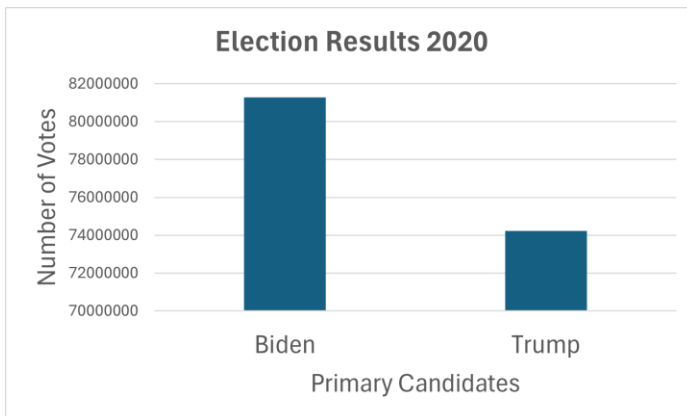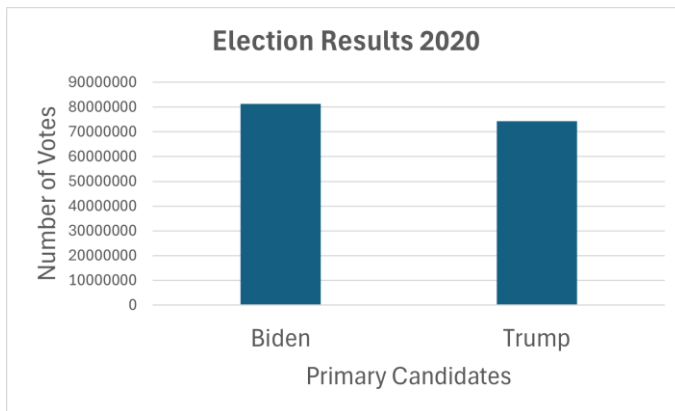**ACTIVITY: Lying with Graphs – Answer Worksheet**
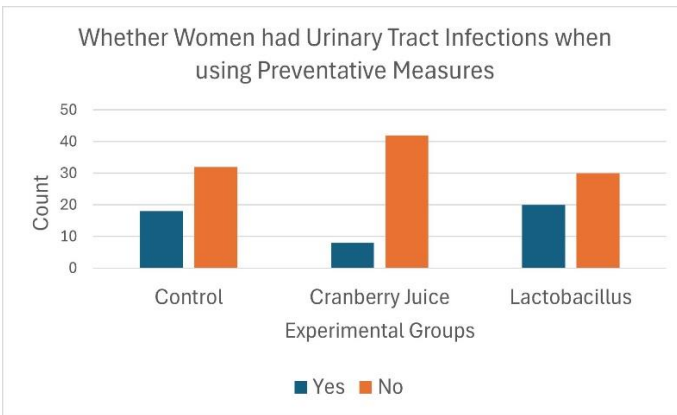
Examine the graphs and answer the questions.

Bar Graph: Simple

1. What variable was used to collect the data for creating these graphs?
   The variable is the candidate a person voted for.

2. Is the variable quantitative or qualitative? Explain.
   For each subject, who they voted for was recorded so this data is qualitative.

3. Approximately how many more votes did Biden get compared to Trump?
   Approximately 7,000,000 people

4. Approximately 155,000,000 people voted for either Trump or Biden. Approximately what percent of the total votes was the difference you calculated above?
   Approximately 4.5%
   (7,000,000*100/155,000,000)

5. Does it appear that Joe Biden won the popular vote by a landslide on the first graph?
   No, the bars are not very different in height.

6. Does the second graph make it appear that Biden won the popular vote by a landslide? Why or why not?
   Yes, the bars are drastically different in height giving the impression that Biden won more than twice as many votes as Trump.

7. What has changed that makes this graph look so different?
   On the second graph, the y-axis no longer starts at zero.

8. Which graph do you think more accurately depicts the data? Why?
   The top graph more accurately depicts the data. When the y-axis does not start at zero, the difference is exaggerated.

Bar Graph – Grouped

Whether Women had Urinary Tract Infections when using Preventative Measures

(Bar graph with Count on vertical axis from 0 to 50, Experimental Groups on horizontal axis: Control, Cranberry Juice, Lactobacillus. Legend: Yes (blue), No (orange).)

9. What two variables were used to collect the data for creating this graph?
The two variables were whether the women had a urinary tract infection and what type of preventative measures they were using (none, cranberry juice, or Lactobacillus).

10. Are the variables quantitative or qualitative? Explain.
Both variables are qualitative. For the first variable, each woman was recorded as either having a urinary tract infection or not having one and for the second variable the woman is put into a group depending on the preventative measure (treatment) they were using.

11. For the graph, does it appear that regardless of which measure is used, the woman is less likely to have a urinary tract infection? Why or why not?
Yes. For each group, the orange bar representing the women who did not have a urinary tract infection is taller than the blue bar which represents those who did have the infection.

12. Approximately how many women had urinary tract infections?
Approximately 46 women

13. Approximately what percent of the women who had urinary tract infections were in each of the experimental groups?
Control: 18*100/46=39%
Cranberry Juice: 8*100/46=17%
Lactobacillus: 20*100/46=43%

14. Approximately how many women were in each experimental group?
Approximately 50 women per group

15. For each experimental group, compute the percentage of women who had a urinary tract infection.
Control: 18*100/50=36%
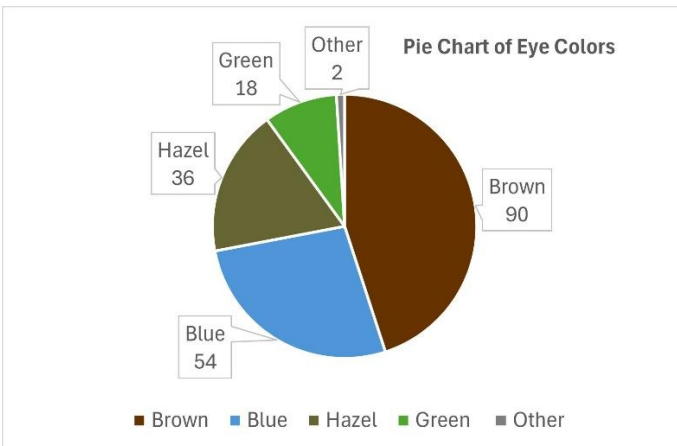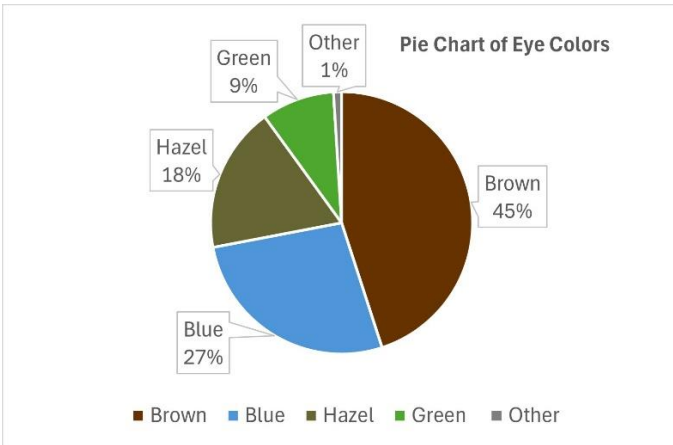Cranberry Juice: 8*100/50=16%
Lactobacillus: 20*100/50=40%

16. Which treatment appeared to be the most effective in preventing urinary tract infections? Explain.
Cranberry Juice. There is a larger gap between the blue and orange bars in the Cranberry Juice group compared to the other groups.

Pie Graphs:

Pie Chart of Eye Colors
- Other 1%
- Green 9%
- Hazel 18%
- Brown 45%
- Blue 27%
Legend: Brown, Blue, Hazel, Green, Other

Pie Chart of Eye Colors
- Other 2
- Green 18
- Hazel 36
- Brown 90
- Blue 54
Legend: Brown, Blue, Hazel, Green, Other

17. What variable was used to collect the data for creating this graph?
The variable in this graph is eye color.

18. Is the variable quantitative or qualitative? Explain.
The variable is qualitative because everyone is placed in a group based on the color of their eyes.

19. If 1,000 individuals were used to determine these percentages, how many of the 1,000 people would have green eyes?
There would be 0.09(1,000)=90 people with green eyes.

20. Using the first chart, what percent of the people have green eyes?
9%

21. Using the second chart, what percent of the people have green eyes? Explain how you obtained your answer.
9%
There are a total of 200 people represented in this chart and 18 of those people have green eyes. So I computed 18/200=9/100=0.09=9%.

22. If out of all the people who were selected to determine these percentages, 54 of them had blue eyes, how many total people would have been surveyed?
0.27x=54
x=54/.27=200 people

Teacher Note: Students may not catch that there are 200 people represented in the bottom chart when answering #21. If this is the case, hopefully, #22 makes them re-evaluate their answer to #21.

23. Do the two charts provide equivalent data?
Yes. If you compute the percentages for each group shown in the second pie chart, you will obtain the first pie chart.

24. Which pie chart do you believe represents the data more clearly?
The first (top) pie chart gives a more appropriate representation of the data. A pie chart aims to show the percentage of units in each group by displaying data as percentages, making it simpler for viewers to understand the distribution.

Line Graphs:

Inflation Rates from January 2014 to May 2024
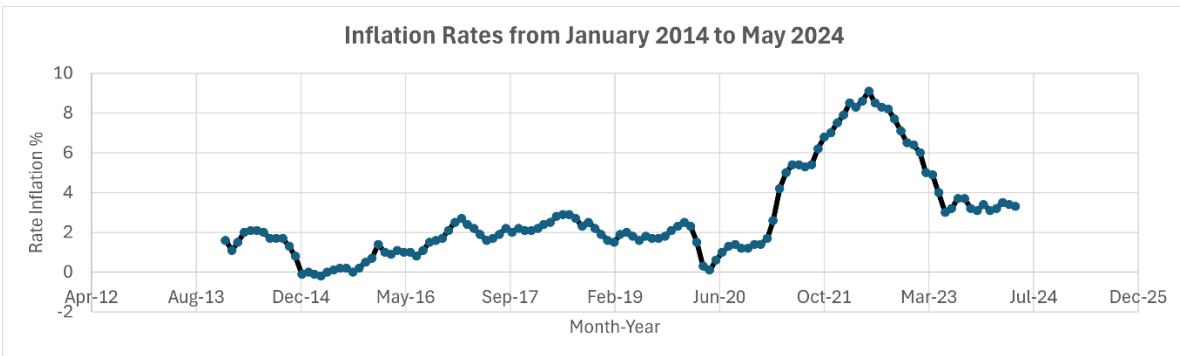
25. What two variables were used when collecting the data for this graph?
The two variables are time (month and year), and the inflation rate as a percentage.

26. Are the two variables quantitative and qualitative? Explain.
The percentage of inflation is quantitative. Although typically months of the year would be considered qualitative, in this case since you are looking at a change over time (time series – changes over time), the time (month and year) would be considered quantitative.

27. Suppose this graphic was provided in a news article regarding inflation rates before, during, and after the COVID-19 pandemic. Make three claims based on the graph and justify those claims.
The graph indicates a reasonably steady inflation rate with small seasonal variations prior to the pandemic as seen by the small fluctuations of between 0% and 3%. During the pandemic, the slope of the graph is steep and positive indicating steadily increasing inflation rates. After the pandemic, the graph shows a steep, negative slope indicating a steady decline in inflation rates.
Teacher Note: Students may need to use the internet to determine the years in which the COVID-19 pandemic took place.

28. Does this graph support the possibility that the COVID-19 pandemic caused inflation? Why or why not?
Yes, because the steady and steep increase in inflation occurred around the time the COVID-19 pandemic took place, and the steady decrease shortly after the pandemic was considered over.

29. What are some top causes of inflation according to the internet?
1. An increase in the cost of production due to raw materials or labor costing more
2. A higher demand for an item
3. Monetary policies such as tax cuts or lower interest rates
4. Increase in money supply

30. Could the COVID-19 pandemic have been a catalyst to any of the reasons mentioned in question 29? Explain.
Yes, there were a lot of labor shortages due to the pandemic thus increasing the cost of labor. Furthermore, raw materials became more expensive as there were shortages due to shutdowns that caused problems in the supply chain. Lastly, lots of money was pumped into the economy to keep it going during the pandemic.

Inflation Rates from January 2014 to June 2022
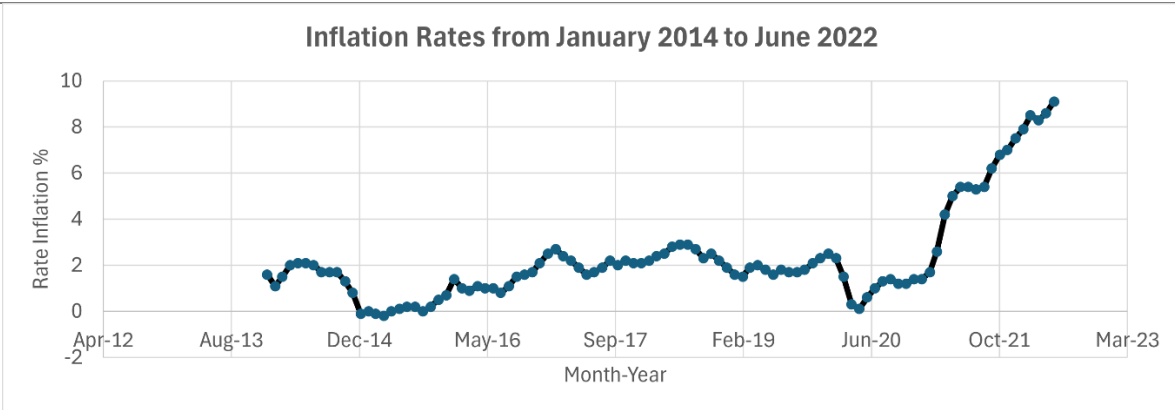
31. How might you use the graph above to criticize Biden's economic policies? Justify your answer.
It appears that Biden's policies are the primary cause to inflation since the sharp increase in inflation started around the time he took office.

Teacher Note: Students may need to use the internet to determine the years in which Biden was in office.

32. What changed from the first graph on the previous page to the second graph shown above?
The range of the x-values changed. The second graph stopped after inflation hit a high.

33. Do you think this would be an accurate reflection of Biden's time in office? Why or why not?
No, looking at the first graph, inflation rates started to decrease steadily while Biden was still in office.

34. When reading line graphs that show a trend over time, what do you need to pay attention to?
It is important to examine the dates to make sure that the graph is showing the entire picture and not just a small range of time to promote a certain agenda.

It is now your turn to create some graphs. The data you will use is provided for you on an Excel Spreadsheet.
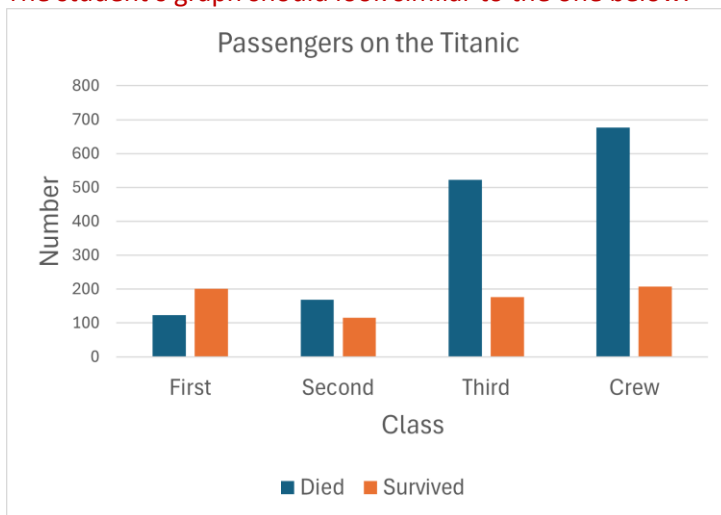
Graph 1:
On Sheet 1 of Excel, is some data regarding the Titanic. Answer the questions based on the data provided.

1. What **two** variables are in this data set?
   The two variables are whether the passengers died or survived and whether they were first class, second class, third class or crew members.

2. Are the **two** variables quantitative or qualitative?
   Both are qualitative. Either the passenger died or survived making the first variable qualitative. For the second variable, the passenger is put in a group depending on their class, or whether they were a crew member which is also qualitative.

3. If you wanted to create a graph, like the ones studied in this lesson, that compared the number of passengers who died or survived based on their class, which graph would work best.
   The grouped bar graph would work best.

Create the graph in Excel and answer the questions below concerning your graph. Instructions on Excel are towards the end of this activity.

1. What class had more people survive than die?
   The passengers in first class.

2. Which group had the biggest difference between the number of passengers who died versus survived?
   The crew had the biggest difference.

The student's graph should look similar to the one below:

Graphs 2 and 3:

On Sheet 2 of Excel, is some data that looks at the level of education among people aged 25 years and older in Oklahoma. The data is represented in thousands.

1. What is the variable for this data?
   The variable is the level of education – Doctorate, Professional, Master's, etc.

2. Is this variable quantitative or qualitative?
   The variable is qualitative since people are placed into groups based on their level of education.

3. If you wanted to create a graph that showed the percentage of people who have each level of education, which graph would work best out of the ones presented in this lesson?
   The pie graph would work best as it shows the percentage of the data that falls into each group.

4. If you wanted to create a graph that showed the total number of people in each group, which graph would work best out of the ones presented in this lesson?
   The simple bar graph would work best as it shows the totals.

Create both graphs you indicated above in Excel and answer the questions below concerning your graphs. Instructions on Excel are towards the end of this activity.

1. What percentage of Oklahomans 25 years or older have a Master's degree as their highest level of education?
   6%

2. What percentage of Oklahomans 25 years or older have a High School diploma as their highest level of education?
   32%

3. How many Oklahomans have a Doctorate degree?
   24,100 Oklahomans

The student's graphs should look similar to the graphs below.
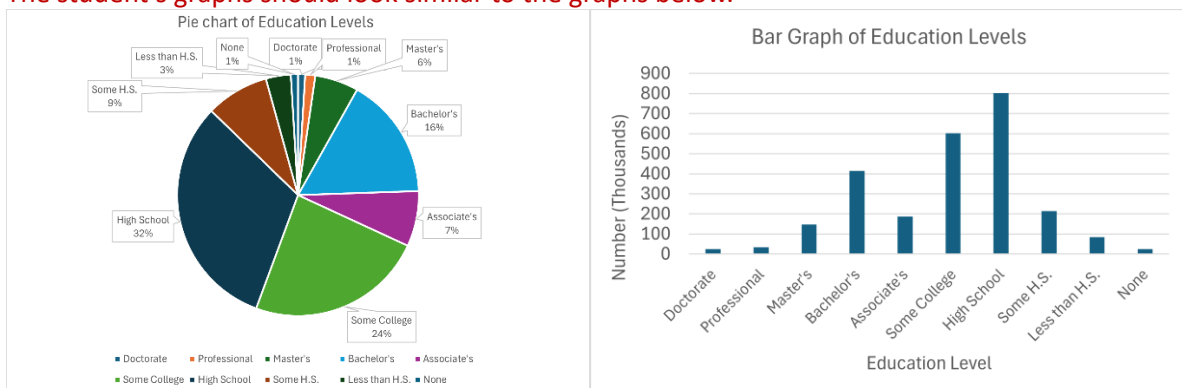
Graph 4:
On Sheet 3 of Excel, is some data that shows the year and the average 30-year fixed mortgage rate.

1. What **two** variables are in this data set?
   The two variables are the year and the average 30-year mortgage rate.

2. Are the **two** variables quantitative or qualitative?
   Both are quantitative as they are represented by numbers.

3. If you wanted to create a graph, like the ones studied in this lesson to look at the trend for 30-year mortgage rates since 1976, which graph would work best?
   The line graph would work best.

Create the graph in Excel and answer the questions below concerning your graph. Instructions on Excel are towards the end of this activity.

1. Are the mortgage rates in 2023 the highest they have ever been?
   No, the mortgage rates prior to 1990 were a lot higher than they were in 2023.

2. Why do you think people in the year 2023 felt that the interest rates were too high that year?
   Part of the reason is that interest rates were quite a bit lower for several years before then.

   Teacher Note: The other reason is due to the high inflation. With the higher mortgage rates and the increase in the cost of houses, it was difficult for people to be able to afford purchasing a home.
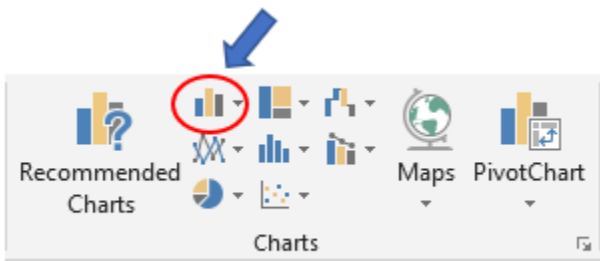
3. One of the reasons to increase interest rates is to control inflation. Compare the graph you created to the one showing inflation rates. Did the recent increase in mortgage rates correspond with a decrease in the inflation rate?
   Yes, the decrease in inflation rates seems to correspond with the increase in the 30-year Fixed Mortgage Rate.

   The student's graph should look similar to the one below.
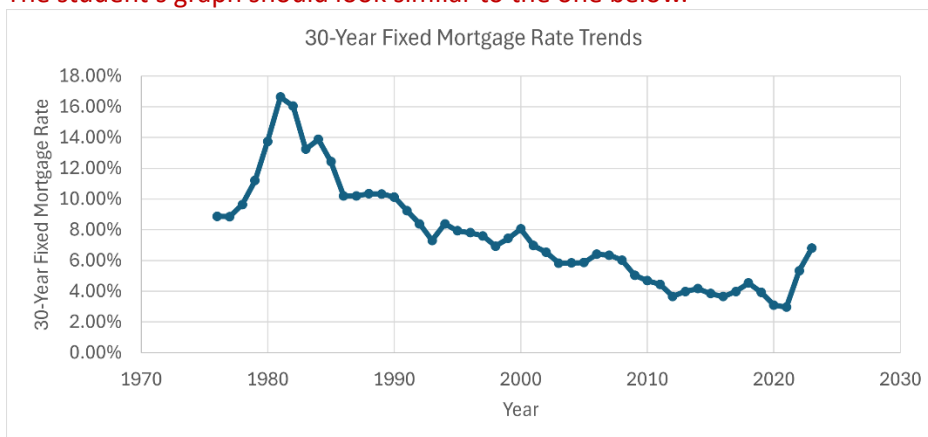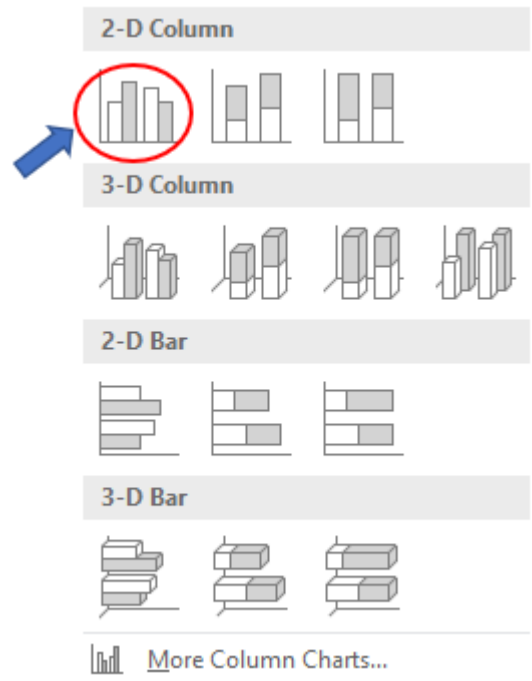
Bar Graphs: Simple

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1. Format your data so that you have the groups in one column and the frequency in the second column.

Brown	45
Blue	27
Hazel	18
Green	9
Other	1

2. Highlight the data (Both the group names and frequencies).

Brown	45
Blue	27
Hazel	18
Green	9
Other	1

3. Select "Insert."

4. Select the bar graph icon that shows three colors as indicated below and choose the top left option.

Bar Graphs: Grouped

1. Set up your data like a contingency table as shown on the right. Notice that the upper left square is left blank.

	Control Group	Cranberry Juice Group	Lactobacillus Group
Yes	37	17	56
No	31	40	29

2. Highlight the data

	Control Group	Cranberry Juice Group	Lactobacillus Group
Yes	37	17	56
No	31	40	29

3. Select "Insert."

4. Select the bar graph icon that shows three colors as indicated below and choose the top left option.

Pie Graphs

Examples:

Brown	45
Blue	27
Hazel	18
Green	9
Other	1

1. Format your data so that you have the groups in one column and the frequency in the second column.

Brown	45
Blue	27
Hazel	18
Green	9
Other	1

2. Highlight the data (Both the group names and frequencies)
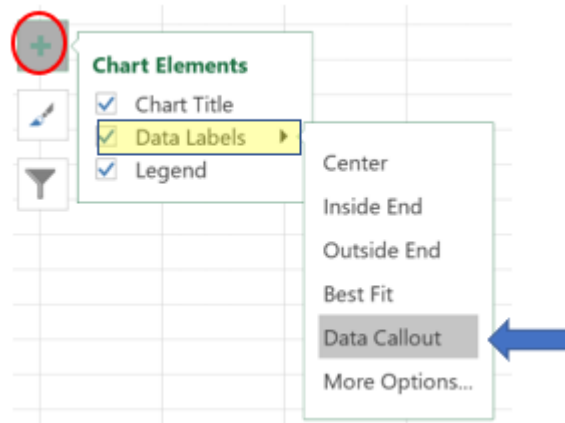

3. Select "Insert."

4. Select the pie graph icon and choose the top left option.
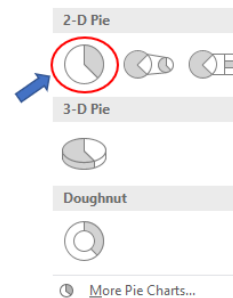
5. To include the percentage for each group, follow the steps below.
   - Click on "+" – Chart Elements
   - Check the box for "Data Labels."
   - Click on the right arrow next to data labels and choose "Data Callout."

Line graphs

Examples:

1. Type your data into two long columns. The left column data will be plotted on the x-axis and the right column data will be plotted on the y-axis.

2. Highlight both columns. Note: Do not include the headings.

3. Select "Insert."

4. Select the icon that looks like random dots plotted on a graph (scatter chart) and choose the upper left picture.
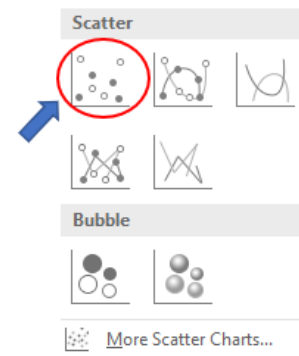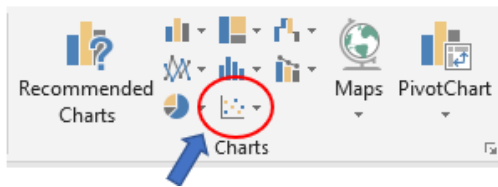
5. To add the line, double click on one of the points to bring up the "Format Data Series" option (it will appear on the right-hand side of the screen).

6. Click on the Paint bucket (Fill and Line).

7. In the "Line" dropdown menu, select "Solid line".
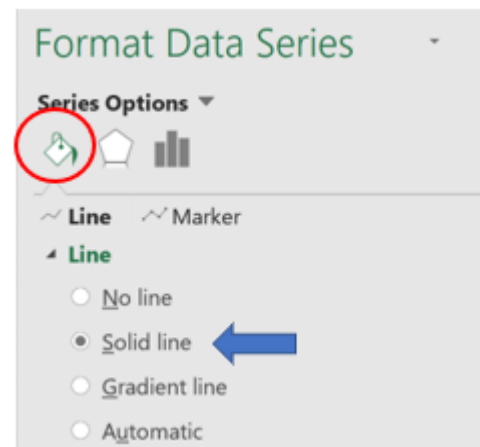
References for data used in this ARC

"Cranberry juice | DASL." *Dasl.datadescription.com*, dasl.datadescription.com/datafile/cranberry-juice/.

"Current US Inflation Rates: 2000-2024." *US Inflation Calculator*, 2024, www.usinflationcalculator.com/inflation/current-inflation-rates/.

"The Demographic Statistical Atlas of the United States - Statistical Atlas." *Statisticalatlas.com*, statisticalatlas.com/state/Oklahoma/Educational-Attainment.

Lee, Young, et al. "Teaching Statistics with Current and Historical Events: An Analysis of Survivor Data from the Sinking of the HMT Birkenhead, the RMS Titanic, and the Korean Ferry MV Sewol." *Comprehensive Psychology*, vol. Volume 5, 7 Sept. 2017, pp. 1–6, www.researchgate.net/publication/301934199_Teaching_Statistics_with_Current_and_Historical_Events_An_Analysis_of_Survivor_Data_From_the_Sinking_of_the_HMT_Birkenhead_the_RMS_Titanic_and_the_Korean_Ferry_MV_Sewol, https://doi.org/10.1177/2165222816647900. Accessed 5 July 2024.

Miller, Peter. "30-Year Mortgage Rates Chart." *The Mortgage Reports*, 7 Oct. 2020, themortgagereports.com/61853/30-year-mortgage-rates-chart.

Wasserman, David, et al. "2020 Popular Vote Tracker." *Cook Political Report*, 2020, www.cookpolitical.com/2020-national-popular-vote-tracker.