5.10 Introduction to Optimization

Calculus Name: ______________________________ **CA #2**

Write out the equation that needs to be "optimized." This equation should be in one variable. You do NOT need to solve the problem. We will solve in the next lesson.

1. Find two positive numbers whose sum of the first and twice the second is 100 and the product is a maximum.

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2. A rectangle has its base on the x-axis and its two upper corners on the parabola $y = 12 - x^2$. What is the largest possible area of the rectangle?

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3. A kayaker is at a point 500 meters from the closest point on a straight shoreline. She needs to reach a cottage located 1800 meters down shore from the closest point. If she can move her kayak at 2 m/s and she walks at 1 m/s, how far from the cottage should she come ashore so as to arrive at the cottage in the shortest time?

4. An iron works company has contracted to design and build a 500-cubic foot, square-based, open top, rectangular steel holding tank for a paper company. The tank is to be made by welding thin stainless steel plates together along their edges. As the production engineer, your job is to find dimensions for the base and height that will make the tank weigh as little as possible. (This means to minimize the total area of the materials being used.)

5. A farmer plans to fence a rectangular pasture adjacent to a river. The pasture must contain 180,000 square meters in order to provide enough grass for the herd. What dimensions would require the least amount of fencing if no fencing is needed along the river?

Answers to 5.10 CA #2

<table>
<tr><td>1. $M = 50x - \frac{1}{x^2}$
or
$M = 100y - 2y^2$</td><td>2. $A = 24x - 2x^3$</td><td>3. $T = \frac{\sqrt{500^2+x^2}}{2} + (1800 - x)$
or
$T = \frac{\sqrt{500^2+(1800-x)^2}}{2} + x$</td></tr>
<tr><td>4. $A = x^2 + \frac{2000}{x}$</td><td colspan="2">5. $P = \frac{360,000}{x} + x$
or
$P = 2y + \frac{180,000}{y}$</td></tr>
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