

ORIGIN := 1

$$S := 15 \text{ m} \quad \text{mass} := 1 \text{ kg} \quad \Delta s := \frac{S}{10} = 1.5 \text{ m} \quad x_0 := 0 \text{ m} \quad x_{10} := 10 \text{ m}$$
$$y_0 := 7 \text{ m} \quad y_{10} := 10 \text{ m}$$

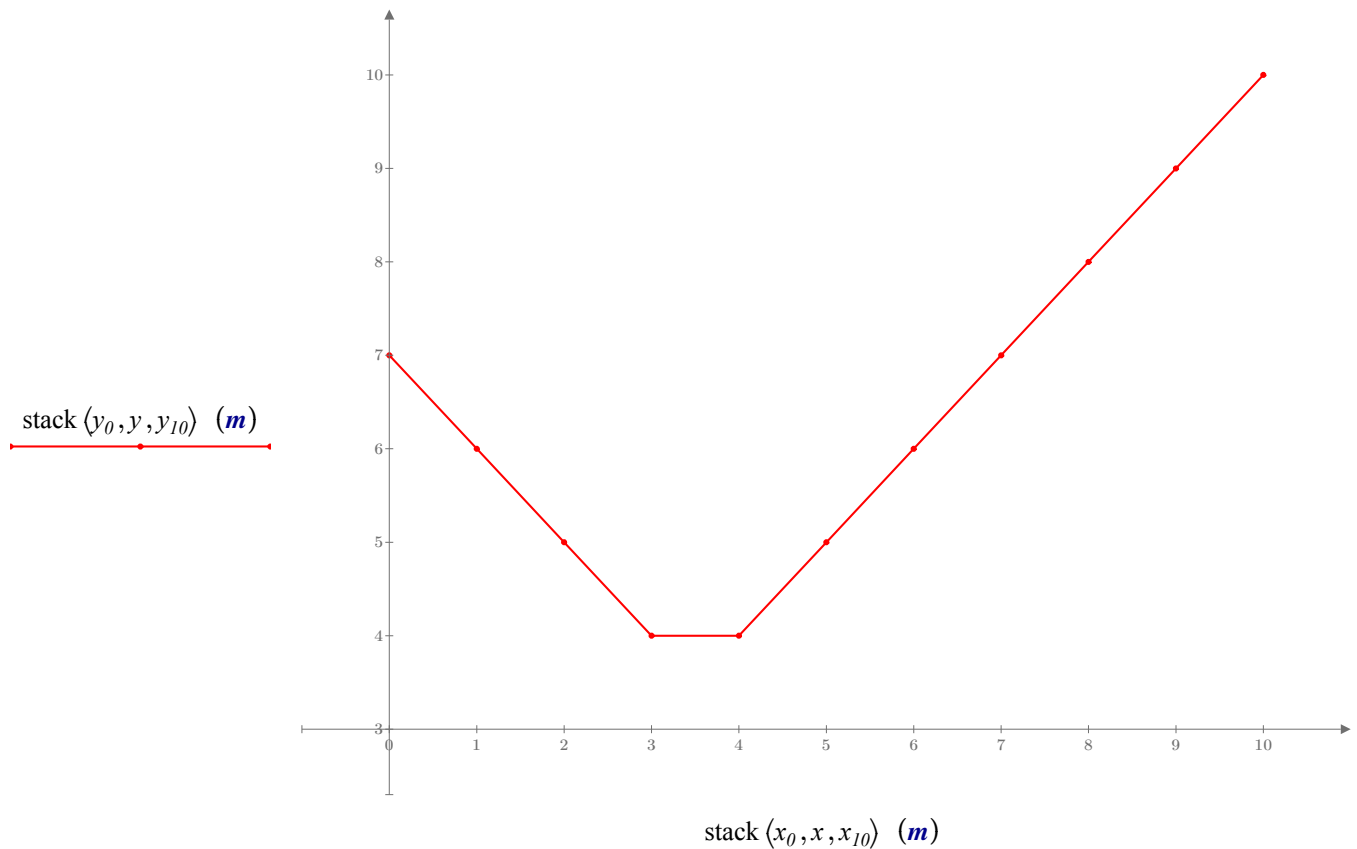
$$PE(x, y) := g \cdot \text{mass} \cdot \sum_{i=1}^9 y_i$$

Guess values

$$x := \begin{bmatrix} 1 \\ 2 \\ 3 \\ 4 \\ 5 \\ 6 \\ 7 \\ 8 \\ 9 \end{bmatrix} \text{ m} \quad y := \begin{bmatrix} 6 \\ 5 \\ 4 \\ 4 \\ 5 \\ 6 \\ 7 \\ 8 \\ 9 \end{bmatrix} \text{ m}$$

$$PE(x, y) = 529.559 \text{ J}$$

$$\sqrt{(x_1 - x_0)^2 + (y_1 - y_0)^2} + \sum_{i=2}^9 \sqrt{(x_i - x_{i-1})^2 + (y_i - y_{i-1})^2} + \sqrt{(x_{10} - x_9)^2 + (y_{10} - y_9)^2} = 13.728 \text{ m}$$



$$S = \sqrt{(x_1 - x_0)^2 + (y_1 - y_0)^2} + \sum_{i=2}^9 \sqrt{(x_i - x_{i-1})^2 + (y_i - y_{i-1})^2} + \sqrt{(x_{10} - x_9)^2 + (y_{10} - y_9)^2}$$

$$\Delta s = \sqrt{(x_1 - x_0)^2 + (y_1 - y_0)^2}$$

$$\Delta s = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$\Delta s = \sqrt{(x_3 - x_2)^2 + (y_3 - y_2)^2}$$

$$\Delta s = \sqrt{(x_4 - x_3)^2 + (y_4 - y_3)^2}$$

$$\Delta s = \sqrt{(x_5 - x_4)^2 + (y_5 - y_4)^2}$$

$$\Delta s = \sqrt{(x_6 - x_5)^2 + (y_6 - y_5)^2}$$

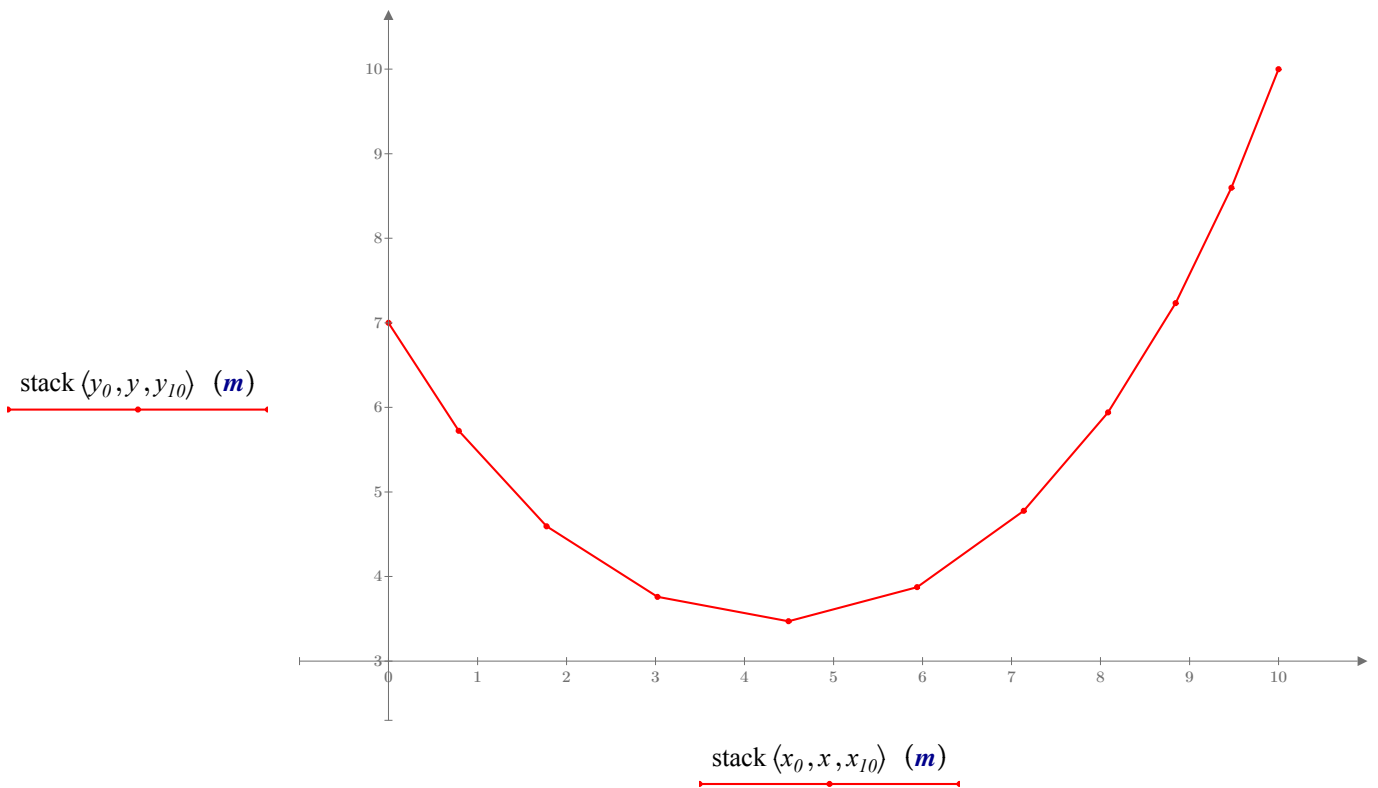
$$\Delta s = \sqrt{(x_7 - x_6)^2 + (y_7 - y_6)^2}$$

$$\Delta s = \sqrt{(x_8 - x_7)^2 + (y_8 - y_7)^2}$$

$$\Delta s = \sqrt{(x_9 - x_8)^2 + (y_9 - y_8)^2}$$

$$\Delta s = \sqrt{(x_{10} - x_9)^2 + (y_{10} - y_9)^2}$$

$\begin{bmatrix} x \\ y \end{bmatrix} := \text{Minimize}(PE, x, y)$



Verify

$$\sqrt{(x_1-x_0)^2 + (y_1-y_0)^2} + \sum_{i=2}^9 \sqrt{(x_i-x_{i-1})^2 + (y_i-y_{i-1})^2} + \sqrt{(x_{10}-x_9)^2 + (y_{10}-y_9)^2} = 15 \text{ m} \quad S = 15 \text{ m}$$

$$\sqrt{(x_1-x_0)^2 + (y_1-y_0)^2} = 1.5 \text{ m} \quad \sqrt{(x_2-x_1)^2 + (y_2-y_1)^2} = 1.5 \text{ m} \quad \sqrt{(x_3-x_2)^2 + (y_3-y_2)^2} = 1.5 \text{ m}$$

$$\sqrt{(x_4-x_3)^2 + (y_4-y_3)^2} = 1.5 \text{ m} \quad \sqrt{(x_5-x_4)^2 + (y_5-y_4)^2} = 1.5 \text{ m} \quad \sqrt{(x_6-x_5)^2 + (y_6-y_5)^2} = 1.5 \text{ m}$$

$$\sqrt{(x_7-x_6)^2 + (y_7-y_6)^2} = 1.5 \text{ m} \quad \sqrt{(x_8-x_7)^2 + (y_8-y_7)^2} = 1.5 \text{ m} \quad \sqrt{(x_9-x_8)^2 + (y_9-y_8)^2} = 1.5 \text{ m}$$

$$\sqrt{(x_{10}-x_9)^2 + (y_{10}-y_9)^2} = 1.5 \text{ m} \quad \Delta s = 1.5 \text{ m}$$

$$PE(x, y) = 470.451 \text{ J}$$