

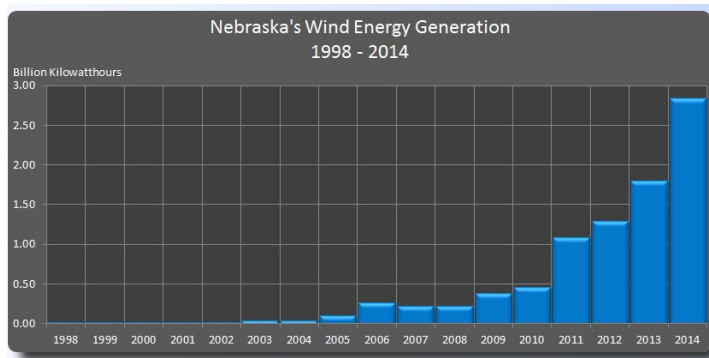
Where do these equations come from?

When businesses, governments and other policy makers prepare to make decisions, they often look at data to find trends. Where new schools are built and where their boundaries will lie is one example of this. By plotting enrollment over time, trends emerge and equations can be created that model the data.

Wind Energy

As we see more wind farms being constructed in Nebraska, you may wonder how much energy is actually created by all of the turbines. A graph from the Nebraska Energy Office shows the growth in wind energy since 1998.

The actual data is also listed in a table on their website. You can take that data and plot it in a graphing calculator, in the Desmos online calculator or in an Excel spreadsheet. All three can use the data to predict a curve of best fit. The chart to the right looks like it would be modeled best by an exponential growth function.

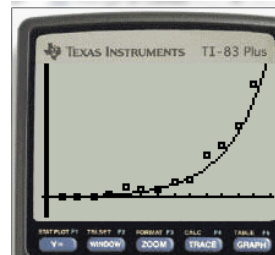
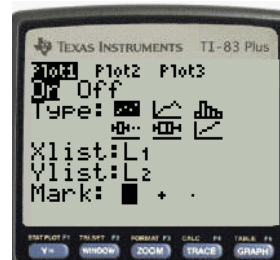
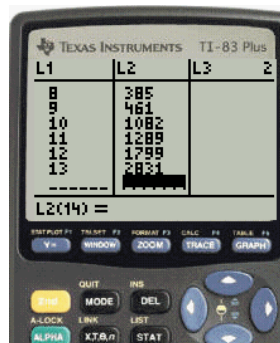


Finding an Equation of Best Fit on a Graphing Calculator

To find the equation of best fit, you enter the data into your calculator and request an exponential regression. On a Texas Instruments graphing calculator do the following:

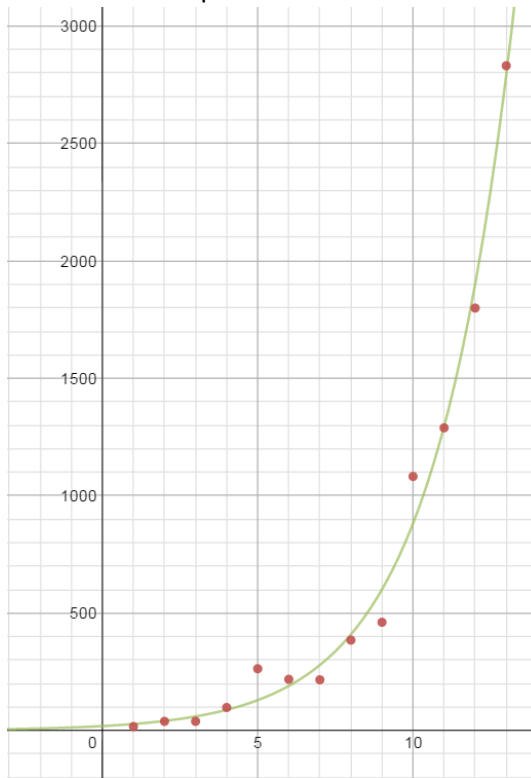
1. Go to **Y=** and clear any equations.
2. Press **Stat** and press **1** or **Enter** to edit a list.
3. If there is any data in list L1 or L2, arrow up to the heading for that list and press the **Clear** button.
4. Enter the data in the table at the right in L1 and L2.
5. If you accidentally have extra data in one column, highlight the data you wish to remove and press **Del**.
6. To see the data plotted, press **2nd** and the **Y=** button.
7. Press **Enter** to look at Plot 1.
8. Turn Plot 1 to **On** by highlighting it and pressing **Enter**.
9. Make the screen match the one on the right.
10. Press your **Zoom** key then arrow down to **9: ZoomStat** and press **Enter**.
11. Find the equation of best fit by pressing **Stat**, arrow to the right to **Calc**, arrow down to **ExpReg**. Press **Enter**.
12. Press the **2nd** key then **1** to get L1, press a **,** (comma) key right above the number 7, then press **2nd** key and **2** to get L2.
13. Press **Enter**.
14. Your calculator will give you an equation. Write it down.
15. Press **Y=** then type your equation in. Press **Graph**.
16. Your data points and equation should match up reasonably well.

Year Since 2001	Nebraska Total Wind Energy in Million kWh
1	17
2	39
3	39
4	98
5	263
6	218
7	216
8	385
9	461
10	1082
11	1289
12	1799
13	2831



Finding an Equation of Best Fit Using Desmos

1. Go to Desmos.com and launch the calculator.
2. Click on the + drop down menu to add an item.
3. Choose **Table**.
4. In the x_1 column type the years since 2001.
5. In the y_1 column type the wind energy values.
6. Click on the + drop down menu and choose **f(x) expression**.
7. Type y_1 then the \sim (above your Tab key) then ab^{x_1} and press **Enter**



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$y_1 \sim ab^{x_1}$

Log Mode ?

STATISTICS $R^2 = 0.988$

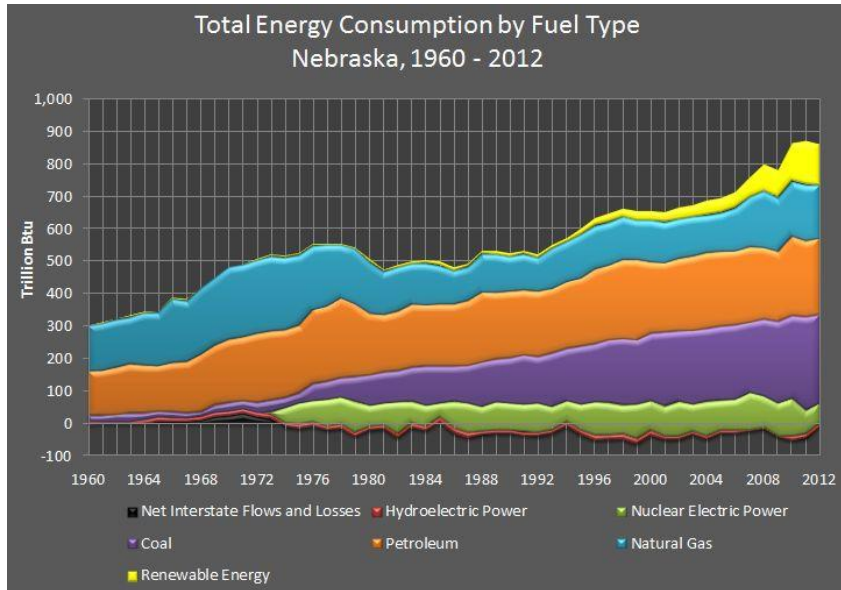
RESIDUALS e_3 plot

x_1	y_1
1	17
2	39
3	39
4	98
5	263
6	218
7	216
8	385
9	461
10	1082
11	1289
12	1799
13	2831

For 5 points extra credit on your test, show me either your graphing calculator screen with the points plotted and the equation plotted or a Desmos graph of the same.

Nebraska Total Energy Consumption

The Nebraska Department of Energy also keeps track of how much of each type of energy is consumed each year. The graph below breaks it down by type. For a color image go to Systry.com and search for Nebraska.



Year Since 2001	Nebraska Total Energy Consumption in Million kWh
1	195000
2	198000
3	201000
4	204000
5	208000
6	223000
7	235000
8	229000
9	253000
10	255000
11	252000

Plot the data to the right using a stat plot. It will appear linear in nature. Because of this, when you find your line of best fit, use a LinReg ($ax+b$) or in Desmos $y_1 \sim mx_1 + b$. Use the two equations to predict when (if wind energy continues to grow at the current rate) Nebraska could rely completely on wind energy.