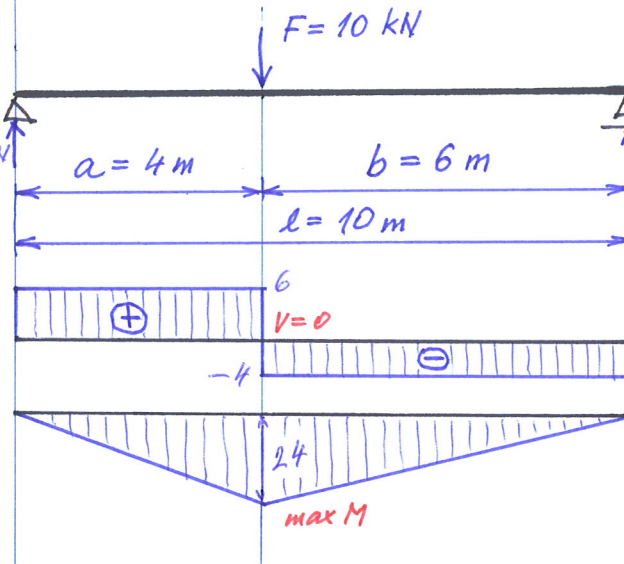


①

$F \frac{b}{l} = 10 \frac{6}{10} = 6 \text{ kN}$

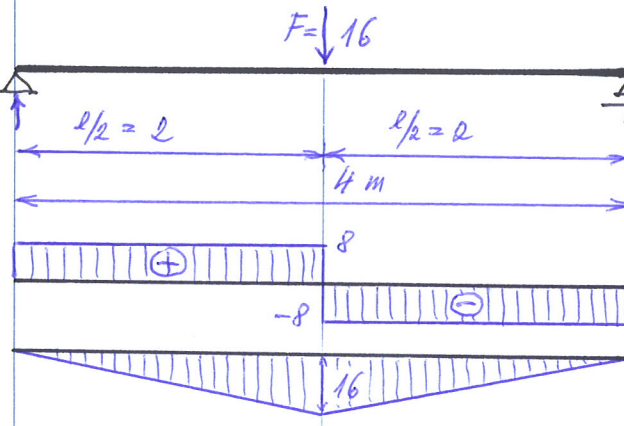


$F \frac{a}{l} = 10 \frac{4}{10} = 4 \text{ kN}$

$6 \cdot 4 = 4 \cdot 6 = 24 \text{ kNm}$

②

$\frac{F}{2} = 8$

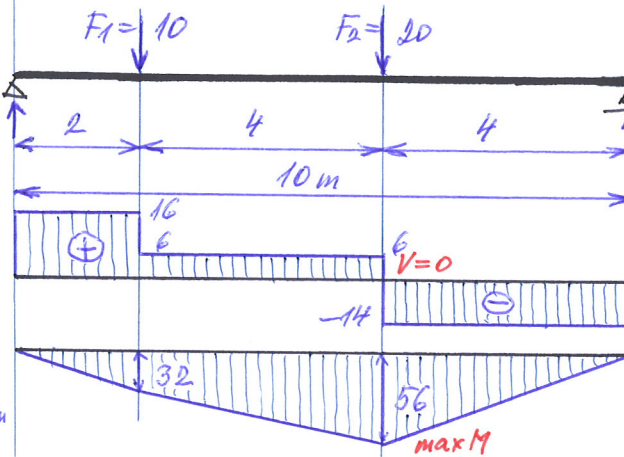


$8 = \frac{F}{2}$

$\frac{1}{2} F \cdot \frac{l}{2} = \frac{1}{4} F l = \frac{1}{4} 16 \cdot 4 = 16 \text{ kNm}$

③

$F_1 \frac{8}{10} + F_2 \frac{4}{10} = 16$



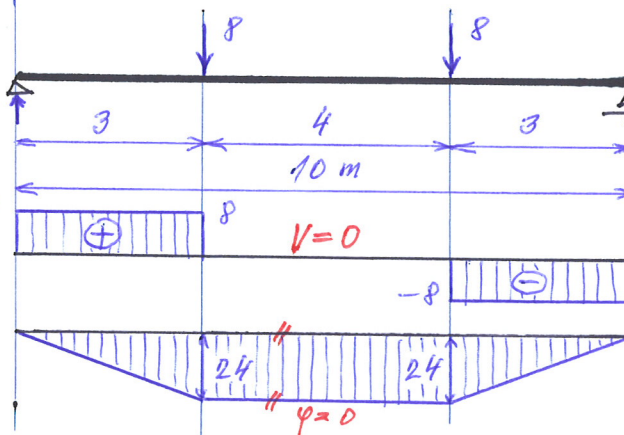
$F_1 \frac{2}{10} + F_2 \frac{6}{10} = 14$

$16 \cdot 2 = 32 \text{ kNm}$
 $14 \cdot 8 - 20 \cdot 4 = 112 - 80 = 32 \text{ kNm}$

$14 \cdot 4 = 56 \text{ kNm}$
 $16 \cdot 6 - 10 \cdot 4 = 96 - 40 = 56 \text{ kNm}$

④

(V)



$8 \cdot 3 = 24 \text{ kNm}$

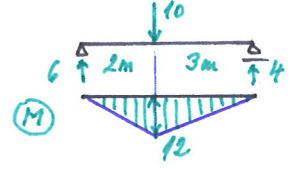
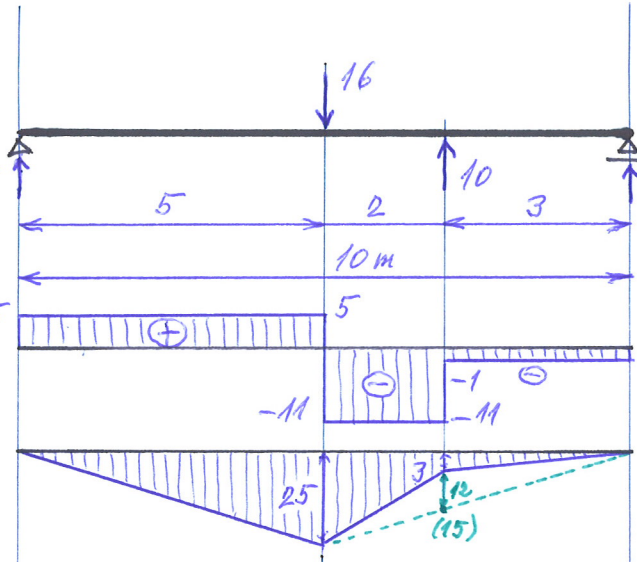
5

$\frac{1}{2} \cdot 16 - 10 \cdot \frac{3}{10} = 8 - 3 = 5$

$\frac{1}{2} \cdot 16 - 10 \cdot \frac{7}{10} = 8 - 7 = 1$

(V)

(M)



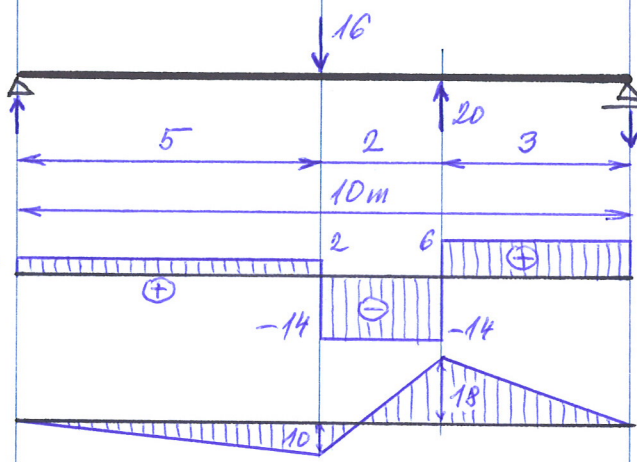
6

$\frac{1}{2} \cdot 16 - 20 \cdot \frac{3}{10} = 8 - 6 = 2$

$\frac{1}{2} \cdot 16 - 20 \cdot \frac{7}{10} = 8 - 14 = -6$

(V)

(M)



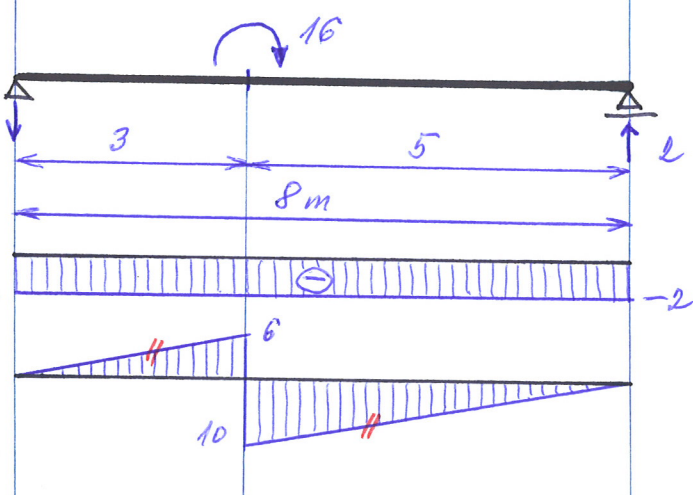
7

$\frac{16}{8} = 2$

$2 \cdot 3 = 6 \text{ kNm}$

(V)

(M)



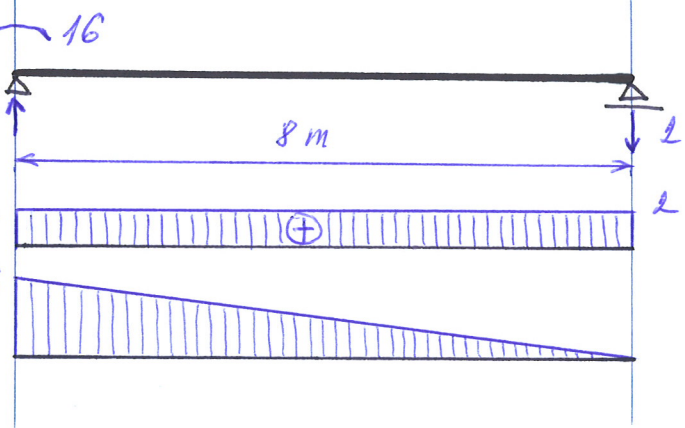
$2 \cdot 5 = 10 \text{ kNm}$

8

$\frac{16}{8} = 2$

(V)

(M)

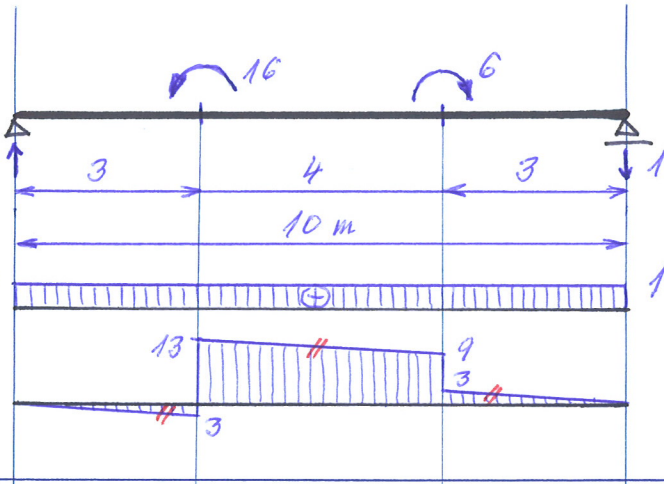


9

$$\frac{16-6}{10} = 1$$

(V)

(M)

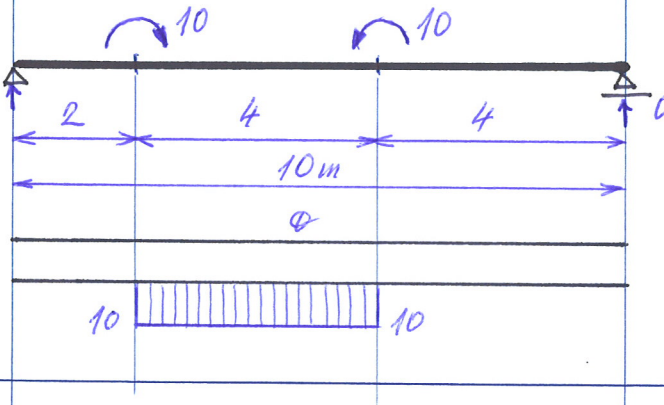
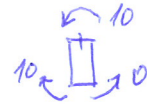
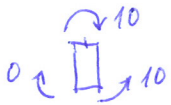


10

$$\frac{10-10}{10} = 0$$

(V)

(M)



11

$$20 \frac{6}{10} - \frac{30}{10} = 12 - 3 = 9$$

(V)

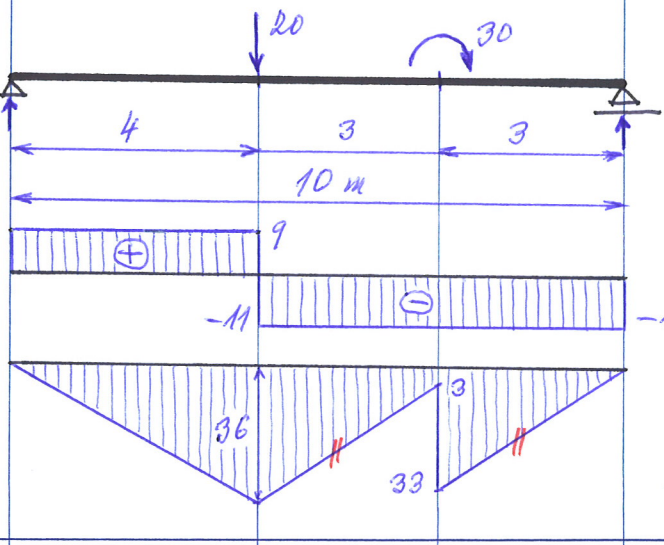
(M)

$$9 \cdot 4 = 36 \text{ kNm}$$

$$20 \frac{4}{10} + \frac{30}{10} = 8 + 3 = 11$$

$$11 \cdot 3 - 30 = 3 \text{ kNm}$$

$$9 \cdot 7 - 20 \cdot 3 = 63 - 60 = 3 \text{ kNm}$$



12

$$30 \frac{4}{10} + \frac{20}{10} = 12 + 2 = 14$$

(V)

(M)

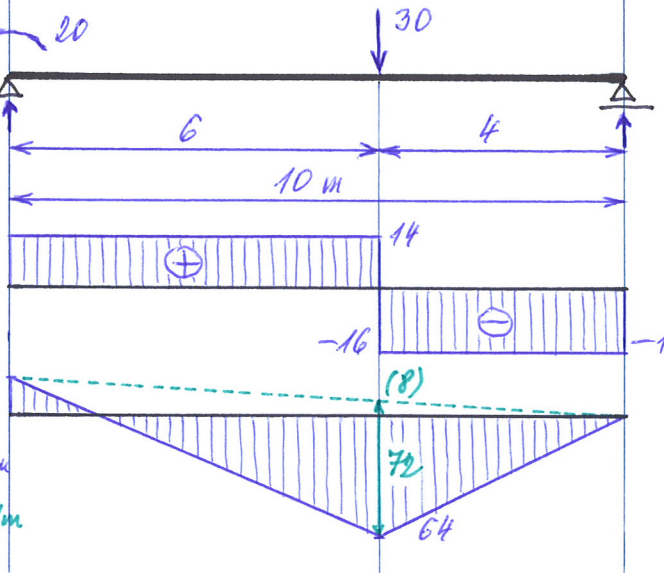
$$14 \cdot 6 - 20 = 84 - 20 = 64 \text{ kNm}$$

$$30 \frac{6}{10} \cdot 6 = 12 \cdot 6 = 72 \text{ kNm}$$

$$30 \frac{6}{10} - \frac{20}{10} = 18 - 2 = 16$$

$$16 \cdot 4 = 64 \text{ kNm}$$

$$30 \frac{6}{10} \cdot 4 = 18 \cdot 4 = 72 \text{ kNm}$$

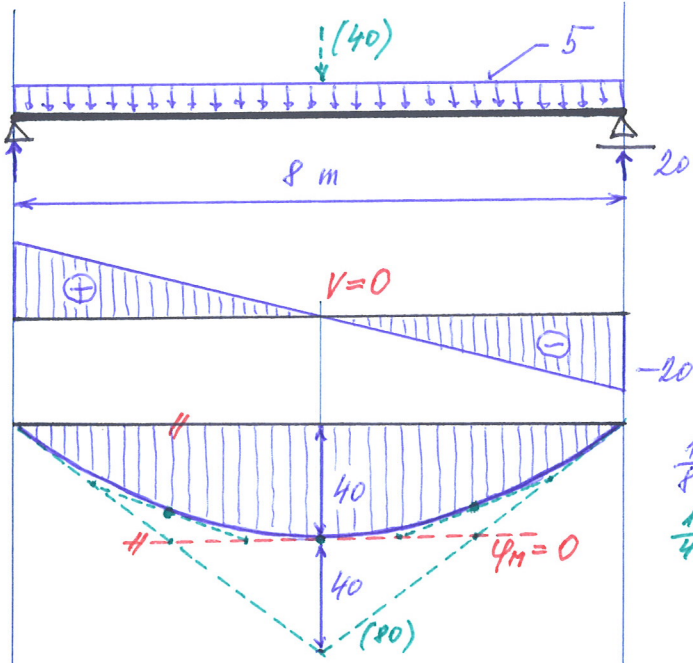


13

$\frac{1}{2} \cdot 5 \cdot 8 = 20$

(V) 20

(M)



$\frac{1}{8} q l^2 = \frac{1}{8} \cdot 5 \cdot 8^2 = 40 \text{ kNm}$
 $\frac{1}{4} Fl = \frac{1}{4} \cdot 40 \cdot 8 = 80 \text{ kNm}$

14

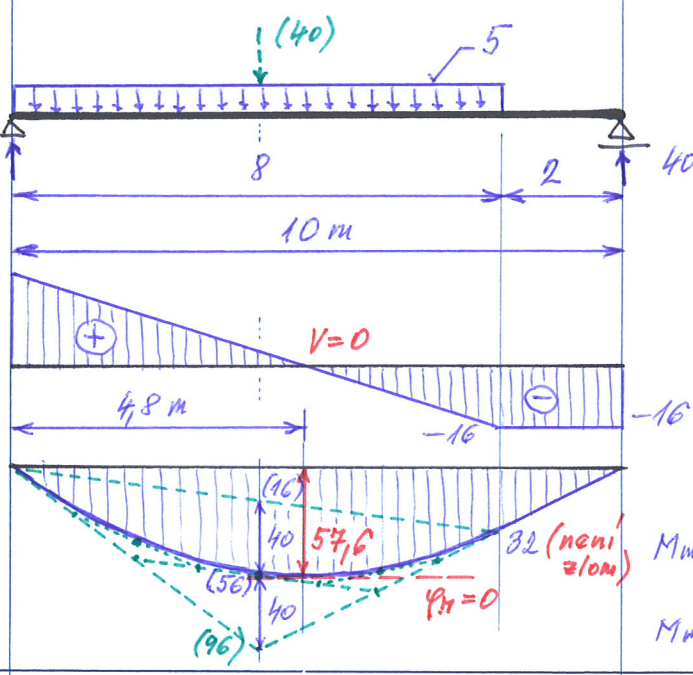
$40 \frac{6}{10} = 24$

(V)

(M)

$x = \frac{V}{q} = \frac{24}{5} = 4,8 \text{ m}$

$M_0 = 24 \cdot 4 = 96 \text{ kNm}$



$\frac{1}{8} q l^2 = \frac{1}{8} \cdot 5 \cdot 8^2 = 40 \text{ kNm}$
 $M_{max} = 24 \cdot 4,8 - \frac{1}{2} \cdot 5 \cdot 4,8^2 = 115,2 - 57,6 = 57,6 \text{ kNm}$
 $M_{max} = \frac{1}{2} \cdot 24 \cdot 4,8 = 57,6 \text{ kNm}$

15

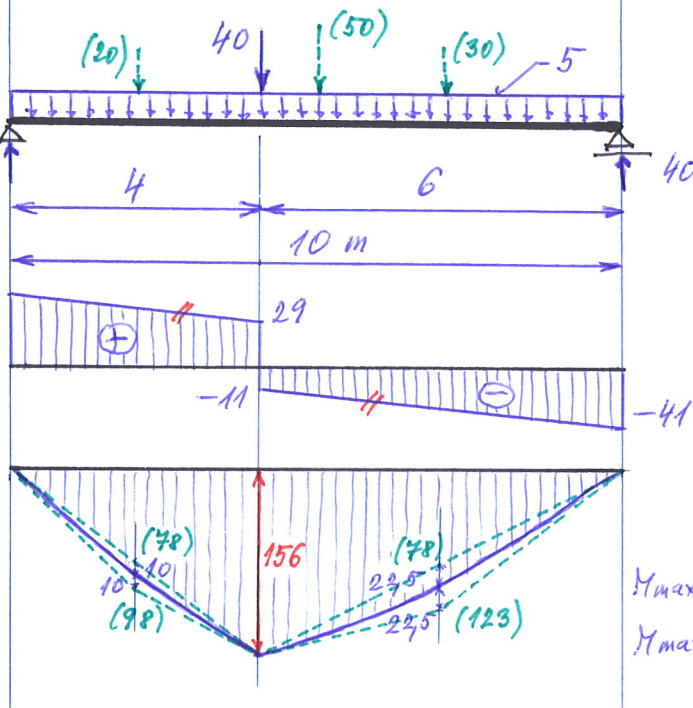
$40 \frac{6}{10} + \frac{1}{2} \cdot 50 = 49$

(V)

(M)

$\frac{1}{8} \cdot 5 \cdot 4^2 = 10 \text{ kNm}$

$M_0^p = 49 \cdot 2 = 98 \text{ kNm}$
 $(= \frac{1}{2} \cdot 156 + 2 \cdot 10)$



$40 \frac{4}{10} + \frac{1}{2} \cdot 50 = 16 + 25 = 41$

$\frac{1}{8} \cdot 5 \cdot 6^2 = 22,5 \text{ kNm}$
 $M_0^p = 49 \cdot 3 = 123 \text{ kNm}$
 $(= \frac{1}{2} \cdot 156 + 2 \cdot 22,5)$
 $M_{max} = 49 \cdot 4 - \frac{1}{2} \cdot 5 \cdot 4^2 = 196 - 40 = 156 \text{ kNm}$
 $M_{max} = \frac{1}{2} (49 + 29) \cdot 4 = 156 \text{ kNm}$

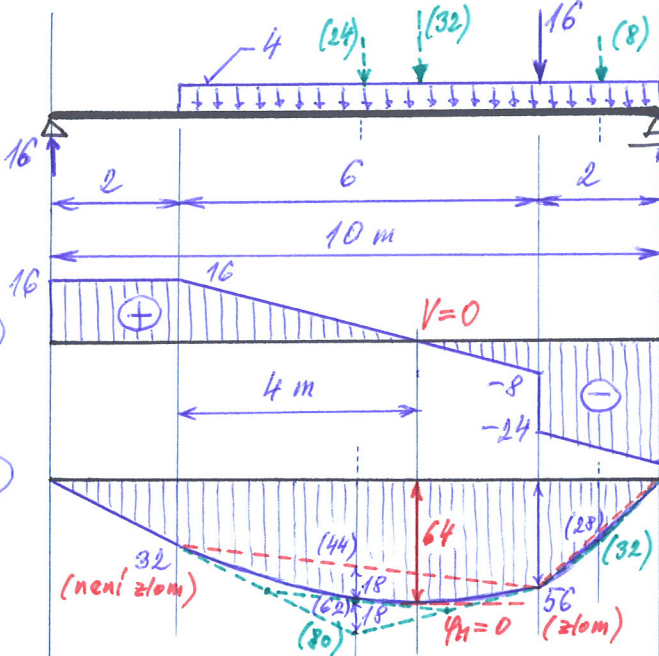
16

$$32 \frac{4}{10} + 16 \frac{2}{10} = 12,8 + 3,2 = 16$$

$$x = \frac{16}{4} = 4 \text{ m}$$

$$M_0^R = 16 \cdot 5 = 80 \text{ kNm}$$

$$\frac{1}{8} 4 \cdot 6^2 = 18 \text{ kNm}$$



$$32 \frac{6}{10} + 16 \frac{8}{10} = 19,2 + 12,8 = 32$$

$$M_{max} = 16 \cdot 6 - \frac{1}{2} 4 \cdot 4^2 = 96 - 32 = 64 \text{ kNm}$$

$$M_{min} = 16 \cdot 2 + \frac{1}{2} 16 \cdot 4 = 32 + 32 = 64 \text{ kNm}$$

$$M_F = 32 \cdot 2 - 8 \cdot 1 = 56 \text{ kNm}$$

$$M_0^P = 32 \cdot 1 = 32 \text{ kNm}$$

$$\frac{1}{8} 4 \cdot 2^2 = 1 \text{ kNm}$$

17

$$\frac{1}{2} 20 - \frac{20}{10} = 10 - 2 = 8$$

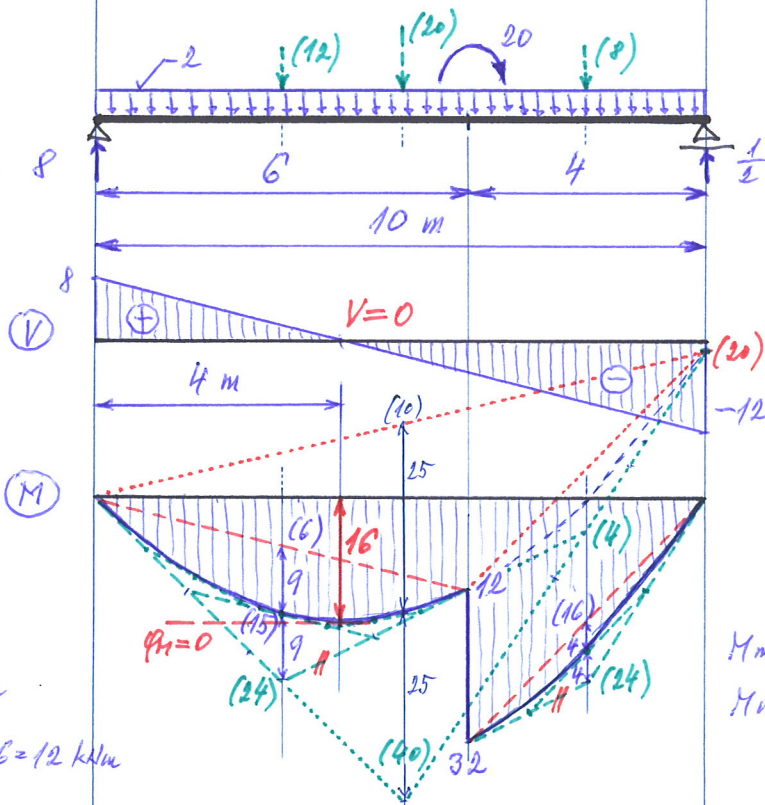
$$x = \frac{8}{2} = 4 \text{ m}$$

$$\frac{1}{8} 2 \cdot 6^2 = 9 \text{ kNm}$$

$$\frac{1}{8} 2 \cdot 10^2 = 25 \text{ kNm}$$

$$M_0^R = 8 \cdot 3 = 24 \text{ kNm}$$

$$M_H^R = 8 \cdot 6 - \frac{1}{2} 2 \cdot 6^2 = 48 - 36 = 12 \text{ kNm}$$



$$\frac{1}{2} 20 + \frac{20}{10} = 10 + 2 = 12$$

$$\frac{1}{8} 2 \cdot 4^2 = 4 \text{ kNm}$$

$$M_0^P = 12 \cdot 2 = 24 \text{ kNm}$$

$$M_H^P = 12 \cdot 4 - \frac{1}{2} 2 \cdot 4^2 = 48 - 16 = 32 \text{ kNm}$$

$$M_{max} = 8 \cdot 4 - \frac{1}{2} 2 \cdot 4^2 = 32 - 16 = 16 \text{ kNm}$$

$$M_{min} = \frac{1}{2} 8 \cdot 4 = 16 \text{ kNm}$$

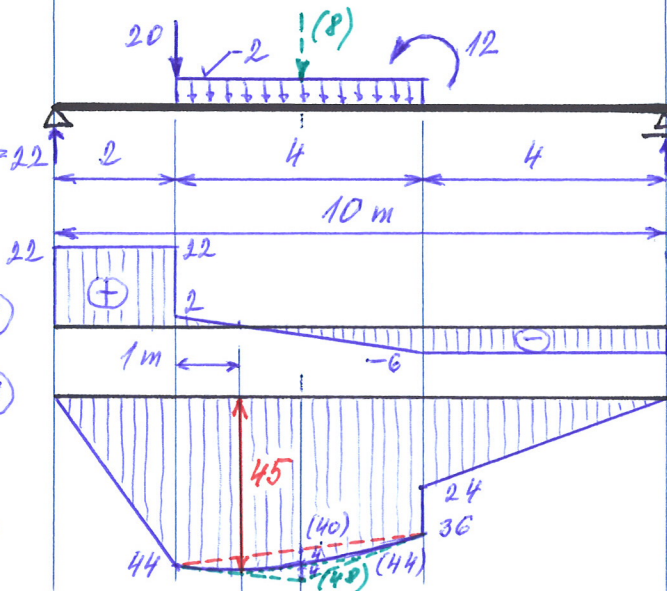
18

$$8 \frac{6}{10} + 20 \frac{8}{10} + \frac{12}{10} = 4,8 + 16 + 1,2 = 22$$

$$x = \frac{2}{2} = 1 \text{ m}$$

$$\frac{1}{8} 2 \cdot 4^2 = 4 \text{ kNm}$$

$$M_0^R = 22 \cdot 4 - 20 \cdot 2 = 88 - 40 = 48 \text{ kNm}$$



$$8 \frac{4}{10} + 20 \frac{2}{10} - \frac{12}{10} = 3,2 + 4 - 1,2 = 6$$

$$M_{max} = 22 \cdot 3 - 20 \cdot 1 - \frac{1}{2} 2 \cdot 1^2 = 66 - 20 - 1 = 45 \text{ kNm}$$

$$M_{min} = 22 \cdot 2 + \frac{1}{2} 2 \cdot 1 = 45 \text{ kNm}$$

19

$$\frac{1}{2}ql + \frac{M}{l} =$$

$$= \frac{1}{2} \cdot 2 \cdot 8 + \frac{16}{8} = 8 + 2 = 10$$

$$\frac{1}{2}ql - \frac{M}{l} =$$

$$= \frac{1}{2} \cdot 2 \cdot 8 - \frac{16}{8} = 8 - 2 = 6$$

$$x = \frac{V}{q} = \frac{10}{2} = 5 \text{ m}$$

$$x' = \frac{6}{2} = 3 \text{ m}$$

$$M_{max} = 10 \cdot 5 - 16 - \frac{1}{2} \cdot 2 \cdot 5^2 =$$

$$= 50 - 16 - 25 = 9 \text{ kNm}$$

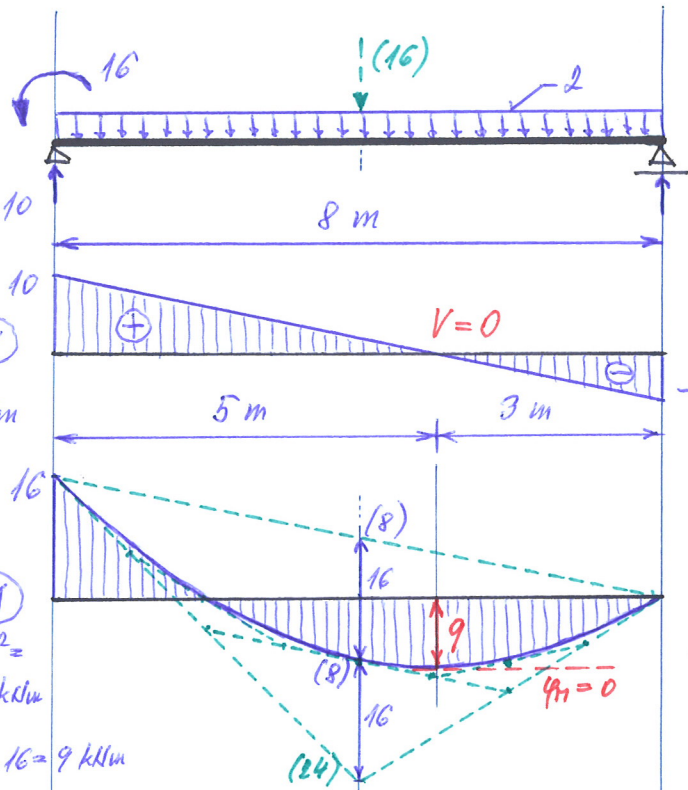
$$M_{max} = \frac{1}{2} \cdot 10 \cdot 5 - 16 = 25 - 16 = 9 \text{ kNm}$$

$$\frac{1}{8}ql^2 = \frac{1}{8} \cdot 2 \cdot 8^2 = 16 \text{ kNm}$$

$$M_0 = 6 \cdot 4 = 24 \text{ kNm}$$

$$M_{max} = 6 \cdot 3 - \frac{1}{2} \cdot 2 \cdot 3^2 = 18 - 9 = 9 \text{ kNm}$$

$$M_{max} = \frac{1}{2} \cdot 6 \cdot 3 = 9 \text{ kNm}$$



20

$$\frac{1}{3}Q = \frac{1}{6}ql = \frac{1}{6} \cdot 8 \cdot 6 = 8$$

$$\frac{2}{3}Q = \frac{1}{3}ql = \frac{1}{3} \cdot 8 \cdot 6 = 16$$

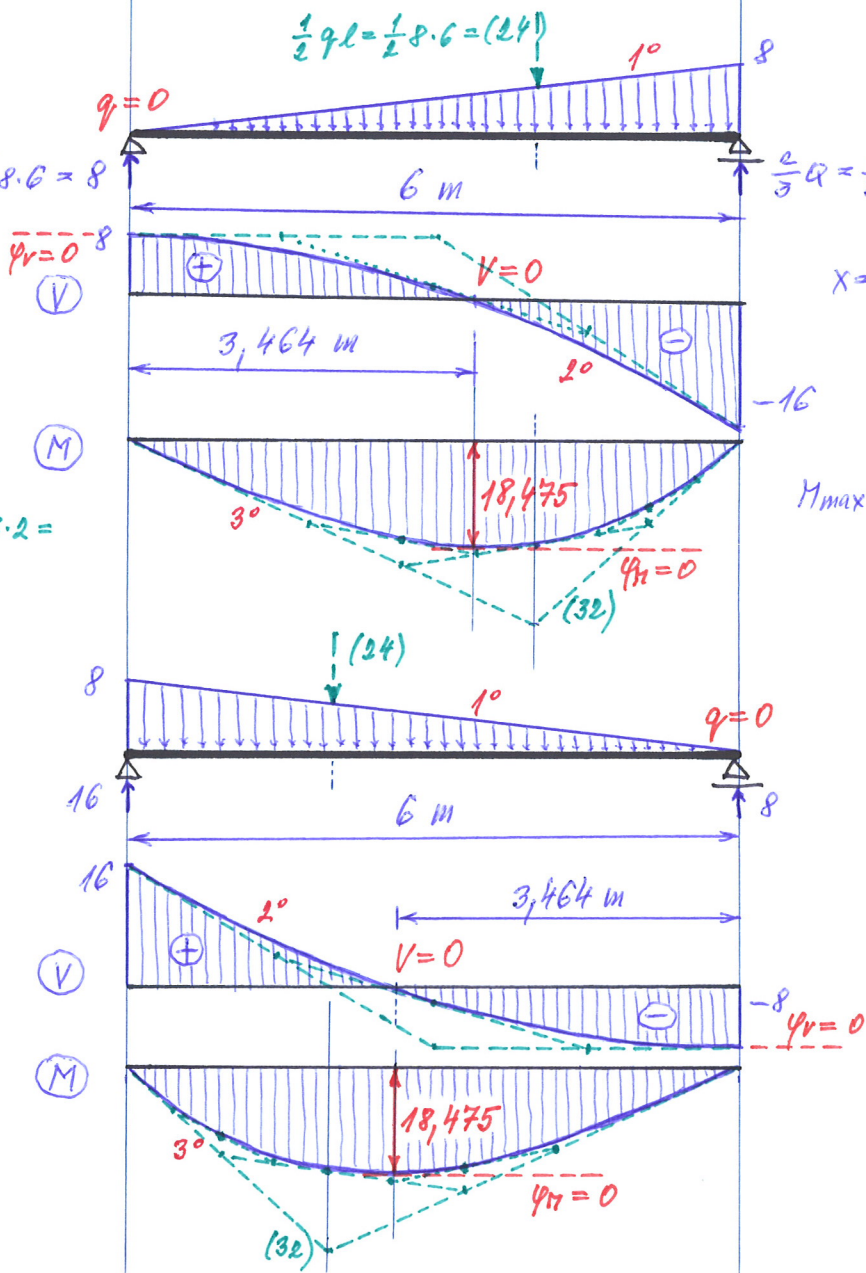
$$x = \frac{l\sqrt{3}}{3} = \frac{6\sqrt{3}}{3} = 3,464 \text{ m}$$

$$M_0 = 8 \cdot 4 = 16 \cdot 2 =$$

$$= 32 \text{ kNm}$$

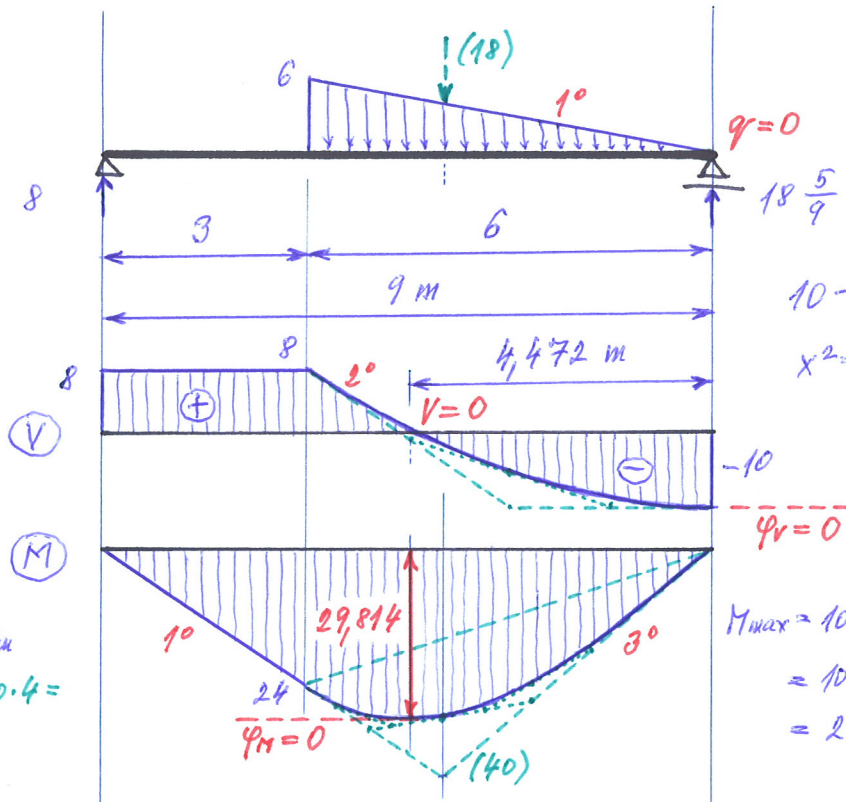
$$M_{max} = \frac{\sqrt{3}}{27} ql^2 = \frac{\sqrt{3}}{27} \cdot 8 \cdot 6^2 =$$

$$= 18,475 \text{ kNm}$$



21

$18 \frac{4}{9} = 8$

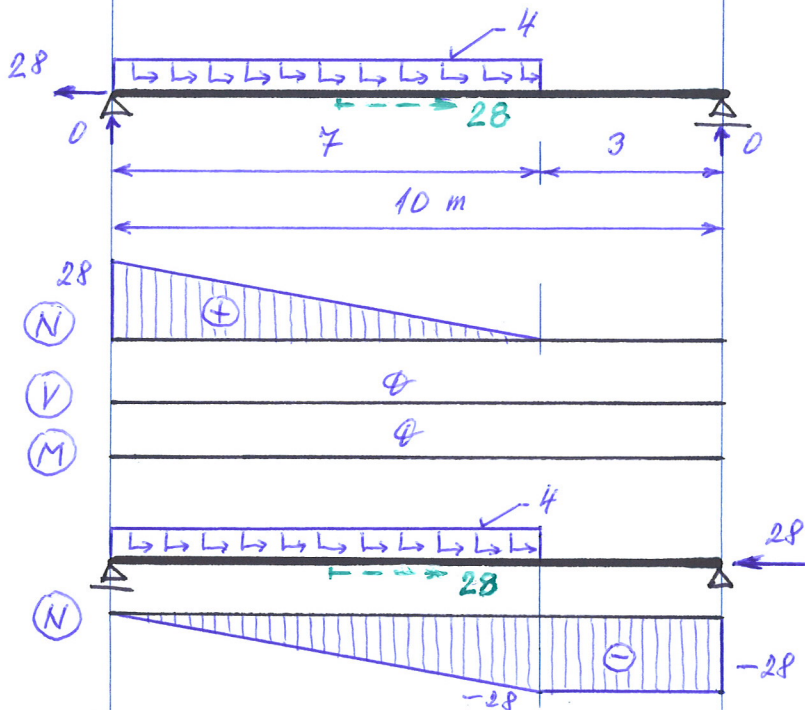


$10 - \frac{1}{2}x \cdot \frac{6}{9}x = 0;$
 $x^2 = 20; x = 4,472 \text{ m}$

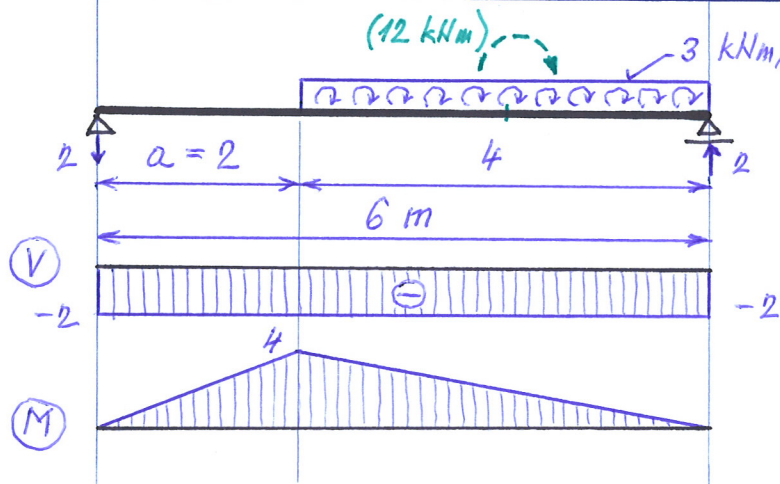
$3 \cdot 8 = 24 \text{ kNm}$
 $M_0 = 8 \cdot 5 = 40 \text{ kNm}$

$M_{max} = 10 \cdot x - \frac{1}{2}x \cdot \frac{6}{9}x \cdot \frac{1}{3}x =$
 $= 10 \sqrt{20} - \frac{1}{6} \cdot 20 \sqrt{20} =$
 $= 29,814 \text{ kNm}$

22

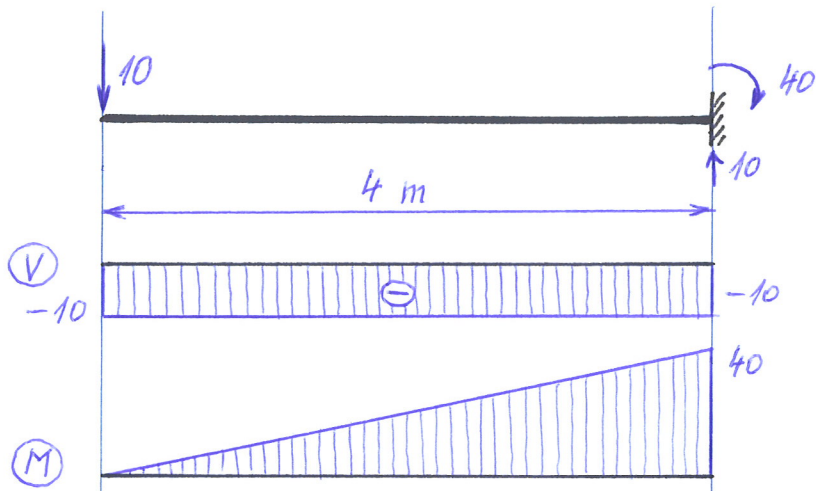


23

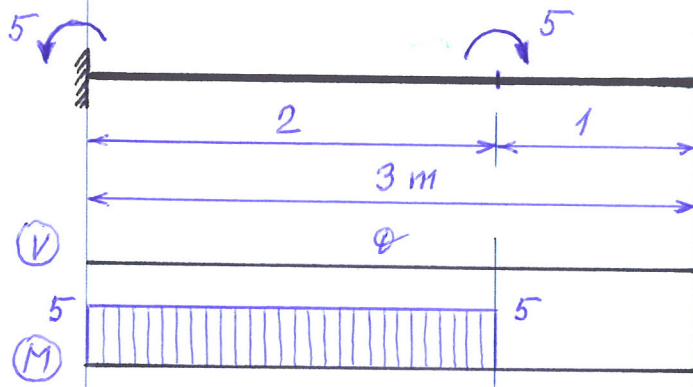


pro $a = 0:$
 $M = 0$

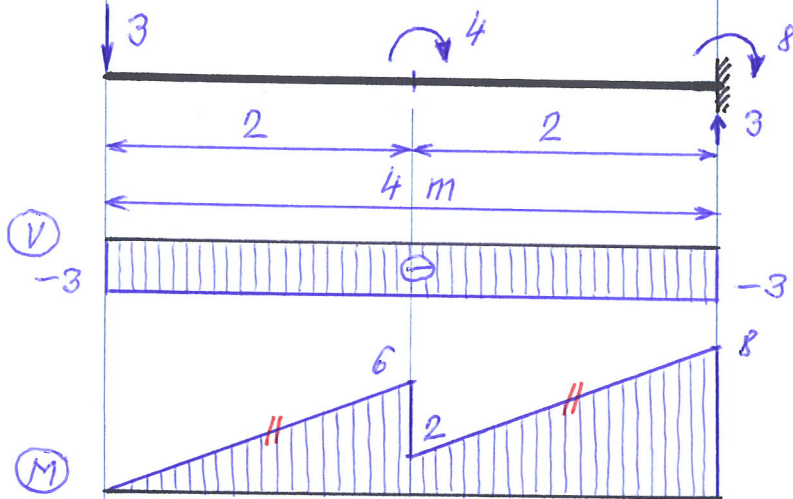
24



25

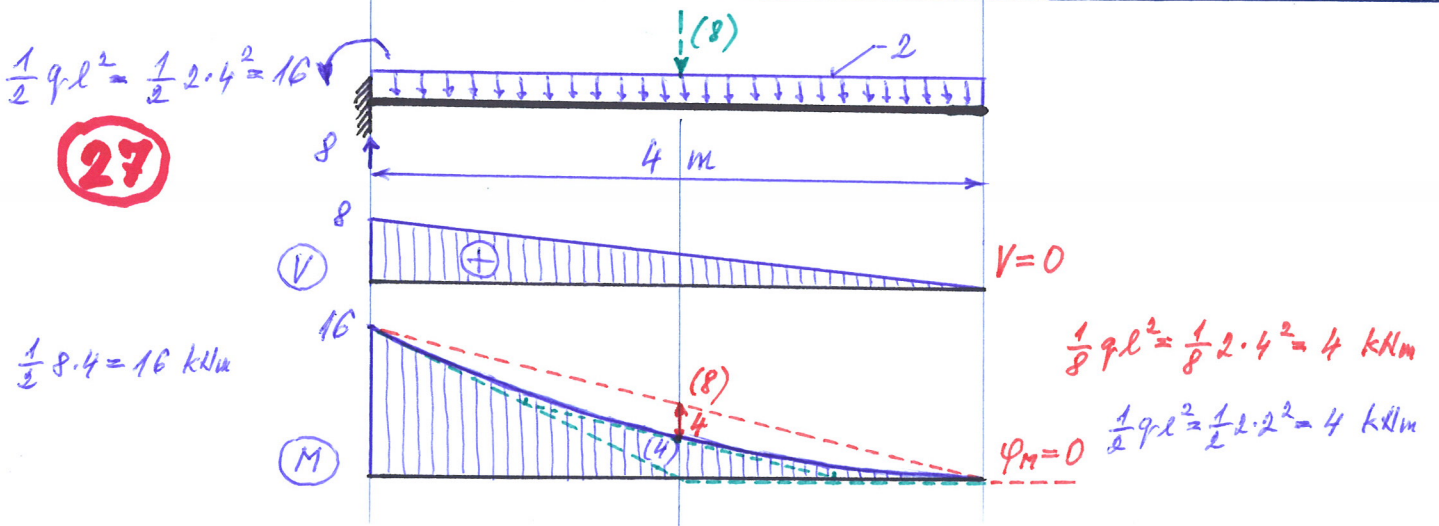


26



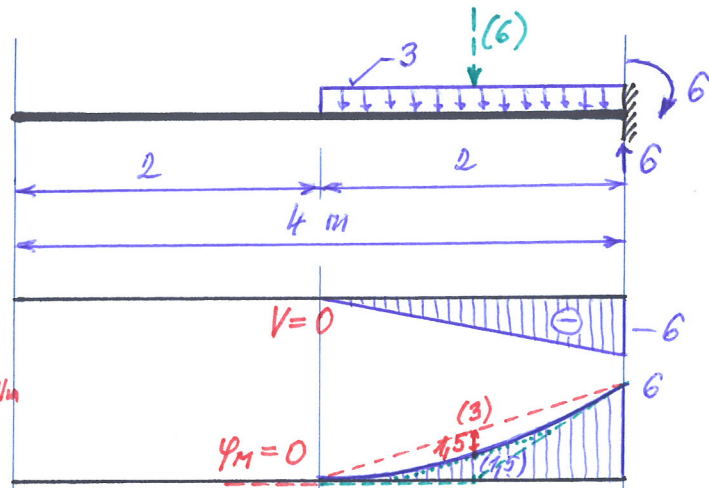
$$\frac{1}{2} q \cdot l^2 = \frac{1}{2} \cdot 2 \cdot 4^2 = 16$$

27



$$\frac{1}{2} \cdot 8 \cdot 4 = 16 \text{ kNm}$$

28

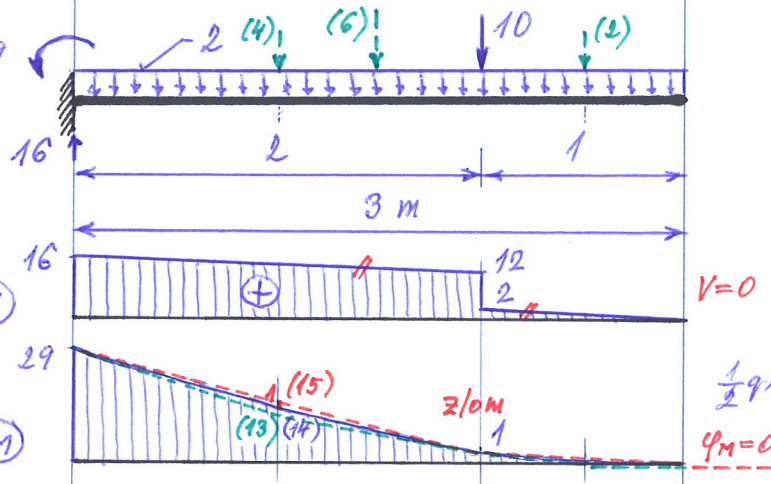


$$\frac{1}{8} q l^2 = \frac{1}{8} 3 \cdot 2^2 = 1.5 \text{ kNm}$$

$$\frac{1}{2} q l^2 = \frac{1}{2} 3 \cdot 2^2 = 6 \text{ kNm}$$

$$\frac{1}{2} 6 \cdot 2 = 6 \text{ kNm}$$

29



$$6 \cdot 1.5 + 10 \cdot 2 = 29$$

$$\frac{1}{2} (29 + 1) = 15 \text{ kNm}$$

$$29 - 16 \cdot 1 = 13 \text{ kNm}$$

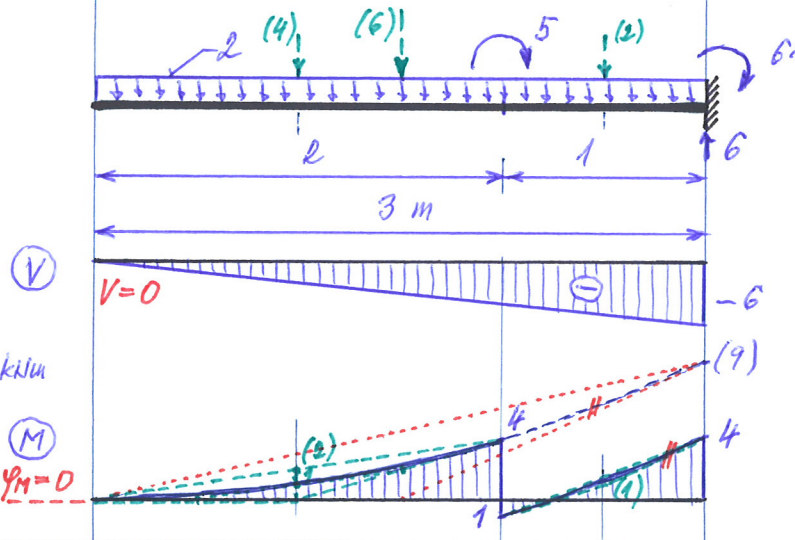
$$\frac{1}{8} 2 \cdot 2^2 = 1 \text{ kNm}$$

$$V=0$$

$$\frac{1}{2} q l^2 = \frac{1}{2} 2 \cdot 1^2 = 1 \text{ kNm}$$

$$\varphi_M = 0$$

30



$$6 \cdot 1.5 - 5 = 4$$

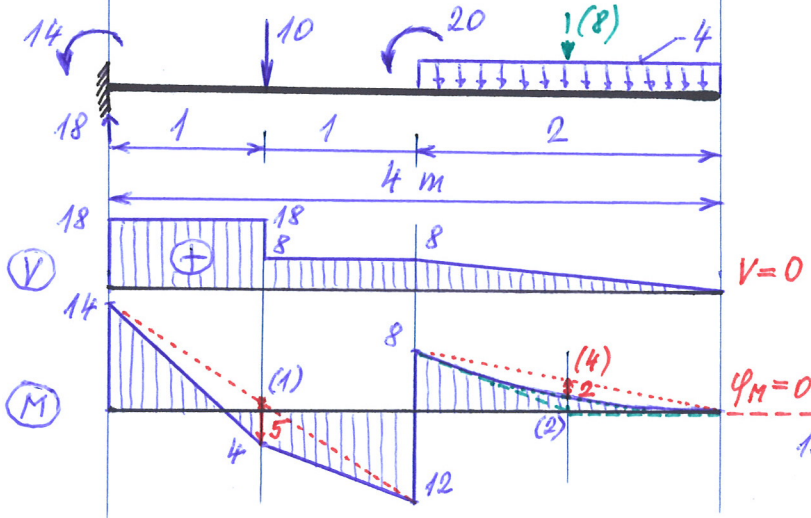
$$\frac{1}{2} q l^2 = \frac{1}{2} 2 \cdot 2^2 = 4 \text{ kNm}$$

$$\frac{1}{8} 2 \cdot 2^2 = 1 \text{ kNm}$$

$$\frac{1}{2} q l^2 = \frac{1}{2} 2 \cdot 3^2 = 9 \text{ kNm}$$

$$\frac{1}{8} 2 \cdot 1^2 = 0.25 \text{ kNm}$$

31



$$\frac{1}{4} F l = \frac{1}{4} 10 \cdot 2 = 5 \text{ kNm}$$

$$18 \cdot 1 - 14 = 4 \text{ kNm}$$

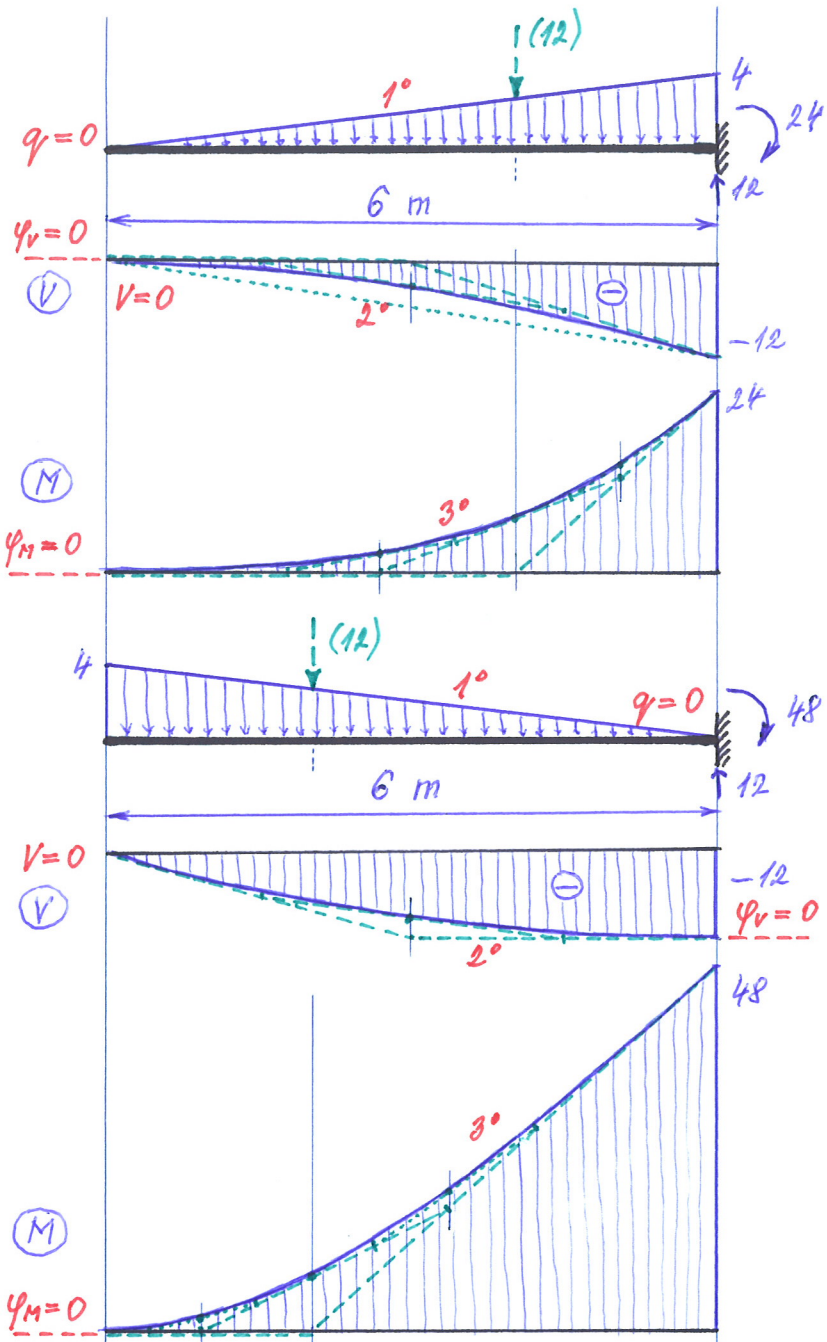
$$V=0 \quad \frac{1}{2} q l^2 = \frac{1}{2} 4 \cdot 2^2 = 8 \text{ kNm}$$

$$\frac{1}{2} 8 \cdot 2 = 8 \text{ kNm}$$

$$\varphi_M = 0 \quad \frac{1}{8} q l^2 = \frac{1}{8} 4 \cdot 2^2 = 2 \text{ kNm}$$

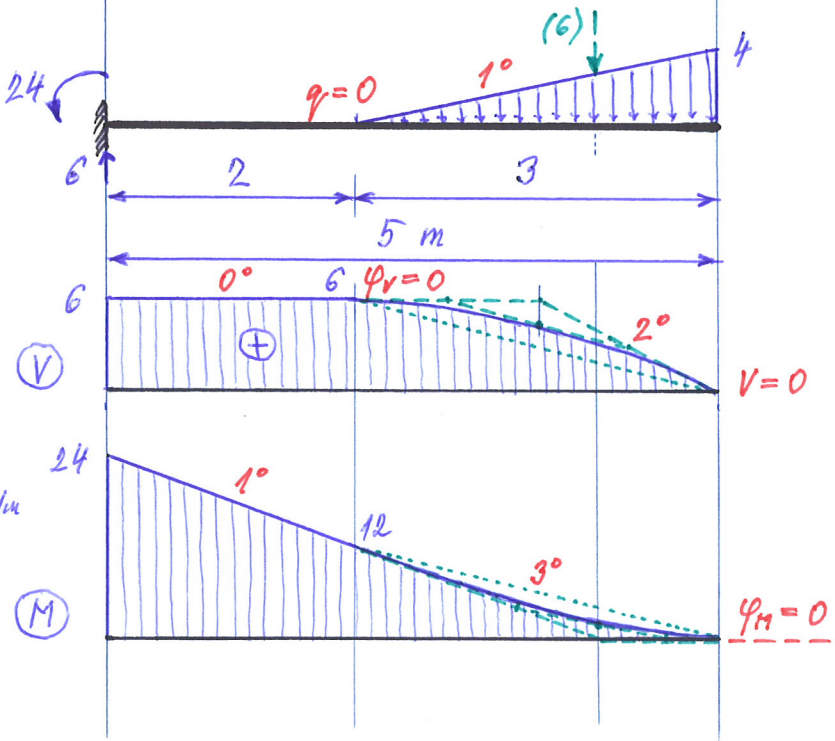
$$18 \cdot 1 + 8 \cdot 1 - 14 = 12 \text{ kNm}$$

32



$6 \cdot 4 = 24 \text{ kNm}$

33



$24 - 6 \cdot 2 = 12 \text{ kNm}$
 $6 \cdot 2 = 12 \text{ kNm}$