

Math 1210: Calculus I

Practical problems

Department of Mathematics, University of Utah

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Accompanying text: Varberg, Purcell, and Rigdon 2007, Section 3.4

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D22-S02(a)

“Practical problems” are word problems that describe a scenario where calculus, in particular finding optimal values, can be exercised.

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Step 1: Draw a picture for the problem and assign appropriate variables to the important quantities.

Step 2: Write a formula for the objective function Q to be maximized or minimized in terms of the variables from step 1.

Step 3: Use the conditions of the problem to eliminate all but one of these variables, and thereby express Q as a function of a single variable.

Step 4: Find the critical points (end points, stationary points, singular points).

Step 5: Either substitute the critical values into the objective function or use the theory from the last section (i.e., the First and Second Derivative Tests) to determine the maximum or minimum.

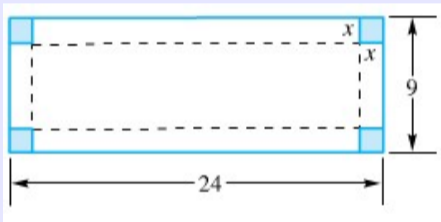
Despite the steps above, there really isn't a recipe to solving these problems.

Example (Problem 3.4.5)

Find the points on the parabola $y = x^2$ that are closest to the point $(0, 5)$. *Hint:* Minimize the square of the distance between (x, y) and $(0, 5)$.

Example (Example 3.4.1)

A rectangular box is to be made from a piece of cardboard 24 inches long and 9 inches wide by cutting out identical squares from the four corners and turning up the sides, as in the figure. Find the dimensions of the box of maximum value. What is this volume?



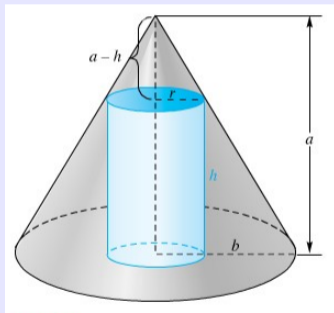
Example (Problem 3.4.13)

A farmer wishes to fence off two identical adjoining rectangular pens, each with 900 square feet of area, as shown in the figure below. What are x and y so that the least amount of fence is required?



Example (Example 3.4.3)

Find the dimensions of the right circular cylinder of greatest volume that can be inscribed in a given right circular cone.





Varberg, D.E., E.J. Purcell, and S.E. Rigdon (2007). *Calculus*. 9th. Pearson Prentice Hall.
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