Math 250a, Section 2, Fall 2007
Homework #3
Due Thursday, September 13

Chapter 1.5 (pages 35-36):	Exercises & Problems: 26, 30, 38
Chapter 3, Review (pages 159-164):	Exercises: 26, 28, 36
Chapter 4, Review (pages 230-235):	Exercises: 4, 8, 12

Exercise #11

Enzymes are proteins whose function is to increase the rate (i.e. catalyze) at which chemical reactions approach equilibrium. Catalysts are important because at typical pH values and temperatures in the human body, reactions without a catalyst would be too slow for basic functions such as nerve impulse "firing" or rapid muscle contractions. The rate at which the reaction occurs, or the velocity V, can be expressed as a function of substrate concentration (i.e. the chemical the enzyme binds with) by the Michaelis-Menten expression

$$V = V_{\max}\frac{[S]}{K_m + [S]}$$

where $V_{\max}$ and K_m are constants that are unique for each enzyme given a specific temperature and pH. As discussed in class $V_{\max}$ is the maximum reaction rate and K_m is the half saturation coefficient (at which substrate concentration the reaction rate is $\frac{1}{2}V_{\max}$).

Chemists measure these reactions to determine values for $V_{\max}$ and K_m for a specific enzyme. Below is a table giving values measured (substrate concentration $[S]$ versus velocity of product formation V) during one experiment.

$[S]$	V
1	0.7912
2	1.1502
3	1.3343
4	1.4734
5	1.5378
6	1.6139
7	1.6597
8	1.7043
9	1.6849
10	1.7120

Use the Lineweaver-Burk method the best fit parameters for $V_{\max}$ and K_m. Show your work .

HINT: To perform a linear least squares parameterization you can use any computer/calculator program available to you. Or you can use the following formulas. Suppose you have n data pairs $(x_1, y_1), (x_2, y_2), \cdots, (x_n, y_n)$. Here's how to calculate the Least Squares estimates for m and b for the linear regression line $y = mx + b$: calculate and denote the means of x_i and y_i by

$$\bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i, \qquad \bar{y} = \frac{1}{n}\sum_{i=1}^{n} y_i$$

and then calculate

$$m = \frac{\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})}{\sum_{i=1}^{n}(x_i - \bar{x})^2}, \qquad b = \bar{y} - m\bar{x}.$$