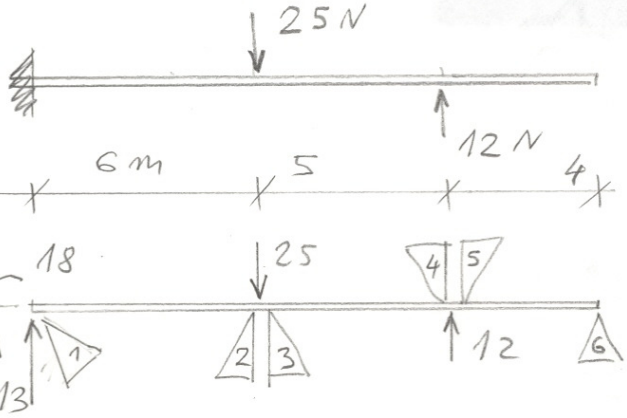
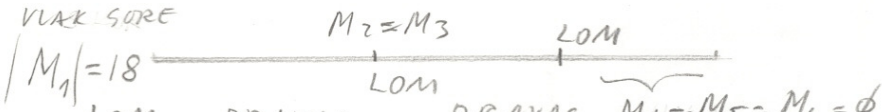
1)



DJELOVANJA U KRUTOM SPOJU (UPETOM KRAJU) ODREĐUJU SE NA POZNATI NAČIN.

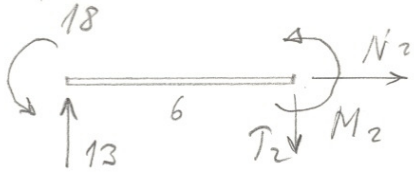
OZNAČENI SU SVI KARAKTERISTIČNI PRESJECI.

KARAKTERISTIKE MOMENTA SAVIJANJA



RUBNE VELIČINE SE DIREKTNO ODREĐUJU.

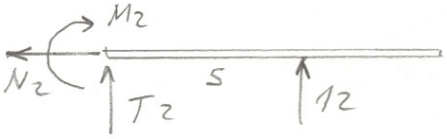
OVDJE TREBA IZRAČUNATI SAMO $M_2 = M_3$. RADI KONTROLE ZA SVAKI DIO ZASEBNO



$M_2 = 6 \cdot 13 - 18$

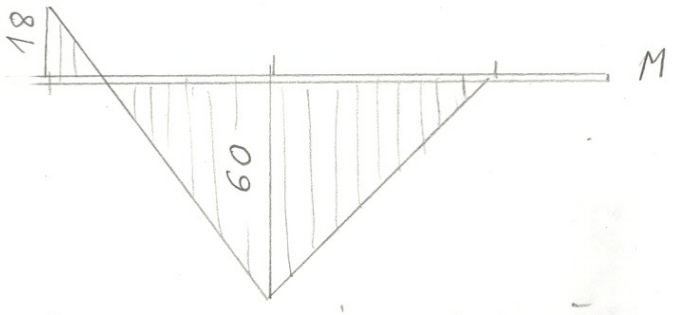
$M_2 = 60$

VLAK DOLJE



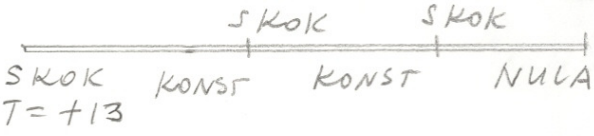
$M_2 = +5 \cdot 12 = 60.$

VLAK DOLJE



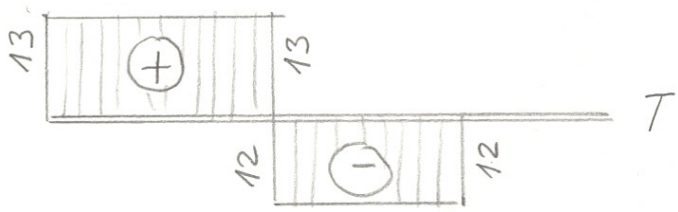
ORDINATA M SE CRTA NA VLAČNU STRANU.

KARAKTERISTIKA POPREČNE SILE



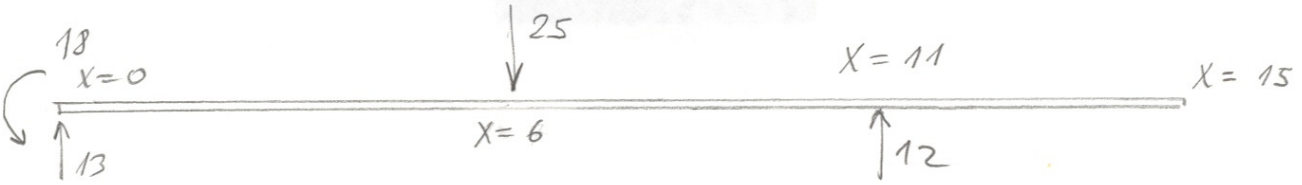
PODRUČJE (5,6) NE UTJEČE, PA SE SILA 12 PROMATRA KAO RUBNA:

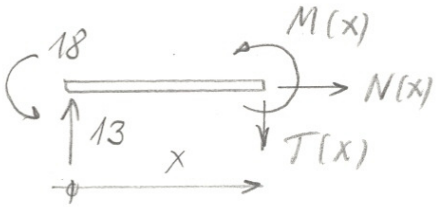
$T_4 = -12$



$N \equiv \phi$

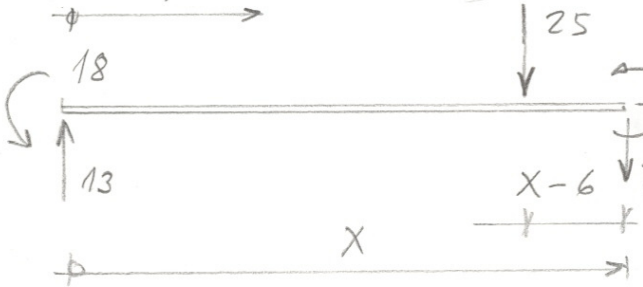
b) ANALITIČKI IZRAZI





ZA $0 \leq X \leq 6$; $M(X) = -18 + 13 \cdot X$

ZA $0 \leq X < 6$; $T(X) = +13$



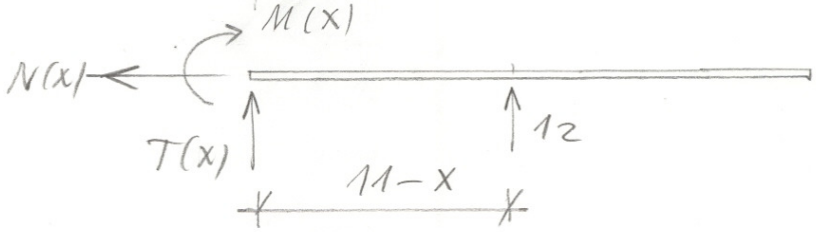
ZA $6 \leq X \leq 11$;

$M(X) = -18 + 13 \cdot X - (X-6) \cdot 25 = 132 - 12 \cdot X$

ZA $6 < X < 11$;

$T(X) = 13 - 25 = -12$

ISTO PODRUČJE, IZRAZI ODREĐENI IZ RAVNOTEŽE DESNOG DIJELA



ZA $6 \leq X \leq 11$; $M(X) = (11-X) \cdot 12 = 132 - 12 \cdot X$

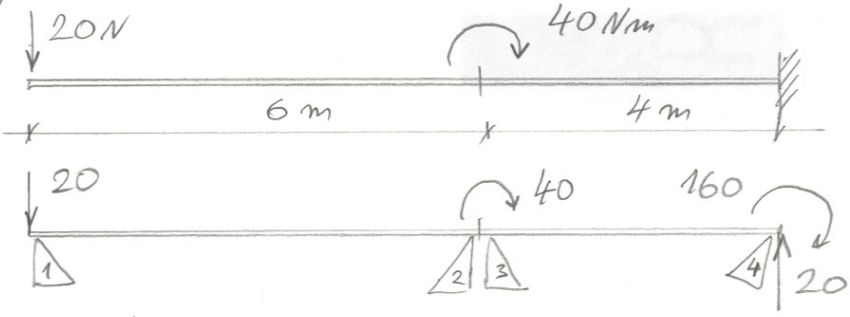
ZA $6 < X < 11$; $T(X) = -12$

ZA $11 \leq X \leq 15$; $M(X) = \emptyset$

ZA $11 < X \leq 15$; $T(X) = \emptyset$

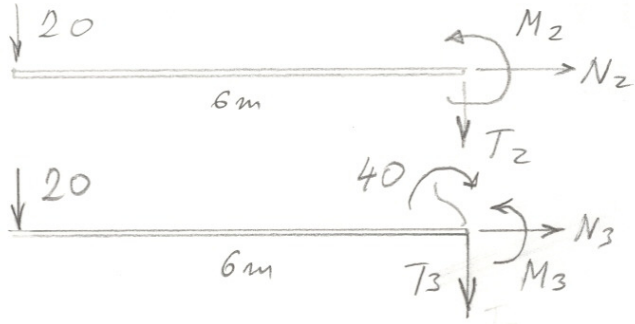
ZA $0 \leq X \leq 15$ $N(X) = \emptyset$.

2)



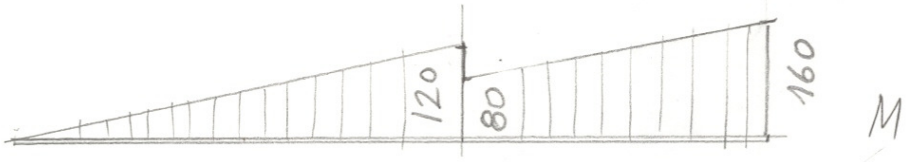
a) STVARNA DJELOVANJA I KARAKTERISTIČNI PRESJECI

KARAKTERISTIKE MOMENTA SAVIJANJA



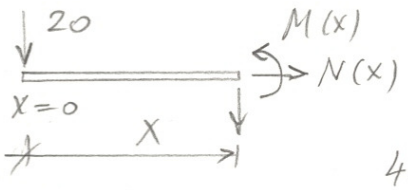
$M_2 = -6 \cdot 20 = -120$ VLAK GORE

$M_3 = -6 \cdot 20 + 40 = -80$ VLAK GORE



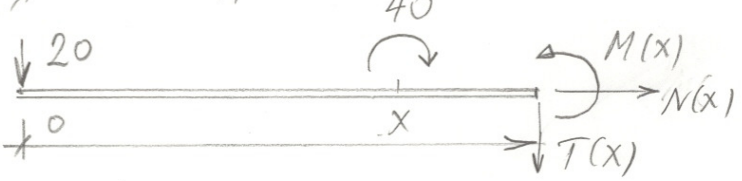
KARAKTERISTIKE POPREČNE SILE

ANALITIČKI IZRAZI:



ZA $0 \leq X < 6$; $M(X) = -20 \cdot X$

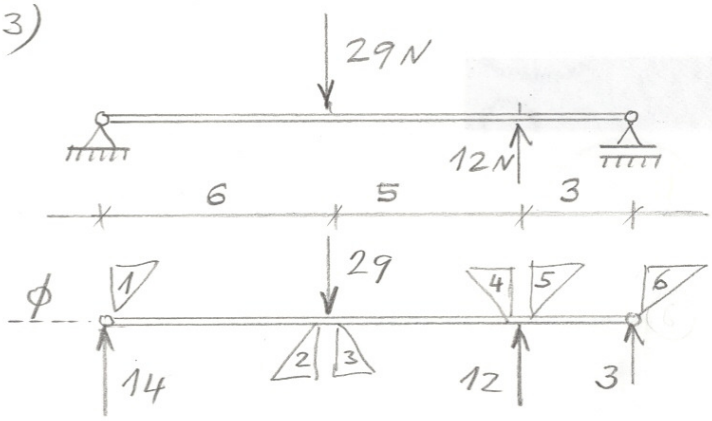
ZA $0 \leq X \leq 10$; $T(X) = -20$; $N(X) = \emptyset$



ZA $6 < X \leq 10$;

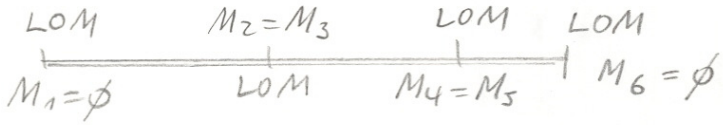
$M(X) = 40 - 20 \cdot X$

3)

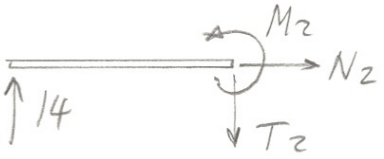


a) STVARNA DJELOVANJA U SPOJEVIMA I KARAKTERISTIČNI PRESJECI

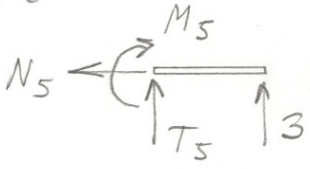
KARAKTERISTIKE MOMENTA SAVIJANJA



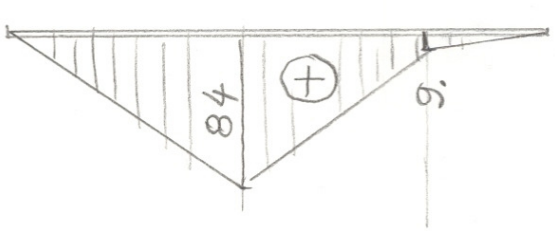
TREBA ODREDITI SAMO M_2 i M_5



$M_2 = +6 \cdot 14 = +84$; VLAK DOLJE

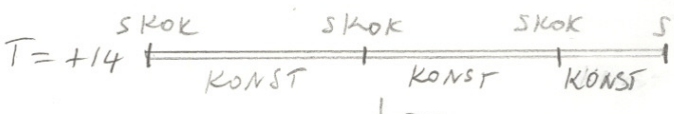


$M_5 = 3 \cdot 3 = +9$; VLAK DOLJE

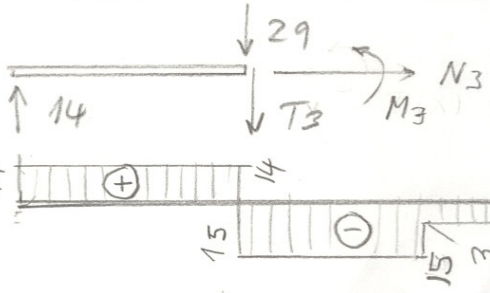


UZ OBVEZATNO NANOŠENJE ORDINATE NA VLAČNU STRANU PREDZNAK SE UNOSI SAMO AKO JE DEFINIRAN. OVDJE: POMOĆU SKICE PROMATRANOG DIJELA

KARAKTERISTIKA POPREČNE SILE



SKOK : $T = -3$ DIREKTNO VIDLJIVO

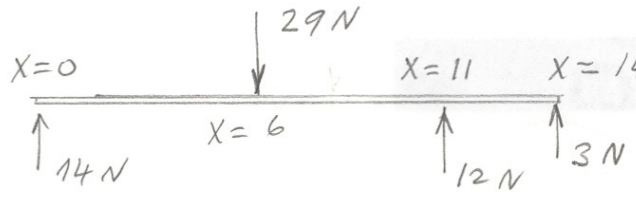


$T_3 = 14 - 29 = -15$

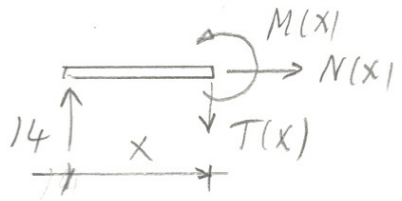
$T_4 = T_3$

KONTROLA ZA (3,4)

$\frac{dM}{dx} = \frac{9-84}{5} = -15$ ✓

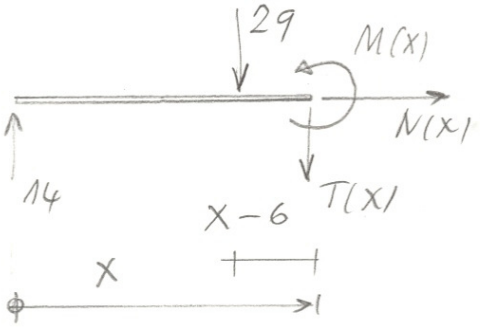


b) ANALITIČKI IZRAZI



ZA $0 \leq X \leq 6$; $M(x) = 14 \cdot x$ (VLAK DOLJE)

ZA $0 \leq x < 6$; $T(x) = +14$



ZA $6 \leq X \leq 11$

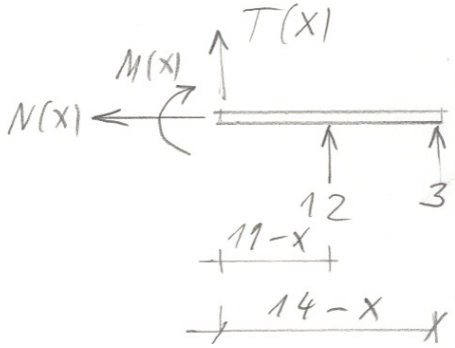
$M(x) = 14 \cdot x - (x-6) \cdot 29$

$= 174 - 15X$

ZA $6 < X < 11$

$T(x) = 14 - 29 = -15$

KONTROLA: RAVNOTEŽA DESNOG DIJELA



ZA $6 \leq X \leq 11$;

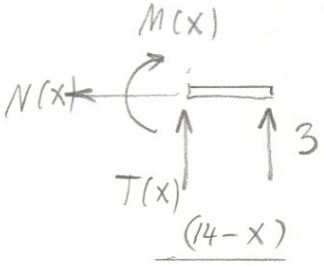
$M(x) = (11-x) \cdot 12 + (14-x) \cdot 3$

$M(x) = 132 - 12x + 42 - 3X$

$M(x) = 174 - 15X$

ZA $6 < X < 11$

$T(x) = -12 - 3 = -15$



ZA $11 \leq X \leq 14$

$M(x) = (14-x) \cdot 3$

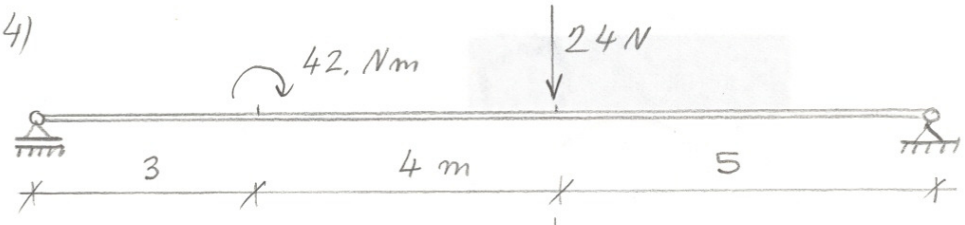
$= 42 - 3X$

ZA $11 < X \leq 14$

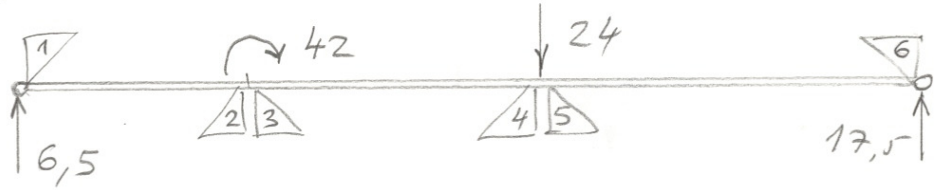
$T(x) = -3.$

ZA $0 \leq X \leq 14$; $N(x) = \phi.$

4)



a)



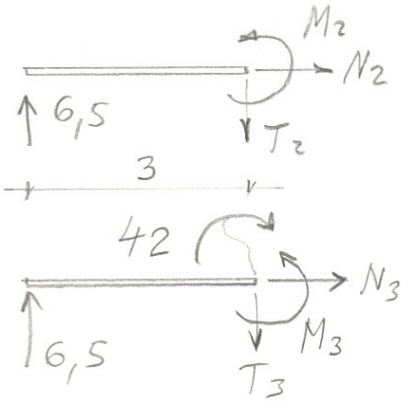
STVARNA DJELOVANJA I KARAKTERIST. PRESJECI.

KARAKTERISTIKE MOMENTA SAVIJANJA

LOM — SKOK — LOM — LOM

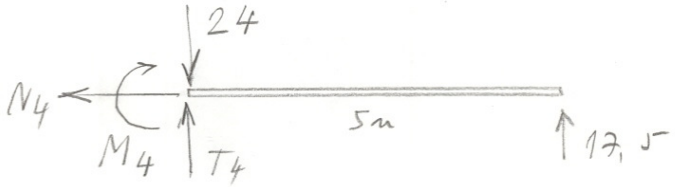
$M_1 = 0$, PRAVAC — PRAVAC — PRAVAC — $M_6 = \emptyset$

TREBA ODREDITI M_2, M_3, $M_4 = M_5$.

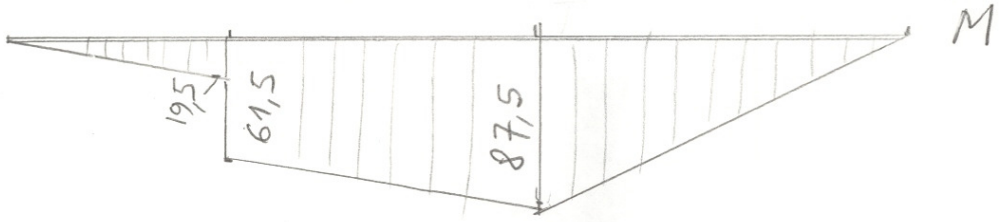


$M_2 = 3 \cdot 6,5 = 19,5$ (VLAK DOLJE)

$M_2 = 3 \cdot 6,5 + 42 = 61,5$ (VLAK DOLJE)



$M_4 = 5 \cdot 17,5 = 87,5$



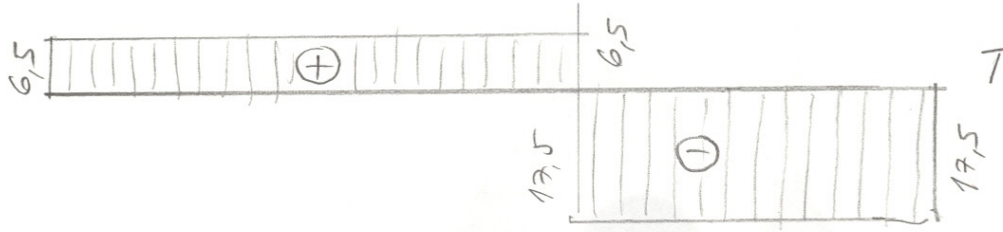
KARAKTERISTIKE POPREČNE SILE

$T_2 = T_3 = T_4 = T_1$

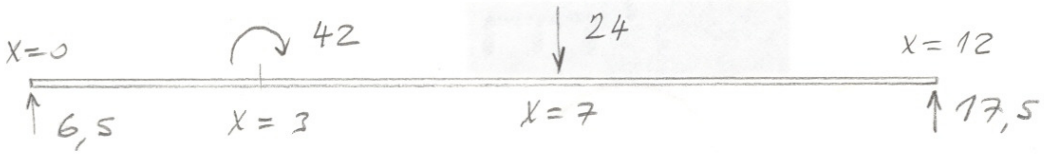
$T_5 = T_6$

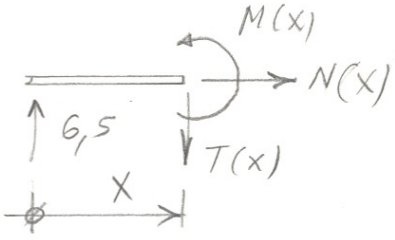
SKOK — SKOK — SKOK

$T_1 = +6,5$ KONST — KONST $T_6 = -17,5$



ANALITIČKI IZRAZI



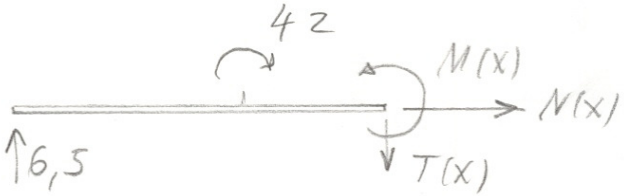


ZA $0 \leq X < 3$

$M(x) = 6,5 \cdot X$

ZA $0 \leq X < 7$

$T(x) = + 6,5$

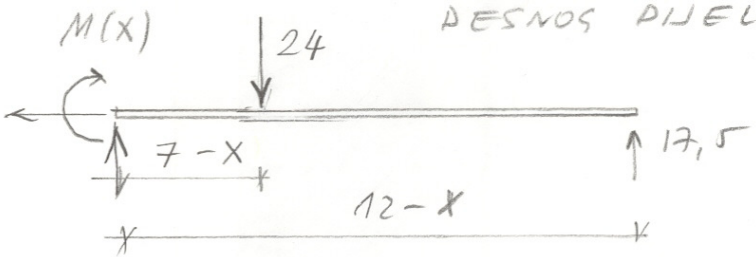


ZA $3 < X \leq 7$

$M(x) = 42 + 6,5 \cdot X$

($T(x)$ DEFINIRAN)

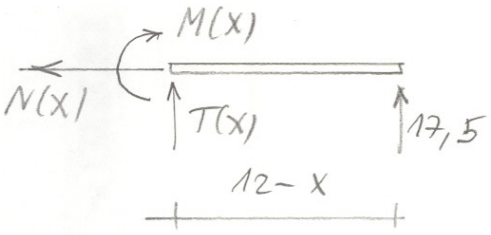
KONTROLA: RAVNOTEŽA DESNOG DIJELA



ZA $3 < X \leq 7$ $\quad M(x) = -(7-x) \cdot 24 + (12-x) \cdot 17,5$

$M(x) = -168 + 24 \cdot X + 210 - 17,5 \cdot X$

$M(x) = 42 + 6,5 \cdot X$

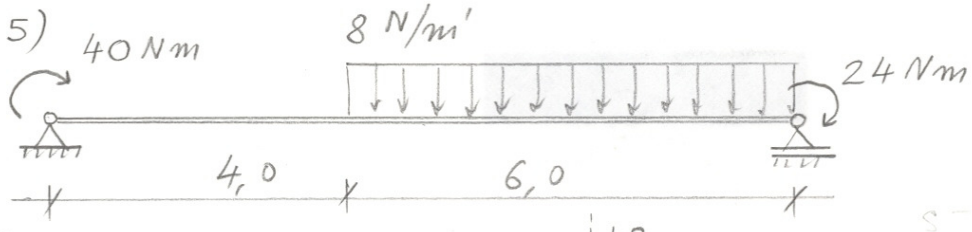


ZA $7 \leq X \leq 12$ $\quad M(x) = (12-x) \cdot 17,5 = 210 - 17,5 \cdot X$

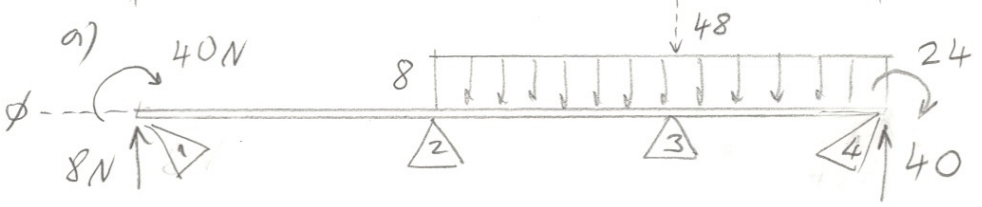
ZA $7 < X \leq 12$ $\quad T(x) = - 17,5$

ZA $0 \leq X \leq 12$; $\quad N(x) = \emptyset$.

5)

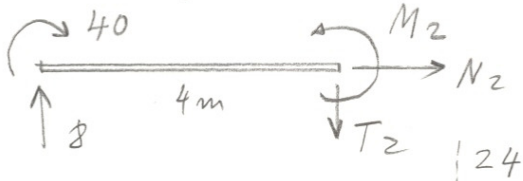


a)



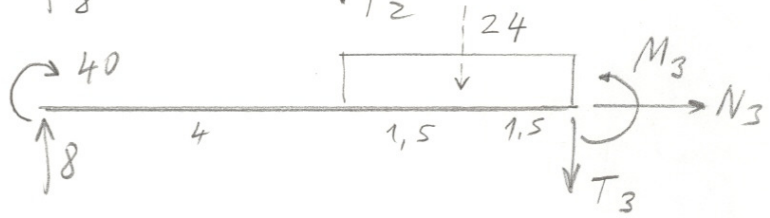
STVARNA DJELOVANJA I KARAKTERISTIČNI PRESJECI

KARAKTERISTIKE MOMENTA SAVIJANJA



$M_2 = 40 + 8 \cdot 4 = 72\ Nm$

$T_2 = 8$



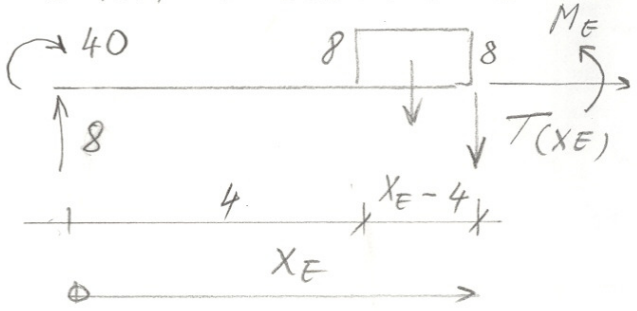
$M_3 = 40 + 7 \cdot 8 - 1{,}5 \cdot 24$

$M_3 = 60$

$T_3 = -16$

NA GREDU NE DJELUJU DISTRIBUIRANI MOMENTI PA VRIJEDI $\frac{dM}{dx} = +T$ NA PODRUČJU (2, 3)

POPREČNA SILA MIJENJA PREDZNAK, A KAKO JE T LINEARAN, UNUTAR PODRUČJA JE NULTOČKA T, U TOM PRESJEKU JE LOKALNI EKSTREM M.

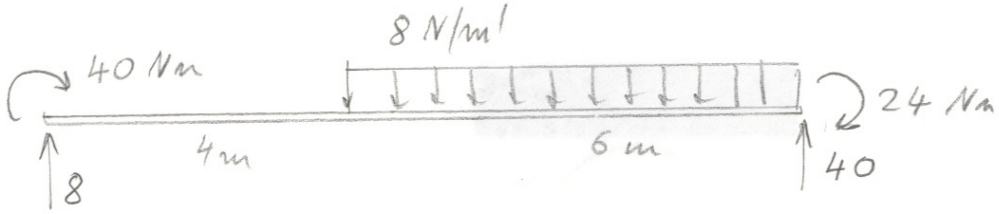


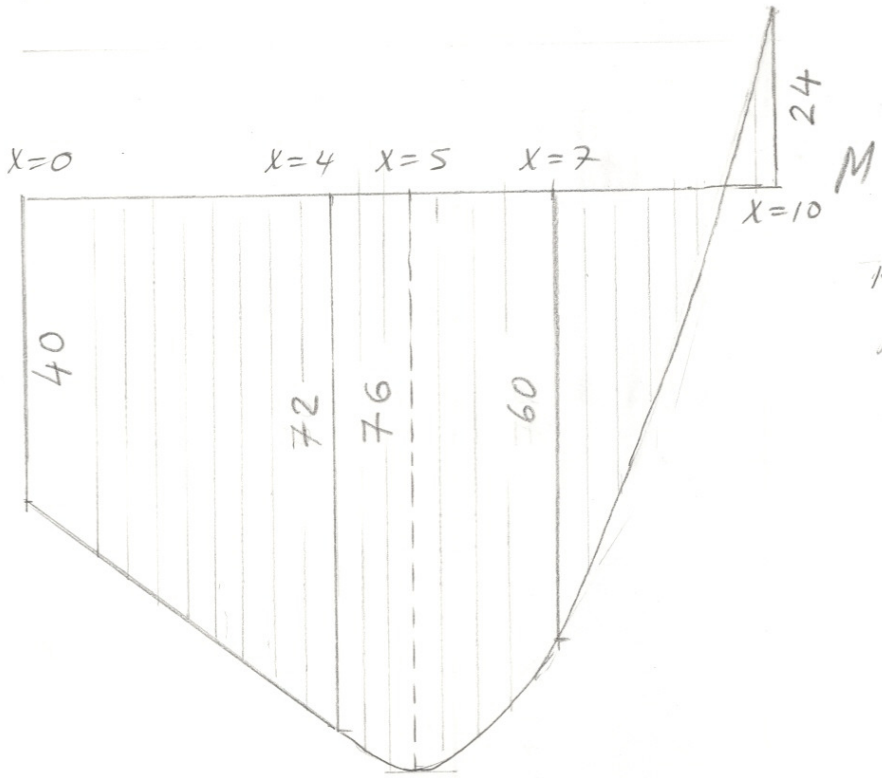
$T(x_E) = 8 - (x_E - 4) \cdot 8$

$8 - 8x_E + 32 = 0$

$x_E = +5$

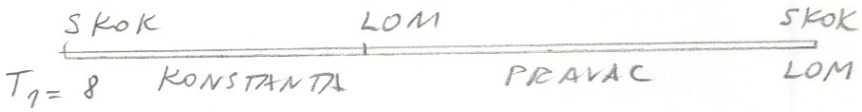
$M_E = M(x_E) = 40 + 5 \cdot 8 - 1 \cdot 8 \cdot 0{,}5 = 76{,}0$

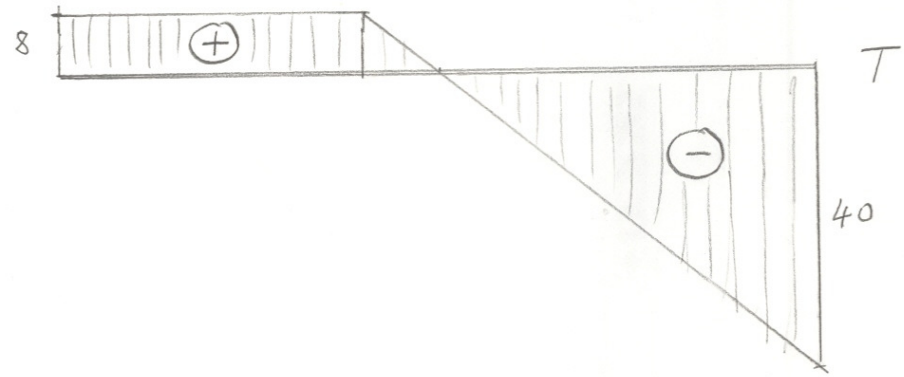




KVADRATNA PARABOLA JE ODREĐENA S 3 ORDINATE, PA JE OSIM PODATAKA ZA PRESJEKE NA KRAJEVIMA, DOVOLJNO ODREDITI M ZA JEDAN PRESJEK UNUTAR PODRUČJA

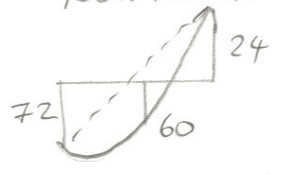
KARAKTERISTIKA POPREČNE SILE



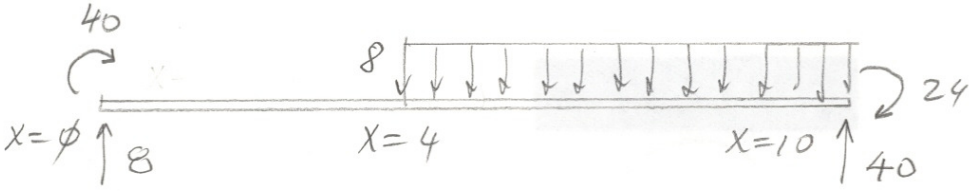


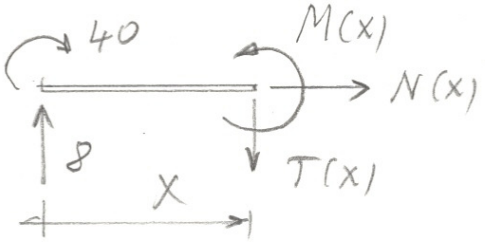
U OVOM SLUČAJU NIJE POTREBNO ODREĐIVATI PODATKE ZA PRESJEKE U POLJU

KONTROLA ODSTUPANJA M OD PRAVCA ZA (4, 10)



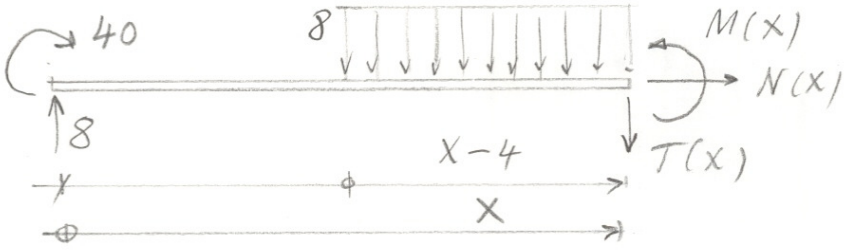
$$\Delta M^q = 60 - \frac{72-24}{2} = 36, \quad \Delta M^s = \frac{8 \cdot 6^2}{8} = 36 \checkmark$$





ZA $0 \leq X \leq 4$, $M(x) = 40 + 8 \cdot X$

$T(x) = +8$



ZA $4 \leq X \leq 10$;

$M(x) = 40 + 8 \cdot X - \frac{8(X-4)^2}{2}$

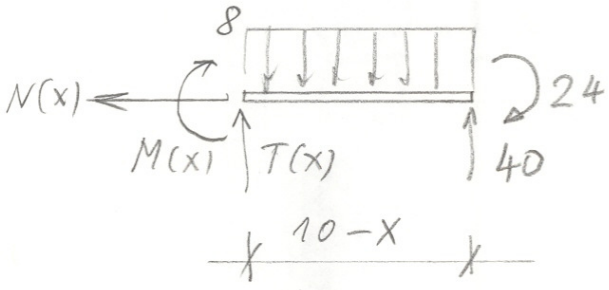
$M(x) = 40 + 8x - 4x^2 + 32x - 64$

$M(x) = -24 + 40x - 4x^2$

$T(x) = 8 - 8(x-4)$

$T(x) = 40 - 8x$

KONTROLA: RAVNOTEŽA DESNOG DIJELA



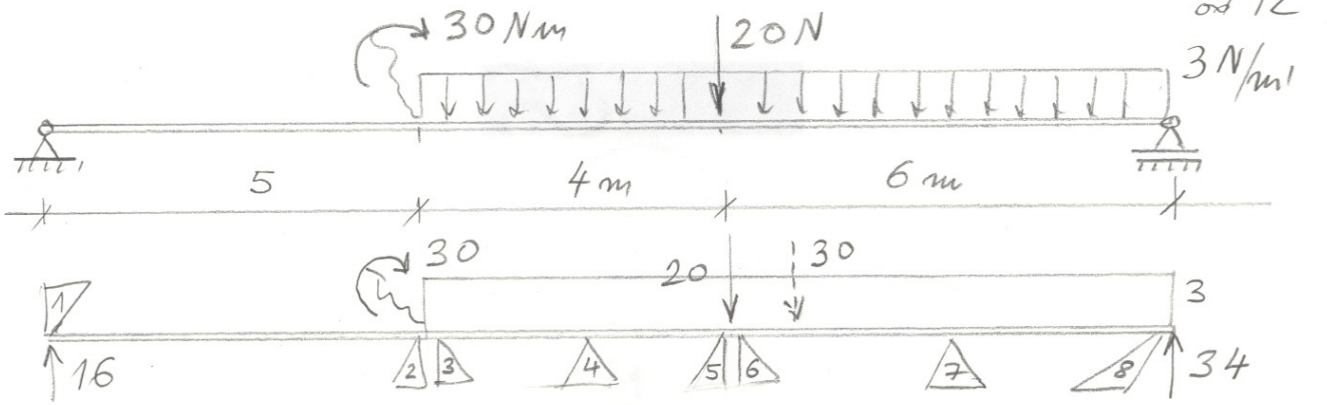
ZA $4 \leq X \leq 10$

$M(x) = (10-X) \cdot 40 - \frac{8}{2}(10-X)^2 - 24$

$400 - 40X - 400 + 80 \cdot X - 4 \cdot X^2 - 24$

$M(x) = -24 + 40 \cdot X - 4 \cdot X^2$

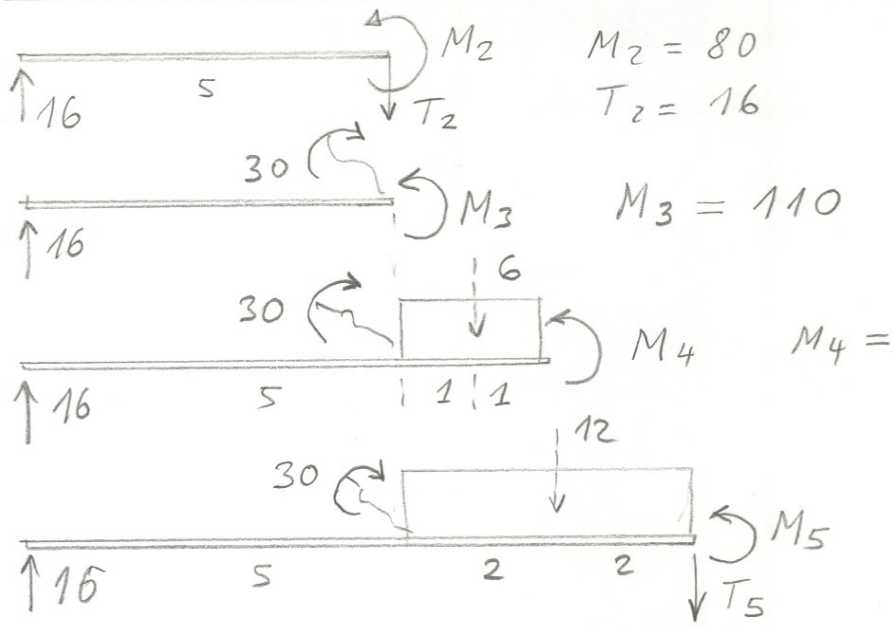
$T(x) = 8(10-X) - 40 = 40 - 8 \cdot X$



KARAKTERISTIKE M i T

$M_1 = 0$ LOM PRAVAC SKOK PARABOLA^{I} LOM PARABOLA^{II} LOM, $M_8 = 0$

$T_1 = 16$ SKOK, KONST. PRAVAC SKOK PRAVAC SKOK, $T_8 = -34$



$M_2 = 80$

$T_2 = 16$

$M_3 = 110$

$M_4 = 136$

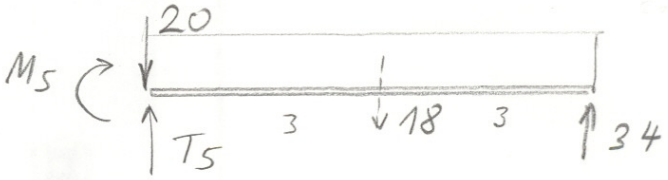
$M_5 = 150$

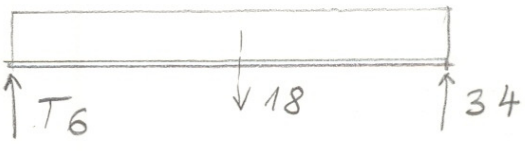
$T_5 = +4$

KONTROLA

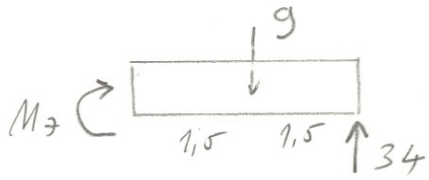
$M_5 = 150$

$T_5 = +4$



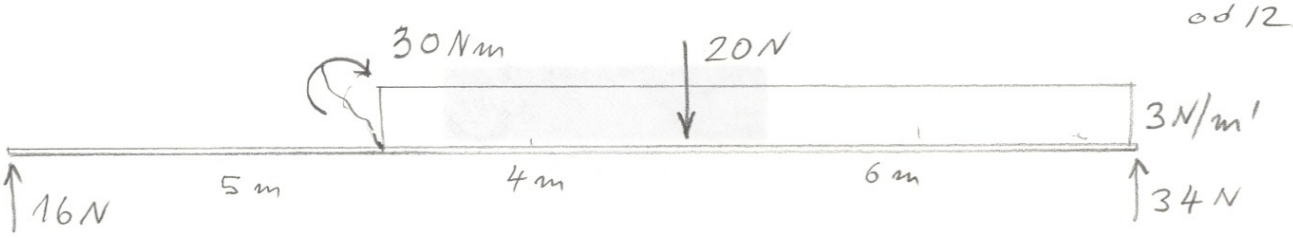


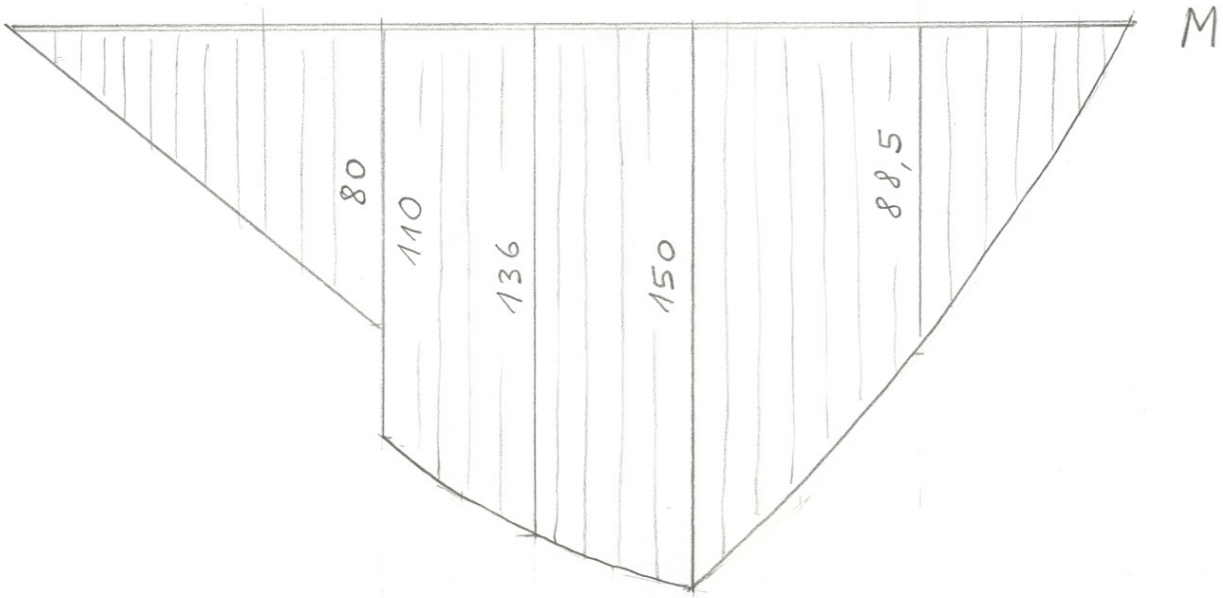
$T_6 = -16$

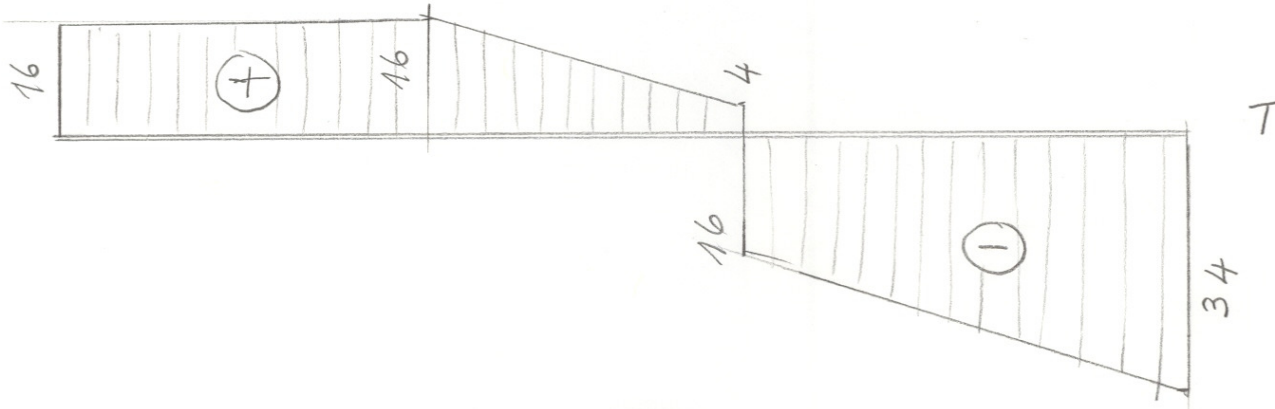


$M_7 = 88,5$

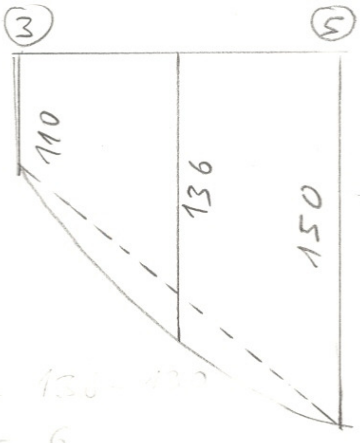
UZ PRESJEKE SU UCRTANE I ISKAZANE SAMO POTREBNA DJELOVANJA







KONTROLA ODSTUPANJA LINIJE M OD PRAVCA



$$\Delta M^q = 136 - \frac{110+150}{2}$$

$$\Delta M^q = 6{,}0$$

$$\Delta M^s = \frac{3 \cdot 4^2}{8} = 6{,}0$$

ZA (6, 8)

$$\Delta M_q = 88{,}5 - \frac{150+0}{2}$$

$$\Delta M^q = 13{,}5$$

$$\Delta M^s = \frac{3 \cdot 6^2}{8} = 13{,}5$$