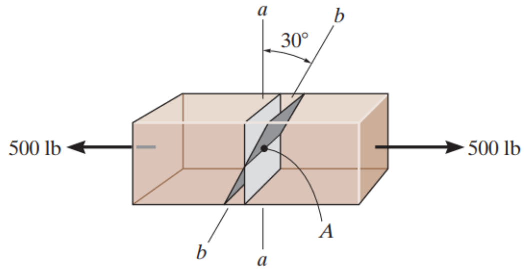
Problem 1-2

Determine the resultant internal normal and shear force in the member at (a) section a–a and (b) section b–b, each of which passes through the centroid A. The 500-lb load is applied along the centroidal axis of the member.

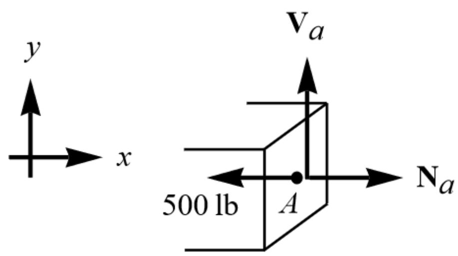


Prob. 1–2

Solution

Part (a)

Use the method of sections to determine the shear and normal forces at A, using cross-section a–a.



Also, use the equilibrium conditions.

$$\sum F_x = N_a - 500 = 0$$

$$\sum F_y = V_a = 0$$

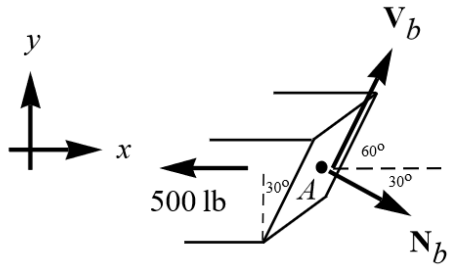
Solve for the normal and shear forces.

$$N_a = 500 \text{ lb}$$

$$V_a = 0$$

Part (b)

Use the method of sections to determine the shear and normal forces at A, using cross-section b–b.



Also, use the equilibrium conditions.

$$\sum F_x = V_b \cos 60^\circ + N_b \cos 30^\circ - 500 = 0$$

$$\sum F_y = V_b \sin 60^\circ - N_b \sin 30^\circ = 0$$

The aim is to solve for V_b and N_b.

$$\frac{V_b}{2} + \frac{\sqrt{3}N_b}{2} - 500 = 0$$

$$\frac{\sqrt{3}V_b}{2} - \frac{N_b}{2} = 0$$

Multiply both sides of the first equation by 2, and solve the second equation for N_b.

$$V_b + \sqrt{3}N_b = 1000$$

$$\sqrt{3}V_b = N_b$$

Substitute this formula for N_b into the first equation and solve for V_b.

$$V_b + \sqrt{3}(\sqrt{3}V_b) = 1000$$

$$4V_b = 1000$$

$$V_b = 250 \text{ lb}$$

Therefore,

$$N_b = \sqrt{3}(250 \text{ lb}) \approx 433 \text{ lb}.$$