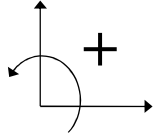
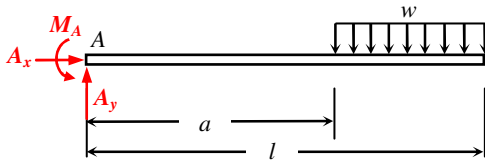


## CVG2140 – Solutions to Exercise Problems No. 1 (External Reactions)

Sign convention



4.



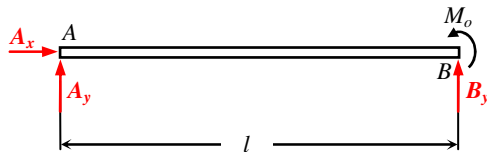
$$\sum F_x = A_x = 0$$

$$\sum F_y = A_y - w(l-a) = 0$$

$$\sum M_A = M_A - \left[ w \times (l-a) \times \left( \frac{a+l}{2} \right) \right] = 0$$

$$A_x = 0; \quad A_y = w(l-a) = 4 \text{ kN}; \quad M_A = \frac{w}{2}(l^2 - a^2) = 22 \text{ kN} \cdot \text{m}$$

5.



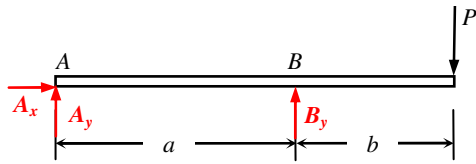
$$\sum F_x = A_x = 0$$

$$\sum F_y = A_y + B_y = 0$$

$$\sum M_A = M_o + (B_y \times l) = 0$$

$$A_x = 0; \quad A_y = \frac{M_o}{l} = 1.875 \text{ kN}; \quad B_y = -\frac{M_o}{l} = -1.875 \text{ kN}$$

7.



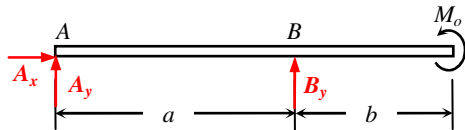
$$\sum F_x = A_x = 0$$

$$\sum F_y = A_y + B_y - P = 0$$

$$\sum M_A = (B_y \times a) - [P \times (a + b)] = 0$$

$$A_x = 0; \quad A_y = -P \frac{b}{a} = -3.33 \text{ kN}; \quad B_y = P \left(1 + \frac{b}{a}\right) = 13.33 \text{ kN}$$

8.



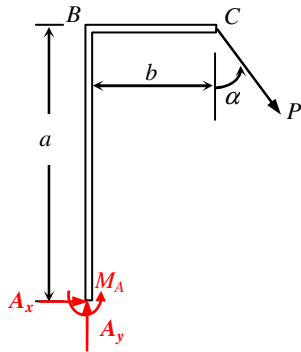
$$\sum F_x = A_x = 0$$

$$\sum F_y = A_y + B_y = 0$$

$$\sum M_A = (B_y \times a) + M_o = 0$$

$$A_x = 0; \quad A_y = \frac{M_o}{a} = 5 \text{ kN}; \quad B_y = -\frac{M_o}{a} = -5 \text{ kN}$$

9.



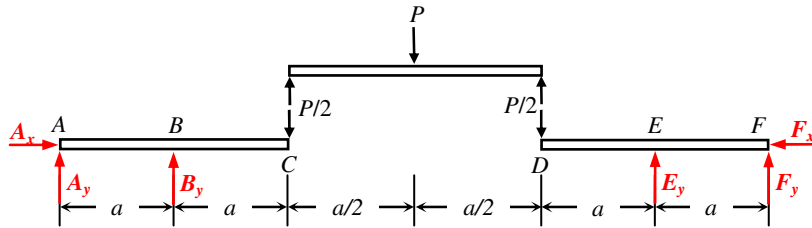
$$\sum F_x = A_x + P \sin \alpha = 0$$

$$\sum F_y = A_y - P \cos \alpha = 0$$

$$\sum M_A = M_A - (P \cos \alpha \times b) - (P \sin \alpha \times a) = 0$$

$$A_x = -P \sin \alpha = -5 \text{ kN}; \quad A_y = P \cos \alpha = 8.66 \text{ kN}; \quad M_A = P(b \cos \alpha + a \sin \alpha) = 23.66 \text{ kN} \cdot \text{m}$$

13.



By establishing equilibrium on segment ABC:

$$\sum F_x = A_x = 0$$

$$\sum F_y = A_y + B_y - P/2 = 0$$

$$\sum M_A = (B_y \times a) - \left( \frac{P}{2} \times 2a \right) = 0$$

$$A_x = 0; \quad A_y = -\frac{P}{2} = -5 \text{ kN}; \quad B_y = P = 10 \text{ kN}$$

Likewise, by establishing equilibrium on segment DEF:

$$\sum F_x = -F_x = 0$$

$$\sum F_y = E_y + F_y - P/2 = 0$$

$$\sum M_F = -(E_y \times a) + \left( \frac{P}{2} \times 2a \right) = 0$$

$$F_x = 0; \quad F_y = -\frac{P}{2} = -5 \text{ kN}; \quad E_y = P = 10 \text{ kN}$$