Optimization Problems

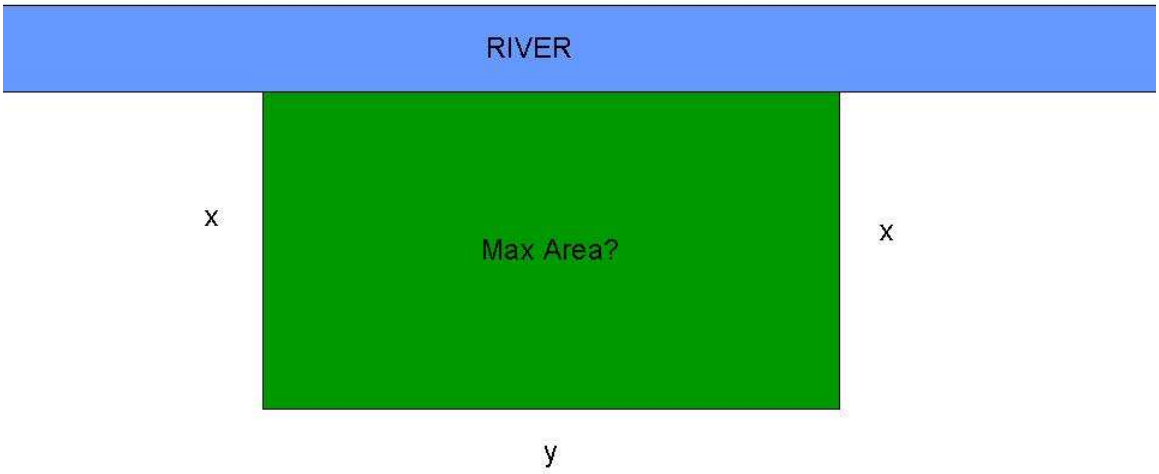
- Optimization problems are ones in which we try to maximize or minimize a value under certain constraints. These are used in very common, real life applications of calculus.

Steps to solve:

1. Identify all quantities to be determined and draw a sketch
2. Find a function relating all information (will have too many variables)
3. Solve for one variable in terms of another (key step!)
4. Substitute
5. Determine max/min by taking derivatives, etc...

[***Make sure your domain makes sense and is feasible.*]

Ex: You are asked to build a fence in a rectangular shaped region with no fence on one side. If given 100 feet of fence to work with, determine the maximum area possible.



$A = L \cdot W$

$A = y \cdot x$ *Notice we have too many variables!

Notice, the width W is x, and the constraint is 2x+y=100, which implies y=100-2x. So...

$A(x) = (100 - 2x)x$ *Now the function is in terms of only x!

$A(x) = 100x - 2x^2$

$A'(x) = 100 - 4x$

$A'(x) = 0$

$A'(x) = 100 - 4x = 0$

$x = 25$

$A''(x) = -4$

$A''(25) = -4 \leftarrow$ Negative: Concave downward at $x = 25$

$A = 25(100 - 50) = 1250ft^2$

Formulas:

- Volume (Box, Sphere)
- Surface Area
- Perimeter
- Distance Formula