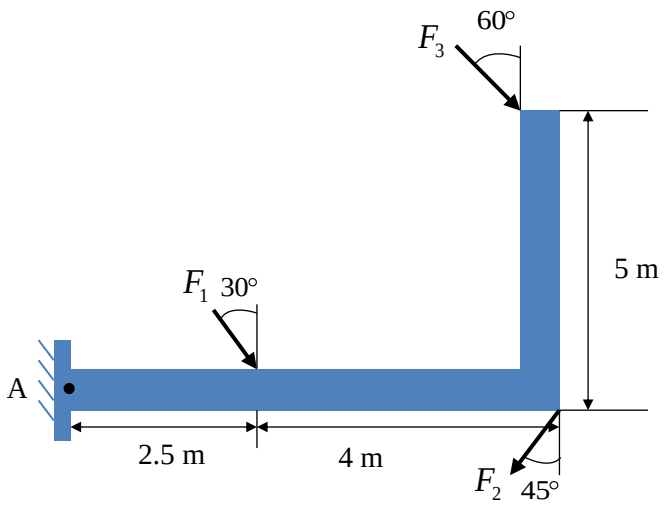
24. F_1, F_2, and F_3 are normally and independently distributed and their distributions are $F_1 \sim N(350, 3^2)$ N, $F_2 \sim N(450, 5^2)$ N, and $F_3 \sim N(650, 8^2)$ N, respectively. Determine the distribution of the resultant moment about point *A*.



Solution

$$M_A = F_1(\cos 30^\circ)(2.5) + F_2(\cos 45^\circ)(6.5) + F_3(\cos 60^\circ)(6.5) + F_3(\sin 60^\circ)(5)$$

Thus

$$\mu_{M_A} = \mu_{F_1}(\cos 30^\circ)(2.5) + \mu_{F_2}(\cos 45^\circ)(6.5) + \mu_{F_3}(\cos 60^\circ)(6.5) + \mu_{F_3}(\sin 60^\circ)(5)$$

$$\sigma_{M_A} = \sqrt{\left(\sigma_{F_1}(\cos 30^\circ)(2.5)\right)^2 + \left(\sigma_{F_2}(\cos 45^\circ)(6.5)\right)^2 + \left(\sigma_{F_3}(\cos 60^\circ)(6.5)\right)^2 + \left(\sigma_{F_3}(\sin 60^\circ)(5)\right)^2}$$

From the distributions $F_1 \sim N(350, 5^2)$ N, $F_2 \sim N(450, 8^2)$ N, and $F_3 \sim N(450, 8^2)$ N, we have

$$\mu_{M_A} = 7753 \text{ N}\cdot\text{m}$$

$$\mu_{M_A} = 495 \text{ N}\cdot\text{m}$$

Finally, we obtain the distribution of M_A is: $M_A \sim N(7753, 495^2)$ N·m **Ans**