Use calculus to solve the following problems. Show your work and your solutions neatly organized. Express any irrational solutions rounded to three significant digits. Show your process neatly organized.

1. A piece of sheet metal 12 inches long and 9 inches wide is to be cut and folded as shown in the diagram to make a box. Find the value of x that corresponds to a maximum volume.



2. One side of a rectangle is on the x-axis and its upper two vertices are on the curve $y = 12 - x^2$. What is the maximum area of the rectangle?

Use calculus to solve the following problems. Show your work and your solutions neatly organized.

3. The sum of the length and the girth of a package mailed second-class must not exceed 100 inches, the girth being defined as the shortest distance around the package. A package is a rectangular box with a square base whose height is greater than the length of its base. (See the diagram below.) What is the maximum volume of the package?



4. A farmer wishes to fence in a rectangular plot of land and to divide it into three equal areas as shown in the diagram. If the total enclosed area must be 5000 square feet, then what dimensions will use the least amount of fencing? How much fencing is needed?