First, please do these three problems: Section 14.8 #3, 37, 55.

Second, do problems C, D, E from the `multipliers.pdf` handout.

Finally, here is one more 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 created tax incentives 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. So your profit behaves as if you spent z dollars, but only $\frac{5}{4}(z + 1)^{4/5}$ of your d dollars are actually used up.

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

2. Start to solve the problem using Lagrange multipliers, clearly identifying which cases you're testing. At some point the algebra gets too difficult; then just stop.