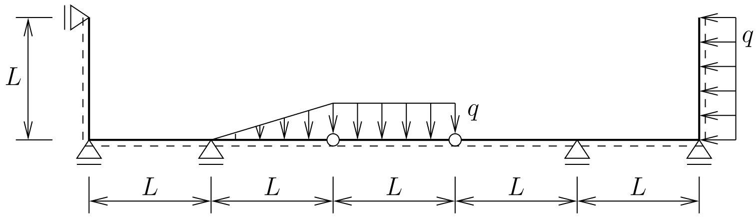
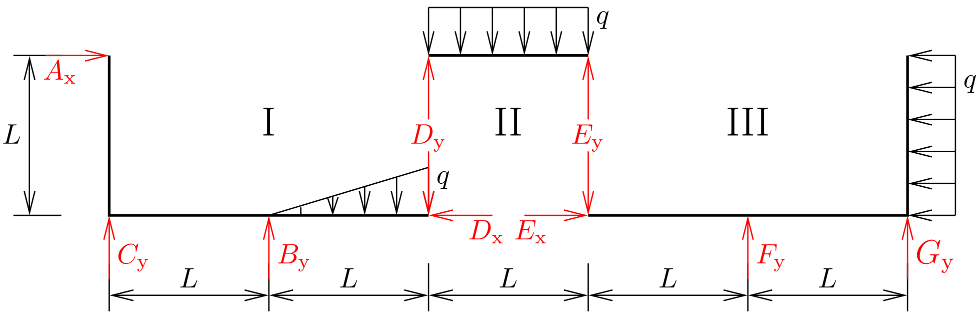
Zadání: Vyjádřete a vykreslete funkce průběhů vnitřních sil $N(x)$, $T(x)$, $M(x)$ na daném nosníku.



Reakce v podporách

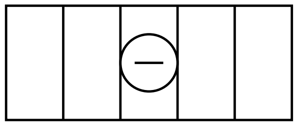


$$
\begin{aligned}
\curvearrowleft d_{II} : -qL\frac{1}{2}L + E_{\mathrm{y}}L &= 0\\
E_{\mathrm{y}} &= \frac{1}{2}qL\\
\uparrow y_{II} : D_{\mathrm{y}} - qL + E_{\mathrm{y}} &= 0\\
D_{\mathrm{y}} - qL + \frac{1}{2}qL &= 0\\
D_{\mathrm{y}} &= \frac{1}{2}qL\\
\rightarrow x_{II} : D_{\mathrm{x}} - E_{\mathrm{x}} &= 0\\
D_{\mathrm{x}} &= qL
\end{aligned}
$$

$$
\begin{aligned}
\rightarrow x_I : A_{\mathrm{x}} - D_{\mathrm{x}} &= 0\\
A_{\mathrm{x}} &= qL\\
\curvearrowleft c_I : -A_{\mathrm{x}}L - B_{\mathrm{y}}L - D_{\mathrm{y}}L - \frac{1}{2}qL\frac{2}{3} &= 0\\
-qL^2 - B_{\mathrm{y}}L - \frac{1}{2}qL^2 - \frac{1}{3}qL^2 &= 0\\
B_{\mathrm{y}} &= -\frac{11}{6}qL\\
\uparrow y_{II} : B_{\mathrm{y}} + C_{\mathrm{y}} - D_{\mathrm{y}} - \frac{1}{2}qL &= 0\\
-\frac{11}{6}qL + C_{\mathrm{y}} - \frac{1}{2}qL - \frac{1}{2}qL &= 0\\
C_{\mathrm{y}} &= \frac{17}{6}qL
\end{aligned}
$$

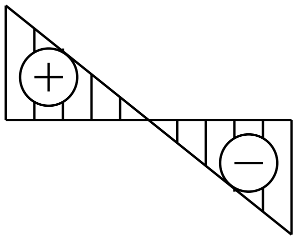
$$
\begin{aligned}
\rightarrow x_{III} : E_{\mathrm{x}} - qL &= 0\\
E_{\mathrm{x}} &= qL\\
\curvearrowleft f_{III} : E_{\mathrm{y}}L + G_{\mathrm{y}}L + qL\frac{1}{2}L &= 0\\
\frac{1}{2}qL^2 + G_{\mathrm{y}}L\frac{1}{2}qL^2 &= 0\\
G_{\mathrm{y}} &= -qL\\
\uparrow y_{III} : -E_{\mathrm{y}} + F_{\mathrm{y}} + G_{\mathrm{y}} &= 0\\
-\frac{1}{2}qL + F_{\mathrm{y}} - qL &= 0\\
F_{\mathrm{y}} &= \frac{3}{2}qL
\end{aligned}
$$

pole II



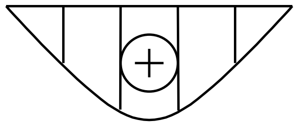
průběh normálových sil

$$\begin{aligned} x \in \langle d, e) : N(x) &= -D_{\mathrm{x}} = -qL \\ N(d) &= -qL \\ N(e) &= -qL \end{aligned}$$



průběh posouvajících sil

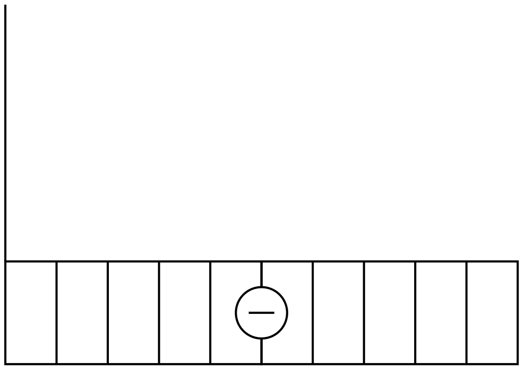
$$\begin{aligned} x \in \langle d, e) : T(x) &= -D_{\mathrm{y}} - qx \\ &= \frac{1}{2}qL - qx \\ T(d) &= \frac{1}{2}qL \\ T(e) &= -\frac{1}{2}qL \\ T(x_{M_{max}}) &= 0 = \frac{1}{2}qL - qx_{M_{max}} \\ x_{M_{max}} &= \frac{1}{2}L \end{aligned}$$



průběh ohybových momentů

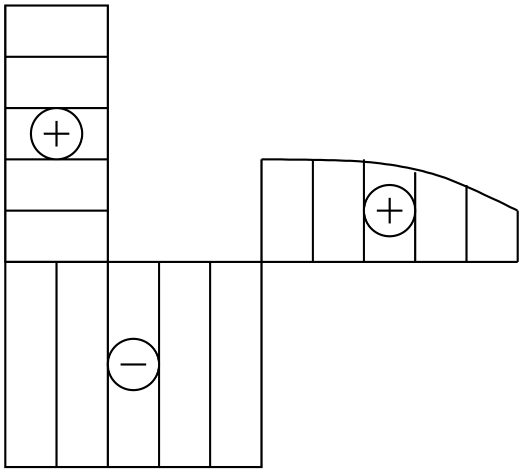
$$\begin{aligned} x \in \langle d, e) : M(x) &= -D_{\mathrm{y}}x - qx\frac{1}{2}x \\ &= \frac{1}{2}qLx - \frac{1}{2}qx^2 \\ M(d) &= 0 \\ M(e) &= 0 \\ M(max) &= \frac{1}{4}qL^2 - \frac{1}{8}qL^2 = \frac{1}{8}qL^2 \end{aligned}$$

pole I



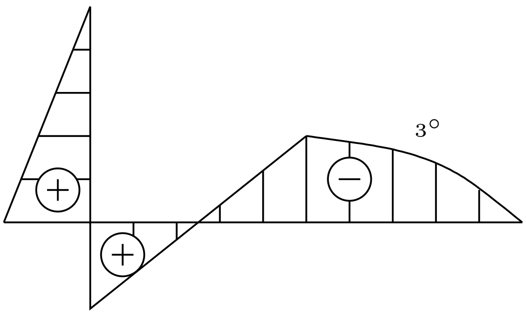
průběh normálových sil

$$\begin{aligned}
x \in \langle a,b\rangle : N(x) &= 0\\
N(a) &= 0\\
N(b) &= 0\\
x \in \langle b,c\rangle : N(x) &= -A_\mathrm{x}\\
N(b) &= -qL\\
N(c) &= -gL\\
x \in \langle d,c\rangle : N(x) &= -D_\mathrm{x}\\
N(d) &= -qL\\
N(c) &= -gL
\end{aligned}$$



průběh posouvajících sil

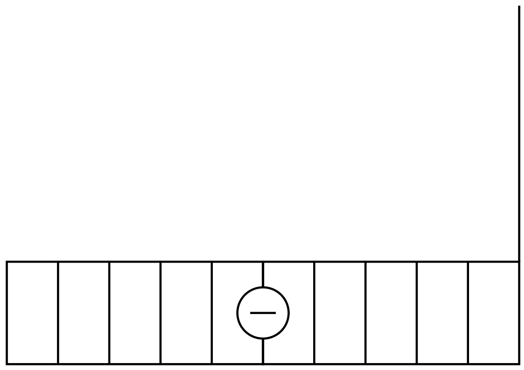
$$\begin{aligned}
x \in \langle a,b\rangle : T(x) &= A_\mathrm{x} = qL\\
T(a) &= qL\\
T(b) &= qL\\
x \in \langle b,c\rangle : T(x) &= -B_\mathrm{y} = -\frac{11}{6}qL\\
T(b) &= -\frac{11}{6}qL\\
T(c) &= -\frac{11}{6}qL\\
x \in \langle d,c\rangle : T(x) &= D_\mathrm{y} + qx - \frac{1}{2}x\frac{q}{L}x\\
&= \frac{1}{2}qL + qx - \frac{1}{2}\frac{q}{L}x^2\\
T(d) &= \frac{1}{2}qL\\
T(c) &= \frac{1}{2}qL + qL - \frac{1}{2}\frac{q}{L}L^2 = qL
\end{aligned}$$



průběh ohybových momentů

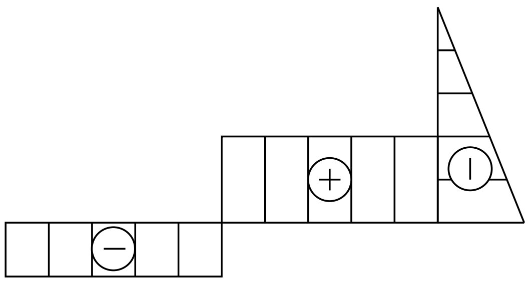
$$\begin{aligned}
x \in \langle a,b\rangle : M(x) &= A_\mathrm{x}x = qLx\\
M(a) &= 0\\
M(b) &= qL^2\\
x \in \langle b,c\rangle : M(x) &= M(b) - B_\mathrm{y}x = qL^2 - \frac{11}{6}qLx\\
M(b) &= qL^2\\
M(c) &= qL^2 - \frac{11}{6}qL^2 = -\frac{5}{6}qL^2\\
x \in \langle d,c\rangle : M(x) &= -D_\mathrm{y}x - qx\frac{1}{2}x + frac12x\frac{q}{L}x\frac{1}{3}x\\
&= -\frac{1}{2}qLx - \frac{1}{2}qx^2 + \frac{1}{6}\frac{q}{L}x^3\\
M(d) &= 0\\
M(c) &= -\frac{1}{2}qL^2 - \frac{1}{2}qL^2 + \frac{1}{6}\frac{q}{L}L^3 = -\frac{5}{6}qL^2
\end{aligned}$$

pole III



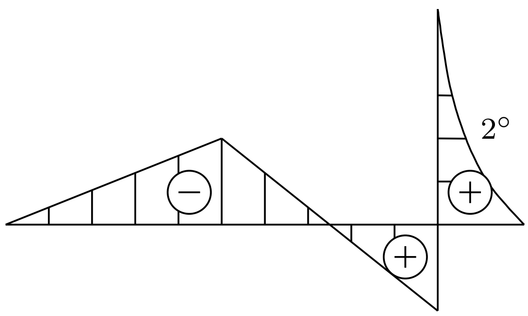
průběh normálových sil

$$\begin{aligned}
x \in \langle h, g\rangle : N(x) &= 0\\
N(h) &= 0\\
N(g) &= 0\\
x \in \langle g, f\rangle : N(x) &= -gL\\
N(g) &= -gL\\
N(f) &= -gL\\
x \in \langle f, e\rangle : N(x) &= -gL\\
\\
N(f) &= -gL\\
N(e) &= -gL
\end{aligned}$$



průběh posouvajících sil

$$\begin{aligned}
x \in \langle h, g\rangle : T(x) &= -qx\\
T(h) &= 0\\
T(g) &= -qL\\
x \in \langle g, h\rangle : T(x) &= -G_{\mathrm{y}} = qL\\
T(g) &= qL\\
T(f) &= qL\\
x \in \langle e, f\rangle : T(x) &= -E_{\mathrm{y}} = -qL\frac{1}{2}\\
T(e) &= -\frac{1}{2}qL\\
T(f) &= -\frac{1}{2}qL
\end{aligned}$$



průběh ohybových momentů

$$\begin{aligned}
x \in \langle h, g\rangle : M(x) &= \frac{1}{2}qx^2\\
M(h) &= 0\\
M(g) &= \frac{1}{2}qL^2\\
x \in \langle g, f\rangle : M(x) &= M(g) + G_{\mathrm{y}}x = \frac{1}{2}qL^2 - qLx\\
M(g) &= \frac{1}{2}qL^2\\
M(f) &= \frac{1}{2}qL^2 - qL^2 = -\frac{1}{2}qL^2\\
x \in \langle d, c\rangle : M(x) &= -E_{\mathrm{y}}x = -\frac{1}{2}qLx\\
M(e) &= 0\\
M(f) &= -\frac{1}{2}qL^2
\end{aligned}$$