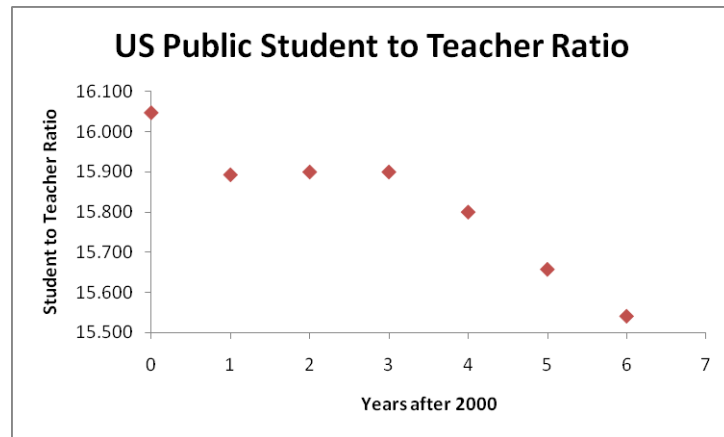


In an earlier technology assignment, you created a scatter plot of the US Student to Teacher Ratio for public schools from the table below. The scatter plot is shown to the right of the table.

Years after 2000	US Student to Teacher Ratio
0	16.048
1	15.893
2	15.900
3	15.900
4	15.800
5	15.657
6	15.540



Now that we have the scatter plot of the data, we want to find a model for the data. In this technology assignment, we'll investigate two models. The first model we'll find is a linear model of the form

$$y = mx + b.$$

After finding the linear model, we'll find a quadratic model of the form

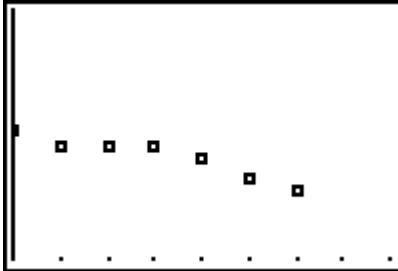
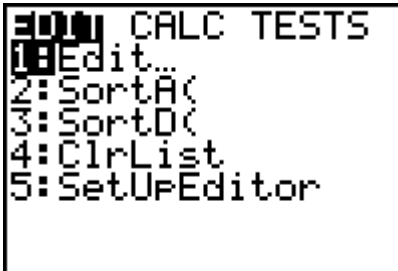
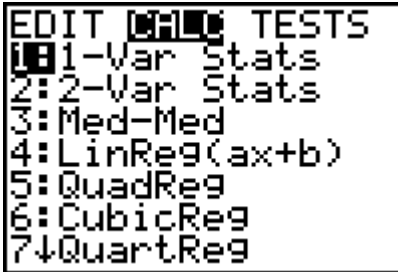
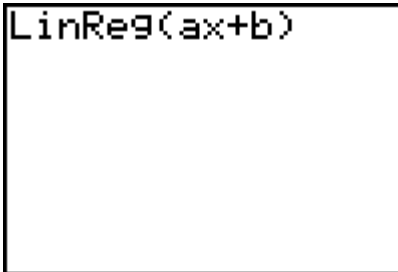
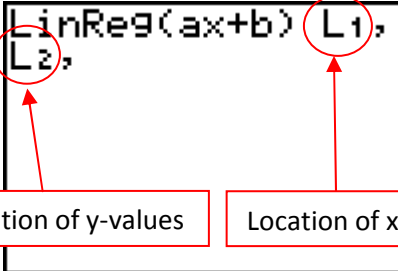
$$y = ax^2 + bx + c$$

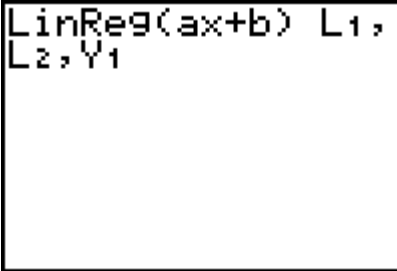
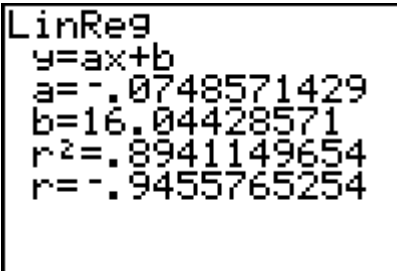
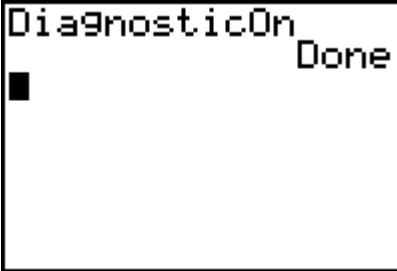
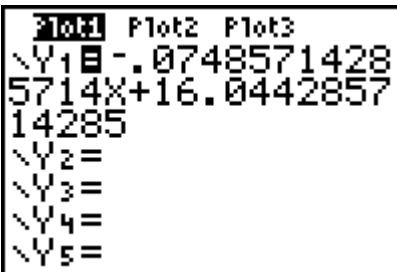
You'll use the student to teacher ratio data for the state you have been assigned in Project 1.

To find these models, we'll use the linear and quadratic regression features on your calculator and in Excel. In this technology assignment you'll add the best line found through linear regression to the scatter plot you created in earlier technology assignments as well as the best quadratic function found through quadratic regression.

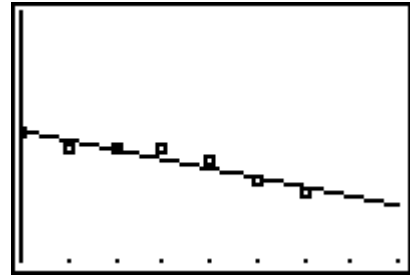
Use Linear Regression to Find the Best Line on a Graphing Calculator

In an earlier technology assignment, you used your calculator to make a scatter plot of some data. We'll start from that scatter plot and add a line of best fit.

<p>1. Press GRAPH to see your scatter plot. If your data does not appear, refer to the earlier technology assignments to recreate them.</p>	
<p>2. Linear regression is performed using the LinReg command on a TI graphing calculator. Start by getting back to the home screen by pressing 2ndMODE.</p> <p>3. Clear the home screen by pressing CLEAR.</p> <p>4. Press STAT.</p>	
<p>5. Press ▸ to move to the CALC menu.</p>	
<p>6. Use ▾ to highlight LinReg(ax+b) and press ENTER or press 4. This pastes the LinReg command to the home screen.</p>	
<p>7. The LinReg command needs to know where the data is stored and where to paste the equation corresponding to the linear model. Press 2nd1,2nd2,. This places L_1 and L_2 separated by commas immediately after the command.</p>	

<p>8. To tell the calculator where to paste the equation, press VAR ▶ ENTER ENTER. This pastes Y_1 at the end of the command meaning that the equation will be pasted into Y_1 in the equation editor.</p>	
<p>9. Press ENTER to execute the LinReg command. This screen tells you that the best line through this data is $y = -0.0748571429x + 16.04428571$.</p>	
<p>10. If you do not see the correlation coefficient (the value for r), press 2nd 0 to access the calculators catalog of commands.</p> <p>11. Use the ▼ button to find DiagnosticOn.</p> <p>12. Press ENTER ENTER. When you use the LinReg command again (steps 6 through 8), the correlation coefficient will be shown.</p>	
<p>13. Press Y= to see the contents of the equation editor. Notice that Plot 1 is highlighted indicating that your scatter plot will appear. Y_1 is the equation of the best fit line.</p>	

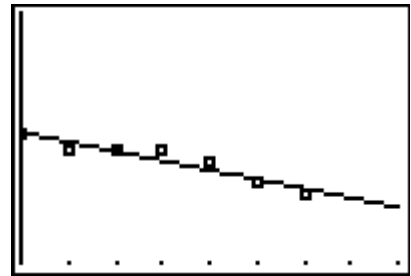
14. Press **GRAPH** to see the scatter plot and line.



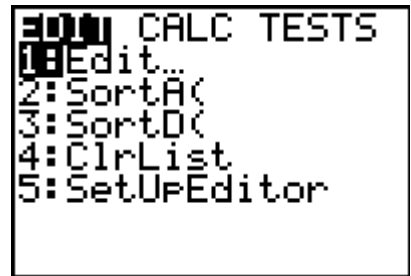
Use Quadratic Regression to Find the Best Parabola on a Graphing Calculator

Now let's add a parabola of best fit to the scatter plot using quadratic regression.

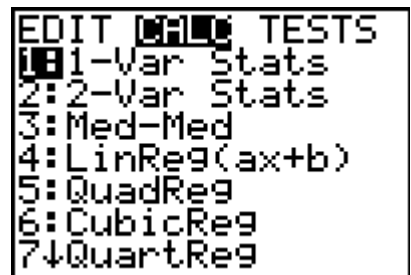
1. Press **GRAPH** to see your scatter plot. Here you see the scatter plot and linear model.


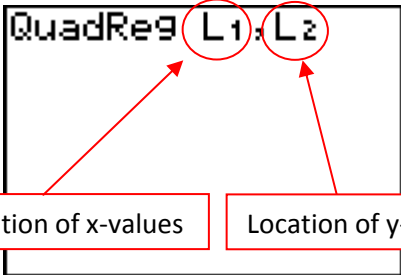
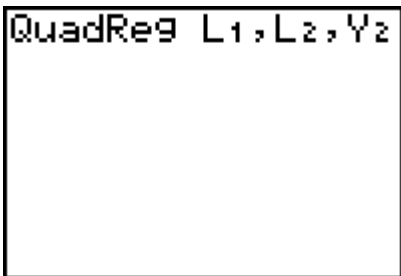
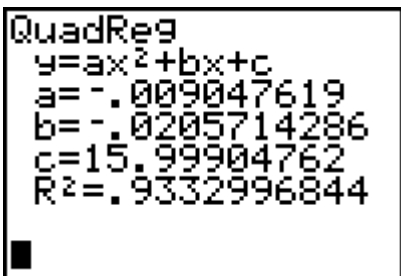
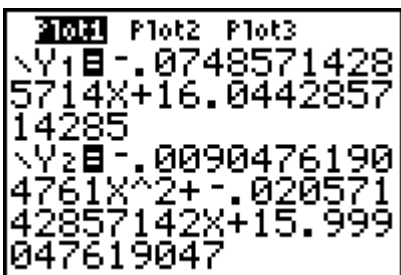


2. Quadratic regression is performed using the QuadReg command on a TI graphing calculator. Start by getting back to the home screen by pressing **2nd****MODE**.
3. Clear the home screen by pressing **CLEAR**.
4. Press **STAT**.

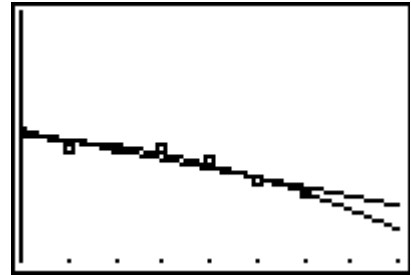


5. Press **▸** to move to the CALC menu.



<p>6. Use \blacktriangledown to highlight QuadReg and press ENTER or press $\boxed{5}$. This pastes the QuadReg command to the home screen.</p>	
<p>7. The QuadReg command needs to know where the data is stored and where to paste the equation corresponding to the linear model. Press $\boxed{2\text{nd}}\boxed{1}\boxed{,}\boxed{2\text{nd}}\boxed{2}\boxed{,}$. This places L_1 and L_2 separated by commas immediately after the command.</p>	
<p>8. To tell the calculator where to paste the equation, press $\boxed{\text{VAR}}\boxed{\blacktriangleright}\boxed{\text{ENTER}}\boxed{\blacktriangledown}\boxed{\text{ENTER}}$. This pastes Y_2 at the end of the command meaning that the equation will be pasted into Y_2 in the equation editor.</p>	
<p>9. Press ENTER to execute the QuadReg command. This screen tells you that the best parabola through this data is approximately $y = -0.009x^2 - 0.021x + 15.999$.</p>	
<p>10. Press $\boxed{\text{Y=}}$ to see the contents of the equation editor. Notice that Plot 1 is highlighted indicating that your scatter plot will appear. Y_1 is the equation of the best fit line and Y_2 is the equation of the best fit parabola.</p>	

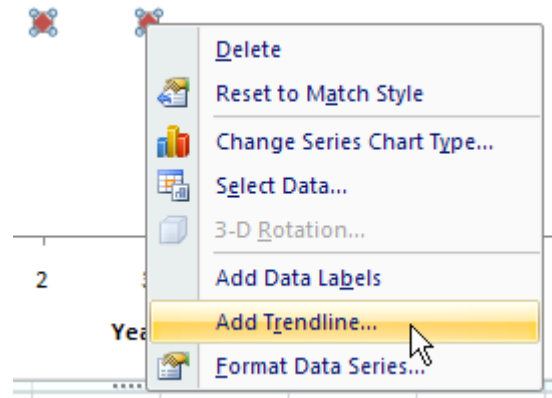
11. Press **GRAPH** to see the scatter plot and line.



Use Linear Regression to Find the Best Line in Excel

In an earlier technology assignment, you used Excel to make a scatter plot of some data. We'll start from that scatter plot and add a line of best fit using Excel. Excel refers to the line of best fit found through linear regression as a linear trendline.

1. Open the worksheet containing the scatter plot and line from the previous technology assignment.
2. Right mouse click on one of the data points in the scatter plot. You may have to right click more than once to make the menu shown to the right appear.
3. Use your mouse to select Add Trendline...



4. The Format Trendline box will appear in your worksheet. Click on the Linear option to insure linear regression is performed on the data.
5. At the bottom of the worksheet, check Display Equation on chart and Display R-squared value on chart.
6. Select Close.

Trendline Options

Trend/Regression Type

- Exponential
- Linear
- Logarithmic
- Polynomial Order: 2
- Power
- Moving Average Period: 2

Trendline Name

- Automatic : Linear (Series1)
- Custom:

Forecast

Forward: 0.0 periods

Backward: 0.0 periods

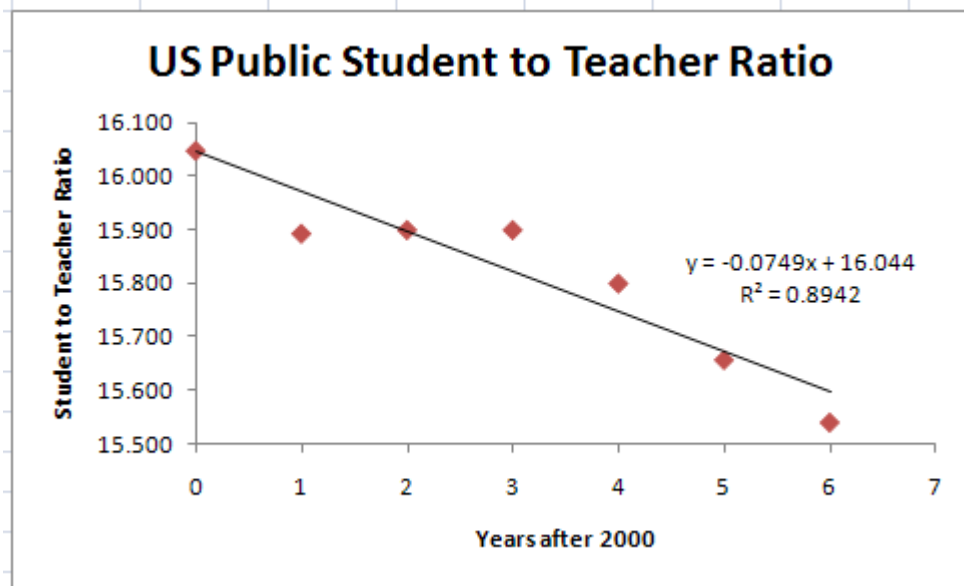
Set Intercept = 0.0

Display Equation on chart

Display R-squared value on chart

Close

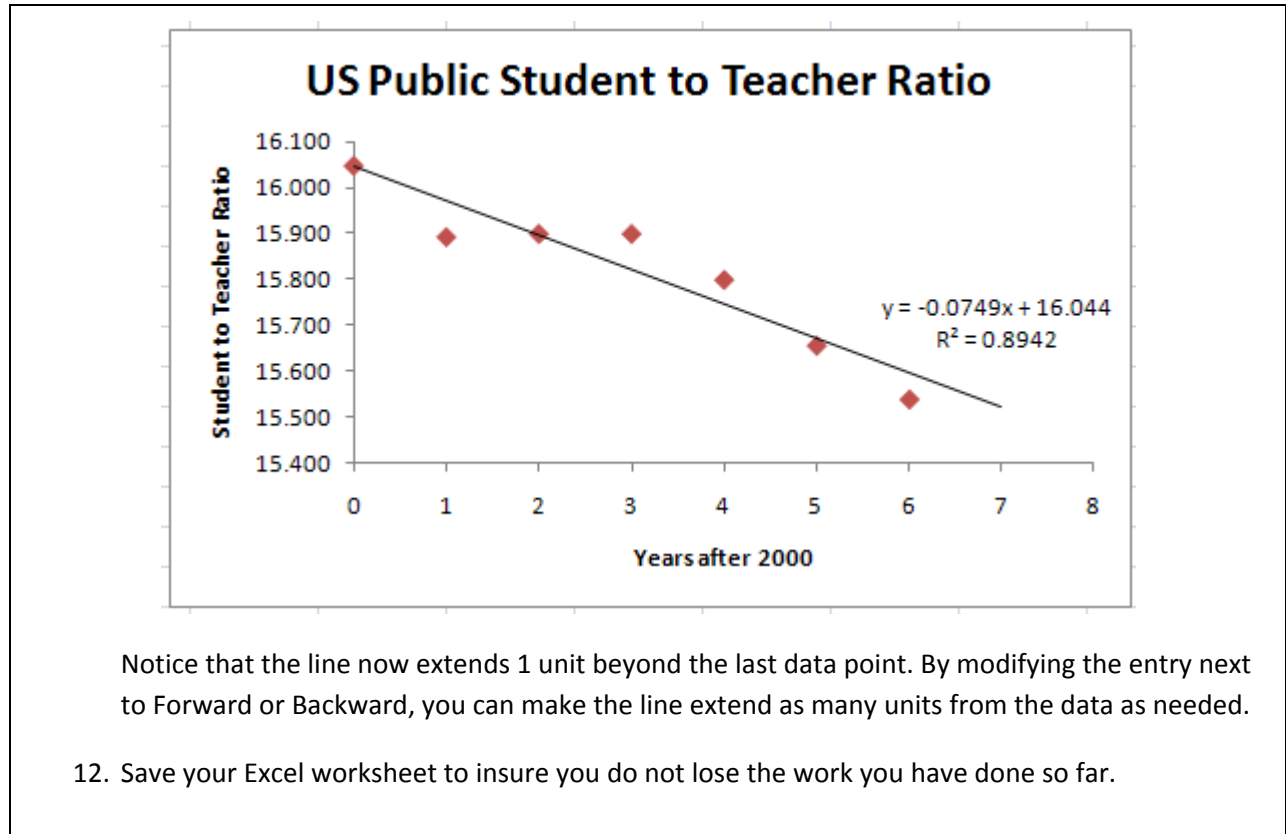
7. The line of best fit is added to the graph as shown below. You can use your mouse to select and drag the equations formula to a more convenient location.



8. Notice that the line of best fit stops abruptly at $x = 6$. You can force the line to extend farther by right mouse clicking on the line.
9. Select Format Trendline.
10. By default, the line of best fit is only plotted between the lowest and highest x -values. You can extend it forward or backwards from the data points by changing the values in the Forecast section of the Format Trendline box. Change the entry next to 1 as shown to the right.

Forecast	
Forward:	<input type="text" value="1"/> periods
Backward:	<input type="text" value="0.0"/> periods

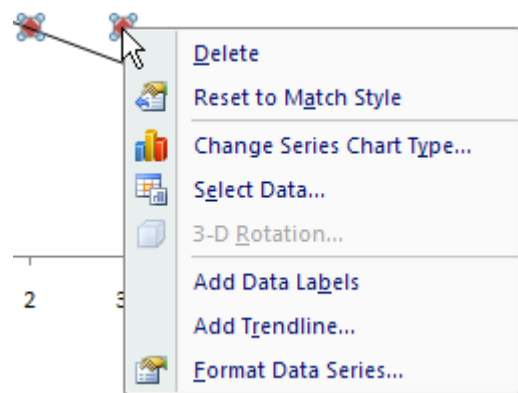
11. Select Close to update the graph.



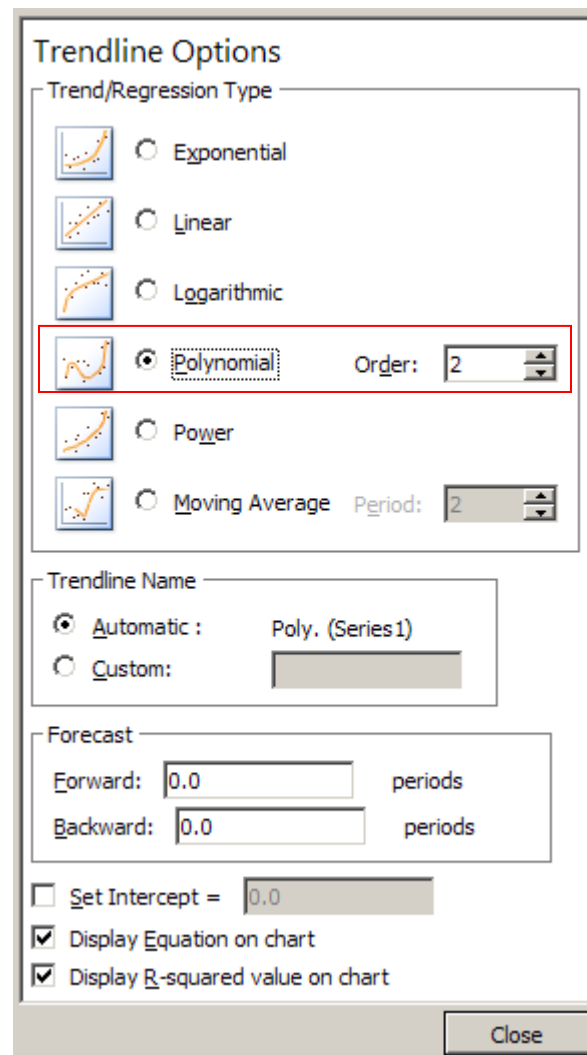
Use Quadratic Regression to Find the Best Parabola in Excel

In an earlier technology assignment, you used Excel to make a scatter plot of some data. We'll start from that scatter plot and add a line of best fit using Excel. Excel refers to the line of best fit found through linear regression as a linear trendline.

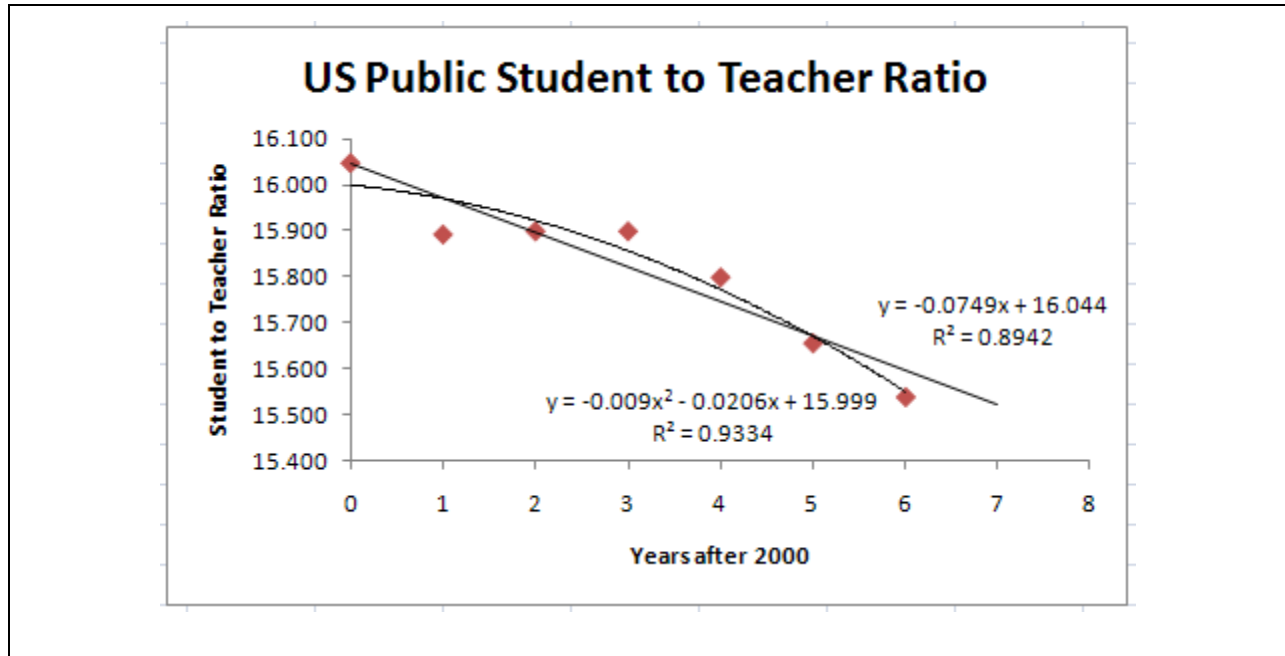
1. Open the worksheet containing the scatter plot and line from above if it is not already open.
2. Right mouse click on one of the data points in the scatter plot. You may have to right click more than once to make the menu shown to the right appear.
3. Use your mouse to select Add Trendline...



4. The Format Trendline box will appear in your worksheet. Click on the Polynomial option. The order of the polynomial is the same as the degree so make sure 2 is chosen.
5. At the bottom of the worksheet, check Display Equation on chart and Display R-squared value on chart.
6. Select Close.



7. The parabola of best fit is added to the graph as shown below. You can use your mouse to select and drag the equations formula to a more convenient location.



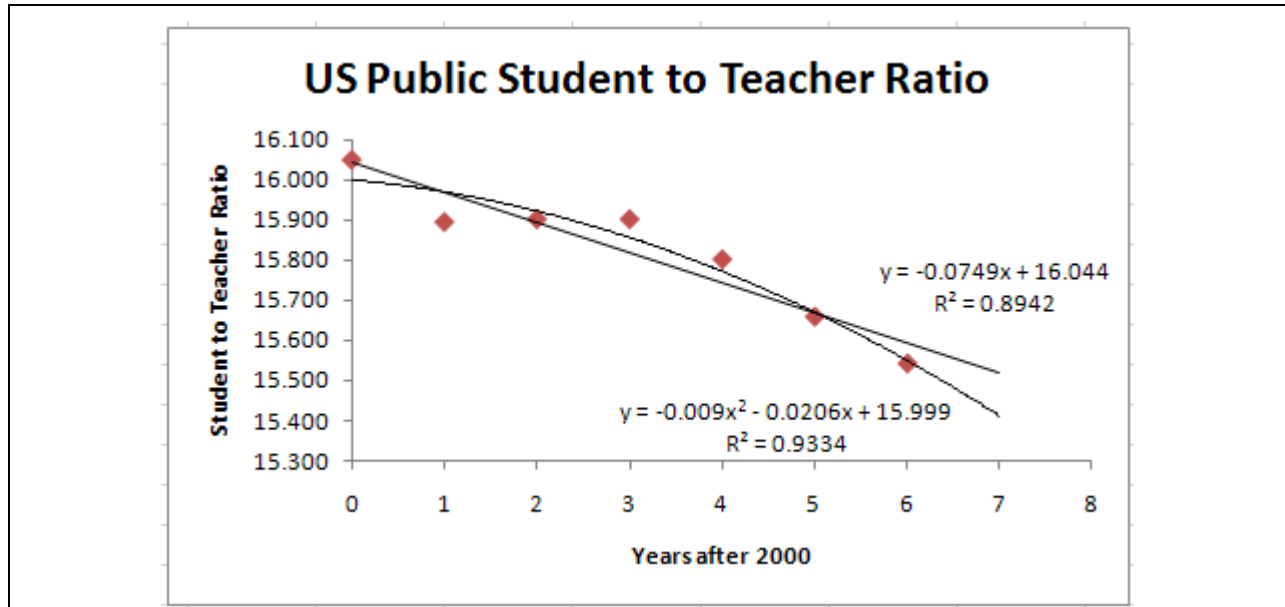
8. Notice that the parabola of best fit stops abruptly at $x = 6$. You can force the parabola to extend farther by right mouse clicking on the parabola.

9. Select Format Trendline.

10. By default, the parabola of best fit is only plotted between the lowest and highest x -values. You can extend it forward or backwards from the data points by changing the values in the Forecast section of the Format Trendline box. Change the entry next to 1 as shown to the right.

Forecast	
Forward:	<input type="text" value="1"/> periods
Backward:	<input type="text" value="0.0"/> periods

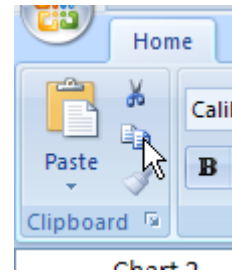
11. Select Close to update the graph.



12. Save your Excel worksheet to insure you do not lose the work you have done so far.

13. To finish this tech assignment, you need to copy your graph from Excel to word processing document in Word (or a similar program). Click on the edge of your graph to select it.

14. On the Home tab, left click on the Copy button to copy the graph to the clipboard.

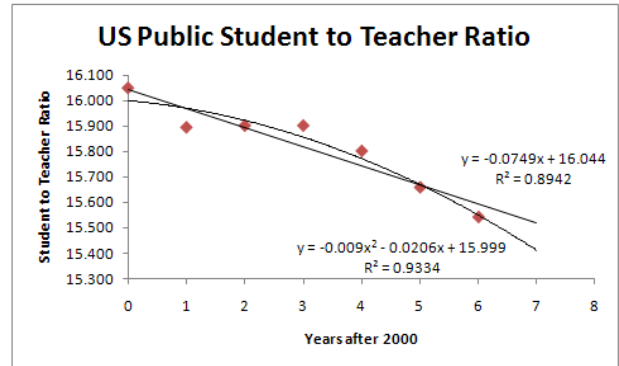


15. Open Word (or another word processing program).
16. At the top of the document, type your name, class, and the date followed by a carriage return (Enter).
17. In Word, left click on the Home tab.
18. Select Paste to paste the graph into your Word document. Your document should look similar to the one shown to the right.

Druzilla Dimiglio

MAT 212 TT 12:15PM

August 18, 2009



19. Finally, you need to save this document to a convenient location. In the upper left hand corner of Word, left click on the disk icon.
20. Give the document an appropriate name and location and select Save.
21. You can also select the Office button to the left of the disk icon. This is useful to save the document with a new file name. In this case you would select Save As... and then give an appropriate name. If you are working on a document over several days, it is advisable to save the document with a slightly different name on each day based on the date. This allows you to recover earlier version of a document in case you need to refer to earlier work.

