Complete, but do not hand in, problem B from the multipliers.pdf handout. Complete and hand in the following problems.

Section 14.8 #3, 37, 55.

Problems C, D, E from multipliers.pdf.

For this last problem, suppose that you work for a company that has three divisions. You have d dollars to distribute among the divisions for the coming year. You want to maximize the company's total profit.

If the world were simple, then there would be a simple relationship between spending and profit. Investing x dollars in the first division would yield ax dollars of profit, where $a > 0$ is some constant. Similarly, investing y in the second division and z in the third division would yield profits of by and cz respectively. So your total profit would be $ax + by + cz$, to be maximized subject to the constraint that $x + y + z = d$. Make sense?

However, the world is not so simple. Some of the first division's products are redundant with the second division's products. So the profit coming out of the first division is better modeled as $ax(y + 1)^{-1/2}$. Also, the government has issued tax breaks that benefit your third division. When you invest z dollars in your third division, the government gives you back $z - \frac{5}{4}(z + 1)^{4/5}$ dollars; in effect, only $\frac{5}{4}(z + 1)^{4/5}$ of your d dollars are used up.

1. Formulate the profit maximization problem in mathematical notation. Be clear about which function you're maximizing under which constraint(s).

2. Solve the problem using Lagrange multipliers, giving your answer in terms of a, b, c, d. If it helps, you may assume that $a > b > c$.