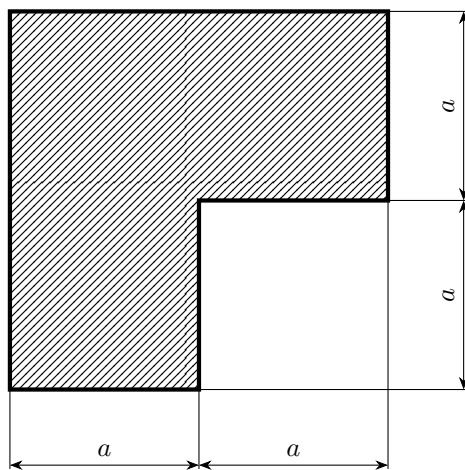


# 1 Průřezové charakteristiky

## 1.1 Vykousnutý čtverec

Určete hlavní centrální kvadratické momenty obrazce

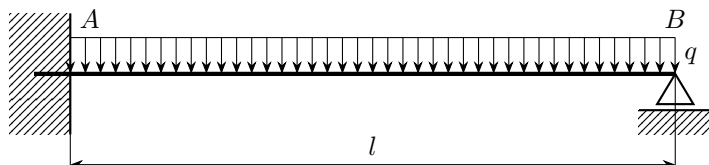


Výsledek:  $J_1 = \frac{5}{4}a^4$ ,  $J_2 = \frac{7}{12}a^4$ .

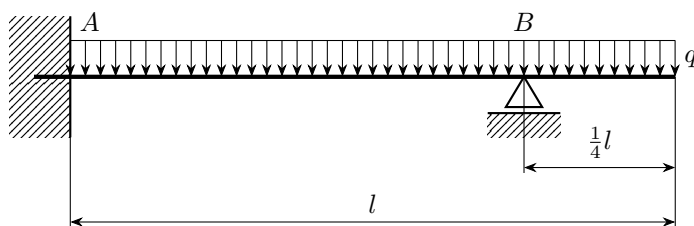
## 2 Staticky neurčité nosníky

### 2.1 Nosník s jedním vetknutým koncem, jednou podporou a spojitým zatížením

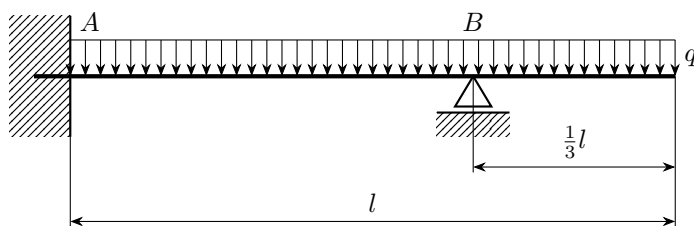
Určete reakce



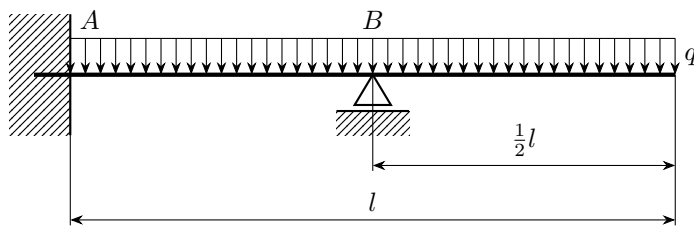
Výsledek:  $R_A = \frac{5}{8}ql$ ,  $R_B = \frac{3}{8}ql$ ,  $M_A = -\frac{1}{8}ql^2$ .



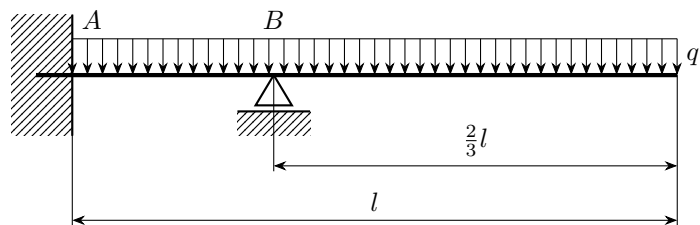
Výsledek:  $R_A = \frac{13}{32}ql$ ,  $R_B = \frac{19}{32}ql$ ,  $M_A = -\frac{7}{128}ql^2$ .



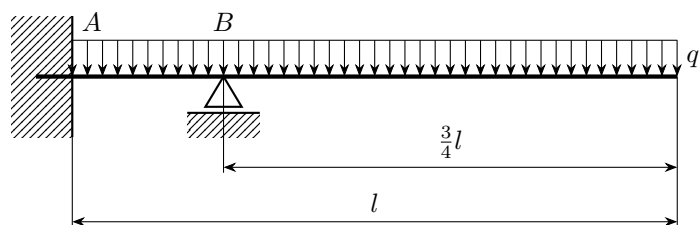
Výsledek:  $R_A = \frac{7}{24}ql$ ,  $R_B = \frac{17}{24}ql$ ,  $M_A = -\frac{1}{36}ql^2$ .



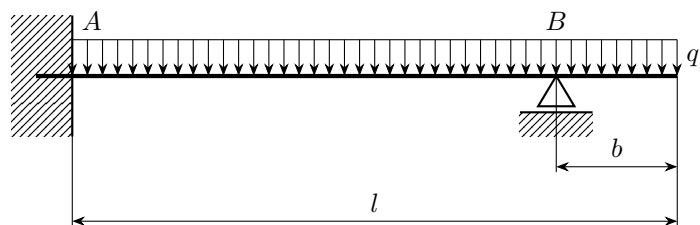
Výsledek:  $R_A = -\frac{1}{16}ql$ ,  $R_B = \frac{17}{16}ql$ ,  $M_A = \frac{1}{32}ql^2$ .



**Výsledek:**  $R_A = -\frac{19}{24}ql$ ,  $R_B = \frac{43}{24}ql$ ,  $M_A = \frac{7}{72}ql^2$ .



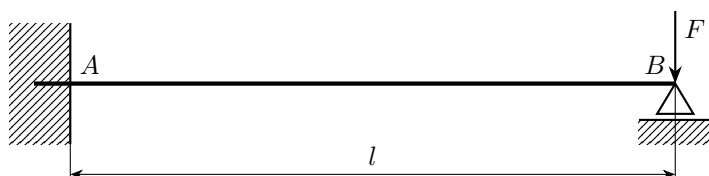
**Výsledek:**  $R_A = -\frac{49}{32}ql$ ,  $R_B = \frac{81}{32}ql$ ,  $M_A = \frac{17}{128}ql^2$ .



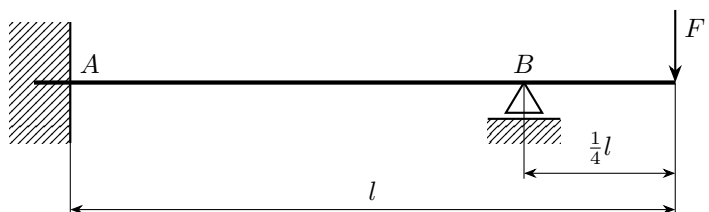
**Výsledek:**  $R_A = \frac{b^2+10bl-5l^2}{8(b-l)}q$ ,  $R_B = \frac{b^2+2bl+3l^2}{8(l-b)}q$ ,  $M_A = \frac{1}{8}(b^2 + 2bl - l^2)q$ .

## 2.2 Nosník s jedním vetknutým koncem, jednou podporou a silou na konci

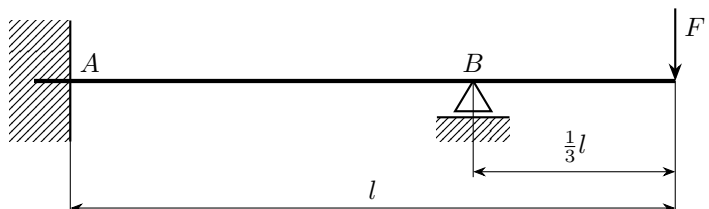
Určete reakce:



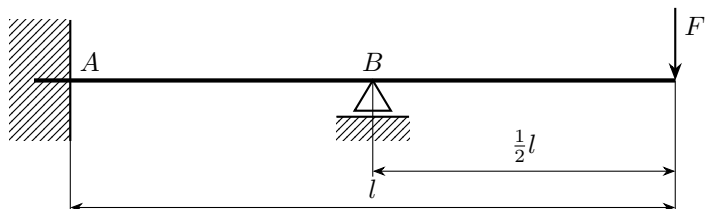
Výsledek:  $R_A = 0, R_B = F, M_A = 0$ .



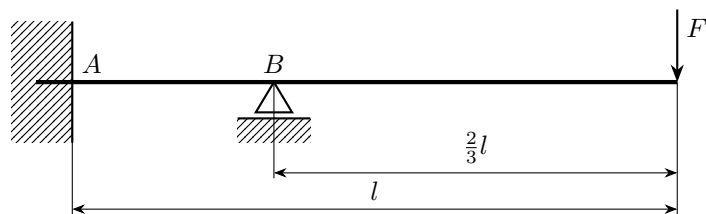
Výsledek:  $R_A = -\frac{1}{2}F, R_B = \frac{3}{2}F, M_A = \frac{1}{8}Fl$ .



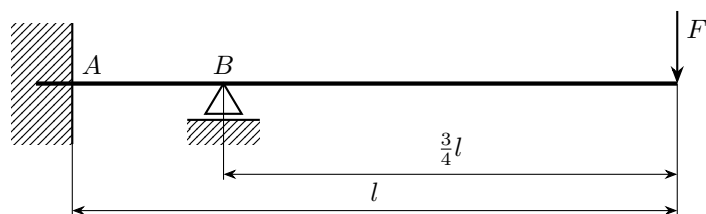
Výsledek:  $R_A = -\frac{3}{4}F, R_B = \frac{7}{4}F, M_A = \frac{1}{6}Fl$ .



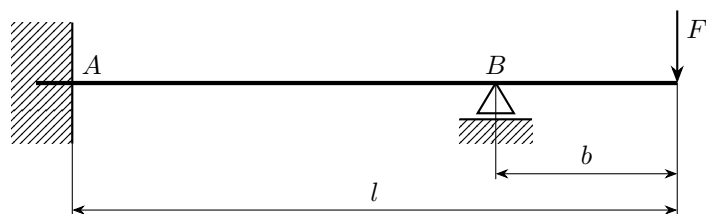
Výsledek:  $R_A = -\frac{3}{2}F, R_B = \frac{5}{2}F, M_A = \frac{1}{4}Fl$ .



**Výsledek:**  $R_A = -3F, R_B = 4F, M_A = \frac{1}{3}Fl$ .



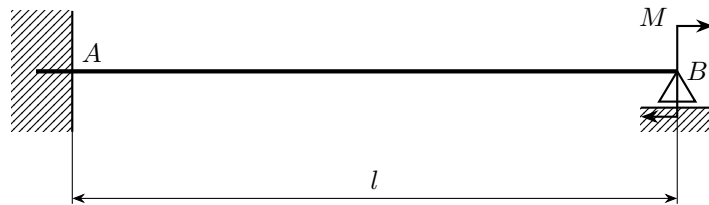
**Výsledek:**  $R_A = -\frac{9}{2}F, R_B = \frac{11}{2}F, M_A = \frac{3}{8}Fl$ .



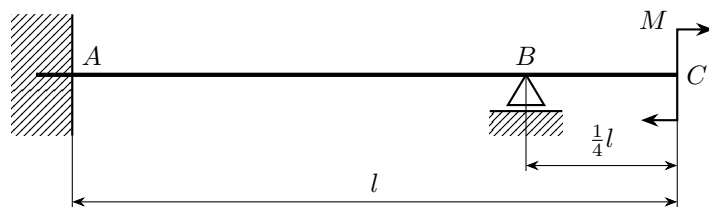
**Výsledek:**  $R_A = -\frac{3b}{2(l-b)}F, R_B = \frac{b+2l}{l-b}F, M_A = \frac{b}{2}F$ .

### 2.3 Nosník s jedním vetknutým koncem, podporou a momentem na konci

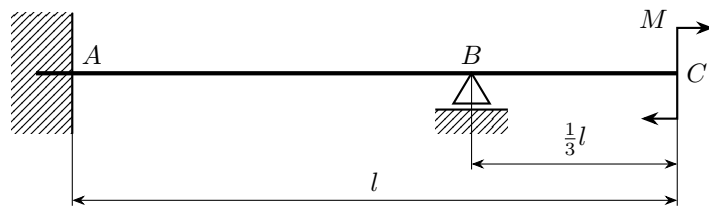
Určete reakce



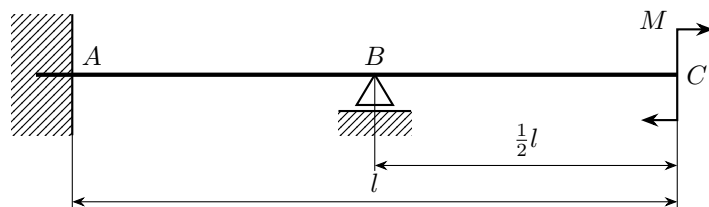
**Výsledek:**  $R_A = -\frac{3M}{2l}$ ,  $R_B = \frac{3M}{2l}$ ,  $M_A = \frac{M}{2}$ .



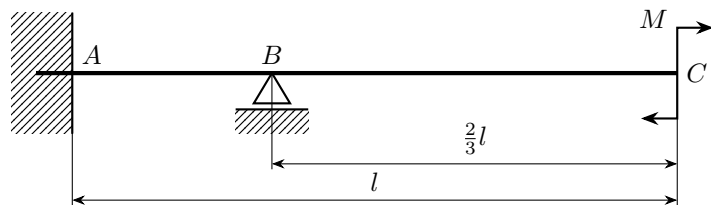
**Výsledek:**  $R_A = -\frac{2M}{l}$ ,  $R_B = \frac{2M}{l}$ ,  $M_A = \frac{M}{2}$ .



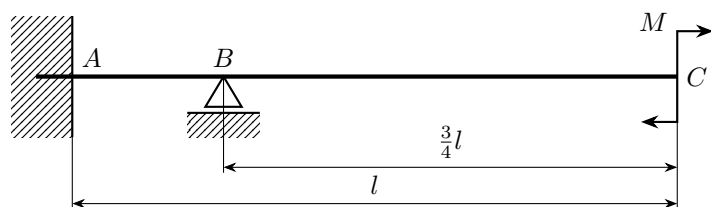
**Výsledek:**  $R_A = -\frac{9M}{4l}$ ,  $R_B = \frac{9M}{4l}$ ,  $M_A = \frac{M}{2}$ .



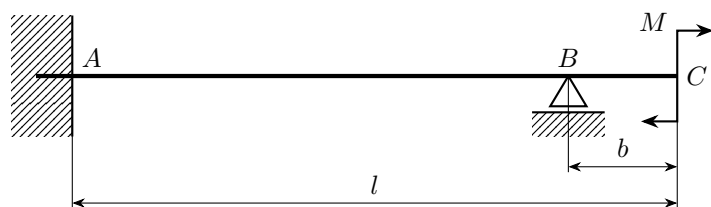
**Výsledek:**  $R_A = -\frac{3M}{l}$ ,  $R_B = \frac{3M}{l}$ ,  $M_A = \frac{M}{2}$ .



**Výsledek:**  $R_A = -\frac{9M}{2l}$ ,  $R_B = \frac{9M}{2l}$ ,  $M_A = \frac{M}{2}$ .



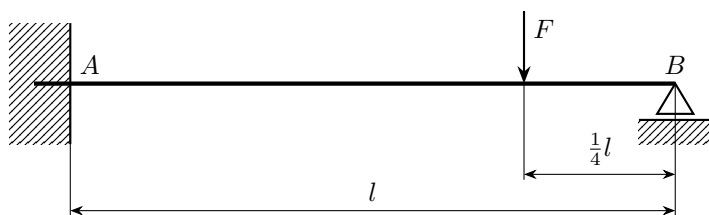
**Výsledek:**  $R_A = -\frac{6M}{l}$ ,  $R_B = \frac{6M}{l}$ ,  $M_A = \frac{M}{2}$ .



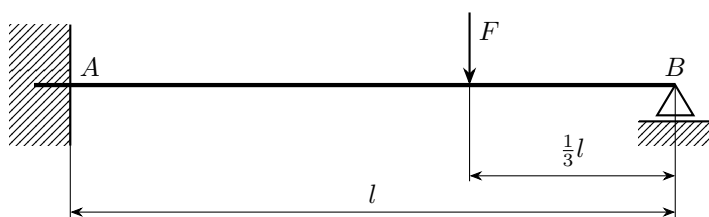
**Výsledek:**  $R_A = -\frac{3M}{2(l-b)}$ ,  $R_B = \frac{3M}{2(l-b)}$ ,  $M_A = \frac{M}{2}$ .

## 2.4 Nosník s jedním vetknutým koncem, podporou na druhém konci a silou

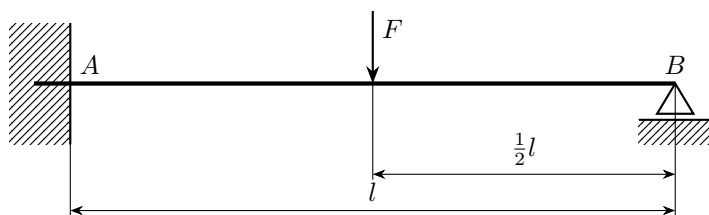
Určete reakce:



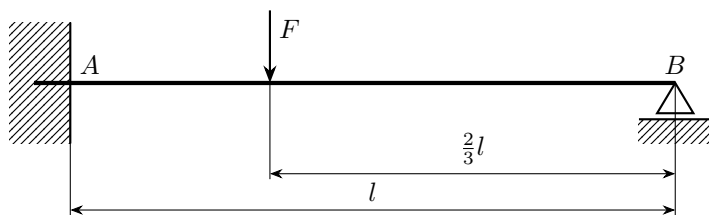
**Výsledek:**  $R_A = \frac{47}{128}F$ ,  $R_B = \frac{81}{128}F$ ,  $M_A = -\frac{15}{128}Fl$ .



**Výsledek:**  $R_A = \frac{13}{27}F$ ,  $R_B = \frac{14}{27}F$ ,  $M_A = -\frac{4}{27}Fl$ .

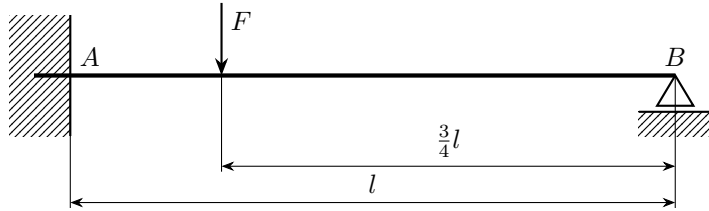


**Výsledek:**  $R_A = \frac{11}{16}F$ ,  $R_B = \frac{5}{16}F$ ,  $M_A = -\frac{3}{16}Fl$ .

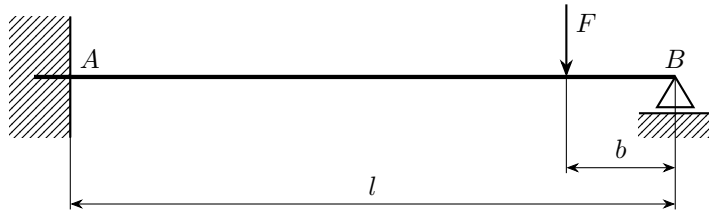




**Výsledek:**  $R_A = \frac{23}{27}F, R_B = \frac{4}{27}F, M_A = -\frac{5}{27}Fl.$



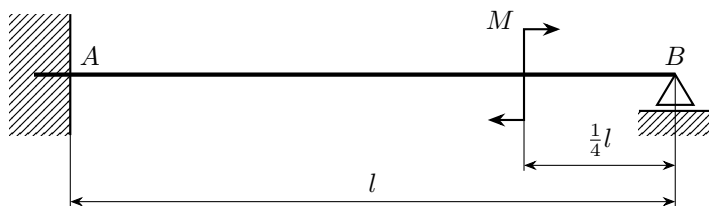
**Výsledek:**  $R_A = \frac{117}{128}F, R_B = \frac{11}{128}F, M_A = -\frac{21}{128}Fl.$



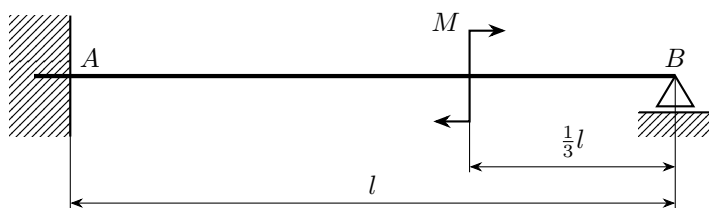
**Výsledek:**  $R_A = \frac{3bl^2 - b^3}{2l^3}F, R_B = \frac{(b-l)^2(b+2l)}{2l^3}F, M_A = \frac{b(b^2 - l^2)}{2l^2}F.$

## 2.5 Nosník s jedním vetknutým koncem, podporou na druhém konci a momentem

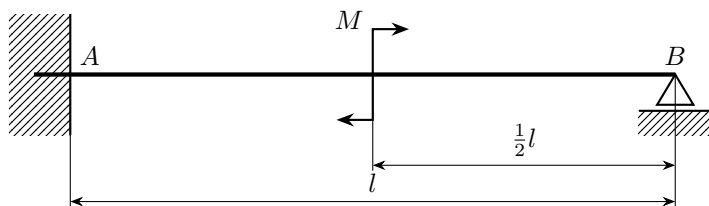
Určete reakce:



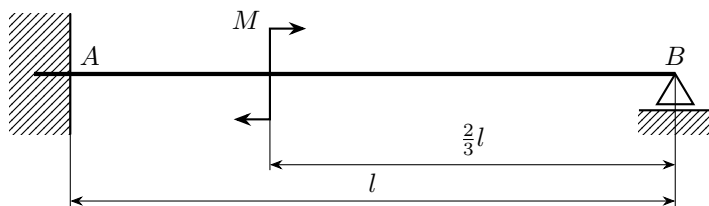
**Výsledek:**  $R_A = -\frac{45M}{32l}$ ,  $R_B = \frac{45M}{32l}F$ ,  $M_A = \frac{13}{32}M$ .



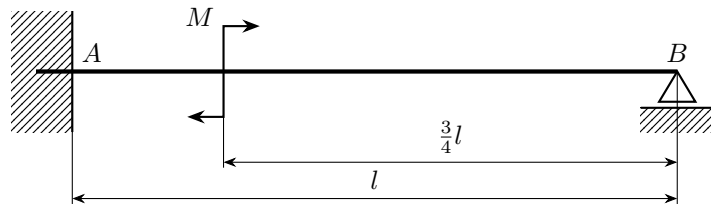
**Výsledek:**  $R_A = -\frac{4M}{3l}$ ,  $R_B = \frac{4M}{3l}F$ ,  $M_A = \frac{1}{3}M$ .



**Výsledek:**  $R_A = -\frac{9M}{8l}$ ,  $R_B = \frac{9M}{8l}F$ ,  $M_A = \frac{1}{8}M$ .



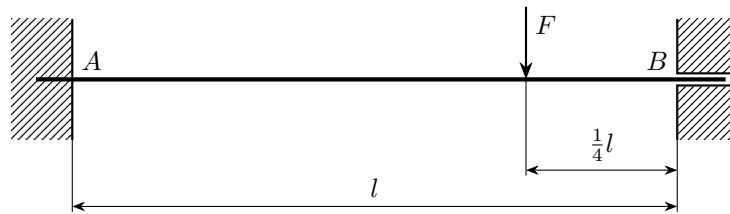
**Výsledek:**  $R_A = -\frac{5M}{6l}$ ,  $R_B = \frac{5M}{6l}F$ ,  $M_A = -\frac{1}{6}M$ .



**Výsledek:**  $R_A = -\frac{21M}{32l}$ ,  $R_B = \frac{21M}{32l}F$ ,  $M_A = -\frac{11}{32}M$ .

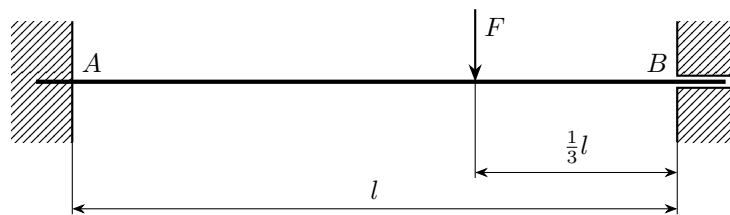
## 2.6 Nosník s vetknutými konci a jednou silou

Určete reakce



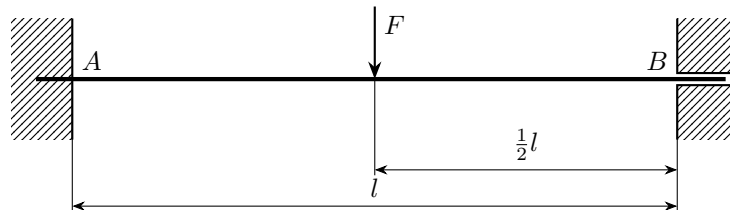
**Výsledek:**

$$R_A = \frac{5}{32}F, R_B = \frac{27}{32}F, M_A = -\frac{3}{64}Fl, M_B = -\frac{9}{64}Fl.$$



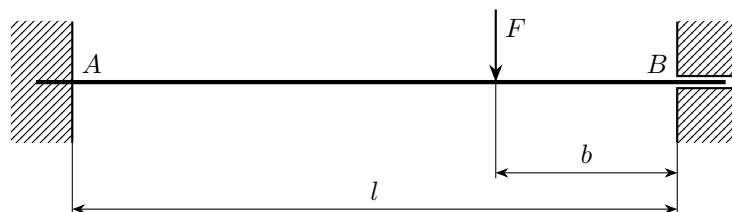
**Výsledek:**

$$R_A = \frac{7}{27}F, R_B = \frac{20}{27}F, M_A = -\frac{2}{27}Fl, M_B = -\frac{4}{27}Fl.$$



**Výsledek:**

$$R_A = \frac{1}{2}F, R_B = \frac{1}{2}F, M_A = -\frac{1}{8}Fl, M_B = -\frac{1}{8}Fl.$$

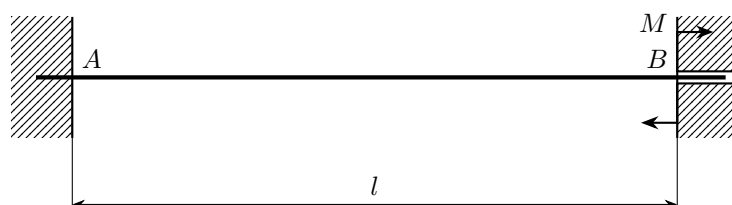


**Výsledek:**

$$R_A = \frac{b^2(3l-2b)}{l^3}F, R_B = \frac{(b-l)^2(2b+l)}{l^3}F, M_A = \frac{b^2(b-l)}{l^2}F, M_B = \frac{b(b-l)^2}{l^2}F.$$

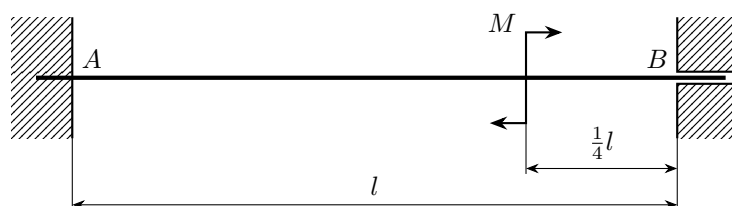
## 2.7 Nosník s vetknutými konci a momentem

Určete reakce



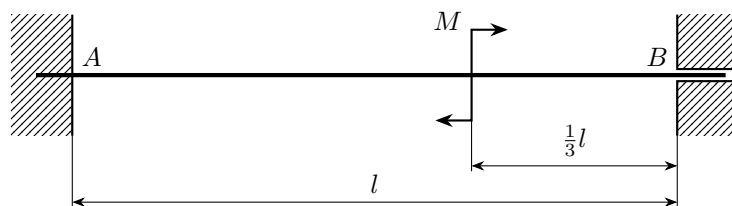
**Výsledek:**

$$R_A = 0, R_B = 0, M_A = 0, M_B = M.$$



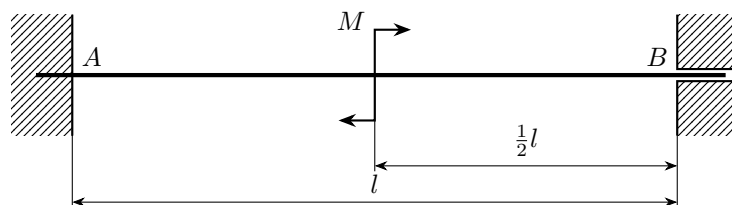
**Výsledek:**

$$R_A = -\frac{9M}{8l}, R_B = \frac{9M}{8l}, M_A = \frac{5}{16}M, M_B = \frac{3}{16}M.$$



**Výsledek:**

$$R_A = -\frac{4M}{3l}, R_B = \frac{4M}{3l}, M_A = \frac{1}{3}M, M_B = 0.$$



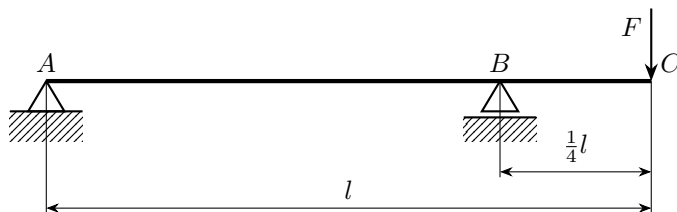
**Výsledek:**

$$R_A = -\frac{3M}{2l}, R_B = \frac{3M}{2l}, M_A = \frac{1}{4}M, M_B = -\frac{1}{4}M.$$

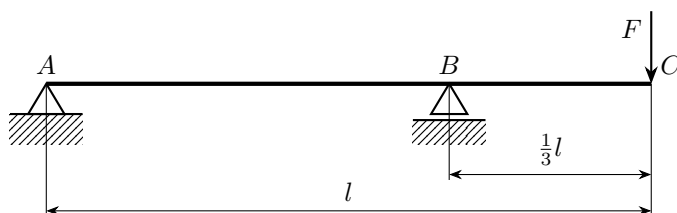
### 3 Staticky určité nosníky

#### 3.1 Nosník se dvěma podporami a silou na konci

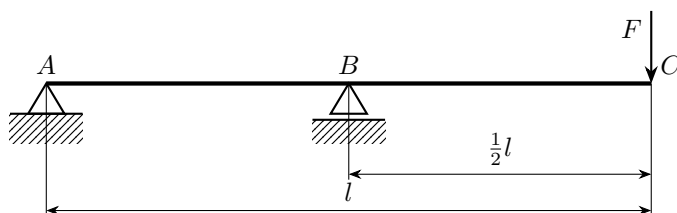
Určete průhyb na pravém konci nosníku



Výsledek:  $w_C = \frac{Fl^3}{48EJ_y}$ .

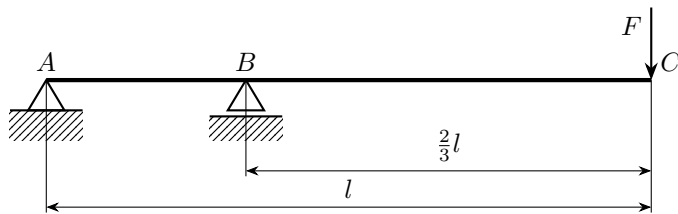


Výsledek:  $w_C = \frac{Fl^3}{27EJ_y}$ .

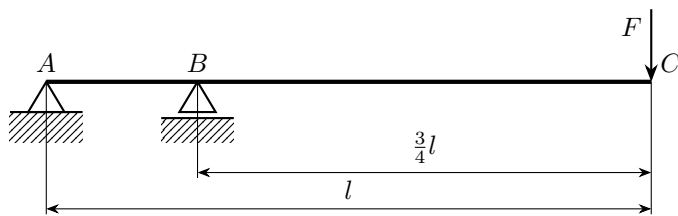


Výsledek:  $w_C = \frac{Fl^3}{12EJ_y}$ .

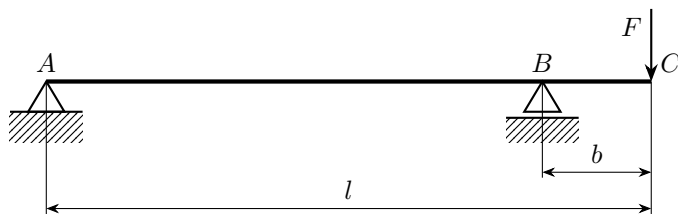




**Výsledek:**  $w_C = \frac{4Fl^3}{27EJ_y}$ .



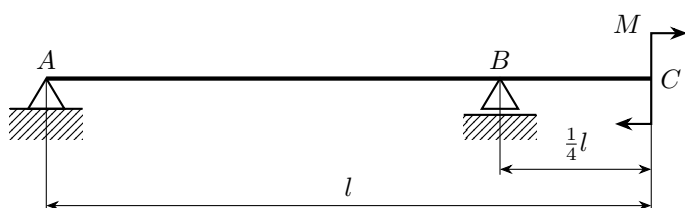
**Výsledek:**  $w_C = \frac{3Fl^3}{16EJ_y}$ .



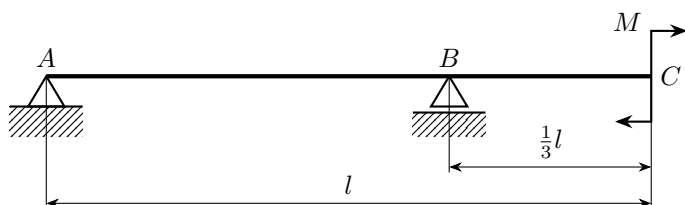
**Výsledek:**  $w_C = \frac{Flb^2}{3EJ_y}$ .

### 3.2 Nosník se dvěma podporami a momentem na konci

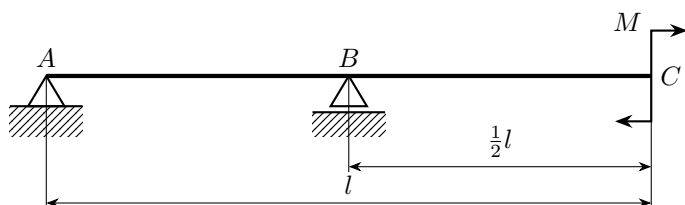
Určete průhyb na pravém konci nosníku



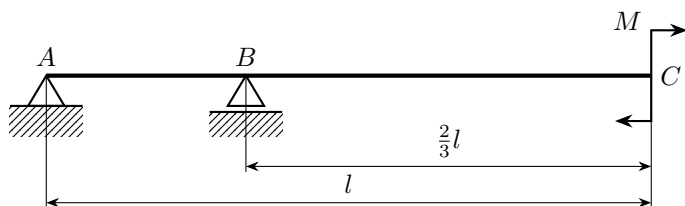
Výsledek:  $w_C = \frac{3Ml^2}{32EJ_y}$ .



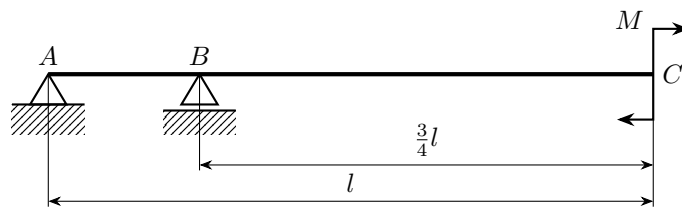
Výsledek:  $w_C = \frac{7Ml^2}{54EJ_y}$ .



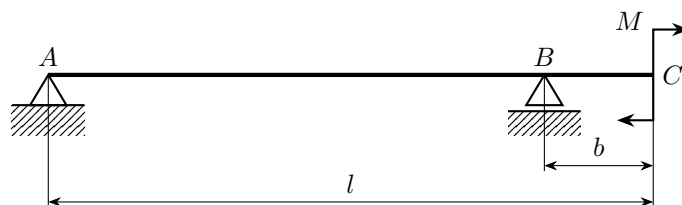
Výsledek:  $w_C = \frac{5Ml^2}{24EJ_y}$ .



**Výsledek:**  $w_C = \frac{8Ml^2}{27EJ_y}$ .



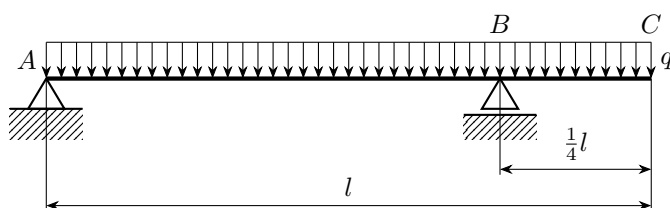
**Výsledek:**  $w_C = \frac{11Ml^2}{32EJ_y}$ .



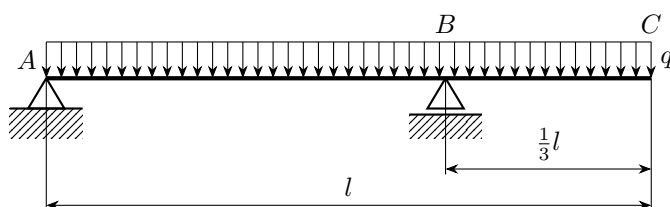
**Výsledek:**  $w_C = \frac{(b^2+2bl)M}{6EJ_y}$ .

### 3.3 Nosník se dvěma podporami a spojitým ztížením

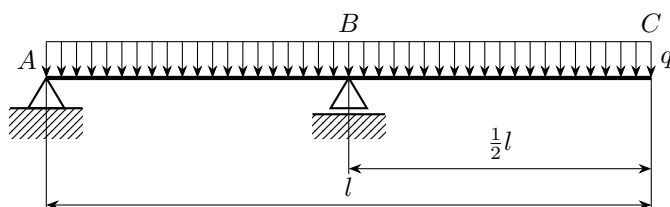
Určete průhyb na pravém konci nosníku



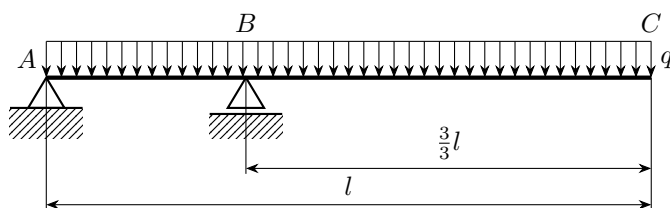
Výsledek:  $w_C = -\frac{ql^4}{512EJ_y}$ .



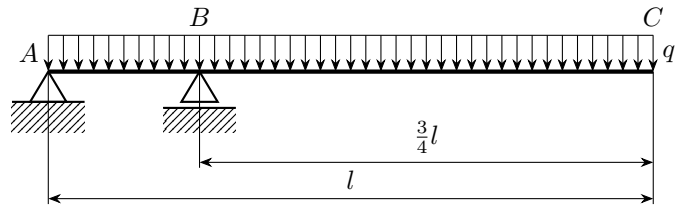
Výsledek:  $w_C = \frac{ql^4}{648EJ_y}$ .



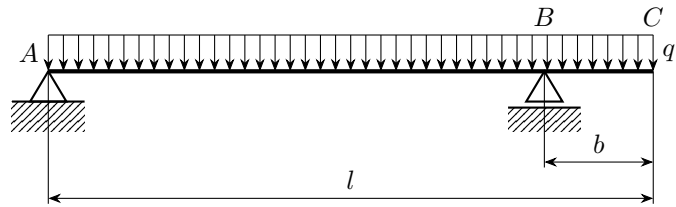
Výsledek:  $w_C = \frac{ql^4}{64EJ_y}$ .



**Výsledek:**  $w_C = \frac{13ql^4}{324EJ_y}$ .



**Výsledek:**  $w_C = \frac{29ql^4}{512EJ_y}$ .



**Výsledek:**  $w_C = \frac{(b^3l + 3b^2l^2 - bl^3)q}{24EJ_y}$ .