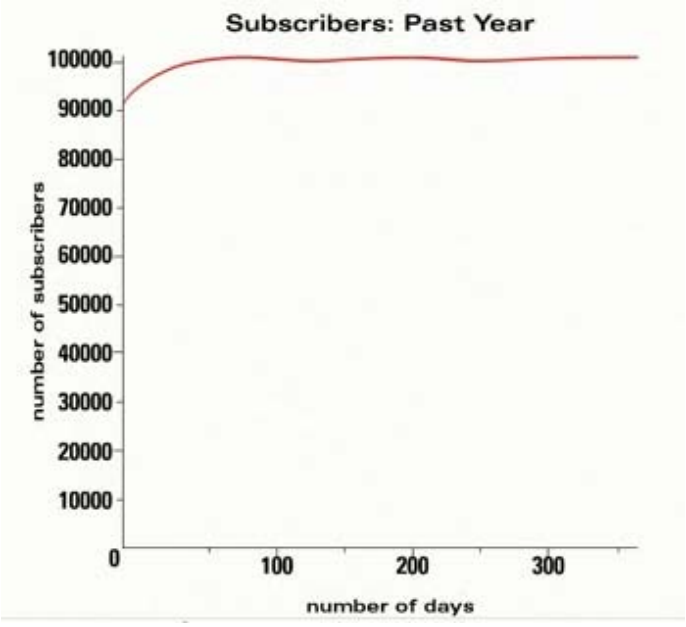
Representing Data Carefully
A Closer Look at the Video

After watching the *Representing Data Carefully* video, make sense of the mathematics by reading through the problem situation and solution. Use the comments and questions in bold to help you understand how various representations of the same data can be used to emphasize different aspects of the data.

Problem: Harun and Zaid are cofounders of an online music lesson site called MyConservatory.com, which offers music lessons with musicians from around the world for a monthly subscription fee. Today, they are meeting with a bank loan officer to ask for a business loan to purchase new equipment and create TV commercials to help their company grow. The last meeting they had with the banker did not go very well; although Harun and Zaid have a great company and the data to support it, they did not effectively make their case. There are many ways to represent the company's data. Help Harun and Zaid choose ways that highlight the strengths of their company.

MyConservatory has been flourishing. Zaid created the graph shown below to show the last banker that the company started with 90,000 subscribers at the beginning of last year and increased that number to 100,000. Subscribers fluctuated close to that number throughout the year. What do the x-axis and y-axis represent in this graph?
Here the x-axis represents the number of days since January first, and the y-axis represents the number of subscribers.



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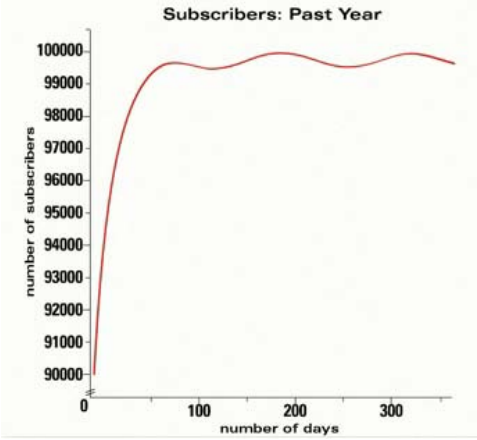
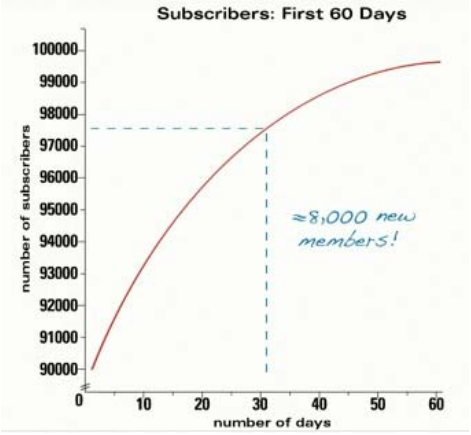
MyConservatory launched their first marketing campaign at the beginning of last year and new subscriptions increased dramatically. Did you notice that? The first banker did not. Is the graph shown above incorrect?
This graph is correct, but it doesn't highlight the growth in new subscriptions.

What happens when we truncate (cut) the y-axis so it begins at 90,000 subscriptions?
The graph shows subscriptions skyrocketing over the first 60 days.

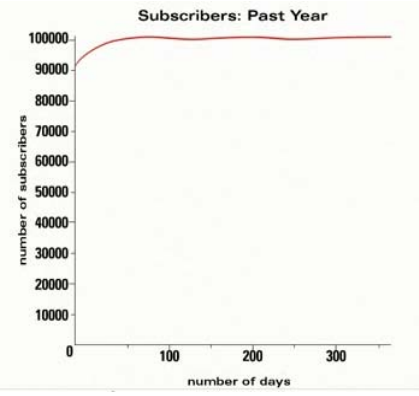


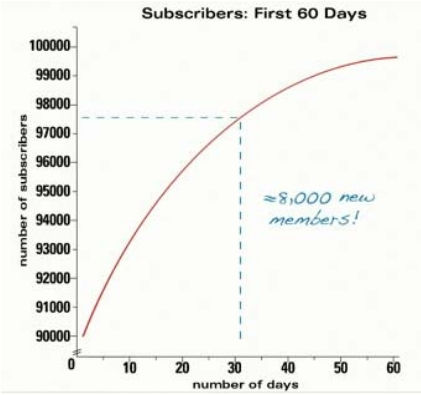
How can we change the graph to highlight the dramatic increase in the first 60 days even more?
We can look at subscription growth during that time period only. We do this by changing the x-axis from ending at 365 days to ending at 60 days. They gained almost 8,000 new subscribers in 30 days. This information should help persuade the banker to loan them money for additional advertising.



Now remember, we started with a graph that, although correct, didn't emphasize what we wanted to show. How did we change the graph to highlight the aspects of the data that we wanted to show?

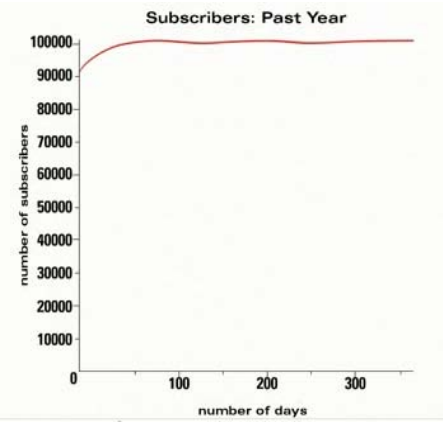
We made some adjustments to both the y-axis and the x-axis, which stretched out the graph and highlighted the successful efforts of the marketing campaign. So, we have one set of data, two different graphs, and two different stories.

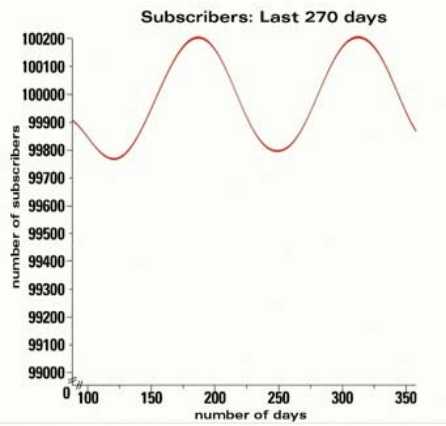




MyConservatory's membership has been fluctuating because the company hasn't had enough video equipment to provide a consistent set of advanced classes. When they made their presentation to the first banker, one could barely see the fluctuation in subscribers. How can we change the graph so that it will show the way membership has risen and fallen over time?

This time, truncate the y-axis at 99,000. Notice how the fluctuations are a lot easier to see. Also, since we are interested in the last 9 months where the fluctuations are happening, we can change the x-axis to only display that part of the data. Again, two different graphs, two different stories.





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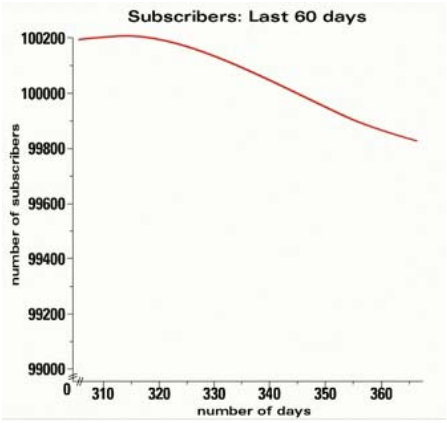
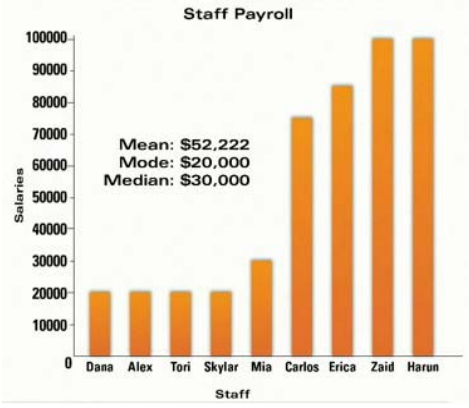
The bank has also asked Zaid and Harun to include information about the last 60 days. Using the graph below, Zaid was concerned the banker would look at the graph and think that enthusiasm for MyConservatory was plummeting. The decline represents about 330 members. What percent out of 100,000 does 330 represent?
Since, 330/100000 = 0.0033, 330 out of 100,000 is about 1/3 of 1%; nothing to be alarmed about. So, they will tell the banker there was only 1/3 of 1% decline.



Harun and Zaid also computed last year's growth as a percentage. The company gained about 10,000 members. What percentage growth does 10,000 represent?
At the beginning of last year the company had 90,000 subscribers, so the percentage growth for last year is 10,000 / 90,000 ≈ 0.11. Harun showed this change as a healthy 11% annual growth.

Next on the agenda was looking at salary information. The bar graph below shows the current salaries of the nine members of the MyConservatory staff.

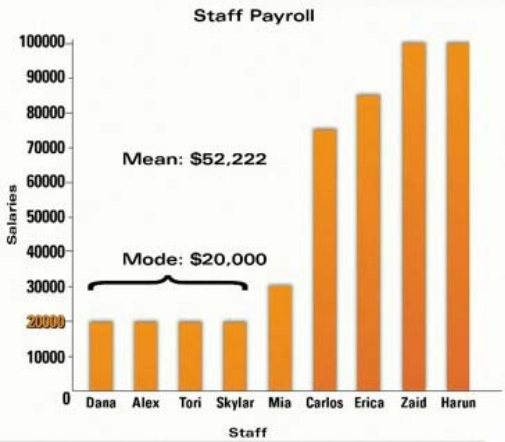


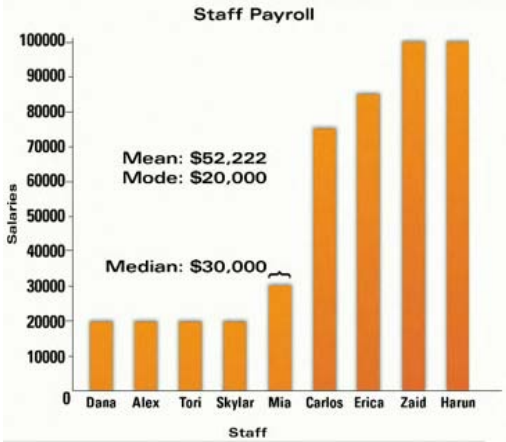
Harun and Zaid did not show this graph to the banker last time; instead Zaid just told the banker that the mean salary is $52,222. The banker was concerned that this average salary was too generous for the company. What causes the mean to be so high and why might it be better for Harun and Zaid to use a different measure of center to summarize their data in this situation?

Harun and Zaid make larger salaries than their employees. These two salaries dramatically raise the mean. This measure of center gives the impression that everyone at the company has a big salary, which is not true.

What other value could Harun and Zaid use to summarize the salary data that would more appropriately convey the information they want to express?

Harun and Zaid could use the mode when describing their payroll to the banker. More members of the staff make $20,000 than any other salary level. They could also use the median salary to describe payroll. The median is $30,000. Half of the staff makes at or below $30,000 and half make at or above $30,000. The mean, median, and mode are all ways of summarizing the nine different values, but as you can see, they each tell a different story.





The meeting went very well this time. Why did this meeting go so well compared to the last one?

When displaying their data, Harun and Zaid chose their x-ranges and y-ranges to show the part of the graph that was relative to what they were describing. They expressed numbers as a percentage when appropriate in order to put them into context. Also, they were careful in choosing whether to use the mean, median, or mode to aggregate data.

- **Choose scale wisely**
- **Use percentages appropriately**
- **Choose measure of center carefully**

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