# Week HW 3, Statics analysis

Anas Khmais Hamrouni

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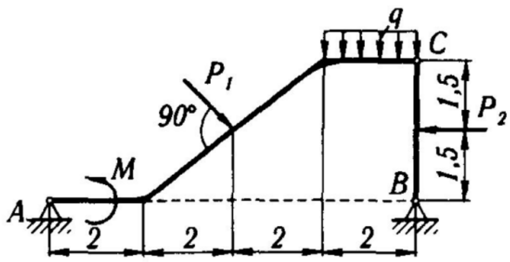
## Task 1:

**Find reaction forces in support of the given construction systems. Sizes and loads are given.**




## Solution:

We notice that joint C can be considered as common point of bodies AC and BC, if we write the moment equation of body BC, it will be easy to find X component of reaction force at C.

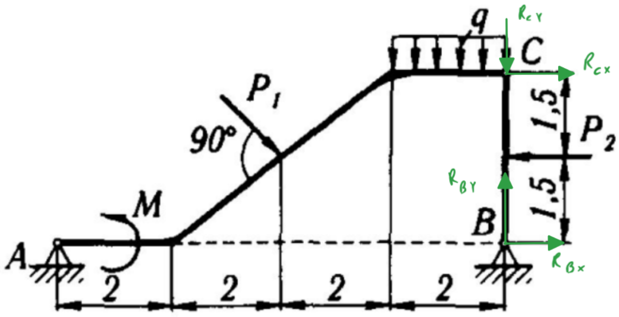



Figure 1: Reaction forces of BC

$$M_{i/B} = P_2 \times 1.5 - R_{c_x} \times (1.5 \times 2) = 0$$

$$\Rightarrow R_{c_x} = P_2 \times \frac{1.5}{1.5 \times 2}$$

$$\boxed{R_{c_x} = \frac{1}{2} P_2}$$

Now we look for the Y component of the reaction force in C by writing the moment equation of the body AC

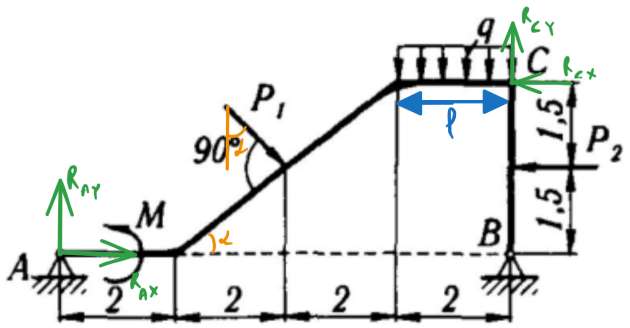



Figure 2: Reaction forces of AC

Angle $\alpha$?

$$\alpha = \tan^{-1}\left(\frac{1.5 \times 2}{4}\right) = 36.86°$$

Body AC:

$$\sum M_{i/A} = M - P_1 \sin\alpha \times 1.5 - P_1 \cos\alpha \times 4 - (q \times l) \times \frac{l}{2} \times (2 \times 3 + 1)$$

$$+ R_{c_x} \times (1.5 \times 2) + R_{c_y} \times (2 \times 4) = 0$$

$$\boxed{R_{c_y} = \frac{-M + P_1 \sin\alpha \times 1.5 + P_1 \cos\alpha \times 4 + q\frac{l^2}{2} \times 7 - R_{c_x} \times 3}{8}}$$

Now let us apply the equation of forces applied on BC along X and Y axis separately to find force of reaction at B

$$\sum_i F_x = 0 \quad \Rightarrow \quad R_{c_x} - P_2 + R_{B_x} = 0$$

$$R_{B_x} = P_2 - R_{c_x}$$

$$\sum_i F_y = 0 \quad \Rightarrow \quad -R_{c_y} + R_{B_y} = 0$$

$$\boxed{R_{B_y} = R_{c_y}}$$

Same for reaction at A

$$\sum F_x = 0$$

$$R_{Ax} + P_1 \sin\alpha - R_{Cx} = 0$$

$$R_{Ax} = R_{Cx} - P_1 \sin\alpha$$

$$\sum F_y = 0$$

$$R_{Ay} - P_1 \cos\alpha - ql + R_{Cy} = 0$$

$$\boxed{R_{Ay} = P_1 \cos\alpha + ql - R_{Cy}}$$