

MA 2550: Calculus I

## Section 4.7: Optimization Problems

In this section, we will learn how to solve applied optimization (maximum and minimum) problems. There are 2 categories of problems:

- 1. Problems that deal with maximizing or minimizing a continuous function over a finite closed interval.
- 2. Problems that deal with maximizing or minimizing a continuous function over an infinite interval or a finite interval that is not closed.

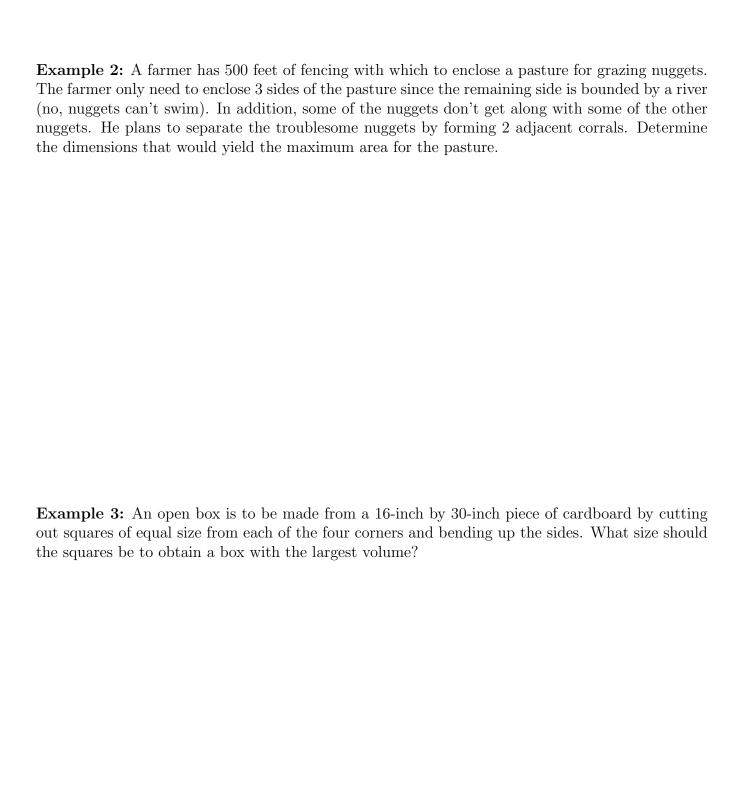
In either case, we need to consider the *feasible domain* of the problem and then use techniques that we have already learned to maximize or minimize a particular function. Part of finding the solution to a given problem is making sure that we have actually found a solution.

## Guidelines for Solving Applied Optimization Problems:

- 1. Identify all given quantities and quantities to be determined. If possible, draw a picture.
- 2. Write a primary equation for the quantity that is to be maximized or minimized.
- 3. Reduce the primary equation to one having a single independent variable. This may involve the use of a *secondary equation* relating the independent variables of the primary equation.
- 4. Determine the *feasible domain* of the primary equation (this is some subset of the natural domain). That is, determine the values for which the stated problem makes sense.
- 5. Determine desired max or min value by using the techniques of the previous sections.

**Important:** Sometimes we want to know what the max or min *is* and sometimes we want to know when the max or min occurs.

**Example 1:** Find two positive numbers such that their product is 192 and the sum of the first and three times the second is as small as possible.



**Example 4:** An interstellar nugget travels along a path given by  $p(x) = 4 - x^2$ . If a star is located at the point (0, 2), find the point(s) on the path of the nugget that are closest to the star.