Calculus

Name: Date:

3F: Optimization Problems

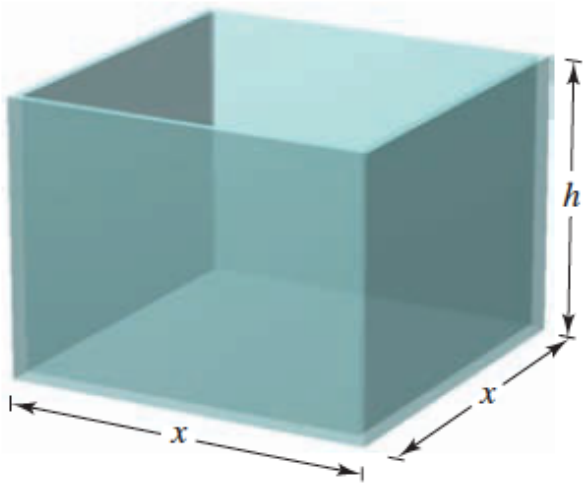
We have seen that derivatives are a useful tool for finding maximums and minimums. So, we can use derivatives to solve problems in which we are looking for the least or greatest, highest or lowest, slowest or fastest, or some type of extreme. These are called optimization problemss

Volumes and Areas

Problem 1: Maximize the Volume: A manufacturer wants to design an open box with a square base that has a surface area of 108 in^2. What dimensions will produce a maximum volume?

a. Begin by find the key equations related to the problem:
Primary Equation (the one that needs to be optimized):
Volume

Secondary Equation (the one that helps relate variables and values: Area



b. Now use some substitution to eliminate variables.

c. Finally use the derivative to find the critical points to the maximum volume (don't forget the endpoints).

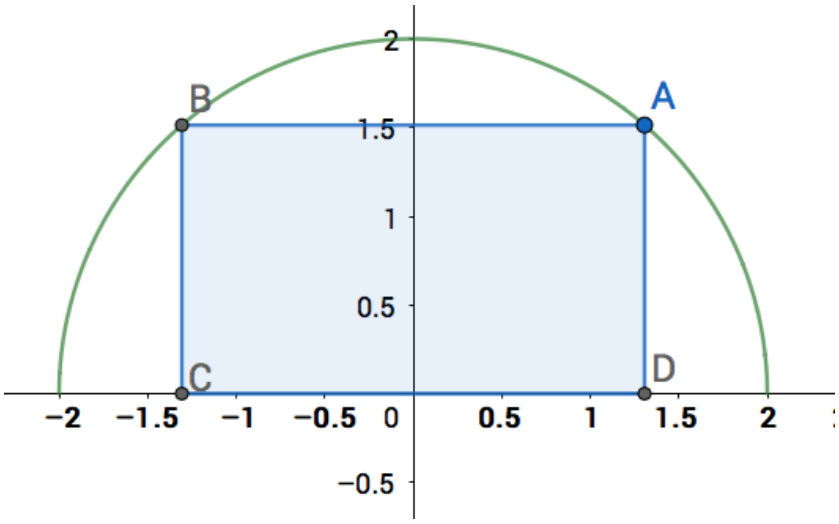
Problem 2: Maximize the area of a pen.

i. Old MacDonald had a farm… And on that farm he had some pigs… He has 200 feet of fencing, and he wants to make a pen for the pigs with the largest area. What should the dimensions of the pen be?

ii. Suppose he farmer decides to make the fence against his barn, what would the dimensions be for a pen with the greatest area?

Problem 3. Rectangles inside a graph.

A rectangle is inscribed in a semicircle $y = \sqrt{4 - x^2}$. Find the largest possible area.



Other Classic Optimization Problems

Problem 4. Sums and Products: Two positive numbers have a sum of 10. Find their largest product.

Problem 5. Closest point on a curve. Find the point on the curve $f(x) = x^2$ to the point (2,1)