

9. (expires 2/27) 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 we used in class. 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.spr13/problems/prob9.txt>, which defines a list `prob9` containing these points.

See the page on [loading a file from the web](#) from the class web page for more details.

10. (expires 2/27) The file <http://www.math.sunysb.edu/~scott/mat331.spr13/problems/prob10.txt> defines 21 data points that approximates an exponential curve of the form $y = ae^{bx}$. This data is called `prob10`.

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 `prob10` data on the same axes.

11. (expires 2/27) 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 at <http://www.math.sunysb.edu/~scott/mat331.spr13/problems/prob11.txt>, which defines a list `prob11` containing these points.

See the page on [loading a file from the web](#) from the class web page for more details.

12. (expires 2/27) 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:

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

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 $8.817 \cdot 10^{-14}$ 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: $e \approx 1.602 \cdot 10^{-19}$ Coulomb]. Physical constants courtesy of N.I.S.T.