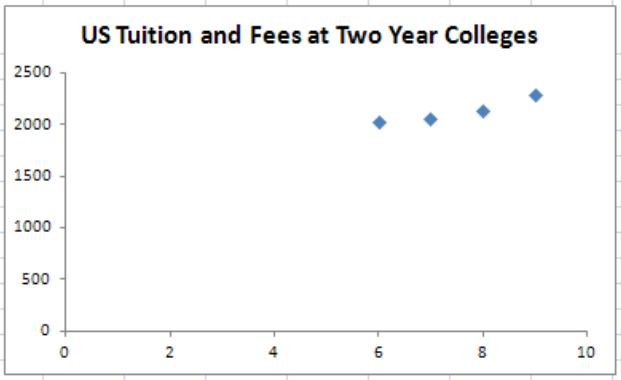
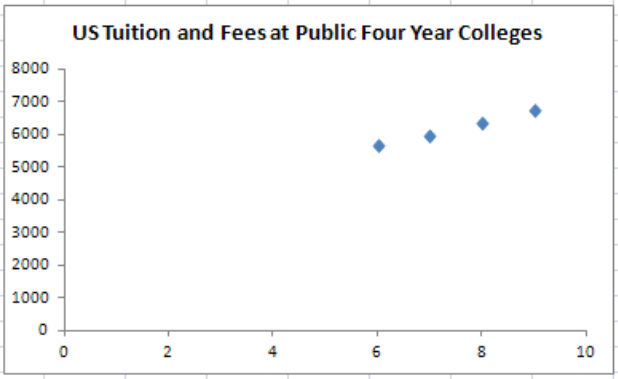
In this technology assignment, you will find a linear function that passes through two of the points on each of the scatter plots you created in the last technology assignment. You will need the file you created in the last technology assignment. The file should contain a worksheet called Tech 1 that looks like the one below.

| | A | B | C |
|---|---|---|---|
| 1 | Years since 200 | US Tuition and Fees at Two Year Colleges | US Tuition and Fees at Public Four Year |
| 2 | 6 | 2018 | 5666 |
| 3 | 7 | 2061 | 5943 |
| 4 | 8 | 2136 | 6312 |
| 5 | 9 | 2285 | 6695 |
| 9 | Your Name | | |
| 10 | Date | | |



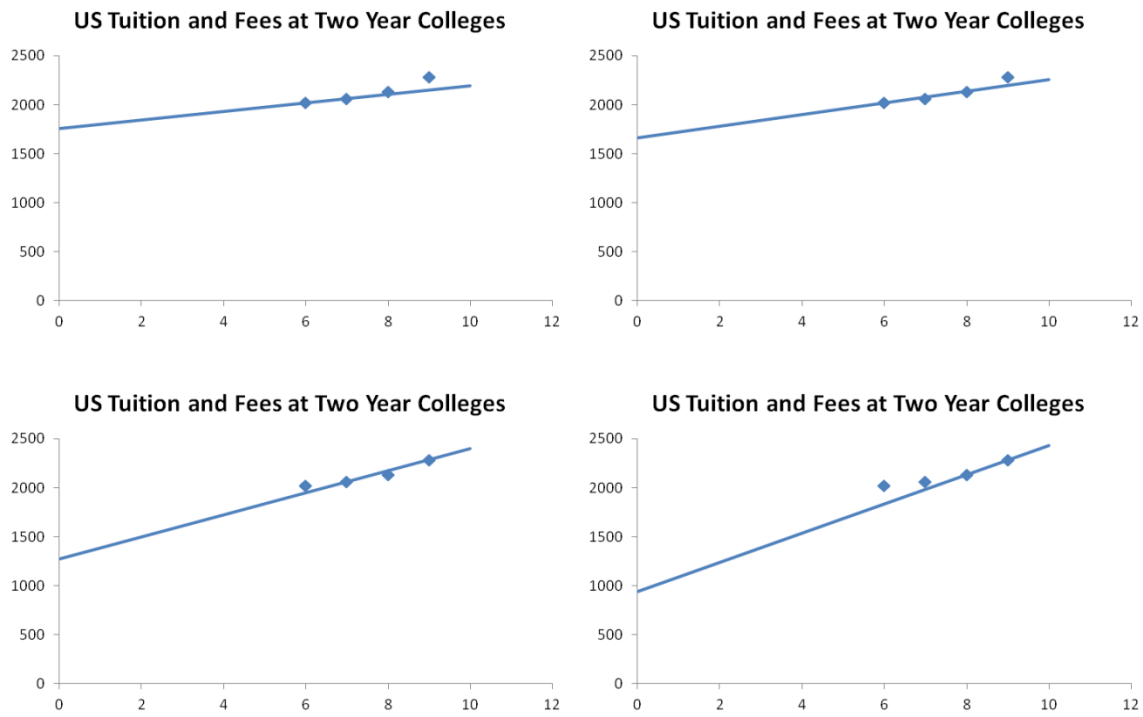




Your worksheet will different from this one since yours uses the data you have been assigned in the project.

Before we can put the linear function that passes through two points on the scatter plot, we need to find the function by doing some mathematics. I'll show you how to do this math using the data for the US Tuition and Fees at two-year colleges. You should complete the same process for both sets of data for the state you are assigned.

## Select the Points You'll Use

For this project, we'll find a linear function that passes close to the data for tuition and fees at two-year colleges by making the line pass through two of the data points. There are many possibilities we could choose. We could pass through the first two points, the first and third, the second and fourth, the last two, or many other combinations of points. Some of these possibilities are pictured below.




Of these four possibilities, the graph on the lower left seems to pass as close to the points as possible. We can see this by looking at the location of the points on the same vertical window of [0, 2500].

Look at your data points. Visualize a line passing through any pair of points. Pick a pair of points to create a line with that appears to represent the data best. These are the points you'll use to find a line for your scatter plot.

## Find the Equation of the Line

We will demonstrate how to find a line through a pair of points using the ordered pairs $(7, 2061)$ and $(9, 2285)$. With these ordered pairs, the $x$ values represent the number of years since 2000 and the $y$ values represent the tuition and fees at US two-year colleges.

The slope between these points is calculated using the formula

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

where $(x_1, y_1)$ and $(x_2, y_2)$ are the ordered pairs we want the line to pass through. For the two points above,

$$m = \frac{2285 - 2061}{9 - 7} = \frac{224}{2} = 112$$

Luckily, the value for the slope is exactly 112 and not some nasty decimal. If the slope had turned out to be a rounded decimal, we would use the fraction as the slope. This ensures that the line passes through the points exactly and not just very close.

Now let's put this slope into the slope-intercept form of a line, $y = mx + b$. We can use different variables for $x$ and $y$. For simplicity, we'll stick with $x$ and $y$. Using the slope, we get

$$y = 112x + b$$

To find the value of the y intercept, substitute one of the ordered pairs on the line for x and y. Solve the resulting equation for b. We will do this using the ordered pair $(7, 2061)$:

$$2061 = 112(7) + b$$ Put in the ordered pair for $x$ and $y$

$$2061 - 112(7) = b$$ Isolate b

$$1277 = b$$ Simplify the expression on the left side

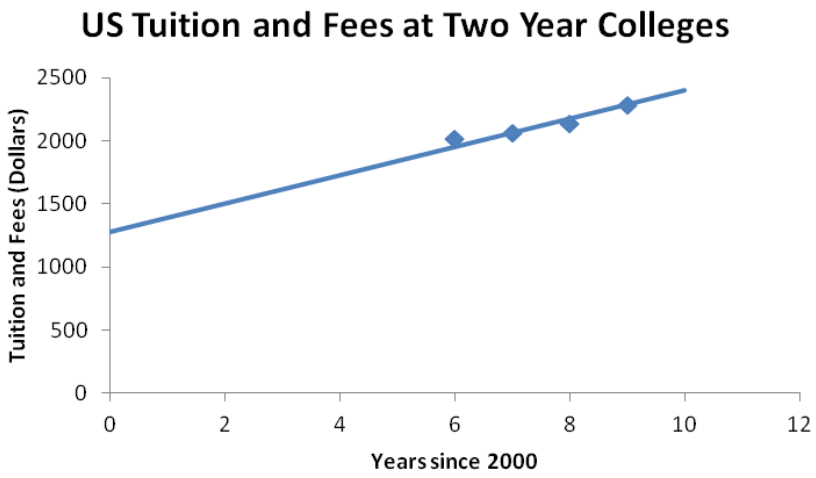
This means the equation of the line passing through the two points is

$$y = 112x + 1277$$

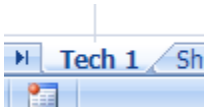
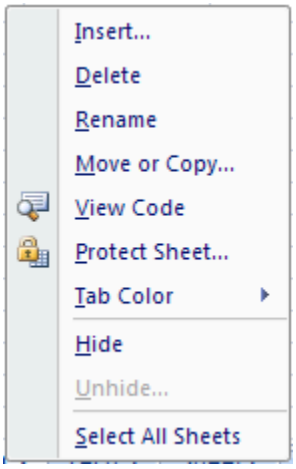
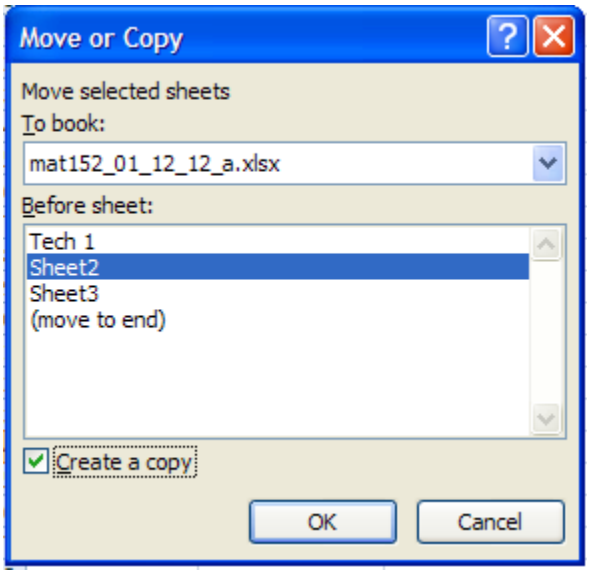
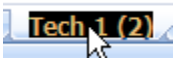
With this equation in hand, we can use Excel to graph the equation on the scatter plot of the tuition and fees at two-year colleges.

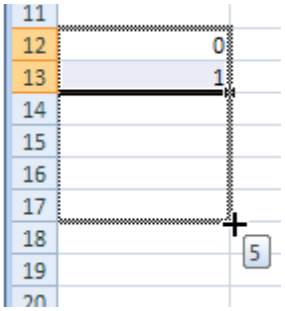
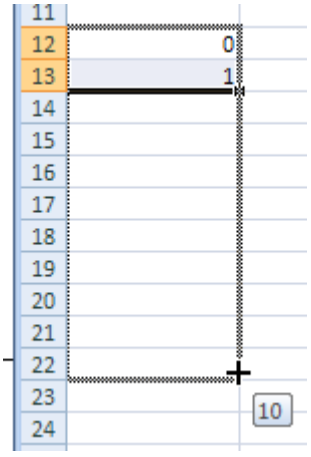
## Graph a Line on a Scatter Plot

Our goal is to use Excel to create a graph like the one below.

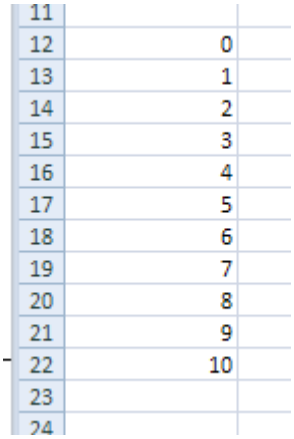



Once you have completed the process for your first scatter plot, you will need to find another line corresponding to the scatter plot for four-year colleges.

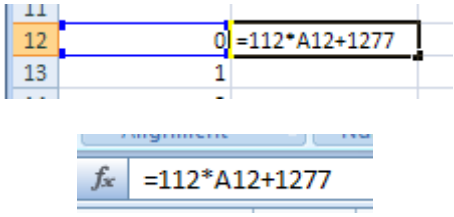
| | |
|---|---|
| 1. Start Excel and open the file you used to complete the previous technology assignment.<br>2. At the bottom of the Excel window, you'll see several tabs indicating the different worksheets in the Excel file. Locate the tab for Tech 1. |  |
| 3. We want to create a new worksheet for Technology Assignment 2. This worksheet will be a copy of the worksheet we used for Technology Assignment 1. To do this, right click on the tab for Technology Assignment 1. From the menu that appears, select **Move or Copy…** |  |
| 4. Since we want to make a copy of the worksheet, make sure the Create a copy box is checked. We can also choose where the copy will go in the file. A good place would be after Tech 1, but before Sheet2. In the box titled "Before sheet:", highlight Sheet2. Select **OK** to copy the worksheet. |  |
| 5. The new worksheet is given the name of the copied worksheet with (2) after it. Double click on the name to highlight it. |  |

| | |
|---|---|
| 6. Now type in a new name like Tech 2 to rename the file. This will help you to separate the work you did in Tech 1 from the work you'll do in Tech 2. For the rest of this assignment, make sure you are working in the Tech 2 worksheet. |   |
| 7. To graph the linear function we found earlier, we must create a table of values on the line. Start by clicking on cell A12 and typing 0. Then click on the cell underneath it, A13, and type a 1. This is the start of the x values we'll use for the line. We will start at 0 and graph points at increments of 1 beginning at 0. |   |
| 8. To help us generate the x values, click on the cell A12. While holding the left mouse button down, drag the cursor to A13. This will select A12 and A13. Notice the dark black line surrounding the selection. In the lower right corner is a black box called the fill handle. |   |
| 9. Click on the fill handle. The cursor will change to a cross. While holding down the left mouse button down, drag the cursor to cell A22. |   |
| 10. As you drag the cursor, notice the small box that appears. This tells us what entries will be filled in the cell. When you release the mouse button at cell A22, those numbers will be filled in cells A14 through A22. The numbers filled in follow the pattern established in cells A12 and A13. |   |

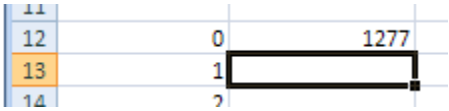
11. This leaves us with the numbers 0 through 10 in cells A12 through A22. If we had started with 0 and 2 in A12 and A13, the column would be filled 0, 2, 4, 6, ….



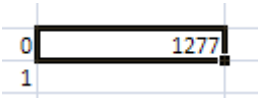

12. In cell B12, we want to put the equation of the line, $y = 112x + 1277$. This is done by clicking on cell B12 and typing =112*A12+1277. Any formula is always preceded by an = sign and the the $x$ value is replaced with the cell containing the corresponding $x$ value. Instead of typing A12, you can click on the cell to paste its location into the formula.



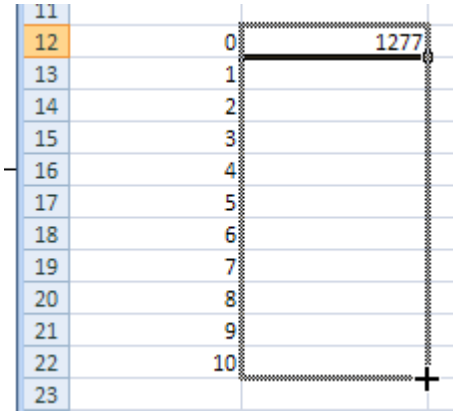

13. Press **Enter** on the keyboard to calculate the y value.

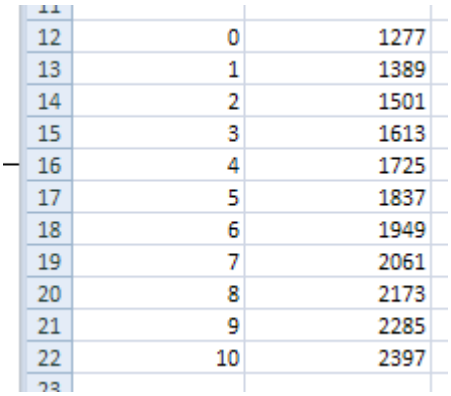



14. To compute the rest of the $y$ values, we'll use a fill. Click on cell B12 to select it.



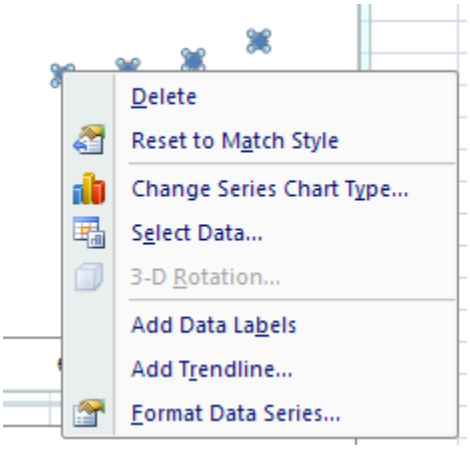

15. Use your mouse to grab the fill handle. While holding the left moune button down, drag the mouse to cell A22. Release the mouse button to fill the rest of the table with $y$ values.



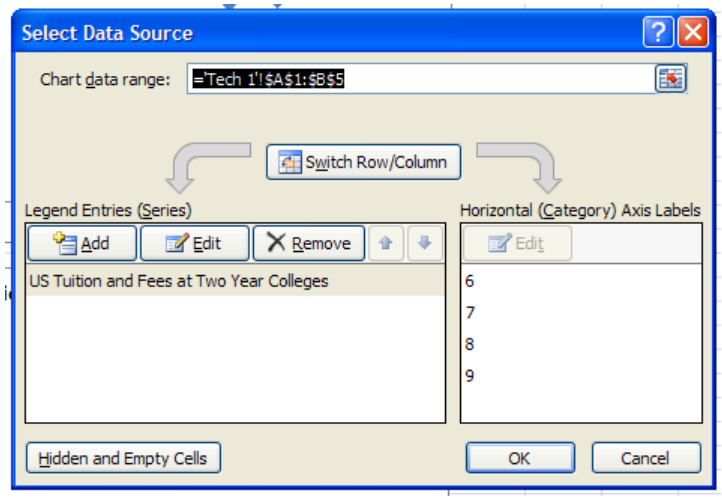




These are the values we'll use to make a line on the scatter plot.

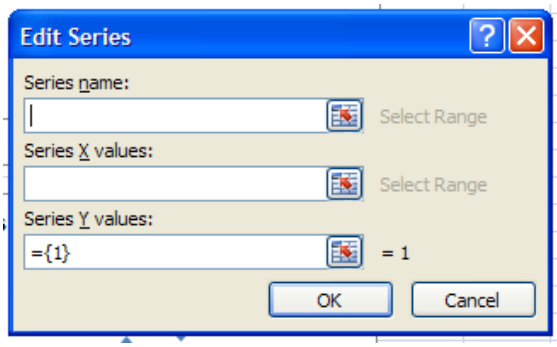
16. To add the line to the scatter plot, right mouse click on one of the data points in the scatter plot. A menu will appear like the one to the right. Choose “Select Data” from this menu.



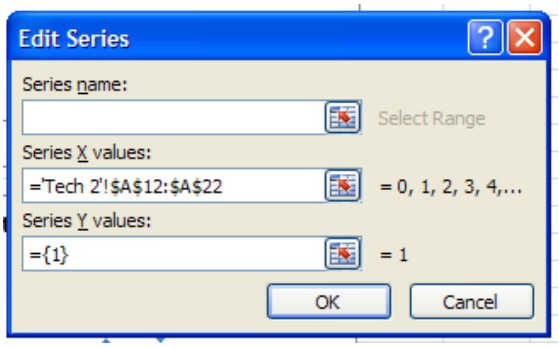

17. The Select Data Source box will appear. Under Legend Entries (Series), you’ll see the title of the existing scatter plot. We want to add another dataset to this scatter plot. Click on **Add**.




18. To put the line on the scatter plot, we need to enter the location in the the worksheet of in the Edit Series box.

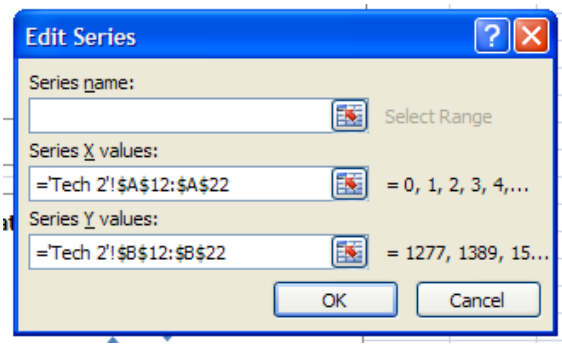


19. Click in the box under "Series X values" to place the insertion point in that box. Now click on cell A12 and drag select (hold the left mouse button) to cell A22. If your $x$ values are not in cells A12 through A22, you may need to drag select a slightly different set of cells.



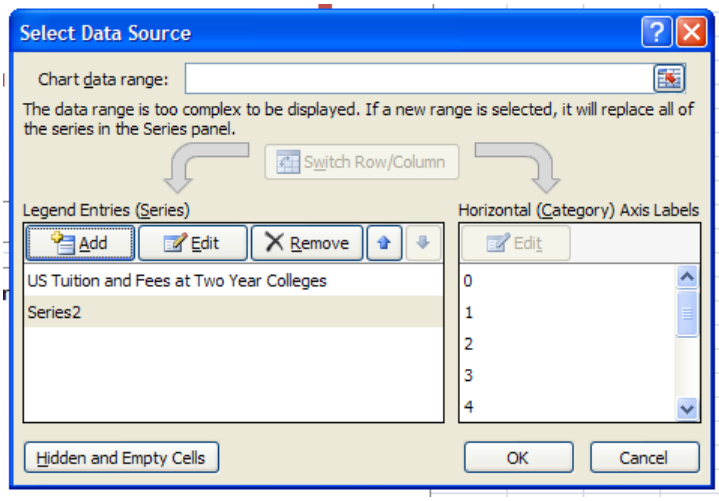

The location of the cells are pasted into "Series X values".

20. Put the insertion point in the box under "Series Y values". Delete any entry in that box. Now click on cell B12 and drag select (hold the left mouse button) to cell B22. If your $x$ values are not in cells B12 through B22, you may need to drag select a slightly different set of cells.

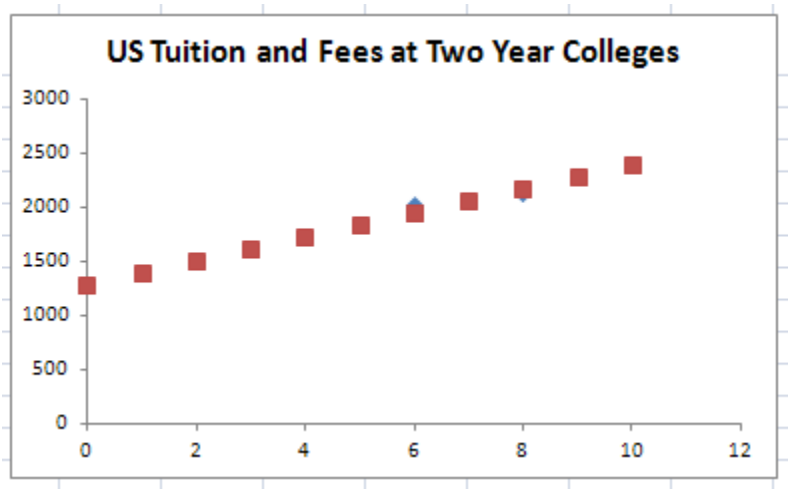



The location of the selected cells are pasted into "Series Y values". Click **OK**.

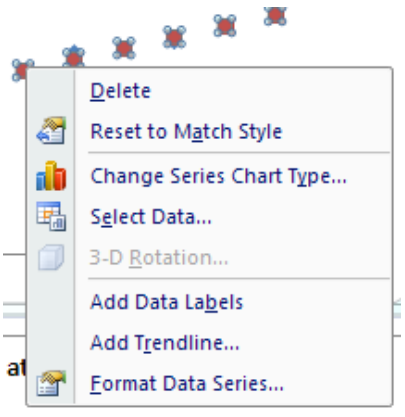
21. You'll return to the "Select Data Source" box. Click OK to see the new scatter plot.




22. By default, the line is graphed as a scatter plot and not as a line graph. We need to modify the red point so that we see a line and not points on the line.

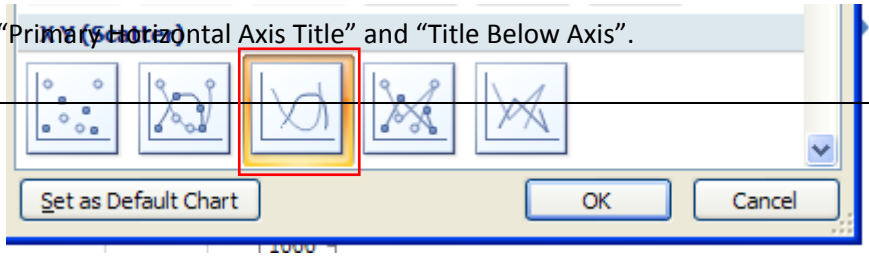



23. Right mouse click on one of the data points on the line. From the menu that appears, select "Change Series Chart Type…".

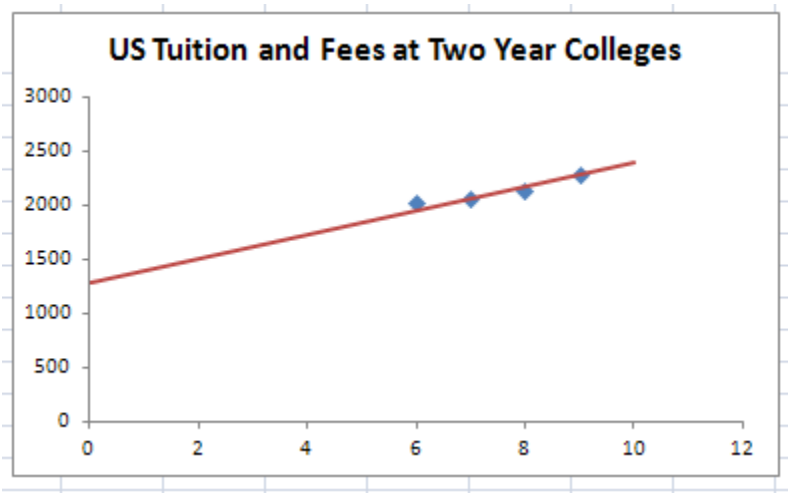


24. Select the line graph from "XY (Scatter)". Click **OK**.

28. Now select "Primary Horizontal Axis Title" and "Title Below Axis".

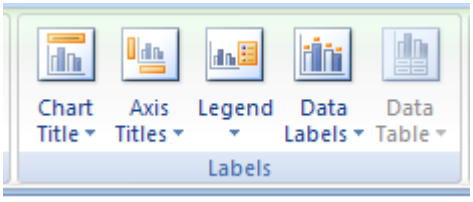


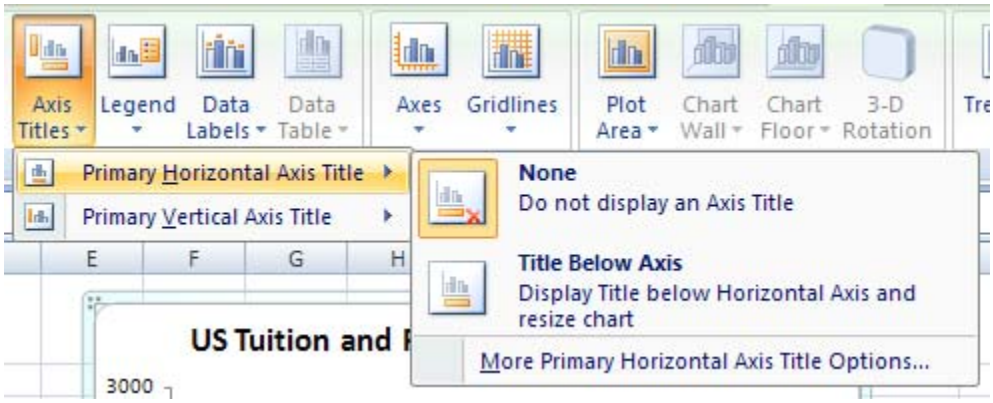

25. The points will change to a line on the scatter plot.




26. To finish the graph, we will add labels on each axis to describe what is being graphed. To begin doing this, click on the outside edge of the graph's window to select it. You'll see a double lined edge appear around the window. Along the top of Excel, you should see a series of tabs entitled "Chart Tools". Click on the "Layout" tab.

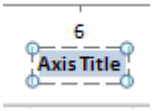

27. Locate the "Labels" panel. Select "Axis Titles".



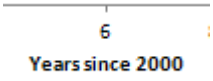



29. You'll see a label appear under the horizontal axis.

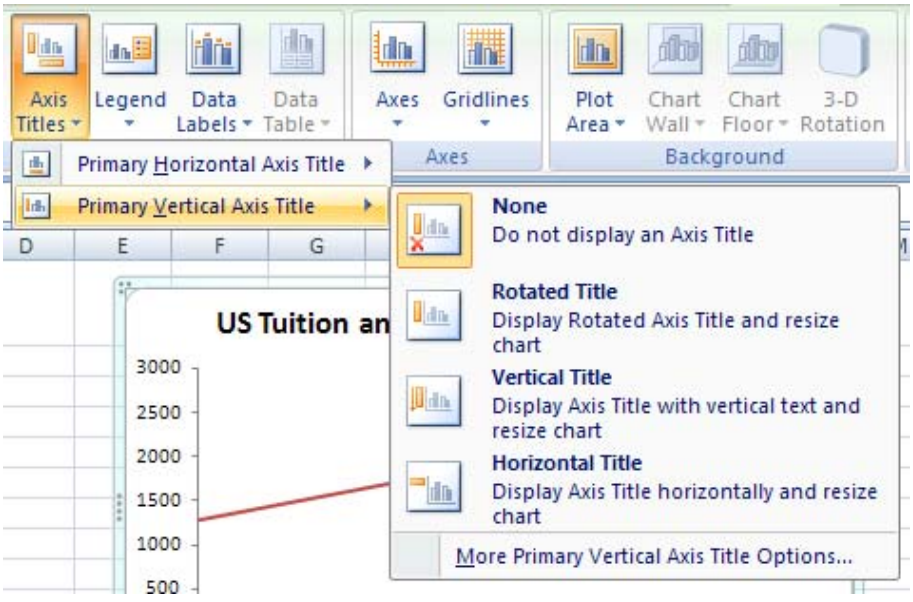

30. Since "Axis Title" is not very descriptive, select the text (or delete it).



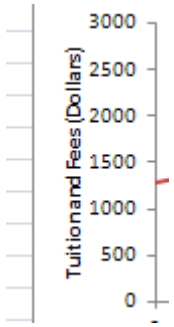

31. Change the text in the label to "Years since 2000".



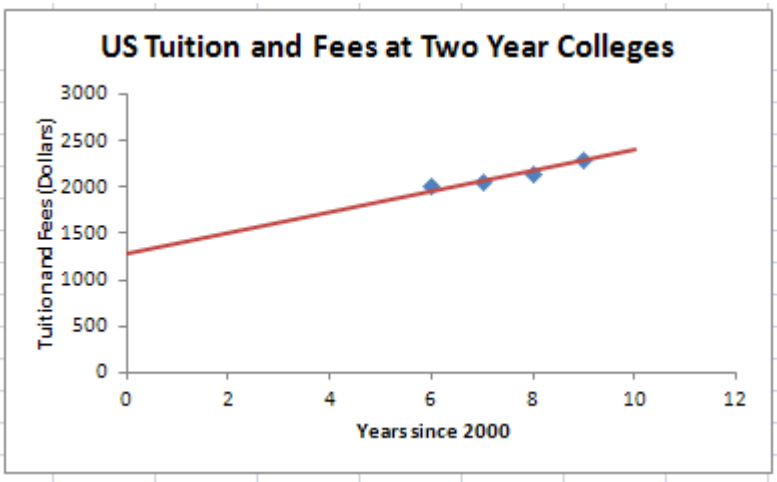

32. Let's follow the same process to add a label to the vertical axis. Make sure the graph is selected and choose "Axis Titles" from the Labels panel. In this case, select "Primary Vertical Axis Title" and "Rotated Title".



33. Edit the label that appears appropriately. Make sure you include the units, dollars, on the axis title.



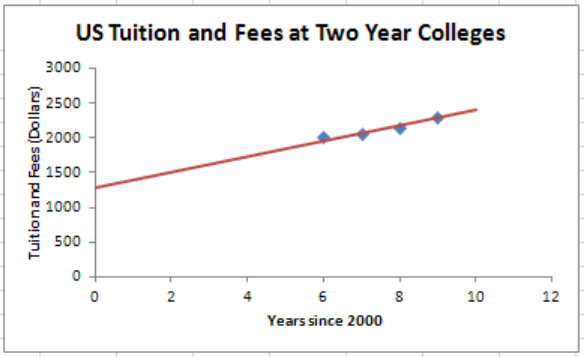

34. The new graph is shown below.

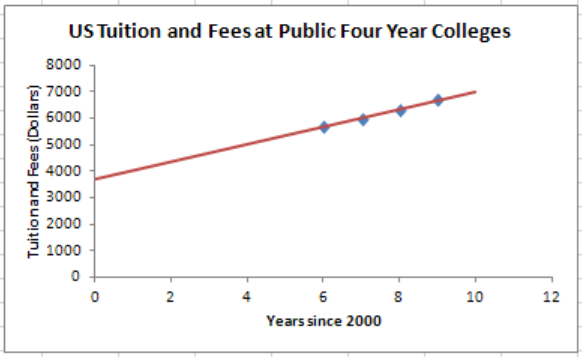



A good graph includes a title, horizontal axis title, vertiucal axis title, and appropriate scatter plots and/or line graphs.

35. To complete this assignment, repeat the steps you completed to find a line for the scatter plot containing the four-year college data. Add the line to the scatter plot. When you are finished, your Excel worksheet should look similar to the once below. You may also right mouse click on the data or the lines and select “Format Data Series”. This will allow you to change other sttributes of the graphs like there color.

| | A | B | C |
|---|---|---|---|
| 1 | Years since 2000 | US Tuition and Fees at Two Year Colleges | US Tuition and Fees at Public Four Year |
| 2 | 6 | 2018 | 5666 |
| 3 | 7 | 2061 | 5943 |
| 4 | 8 | 2136 | 6312 |
| 5 | 9 | 2285 | 6695 |
| 6 | | | |
| 7 | | | |
| 8 | | | |
| 9 | Your Name | | |
| 10 | Date | | |
| 11 | | | |
| 12 | 0 | 1277 | 3728 |
| 13 | 1 | 1389 | 4051 |
| 14 | 2 | 1501 | 4374 |
| 15 | 3 | 1613 | 4697 |
| 16 | 4 | 1725 | 5020 |
| 17 | 5 | 1837 | 5343 |
| 18 | 6 | 1949 | 5666 |
| 19 | 7 | 2061 | 5989 |
| 20 | 8 | 2173 | 6312 |
| 21 | 9 | 2285 | 6635 |
| 22 | 10 | 2397 | 6958 |




Make sure you save your Excel file. This is the file you will submit (using the data from the state you are assigned) for this technology assignment.