



Monday cup #25- Solution

Posted on: September, 30, 2019

Due on: October, 29, 2019

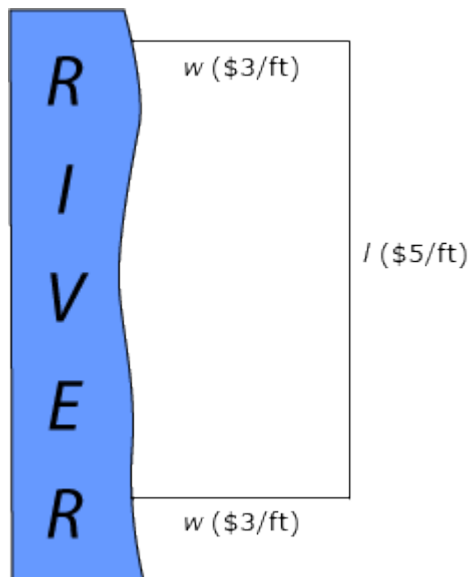


Problem

Question: Irakli wants to build a rectangular enclosure for his herd. He Irakli has \$900 to spend on the fence and wants the largest size for his money. He plans to build the pen along the river on his property, so he does not have to put a fence on that side. The side of the fence parallel to the river will cost \$5 per foot to build, whereas the sides perpendicular to the river will cost \$3 per foot. What dimensions should

Solution:

Start by drawing a picture of the situation.



According to the problem, the farmer is attempting to maximize the size of the rectangular plot. Therefore, the primary equation will be area: $A = l \cdot w$. However, to take the derivative (maximizing the function), you need to eliminate a variable, either l or w ; for that, you'll need a secondary equation.

You know he wants to spend \$900. Furthermore, each foot of the 2 fences he'll use for the width of the yard will cost \$3. Each foot of the fence parallel to the river will cost \$5.

$$\text{cost} = 2w (\text{price}) + l (\text{price})$$

$$900 = 2w (3) + l (5)$$

$$900 = 6w + 5l$$

Solve the cost equation for one of its variables; I'll solve for l .

$$5l = 900 - 6w$$

$$l = 180 - \frac{6}{5}w$$

Now plug this in for l in the primary area equation.

$$A = l \cdot w$$

$$= \left(180 - \frac{6}{5}w\right)w$$

$$= 180w - \frac{6}{5}w^2$$

Now that you've got one variable, maximize by finding the derivative and setting it equal to 0.

$$180 - \frac{12}{5}w = 0$$

$$\frac{12}{5}w = 180$$

$$w = 75 \text{ feet}$$

To find the corresponding length of the optimized field, plug 75 in for w into the modified secondary equation.

$$l = 180 - \frac{6}{5}w$$

$$= 180 - \frac{6}{5}(75)$$

$$= 180 - 90$$

$$= 90 \text{ feet}$$

So the optimized field has a fence parallel to the river measuring 90 feet and two other fences connecting it to the river that measure 75 feet each.

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There was no correct solution to problem 25

Rules

1. Anyone is eligible to participate. Each solution is to be the work of one individual without any input from faculty or others. An answer must be accompanied by appropriate justifications to be considered correct.
2. The solution is to be submitted with the solver's name, email, year in school (if applicable), local phone number, and local address. If you are submitting this for possible credit in a class, include your class number and instructors name.
3. The solution is to be typed or legibly written. Solutions must be submitted to the by 2 p.m. on the due date.
4. Entries will be graded on clarity of exposition and elegance of solution. An award of **GEL10** will be given for the best correct solution. In the case of a two-way tie, the award will be split. If there are more than two best solutions, a drawing will be held to determine two award winners.
5. Graduate students, faculty, and members of the general public are encouraged to submit solutions, but they will not be considered.

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Solution for this problem can be submitted proveweek@gmail.com