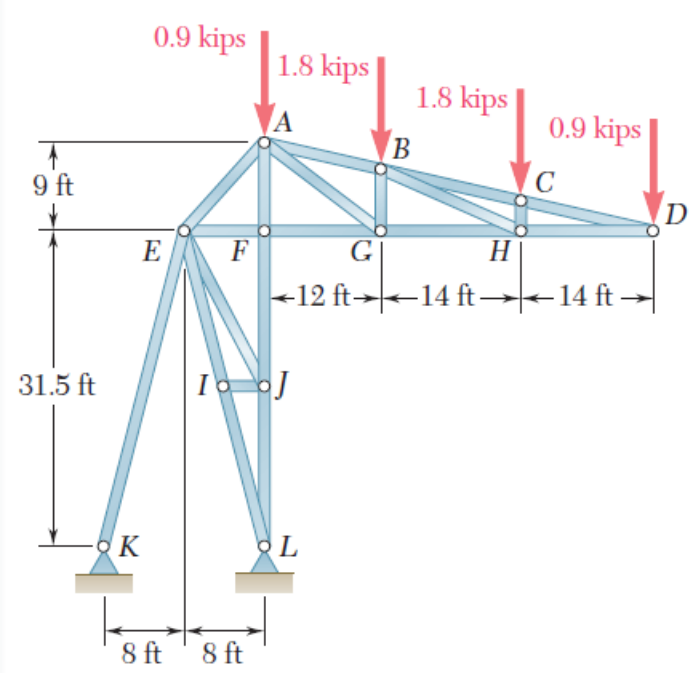


Figure 4



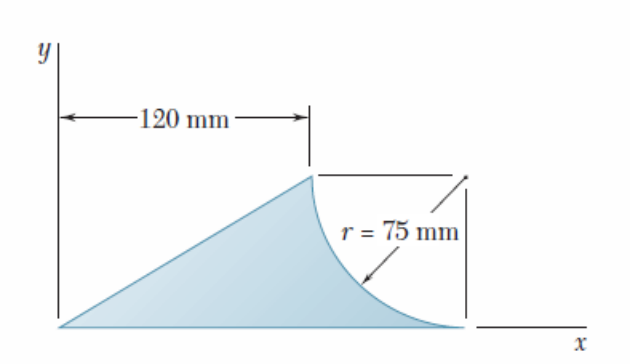


Figure 5 (a)

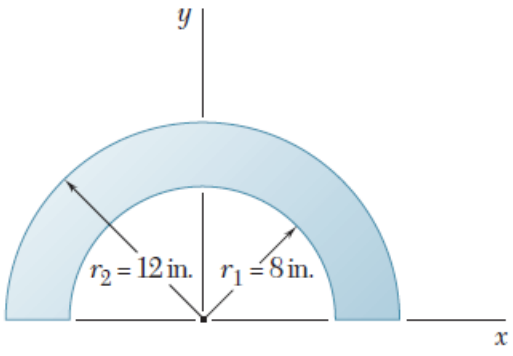


Figure 5 (b)

Figure 6

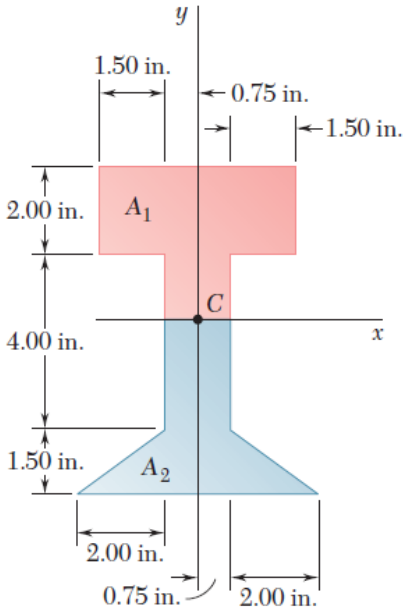


Figure 7

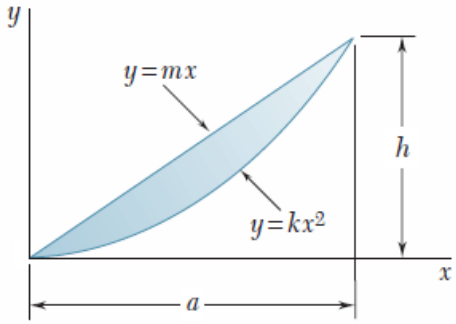


Figure 8

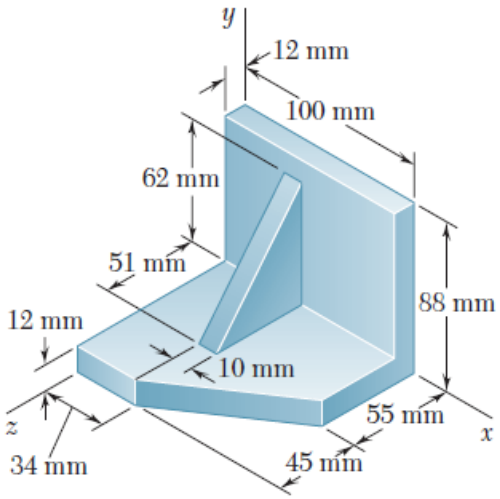


Figure 9

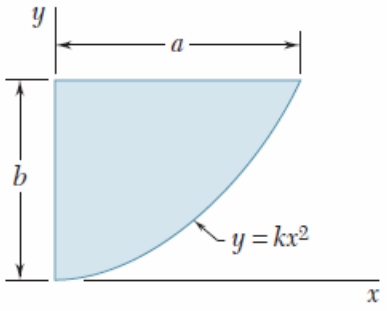


Figure 10

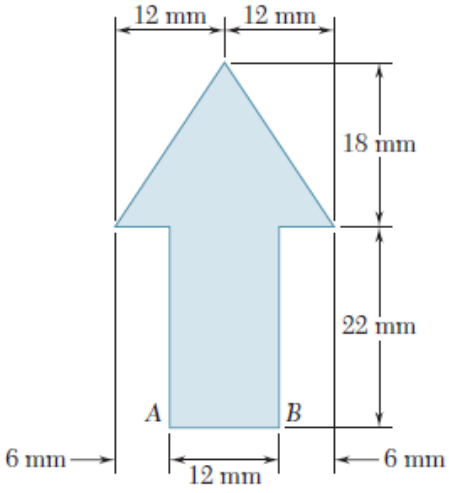


Figure 11