

Lab 2, Math 462 February 1, 2008

We are going to verify Figures 2.11, 2.13, 2.14 and 2.15 in the Meerschaert Book on Mathematical Modeling. These examples will help you understand how to use contour plots (level sets) to verify the analytical results you obtained using Lagrange Multipliers. The problem we are considering is

$$y = f(x_1, x_2) = (339 - 0.01x_1 - 0.003x_2)x_1 + (399 - 0.004x_1 - 0.01x_2)x_2 - (400,000 + 195x_1 + 225x_2) \quad (1)$$

We wish to maximize f over the set S consisting of all x_1 and x_2 satisfying the constraints

$$x_1 \leq 5,000 \quad (2)$$

$$x_2 \leq 8,000 \quad (3)$$

$$x_1 + x_2 \leq 10,000 \quad (4)$$

$$x_1 \geq 0 \quad (5)$$

$$x_2 \geq 0 \quad (6)$$

Problem 1: Generate Figure 2.11 for various level sets, i.e., values for which $f = C$. What value of C maximizes the equation? (Hint: To work on this problem you will need to look up contour plots in the matlab help command and may also want to search on the internet.)

Problem 2: Change your constraints such that there is a 10% increase in production levels. How does this change your profit?

Problem 3 (Maple): Now consider the sensitivity equations, where the price elasticity a of 19" TV sets is variable. Following the guidelines in the book, re-derive the sensitivity equations. Using this information generate Figures 2.13 and 2.14.

Problem 3a: Verify that at $a = 0.01$ that the slopes are correct. Also verify where the range $0.07 \leq a \leq 0.022$ comes from.

Problem 4 Reproduce Figure 2.15