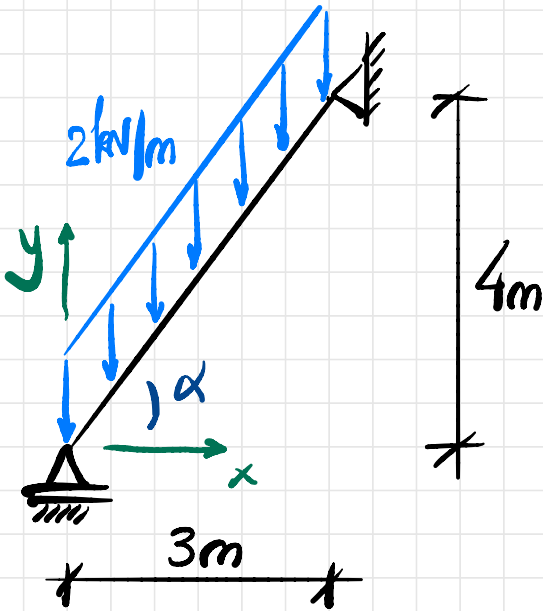


# Vigas Inclinadas

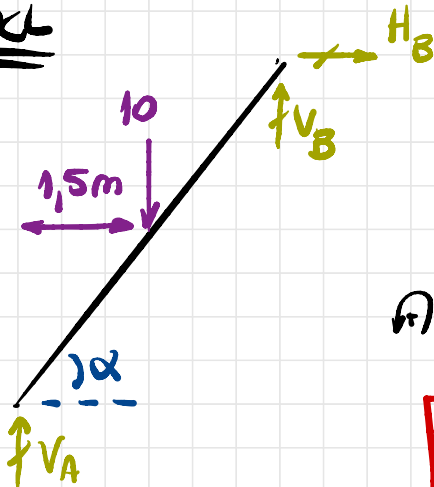
Exemplo: Traçar os diagramas de esforços solicitantes para a estrutura a seguir (escada):



$$\sin \alpha = \frac{4}{5}$$

$$\cos \alpha = \frac{3}{5}$$

DL



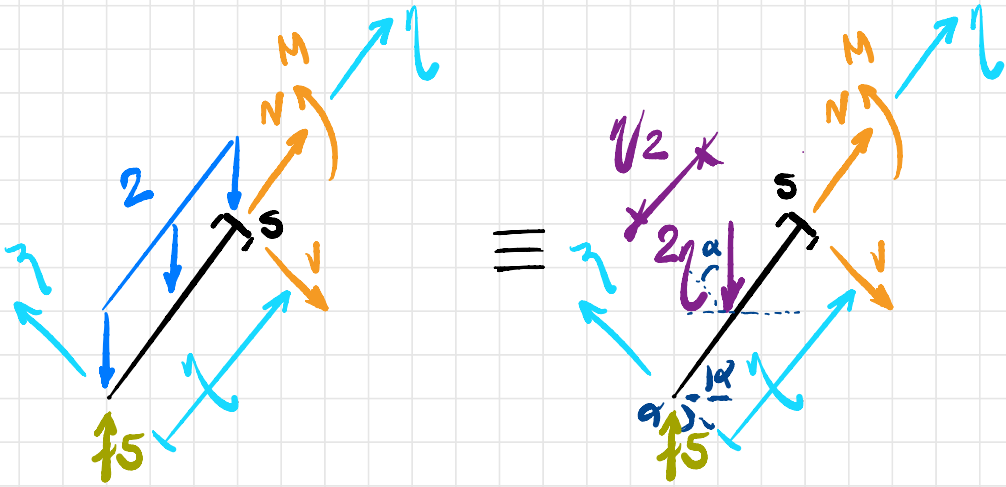
$$\sum F_x = 0: H_B = 0$$

$$\sum F_y = 0: V_A + V_B = 10$$

$$\sum M_A = 0: -10 \cdot 1,5 + V_B \cdot 3 - H_B \cdot 4 = 0$$

$$V_B = 5 \text{ kN} \Rightarrow V_A = 5 \text{ kN}$$

Para obter o diagrama, faz-se um corte e equilibra-se a estrutura:



Fazendo o equilíbrio nas direções  $\eta$  e  $\zeta$ :

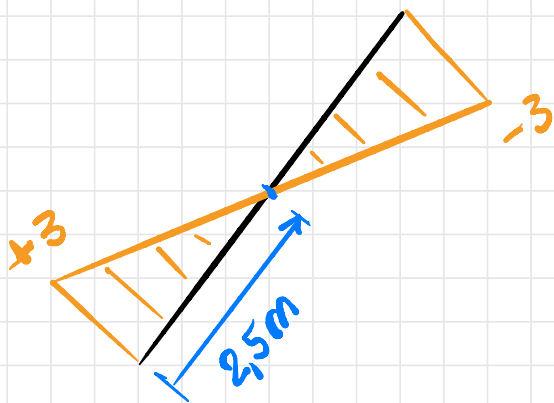
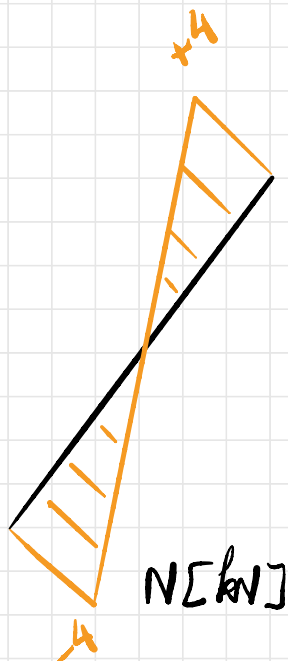
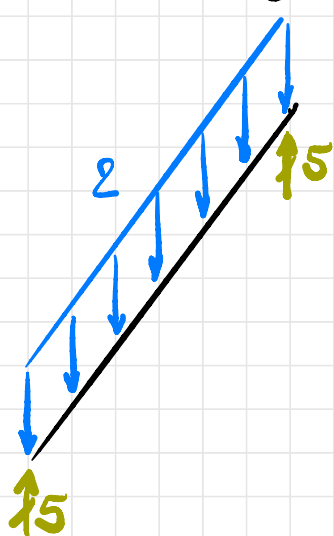
$$\sum F_{\eta} = 0: N + 5 \operatorname{sen} \alpha - 2\eta \operatorname{sen} \alpha = 0 \Rightarrow N = \frac{8}{5}\eta - 4$$

$$\sum F_{\zeta} = 0: -V + 5 \operatorname{cos} \alpha - 2\eta \operatorname{cos} \alpha = 0 \Rightarrow V = 3 - \frac{6}{5}\eta$$

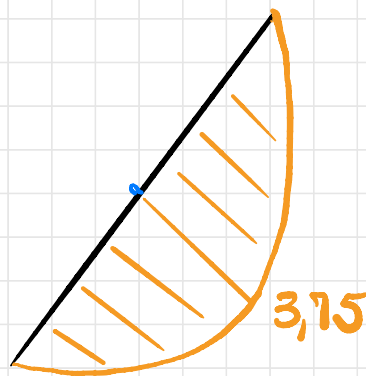
$$\sum M_S = 0: M + 2\eta \operatorname{cos} \alpha \cdot \frac{\eta}{2} - 5 \operatorname{cos} \alpha \cdot \eta = 0$$

$$M = 3\eta - \frac{3}{5}\eta^2$$

Trazando os diagramas:



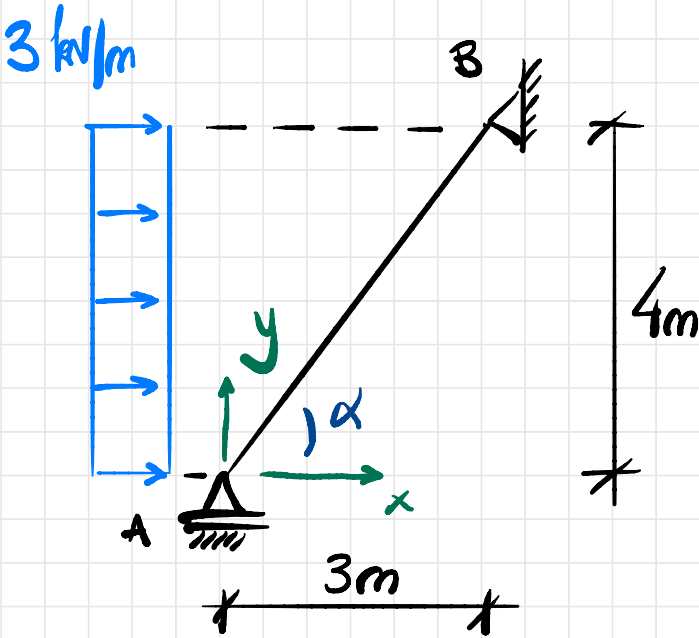
V [kN]



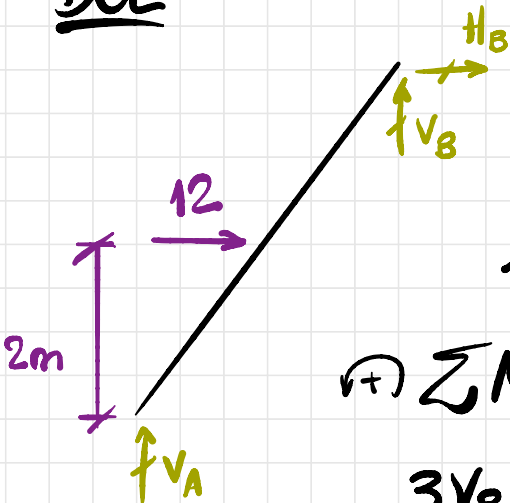
M [kNm]

\* Diagramas sempre perpendiculares à barra!

## Exemplo 2:



DCL



$$\sum F_H = 0: 12 + H_B = 0$$

$$\therefore H_B = -12 \text{ kN}$$

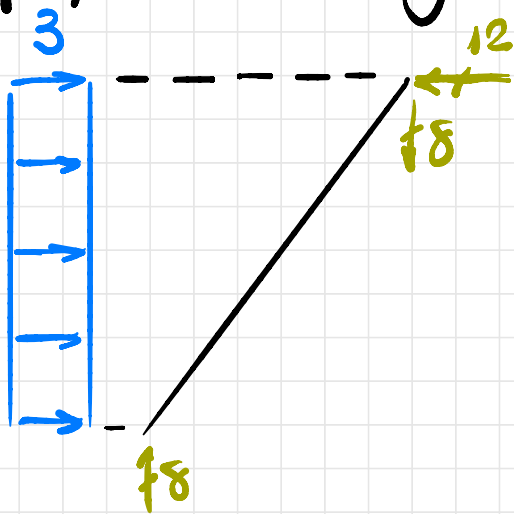
$$\sum F_V = 0: V_A + V_B = 0$$

$$\textcircled{+} \sum M_A = 0: -12 \cdot 2 + V_B \cdot 3 - H_B \cdot 4 = 0$$

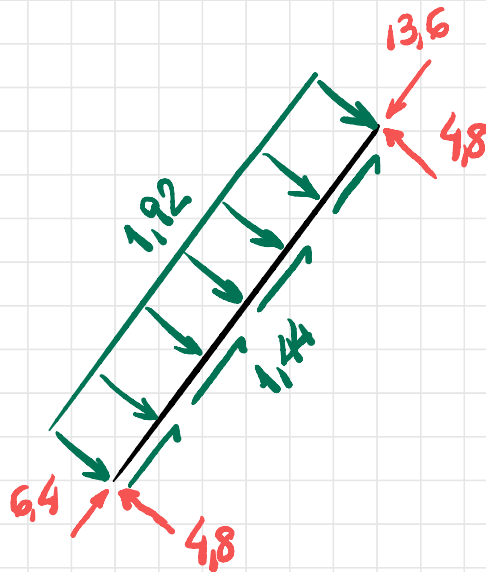
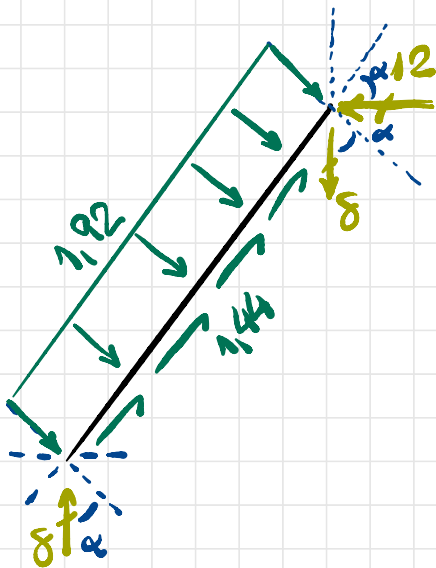
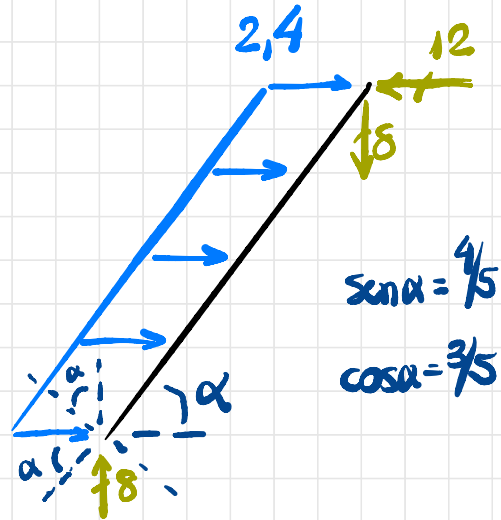
$$3V_B = 24 - 48 \Rightarrow V_B = -8 \text{ kN}$$

$$V_A = -V_B \Rightarrow V_A = 8 \text{ kN}$$

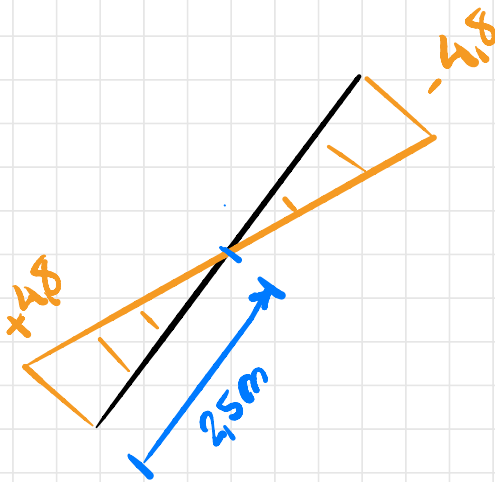
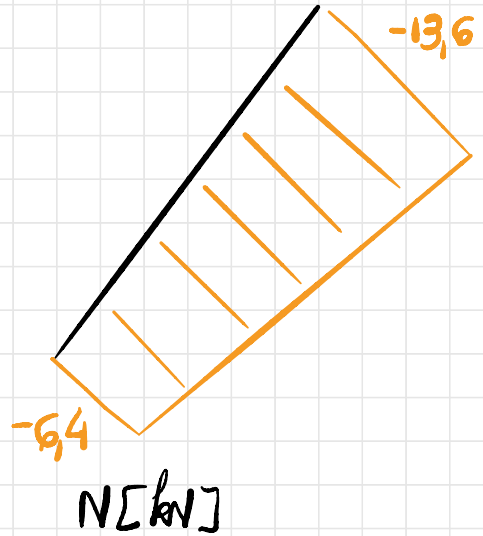
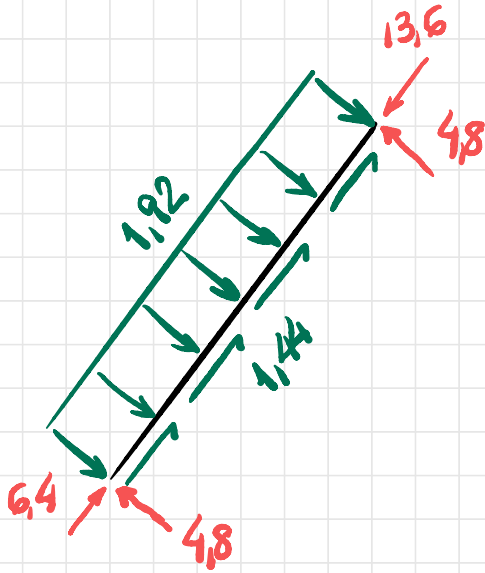
**Método Gráfico:** faz-se a equivalência entre os esforços aplicados e os esforços atuantes na direção perpendicular da viga.



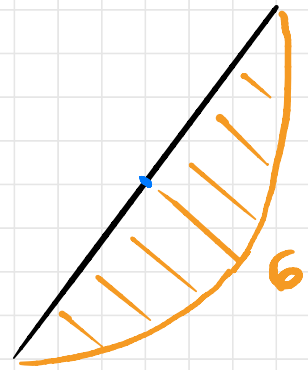
≡



Trazando os diagramas:



V [kN]



M [kNm]