

Time Limit: 5 minutes**Instructions:** Open book. Closed notes. No calculator allowed.Instructions for all quizzes: Do not discuss any aspect of this quiz with other midshipmen until after 6th period.

Print your last name above. Also, fill in the bubble for your section.

Fill the bubble for the correct answer. Also, write your answers in any blanks provided.

Your work will not be graded unless the instructions request you show your work.

We are constructing a open-top aquarium with glass sides and a slate base.

The volume of the aquarium must be 5000 cm^3 .Glass costs a cents/cm², and slate costs b cents/cm².The height of the aquarium is z , and the base has length x and width y .

- Express the total cost of the aquarium in terms of the variables x , y , and z .
(Of course, your answer will also involve the constants a and b .)

$$C(x, y, z) = \underline{bxy + 2axz + 2ayz}$$

Reason. Total cost = cost of base + cost of sides = $bxy + 2(axz) + 2(ayz)$
(in cents).

- What is our constraint on x , y , and z ?

$$\underline{V(x, y, z) = xyz = 5000}$$

- List the four equations in four unknowns that arise when the method of Lagrange multipliers is used to minimize the cost of the aquarium.

DO NOT SOLVE THE SYSTEM.

$$\underline{by + 2az = \lambda \cdot yz}$$

$$\underline{bx + 2az = \lambda \cdot xz}$$

$$\underline{2ax + 2ay = \lambda \cdot xy}$$

$$\underline{xyz = 5000}$$

The first three equations come from $\nabla C(x, y, z) = \lambda \nabla V(x, y, z)$.

Note that

$$\nabla C = \langle by + 2az, bx + 2az, 2ax + 2ay \rangle$$

and

$$\nabla V = \langle yz, xz, xy \rangle.$$

The constraint is the fourth equation in the system.