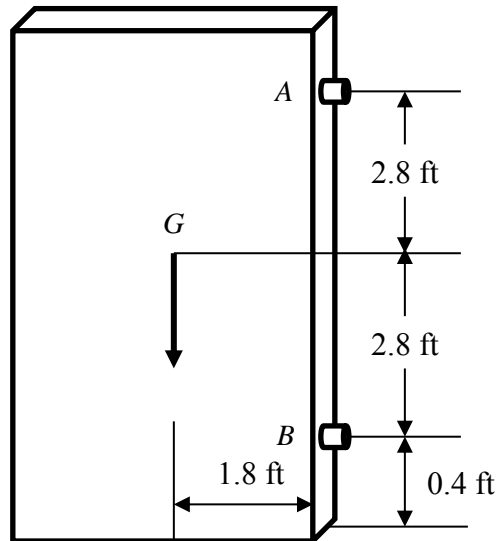
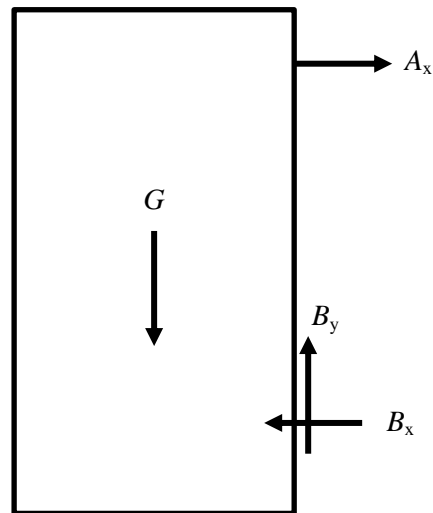


8. The weight of a door follows a normal distribution $N(95, 0.3^2)$ lb due to manufacturing variations. Its center of gravity is located at G . Determine the distributions of the reactions at the hinges if the hinge at A supports only a horizontal reaction on the door, whereas the hinge at B supports both horizontal and vertical reactions.



Solution



$$\begin{aligned} \sum M_B = 0; \quad G(1.8) - A_x(2.8 + 2.8) &= 0; \\ \sum F_x = 0; \quad A_x - B_x &= 0; \\ \sum F_y = 0; \quad B_y - G &= 0. \end{aligned}$$

Since the weight of the door follows the normal distribution $G \sim N(95, 0.3^2)$ lb, therefore, we have

$$\mu_{A_x} = \mu_G(1.8) / 5.6 = 30.54 \text{ lb,}$$

$$\sigma_{A_x} = \sigma_G(1.8) / 5.6 = 0.096 \text{ lb;}$$

$$\mu_{B_x} = \mu_{A_x} = 30.54 \text{ lb,}$$

$$\sigma_{B_x} = \sigma_{A_x} = 0.096 \text{ lb;}$$

$$\mu_{B_y} = \mu_G = 95 \text{ lb,}$$

$$\sigma_{B_y} = \sigma_G = 0.3 \text{ lb.}$$

Consequently, we have all three reactions distributions, $A_x \sim N(30.54, 0.096^2)$ lb, $B_x \sim N(30.54, 0.096^2)$ lb and $B_y \sim N(95, 0.3^2)$ lb. **Ans.**