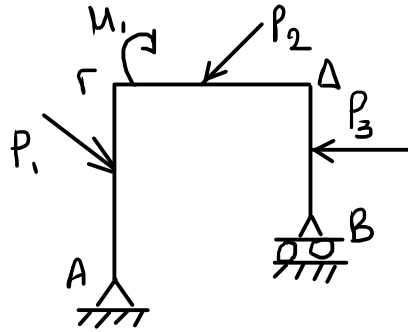
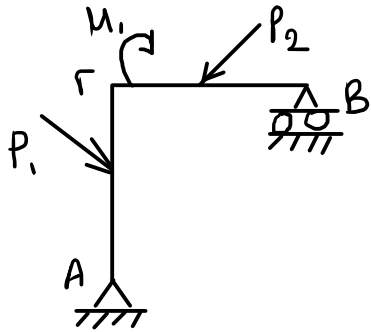


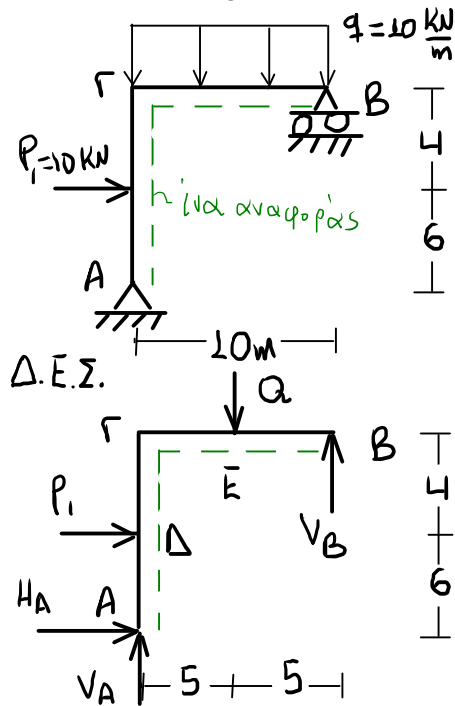
Μηχανική Ι:

Πλαίσια:



Σύνολο δοκών που ενώνονται με
εσωτερική πλάκωση (συγκόλληση)
όαν να είναι ένας ενιαίος φορέας

Παράδειγμα:



$$Q = 10 \cdot 10 = 10 \cdot 10 = 100 \text{ kN}$$

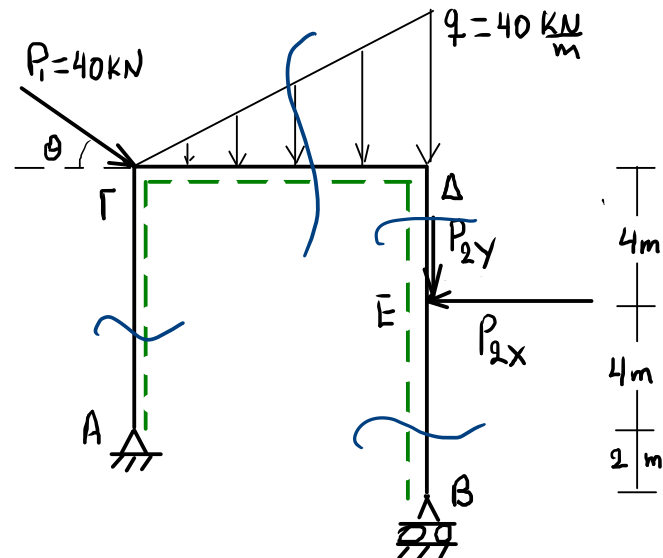
$$\begin{aligned} (+) \sum F_x = 0 &\Rightarrow H_A + P_1 = 0 \Rightarrow H_A = -P_1 \Rightarrow H_A = -10 \text{ kN} \quad (1) \end{aligned}$$

$$\begin{aligned} (+) \uparrow \sum F_y = 0 &\Rightarrow V_A - Q + V_B = 0 \Rightarrow V_A + V_B = 100 \quad (2) \end{aligned}$$

$$\begin{aligned} \curvearrowright \sum M_A = 0 &\Rightarrow -P_1 \cdot 6 - Q \cdot 5 + V_B \cdot 10 = 0 \Rightarrow \\ V_B &= \frac{6 \cdot 10 + 100 \cdot 5}{10} \Rightarrow V_B = 56 \text{ kN} \quad (3) \end{aligned}$$

$$(2) \xrightarrow{(3)} V_A = 100 - 56 \Rightarrow V_A = 44 \text{ kN}$$

Παράδειγμα :



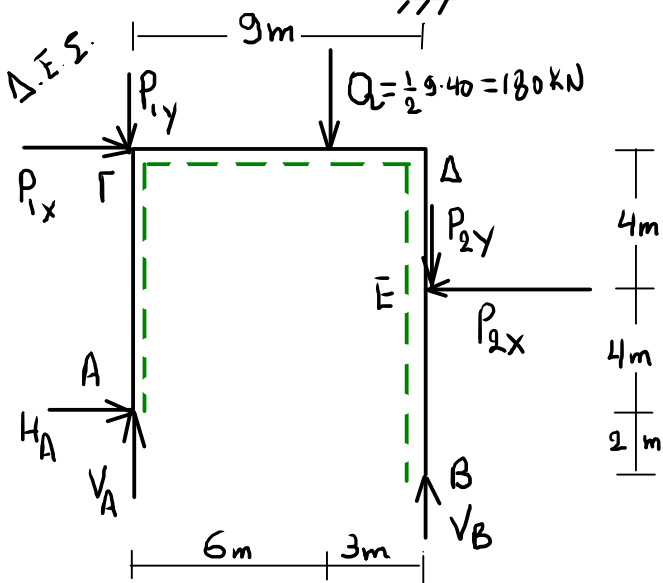
$$\sin \theta = 0,6, \quad \cos \theta = 0,8$$

$$P_{1x} = P_1 \cos \theta = 40 \cdot 0,8 = 32 \text{ kN}$$

$$P_{1y} = P_1 \cdot \sin \theta = 40 \cdot 0,6 = 24 \text{ kN}$$

$$P_{2x} = 14 \text{ kN}$$

$$P_{2y} = 10 \text{ kN}$$



$$\sum F_x = 0 \Rightarrow H_A + P_{1x} - P_{2x} = 0 \Rightarrow H_A = -18 \text{ kN}$$

$$\sum F_y = 0 \Rightarrow V_A - P_{1y} - Q - P_{2y} + V_B = 0 \quad (1)$$

$$\Rightarrow V_A + V_B = 214 \text{ kN} \quad (2)$$

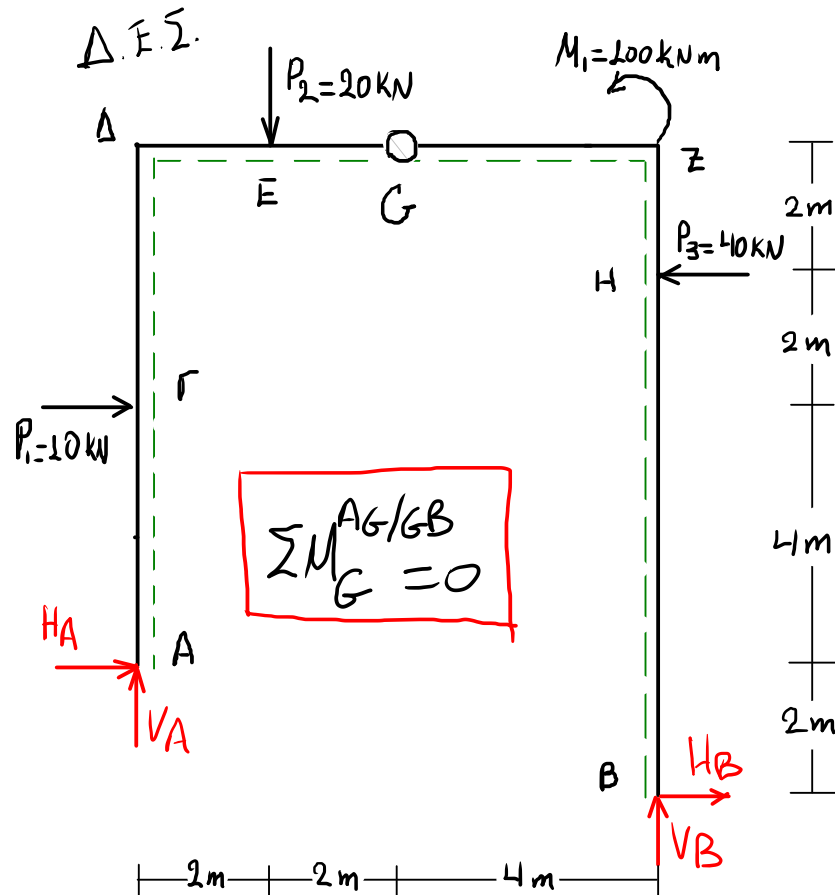
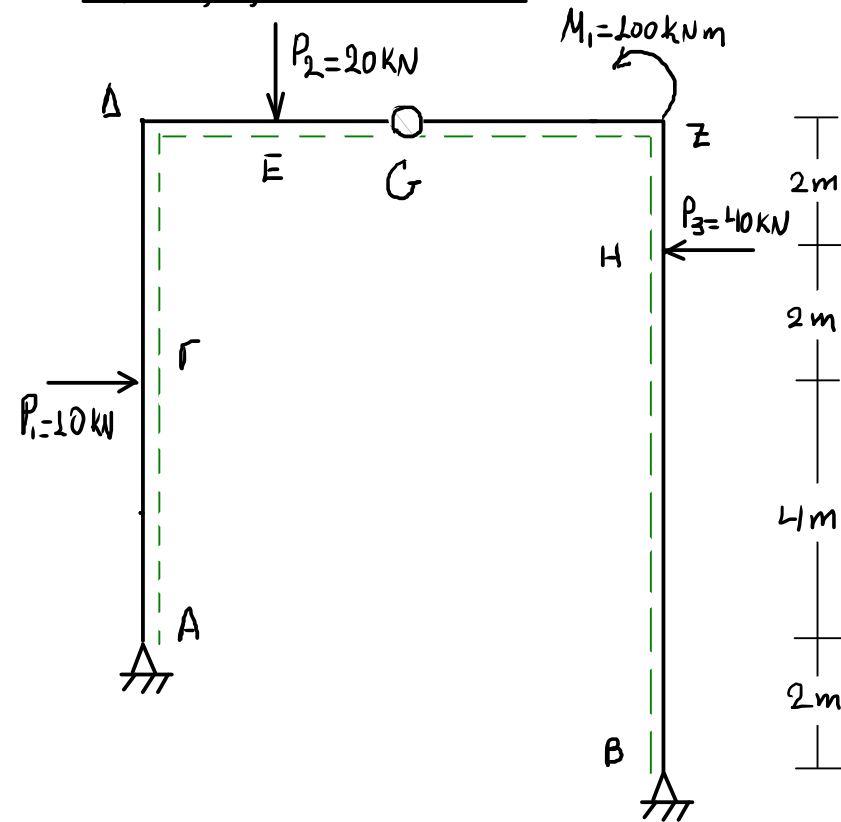
$$\sum M_A = 0$$

$$\Rightarrow -P_{1x} \cdot 8 - Q \cdot 6 - P_{2y} \cdot 9 + P_{2x} \cdot 4 + V_B \cdot 9 = 0$$

$$\Rightarrow V_B = 152,2 \text{ kN} \quad (3)$$

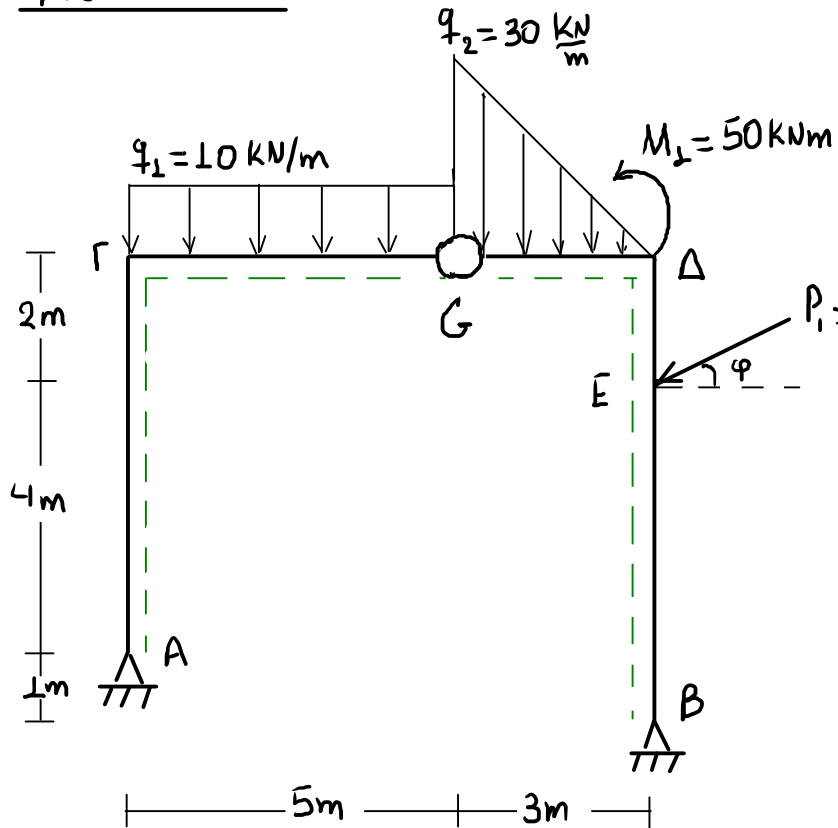
$$(2) \xrightarrow{(3)} V_A = 61,8 \text{ kN}$$

Τριερθρωτά Πλαίσια:



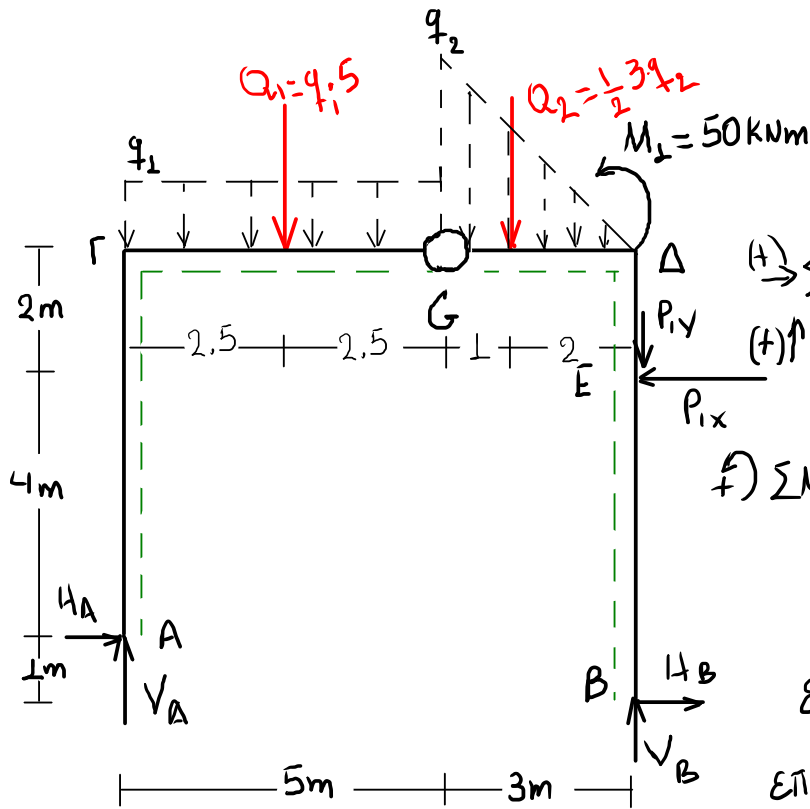
$$\begin{aligned}
 & \uparrow \sum F_x = 0 \Rightarrow H_A + 10 - 40 + H_B = 0 \Rightarrow \underline{H_A + H_B = 30} \quad (1) \\
 & \uparrow \sum F_y = 0 \Rightarrow V_A - 20 + V_B = 0 \Rightarrow \underline{V_A + V_B = 20} \quad (2) \\
 & \uparrow \sum M_A = 0 \Rightarrow -10 \cdot 4 - 20 \cdot 2 + 100 + 40 \cdot 6 + H_B \cdot 2 + V_B \cdot 8 = 0 \\
 & \Rightarrow -40 - 40 + 100 + 240 + 2H_B + 8V_B = 0 \Rightarrow \underline{2H_B + 8V_B = -260} \quad (3) \\
 & \uparrow \sum M_G = 0 \Rightarrow +100 - 40 \cdot 2 + H_B \cdot 10 + V_B \cdot 4 = 0 \Rightarrow \underline{4V_B + 10H_B = -20} \quad (4) \\
 & -2 \times (4) + (3) \Rightarrow H_B \approx 12.22 \text{ kN}, H_A = 17.78 \text{ kN}, V_B \approx -35.56 \text{ kN}, V_A = 55.56 \text{ kN}
 \end{aligned}$$

Άσκηση:



- Να βρεθούν οι αντιδράσεις στις βελτι-
ξεις και οι αντιδράσεις στον εσωτερικόν
άρθρων Γ.

Λύση:



$$Q_1 = q_1 \cdot 5 = 10 \cdot 5 = 50 \text{ kN}$$

$$Q_2 = \frac{1}{2} 3 q_2 = \frac{1}{2} 3 \cdot 30 = 45 \text{ kN}$$

$$P_{1x} = P_1 \cos \varphi = 40 \cdot 0,8 = 32 \text{ kN}$$

$$P_{1y} = P_2 \sin \varphi = 40 \cdot 0,6 = 24 \text{ kN}$$

$$A) \sum F_x = 0 \Rightarrow H_A - P_{1x} + H_B = 0 \Rightarrow H_A + H_B = 32 \quad (1)$$

$$B) \sum F_y = 0 \Rightarrow V_A - Q_1 - Q_2 - P_{1y} + V_B = 0$$

$$\Rightarrow V_A + V_B = 119 \quad (2)$$

$$C) \sum M_A = 0 \Rightarrow -Q_1 \cdot 2,5 - Q_2 \cdot 6 + M_1 - P_{1y} \cdot 8$$

$$+ P_{1x} \cdot 4 + V_B \cdot 8 + H_B \cdot 1 = 0$$

$$\Rightarrow 8V_B + H_B = 409 \quad (3)$$

Επιπλέον εξίσωση $\sum M_{G/GB} = 0$

Επιπλέον $\sum M_G = 0$

$$\Rightarrow Q_2 \cdot 2,5 + H_A \cdot 6 - V_A \cdot 5 = 0 \Rightarrow 6H_A - 5V_A = -125 \quad (4)$$

$$6 \cdot (3) + (4) \Rightarrow 48V_B + 6H_B + 6H_A - 5V_A = 6 \cdot 409 - 125 \stackrel{(1)}{\Rightarrow} 48V_B - 5V_A = 6 \cdot 409 - 125 - 6 \cdot 32$$

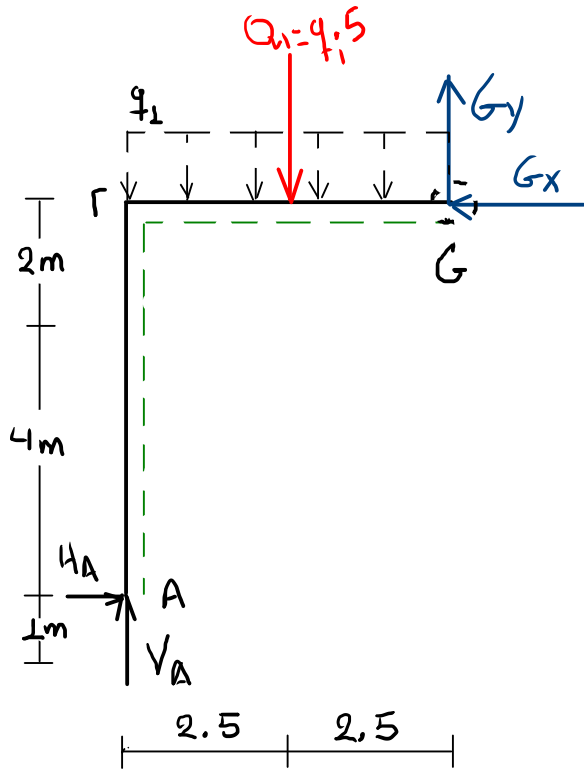
$$\Rightarrow 48V_B - 5V_A = 2137 \quad (5)$$

$$5 \cdot (2) + (5) \Rightarrow 5V_A + 5V_B + 48V_B - 5V_A = 2732 \Rightarrow 53V_B = 2732 \Rightarrow V_B \approx 51,55 \text{ kN} \quad (6)$$

$$48 \cdot (2) - (5) \Rightarrow 48V_A + 48V_B - 48V_B + 5V_A = 3575 \Rightarrow 53V_A = 3575 \Rightarrow V_A \approx 67,45 \text{ kN} \quad (7)$$

$$(3) \stackrel{(6)}{\Rightarrow} H_B = 409 - 8 \cdot 51,55 = -34 \text{ kN}, \quad (4) \stackrel{(7)}{\Rightarrow} 6H_A = -125 + 5 \cdot 67,45 \Rightarrow H_A = 35,4 \text{ kN}$$

Εύρεση εξωτερικά παραβιβασμένων αντιδράσεων:



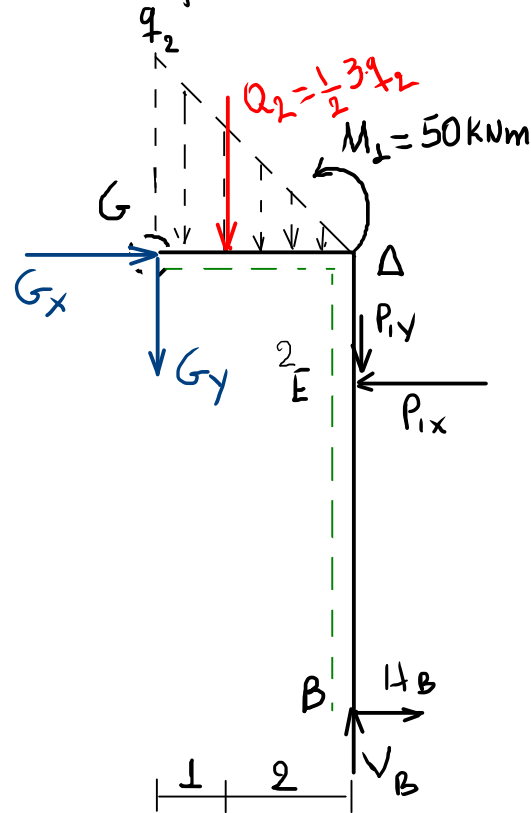
AG:

$$(+)\sum F_x = 0 \Rightarrow H_A - G_x = 0 \Rightarrow G_x = 35,4 \text{ kN}$$

$$(+)\uparrow \sum F_y = 0 \Rightarrow V_A - Q_1 + G_y = 0$$

$$\Rightarrow G_y = Q_1 - V_A = 50 - 67,45$$

$$\Rightarrow G_y = -17,45 \text{ kN}$$



GB: (για επαληθεύση)

$$(+)\sum F_x = 0 \Rightarrow G_x - P_{1x} + H_B = 0 \Rightarrow G_x = P_{1x} - H_B = 32 - (-3,4)$$

$$\Rightarrow G_x = 35,4 \text{ kN}$$

$$(+)\uparrow \sum F_y = 0 \Rightarrow -G_y - Q_2 - P_{1y} + V_B = 0 \Rightarrow$$

$$G_y = -45 - 24 + 51,55 \Rightarrow G_y = -17,45 \text{ kN}$$