MTH 1210, FALL 2013
DR. GRAHAM-SQUIRE

SECTION 3.1: IN CLASS ACTIVITY
MODELING TO MAXIMIZE A QUADRATIC

1. Names

_____

_____

_____

2. Instructions

Read the problem given below, then work on it with the other members of your group. You should give a complete answer with all of your work shown for each question. It is fine for different people to work on different parts of the question, but you should check each other's work since everyone in the group will receive the same grade for the assignment. If you have any questions, ask the other members of your group first. If all of you are stuck, everyone in the group must raise their hand in order to get help from the professor. Attach this as a cover sheet to the work you turn in.

Exercise 1. At a vineyard it is found that each grape vine produces about 10 pounds of grapes in a season when about 70 vines are planted. For each additional vine planted, the production of each vine decreases by 1%, or approximately 0.1 pounds. We are interested in maximizing the total production of grapes and thus want to model this situation. The total pounds of grapes produced is given by

$$(\text{number of vines}) \cdot (\text{production per vine})$$

Let n be the number of additional vines over 70 that are planted (thus if 75 vines were planted, n would equal 5 and the production of each vine would be 10-(5)(0.1)).

(a) Explain why if 75 vines were planted, the production of each vine would be 10-(5)(0.1). You should explain why each number is what it is and where each operation comes from.
(b) Express the 'total number of vines' in terms of n. (Note that if $n = 5$, the total number of vines planted would be 75).
(c) Express the 'production per vine' in terms of n.
(d) Let $P(n)$ =(number of vines)·(production per vine). Substitute your expressions from parts (b) and (c) and multiply to get a quadratic expression for $P(n)$.
(e) Find (i) the number of extra vines that should be planted in order to maximize production.
(ii) How many total pounds of grapes would be produced if that many vines are planted?
(iii) How do you know your answer is a maximum and not a minimum?