Steps for Solving Optimization Problems

1. Read and organize the information. Determine what's given and what's unknown. Draw a diagram.
2. Assign a symbol to the quantity that is to be optimized (maximized or minimized); for example this may be called Q. Assign symbols to any other unknown quantities.
3. Write an equation (perhaps by using a geometric fomula) that relates Q to the other quantities. If the equation relates Q to more than one other quantity, use the other relationships between the unknown quantities in order to relate Q to just one other quantity.
4. Once Q is expressed as a function of one variable, say $Q = f(x)$, find the domain of this function.
5. Find $f'(x)$ in order to find the critical numbers of $Q = f(x)$. Don't forget to test the endpoints if $Q = f(x)$ is only defined on a closed interval.

1. Find *two numbers* whose **difference is 100** and whose **product is a minimum**.

2. A farmer has **2400 ft of fencing** and wants to fence off a **rectangular** field that borders a straight river. He needs no fence along the river. *What are the dimensions of the field* that would have the **largest area**.

3. A **cylindrical** can is to be made to hold **1 L** of oil. *Find the dimensions* that will **minimize the cost** of the metal to manufacture the can. Note: $1L = 1000cm^3$ and the cost depends on the amount of metal used to make the can.

4. When coughing, your windpipe contracts to create a wind velocity sufficient for clearing your throat. The speed v with which air comes out is given by the formula, $v = a(R - v)r^2$ where a is positive constant, R is the radius of the unconstricted windpipe, and r is the radius of the constricted windpipe. What value of r maximizes air speed.