

Optimization Problems

Mini/Max Problems

I Introduction The first step is to read the problem carefully until it is clearly understood. Ask yourself: What is the objective? What are the constraints? Identify the given quantities, and conditions?

Draw a Diagram In most problems it is useful to draw and identify the given and required quantities on the diagram.

Introduce Notation Assign a symbol to the quantity that is to be maximized or minimized (let's call it Q for now). Also select symbols (a, b, c, \dots, x, y, z) for other unknown quantities and label the diagram with these symbols. It may help to use initials as suggestive symbols – for example, A for area, h for height, t for time.

II Write an Objective Function Express Q in terms of the variables introduced in part I.

Express Your Objective Function in One Variable If Q has been expressed as a function of more than one variable, use the given information to find relationships (in the form of equations) among these variables. Then use these equations to eliminate all but one of the variables in the objective equation for Q . Thus, Q will be expressed as a function of one variable, say x , $Q = f(x)$.

III Write the domain of this function!!

IV Find the Extrema of $Q(x)$ Find the absolute maximum or minimum value for your objective function Q . In particular, if the domain of Q is a closed interval use the **Extreme Value Theorem**, if an open interval use **OLE**. Be a name dropper!

V Conclusion State your results.