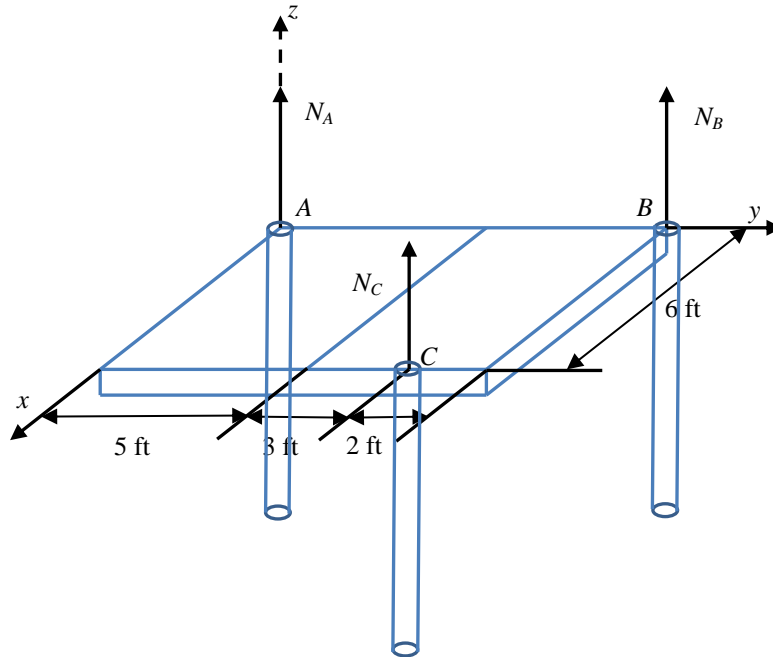


22. The uniform plate with a weight of  $W \sim N(500, 10^2)$  lb is supported by three columns. Determine the forces to which the columns are subject. Assume that the radius of the column is so small that the corresponding normal force can be regarded as point force which is shown as below.



### Solution

Equations of equilibrium

$$\sum M_y = 0; \quad W(3) - N_C(6) = 0$$

Then, we have

$$\mu_{N_C} = \mu_W / 2 = 250 \text{ lb}$$

$$\sigma_{N_C} = \sigma_W / 2 = 5$$

$$N_C \sim N(250, 5^2) \text{ lb}$$

**Ans.**

Also

$$\sum M_x = 0; \quad W(5) - N_C(8) - N_B(10) = 0$$

Then, we have:

$$\mu_{N_B} = \mu_W / 2 - \mu_{N_C} (4/5) = 50 \text{ lb}$$

$$\mu_{N_B} = \sqrt{(\mu_W / 2)^2 + (4\mu_{N_C} / 5)^2} = 6.4$$

$$N_B \sim N(50, 6.4^2) \text{ lb}$$

**Ans.**

Also, we have

$$\sum F_z = 0; \quad W = N_A + N_B + N_C$$

Then, we can obtain

$$\mu_{N_A} = \mu_W - \mu_{N_B} - \mu_{N_C} = 200 \text{ lb}$$

$$\sigma_{N_A} = \sqrt{\sigma_W^2 + \sigma_{N_B}^2 + \sigma_{N_C}^2} = 12.88$$

$$N_A \sim N(200, 12.88^2) \text{ lb}$$

**Ans.**