B2T4N0512A

Considerando o modelo estrutural esboçado, responda os questionamentos.

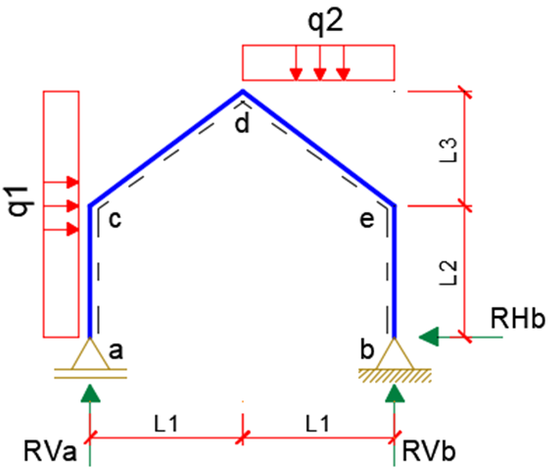
$L1 := 4\ \text{m}$

$L2 := 4\ \text{m}$

$L3 := 3\ \text{m}$

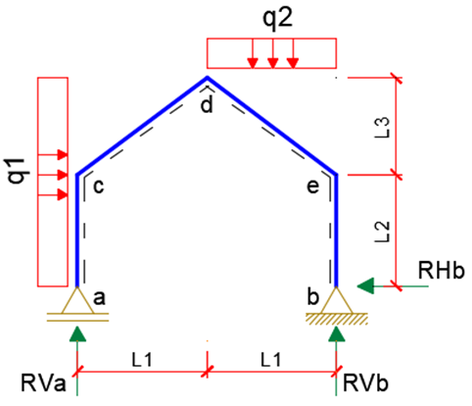
$q1 := 18\ \frac{\text{kN}}{\text{m}}$

$q2 := 25\ \frac{\text{kN}}{\text{m}}$



OBS: Todas as respostas devem ser dadas com sinal respeitando a convenção de diagramas
Q01) Qual o valor do esforço cortante no ponto "d" da barra "cd"? [em kN]
Q02) Qual o valor do esforço axial no ponto "d" da barra "cd"? [em kN]
Q03) Qual o valor do esforço cortante no ponto "e" da barra "de"? [em kN]
Q04) Qual o valor do esforço axial no ponto "e" da barra "de"? [em kN]

Reações de Apoio:



ΣFh = 0 (+) para esquerda

$RHb - q1 \cdot (L2 + L3) = 0$

$RHb := q1 \cdot (L2 + L3) = 126\ \text{kN}$

ΣMb = 0 (+) giro horário

$RVa \cdot 2 \cdot L1 + q1 \cdot (L2 + L3) \cdot \frac{(L2 + L3)}{2} - q2 \cdot L1 \cdot \frac{L1}{2} = 0$

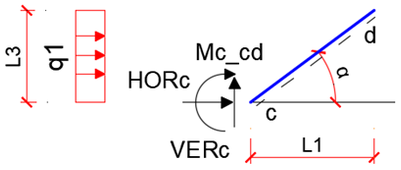
$RVa := \frac{1}{2 \cdot L1} \cdot \left(- q1 \cdot \frac{(L2 + L3)^2}{2} + q2 \cdot \frac{L1^2}{2} \right) = -30{,}125\ \text{kN}$

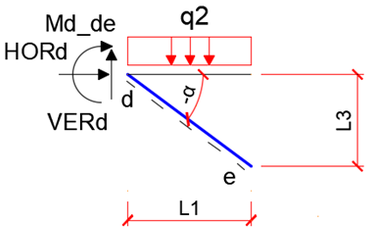
ΣFV = 0 (+) para cima

$RVb + RVa - q2 \cdot L1 = 0$

$RVb := - RVa + q2 \cdot L1 = 130{,}125\ \text{kN}$

Esforços na Extremidades das Barras e Equações:



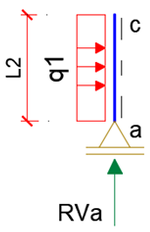


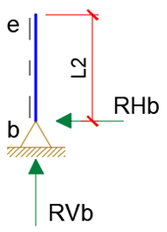
$HORc := q1 \cdot L2 = 72\ kN$

$VERc := RVa = -30,125\ kN$

$HORd := q1 \cdot (L2 + L3) = 126\ kN$

$VERd := RVa = -30,125\ kN$





$Lcd := \sqrt{L1^2 + L3^2} = 5\ m$

$cos\alpha := \frac{L1}{Lcd} = 0,8$

$sen\alpha := \frac{L3}{Lcd} = 0,6$

Cálculo dos Esforços Cortante e Axial no ponto "c" (via fórmula "enlatada"):

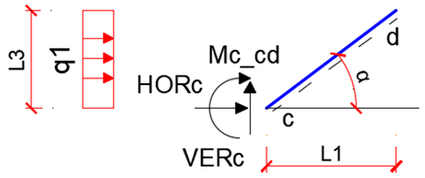
$Nc_cd := -HORc \cdot cos\alpha - VERc \cdot sen\alpha = -39,525\ kN$

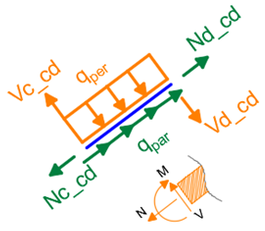
$Vc_cd := -HORc \cdot sen\alpha + VERc \cdot cos\alpha = -67,3\ kN$

Cálculo dos Esforços Cortante e Axial no ponto "d" (via fórmula "enlatada"):

$Nd_de := -HORd \cdot cos\alpha - VERd \cdot (-sen\alpha) = -118,875\ kN$

$Vd_de := -HORd \cdot (-sen\alpha) + VERd \cdot cos\alpha = 51,5\ kN$





$q1per := q1 \cdot (sen\alpha)^2 = 6,48\ \frac{kN}{m}$

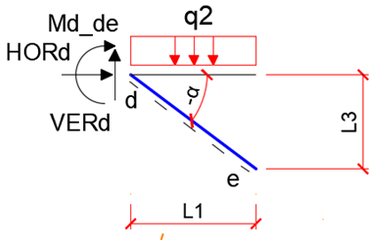
$q1par := q1 \cdot sen\alpha \cdot cos\alpha = 8,64\ \frac{kN}{m}$

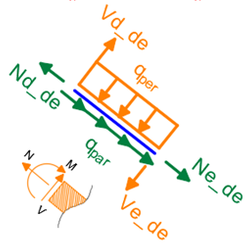
$Vcd(x) := Vc_cd - q1per \cdot x$

$Ncd(x) := Nc_cd - q1par \cdot x$

$Vd_cd := Vcd(Lcd) = -99,7\ kN$

$Nd_cd := Ncd(Lcd) = -82,725\ kN$





$q2per := q2 \cdot (cos\alpha)^2 = 16\ \frac{kN}{m}$

$q2par := q2 \cdot sen\alpha \cdot cos\alpha = 12\ \frac{kN}{m}$

$Vde(x) := Vd_de - q2per \cdot x$

$Nde(x) := Nd_de - q2par \cdot x$

$Ve_de := Vde(Lcd) = -28,5\ kN$

$Ne_de := Nde(Lcd) = -178,875\ kN$

Respostas :

$Q01 := Vd_cd = -99,7\ kN$

$Q02 := Nd_cd = -82,725\ kN$

$Q03 := Ve_de = -28,5\ kN$

$Q04 := Ne_de = -178,875\ kN$
