Cable length: $L_0 := 15 \cdot m$

Sections: $N_S := 10$ $\quad i := 0 .. N_S - 2$

Min. x: $a := 0 \cdot m$ $\quad y_a := 7 \cdot m$

Max. x: $b := 10 \cdot m$ $\quad y_b := 10 \cdot m$

Function for sections:

$$\text{Abschnitte}(a, b, x, y) := \left| \begin{array}{l} \Delta s_0 \leftarrow \sqrt{(x_0 - a)^2 + (y_0 - y_a)^2} - \frac{L_0}{N_S} \\ \text{for} \quad i \in 1 .. N_S - 2 \\ \quad \Delta s_i \leftarrow \sqrt{(x_i - x_{i-1})^2 + (y_i - y_{i-1})^2} - \frac{L_0}{N_S} \\ \Delta s_9 \leftarrow \sqrt{(b - x_8)^2 + (y_b - y_8)^2} - \frac{L_0}{N_S} \\ \Delta s \end{array} \right.$$

Potential Energy: $m_0 := 1 \cdot kg$

$$E_{pot}(x, y) := m_0 \cdot g \cdot \left(y_a + \sum_{i=0}^{8} y_i + y_b \right)$$

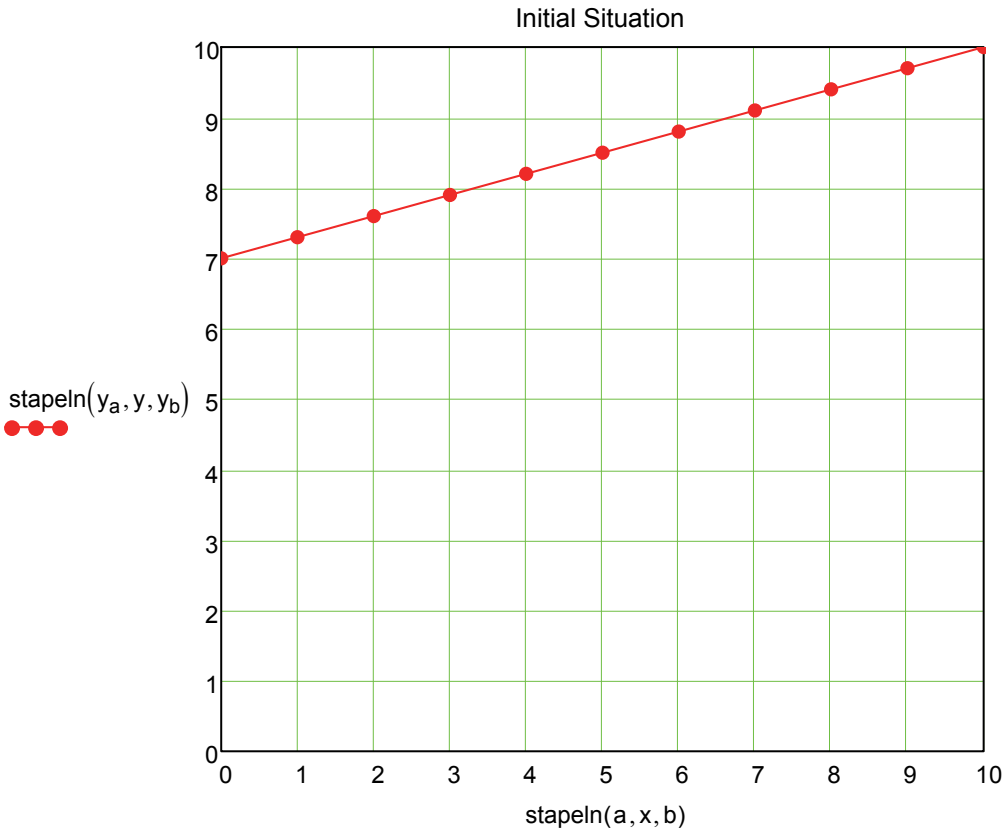
Initial values:

$$x_i := a + (i + 1) \cdot \frac{b - a}{10} \qquad y_i := y_a + (i + 1) \cdot \frac{y_b - y_a}{10}$$

$$\text{Abschnitte}(a, b, x, y) = \begin{pmatrix} -0.456 \\ -0.456 \\ -0.456 \\ -0.456 \\ -0.456 \\ -0.456 \\ -0.456 \\ -0.456 \\ -0.456 \\ -0.456 \end{pmatrix} \cdot m$$

$$\frac{\sqrt{(b - a)^2 + (y_b - y_a)^2}}{N_S} - \frac{L_0}{N_S} = -0.456 \cdot m$$

$$E_{pot}(x, y) = 916.922 \cdot J$$



Minimize for cable:

Vorgabe

$\text{Abschnitte}(a, b, x, y) = 0$

$\begin{pmatrix} x \\ y \end{pmatrix} := \text{Minimieren}(E_{pot}, x, y)$

$ERR = 8.281 \times 10^{-10}$

$TOL = 1 \times 10^{-8}$

$CTOL = 1 \times 10^{-9}$

$\text{Abschnitte}(a, b, x, y) =$

	0
0	$1.668 \cdot 10^{-13}$
1	$5.915 \cdot 10^{-11}$
2	$1.468 \cdot 10^{-11}$
3	$2.605 \cdot 10^{-10}$
4	$1.678 \cdot 10^{-11}$
5	$2.807 \cdot 10^{-10}$
6	$6.59 \cdot 10^{-13}$
7	$1.279 \cdot 10^{-10}$
8	$6.22 \cdot 10^{-10}$
9	$3.631 \cdot 10^{-10}$

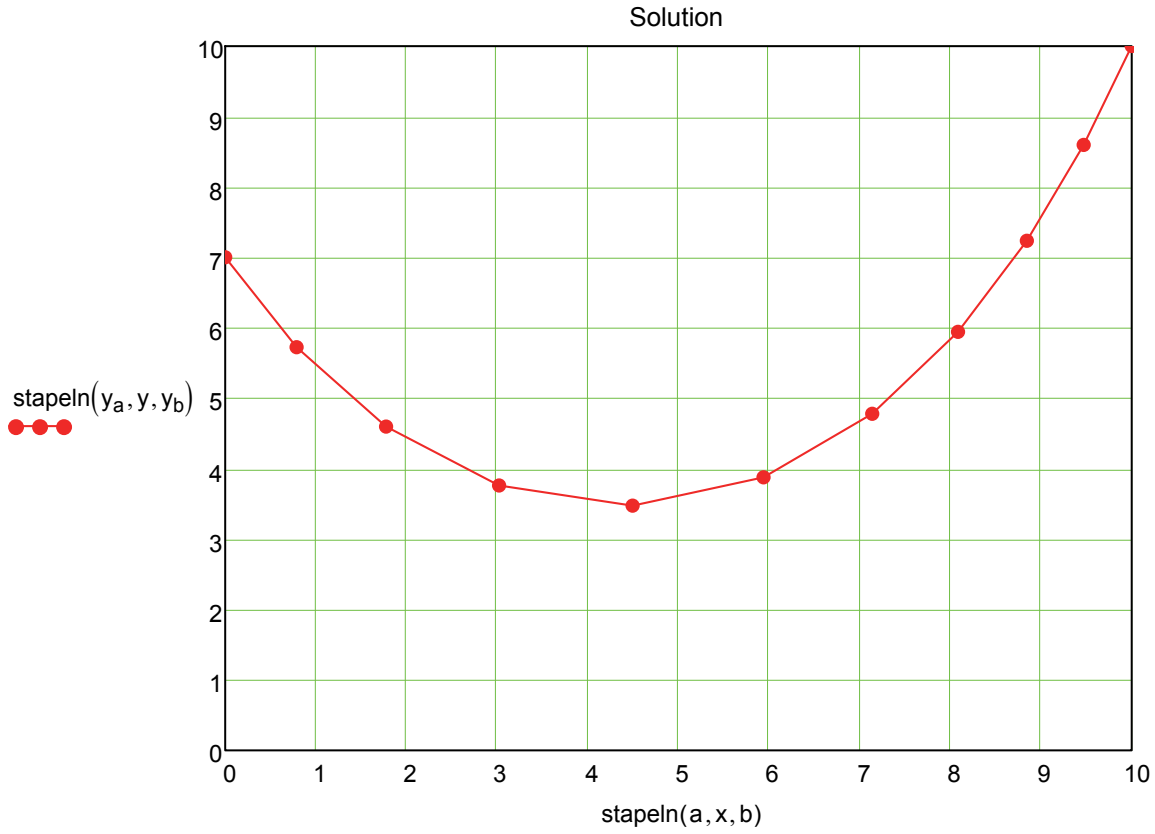
$\cdot m$

$E_{pot}(x, y) = 637.164 \cdot J$

To get Valery's value:

$E_{pot}(x, y) - m_0 \cdot g \cdot (y_a + y_b) = 470.451 \cdot J$

$E_{pot}(x, y) - m_0 \cdot g \cdot (y_a + y_b) = 47.973 \cdot kgf \cdot m$



Maximize for arch:

Vorgabe

Abschnitte(a, b, x, y) = 0

$\begin{pmatrix} x \\ y \end{pmatrix} :=$ Maximieren(E_{pot}, x, y)

$ERR = 9.508 \times 10^{-10}$

$TOL = 1 \times 10^{-8}$

$CTOL = 1 \times 10^{-9}$

Abschnitte(a, b, x, y) =

	0
0	$1.885 \cdot 10^{-13}$
1	$3.193 \cdot 10^{-11}$
2	$8.249 \cdot 10^{-10}$
3	$4.083 \cdot 10^{-10}$
4	$5.805 \cdot 10^{-12}$
5	$1.427 \cdot 10^{-10}$
6	$1.489 \cdot 10^{-10}$
7	$5.601 \cdot 10^{-11}$
8	$8.652 \cdot 10^{-11}$
9	$5.163 \cdot 10^{-11}$

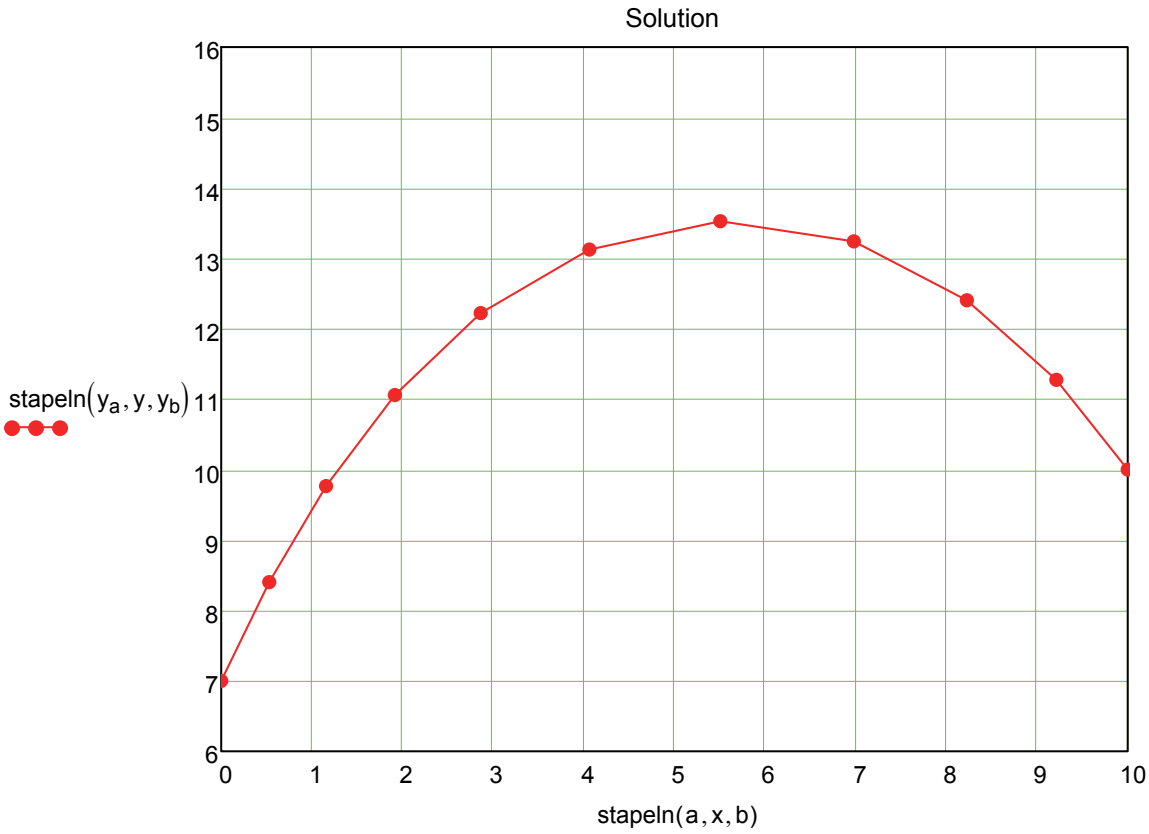
·m

$E_{pot}(x, y) = 1.197 \times 10^{3} \cdot J$

To get Valery's value:

$E_{pot}(x, y) - m_0 \cdot g \cdot (y_a + y_b) = 1.03 \times 10^{3} \cdot J$

$E_{pot}(x, y) - m_0 \cdot g \cdot (y_a + y_b) = 105.027 \cdot kgf \cdot m$


Solution
stapeln(y_a, y, y_b)
16
15
14
13
12
11
10
9
8
7
6
0
1
2
3
4
5
6
7
8
9
10
stapeln(a, x, b)