17. (*expires 3/15*) *(a last gasp for curve-fitting problems)* The file bdata.txt on the class website defines a list called `bdata`. This is a list of 54 points which approximate a line, but several of the points are quite far away from the rest.

    Using the robust fitting method discussed in class on February 28, or in chapter 7 of the notes, with the objective functions

    $$R(m,b,data)=\sum_{i=1}^{n}\ln(1+(mx_i+b-y_i)^2) \quad \text{and} \quad S(m,b,data)=\sum_{i=1}^{n}1-e^{-(mx_i+b-y_i)^2}.$$

    Determine the best lines for the data using regular least squares, as well as those given by R and S above. Plot the data and the lines you found on the same plot, both in a view that shows all the data points, and in another which restricts the y values to those for which there is a data point within 10 units of a fit line (ie, $0<y<35$).

18. (*expires 3/15*) Find all the solutions to the differential equation

    $$\frac{dx}{dt}(t)=-2x(t), \quad t\in\mathbb{R}.$$

    Among them, single out the one for which $x(0)=3$. [*Hint: read the help page for* `dsolve`*, or just do it in your head. It is that easy.*]

19. (*expires 3/15*) Have `Maple` find analytic solutions to the following system of differential equations,

    $$\begin{cases} y''(t)-z(t) &= e^t, \\ z'(t)-y(t) &= 0, \end{cases}$$

    with initial conditions: $y(0)=1,\ y'(0)=0,\ z(0)=k$. Let us denote the solutions by $y_k(t),\ z_k(t)$ (since they depend on the parameter k).

    For k taking all integer values from -10 to 10, and $t\in[-4,2]$, plot the functions y_k in blue, and the functions z_k in red, all on the same graph. (Yes, you will then have 42 functions plotted on the same graph.) [*This is certainly a case when you don't want to retype the functions that* `Maple` *finds. You will almost certainly need to read the help page for* `dsolve`*. I also found* `subs`, `unapply`, *and* `seq` *useful.*]

20. (*expires 3/15*) For the functions $y_k(t)$ and $z_k(t)$ found in the previous problem, plot the parametric curves $\varphi_k(t)=[y_k(t),z_k(t)]$ for integer values of k between -5 and 5 and $-6<t<4$ on the same graph. Use the `view` option of plot to only show what lies in the region $-10<y<10, -10<z<10$, and use a sequence of colors so that each solution is a different color. [*HINT: you might find something like* `seq(COLOR(HUE,i/11),i=0..10)` *useful for the latter.*]

21. (*expires 3/15*) Find all the fixed points of the system

    $$\begin{cases} \dot{x} &= x^2+y, \\ \dot{y} &= x(y^2-1), \end{cases}$$

    where a "fixed point" is a solution for which **both** $x(t)$ **and** $y(t)$ are constant. For each of these solutions you find, describe the behavior of the solutions that have initial conditions nearby. You can use `Maple` to figure out what happens for nearby points, or you can use more mathematical methods.

NOTE: The fact that there are various notations for differential equations is purely intentional.