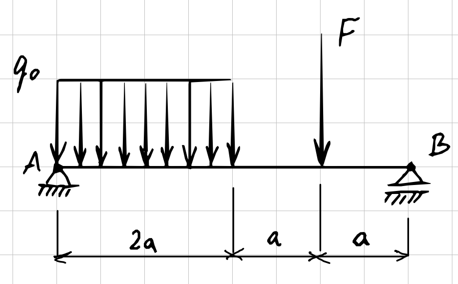
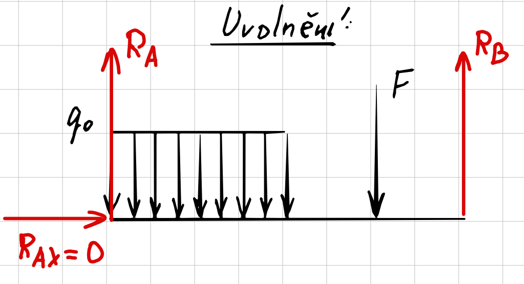
PŘ 3

Zadání:



Uvolnění:



R.R.: (y): $R_A + R_B - F - q_0 2a = 0$ (1)

$(\overset{\curvearrowleft}{M_A})$: $R_B \cdot 4a - F \cdot 3a - q_0 \cdot 2a \cdot a = 0$ (2)

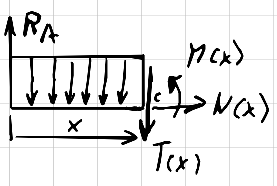
(2) → $R_B = \dfrac{3Fa + 2q_0a^2}{4a} = \dfrac{3F + 2q_0a}{4} = \frac{3}{4}F + \frac{1}{2}q_0a$

(1) → $R_A = F + q_0 2a - R_B = F + 2q_0a - \frac{3}{4}F - \frac{1}{2}q_0a$

$\boxed{R_A = \frac{1}{4}F + \frac{3}{2}q_0a}$ $\boxed{R_B = \frac{3}{4}F + \frac{1}{2}q_0a}$

VSÚ:

I. interval $x \in (0, 2a)$



$N(x) = 0$

R.R.: (y): $R_A - q_0x - T(x) = 0$ (3)

$(\overset{\curvearrowleft}{M_C})$: $M(x) + q_0 x \cdot \frac{x}{2} - R_A \cdot x = 0$ (4)

(3) → $T(x) = R_A - q_0x = \frac{1}{4}F + \frac{3}{2}q_0a - q_0x$

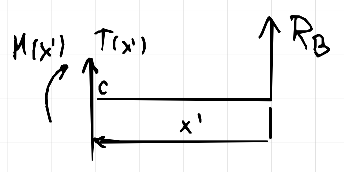
(4) → $M(x) = R_A \cdot x - \frac{1}{2}q_0x^2 = \left(\frac{1}{4}F + \frac{3}{2}q_0a\right)x - \frac{1}{2}q_0x^2$

$T(0) = R_A$

$T(2a) = \frac{1}{4}F + \frac{3}{2}q_0a - q\,2a = \frac{1}{4}F - \frac{1}{2}qa$

$M(0) = 0$, $M(2a) = \frac{1}{2}Fa + 3q_0a^2 - 2q_0a^2 = \frac{1}{2}Fa + q_0a^2$

II. interval $x' \in (0, a)$

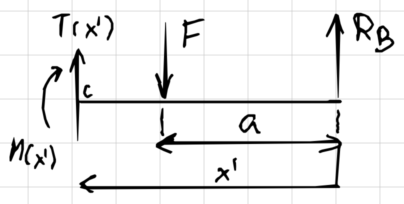


R.R.: (y): $T(x') + R_B = 0$ → $T(x') = -R_B = -\frac{3}{4}F - \frac{1}{2}q_0a$

$(\overset{\curvearrowleft}{M_C})$: $R_B \cdot x' - M(x') = 0$ → $M(x') = R_B \cdot x' = \left(\frac{3}{4}F + \frac{1}{2}q_0a\right)x'$

$M(0) = 0$, $M(a) = \frac{3}{4}Fa + \frac{1}{2}q_0a^2$

III. interval $x' \in (a, 2a)$

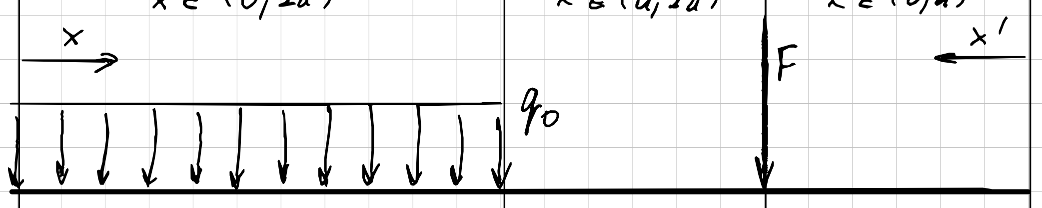


R.R. (y): $T(x') - F + R_B = 0$ → $T(x') = F - R_B = F - \frac{3}{4}F - \frac{1}{2}q_0a = \frac{1}{4}F - \frac{1}{2}q_0a$

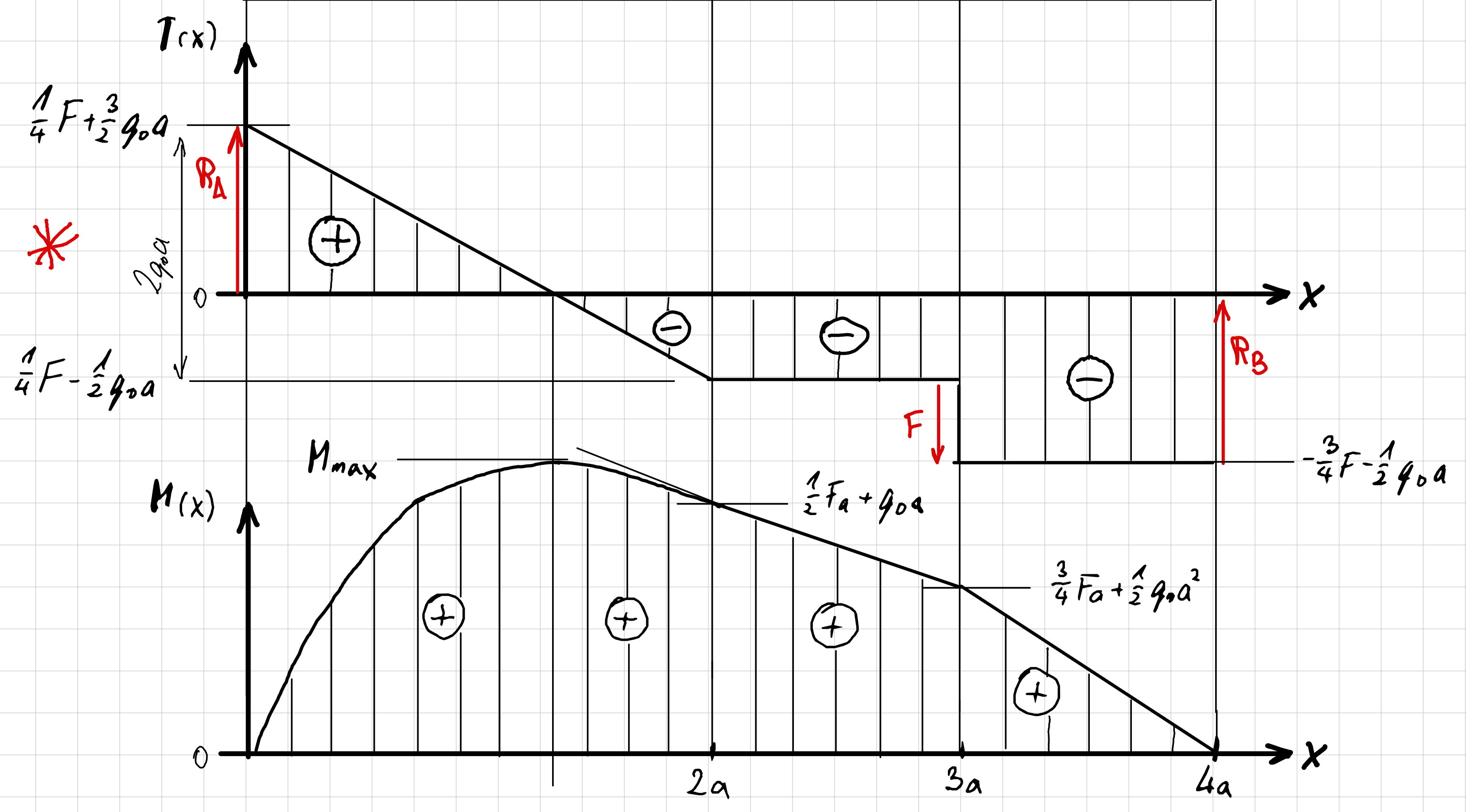
$(\overset{\curvearrowleft}{M_C})$: $R_B \cdot x' - F(x' - a) - M(x') = 0$ → $M(x') = R_B \cdot x' - F(x' - a)$
$= \left(\frac{3}{4}F + \frac{1}{2}q_0a\right) \cdot x' - F(x' - a)$

$M(a) = \frac{3}{4}Fa + \frac{1}{2}q_0a^2$, $M(2a) = \frac{3}{2}Fa + q_0a^2 - Fa = \frac{1}{2}Fa + q_0a^2$

Souhrn:



	I. interval $x \in (0, 2a)$	III. interval $x' \in (a, 2a)$	II. interval $x' \in (0, a)$
VSÚ:	$T(x) = \frac{1}{4}F + \frac{3}{2}q_0a - q_0x$ $M(x) = \left(\frac{1}{4}F + \frac{3}{2}q_0a\right)x - \frac{1}{2}q_0x^2$	$T(x') = \frac{1}{4}F - \frac{1}{2}q_0a$ $M(x') = \left(\frac{3}{4}F + \frac{1}{2}q_0a\right)x' - F(x' - a)$	$T(x') = -\frac{3}{4}F - \frac{1}{2}q_0a$ $M(x') = \left(\frac{3}{4}F + \frac{1}{2}q_0a\right)x'$
krajní body intervalu:	$T(0) = \frac{1}{4}F + \frac{3}{2}q_0a$ $T(2a) = \frac{1}{4}F - \frac{1}{2}q_0a$ $M(0) = 0$ $M(2a) = \frac{1}{2}Fa^2 + q_0a^2$	$T(a) = \frac{1}{4}F - \frac{1}{2}q_0a$ $T(2a) = T(a)$ $M(a) = \frac{3}{4}Fa + \frac{1}{2}q_0a^2$ $M(2a) = \frac{1}{2}Fa + q_0a^2$	$T(0) = -\frac{3}{4}F - \frac{1}{2}q_0a$ $T(a) = T(0)$ $M(0) = 0$ $M(a) = \frac{3}{4}Fa + \frac{1}{2}q_0a^2$



* $\frac{1}{4}F - \frac{1}{2}q_0a < 0$ ... grafy kreslíme s ohledem na tuto nerovnost

↳ tato hodnota ale může být i kladná, záleží na zadaných hodnotách F, q_0, a

- Přiložený Matlab skript vykreslí grafy, zkuste zadat různé hodnoty F, q_0, a a pozorujte, kde bude největší ohybový moment. (skript VSU_pr3.m)

Výpočet M_{max}: $\dfrac{dM}{dx} = T(x) = 0$

Pohybujeme se v I. intervalu, takže: $T(x) = \frac{1}{4}F + \frac{3}{2}q_0a - q_0x$

$$\frac{1}{4}F + \frac{3}{2}q_0a - q_0x_{max} = 0 \rightarrow x_{max} = \frac{1}{4}\frac{F}{q_0} + \frac{3}{2}a$$

↳ místo, kde je největší moment

$M_{max} = M(x_{max}) = \left(\frac{1}{4}F + \frac{3}{2}q_0a\right)x_{max} - \frac{1}{2}q_0(x_{max})^2$

$M_{max} = \left(\frac{1}{4}F + \frac{3}{2}q_0a\right)\left(\frac{1}{4}\frac{F}{q_0} + \frac{3}{2}a\right) - \frac{1}{2}q_0\left(\frac{1}{4}\frac{F}{q_0} + \frac{3}{2}a\right)^2$

po úpravě: $M_{max} = \dfrac{(F + 6q_0a)^2}{32q_0}$