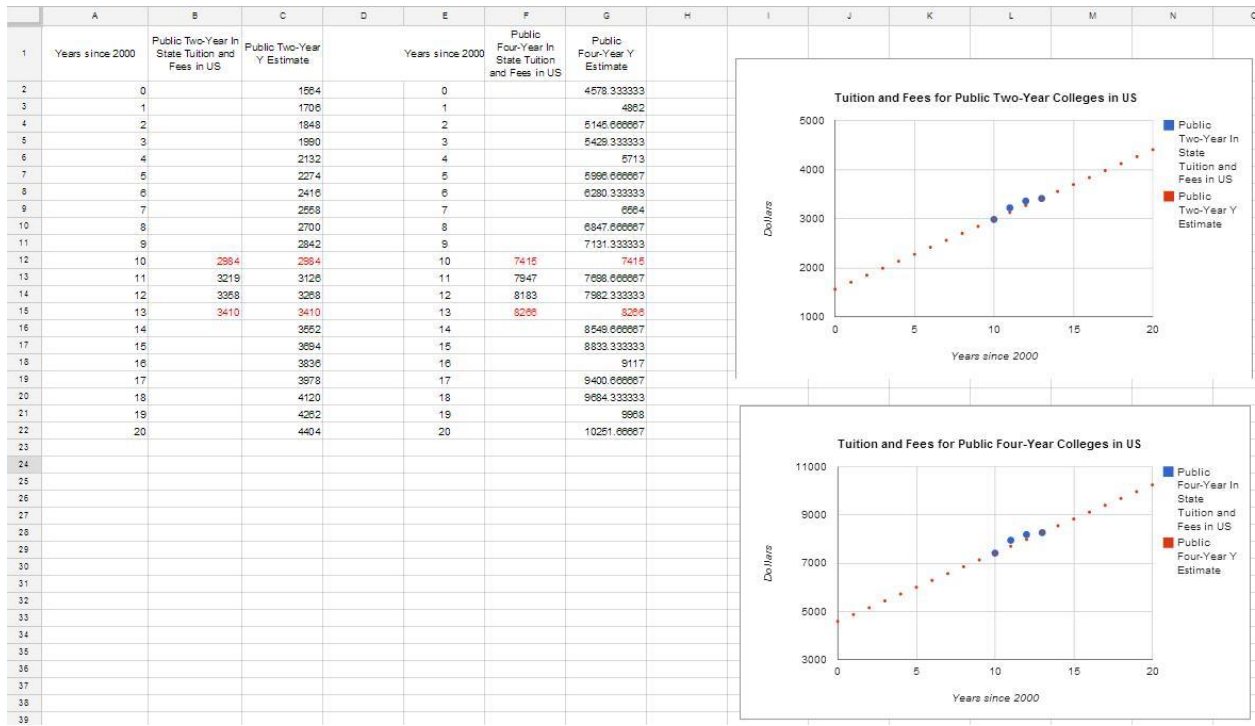


In a previous assignment, you created graphs showing the data for college costs and a corresponding linear model. Your worksheet probably looks something like the one below.



Notice the red highlights. Let's look at these cells closer.

12	10	2984	2984	10	7415	7415
13	11	3219	3126	11	7947	7698.666667
14	12	3358	3268	12	8183	7982.333333
15	13	3410	3410	13	8266	8266

The numbers in red match because I used these pairs of points to create the linear models. You should find that your points match. Which ones match depends on what pairs of points you used to create the model.

The other two data points do not lie along line we found in an earlier assignment. To help us measure how far the line is from the data points, we'll measure the percentage error between the line and the data points at each  $x$  value,  $x = 10, 11, 12,$  and  $13$ . For instance, the percentage error at the second data point is

$$\text{Percent Error} = \frac{\text{y value on line at } x = 11 - \text{Data value at } x = 11}{\text{Data value at } x = 11} = \frac{3126 - 3219}{3219} \approx -0.029$$

This indicates that the estimate of cost at  $x = 11$  is 2.9% lower than the actual data value.

Let's think of each data value with subscripts like

$$(x_1, y_1), (x_2, y_2), (x_3, y_3), (x_4, y_4)$$

The percentage error at a particular data point is

$$\text{Percentage Error} = \frac{y - y_i}{y_i}$$

where  $i$  is 1, 2, 3, or 4. For instance, if  $i = 3$ , the percentage error at the third data point is

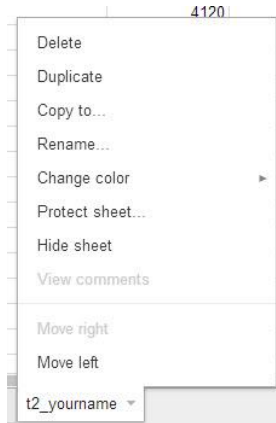
$$\begin{aligned} \text{Percentage Error} &= \frac{y - y_3}{y_3} \\ &= \frac{3268 - 3358}{3358} \\ &= -0.027 \end{aligned}$$

This means that the line is 2.7% lower than the data point at  $x = 12$ .

The goal of this technology assignment is calculate the percentage error at each data point. This will help you to see how well your line matches the data values.

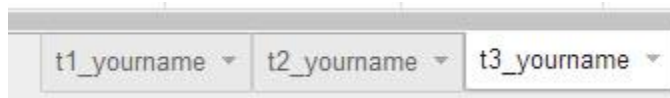
### Measure the Percentage Error

1. Make a copy of your previous technology assignment. To do this, right click on the tab at the bottom of your Google Sheet that you want to make a copy of.



Select Duplicate.

- This will add a new sheet called Copy of t2\_yourname. Double click on this tab and rename the sheet to something like t3\_yourname.



We'll add to this worksheet the required formulas to calculate the percentage error.

- Click your mouse in the cell to the right of the estimate for the first data point (probably D12). In this cell type

8		2700	
9		2842	
10	2984	2984	$= (C12 - B12) / B12$
11	3219	3126	

Press Enter to see the calculated value.

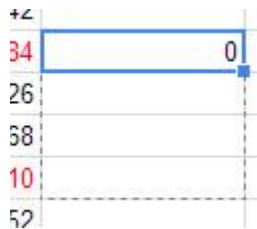
9		2042	
10	2984	2984	0
11	3219	3126	
12	3268	3268	

Since the line passes through this data point, the percentage error is 0. If you did not use the first data point to calculate the equation of the line, you probably will not get 0.

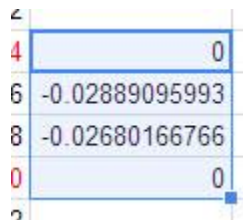
- Click in cell D12 again. Use the mouse to grab the fill handle.




While holding the left mouse button down, drag the cursor to cell D15.



When you release the button, the percentage error should be calculated for cells D13 through D15.



The numbers should be selected (highlighted) now. To change these

decimals to percentages, press  on the button bar at the top of the worksheet. The numbers will change to percentages. Note that you must select the numbers you want to change before pressing the button.

4	0.00%
6	-2.89%
8	-2.68%
0	0.00%

5. Once you have completed these steps, your worksheet should look similar to the one below.

	A	B	C	D	E	F	G	H
1	Years since 2000	Public Two-Year In State Tuition and Fees in US	Public Two-Year Y Estimate		Years since 2000	Public Four-Year In State Tuition and Fees in US	Public Four-Year Y Estimate	
2	0		1564		0		4578.333333	
3	1		1706		1		4862	
4	2		1848		2		5145.666667	
5	3		1990		3		5429.333333	
6	4		2132		4		5713	
7	5		2274		5		5996.666667	
8	6		2416		6		6280.333333	
9	7		2558		7		6564	
10	8		2700		8		6847.666667	
11	9		2842		9		7131.333333	
12	10	2984	2984	0.00%	10	7415	7415	
13	11	3219	3126	-2.89%	11	7947	7698.666667	
14	12	3358	3268	-2.68%	12	8183	7982.333333	
15	13	3410	3410	0.00%	13	8266	8266	
16	14		3552		14		8549.666667	
17	15		3694		15		8833.333333	
18	16		3836		16		9117	
19	17		3978		17		9400.666667	
20	18		4120		18		9684.333333	
21	19		4262		19		9968	
22	20		4404		20		10251.666667	

Label the top of the column (in cell D1) Percentage Error.

6. Repeat these step to find the percentage error for the second line. The percentage error should be in the cells to the right of the estimate for the second line. In the picture below, the percentage errors are boxed in blue.

## Tech Assignment: Measure Fit

	A	B	C	D	E	F	G	H
1	Years since 2000	Public Two-Year In State Tuition and Fees in US	Public Two-Year Y Estimate	Percentage Error	Years since 2000	Public Four-Year In State Tuition and Fees in US	Public Four-Year Y Estimate	Percentage Error
2	0		1564		0		4578.333333	
3	1		1706		1		4862	
4	2		1848		2		5145.666667	
5	3		1990		3		5429.333333	
6	4		2132		4		5713	
7	5		2274		5		5996.666667	
8	6		2416		6		6280.333333	
9	7		2558		7		6564	
10	8		2700		8		6847.666667	
11	9		2842		9		7131.333333	
12	10	2984	2984	0.00%	10	7415	7415	0.00%
13	11	3219	3126	-2.89%	11	7947	7698.666667	-3.12%
14	12	3358	3268	-2.68%	12	8183	7982.333333	-2.45%
15	13	3410	3410	0.00%	13	8266	8266	0.00%
16	14		3552		14		8549.666667	
17	15		3694		15		8833.333333	
18	16		3836		16		9117	
19	17		3978		17		9400.666667	
20	18		4120		18		9684.333333	
21	19		4262		19		9968	
22	20		4404		20		10251.666667	
23								

Notice that the lines fall at or below all of the data points. A better fit would likely have some of the line above the data points and some below.