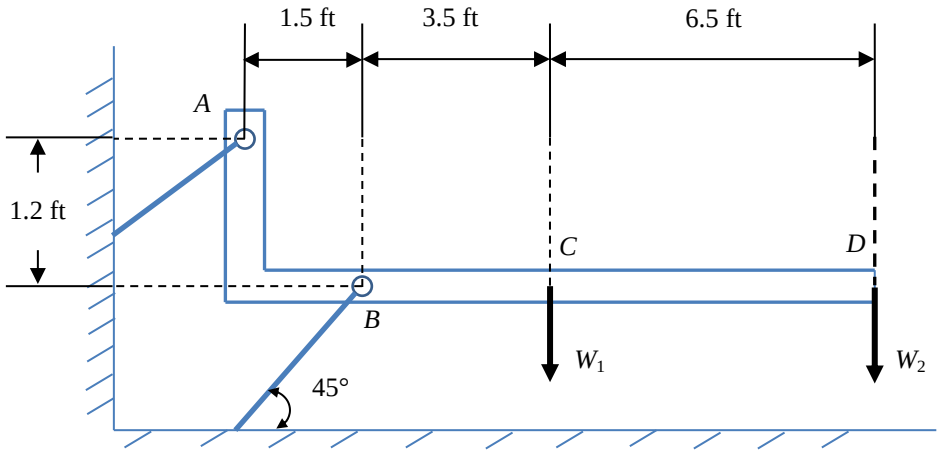
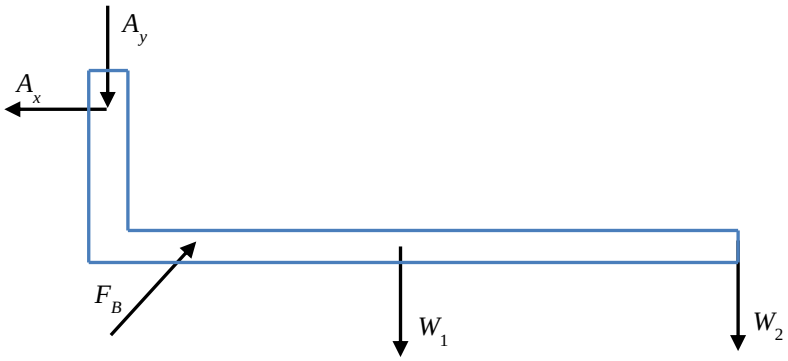
19. Component *ABCD* supports two independent loads $W_1 \sim N(150, 5^2)$ lb and $W_2 \sim N(550, 7.5^2)$ lb. Determine the distributions of *x* and *y* components of the force acting on pin *A*.



Solution



$$\sum M_A = 0; \quad F_B \cos 45^\circ (1.5) + F_B \sin 45^\circ (1.2) - W_1(5) - W_2(11.5) = 0$$

Therefore, we can obtain:

$$\mu_{F_B} = \frac{\mu_{W1}(5) + \mu_{W_2}(11.5)}{\cos 45^\circ (1.5) + \sin 45^\circ (1.2)} = 3705.8 \text{ lb}$$

$$\sigma_{F_B} = \frac{\sqrt{\sigma_{W_1}^2 (5^2) + \sigma_{W_2}^2 (11.5^2)}}{\cos 45^\circ (1.5) + \sin 45^\circ (1.2)} = 47$$

Also, we have:

$$\sum F_x = 0; \quad -A_x + F_B \cos 45^\circ = 0$$

And,

$$\sum F_y = 0; \quad -A_y + F_B \sin 45^\circ - W_1 - W_2 = 0$$

Thus, we can obtain:

$$\mu_{A_x} = \mu_{F_B} \cos 45^\circ = 2620.4 \text{ lb}$$

$$\sigma_{A_x} = \sigma_{F_B} \cos 45^\circ = 33.23$$

$$\mu_{A_y} = \mu_{F_B} \sin 45^\circ - \mu_{W_1} - \mu_{W_2} = 1920.4 \text{ lb}$$

$$\sigma_{A_y} = \sqrt{\sigma_{w_1}^2 + \sigma_{w_2}^2 + (\sigma_{F_B} \sin 45^\circ)^2} = 34.43$$

Finally, we have $A_x \sim N(2620.4, 33.23^2)$ lb and $A_y \sim N(1920.4, 34.43^2)$ lb. **Ans**.