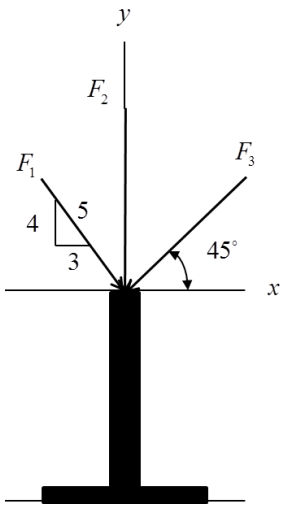
11. In the figure, F_1, F_2 and F_3 are normally and independently distributed, respectively. Their distributions are $F_1 \sim \text{N}(180,10)$ lb, $F_2 \sim \text{N}(300,20)$ lb, and $F_3 \sim \text{N}(100,5)$ lb. Determine the distribution of magnitude of the resultant force in *y* axis.



Solution

$$F_y = F_1\left(\frac{4}{5}\right) + F_2 + F_3 \sin 45^\circ$$

$$\mu_{F_y} = \mu_{F_1}\left(\frac{4}{5}\right) + \mu_{F_2} + \mu_{F_3} \sin 45^\circ = 180\left(\frac{4}{5}\right) + 300 + 100\left(\frac{\sqrt{2}}{2}\right) = 514.7 \text{ lb}$$

$$\sigma_{F_y} = \sqrt{\sigma_{F_1}^2\left(\frac{4}{5}\right)^2 + \sigma_{F_2}^2 + \sigma_{F_3}^2 (\sin 45^\circ)^2} = \sqrt{8^2 + 20^2 + 5^2\left(\frac{\sqrt{2}}{2}\right)^2} = 21.83$$

Thus, the distribution of magnitude of the resultant force in *y* axis is: $F_y \sim \text{N}(514.7, 21.83)$ lb. **Ans.**