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

Sections: $N_S := 20$ $i := 0 .. N_S - 2$

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

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

Function for sections:

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

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

$$E_{pot}(x, y) := m_0 \cdot g \cdot \left(y_a + \sum_{i=0}^{N_S - 2} y_i + y_b \right)$$

Initial values:

$$x_i := a + (i + 1) \cdot \frac{b - a}{N_S}$$

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

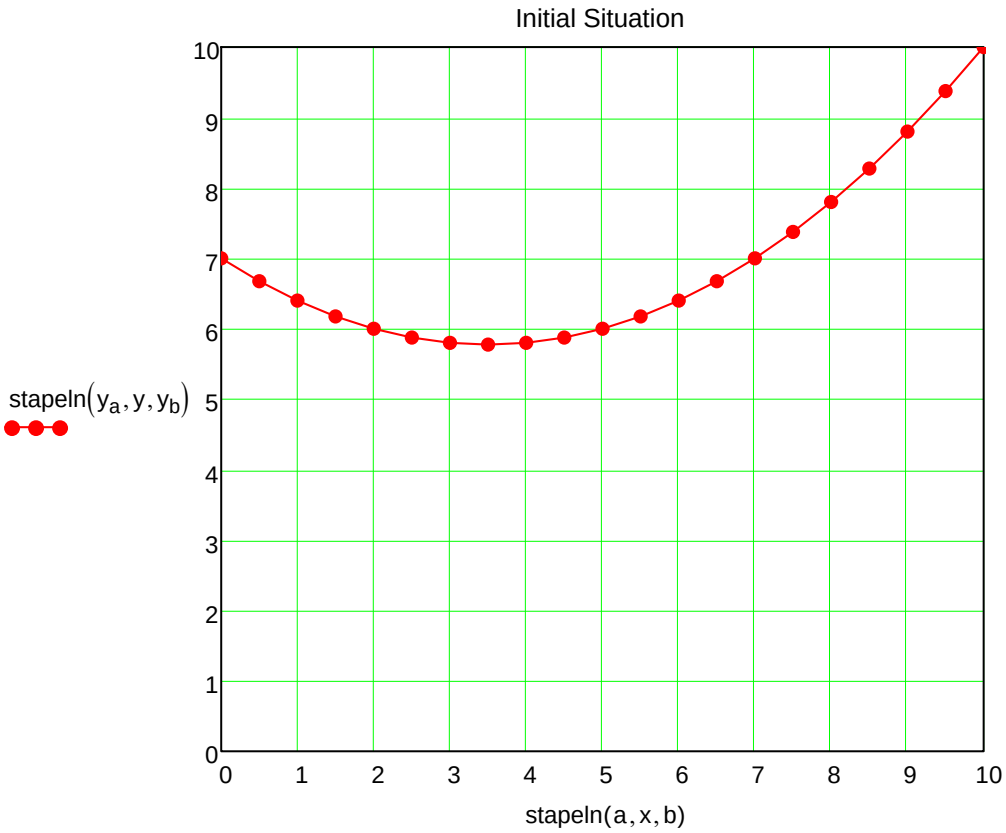
$\text{Abschnitte}(a, b, x, y) =$

	0
0	-0.154
1	-0.179
2	-0.202
3	-0.22
4	-0.235
5	-0.244
6	-0.249
7	-0.249
8	-0.244
9	-0.235
10	...

$\cdot m$

$$\frac{\sqrt{(b - a)^2 + (y_b - y_a)^2}}{N_S} - \frac{L_0}{N_S} = -0.228 \cdot m$$

$$E_{pot}(x, y) = 1.424 \times 10^3 \cdot J$$



Minimize for cable:

Vorgabe

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

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

$ERR = 3.464 \times 10^{-13}$

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

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

$\text{Abschnitte}(a, b, x, y) =$ ·m

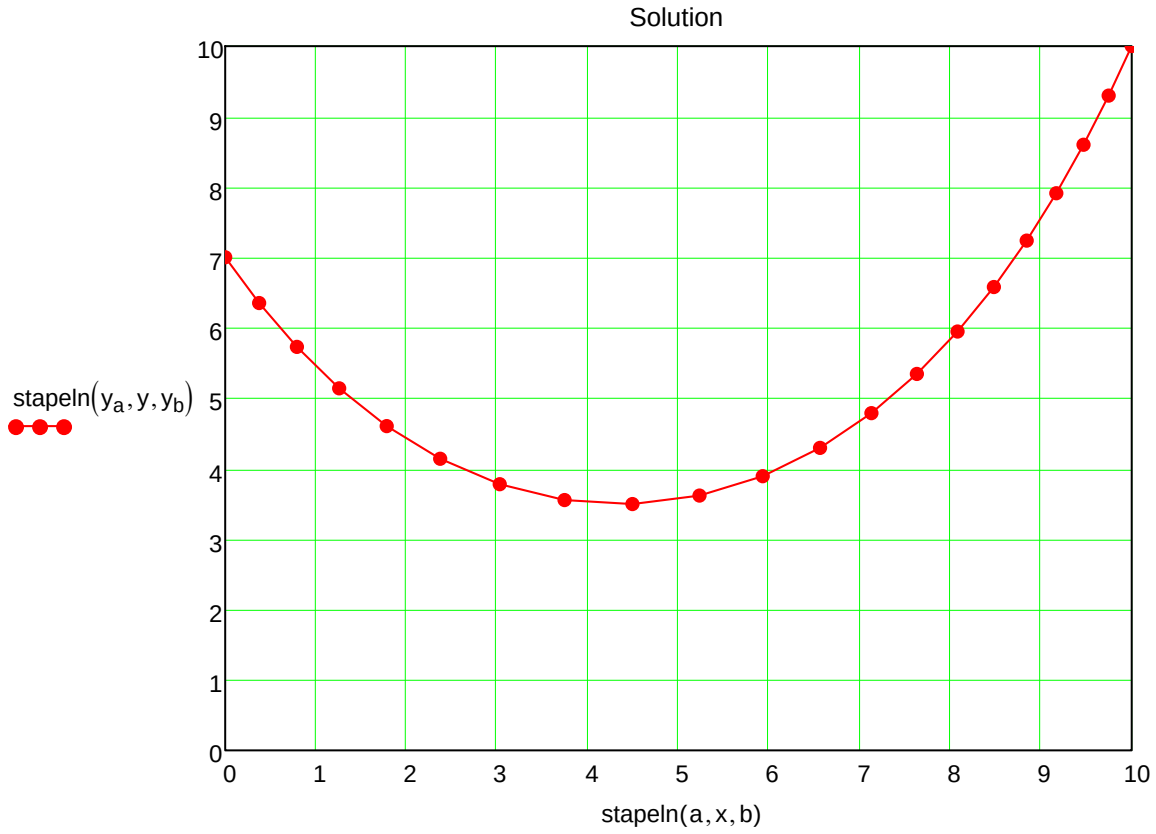
	0
0	0
1	0
2	0
3	$2.776 \cdot 10^{-15}$
4	$2.72 \cdot 10^{-14}$
5	$-1.155 \cdot 10^{-14}$
6	0
7	0
8	$-2.331 \cdot 10^{-13}$
9	$-2.381 \cdot 10^{-13}$
10	...

$E_{pot}(x, y) = 1.189 \times 10^{3} \cdot J$

To get Valery's value:

$E_{pot}(x, y) - m_0 \cdot g \cdot (y_a + y_b) = 1.023 \times 10^{3} \cdot J$

$E_{pot}(x, y) - m_0 \cdot g \cdot (y_a + y_b) = 104.274 \cdot kgf \cdot m$



Maximize for arch:

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

Vorgabe

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

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

$ERR = 3.072 \times 10^{-12}$

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

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

$Abschnitte(a, b, x, y) =$ ·m

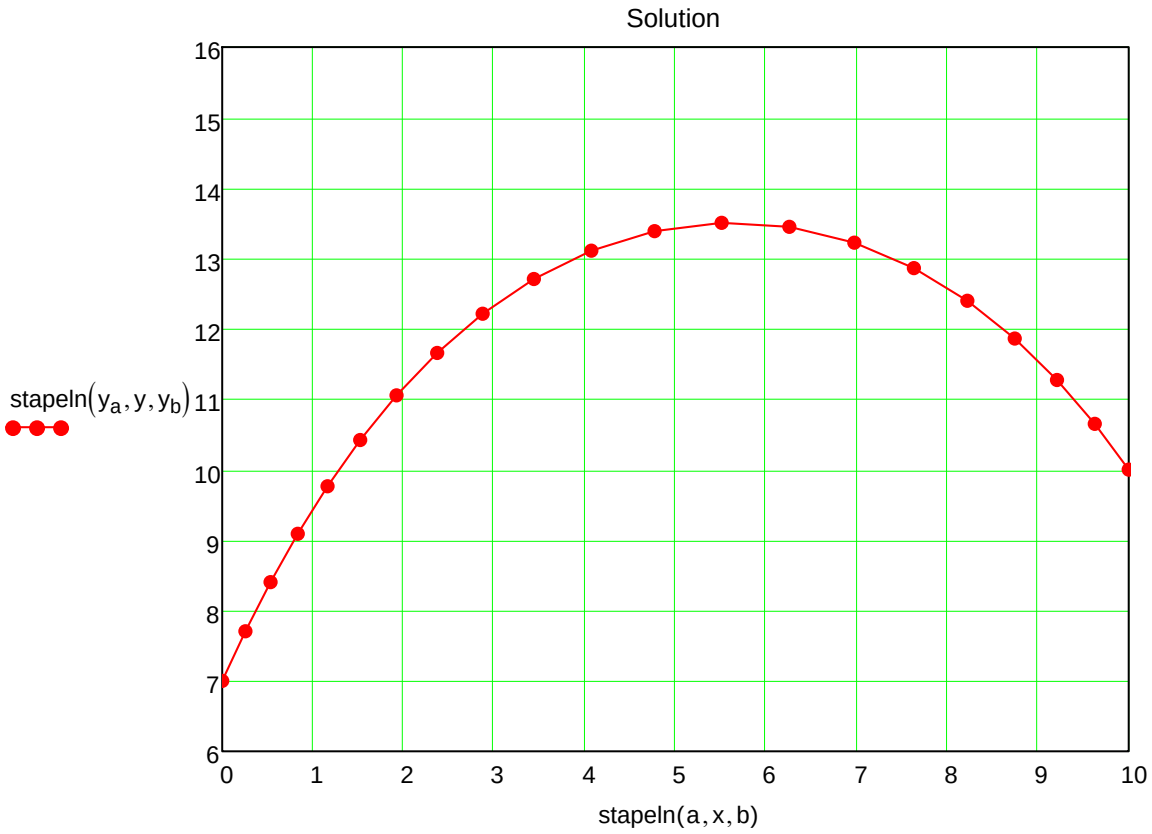
	0
0	0
1	0
2	0
3	0
4	$-1.221\cdot10^{-15}$
5	$1.11\cdot10^{-15}$
6	$-8.549\cdot10^{-15}$
7	0
8	$6.994\cdot10^{-15}$
9	...

$E_{pot}(x, y) = 2.312 \times 10^{3}\cdot J$

To get Valery's value:

$E_{pot}(x, y) - m_0\cdot g\cdot(y_a + y_b) = 2.145 \times 10^{3}\cdot J$

$E_{pot}(x, y) - m_0\cdot g\cdot(y_a + y_b) = 218.726\cdot kgf\cdot m$


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)