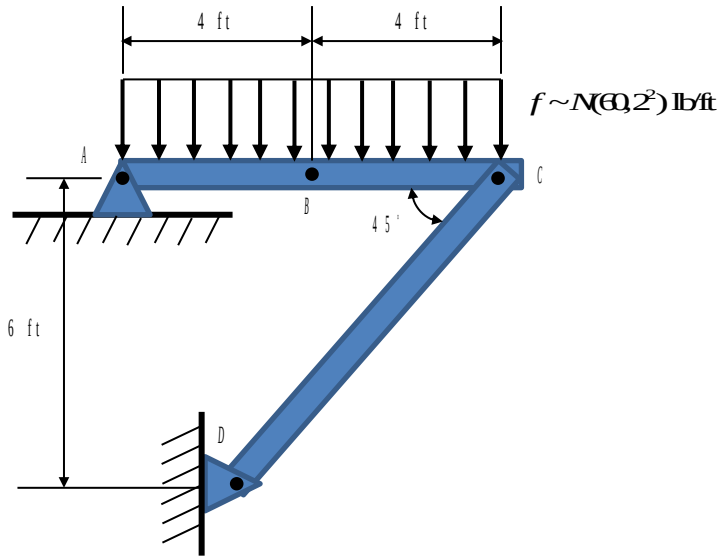
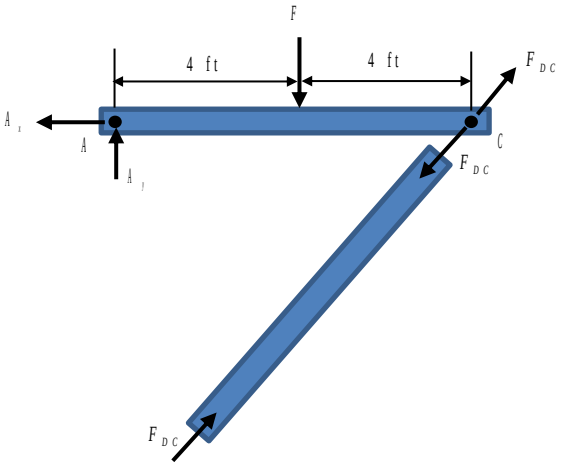
4. If the distributed load follows a normal distribution $f \sim N(60, 2^2)$ lb/ft, determine the distributions of the internal normal force and shear force acting at point *B* of the two-member frame shown in the figure.



Solution

A free-body diagram is shown below.



Due to $f \sim N(60, 2^2)$ lb/ft , we know $F = 8f \sim N(480, 16^2)$ lb .

$$\Sigma M_A = 0; \quad -F(4) + F_{DC} \sin 45^\circ (8) = 0$$

$$\mu_{F_{DC}} = \frac{4\mu_F}{8\sin 45^\circ} = \frac{4(480)}{8\sin 45^\circ} = 339.46 \text{ lb}$$

$$\sigma_{F_{DC}} = \frac{4\sigma_F}{8\sin 45^\circ} = \frac{4(16)}{8\sin 45^\circ} = 11.32$$

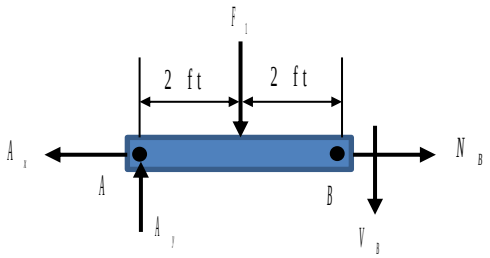
Thus, $F_{DC} \sim N(339.46, 11.32^2)$ lb.

$$\Sigma F_x = 0; \; -A_x + F_{DC}\cos 45^\circ = 0$$

$$\Sigma F_y = 0; \; A_y - 400 + F_{DC}\sin 45^\circ = 0$$

Solving the equations, we have $A_x \sim N(240, 8^2)$ lb and $A_y \sim N(160, 8^2)$ lb.

From the free-body diagram below,



$$\Sigma F_x = 0; \; A_x - N_B = 0$$

$$\Sigma F_y = 0; \; A_y - V_B - F_1 = 0$$

$$F_1 = 4f$$

Thus, the normal force is $N_B = A_x \sim N(240, 8^2)$ lb; the shear force is $V_B \sim N(-80, 11.3^2)$ lb. **Ans.**