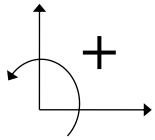
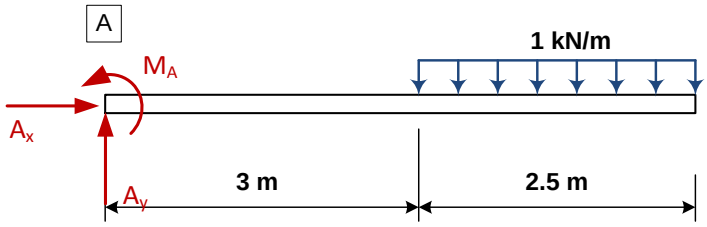
CVG 2140 – Solution to Assignment No. 1 (External Reactions)

Sign convention

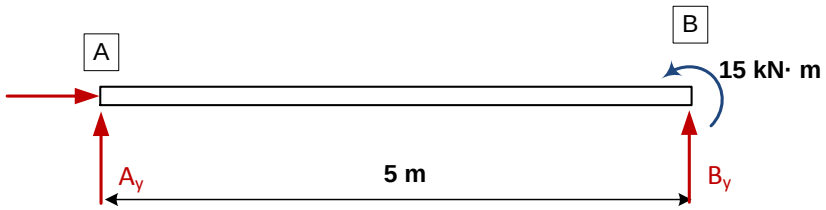


1.



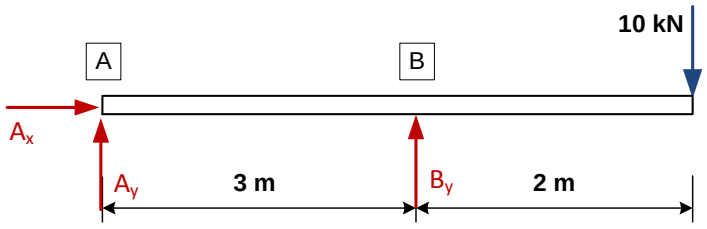
$$\left.\begin{aligned}\sum F_x &= A_x = 0\\ \sum F_y &= A_y - (1)(2.5) = 0\\ \sum M_A &= M_A - \left[(1)\times(2.5)\times(3+1.25)\right] = 0\end{aligned}\right\} \Rightarrow \begin{aligned}A_x &= 0\\ A_y &= 2.5\ \text{kN}\\ M_A &= 10.6\ \text{kN}\cdot\text{m}\end{aligned}$$

2.



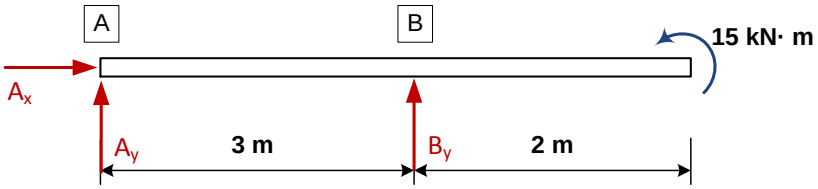
$$\left.\begin{aligned}\sum F_x &= A_x = 0\\ \sum F_y &= A_y + B_y = 0\\ \sum M_A &= 15 + (B_y \times 5) = 0\end{aligned}\right\} \Rightarrow \begin{aligned}A_x &= 0\\ A_y &= 3\ \text{kN}\\ B_y &= -3\ \text{kN}\end{aligned}$$

3.



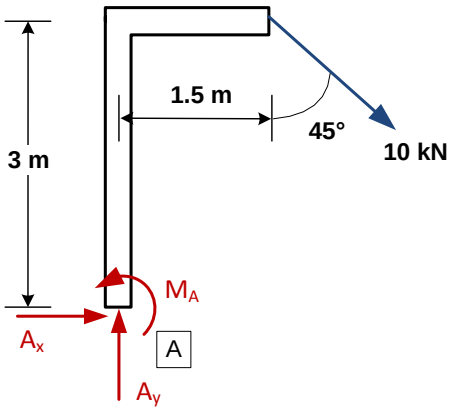
$$\left.\begin{aligned}\sum F_x &= A_x = 0\\ \sum F_y &= A_y + B_y - 10 = 0\\ \sum M_A &= (B_y \times 3) - (10\times 5) = 0\end{aligned}\right\} \Rightarrow \begin{aligned}A_x &= 0\\ A_y &= -6.7\ \text{kN}\\ B_y &= 16.7\ \text{kN}\end{aligned}$$

4.



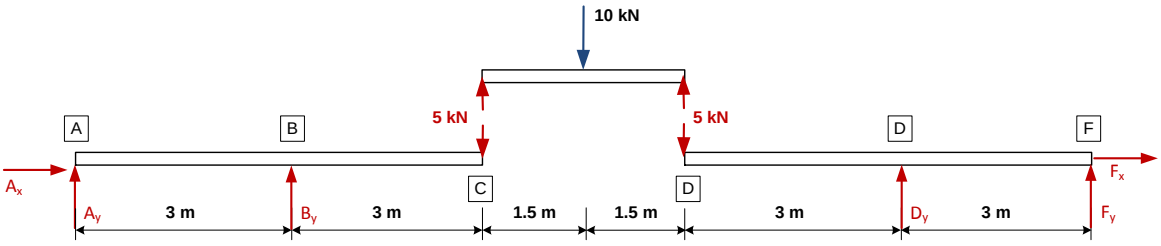
$$\left.\begin{aligned}\sum F_x &= A_x = 0\\ \sum F_y &= A_y + B_y = 0\\ \sum M_A &= \left(B_y \times 3\right) + 15 = 0\end{aligned}\right\} \Rightarrow \begin{aligned}A_x &= 0\\ A_y &= 5\ \text{kN}\\ B_y &= -5\ \text{kN}\end{aligned}$$

5.



$$\sum F_x = A_x + 10\sin 45^\circ = 0$$
$$\sum F_y = A_y - 10\cos 45^\circ = 0$$
$$\sum M_A = M_A - \left(10\cos 45^\circ \times 1.5\right) - \left(10\sin 45^\circ \times 3\right) = 0$$
$$A_x = -7.1\ \text{kN},\quad A_y = 7.1\ \text{kN},\quad M_A = 31.9\ \text{kN}\cdot\text{m}$$

6.



By establishing equilibrium on segment *ABC*:

$$\left.\begin{aligned}\sum F_x &= A_x = 0\\ \sum F_y &= A_y + B_y - 5 = 0\\ \sum M_A &= \left(B_y \times 3\right) - \left(5 \times 6\right) = 0\end{aligned}\right\} \Rightarrow \begin{aligned}A_x &= 0\\ A_y &= -5\ \text{kN}\\ B_y &= 10\ \text{kN}\end{aligned}$$

Likewise, by establishing equilibrium on segment *DEF*:

$$\left.\begin{aligned}\sum F_x &= F_x = 0\\ \sum F_y &= D_y + F_y - 5 = 0\\ \sum M_F &= -\left(D_y \times 3\right) + \left(5 \times 6\right) = 0\end{aligned}\right\} \Rightarrow \begin{aligned}F_x &= 0\\ F_y &= -5\ \text{kN}\\ D_y &= 10\ \text{kN}\end{aligned}$$