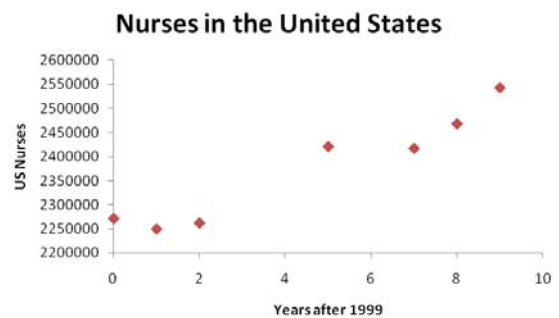
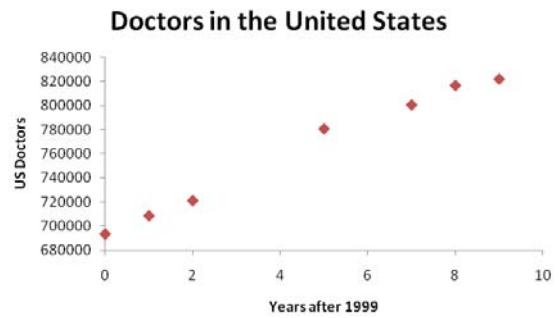


In an earlier technology assignment, you created scatter plots of the number of doctors and the number of nurses in the United States from the table below. The scatter plots are shown to the right of the table.

Years after 1999	US Doctors	US Nurses
0	693345	2271340
1	708463	2249440
2	721034	2262020
5	780662	2421000
7	800586	2417150
8	816727	2468340
9	822016	2542760



Now that we have the scatter plots of the data, we want to find models 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

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

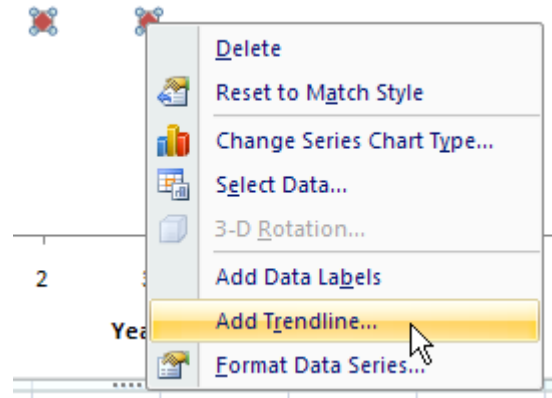
In both models, x represents the number of years after 1999 and y represents the number of doctors or the number of nurses. You'll use the doctor and nurse data for the state you have been assigned in Project 1.

To find these models, we'll use the linear and quadratic regression features 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 in Excel

In an earlier technology assignment, you used Excel to make scatter plots of some data. We'll start from these scatter plots 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 plots from the previous technology assignment.
2. Right mouse click on one of the data points in the scatter plot for the doctors in the United States. 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:

 Power

 Moving Average Period:

Trendline Name

Automatic : Linear (Series1)

Custom:

Forecast

Forward: periods

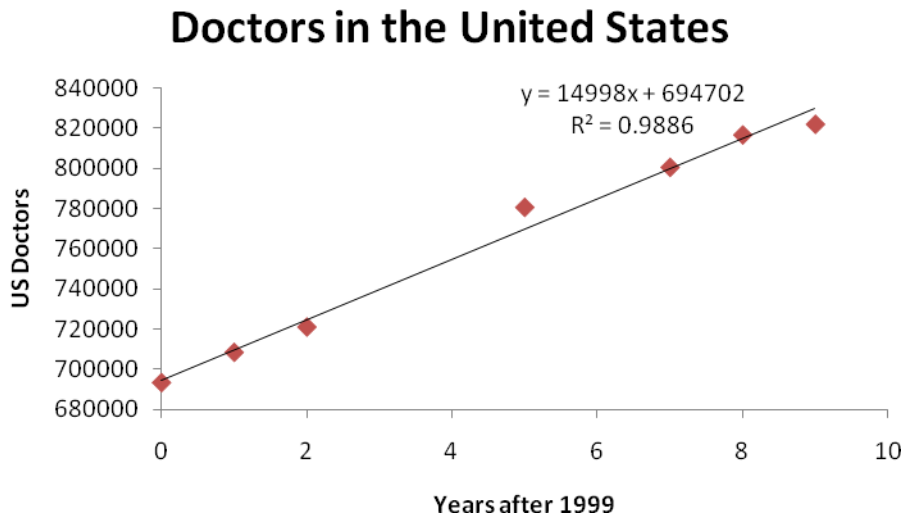
Backward: periods

Set Intercept =

Display Equation on chart

Display R-squared value on chart

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



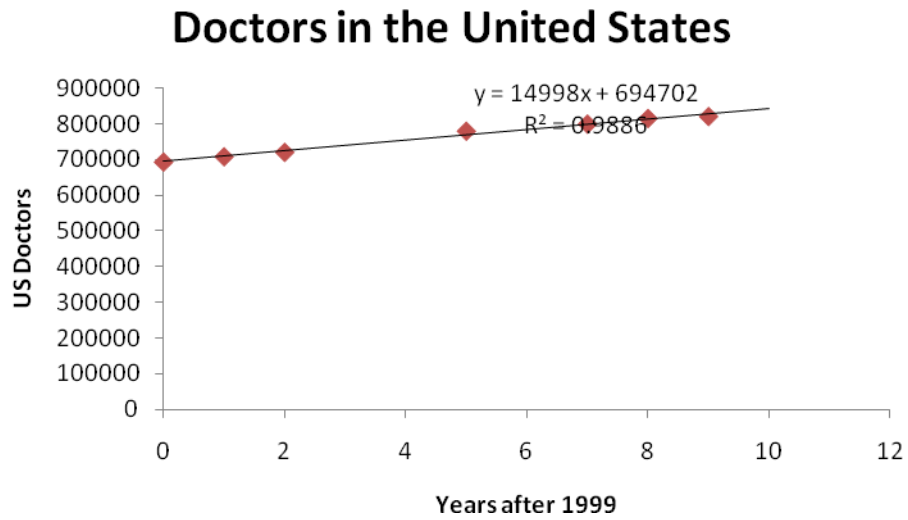
8. Notice that the line of best fit stops abruptly at $x = 9$. You can force the line to extend farther by right mouse clicking on the line.
9. Select Format Trendline.
10. By default, the line of best fit is only plotted between the lowest and highest x -values. You can extend it forward or backwards 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: periods

Backward: periods

11. Select Close to update the graph.

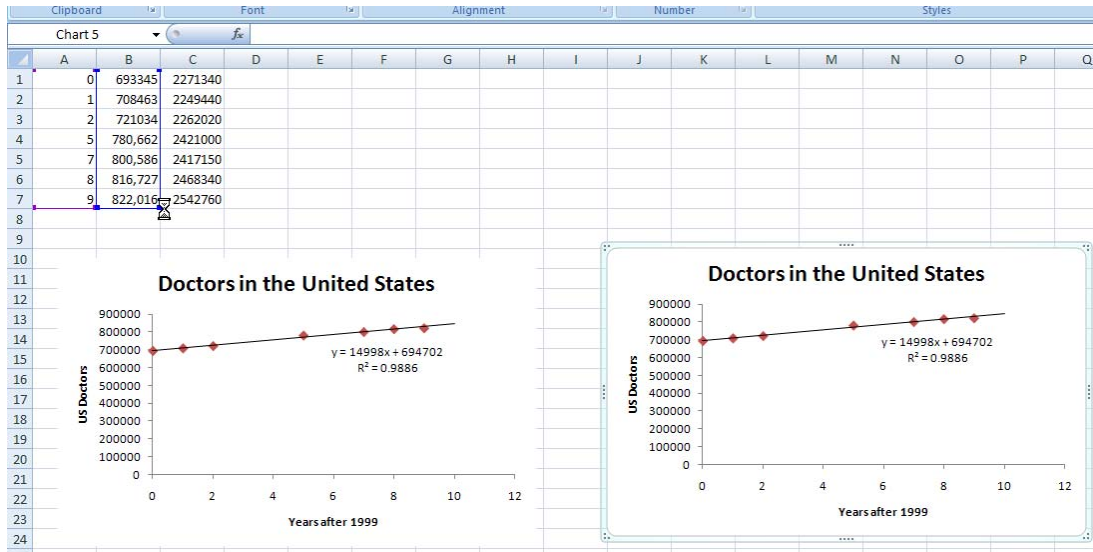


Notice that the line now extends 1 unit beyond the last data point. By modifying the entry next to Forward or Backward, you can make the line extend as many units from the data as needed.

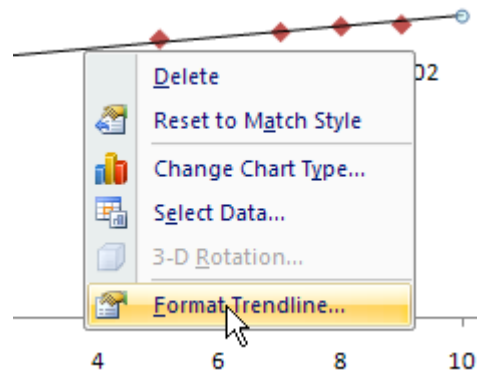
12. Save your Excel worksheet to insure you do not lose the work you have done so far.

Use Quadratic Regression to Find the Best Parabola in Excel

1. Open the worksheet containing the scatter plot and line from above if it is not already open. You should have a scatter plot of the doctor data with the line of best fit on it.
2. Click on the border of this doctor scatter plot to select it. From the Home tab, select Copy. Now click in the worksheet to the right of the scatter plot and select Paste from the Home Tab. A copy of the scatter plot will be pasted on the right side of your earlier scatter plot.



3. On the new scatter plot, right mouse click on the line and select Format Trendline... We'll use the Format Trendline dialog box to change the linear trendline to a quadratic trendline. We could also change the trendline to any of the other types of regression that can be carried out in Excel.



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.

Trendline Options

Trend/Regression Type

Exponential

Linear

Logarithmic

Polynomial Order: 2

Power

Moving Average Period: 2

Trendline Name

Automatic: Poly. (Series1)

Custom: []

Forecast

Forward: 0.0 periods

Backward: 0.0 periods

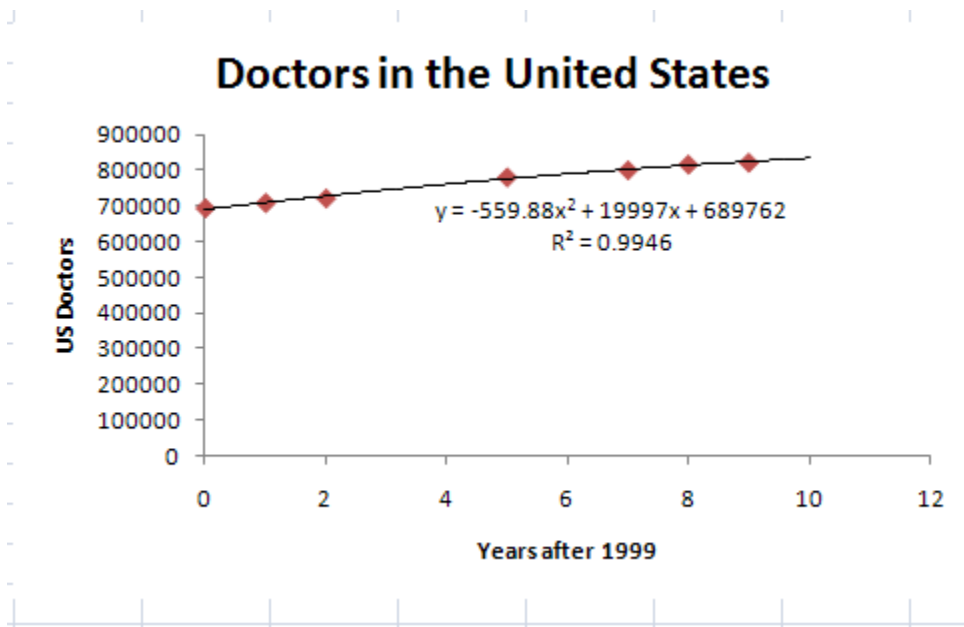
Set Intercept = 0.0

Display Equation on chart

Display R-squared value on chart

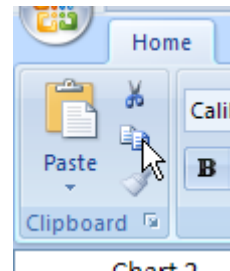
Close

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



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

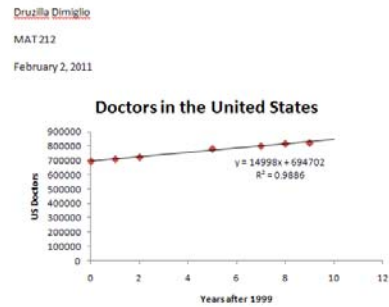
9. You need to copy your scatter plots from Excel to word processing document in Word (or a similar program). Open Word (or another word processing program).
10. Click on the edge of your doctor scatter plot with a linear trendline to select it.
11. On the Home tab, left click on the Copy button to copy the scatter plot to the clipboard.



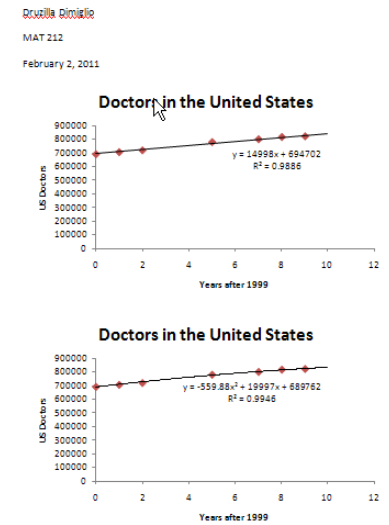
12. At the top of the document in Word, type your name, class, and the date followed by a carriage return (Enter).

13. In Word, left click on the Home tab.

14. Select Paste to paste the graph into your Word document. Your document should look similar to the one shown to the right.



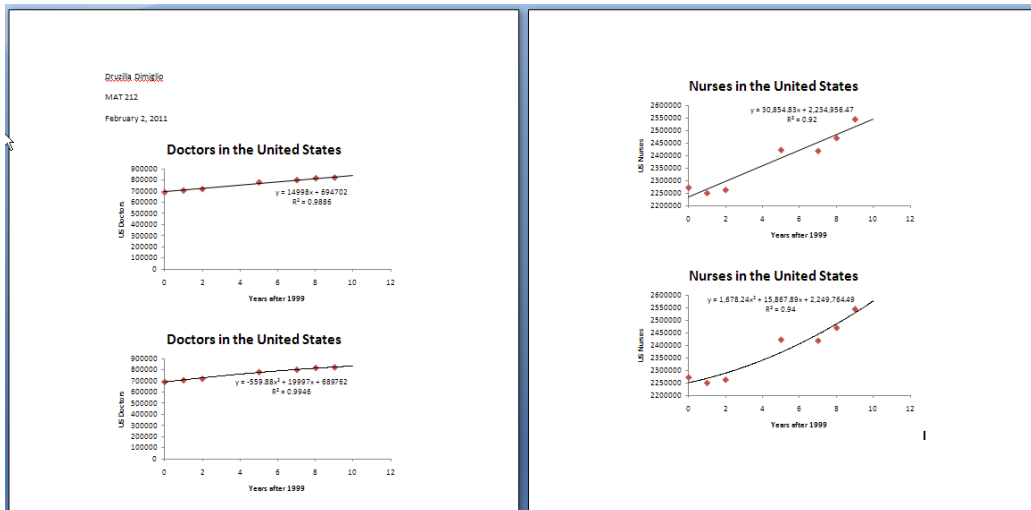
15. Now we need to repeat steps 10 through 14 with the doctor and quadratic trendline scatter plot. Once complete, your Word document should look similar to the one on the right.



16. Finally, you need to save this Word document to a convenient location. In the upper left hand corner of Word, left click on the disk icon.
17. Give the document and appropriate name and location and select Save.
18. 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.



19. To complete this assignment, you need to repeat the steps in this document to add a linear trendline and a quadratic trendline to your nurse scatter plot. In your Word document, add these two scatter plots so that you have a total of 4 scatter plots.



You will use these scatter plots and trendlines to create rational functions in later assignments.

20. Make sure you save your Word and Excel documents. The document you will need to turn in is the Word document.