Name: _____ Section: _____

Principles of Problem Solving [1]

1. Understand the problem: Read the problem carefully.
   (a) What is *the unknown*? What are we optimizing?
   (b) What are the *data*? What descriptions and restrictions are we given?
   (c) If possible, draw a technical sketch (see below).
   (d) Introduce notation that allows you to use the data to write an equation for the unknown.
2. Think of a plan: find the function to optimize.
   (a) Use the data to write an equation for the unknown in terms of the other variables.
   (b) Find equations linking the other variables.
   (c) Express the unknown as a function of a **single** variable.
3. Carry out the plan: find the absolute minimum/maximum.
   (a) Find the derivative of the unknown, and find the critical points.
   (b) Find the min/max value either by (i) using the first derivative test for absolute extrema, or (ii) by plugging in values from a closed interval.
4. Look back
   (a) Check your work! Does your answer make sense?
   (b) Can you use this result or method for another problem?

Principles of Sketching[2]

There are four basic elements of a sketch

1. **The Drawing:** Sketch the physical objects being described. Try to match the scale and relations between things.
2. **Annotations:** Add names, labels, and explanatory notes.
   - Label quantites that can change with *letters*. If a quantity (length, angle, etc) *cannot* change, you can label the drawing with its value.
   - You might also want to add additional lines to create a shape like a triangle, which can be used along with trigonometry or the Pythagorean theorem.
3. **Arrows:** Draw arrows to indicate motion. Once drawn, these arrows can often help you find out where to fill in the missing lines to create a triangle.
4. **Notes:** Next to your drawing, write down any formulas that may be useful for relating the relevant quantities. Common examples are area, volume, trig, simila, and distance formulas. You may also use facts about similar triangles.

[1] Adapted from Polya's *How To Solve It* and Stewart's *Calculus* 7e
[2] Adapted from §3.4 of *Sketching User Experiences: The Workbook*, by Greenberg et.al.