Last Name, First Name	Discussion Section	Student ID

Worksheet 6 ● Vertices of Parabolas and Optimization

1. Find the minimum y value of a point on the graph given by the set of points satisfying

$$y = x^2 + x + 1.$$

2. Find the maximum y value of a point on the graph given by the set of points satisfying

$$y = -x^2 + 2x + 4.$$

3. You have 400 feet of fencing. You will fence in a rectangular region of your backyard. What should the side lengths of the rectangle be so that the area is maximal? What shape will the yard be?

4. You have 400 feet of fencing. You will fence in a rectangular region of your backyard with this fencing but can use an already existing stone wall as one side of the rectangular region. What should the side lengths of the rectangle be so that the area is maximal?

5. In the problem above, what should the side lengths of the rectangle be so that the area is minimal?

6. You have a fixed amount of fencing and you will only fence off square regions. Will you fence in more area by making a single square region or two square regions? Note that the two regions may have different side lengths. What is the smallest area that you can fence off if the two regions that you fence off are square?

7. Initially at time zero, Boat 1 is at $(2, 3)$ and Boat 2 is at $(9, 4)$. Boat 1 is traveling four miles per hour North (the positive y direction) and ten miles per hour East. Boat 2 is traveling two miles per hour North and one mile per hour East. What is the closest the boats get to each other and at what time does this occur?