Math 164, Lecture 2
Homework #1, due on Wednesday, October 5, 2005

[**1**] (Fitting a quadratic function to data) The following points in the plane are assumed to lie on the graph of a quadratic function $(t, b(t))$. These points, denoted by (t_i, b_i), have the coordinates $(0, 1)$, $(2, 7)$, and $(5, 46)$. Find the quadratic function and plot its graph.

[**2**] A manufacturer of office furniture is trying to maximize the monthly revenue of the factory. Various orders have come in that the company could accept. They include desks, bookshelves, cabinets with doors, and cabinets with drawers. The table above indicates the quantities of materials and labor required to assemble the four types of furniture, as well as the revenue earned. Suppose that 6000 units of wood and 2000 units of labor are available. Formulate the linear programming model that will maximize the revenue under the given conditions, where x_i, $i = 1, 2, 3, 4$ is the number of pieces of furniture to be produced for each type.

Piece	Labor	Wood	Revenue
desk	8	12	200
bookshelf	6	10	100
with doors	2	25	150
with drawers	4	20	200

[**3**] Four buildings are to be connected by electrical wires. The positions of the buildings are as follows: the first building is an ellipse with center (a_1, a_2) and axes b_1 and b_2. The second building is a circle with center (c_1, c_2) and radius r. The other two buildings are both squares centered at (d_1, d_2) and at (e_1, e_2) and sides of length l. The electrical wires will be joined at some central point (x_0, y_0), and will connect to building i at position (x_i, y_i). Formulate the non-linear optimization problem that minimizes the amount of wire used.

[**4**] Consider the one-variable function

$$f(x) = (x + 1)x(x - 2)(x - 5) = x^4 - 6x^3 + 3x^2 + 10x.$$

Graph this function and locate (approximately) the stationary points, local minima, and global minima.