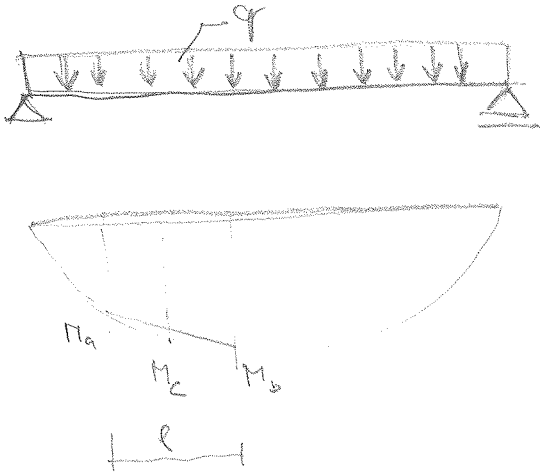
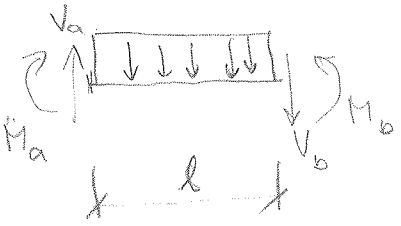
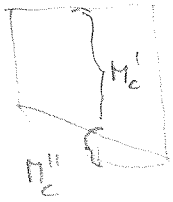
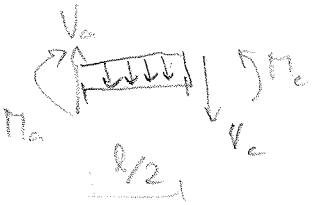
$M_x = M_a + V_a x - q\frac{x^2}{2}$





$$M_b = M_a + V_a l - \frac{q l^2}{2}$$





$$M_c = M_a + V_a \frac{l}{2} - \frac{q l}{2} \cdot \frac{l}{4}$$

$$= M_a + V_a \frac{l}{2} - q\frac{l^2}{8}$$

$$M_c' = \frac{M_a + M_b}{2}$$

$$= \frac{M_a + M_a + V_a l - \frac{q l^2}{2}}{2}$$

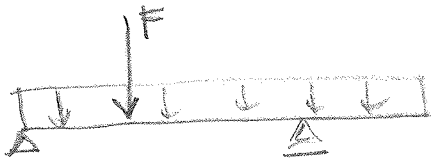
$$= M_a + V_a \frac{l}{2} - q\frac{l^2}{4}$$

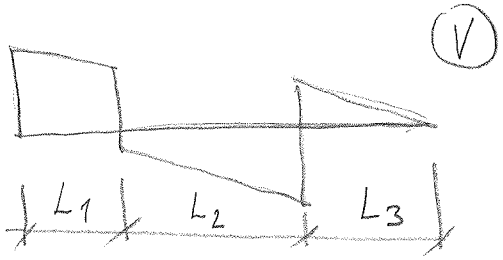
$$M_c'' = M_c - M_c'$$

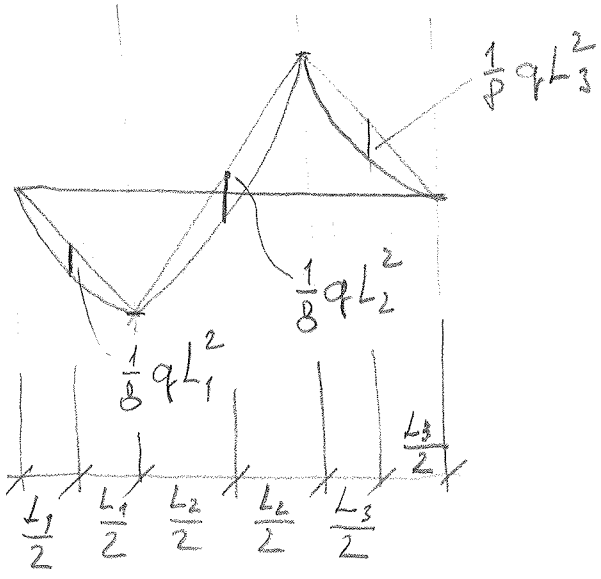
$$= \left(M_a + V_a \frac{l}{2} - q\frac{l^2}{8}\right)$$

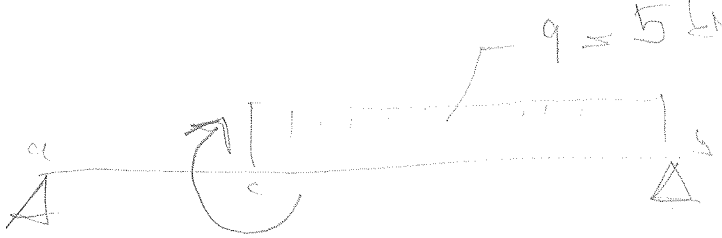
$$-\left(M_a + V_a \frac{l}{2} - q\frac{l^2}{4}\right) = q\frac{l^2}{8}$$

APLIKACE







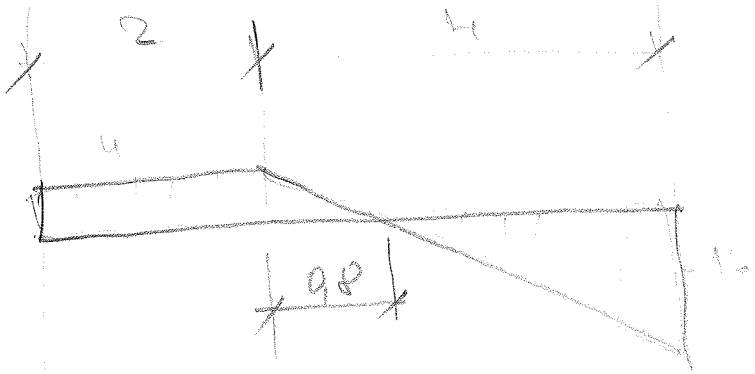


$M_A = -16$ kNm

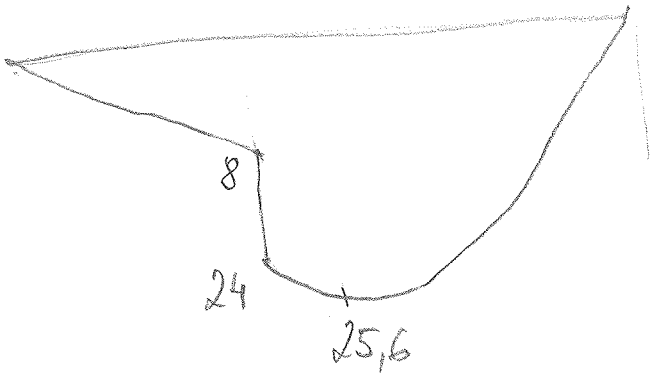
$A = \frac{-16 + 5 \cdot 4 \cdot 2}{6} = 4$

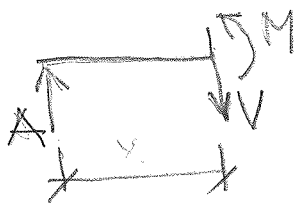
$B = \frac{16 + 20 \cdot 4}{6} = 16$

V



M





$\sum A - V = 0$

$V = A = 4$

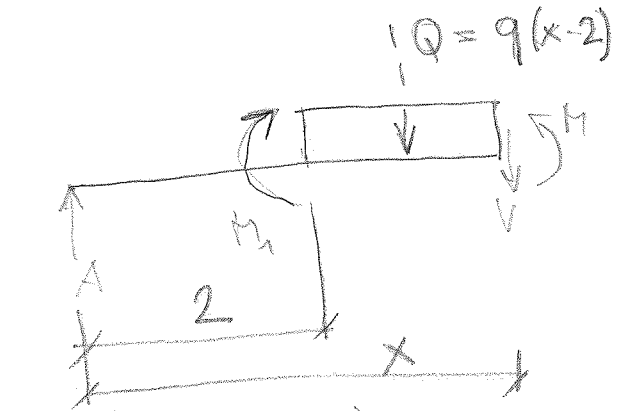
$A \cdot x - M = 0$

$M = A \cdot x = 4x$

$V = 4$

$M_{(x=0)} = 0$

$M_{(x=2)} = 8$



$A - Q - V = 0$

$V = A - Q = A - q(x-2)$

$V = 4 - 5(x-2) = -5x + 14$

$V_{(x=2)} = 4 \qquad V_{(x=6)} = -16$

$Ax - M_1 - Q \cdot \frac{(x-2)}{2} - M = 0$

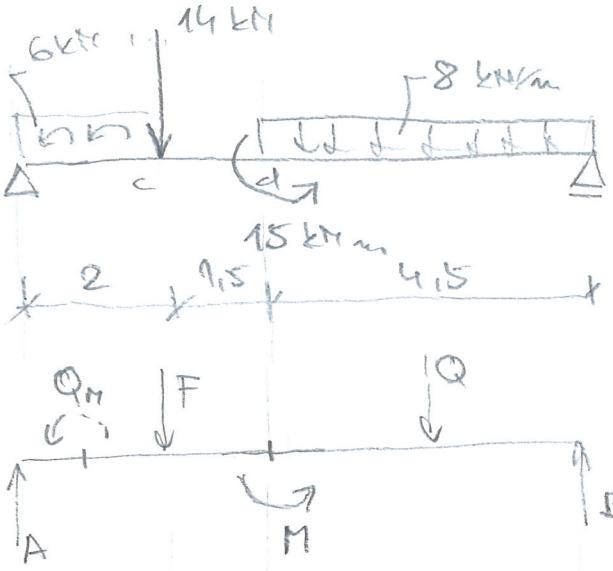
$M = Ax + M_1 - q(x-2)\frac{(x-2)}{2}$

$M = 4x + 16 - \frac{5}{2}(x-2)(x-2)$

$M = -2,5(x^2 - 4x + 4) + 4x + 16$

$= -2,5x^2 + 14x + 6$

$M_{(2)} = 24 \qquad M_{(6)} = 10 \qquad M_{max} = 25,6$



$Q_M = 6 \cdot 2 = 12$ kNm

$Q = 4,5 \cdot 8 = 36$ kN

$-Q_M + 3,5 \cdot F - M + 5,75 \cdot Q - 8B = 0$

$B = \frac{-12 + 3,5 \cdot 14 - 15 + 5,75 \cdot 36}{8} = 26$ kN

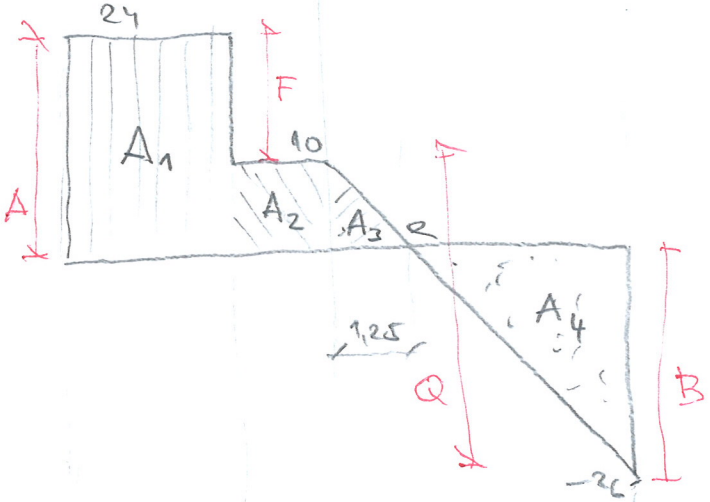
$Q_M + 4,5 \cdot F + M + 2,25 \cdot Q - 8A = 0$

$A = \frac{12 + 4,5 \cdot 14 + 15 + 2,25 \cdot 36}{8}$

$A = 24$ kN

KONTROLA

$A + B - F - Q = 24 + 26 - 14 - 36 = 0$ ✓



VNITŘNÍ SÍLY VIZ DALŠÍ STRANA

ALTERNATIVNĚ:

$V_a = A = 24$ kN

$V_{cP} = V_a - F = 24 - 14 = 10$ kN

$V_b = V_{cP} - Q = 10 - 36 = -26$ kN

$M_a = 0$ $\quad M = \int (V - m)\,dx + C$

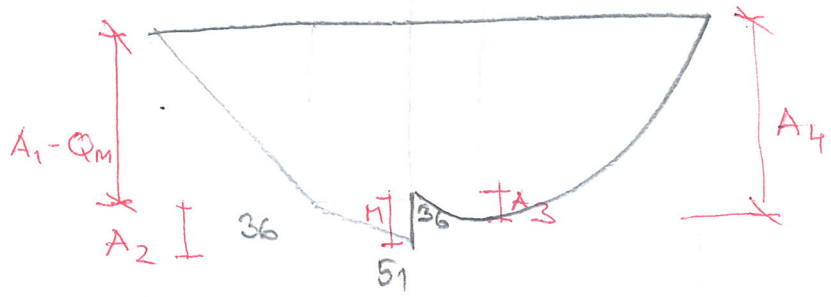
$M_C = M_a + A_1 - Q_M = 0 + 48 - 12 = 36$

$M_{dL} = M_C + A_2 = 36 + 15 = 51$

$M_{dP} = M_{dL} - M = 51 - 15 = 36$

$M_e = M_{dP} + A_3 = 36 + 6,25 = 42,25$

$M_b = M_e - A_4 = 42,25 - 42,25 = 0$ ✓



$A_1 = 24 \cdot 2 = 48$

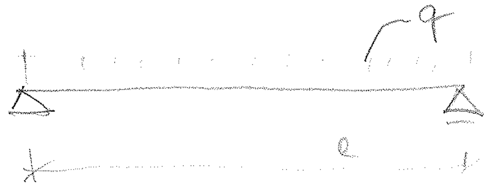
$A_2 = 10 \cdot 1,5 = 15$

$A_3 = \frac{10 \cdot 1,25}{2} = 6,25$

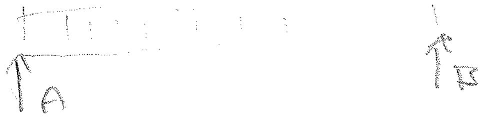
$A_4 = \frac{3,25 \cdot 26}{2} = 42,25$

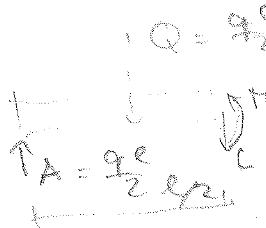
TECHOVÝ POLYGON

- MOSTÍK ZATÍŽENÝ SPOJITÝM ROVNOMĚRNÝM ZATÍŽENÍM



$A = B = \frac{ql}{2}$





$M_c + Q\frac{l}{4} - A\frac{l}{2} = 0$

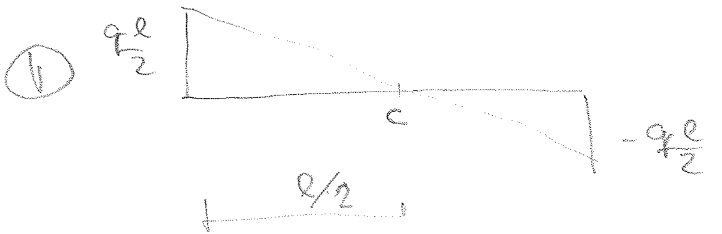
točí proti momentu M_c ⇒ (+)

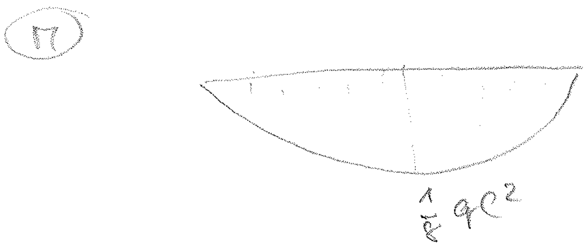
$M_c = A\, l/2 - Q\, l/4$

točí ve shodě s momentem M_c ⇒ (−)

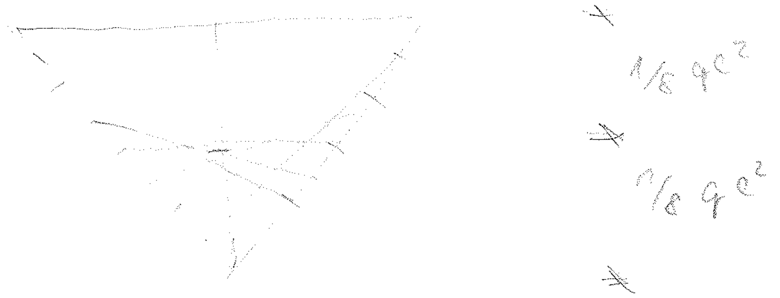
$= \frac{ql}{2}\frac{l}{2} - \frac{ql}{2}\frac{l}{4}$

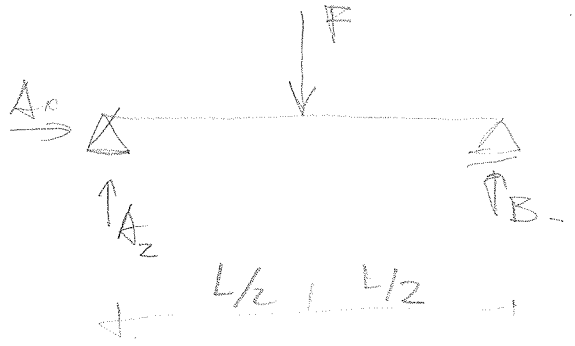
$= \frac{ql^2}{8}$





VYKRESLENÍ





$\Sigma F_{xi} = 0$

$A_x = 0$

$\Sigma M_{iA} = 0$ (+)

$-F \cdot L/2 + B \cdot L = 0$

$B = F/2$

$\Sigma F_{zi} = 0$

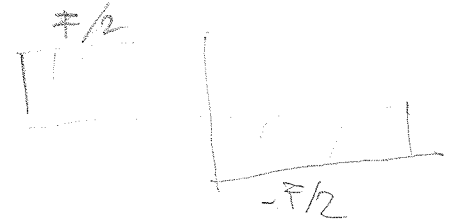
$-A - B + F = 0$

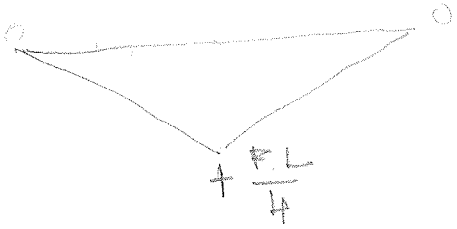
$A = F - B$

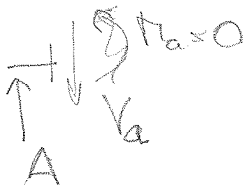
$A = F/2$

N

V

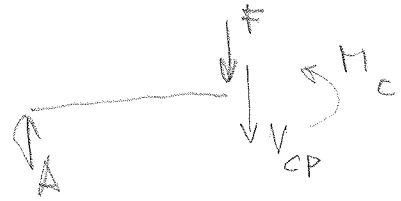






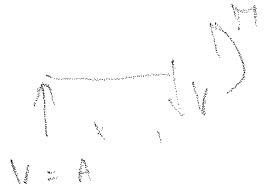
$-A + V_a = 0$

$V_a = A = F/2$



$-A + F + V_{cp} = 0$

$V_{cp} = A - F = -F/2$

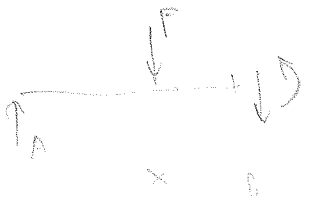


$-A \cdot L/2 + M_c = 0$

$M_c = +A \cdot L/2 = +\frac{FL}{4}$

$M' = A$

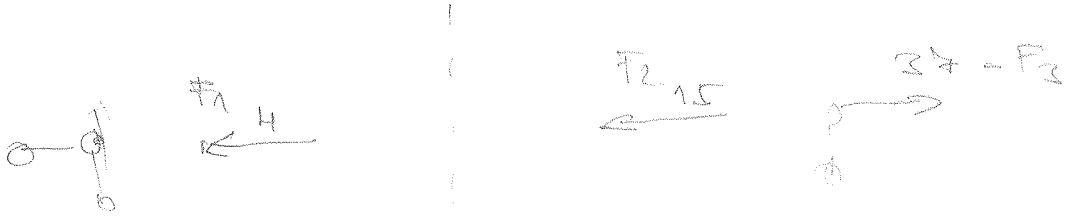
$M_{(L/2)} = A \cdot \frac{L}{2} = \frac{FL}{4}$

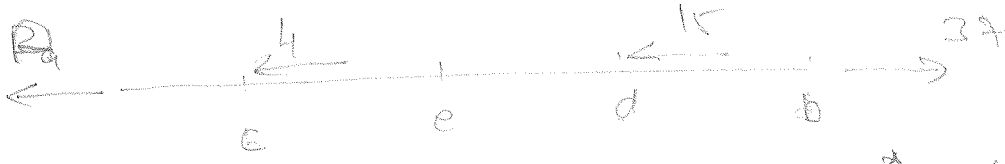


$V = A - F$

$M = Ax - F\left(x - \frac{L}{2}\right)$ $\quad M' = A - F$

$M_{(L/2)} = \frac{F}{2}\frac{L}{2} - F\left(\frac{L}{2} - \frac{L}{2}\right) = \frac{FL}{4}$



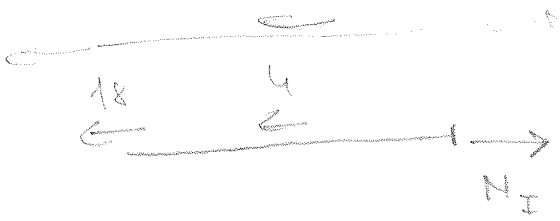


$\curvearrowleft + 4 + 15 - 37 = 0$

$R_a = 18$

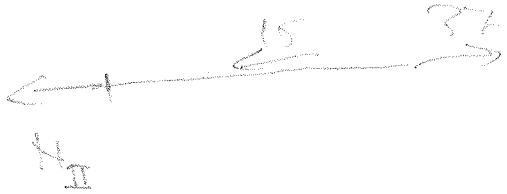
$R_I = 18 + 4 = 22$

$R_{II} = 37 - 15 = 22$



UVEDENÍ DO ROVNOVÁHY

$N_I = 18 + 4 = 22$



$N_{II} = 37 - 15 = 22$

N_{II} & UVÁDÍ DO ROVNOVÁHY DRUHOU ČÁST

PLNÍ FUNKCI R_I

$N_{II} = R_I$

N_I - ÚČINEK ODEBRANÉ ČÁSTI I NA ZBÝVAJÍCÍ ČÁST II

DĚLÁ TUTO FUNKCI (UVEDENÍ DO ROVNOVÁHY ČÁSTI I) PLNILA R_{II}

NYNÍ STEJNOU ÚLOHU MÁ N_I

$\Rightarrow N_I = R_{II}$

VNITŘNÍ SÍLA PŮSOBÍCÍ ZBÝVAJÍCÍ NAHRAZUJE I PŘEDSTAVUJE ÚČINEK ODEBRANÉ ČÁSTI II

R_I a R_{II} JSOU V ROVNOVÁZE $\Rightarrow$

N_I a N_{II} JSOU V ROVNOVÁZE $\Rightarrow N$... PŮSOBÍ NA OBĚ STRANY ŘEZU V OPAČNÉ

$M = -2{,}5x^2 + 14x + 6$

$M' = -5x + 14 \quad = V$

$M' = 0 \quad -5x + 14 = 0$

$x = 2{,}8$

$M_{(x=2{,}8)} = 25{,}6$