SeaGlide_TEAM	Graphing Unit Plan	Lesson # 4 - 5 (60 minutes each)

Description:

You are an environmental scientist. Your lab works on information with climate change while a colleague of yours works in a lab concerned about wildlife population. The labs share information with each other, and you have received data in the form of graphs and charts from your colleague. First, interpret the data they have sent you. Then, take the data that your lab has collected and turn it into graphs so that you can share it with the other lab. Next, there are several graphs from your lab that are not quite right. You need to identify what is wrong with them to prevent data misrepresentation.

Students will be able to:

- Read and interpret bar graphs, line charts, scatter plots, and histograms
- Create their own bar graphs, line charts, scatter plots, and histograms
- Create a line of best fit
- Identify problems with misrepresenting data in graphs and charts.

Students will understand:

Students will understand the importance of accurate data reporting and how it can be manipulated. They will be able to read, interpret, and create line charts, bar graphs, scatter plots, and histograms. Students will also understand the differences between the multiple data representations and when each representation should be used. They will also be able to recognize manipulations within a graph or chart.

Key Definitions & Concepts: [1], [2]

- **Bar graph**: a diagram in which the numerical values of variables are represented by the height or length of lines or rectangles of equal width
- **Line chart**: a type of chart which displays information as a series of data points called “markers” connected by straight line segments. It is a basic type of chart common in many fields
- **Scale**: a ratio or proportion compared to the whole.
- **Histogram**: a diagram consisting of rectangles whose area is proportional to the frequency of a variable and whose width is equal to the class interval.
- **Scatter Plot**: a graph in which the values of two variables are plotted along two axes, the pattern of the resulting points revealing any correlation present.
- **Line of Best Fit**: also known as a trend line, it represents the data on a scatter plot. This line may pass through some of the points, none of the points, or all of the points.

Standards[Copied from: 3]:

CC.2.4.HS.B.1 Summarize, represent, and interpret data on a single count or measurement variable.
CC.2.4.HS.B.2 Summarize, represent, and interpret data on two categorical and quantitative variables.

Background Information

Prior Knowledge:

- All previous lessons in the *Measurement and Data Analysis* module
- Understanding of variables.
- Percents/fractions
- Venn Diagrams

Math Practices[Copied from: 4]:	**Core Ideas[Copied from: 5]:**	**Cross Cutting Concepts[Copied from: 6]:**
● Model with mathematics. ● Attend to precision.	● Information Processing ● Defining and Delimiting Problems	● Scale, Proportion, and Quantity ● Cause and Effect

Possible Preconceptions/Misconceptions:

Students may not understand that data can be manipulated to show whatever someone wants it to show. Students and people in general tend to take graphs and statistics at face value because they assume numbers are hard facts that do not lie. What they do not realize is that numbers can be manipulated so that they tell a different story. It is important to catch this because a lot of important decisions are made based on data and statistics. This lesson addresses several types of manipulation dealing with scales, axis manipulation, and cherry picking so students develop a set of tools to determine the validity of a graph.

Lesson Plan - 5E(+) Model

Engage: Lesson #1: Bar & Line[1]

Students will watch the video How to Spot a Misleading Graph. This video introduces ways in which data can be misrepresented through graphs and charts. This activity gives real life examples from adds and scientific data while allowing students to see how this affects their everyday lives. While watching the video, students should complete the *How Can a Graph be Misleading* worksheet. This goes over the basic and important information from the video. The teacher should then go over this worksheet through a whole class discussion. The teacher should emphasize a brief discussion on the last question: *Why is an accurate representation of data important?* This should take less than 10 minutes.

Engage: Lesson #2: Histograms & Scatter Plots

Students will complete a brief review of lesson 1. This helps them recall necessary information that they will need for the lesson. Each student will answer two questions on a half sheet titled *Review*. This sheet asks students to recall why it is important to recognize data manipulation and to review the basics of the graphs learned the day before. This sets students up to continue to learn about manipulations in other graphs and build off of what they had learned the day before. This should take 5 minutes to complete and review as a whole class.

Explore: Lesson #1: Bar & Line [9-15] (images)

Part I: Introduction

Students in small groups of 2 or 3 will complete a brief worksheet titled *Practice Reading Graphs*. This allows students to practice reading and interpreting basic bar and line graphs with guided questions. This activity sets the students to be able to read and interpret other graphs throughout the lesson. This should take 10 minutes.

Part II: *Benchmark Lesson*: Environmental Data

Students may work in pairs to complete the *Environmental Data* worksheet. Here, students are acting as environmental scientists looking at data. Students will both interpret data from a given graph and also represent given data through making their own graphs, including bar graphs and line charts. Students will have to interpret different types of bar and line graphs and will have to go more in depth with some of the questions, such as the type of statistics and variables being compared. Students will also use bar and line graphs to compare data and compare types of representation. Students will discuss things such as trend and scale, but they also will discuss how the data in two sets differs. After interpreting given data, students will have the opportunity to create their own bar and line graphs to represent that data. They will need to include things such as labels, titles, scales etc. Students will have to appropriately choose the each of those graphing descriptors and how the data is set up so that it is not misrepresented. This activity should take 20 minutes.

Part III: *Investigation Lesson*: What's Missing?

Students will work in small groups of two or three to investigate what is wrong with several examples of graphs through the *What's Missing?* worksheet. They will have to answer questions about what is missing from the graph, and students also will have to explain how to fix the mistakes or incorporate what is missing. They will also answer questions about data manipulation and how the graphs can be edited to become misleading. This pulls the lesson full circle as it connects back to the video watched in the engage at the beginning of the lesson. This activity should take 15 minutes.

Explore: Lesson #2: Histograms & Scatter Plots [2], [7], [8], [9-15] (images)

Part I: Introduction

Students will work on the *Compare and Contrast Data Displays* worksheet in small groups of 2 or 3. This worksheet gives an introduction of what histograms and scatter plots look like, and it allows students to explore how histograms and scatter plots are different from other types of graphs. This can address any misconceptions students may have about graphs that look similar but that are used for different purposes. This activity also allows students to make connections to prior lessons. This activity should take 10 minutes to complete.

Part II: *Benchmark*: Understanding Scatter Plots and Histograms: Parts 1 through 3

Students will work in small groups of 2 or 3 to complete the Parts 1 through 3 of the *Understanding Scatter Plots and Histograms* worksheet. In Part 1, students will work through an online interface known as Desmos to complete an interactive activity on Scatter Plots and lines of best fit. Prior to the lesson day, teachers should use the Teacher Desmos Link to set up a class code for the students to utilize when completing Part 1 of the *Understanding Scatter Plots and Histograms* worksheet. Students will then access the Desmos Activity and use the class key provided. Hence, each group of students needs to have access to one tablet or computer to complete Part 1 of the worksheet. This activity allows students to explore scatter plots, lines of best fit and the importance of both in an interactive

way. Also, teachers receive immediate feedback of how the class is doing while the students are completing the Desmos activity. In parts 2 and 3 of the worksheet, students will analyze a scatter plot and a histogram, then answer conceptual questions related to the graphs and the data displayed. This portion of the activity is an introduction into reading these types of graphs. This also allows for students to get a better understanding of how scatter plots and histograms can be used and to understand why each of those graphs types are used to represent particular data spreads. The theme of being an environmental scientist working with data is also carried into this part from the previous lesson on bar and line graphs. This should take 25 minutes to complete.

Part III: *Investigation*: Understanding Scatter Plots and Histograms: Parts 4 and 5
Students will continue to work in small groups of 2 or 3 to complete Parts 4 and 5 of the *Understanding Scatter Plots and Histograms* worksheet. In Part 4, students will have a chance to delve further into gaining understanding of histograms by having the opportunity to turn a frequency chart into a histogram. In Part 5 of the worksheet, students will also investigate curve fitting through a PHET online simulator. Hence, each group of students needs to have access to one tablet or computer to complete Part 5 of the worksheet. This activity allows students to conceptually understand how lines of best are chosen for scatter plots. In this simulation, students plot points on a graph like a scatter plot and fit a line to the data. Students can experiment with different types of curves to fit the line. They can also attempt to fit the line themselves by adjust variables. Students can also explore error of trend lines through this simulator. This should take 20 minutes to complete.

Explain:
During each activity in the exploration of this lesson, students are expected to explain their reasoning, choices, and/or answers (depending the worksheet). In the exploration, students must explain the purpose and meaning behind data representation terms of their significance in the data set at-hand. They must also explain certain aspects of various graphs and their importance. From this, the students must draw conclusions and support such via reasoning and sound explanations. Student must be able to explain what is wrong with various graphs and why. The teacher should also be asking probing questions during completion of the worksheets that prompt the students to explain what they are doing and why. This allows for students to learn through inquiry and discovery, which ensures that they gain deeper understanding of the learning goals of this lesson.

Elaborate:
Students will explore real world examples throughout the lesson. The engage for Lesson #1: Bar & Line Graphs begins with prompting the students to understanding how and why the given graphs are misleading. During the exploration of both lessons, students will connect data representation with examples from environmental science and climate change. This allows students to see how data representation and interpretation is important in many other fields and how it is used in everyday life. Through these examples, students will understand that the misrepresentation of data can affect them directly, and that data analysis is utilized in not just mathematics, but also in environmental science.

Evaluate:

Students are evaluated both informally and formally throughout the entirety of this lesson. The informal evaluations occur during the open class discussions. When the teacher is circulating the classroom, they are able to check for surface level understanding and make sure that the class is all on the same page by listening to students' discussions and responses. The instructor can gauge students' progress through observing whether or not they are struggling to complete the activities. The formal assessments of this unit plan are the culmination of all the worksheets. It is strongly recommended to instruct the students to return all documents used during each lesson for grading.

Enrich:

This lesson can be differentiated into an introductory ecology class. In general, ecology requires the utilization of more complex data representations since the data collected are more dense, are multivariate, etc. Students can not only practice reading graphs and interpreting the meaning of the data, but students also begin to think about causation of the data spreads. By applying upper-level critical thinking techniques, ecology students will be able to make inferences and evidence-based conclusions about the data, to represent the data in more complex graphs, and to determine any reason(s) for causation by referencing ecological theory.

All associated documents are attached below

Reference *Annotated Bibliography* on the very last page of this packet

Lesson #1: Bar & Line Worksheets

Name:_____ Date:_____

How Can a Graph be Misleading? [1]

How can a bar graph be constructed such that the data is misrepresented?

Why is it easy to manipulate data on a bar graph?

What do line charts normally show?

How are line charts typically manipulated?

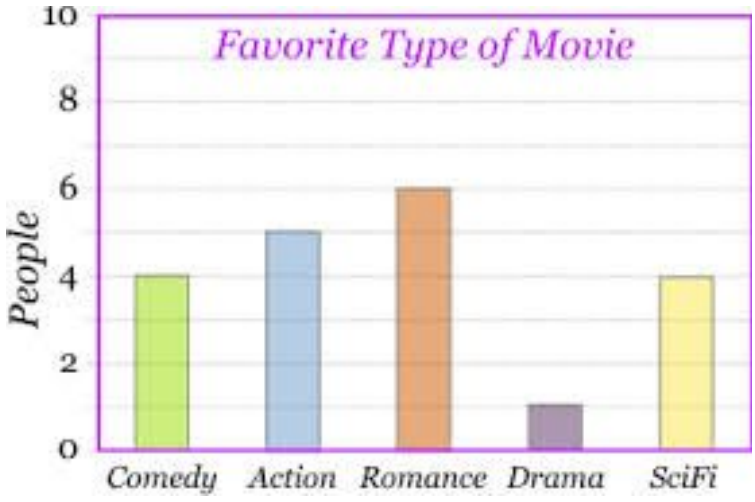
What is Cherry Picking?

Why is an accurate representation of data important?

Name:_____ Date:_____

Practice Reading Graphs

Practice reading the bar graph by answering the following questions.



[9]

What is the scale on the graph?

How many people were polled?

How many people said that “Action” is their favorite type?

What percent of the population said that “Action” is their favorite type?

Is this graph an accurate representation of the data? Why or why not?

Practice reading the line chart by answering the following questions.

What does the line graph represent?

What is the scale of the graph? Discuss both axes.

What are the extremes of the graph?

What is the overall trend of the graph?

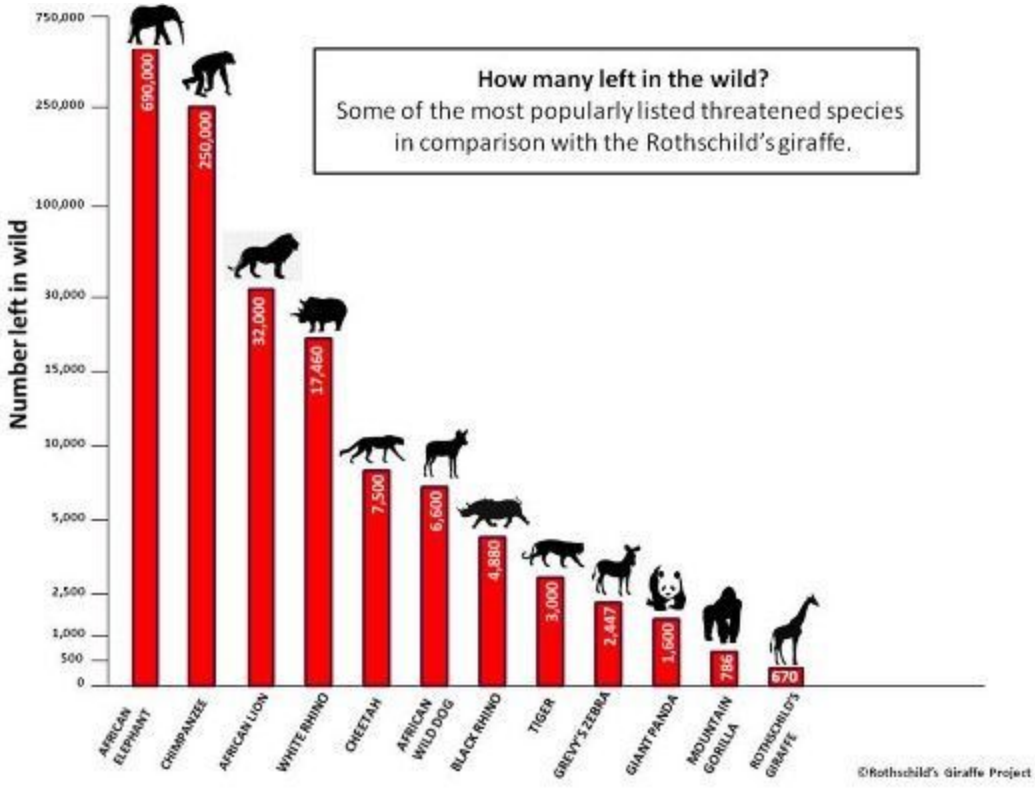
Explain what is happening between April and June?

Name:_____ Date:_____

Environmental Data

You are an environmental scientist. Your lab works on information with climate change while a colleague of yours works in a lab concerned about wildlife population. The labs share information with each other, and you have received data in the form of graphs and charts from your colleague. First, interpret the data they have sent you. Then, take the data that your lab has collected and turn it into graphs so that you can share it with the other lab.

The Wildlife Conservation Laboratory has sent you the following information about endangered species.



[10]

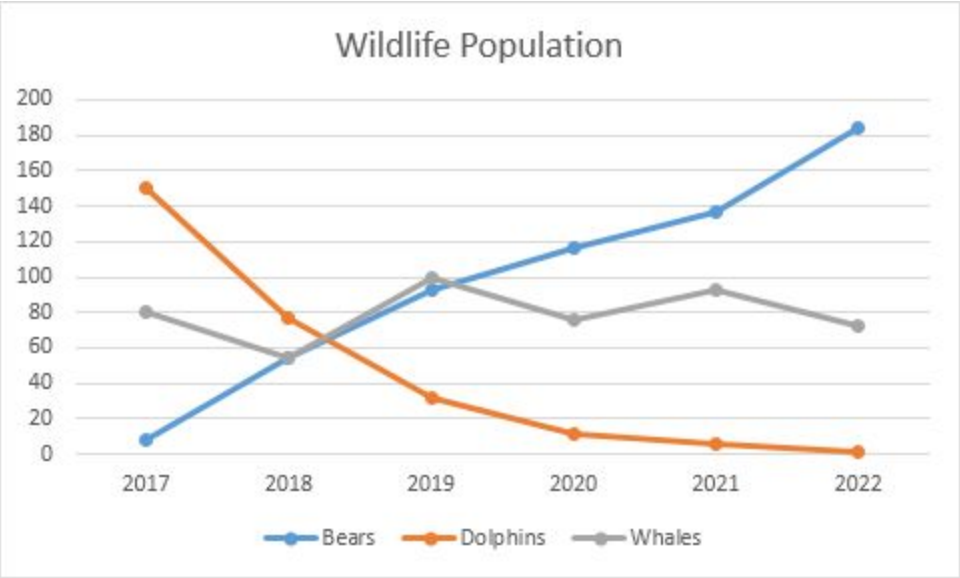
What is this goal of this graph? What does the creator want people to interpret?

What is the scale?

How many variables is this graph dependent upon?

Does this show this descriptive or inferential statistics? Defend your response.

The Wildlife Conservation Laboratory has sent you information conducted by two research studies on the same topic. Each study chose to represent their data differently. Observe the graphs from each study and answer the associated questions questions.

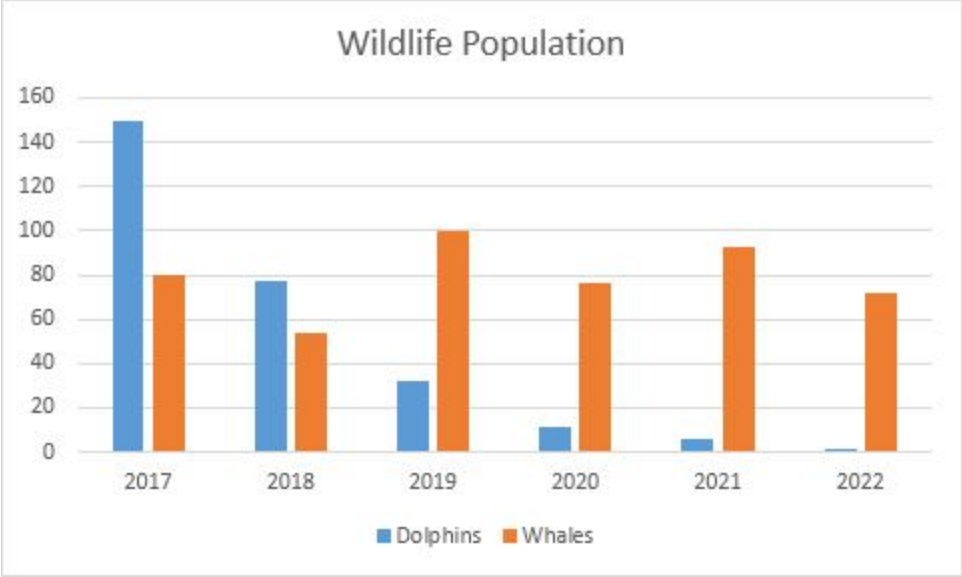


What is the general trend of each line?

What is the scale of the graph?

How many variables are used?

Does this show descriptive or inferential statistics? Why?



How does the data in this graph vary from the data in the previous graph?

Compare the numbers for each year. Are they different? If so how different? Does this affect the general trend and purpose of the graphs?

Which graph do you prefer and why?

Listed below in the table is the data about temperature from a local stream that your lab collected. You are to take this data and accurately represent it using both a bar graph and a line graph. Be sure to include all graphical descriptors (i.e. titles, scales, labels, etc.)

Temperature Degrees Celsius	Month
13.40	September
12.50	October
10.35	November
8.52	December
8.23	January
1.17	February
8.48	March
10.00	April
11.95	May
13.71	June
14.82	July
14.05	August

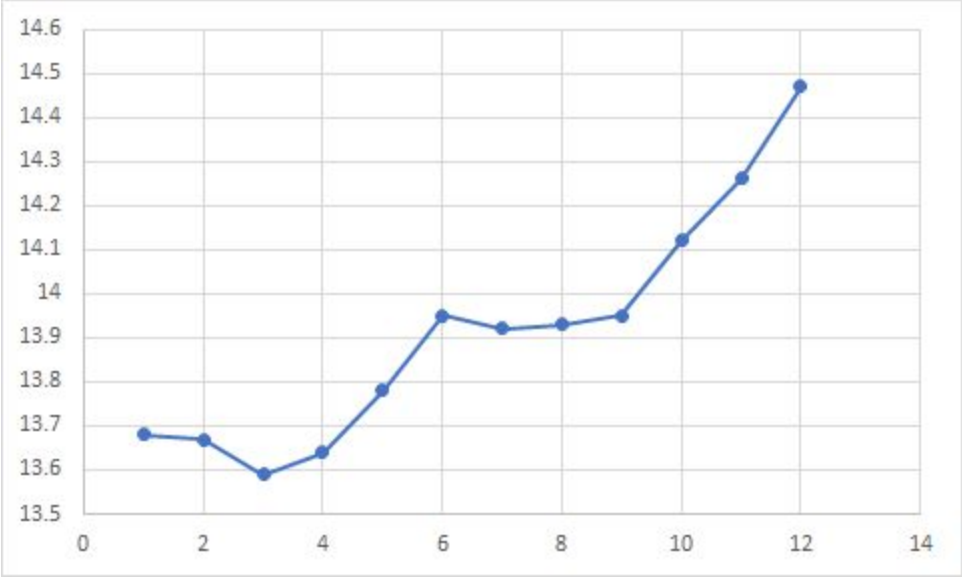
Bar Graph

Line Chart

Name:_____ Date:_____

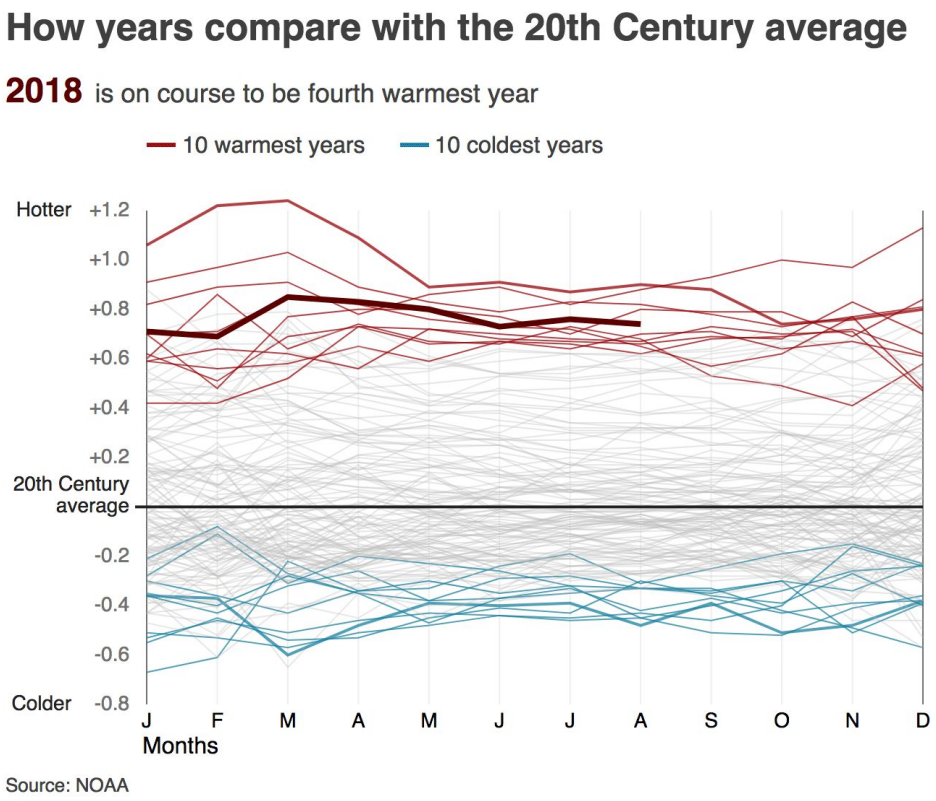
What's Missing?

There are several graphs from your lab that are not quite right. You need to identify and correct what is wrong with them to prevent data misrepresentation.



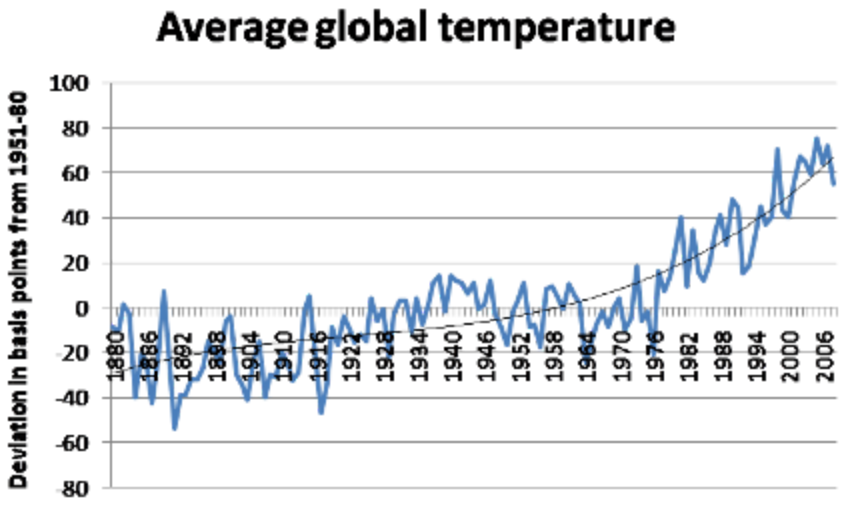
What is wrong with this chart?

Is it usable for anything? Why or why not?



[11]

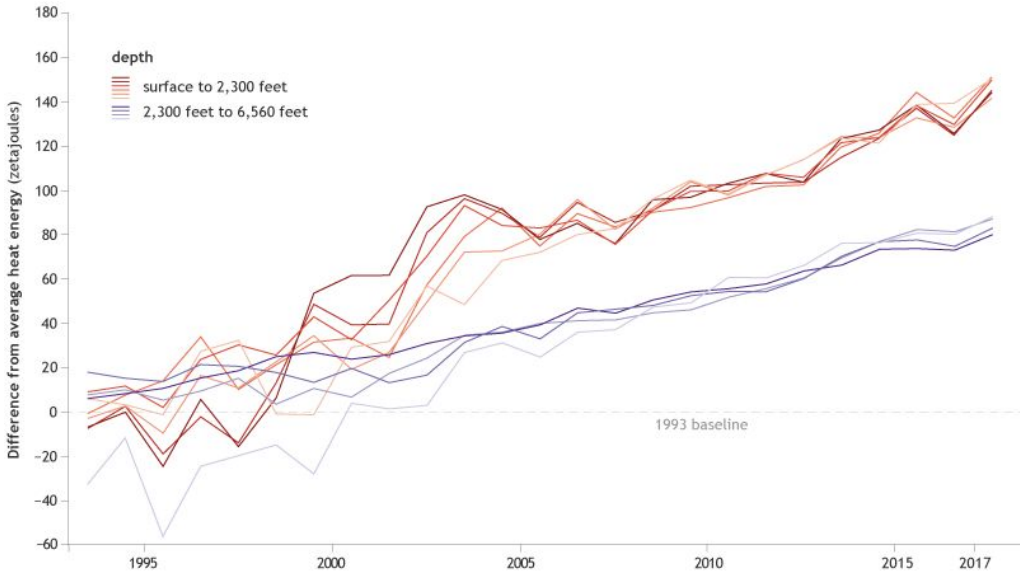
What is missing from this chart? How can it be made better?



[12]

Is this a good graph? Why or Why not?

How could someone cherry pick this graph to make it look like global temperature is not changing? Provide at least one example, and explain your reasoning.



[13]

What is missing from the graph?

What is the scale?

What would happen if the scale was changed?

Lesson #2: Histograms & Scatter Plots Worksheets

Name:_____ Date:_____

Review

What is important to include in data representations and graphs so that it is accurate?

What are the differences between line and bar graphs? Are they interchangeable? Why or why not?

Name:_____ Date:_____

Review

What is important to include in data representations and graphs so that it is accurate?

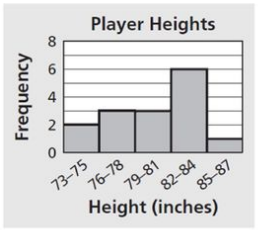
What are the differences between line and bar graphs? Are they interchangeable? Why or why not?

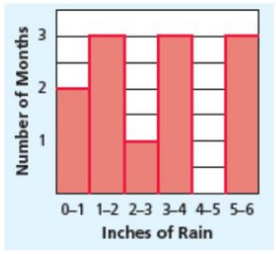
Name:_____ Date:_____

Compare and Contrast Data Displays [2]

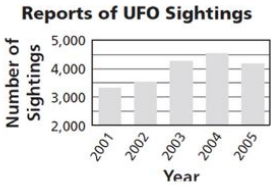
Observe the images of histograms and bar graphs below. Use the Venn Diagram to compare and contrast these graph types.

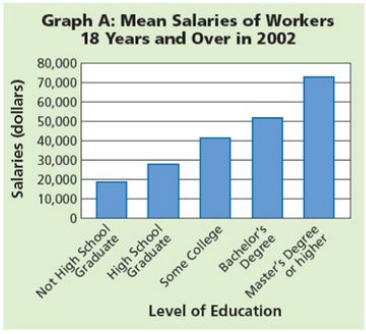
Histograms

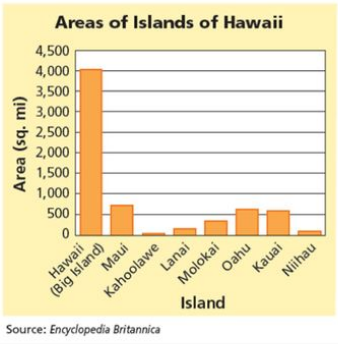


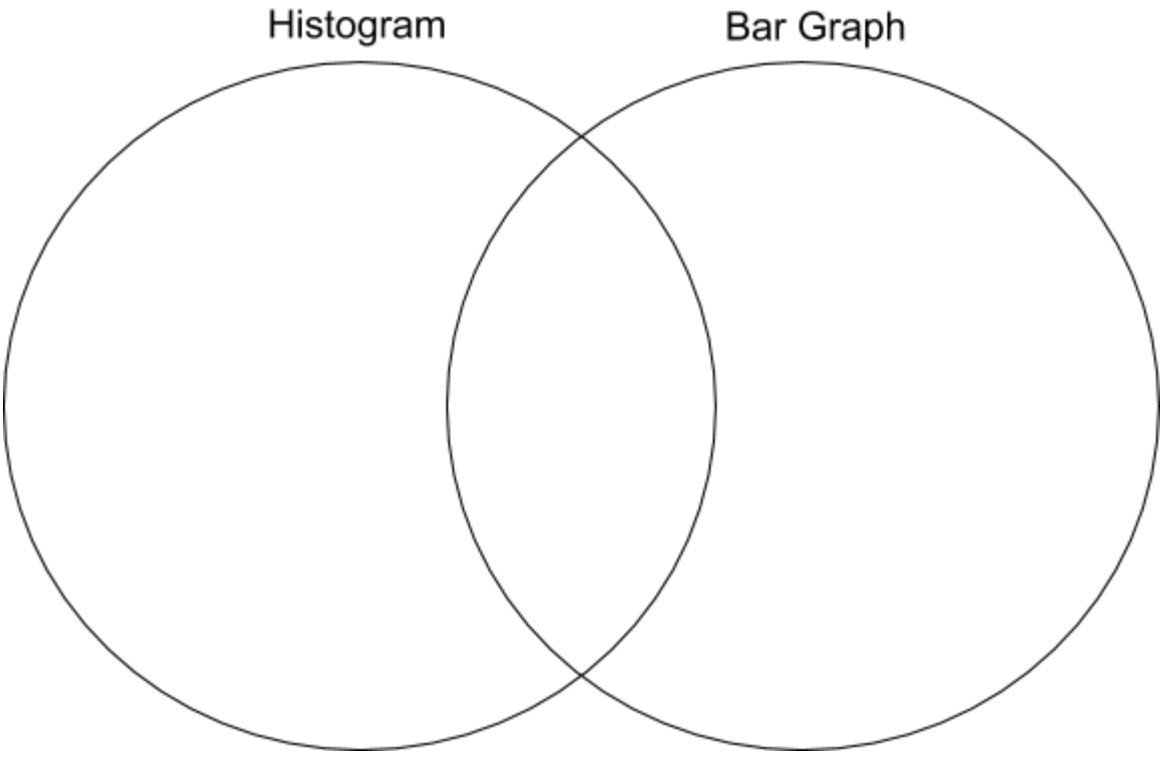


Bar Graphs



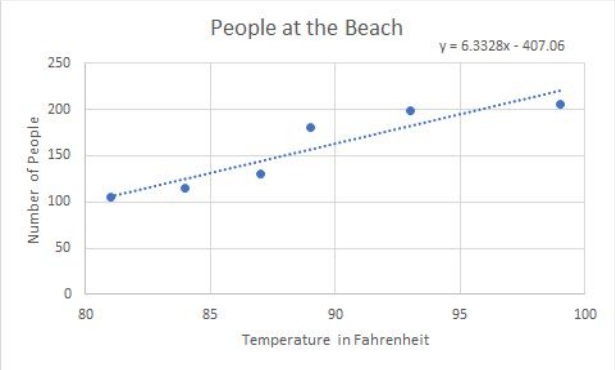




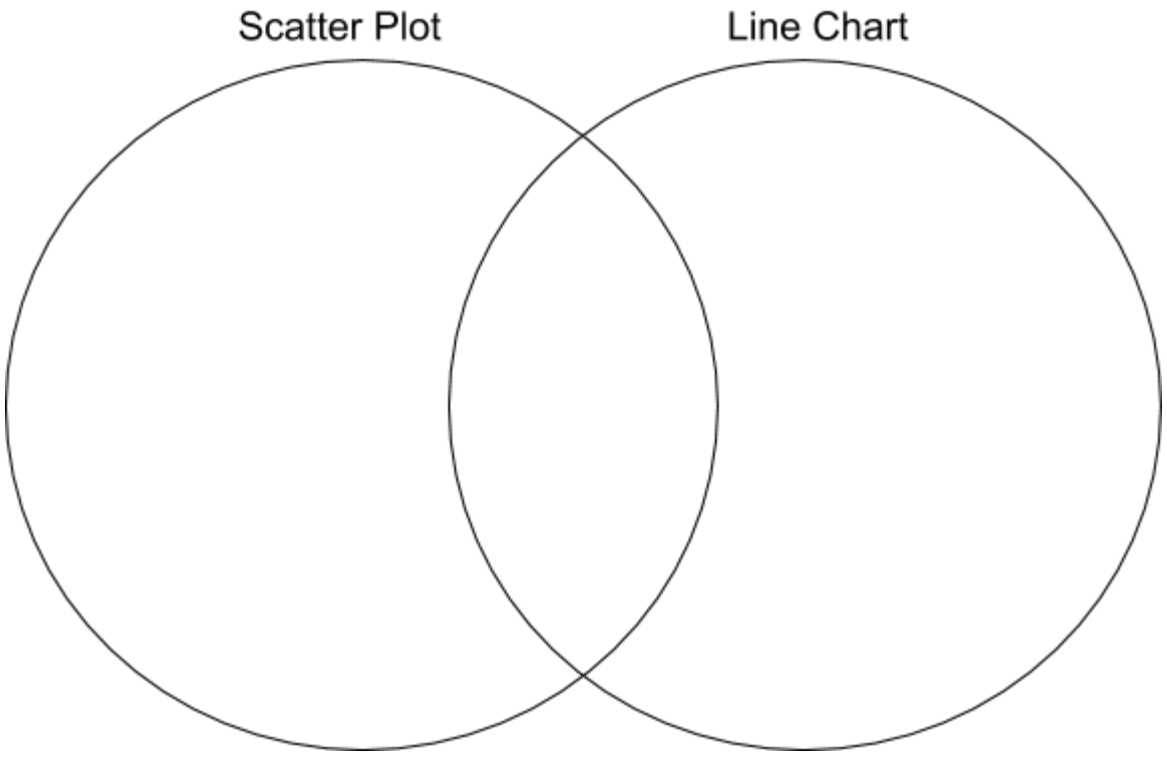


Observe the scatter plot and line chart below. Use the Venn Diagram to compare and contrast these graph types.

Scatter Plot



Line Chart



Name:_____ Date:_____

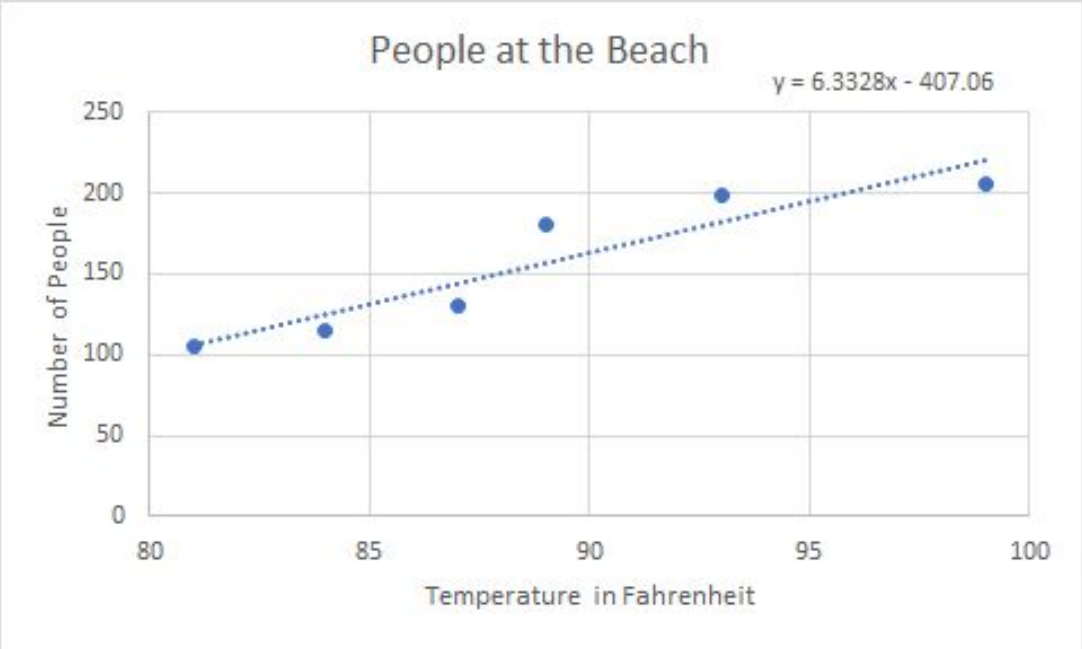
Understanding Scatter Plots and Histograms [8]

Part I:

Use the class key given by the instructor to access the Desmos Activity that explores scatter plots.

Part II:

Analyze the following scatter plot



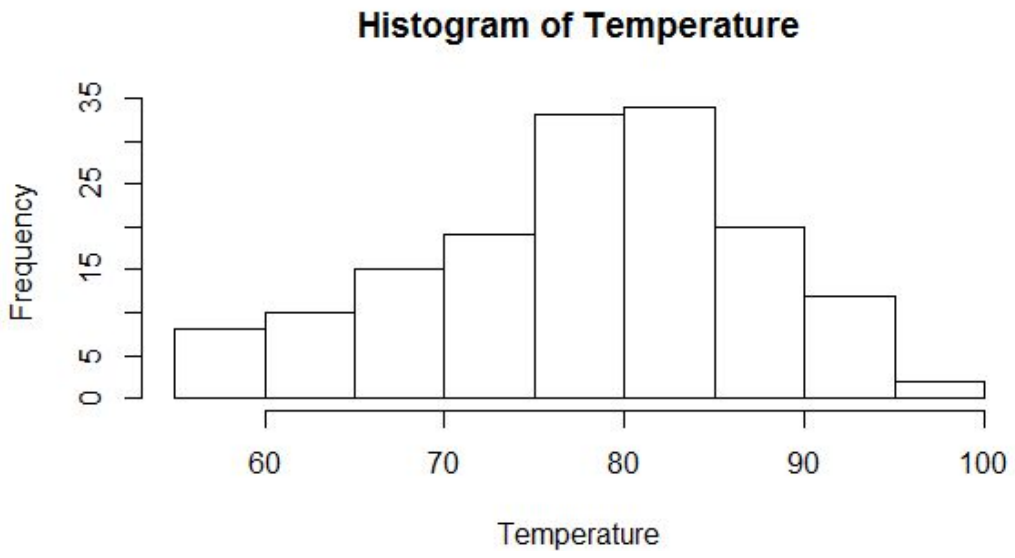
Roughly, how many people were at the beach when it was 89℉?

What is the equation for the best fit line?

Does the trendline have a positive or negative correlation? How can you tell?

Part III:

Your Environmental Science Laboratory collected data about daily average temperatures in the Northeast for the month of June over the last 5 years. This data was compiled and represented by a histogram. Observe the following graph and answer the associated questions.



[14]

What does frequency mean on the graph?

What is the most frequent temperature?

What is the least frequent temperature?

What is the average temperature?

What other statical representation does this remind you of? Defend your answer.

Part IV:

Your Environmental Science Laboratory collected data about daily average temperatures in the Northeast for the month of March over the last 5 years. This data was compiled into a table. Create a histogram that accurately represents the data. Be sure to include all graphical descriptors.

Temperature ℉	Frequency
Under 30	5
31-40	21
41-50	38
51-60	30
61-70	23
Over 70	2

Histogram:

Part V: [7]

For this activity, you will explore the Curve Fitting PHET simulation and answer the following questions. Before answering the questions, take a couple minutes by creating scatter plots and a fitting curve. Be sure to create different graphs shapes with differing trends.

What do the blue lines on each point show?

Where is the error of the line of best fit shown?

Is every line of best fit considered linear? Why or why not?

What happens if you fit the wrong type of line to a data set?

What causes a lot of error? What causes little error?

Lesson #1: Bar & Line
Answer Keys

Name:_____ANSWER KEY_____ Date:_____

How Can a Graph be Misleading? [1]

How can a bar graph be constructed such that the data is misrepresented?

Data can be represented in any multitude of ways depending how a graph is constructed. Consider altering the scale of a y-axis. This can lead to readers misinterpreting trends (or lack thereof) within the data because the y-axis manipulation ensures that the bars on the bar graph are visibly altered.

Why is it easy to manipulate data on a bar graph?

People tend to associate the size of the bar with either a negative or a positive connotation, depending the variable being compared. In turn, these association lead to the assignment of ratios between bar sizes, which are not frequently correct assumptions. Changing the scale of either axis can take advantage of this.

What do line charts normally show?

Change of one variable over the variable time.

How are line charts typically manipulated?

Both the x- and the y-axis can be manipulated. Certain information or trends can be left out as well, such as outliers.

What is Cherry Picking?

Cherry picking is the active, manipulative process of removing certain data or trends from a data representation. In essence, it is the removal of minute portions from a graph with the intention of presenting a specific expectation or result over depicting a true and accurate data representation.

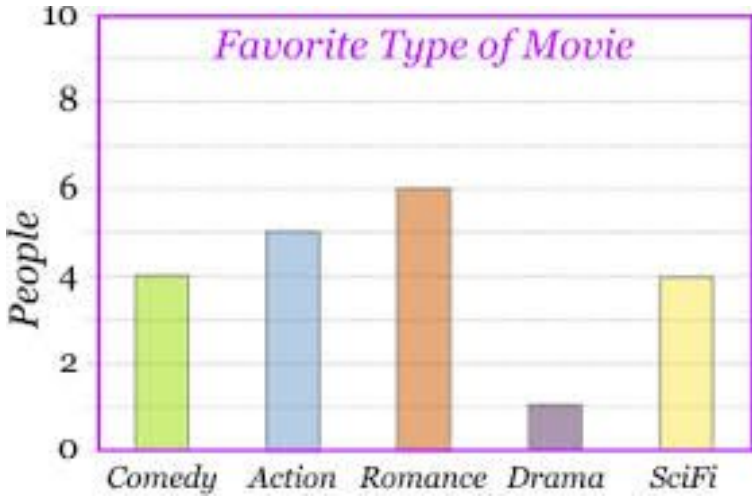
Why is an accurate representation of data important?

(There may be some student variation here.) Expect students to answer close to the following: accurate data representation is important because it allows for readers to make proper inferences and conclusions for the data set. It also allows for the creation of more effective solutions to real-world problems that are represented through the data.

Name:_____ANSWER KEY_____ Date:_____

Practice Reading Graphs

Practice reading the bar graph by answering the following questions.



[9]

What is the scale on the graph?

Each line of the y-axis is incremented by 1 unit (per person), but only the even numbers are shown.

How many people were polled?

20

How many people said that “Action” is their favorite type?

5

What percent of the population said that “Action” is their favorite type?

(5/20)*100 = 25%

Is this graph an accurate representation of the data? Why or why not?

Yes, the graph is not manipulated to favor one result over another e=because the scales are accurate.

Practice reading the line chart by answering the following questions.

What does the line graph represent?

Change in revenue over a time period of 6 months.

What is the scale of the graph? Discuss both axes.

The scale on the y-axis is incremented by 200K. The scale on the x-axis is incremented by 1 month.

What are the extremes of the graph?

Upper Extreme: 1,000K Lower Extreme: 500K

What is the overall trend of the graph?

It is increasing, almost linearly but not exact.

Explain what is happening between April and June?

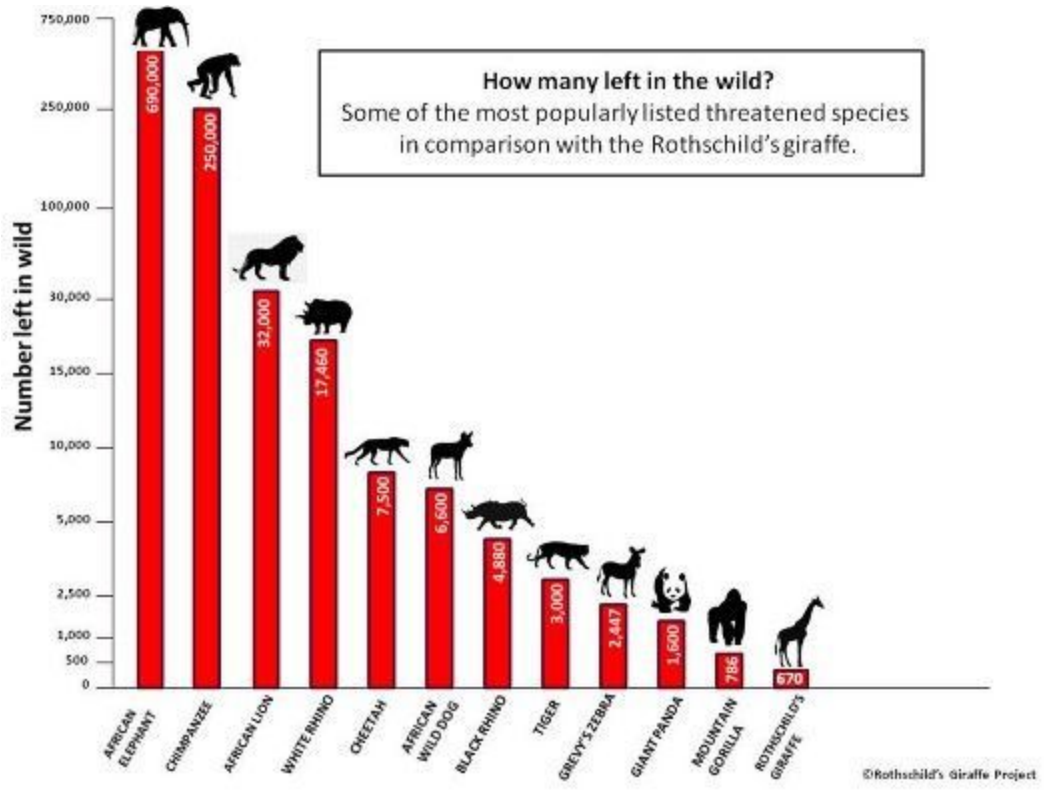
The revenue decreases from April to May. Then, the revenue increases from May to June.

Name:_____ANSWER KEY_____ Date:_____

Environmental Data

You are an environmental scientist. Your lab works on information with climate change while a colleague of yours works in a lab concerned about wildlife population. The labs share information with each other, and you have received data in the form of graphs and charts from your colleague. First, interpret the data they have sent you. Then, take the data that your lab has collected and turn it into graphs so that you can share it with the other lab.

The Wildlife Conservation Laboratory has sent you the following information about endangered species.



[10]

What does the creator of the graph want people to interpret about the data?

This graph is designed to show the extreme difference in the amount of Rothschild's giraffes left in the wild versus other popular endangered African mammals.

What is the scale?

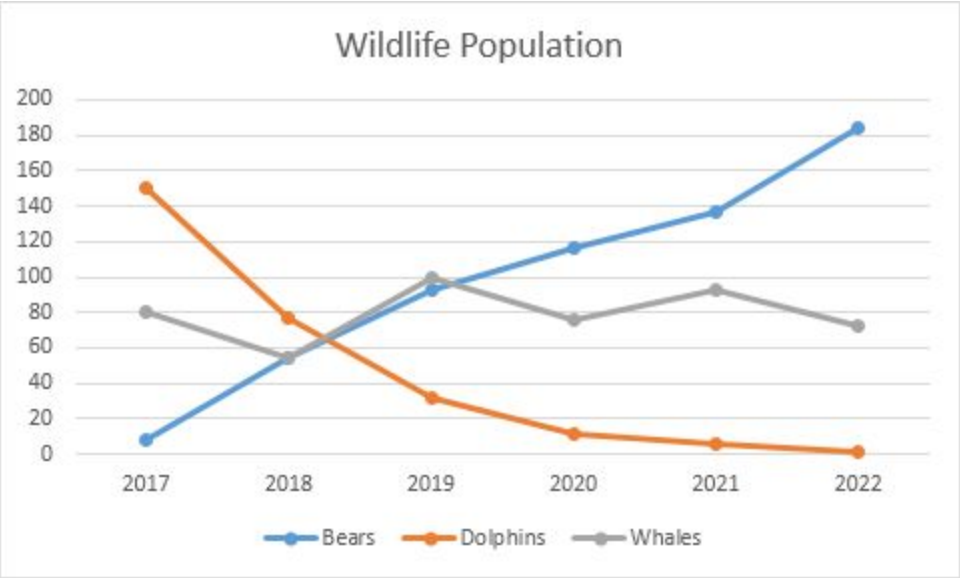
The y-axis scale varies and increases as incrementation continues. It is not consistent, and it is not clear if this increase is proportional or not.

How many variables is this graph dependent upon?
One (how many there are)

Does this show this descriptive or inferential statistics? Defend your response.

This is strictly descriptive because it only shows quantities that can be used to describe populations of animals.

The Wildlife Conservation Laboratory has sent you information conducted by two research studies on the same topic. Each study chose to represent their data differently. Observe the graphs from each study and answer the associated questions questions.



What is the general trend of each line?

The orange line is decreasing, more specifically exponential decay.
The blue line is increasing, more specifically linearly
The grey line is fluctuating but overall the trend is a relatively steady

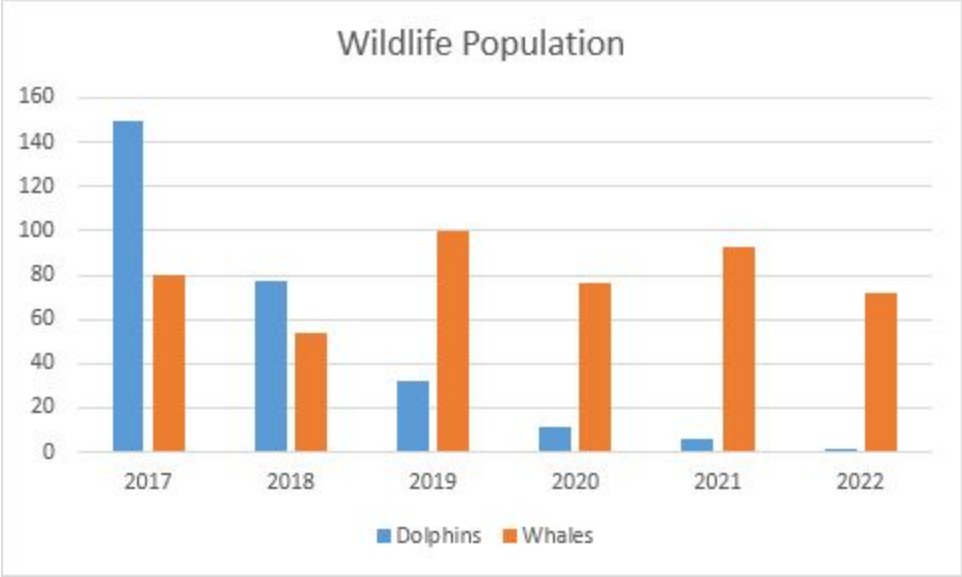
What is the scale of the graph?

Y-axis is incremented by 20 units
X-axis is incremented by a time period of 1 year

How many variables are used?
2: time and population

Does this show descriptive or inferential statistics? Why?

This graph shows both descriptive and inferential statistics. It is descriptive because the numbers can be used to describe the population size, but it is also inferential because future predictions are made.



How does the data in this graph vary from the data in the previous graph?

The colors assigned to the specific populations of animals are different than the previous graph. The data is represented by bars instead of points.

Compare the numbers for each year. Are they different or the same? Does this affect the general trend or purpose of the graphs?

The numbers in both graphs are the same; they are just shown differently. You can still see a similar trend in both graphs even though they show the same information in different ways. You could draw a trend line over the bars and it would be very similar to the trend line on the previous line chart.

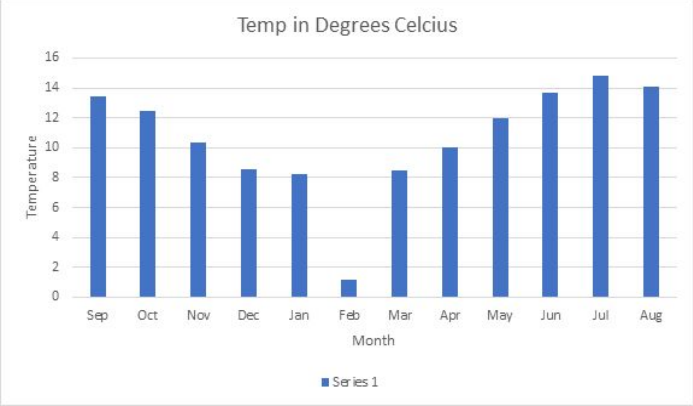
Which graph do you prefer and why?

This is based on the students' opinion, but they should have at least one reason as to why they made a specific decision, e.g. "it's easier to read," "it shows the trend line," etc.

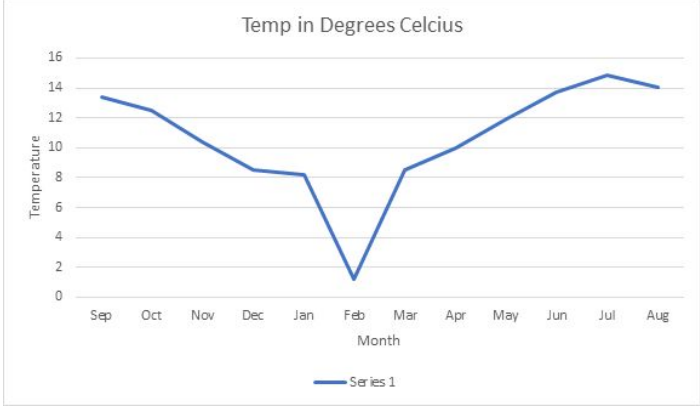
Listed below in the table is the data about temperature from a local stream that your lab collected. You are to take this data and accurately represent it using both a bar graph and a line graph. Be sure to include all graphical descriptors (i.e. titles, scales, labels, etc.)

Temperature Degrees Celsius	Month
13.40	September
12.50	October
10.35	November
8.52	December
8.23	January
1.17	February
8.48	March
10.00	April
11.95	May
13.71	June
14.82	July
14.05	August

Bar Graph



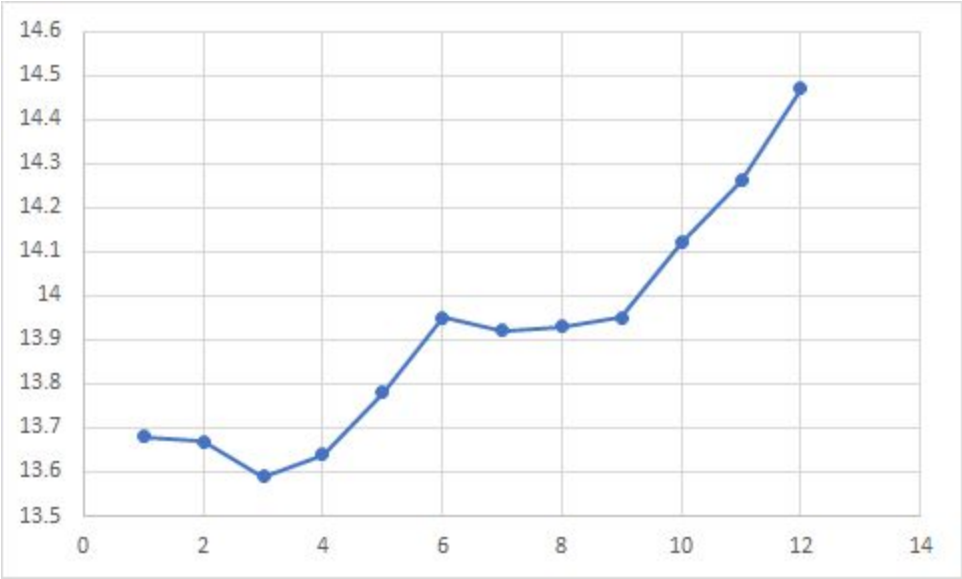
Line Chart



Name:_____ANSWER KEY_____ Date:_____

What's Missing?

There are several graphs from your lab that are not quite right. You need to identify and correct what is wrong with them to prevent data misrepresentation.

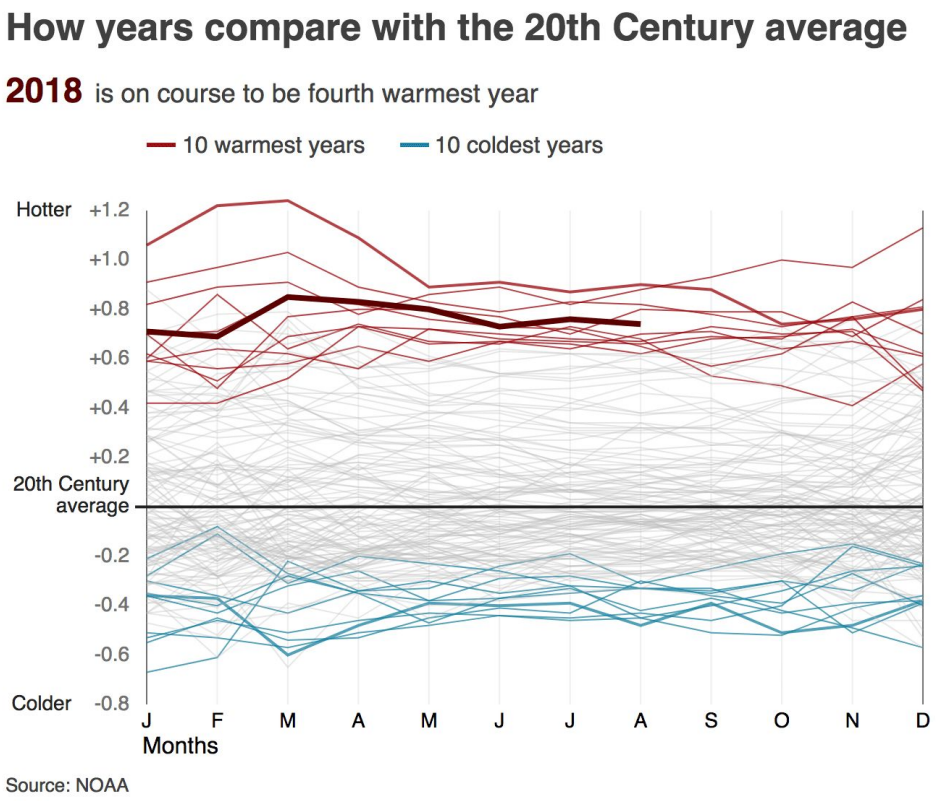


What is wrong with this chart?

There are no labels or title.

Is it usable for anything? Why or why not?

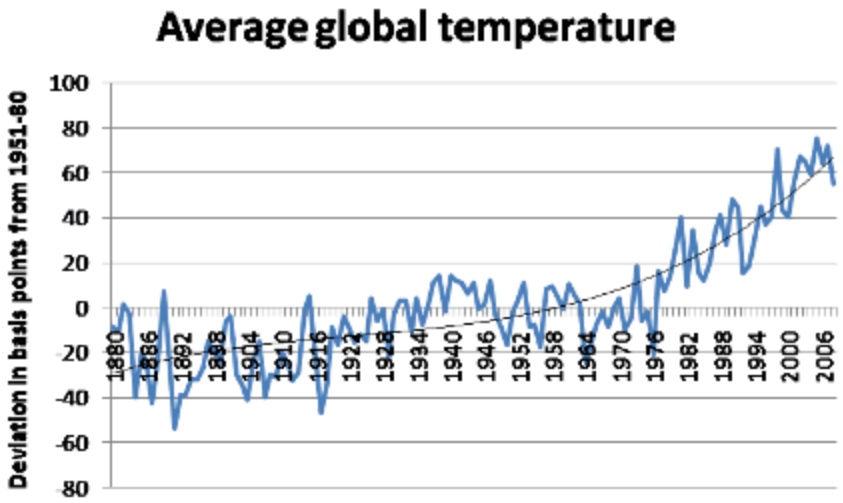
No it is not because there is no way of knowing the purpose of the graph or what data represents.



[11]

What is missing from this chart? How can it be made better?

The lines are not labeled so there is no way of knowing which line is for what year and how the information can then be used. It can be made better by labeling lines by year to see trends over time.



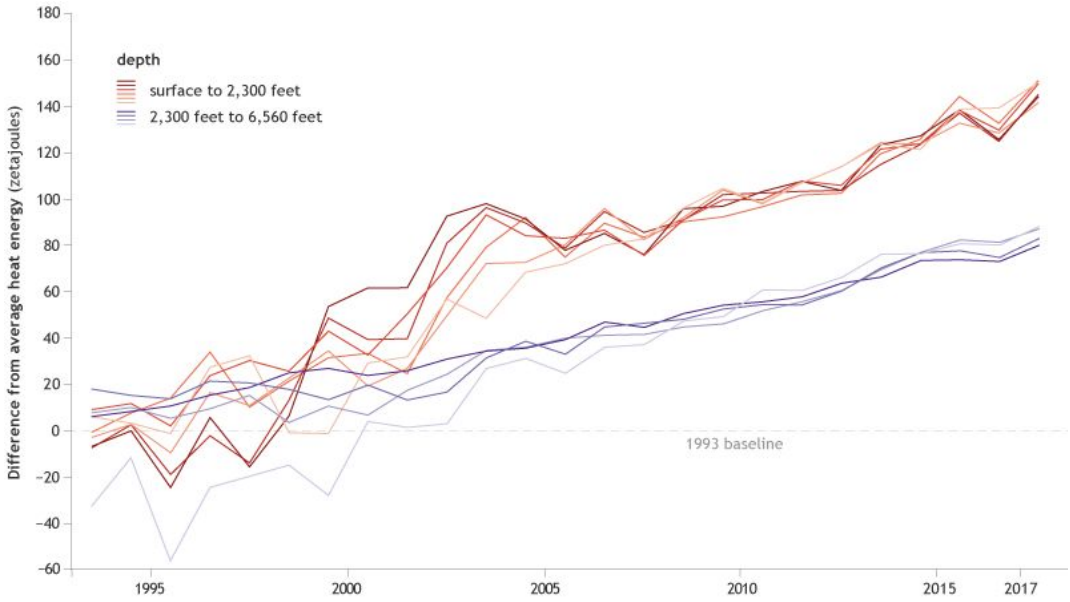
[12]

Is this a good graph? Why or Why not?

Yes, because it is properly labeled with an accurate scale and proper trendline.

How could someone cherry pick this graph to make it look like global temperature is not changing? Provide at least one example, and explain your reasoning.

Someone could cherry pick this graph by only representing a small window of time. For example, one could choose to show trends between the years of 1886 and 1892 or between 1910 and 1916. Both of these cherry picked representations would result in a drastically different trendline, which would lead to misrepresentation and possible misinterpretation.



[13]

What is missing from the graph?

A title.
What is the scale?

20 zetajoules

What would happen if the scale was changed?

If the scale was increased, then the trendline would look like horizontal line.
If the scale was decreased, then the trendline would look like vertical line.

Lesson #2: Histograms & Scatter Plots Answer Keys

Name:_____ANSWER KEY_____ Date:_____

Review

What is important to include in data representations and graphs so that it is accurate?

Title, axis labels, proper scales, and proper reporting of all the collected data

What are the differences between line and bar graphs? Are they interchangeable? Why or why not?

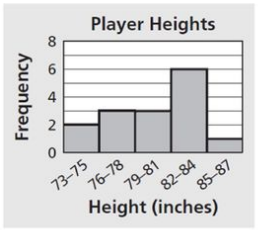
Bar graphs use bars to show quantities for each category while line graphs use points connected by a line to show a possible trend. Typically, a line graph shows change over time. They are interchangeable only if there are two variables being compared and if they both show change over time.

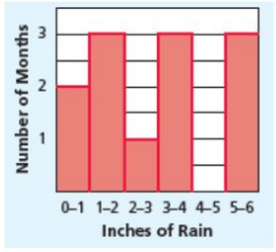
Name:_____ANSWER KEY_____ Date:_____

Compare and Contrast Data Displays [2]

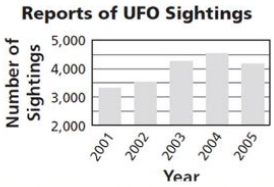
Observe the images of histograms and bar graphs below. Use the Venn Diagram to compare and contrast these graph types.

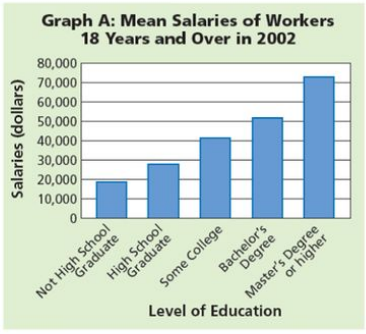
Histograms

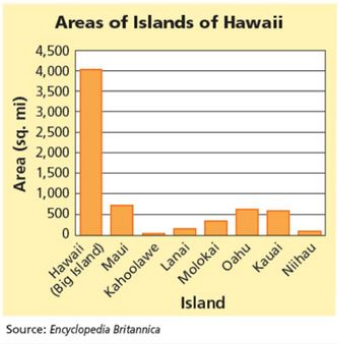




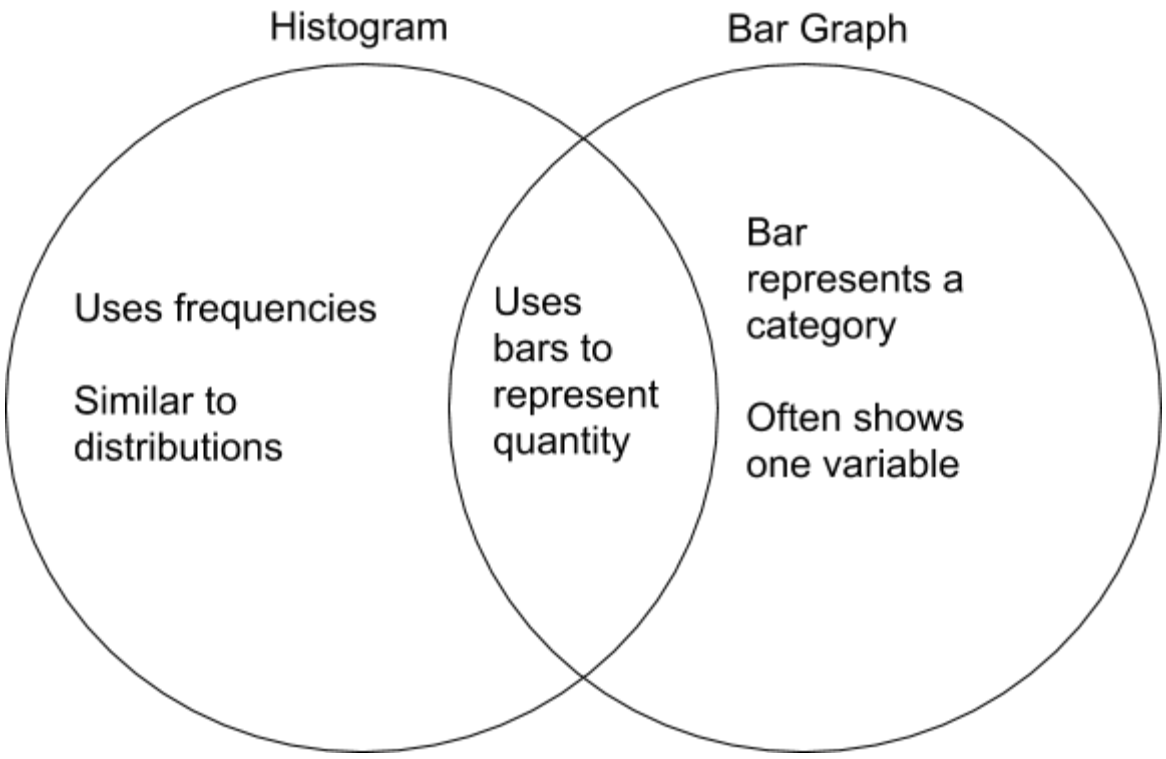
Bar Graphs





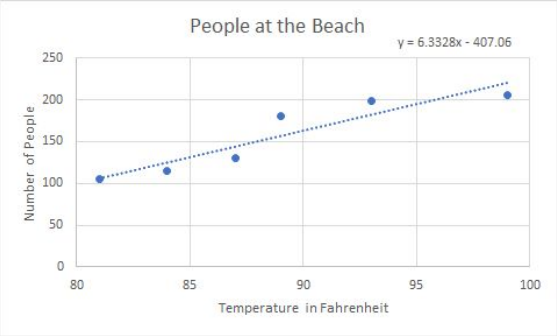


Source: *Encyclopedia Britannica*

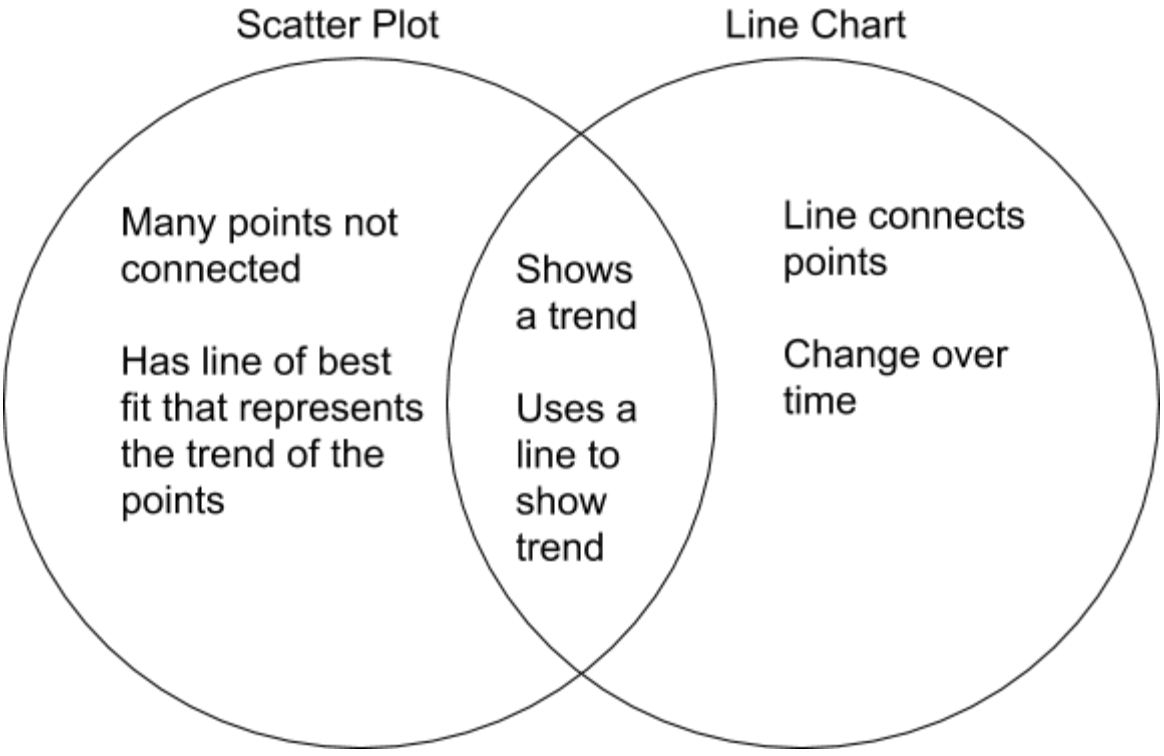


Observe the scatter plot and line chart below. Use the Venn Diagram to compare and contrast these graph types.

Scatter Plot



Line Chart



Name:_____ANSWER KEY_____ Date:_____

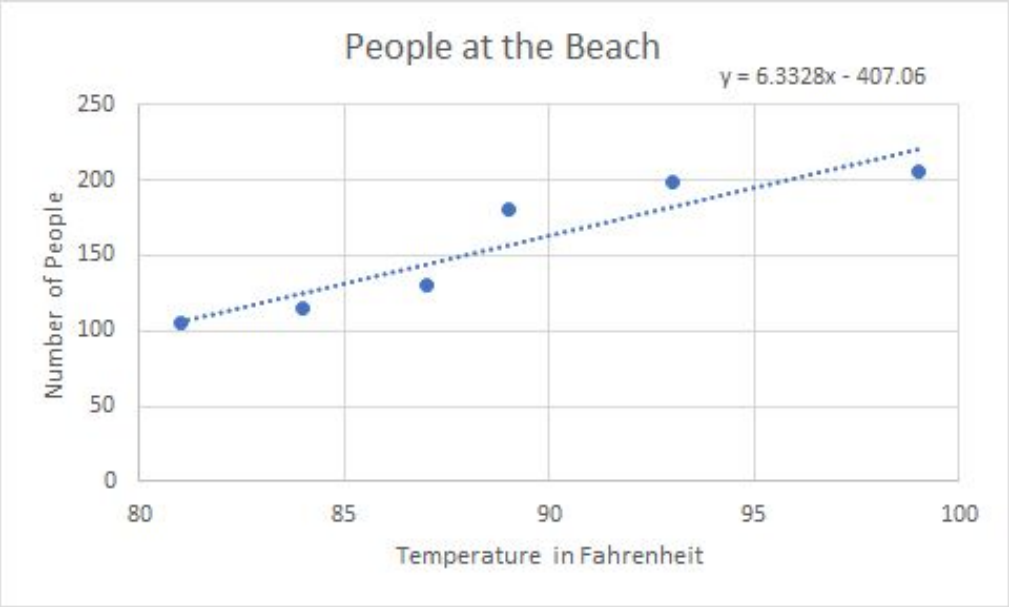
Understanding Scatter Plots and Histograms [8]

Part I:

Use the class key given by the instructor to access the Desmos Activity that explores scatter plots.

Part II:

Analyze the following scatter plot



Roughly, how many people were at the beach when it was 89℉?

160

What is the equation for the best fit line?

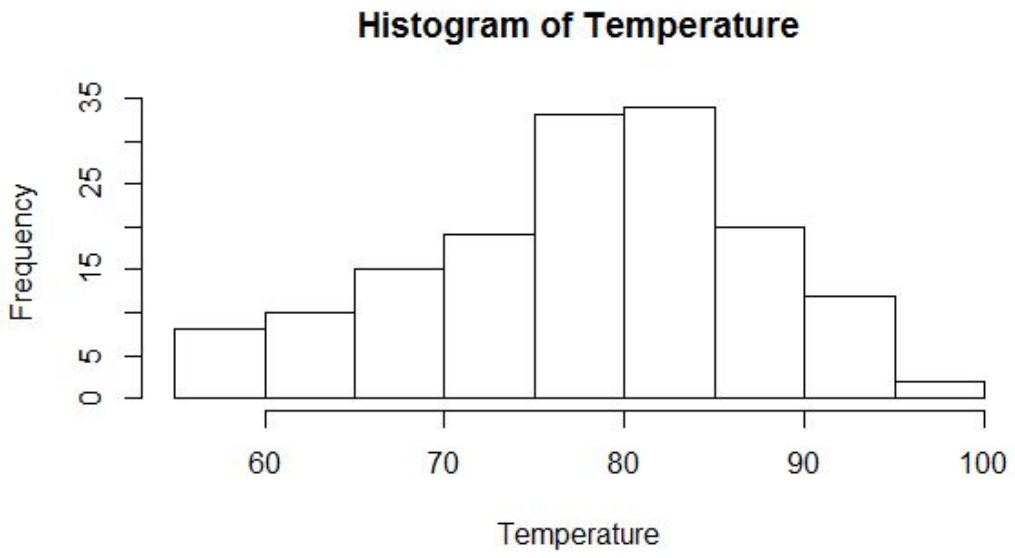
y = 22.9x+98.4

Does the trendline have a positive or negative correlation? How can you tell?

Positive because the line is linearly increasing.

Part III:

Your Environmental Science Laboratory collected data about daily average temperatures in the Northeast for the month of June over the last 5 years. This data was compiled and represented by a histogram. Observe the following graph and answer the associated questions.



[14]

What does frequency mean on the graph?

How often a given temperature occurred.

What is the most frequent temperature?

85

What is the least frequent temperature?

95-100

What is the average temperature?

About 80

What other statical representation does this remind you of? Defend your answer.

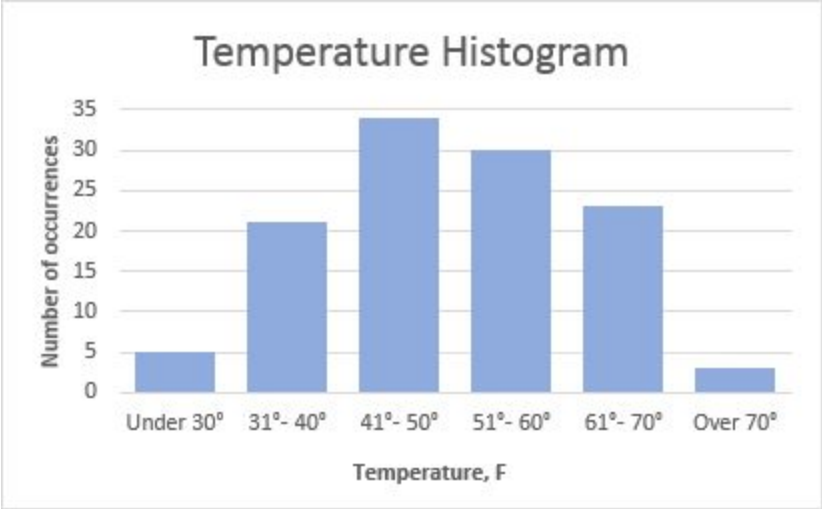
A normal distribution because of its bell-shape

Part IV:

Your Environmental Science Laboratory collected data about daily average temperatures in the Northeast for the month of March over the last 5 years. This data was compiled into a table. Create a histogram that accurately represents the data. Be sure to include all graphical descriptors.

Temperature ℉	Frequency
Under 30	5
31-40	21
41-50	38
51-60	30
61-70	23
Over 70	2

Histogram:



[15]

Part V: [7]

For this activity, you will explore the Curve Fitting PHET simulation and answer the following questions.

What do the blue lines on each point show?

They show the deviation, which is the range that the point can be in to the line of best fit without showing a lot of error

Where is the error of the line of best fit shown?

On the left hand side

Is every line of best fit considered linear? Why or why not?

No, because it is dependent on the shape of the point and the type of correlation resulting from the points.

What happens if you fit the wrong type of line to a data set?

The error can be very large

What causes a lot of error? What causes little error?

Proper curve fitting reduces error. Large deviations cut down on error while smaller deviation causes greater error. The closer the points are to a trend line also reduces error. If there is an outlying point, then error increases.

Annotated Bibliography

[1] TED-Ed. (2017, July 06). How to spot a misleading graph - Lea Gaslowitz. Retrieved from https://www.youtube.com/watch?v=E91bGT9BjYk

This video is used the Graphing Unit Plan as part of the Measurements and Data Analysis module. This video is used as an educational tool for students to watch. Definitions are also taken from this video.

[2] Hammel, J., & Hammel, J. (2013, July 16). An Introduction to Histograms. Retrieved from https://betterlesson.com/lesson/448257/an-introduction-to-histograms?from=search

This lesson plan was used for research and content inspiration. This reference aided in the completion of definitions and graphing activities in this lesson. Images were also take from this source.

[3] Standards Aligned System. (n.d.). Retrieved from https://www.pdesas.org/

This website was used in each lesson in the Measurements and Data Analysis module to select proper Pennsylvania State standards, which are based in Common Core, that each lesson is centered around.

[4] Standards for Mathematical Practice. (n.d.). Retrieved from http://www.corestandards.org/Math/Practice/

This website used in every lesson in the Measurements and Data Analysis module to find Standards for Mathematical Practices that are applicable in each lesson.

[5] Nsta. (n.d.). Disciplinary Core Ideas. Retrieved from https://ngss.nsta.org/DisciplinaryCoreIdeasTop.aspx

This website was used in each lesson in the Measurements and Data Analysis module to select appropriate disciplinary core ideas set forth by the NSTA that are at the center of each lesson.

[6] Nsta. (n.d.). Crosscutting Concepts. Retrieved from https://ngss.nsta.org/CrosscuttingConceptsFull.aspx

This website was used in each lesson in the Measurements and Data Analysis module to selecting appropriate crosscutting concepts set forth by the NSTA that apply to each mathematics lesson.

[7] Curve Fitting. (2014, July 28). Retrieved from https://phet.colorado.edu/en/simulation/legacy/curve-fitting

This is used in the Graphing Unit Plan in the Measurements and Data Analysis module as an educational tool for students to explore curve fitting. It was also used as inspiration for the creation of questions that students answer as part of the activity.

[8] Exploring Scatterplots. (n.d.). Retrieved from https://teacher.desmos.com/activitybuilder/custom/56494962c2926ca30fdae36a

This is used in the Graphing Unit Plan in the Measurement and Data Analysis module as an educational tool for students and teachers to explore scatter plots.

[9] (n.d.). Retrieved from https://www.mathsisfun.com/data/bar-graphs.html

This image was excerpted from the reference for use within the Graphing Unit Plan in the Measurement and Data Analysis module. This image aided in the completion the Practicing Reading Graphs worksheet.

[10] Girafferesearch. (2014, November 07). The Rothschild's Giraffe Project - wildlife conservation work in Kenya to save giraffes in the wild. Retrieved from https://www.youtube.com/watch?v=ptqGxsCopfo&t=53s

This video was used to excerpt an image of a graph within the Graphing Unit Plan in the Measurement and Data Analysis module. This image aided in the completion the Environmental Data worksheet.

[11] What is climate change? (2018, December 03). Retrieved from https://www.bbc.com/news/science-environment-24021772

This image was excerpted from the reference for use within the Graphing Unit Plan in the Measurement and Data Analysis module. This image aided in the completion the What's Missing? worksheet.

[12] Temperature trends. (2009, June 27). Retrieved from https://krugman.blogs.nytimes.com/2009/06/27/temperature-trends/

This image was excerpted from the reference for use within the Graphing Unit Plan in the Measurement and Data Analysis module. This image aided in the completion the What's Missing? worksheet.

[13] Dahlman, L., & Lindsey, R. (2018, August 01). Climate Change: Ocean Heat Content. Retrieved from https://www.climate.gov/news-features/understanding-climate/climate-change-ocean-heat-content

This image was excerpted from the reference for use within the Graphing Unit Plan in the Measurement and Data Analysis module. This image aided in the completion the What's Missing? worksheet.

[14] R hist() to Create Histograms (With Numerous Examples). (2018, April 11). Retrieved from https://www.datamentor.io/r-programming/histogram/

This image was excerpted from the reference for use within the Graphing Unit Plan in the Measurement and Data Analysis module. This image aided in the completion the Understanding Scatter Plots and Histograms worksheet.

[15] How to create a histogram chart in Excel 2019, 2016, 2013 and 2010. (2019, April 02). Retrieved from https://www.ablebits.com/office-addins-blog/2016/05/11/make-histogram-excel/

This image was excerpted from the reference for use within the Graphing Unit Plan in the Measurement and Data Analysis module. This image aided in the completion the answer key for Understanding Scatter Plots and Histograms worksheet.