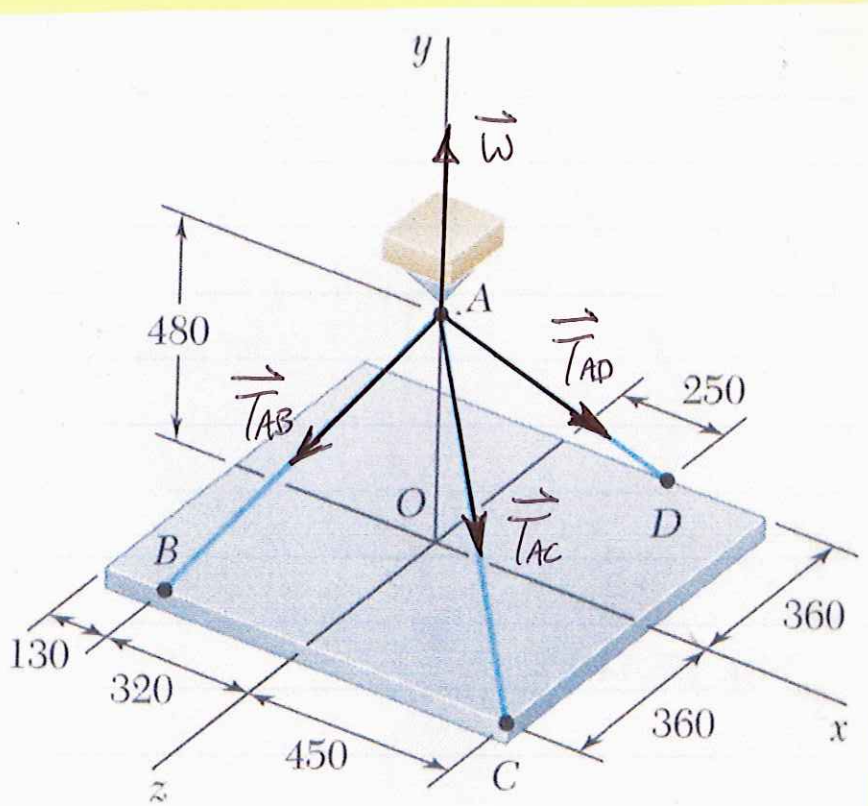


①

PROB. 2.109

$$T_{AC} = 60 \text{ N}, \text{ FIND } W_p$$



Dimensions in mm

Fig. P2.109 and P2.110

$$\text{LOCATE POINTS: } A(0, 480, 0)^{\text{mm}}, B(-320, 0, 360)^{\text{mm}}$$

$$C(450, 0, 360)^{\text{mm}}, D(250, 0, -360)^{\text{mm}}$$

$$\vec{T}_{AB}: dx = x_B - x_A = -320 - 0 = -320^{\text{mm}}$$

$$dy = y_B - y_A = 0 - 480 = -480^{\text{mm}}$$

PROB. 2.109 CONT.

(2)

$$dz = z_B - z_A = 360 - 0 = 360 \text{ mm}$$

$$d = \sqrt{320^2 + 480^2 + 360^2} = 680 \text{ mm}$$

$$F_x = F \frac{dx}{d} = T_{AB} \left(\frac{-320}{680} \right) = -0.470 T_{AB}$$

$$F_y = F \frac{dy}{d} = T_{AB} \left(\frac{-480}{680} \right) = -0.706 T_{AB}$$

$$F_z = F \frac{dz}{d} = T_{AB} \left(\frac{360}{680} \right) = 0.529 T_{AB}$$

$$\vec{T}_{AB} = (-0.470 T_{AB}) \hat{i} + (-0.706 T_{AB}) \hat{j} + (0.529 T_{AB}) \hat{k} \text{ N}$$

$$\vec{T}_{AC}: dx = x_C - x_A = 450 - 0 = 450 \text{ mm}$$

$$dy = y_C - y_A = 0 - 480 = -480 \text{ mm}$$

$$dz = z_C - z_A = 360 - 0 = 360 \text{ mm}$$

$$d = \sqrt{450^2 + 480^2 + 360^2} = 750 \text{ mm}$$

$$F_x = F \frac{dx}{d} = (60 \text{ N}) \left(\frac{450}{750} \right) = 36 \text{ N}$$

$$F_y = F \frac{dy}{d} = (60) \left(\frac{-480}{750} \right) = -38.4 \text{ N}$$

$$F_z = F \frac{dz}{d} = (60) \left(\frac{360}{750} \right) = 28.8 \text{ N}$$

PROB. 2.109 CONT.

3

$$\vec{T}_{AC} = (36)\hat{i} + (-38.4)\hat{j} + (28.8)\hat{k} \text{ N}$$

$$\vec{T}_{AD}: dx = x_D - x_A = 250 - 0 = 250 \text{ mm}$$

$$dy = y_D - y_A = 0 - 480 = -480 \text{ mm}$$

$$dz = z_D - z_A = -360 - 0 = -360 \text{ mm}$$

$$d = \sqrt{250^2 + 480^2 + 360^2} = 650 \text{ mm}$$

$$F_x = F \frac{dx}{d} = T_{AD} \left(\frac{250}{650} \right) = 0.385 T_{AD}$$

$$F_y = F \frac{dy}{d} = T_{AD} \left(\frac{-480}{650} \right) = -0.738 T_{AD}$$

$$F_z = F \frac{dz}{d} = T_{AD} \left(\frac{-360}{650} \right) = -0.554 T_{AD}$$

$$\vec{T}_{AD} = (0.385 T_{AD})\hat{i} + (-0.738 T_{AD})\hat{j} + (-0.554 T_{AD})\hat{k} \text{ N}$$

$$\vec{W} = (W)\hat{j} \text{ N}$$

EQUILIBRIUM EQUATIONS:

$$\sum F_x = 0: -0.470 T_{AB} + 36 + 0.385 T_{AD} = 0$$

$$T_{AB} = 0.819 T_{AD} + 76.6$$

PROB. 2.109 CONT.

(4)

$$\sum F_z = 0: 0.529 T_{AB} + 28.8 - 0.554 T_{AD} = 0$$

$$0.529 (0.819 T_{AD} + 76.6) - 0.554 T_{AD} = -28$$

$$-0.121 T_{AD} = -68.5$$

$$T_{AD} = 566^N$$

$$T_{AB} = 0.819 (566) + 76.6 = 540^N$$

$$\sum F_y = 0: -0.706 T_{AB} - 38.4 - 0.738 T_{AD} + W = 0$$

$$\underline{W = 0.706 (540) + 38.4 + 0.738 (566) = 838^N}$$