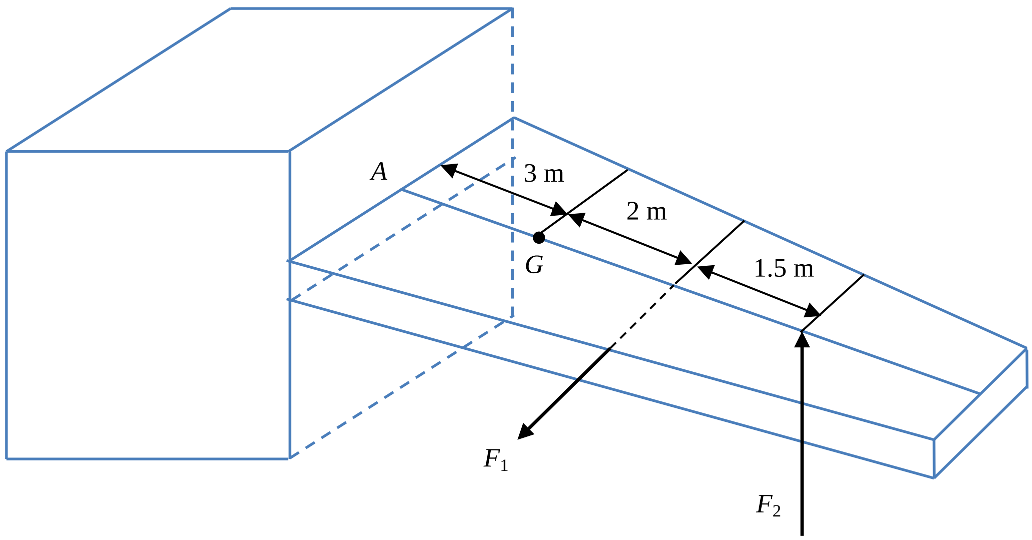
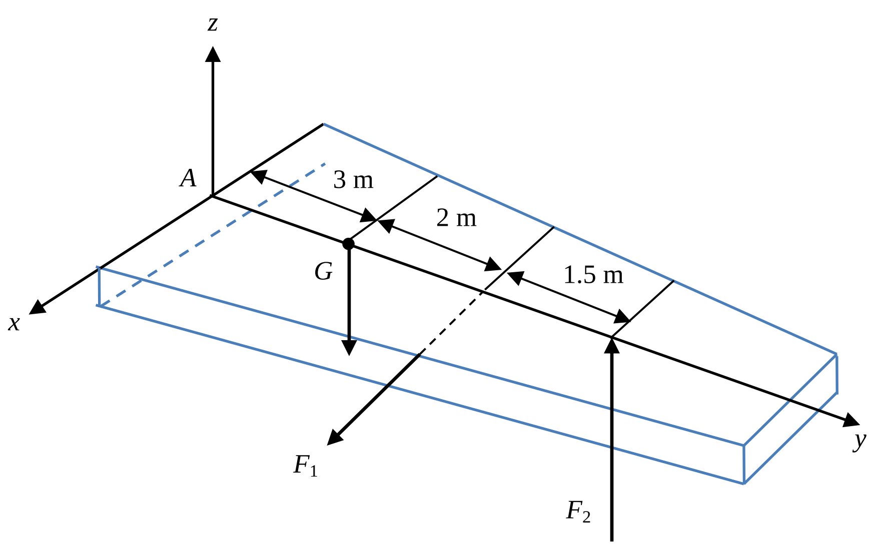
26. A slab is subjected to two independently and normally distributed forces $F_1 \sim N(500,5^2)$ N and $F_2 \sim N(250, 2^2)$ N. If the mass of the slab is $m \sim N(100, 2.5^2)$ kg, determine the x, y, z components of the reaction at A where the slab is fixed to the box. Assuming the thickness of the slab is negligible.



Solution



$$\sum F_x = 0; \quad A_x = F_1$$

Therefore, we have

$$\mu_{A_x} = \mu_{F_1} = 500 \text{ N}$$

$$\sigma_{A_x} = \sigma_{F_1} = 5 \qquad \textbf{Ans.}$$

Also, we have

$$\sum F_y = 0; \quad A_y = 0 \qquad \textbf{Ans.}$$

And,

$$\sum F_z = 0; \quad A_z + F_2 = mg$$

Thus, we have

$$\mu_{A_z} = \mu_m(g) - \mu_{F_2} = 731 \text{ N}$$

$$\sigma_{A_z} = \sqrt{(\sigma_m g)^2 + \sigma_{F_2}^2} = 24.6 \qquad \textbf{Ans}.$$

Also, we can obtain,

$$\sum M_y = 0; \quad M_y = 0 \qquad \textbf{Ans}.$$

$$\sum M_x = 0; \quad F_2(6.5) - mg(3) - M_x = 0$$

Thus, we can have,

$$\mu_{M_x} = \mu_m g(3) - \mu_{F_2}(6.5) = 1318 \text{ N/m}$$

$$\sigma_{M_x} = \sqrt{(\sigma_m g(3))^2 + (\sigma_{F_2}(6.5))^2} = 74.7 \qquad \textbf{Ans}.$$

Also,

$$\sum M_z = 0; \quad M_z = F_1(5)$$

We can obtain,

$$\mu_{M_z} = \mu_{F_1}(5) = 2500 \text{ N}$$

$$\sigma_{M_z} = \sigma_{F_1}(5) = 25 \qquad \textbf{Ans}.$$