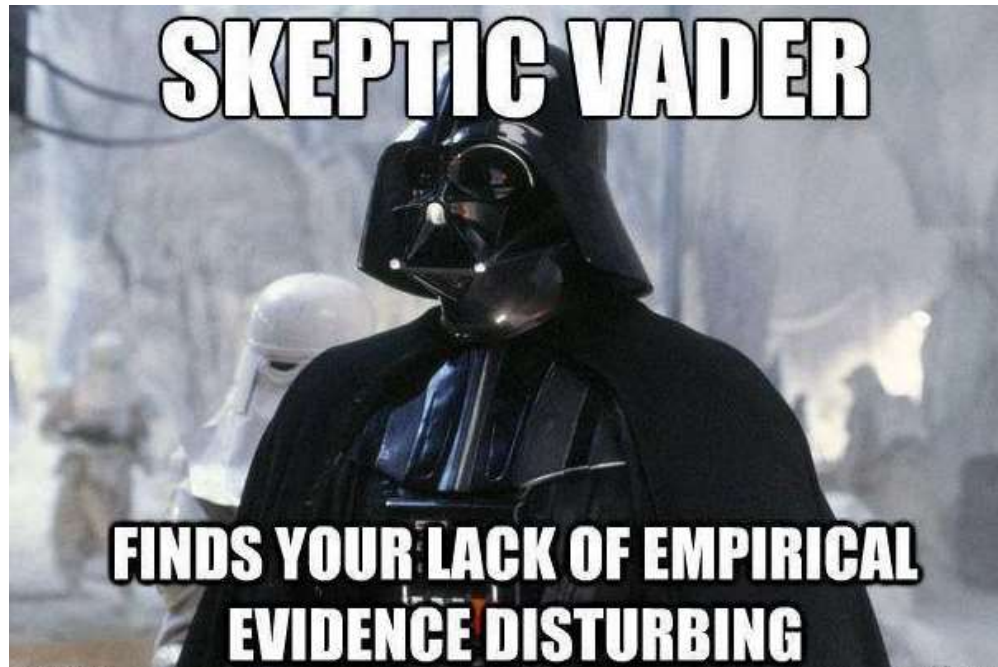


Friday, August 9, 2019

**Welcome to Investigative Science
with Mr. Fireng**



1. Get out your stampsheet
2. Get out your homework
3. Write tomorrow's homework in agenda
4. START WORKING QUIETLY

Investigative Science



Learning goal: Properly apply all steps in the scientific method when problem solving.

Friday, August 9, 2019

Learning goal: Properly apply all steps in the scientific method when problem solving.

Learning scale:

1	2	3	4
Name the steps	Name the steps and follow directions in an investigation	Can design and conduct an investigation leading to a conclusion	Design and carry out an investigation leading to a valid and rational conclusion

Student's self-evaluation: Complete at home or at the end of class, use the **4-3-2-1** Learning scale (two to three sentences).



- 4**
Design, complete, valid conclusion
- 3**
Design & complete
- 2**
Know steps, follow directions
- 1**
Know the steps

Investigative Science

Learning goal: Properly apply all steps in the scientific method when problem solving.

Review



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I-TALK



I = Information: Type of information matches the graph. The correct type of graph is being used (bar vs. line graph, etc..).

T = Title: The graph contains a title that describes what the graph is about. An experimental question works well for a title.

A = Axis: The X, Y-axis are scaled correctly and spaced evenly. The graph takes up as much of the paper as possible.

L = Labels: Each axis is label with units

K = Key: If more than one data set is in the graph, the key describes which line is which.

4

Design, complete, valid conclusion

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Review



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Graphing Skill #2: What Type of Graph is it?

There are several types of graphs that scientists often use to display data. They include:

Pie Graphs	Bar Graphs	Histograms	Line Graphs	Scatter Plots
<ul style="list-style-type: none"> Dependent variable is NOT continuous Usually presents data as a "part of a whole" or as percentages 	<ul style="list-style-type: none"> Dependent variable is NOT continuous There is no order to the categories on the X-axis Bars typically don't touch Y-axis is usually a percentage or a frequency (count) 	<ul style="list-style-type: none"> A specific type of bar graph Dependent variable must have a natural order that can be grouped into defined "chunks" Bars must always touch Y-axis is usually a percentage or a frequency (count) 	<ul style="list-style-type: none"> Dependent variable IS continuous Points are plotted using x- and y-components The points are connected because the observations are NOT independent (the next value depends on the previous value) 	<ul style="list-style-type: none"> Dependent variable IS continuous Points are plotted using x- and y-components The points are NOT connected because the observations are independent (the next value does NOT depend on the previous value) Uses a best-fit line or curve to show relationship

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Design,
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Review



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Graphing Skill #2: What type of graph?

What are you trying to do? When you're putting together a chart, you're trying to show one of four things with the data you have: a *relationship* between data points, a *comparison* of data points, a *composition* of data, or a *distribution* of data.

- **A relationship** tries to show a connection or correlation between two or more variables
- **A comparison** tries to set one set of variables apart from another
- **A composition** tries to collect different types of information that make up a whole and display them together
- **A distribution** tries to lay out a collection of related or unrelated information simple to see how it correlates

4

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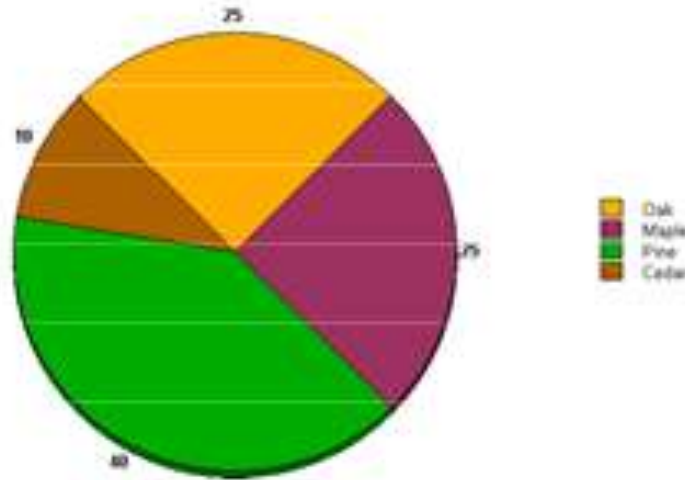
Review



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Pie Graphs

Percent of Trees Found in Missouri



- Dependent variable is NOT continuous
- Usually presents data as a “part of a whole” or as percentages

4

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Learning goal: Properly apply all steps in the scientific method when problem solving.

Review

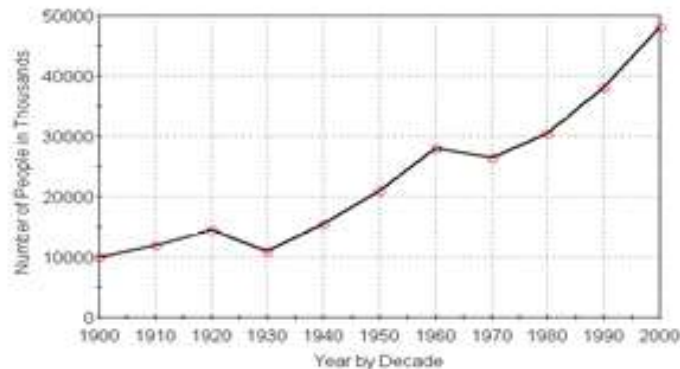


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4

Line Graphs

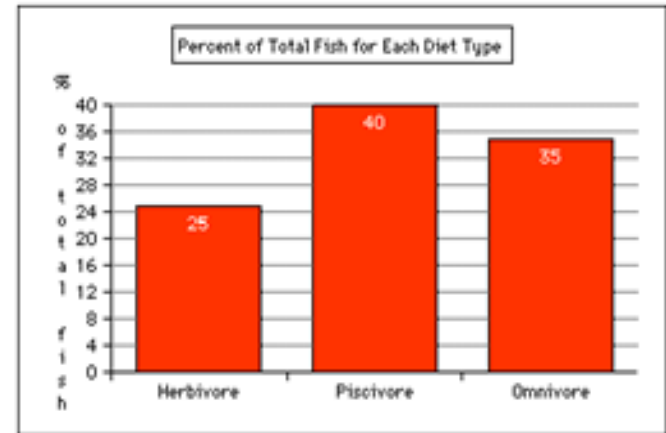
Population of Wildwood



- Dependent variable IS continuous
- Points are plotted using x- and y-components
- The points are connected because the observations are NOT independent (the next value depends on the previous value)

Bar Graphs

Percent of Total Fish for Each Diet Type



- Dependent variable is NOT continuous
- There is no order to the categories on the X-axis
- Bars typically don't touch
- Y-axis is usually a percentage or a frequency (count)

KNOW THE steps

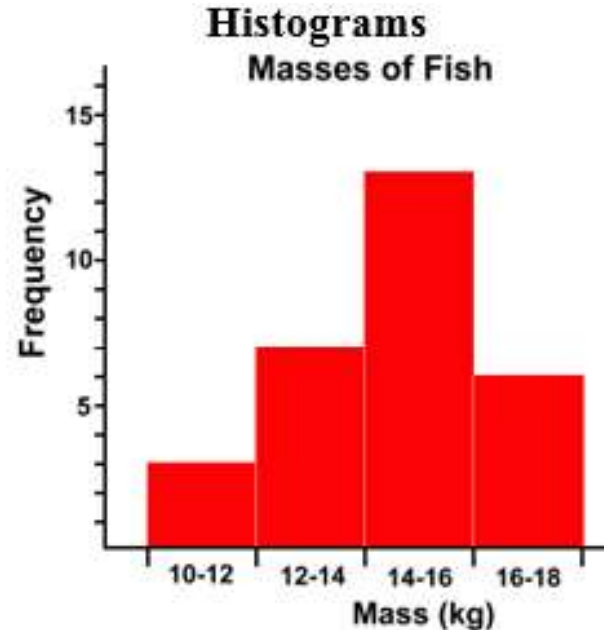
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Review



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- A specific type of bar graph
- Dependent variable must have a natural order that can be grouped into defined “chunks”
 - Bars must always touch
- Y-axis is usually a percentage or a frequency (count)

4

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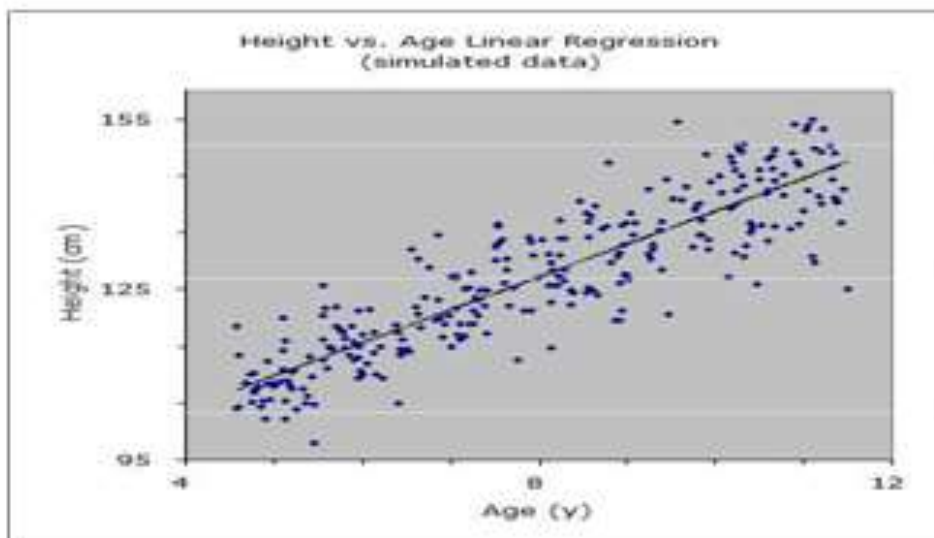
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Review



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Scatter Plots



- Dependent variable IS continuous
- Points are plotted using x- and y-components
- The points are NOT connected because the observations are independent (the next value does NOT depend on the previous value)
- Uses a best-fit line or curve to show relationship

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Design, complete, valid conclusion

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Review



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Graphing Skill #3: Labeling Axes

When labeling your axes, keep 3 things in mind: Remember **DRY-MIX!**

1. The **independent** (manipulated) variable is written along the horizontal axis (**X axis**)
2. **Dependent** (responding) variable is written along the vertical axis (**Y axis**)
3. **Units** on any variables should be included in **parentheses ()** following the axis title

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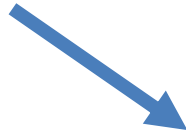
Learning goal: Properly apply all steps in the scientific method when problem solving.

Review



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Write this ON graph handout



DRY MIX

Dependent variable

Responding

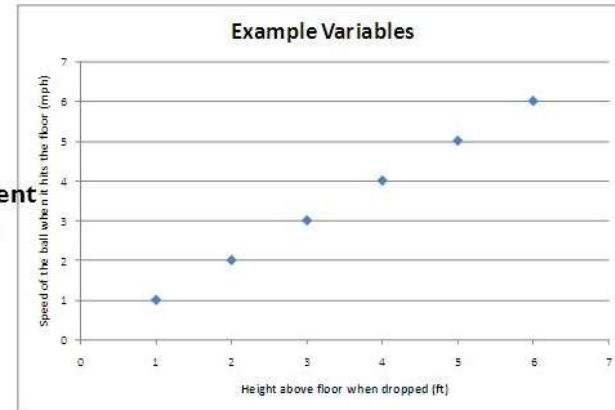
Y-Axis

Manipulated

Independent variable

X-Axis

Dependent Variable



Independent Variable

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Review



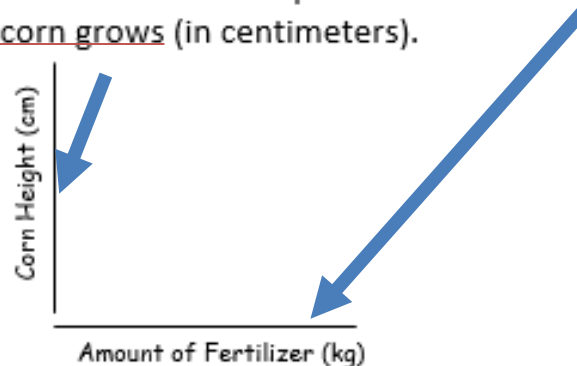
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Graphing Skill #3: Labeling Axes

Practice Problems

For each experiment described below, write the independent and dependent variable on the appropriate axis. Be sure to include units when appropriate.

SAMPLE: A farmer wants to know if there is a relationship between the amount of fertilizer (in kilograms) she uses and how tall her corn grows (in centimeters).



3.1

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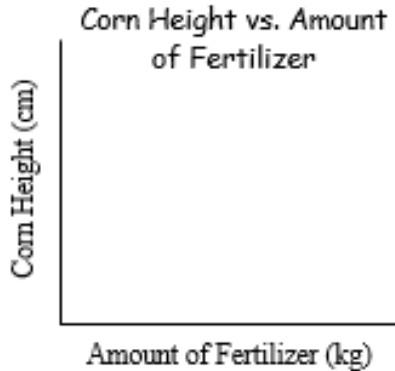
Review



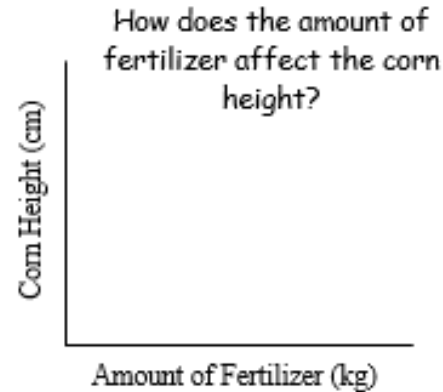
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Graphing Skill #4: Creating Titles

SAMPLE: A farmer wants to know if there is a relationship between the amount of fertilizer (in kilograms) she uses and how tall her corn grows (in centimeters).



OR



Good

Better

4
Design, complete, valid conclusion

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Investigative Science



Learning goal: Properly apply all steps in the scientific method when problem solving.

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Graphing Skill #5: Scaling Axes

There are a few important steps involved in correctly scaling an axis:

STEP 1: Find the range for the variable

Range = Largest Value - Smallest Value

EX.	Mass (g)
	5
	11
	14
	19
	26
	30
	40

Largest #: 40

Smallest #: 5

Range: 35-5 = 35

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Graphing Skill #4: Scaling Axes

There are a few important steps involved in correctly scaling an axis:

STEP 2: Divide the range by the number of squares on your graph (intervals). After dividing, we may need to **round up** to get a number that is easy to count by. (It is easier to count by 2s instead of 1.9s).

Assume that our graph has **9** intervals

$$\text{Range} = \underline{\quad 35 \quad}$$

$$\# \text{ of intervals} = \underline{\quad 9 \quad}$$

$$\frac{\text{Range}}{\text{Intervals}} = \frac{35}{9} = 3.8$$

$$\text{Round to Count} = 4$$

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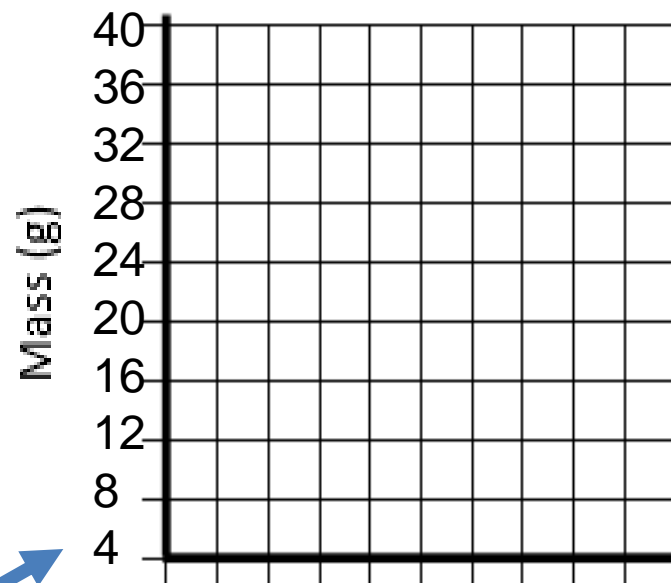
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Graphing Skill #5: Scaling Axes

There are a few important steps involved in correctly scaling an axis:

STEP 3: Use the rounded number to mark off intervals along the axis. (write this!!) Start one value below lowest number (not always 0)**

The interval must be the same amount each time (count up by the same number).



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Review



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Graphing Skill #6: Plotting Points

Plotting points can be easy if you follow these simple steps...

STEP 1: **Select** the first pair of values from the data table (**X and Y**).

STEP 2: Draw a light dashed line up from the number on the X axis and over from the number on Y axis (if you want).

Once you get good at plotting points, you won't need to draw these lines anymore

STEP 3: Where these dotted lines cross, **put a dark point**. Repeat for the next pair of points.

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Review

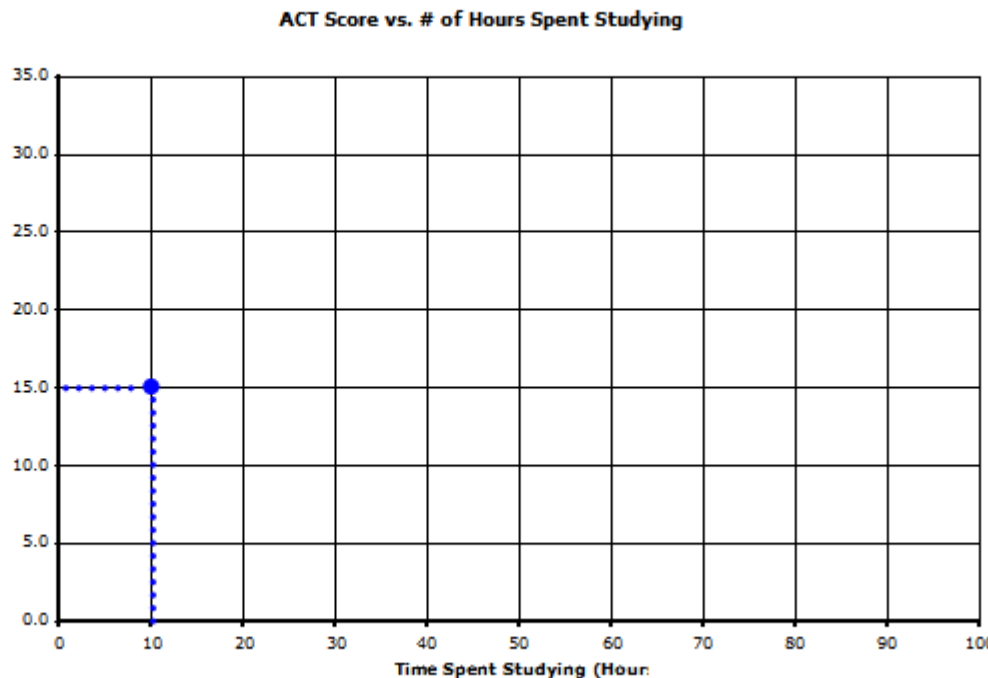


Friday, August 9, 2019

Graphing Skill #6: Plotting Points

Practice: Please plot these points. The first pair has been plotted for you as an example.

Time Spent Studying (hours)	Score (pts)
10	15.0
20	17.0
30	19.0
40	21.0
50	23.0
60	25.0
70	27.0
80	29.0
90	31.0



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How does distance affect time?

Distance (cm)
3
5
6
7
9
10
12

Time (s)
0.22
0.51
0.78
1.01
1.23
1.60
1.74

Largest #: _____

Largest #: _____

Smallest #: _____

Smallest #: _____

Range: _____

Range: _____

How does distance affect time?

Range = _____

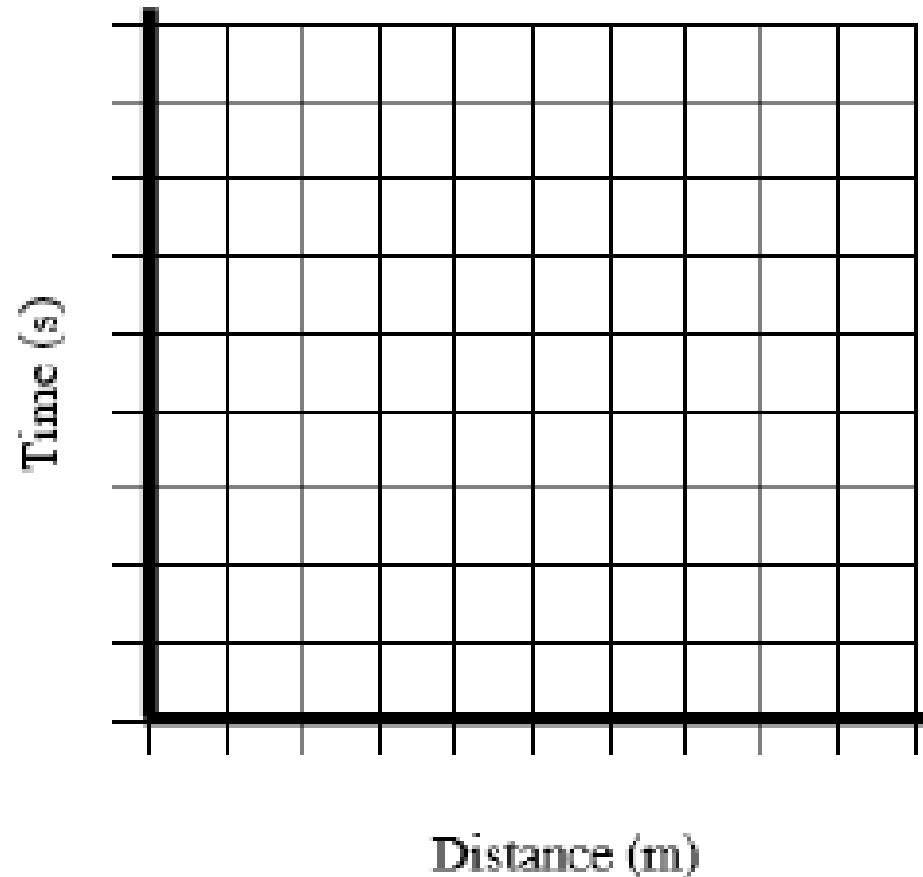
Range = _____

of intervals = _____

of intervals = _____

How does distance affect time?

Distance vs. Time



<https://www.youtube.com/watch?v=GUYRMdcEs00>



bozemanscience.com

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Learning goal: Properly apply all steps in the scientific method when problem solving.

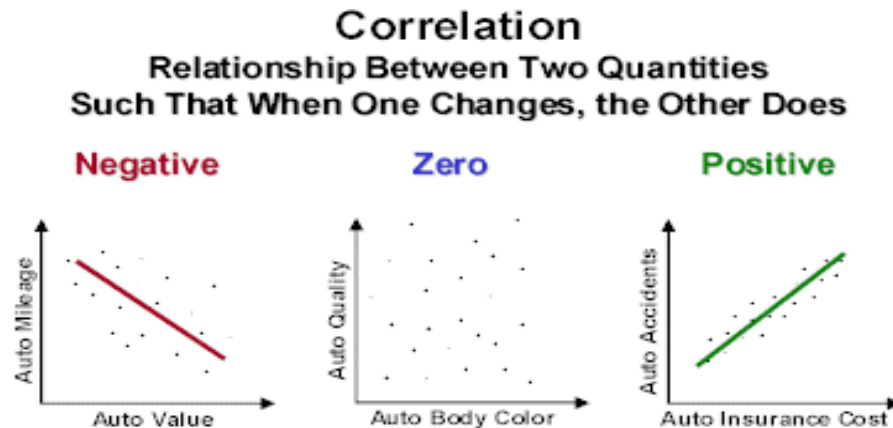
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Graphing Skill #7: Graphing Correlations

First, draw a best fit line:

1. Do you notice a pattern or trend in the data?
2. If so, **draw a straight line or curve that represents that trend.**
3. **All points should lie on or very near the line**

Then, what does the line look like?



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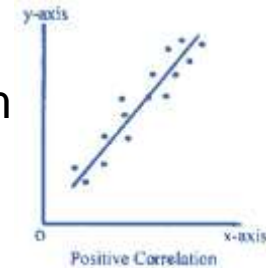


Learning goal: Properly apply all steps in the scientific method when problem solving.

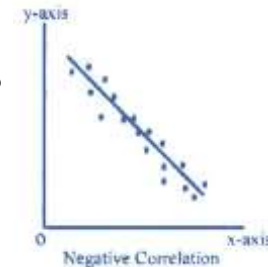
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Graphing Skill #7: Graphing Correlations

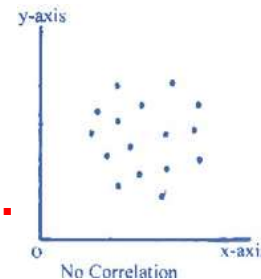
Positive Correlation: General trend in the plotted points is from **bottom left to top right** “line goes up”



Negative Correlation: General trend in the plotted points is from **top left to bottom right**. “line goes down”



No Correlation: No trend in plotted points.



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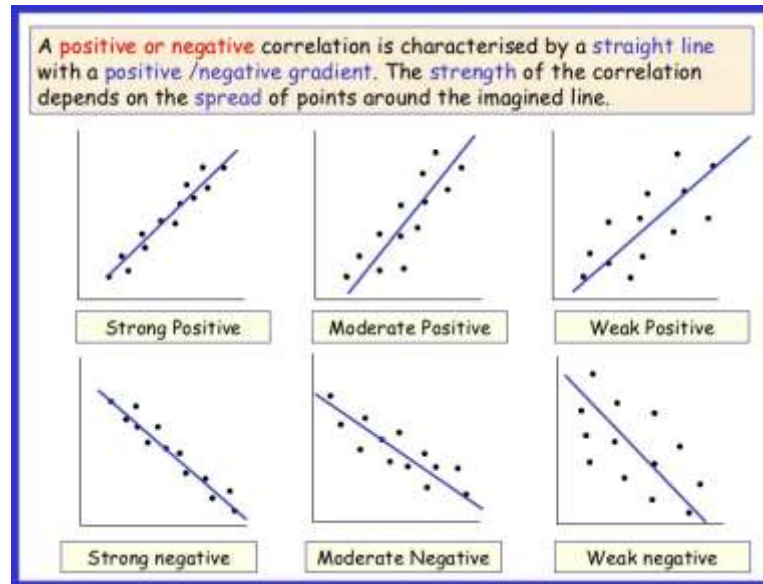


Learning goal: Properly apply all steps in the scientific method when problem solving.

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Graphing Skill #7: Graphing Correlations

The strength of the linear correlation can be judged by looking at how closely the points approximate a straight line.



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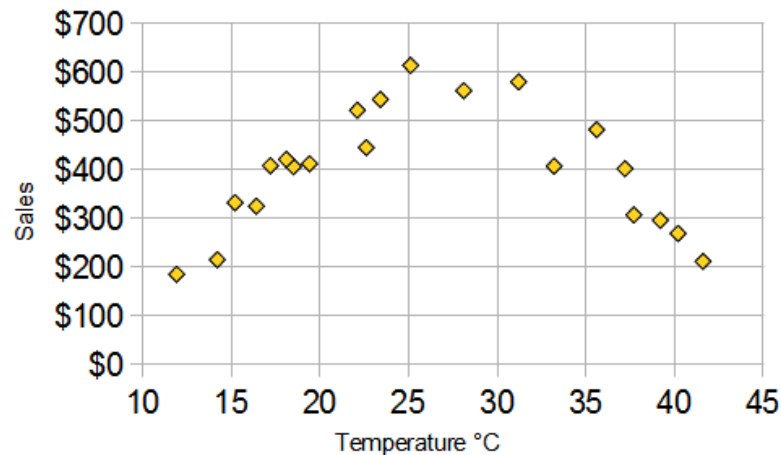
Learning goal: Properly apply all steps in the scientific method when problem solving.

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Graphing Skill #7: Graphing Correlations

Warning! Correlation not good with covered lines.

The graph at the right looks like no correlation, but we can see the data follows a nice curve that reaches a peak around 25° C. But the correlation calculation is not "smart" enough to see this.



4

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