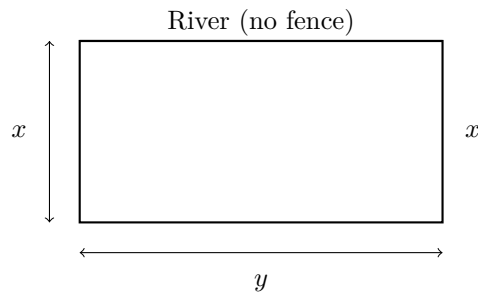


Question 1

A rectangular garden is to be fenced on three sides (two widths and one length), with the fourth side along a straight river needing no fence. The area of the garden must be 120 m^2 . What dimensions will minimize the amount of fencing used?

Clearly define variables, write the function to be minimized, and find the minimum using calculus.

Diagram:



Question 1 - Solution

Let:

- x = width (perpendicular to the river) - y = length (along the river)

Given: - Area constraint: $A = xy = 120 \Rightarrow y = \frac{120}{x}$ - Fence needed: two widths and one length
 $\Rightarrow F = 2x + y$

Substitute into fencing function:

$$F(x) = 2x + \frac{120}{x}$$

Minimize $F(x)$:

Take derivative:

$$F'(x) = 2 - \frac{120}{x^2}$$

Set $F'(x) = 0$:

$$2 = \frac{120}{x^2} \Rightarrow x^2 = 60 \Rightarrow x = \sqrt{60} = 2\sqrt{15}$$

Then:

$$y = \frac{120}{x} = \frac{120}{2\sqrt{15}} = \frac{60}{\sqrt{15}} = \frac{60\sqrt{15}}{15} = 4\sqrt{15}$$

Answer: Width = $\boxed{2\sqrt{15} \text{ m}}$, Length = $\boxed{4\sqrt{15} \text{ m}}$