12. (*expires 3/4*) Fit the set of points

$$(1.02, -4.30), (1.00, -2.12), (0.99, 0.52), (1.03, 2.51), (1.00, 3.34), (1.02, 5.30)$$

with a line, using the least square method. You will see that this is not a good fit. Think of a better way to find a line which *is* a good fit and use `Maple` to do it. Explain in your solution why you think your better way is indeed better.

You can load these data points from the web at `http://www.math.sunysb.edu/~scott/mat331.spr14/problems/fit6.txt`, which defines a list `fit6` containing these points.

See the page on loading a file from the web from the class web page for more details.

13. (*expires 3/4*) The file `http://www.math.sunysb.edu/~scott/mat331.spr14/problems/fitexp.txt` defines 21 data points that approximates an exponential curve of the form $y = ae^{bx}$. This data is called `fitexp`.

Find a and b by taking the appropriate logarithm, then use `LeastSquares` to find the resulting "best" line. Transform this line appropriately to get an exponential curve.

Plot the exponential and the `fitexp` data on the same axes.

14. (*expires 3/4*) Fit the points $(-1.9, -4.7), (-0.8, 1.2), (0.1, 2.8), (1.4, -1.2), (1.8, -3.5)$ by means of a quadratic function $f(x) = ax^2 + bx + c$, using the least square method.

You can load these data points from the web via the link at fitquad.txt which defines a list `fitquad` containing these points.

See the page on loading a file from the web from the class web page for more details.

15. (*expires 3/4*) In this problem we will estimate the charge of the electron.

If an electron of energy E is thrown into a magnetic field B which is perpendicular to its velocity, the electron will be deflected into a circular trajectory of radius r. The relation between these three quantities is:

$$B\,r\,e = \frac{E^2}{m^2c^4}\sqrt{E^2 - m^2c^4}, \tag{1}$$

where e and m are, respectively, the charge and the mass of the electron, and c is the speed of light. The rest mass of the electron is defined as $E_0 = mc^2$, and is about equal to $8.817\,10^{-14}$ Joules. In our experimental set-up the energy of the emitted electrons is set to be $E = 2.511E_0$.

The file electron.txt defines a list called `electron`. Each element of the list is a pair of the form $[B_i, r_i]$, and these quantities are expressed in Teslas and meters. Use least square fitting to determine the best value for e.

[*Hint: Notice that the right hand side of eqn (1) is just a constant—calculate it once and for all and give it a name. Then eqn (1) becomes an equation which is linear in the unknown e. To verify your solution:* $e \approx 1.602\,10^{-19}$ Coulomb]. Physical constants courtesy of N.I.S.T.