Algebra

Unit 10

Functions & Data

Measures of Central Tendency

MEAN

What is it?

How do I calculate it?

Example:

MEDIAN

What is it?

How do I calculate it?

Example:

Two numbers in the middle?

MODE

What is it?

How do I calculate it?

Example:

There can be one mode, no mode, or _____.

RANGE

What is it?

How do I calculate it?

Example:

RANGE IS NOT A MEASURE OF CENTRAL TENDENCY.

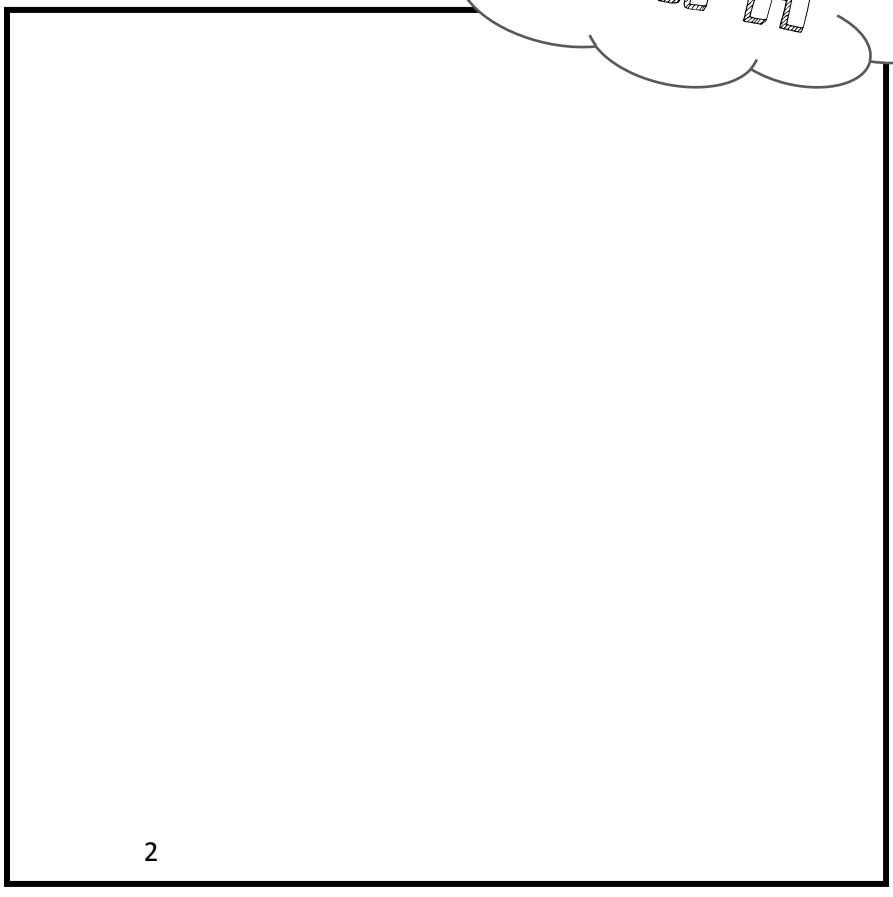
Histograms

IMPORTANT CHARACTERISTICS:

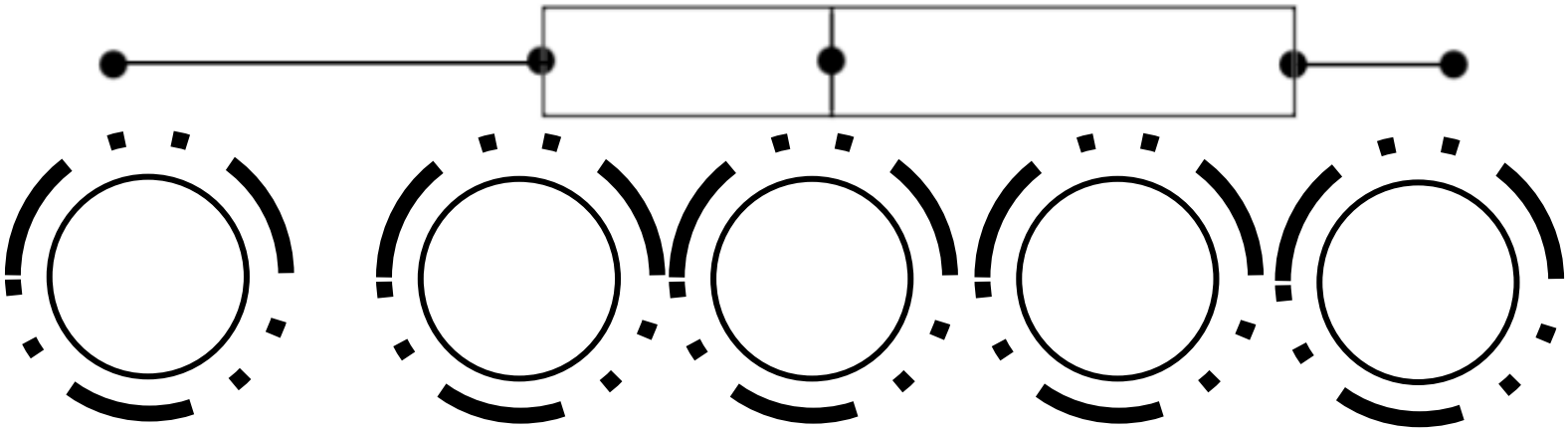
In a histograph, there are _____ spaces between _____

TABLE

GRAPH



BOX PLOTS



Step 1:

Step 2:

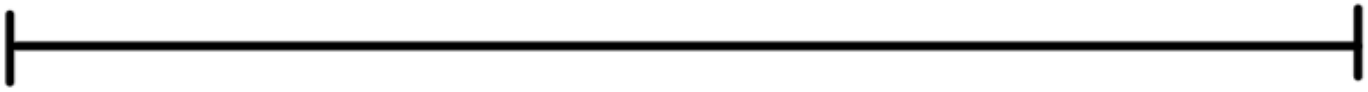
Step 3:

Median: _____

Median of lower half (1st quartile): _____

Median of top half (3rd quartile): _____

Data:
1, 2, 5, 6, 10, 3, 4, 5, 4, 6, 10, 12, 2

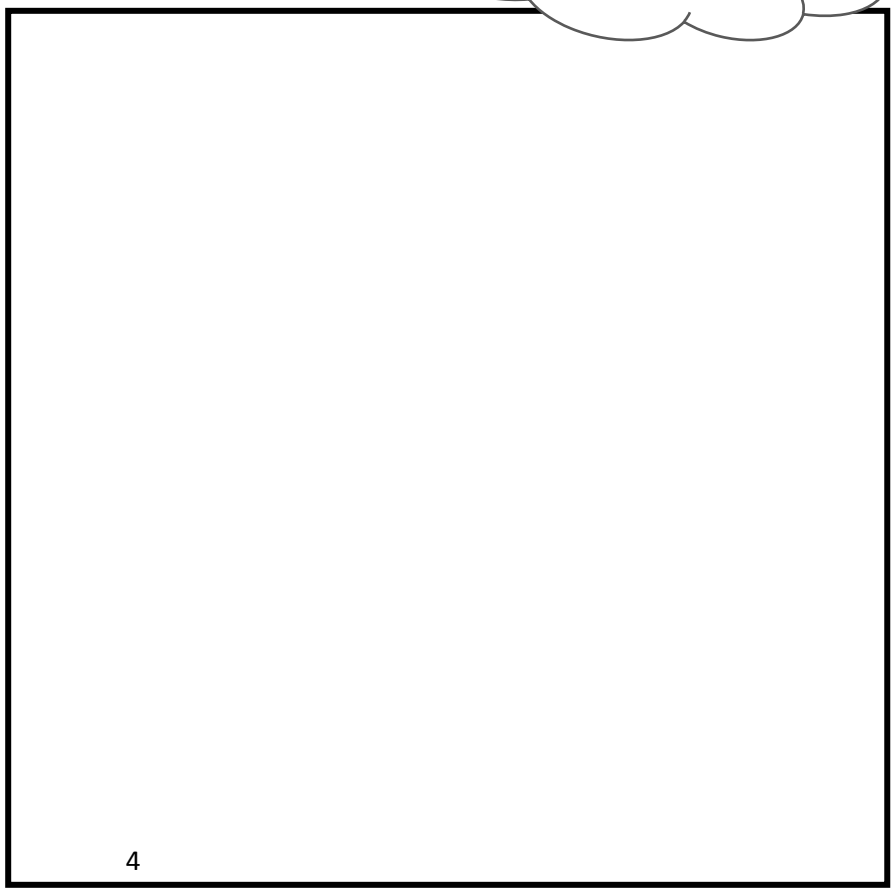


DOT PLOTS

Important Characteristics:

TABLE

GRAPH



SCATTER PLOTS

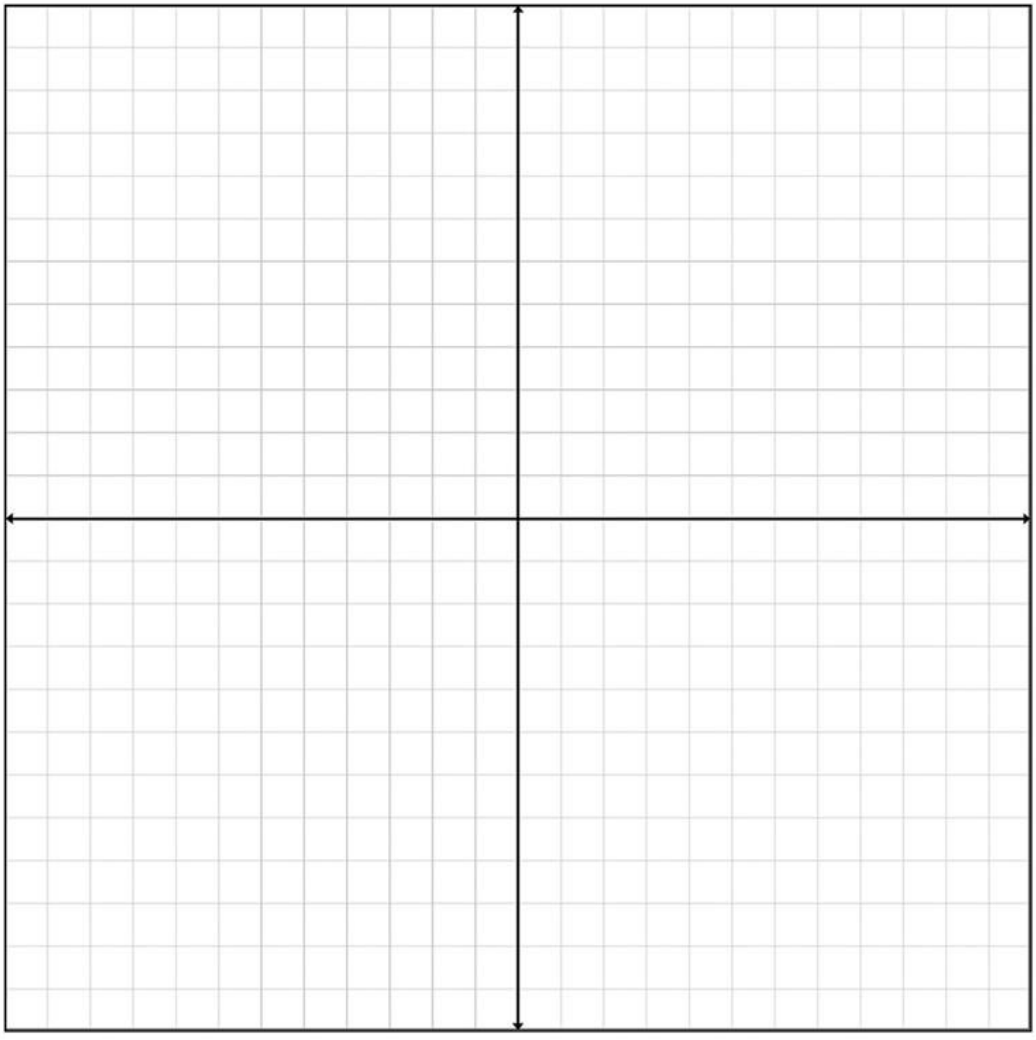
1	2	3	4

DATA

SLOPE

Y-INTERCEPT

EQUATION



Quantity

POSITIVE

DEFINITION:

GRAPH

NEGATIVE

DEFINITION:

GRAPH

NO

DEFINITION:

GRAPH

CAUSATION

WHAT IS IT?

Correlation ---------- Causation.

Sleeping with one's shoes on is strongly correlated with waking up with a headache.

Therefore, sleeping with one's shoes on causes headaches.

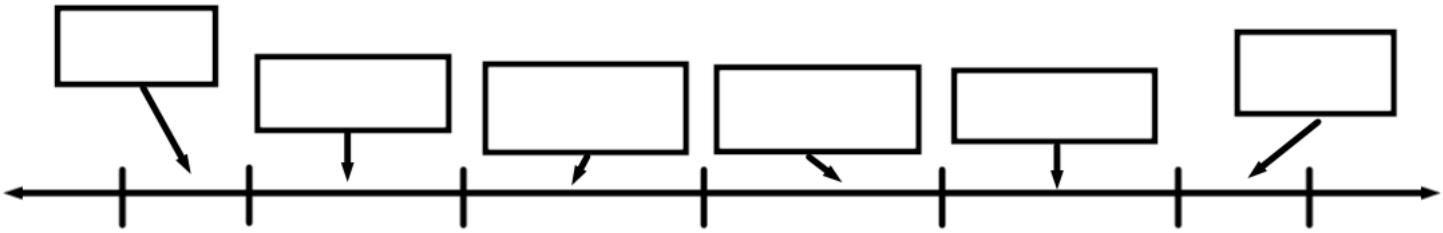
As ice cream sales increase, the rate of drowning deaths increases sharply.

Therefore, ice cream consumption causes drowning.

Correlation Coefficient

_____ is the correlation coefficient.

_____ R _____



What does it tell me?

ABSOLUTE VALUE GRAPHS

LOOKS LIKE?

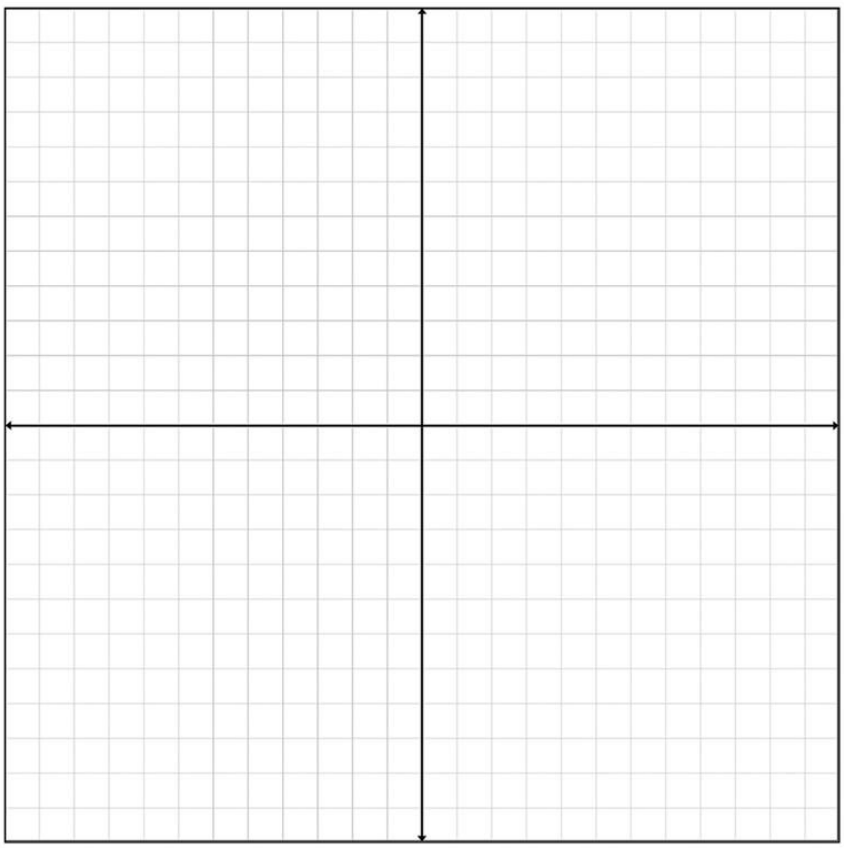
PARENT FUNCTION?

WHERE IS THE VERTEX?

GRAPH:

$y = |x|$ &

$y = -|x|$



SQUARE ROOT FUNCTIONS

LOOKS LIKE?

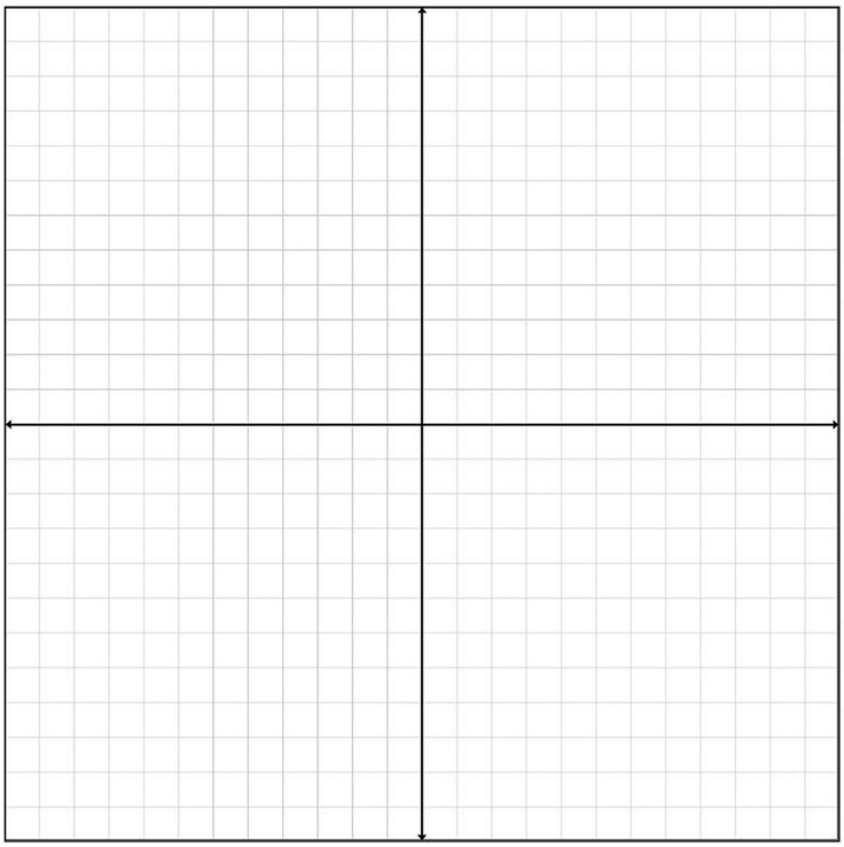
PARENT FUNCTION?

CHARACTERISTICS

GRAPH:

$y = \sqrt{x}$ &

$y = -\sqrt{x}$



CUBE ROOT FUNCTIONS

LOOKS LIKE?

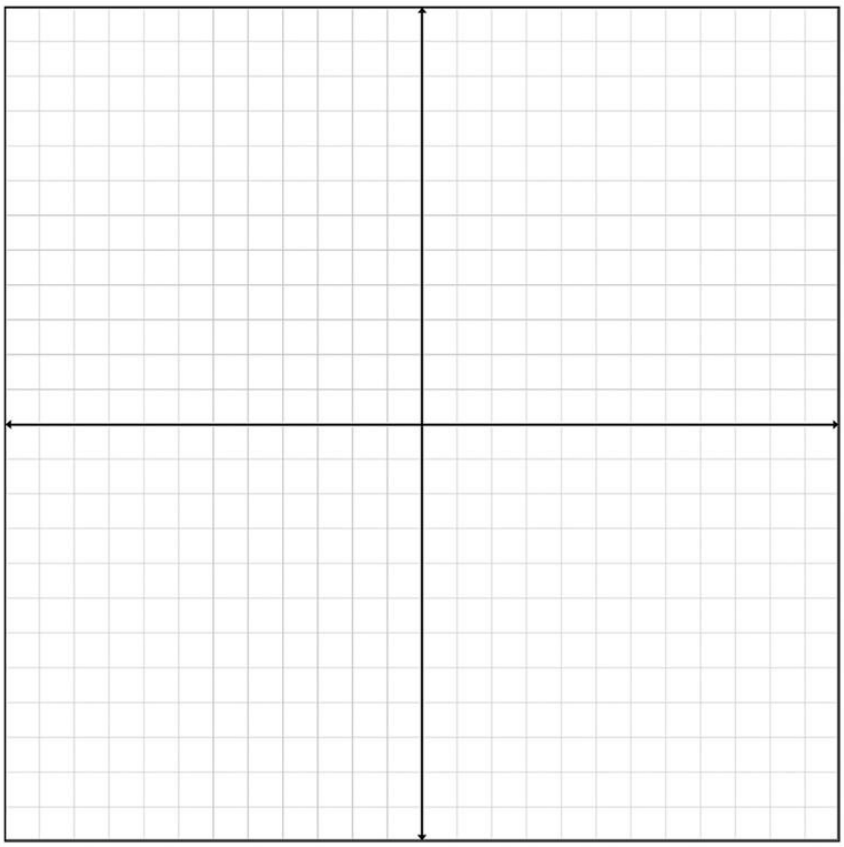
PARENT FUNCTION?

CHARACTERISTICS

GRAPH:

$y = \sqrt[3]{x}$ &

$y = -\sqrt[3]{x}$



PERFECT CUBES:

MEASURES OF CENTRAL TENDENCY

a) Circle the outlier in each problem below.
b) Determine the mean, median, mode, and range of the data set ***without*** the outlier.
c) Determine the mean, median, mode, and range of the data set ***with*** the outlier.
d) Describe the effect the outlier has on the mean, median, mode, and range.

1. 3, 2, 6, 4, 3, 5, 16

	Without Outlier	With Outlier
Mean		
Median		
Mode		
Range		

Effect:

2. 20, 17, 19, 22, 18, 17, 5

	Without Outlier	With Outlier
Mean		
Median		
Mode		
Range		

Effect:

3. 42, 38, 45, 68, 40, 39, 39, 41,

	Without Outlier	With Outlier
Mean		
Median		
Mode		
Range		

Effect:

3. 12, 24, 12, 15, 9, 11, 10, 13

	Without Outlier	With Outlier
Mean		
Median		
Mode		
Range		

Effect:

5. 4, 2, 8, 5, 6, 20, 7, 9,

	Without Outlier	With Outlier
Mean		
Median		
Mode		
Range		

Effect:

6. 105, 98, 101, 100, 99, 89, 40, 98

	Without Outlier	With Outlier
Mean		
Median		
Mode		
Range		

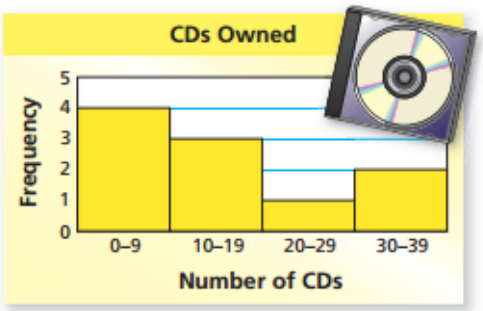
Effect:

Histograms

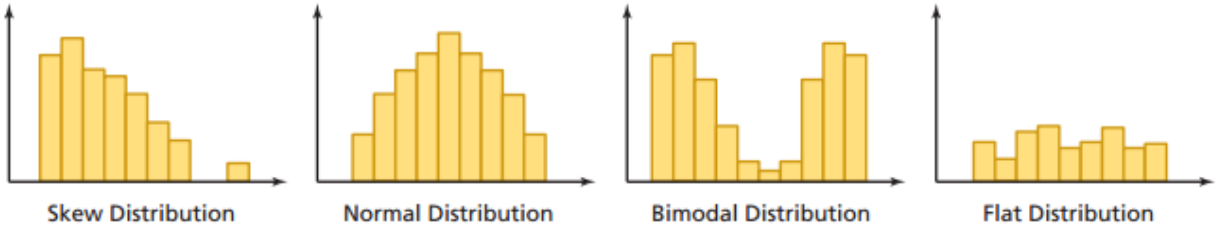
Histograms

A **histogram** is a bar graph that shows the frequency of data values in intervals of the same size.

The height of a bar represents the frequency of the values in the interval.



1.) The histograms show four different types of distributions.



a. Describe a real-life example of each distribution.

b. Describe the mean, median, and mode of each distribution.

c. In which distributions are the mean and median about equal? Explain your reasoning.

d. How did each type of distribution get its name?

2.) Work with a partner. Conduct two experiments. Make a frequency table and a histogram for each experiment. Compare and contrast the results of the two experiments.

a. toss one die 30 times.

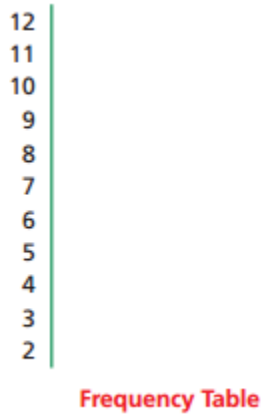
6
5
4
3
2
1

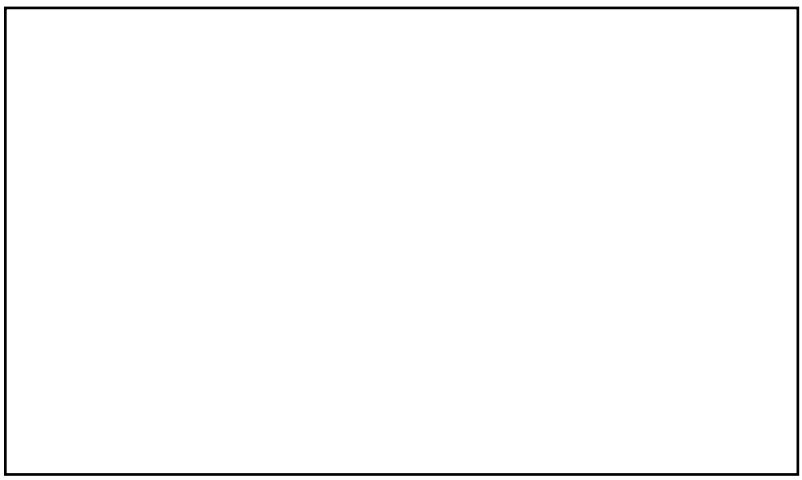
Frequency Table

Histogram

b. toss two dice 30 times.

Histogram





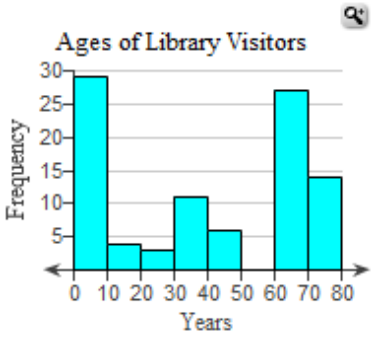
3. What are the important components of a histogram?

4. How do histograms show the differences in distributions of data?

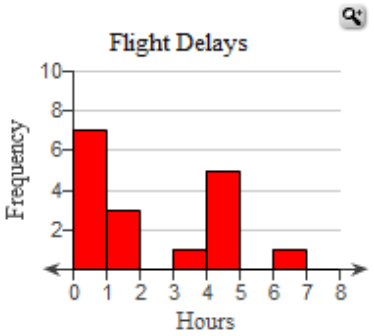
5. Describe an experiment that you can conduct to collect data. Predict the type of data distribution the results will create.

Interpreting Histograms

1.) This histogram groups recent visitors to a library by their ages. From which age group were there the most visitors?



2.) The histogram shows the lengths of flight delays at several airports. How many flights were delayed?

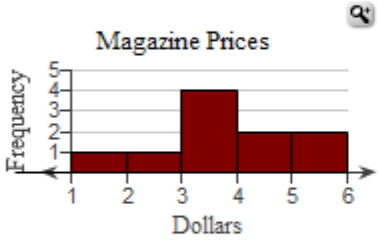


3.) The table shows the prices for ten different magazines. Make a histogram of the data.

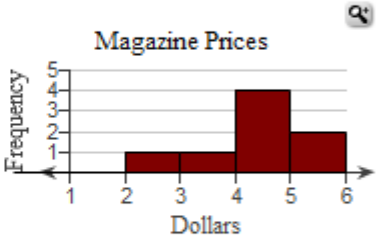
Magazine Prices in Dollars									
1.99	5.25	3.25	4.75	5.95	3.50	2.95	3.25	4.95	3.75

Which histogram shows the data?

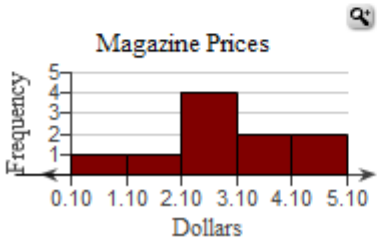
A.



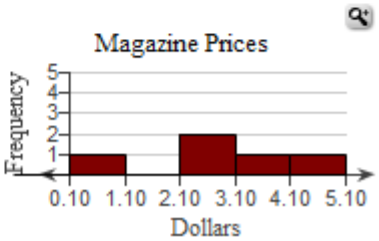
B.



C.



D.



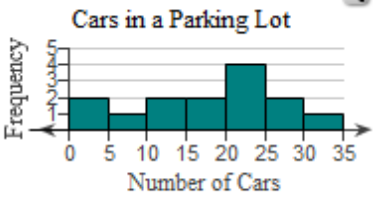
4.) The table shows the number of cars in a parking lot at 6 P.M. each day for two weeks. Make a histogram of the data.

Cars in a Parking Lot

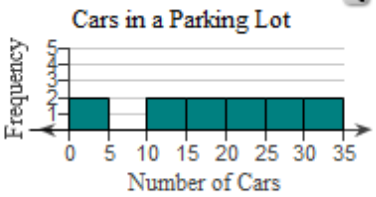
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
6	39	29	27	19	8	21
28	13	31	33	16	23	26

Which histogram shows the data?

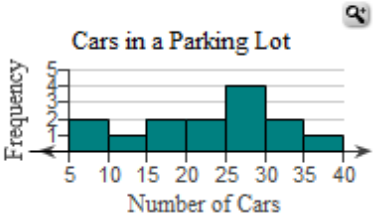
○ A.



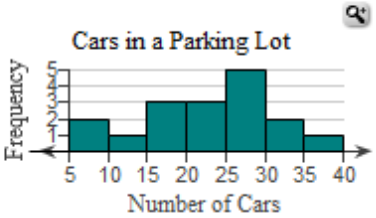
○ B.



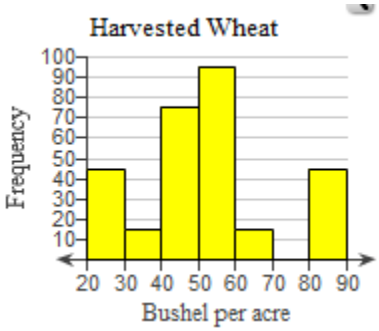
○ C.



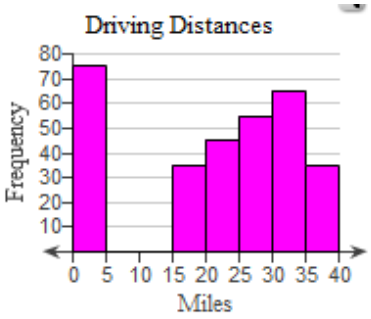
○ D.



5.) A group of farmers recorded the number of bushels of wheat per acre they harvested. What do clusters of two side-by-side bars tell you?



6.) A survey asked 310 people how far they drive to work. The histogram shows the results of the survey. One bar in the histogram stands out. What might it tell you about the drives?



What does the bar that stands out tell you about the drives?

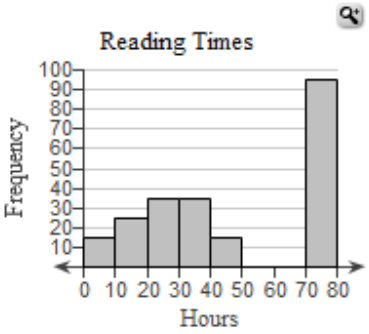
○ A. The number of people that do not drive to work

○ B. The number of people with a long drive to work

○ C. The number of people with a moderate drive to work

○ D. The number of people with a short drive to work

7.) **Writing** The histogram shows how much time 220 people spend reading each month. One bar in the histogram stands out. What might it tell you about these times? Use pencil and paper. What could you say about the reading times if that particular bar were not there?



What does the bar that stands out tell you about the reading times?

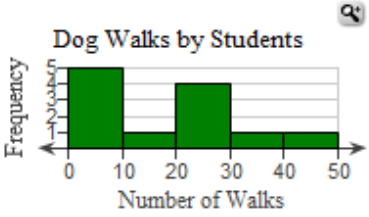
- A. The number of people that read for a moderate time
- B. The number of people that do not read
- C. The number of people that read for a short time
- D. The number of people that read for a long time

8.) **Reasoning** The table shows how many times each of ten students walked a dog last month. Make a histogram of the data. Use pencil and graph paper. Think about other histograms for this data that use increasingly wider intervals. Describe how the shapes of the histograms change.

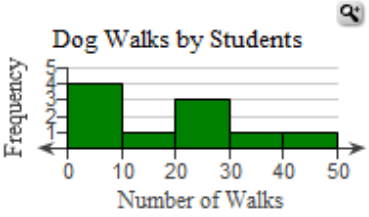
Dog Walks by Students									
1	6	42	4	32	16	24	28	23	4

Which histogram shows the data?

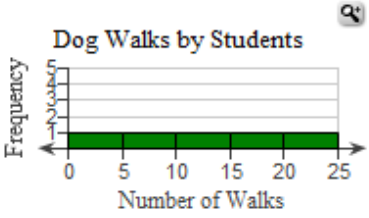
A.



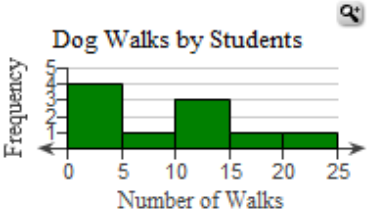
B.



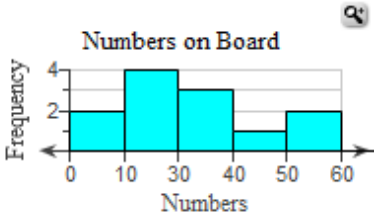
C.



D.

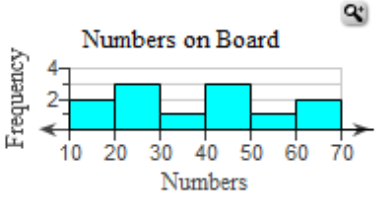


9.) **Error Analysis** Priya's teacher writes the numbers 1, 7, 12, 13, 18, 29, 31, 34, 39, 49, 52, and 53 on the board. The teacher asks the class to make a histogram of the data with interval width 10. Priya makes the incorrect histogram of the data as shown. What is a correct histogram of the data? What is Priya's error?

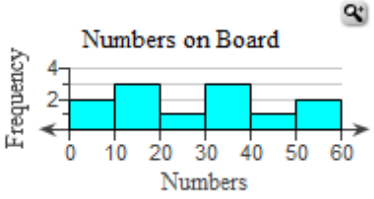


Which histogram shows the data?

A.



B.



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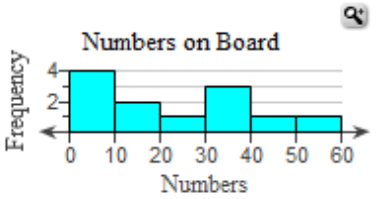
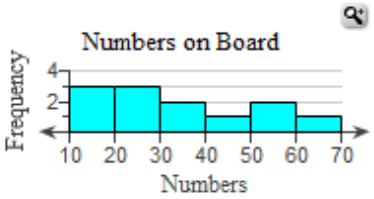


D.

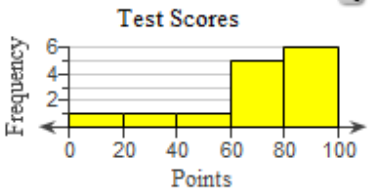


10.) **Multiple Representations** The table shows the test scores for 14 students on a math test. Make a histogram of the data using an interval width of 20. Use pencil and graph paper. Make at least two more histograms of the data using different interval widths. Explain which histogram best represents the data.

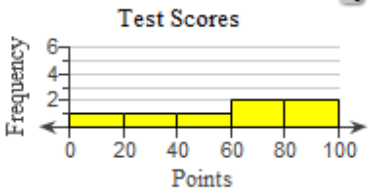
Test Scores						
91	81	88	69	18	71	63
74	79	32	59	97	89	92

Which histogram shows the data with interval width 20?

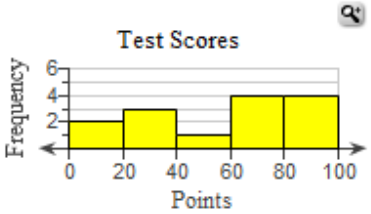
A.



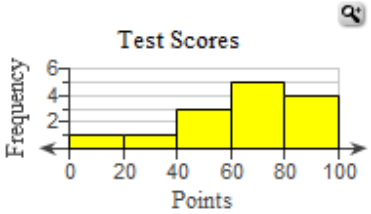
B.



C.



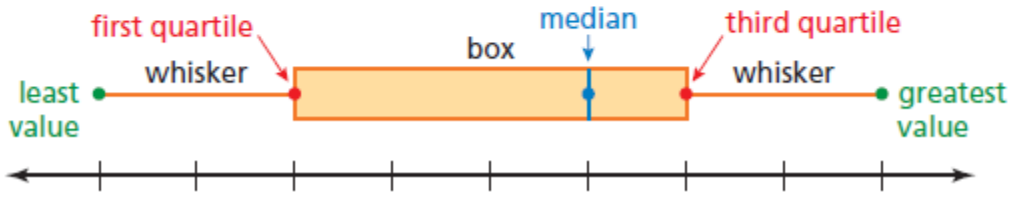
D.



Box and Whisker Plot (Box Plot)

Box-and-Whisker Plot

A **box-and-whisker plot** displays a data set along a number line using medians. **Quartiles** divide the data set into four equal parts. The median (second quartile) divides the data set into two halves. The median of the lower half is the first quartile. The median of the upper half is the third quartile.



Step 1: Order the data. Find the median and the quartiles. (Find the quartiles by finding the median of the lower half of the data and the top half of the data)

Step 2: Draw a number line that includes the least (minimum) and greatest value (maximum). Graph points above the number line for the least value, greatest value, median, first quartile, and third quartile.

Step 3: Draw a box using the quartiles. Draw a line through the median. Draw whiskers from the box to the least and greatest values. *Add the numbers to the number line!*

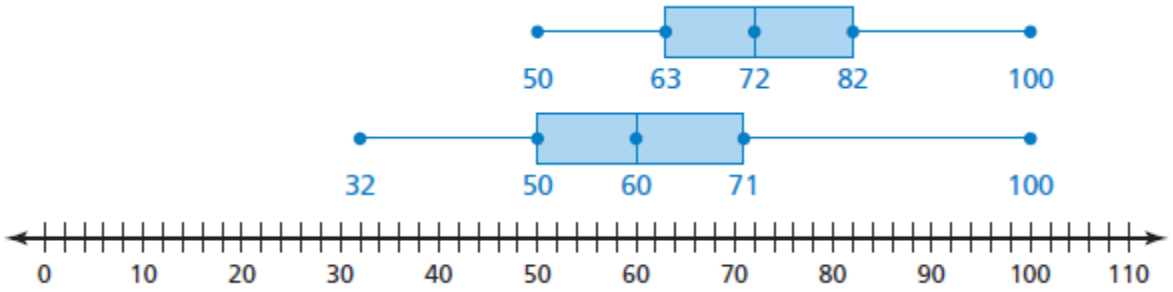
Creating:

1.) A basketball player scores **14, 16, 20, 5, 22, 30, 16, and 28** points during a tournament. Make a box-and-whisker plot for the points scored by the player.

2.) Elevation of feet **-3, 2, 0, 2, -3, 6, 1, -2, 0, 5, -4, -1.** Make a box-and-whisker plot.

Interpreting:

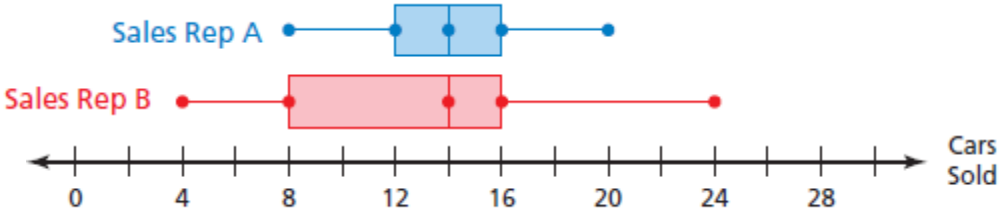
1.) Work with a partner. The box-and-whisker plots show the test score distributions of two eighth-grade standardized tests. The tests were taken by the same group of students. One test was taken in the fall and the other was taken in the spring.



a. Compare and contrast the test results.

b. Decide which box-and-whisker plot represents the results of which test. How did you make your decision?

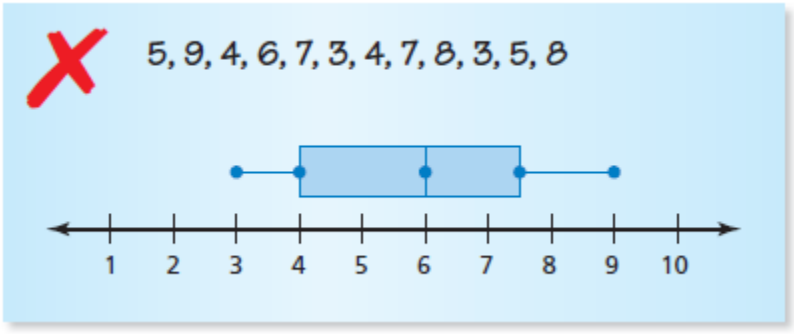
2.) The box-and-whisker plots show the monthly car sales for a year for two sales representatives.



a. Compare and contrast the sales of the two representatives.

Find the error:

1.) **Describe** and **correct** the error in making a box-and-whisker plot for the data.



Dot Plots

Create a dot plot using the following information:

This data set gives pulse rates, in beats per minute, for a group of 30 students.

68 60 76 68 64 80 72 76 92 68 56 72 68 60 84 72 56 88 76 80 68 80 84 64 80 72 64 68 76 72

- To make a dot plot of the pulse rates, first draw a number line with the minimum value at the left end. Select a scale and label equal intervals until you reach the maximum value.

- For each value in the data set, put a dot above that value on the number line. When a value occurs more than once, stack the dots. Be sure to label the axis so that it is clear what the data are.

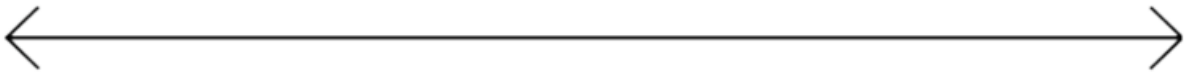
1.) What is the range?

2.) What are the mean, mode, and median?

3.) Why would a person use a dot plot to show data rather than some other method? What are the benefits to creating a dot plot?

Create a dot plot using the following information:

You have been given a number of pennies. You will need to create a dot plot to represent the year of production for each penny. Then answer the questions that follow.



1.) Circle the mode.

2.) Box the mean.

3.) Draw a line at the median.

4.) Identify the outliers.

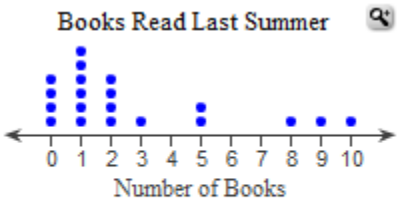
5.) What conclusions about the U.S. Mint can you make based on the information provided?

Interpreting Dot Plots

1.)

A teacher asked 20 students how many books they read last summer. The dot plot displays the data.

What is the greatest number of books a student read?

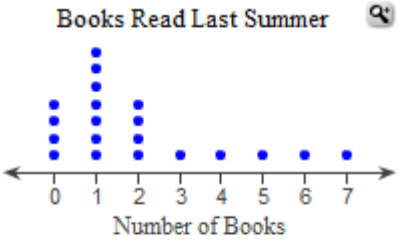


The greatest number is ☐ books.

2.)

A teacher asked 20 students how many books they read last summer. The dot plot displays the data.

How many of these students read exactly 0 books?



Of these students, ☐ read exactly 0 books last summer.

3.)

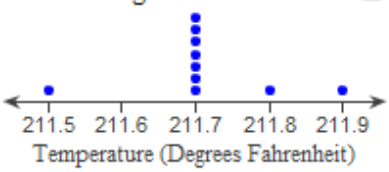
A scientist measured the temperature at which water boils. The table shows the results for 10 measurements.

Boiling Point of Water (°F)				
211.5	211.6	211.7	211.5	211.8
211.8	211.7	211.8	211.7	211.9

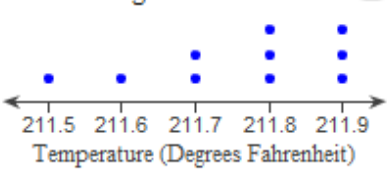
Make a dot plot of the data.

Which dot plot represents the data?

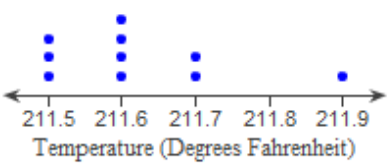
○ A.



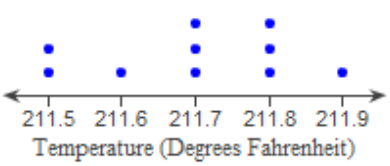
○ B.



○ C.



○ D.



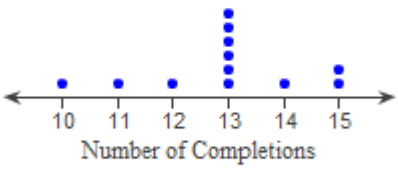
4.) Researchers recorded the number of times lab rats completed a maze in 30 minutes. The table shows the data for 12 rats.

Maze Completions			
15	12	15	12
13	11	10	13
11	14	12	13

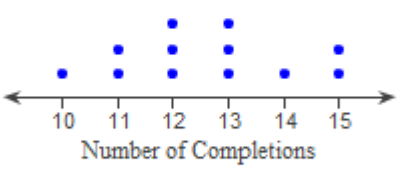
Make a dot plot of the data.

Which dot plot represents the data?

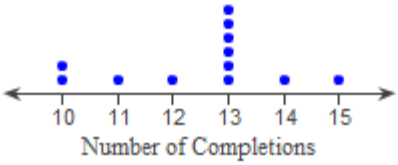
A.



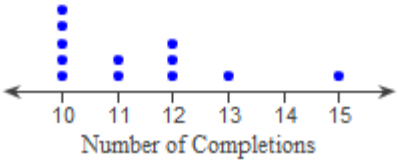
B.



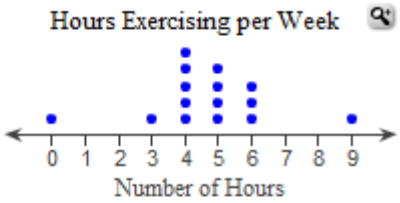
C.



D.



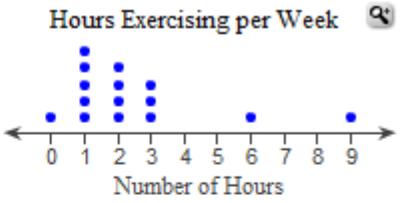
5.) A doctor asked 15 people how many hours they spend exercising each week. The dot plot displays the data.



What do any clusters and gaps in the dot plot tell you about the exercise habits of these people?

Most of the people exercise [ ] hours per week.

6.) A doctor asked 15 people how many hours they spend exercising each week. The dot plot displays the data.



What do any stray values tell you about the exercise habits of some of these people?

Choose the correct answer below.

A. Two people exercise more than some, but less than others.

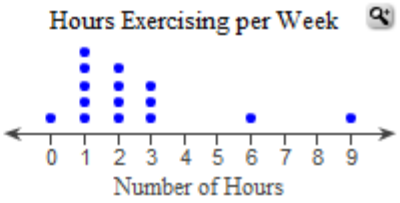
B. Two people exercise less than the others.

C. Two people exercise more than the others.

D. Only one person exercises for 4 hours.

7.) A doctor asked 15 people how many hours they spend exercising each week. The dot plot displays the data.

What do any stray values tell you about the exercise habits of some of these people?



Choose the correct answer below.

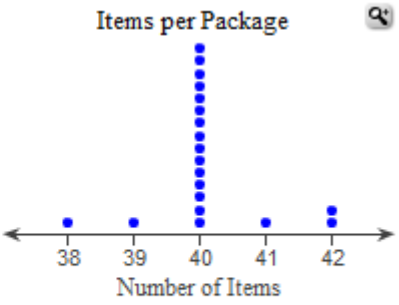
- A. Two people exercise more than some, but less than others.
- B. Two people exercise less than the others.
- C. Two people exercise more than the others.
- D. Only one person exercises for 4 hours.

8.) **Writing** Use pencil and paper. Copy the dot plot. Describe the pattern in the dot plot. Then write about a situation that this data could represent. Be sure to explain why your situation has this pattern.

Most of the times are [ ] hours.

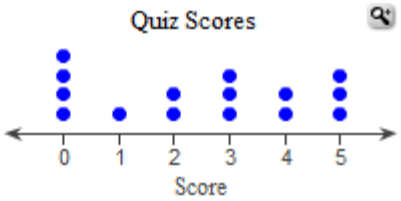
9.) **Reasoning** A machine is designed to place 40 items in each package. A manager opened 20 packages and counted the number of items in each. The dot plot displays the data.

How many of the 20 packages did not contain 40 items? How many items would you expect to find in a package? Use pencil and paper. What should the manager conclude? Explain your reasoning.



Of the 20 packages opened, [ ] did not contain 40 items.

10.) **Error Analysis** The dot plot shows the scores for 15 students on a 5-point quiz. The teacher stated that 5 of the students passed the quiz. One student incorrectly claimed that the lowest passing score for this quiz was 1 point.



What was the correct lowest passing score for this quiz? What was the student's error?

The lowest passing score was [ ] point(s).

Scatter Plots

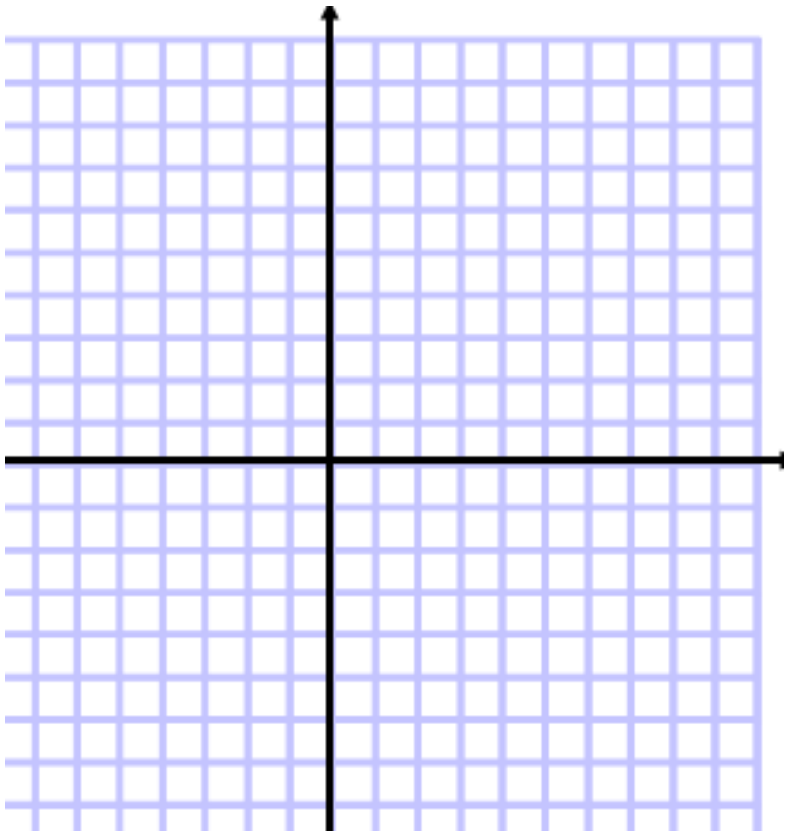
Directions: Use the information in each table to create a scatter plot. Then, draw in a line that would represent your data the best. Then find an equation (in slope-intercept form), for your line of best fit.

1.

Air Temp (°F)	Wind Chill Temp (°F)
35	16
30	9
25	2
20	-5
5	-25
0	-31

Slope:
Y-Intercept:

Equation:

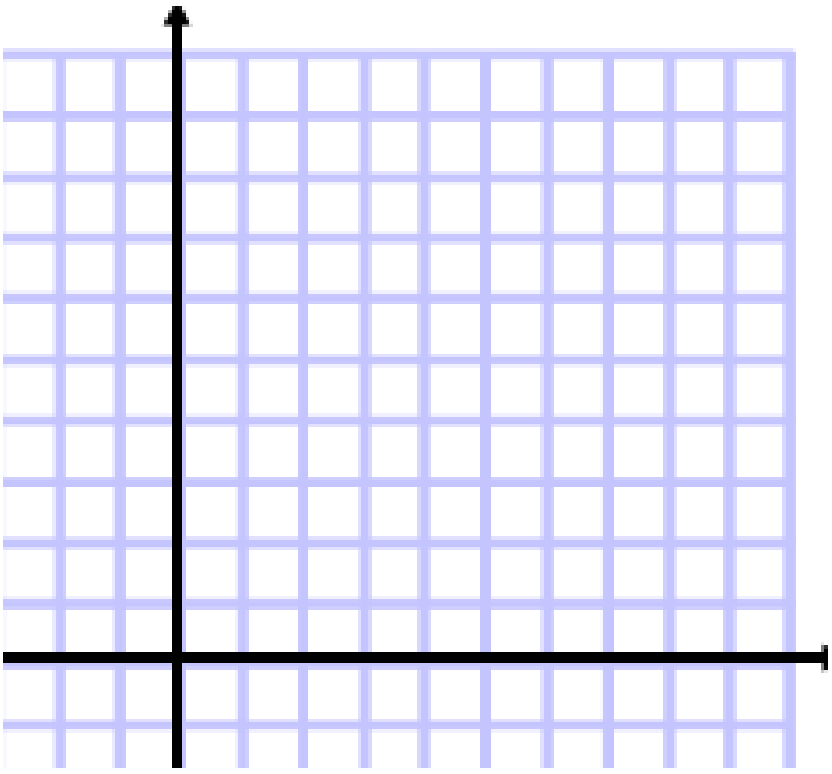


2.

Math Scores	Science Scores
76	82
89	94
71	84
91	89
94	94
84	84
84	89

Slope:
Y-Intercept:

Equation:

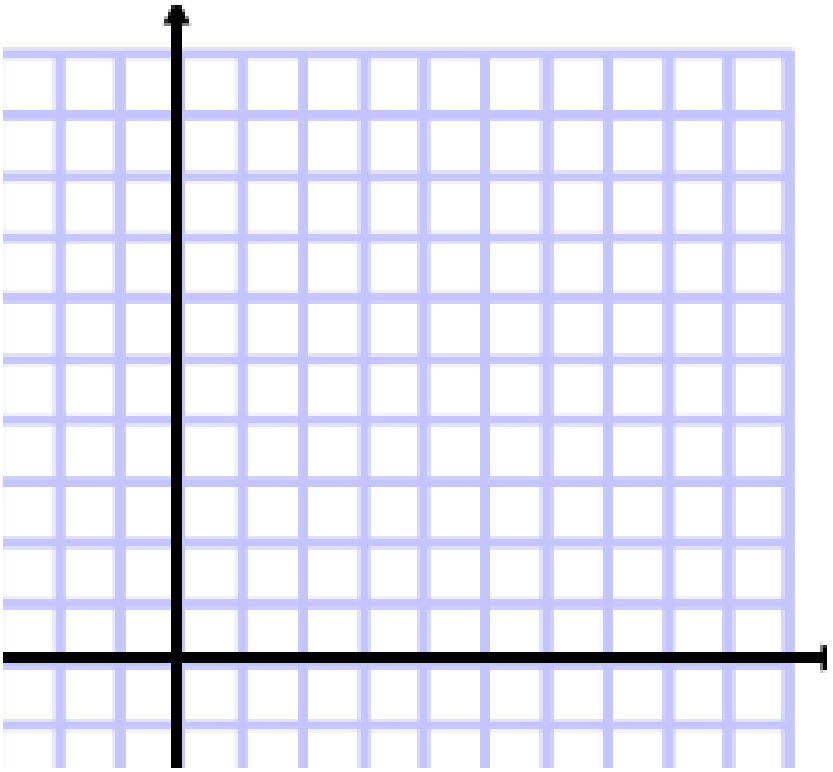


3.

Year	Sales (billions)
1980	86
1985	126
1990	166
1995	231
1996	245
1997	261
1998	279

Slope:
Y-Intercept:

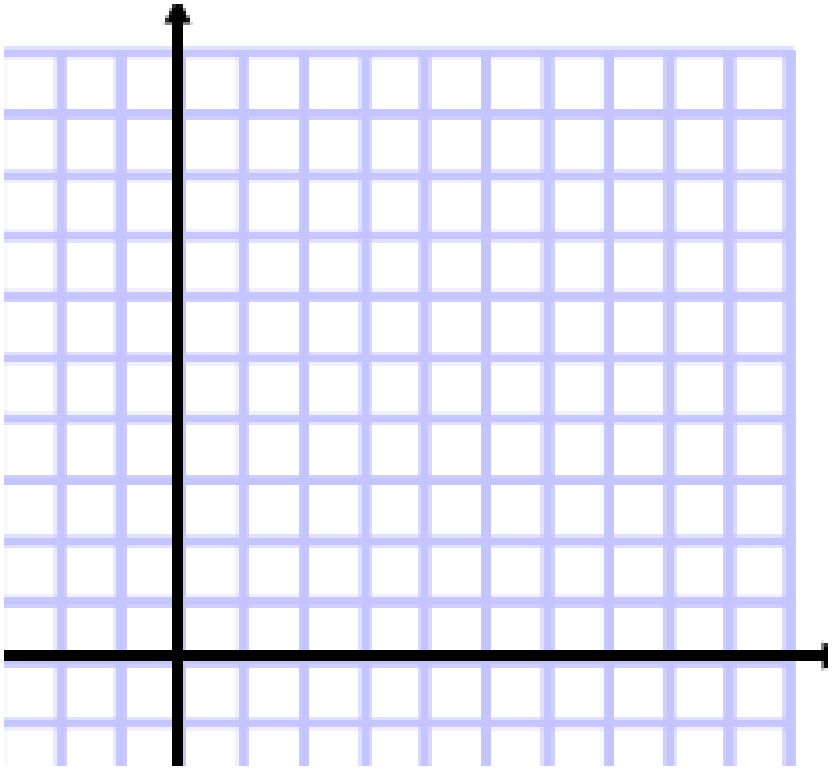
Equation:



4. Make your own data.

Slope:
Y-Intercept:

Equation:



1. Variable ***x*** is the number of students trained on new projects, and variable ***y*** is the number of calls to the other institute. You suspect that more training reduces the number of calls. Does this follow positive correlation or negative correlation?

2. The table lists the population of a town from the year 1970 to 2003. Sketch a scatter plot of the data.

Year	1970	1980	1990	2000	2001	2002	2003
Population (in thousands)	50	35	45	30	60	65	70

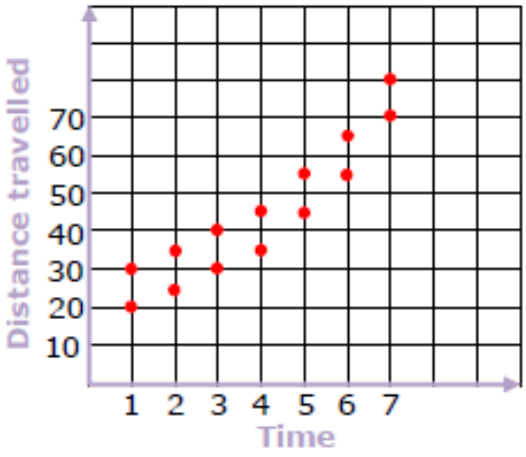
3. Draw the line of best fit.

4. What type of correlation does this graph show?

5. Calculate the slope of the line through points (25, 2001) and (60, 2003).

6. Write the equation of the line.

7. Predict the population based in year 2003.



Use graph shown for question 8-10

8. What type of correlation does this graph show?

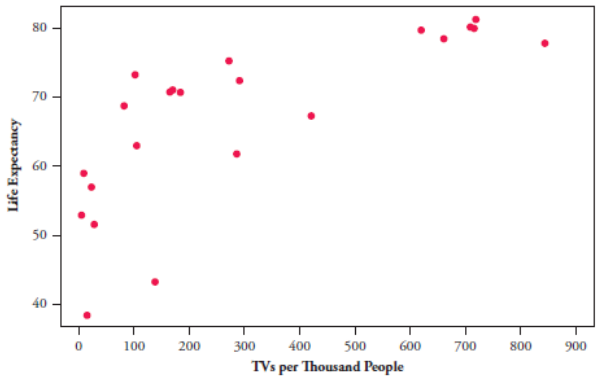
9. Predict the distance travelled at time = 4

10. Predict the distance travelled at time = 2

Correlation Coefficient

Describe the direction and strength of the association between life expectancy and number of televisions per thousand people in these countries.

I.) Is this association linear?



a. Based on this scatterplot, guess the value of the correlation coefficient between *life expectancy* and *televisions per thousand people* in these countries.

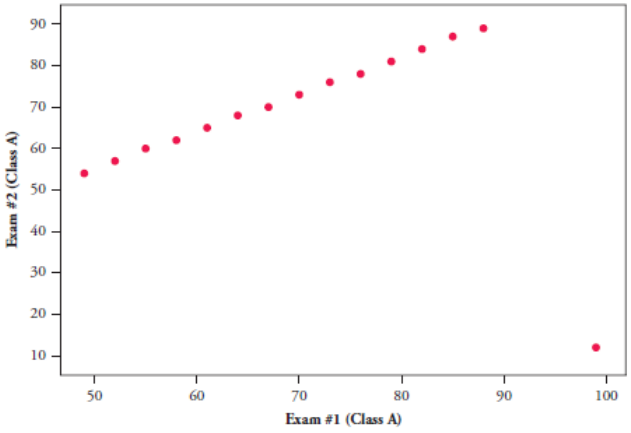
b. Would you say the value of the correlation coefficient is fairly high, even though the association between the variables is not linear?

c. Does the fairly high value of the correlation coefficient provide evidence of a cause-and-effect relationship between number of televisions and life expectancy? Explain.

---

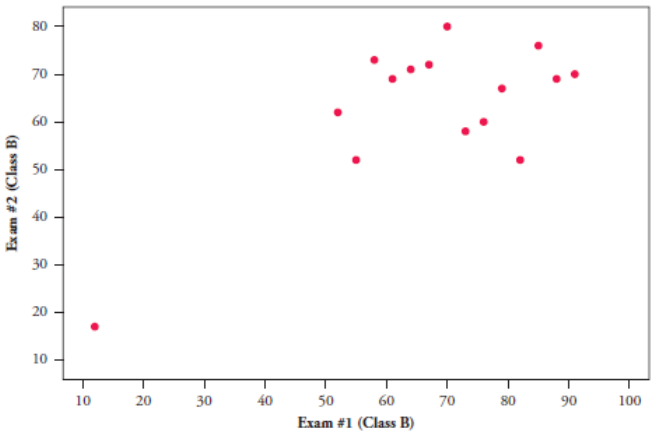
a. In class A, do most of the exam scores follow a linear pattern? Are there any exceptions?

b. In class B, are most of the exam scores scattered haphazardly with no apparent pattern? Are there any exceptions?



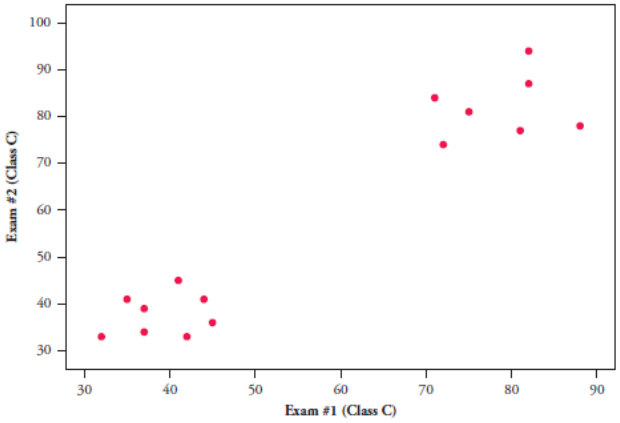
c. Find the correlation coefficient between *exam 1 score* and *exam 2 score* for each of these classes.

I.) What do you notice about the correlation coefficients?

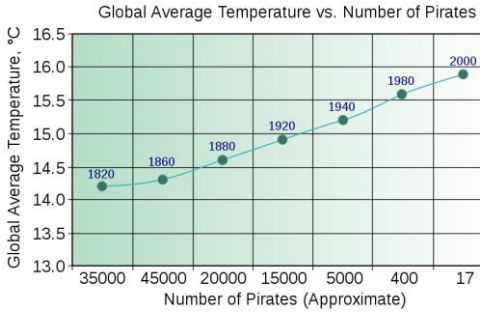


a. Describe what the scatterplot reveals about the relationship between exam scores in class C.

b. Find the correlation coefficient between exam scores in class C. Is its value higher than you expected? Explain what this example reveals about correlation.



Correlation



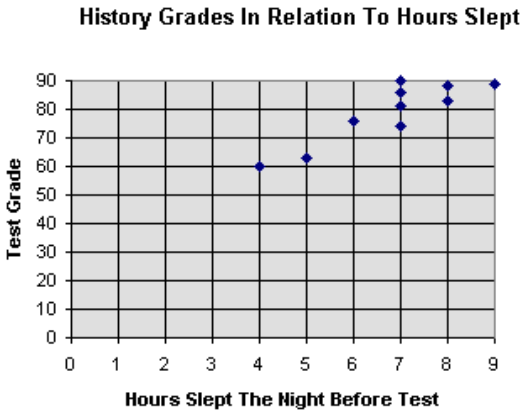
1. From the information given,
   a. Determine if the correlation is positive, negative or none.

   b. Is there causation? Why or why not?

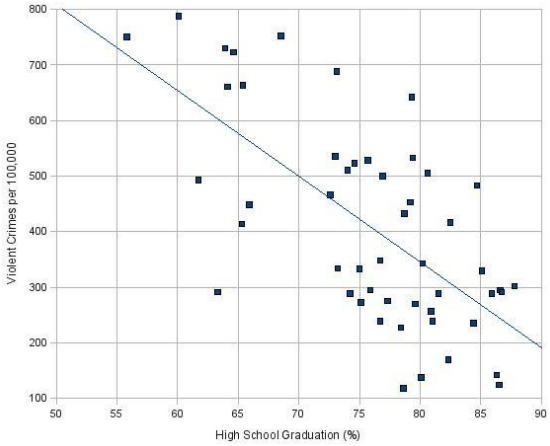
2. A history teacher asked her students how many hours of sleep they had the night before a test. The data above shows the number of hours the student slept and their score on the exam. The graph is a scatter plot from the given data.

   a. Determine if the correlation is positive, negative, or none.

   b. Is there causation? Would this information affect your behavior the night before a test?



3. The following chart shows violent crime rates compared to high school graduation for all fifty states.
   a. Determine if the correlation is positive, negative, or none.



   b. Is this an illustration of cause and effect, or are these two variables simply correlated?

Causation

For the given situations below,

a. Is the association positive, negative or none?
b. Is the causation statement is true or false?

4. a.) When you are on a diet, the less calories you eat daily vs. the more weight you lose.
   b.) Causation statement: *Therefore, eating less calories makes you lose weight.*

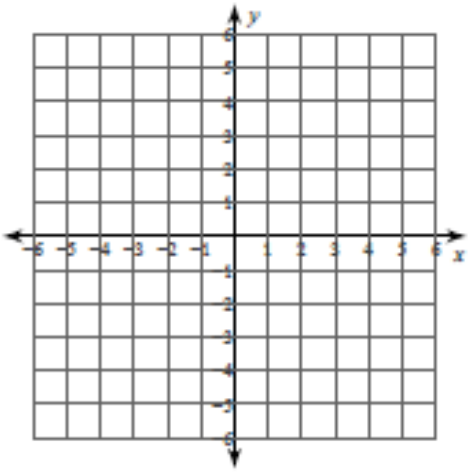
5. a.) The more ice cream consumed on a beach vs. the increased number of people who go in the water.
   b.) Causation statement: *Therefore, eating more ice cream on the beach makes people go in the water.*

6. a.) The more people in a family vs. the increased number of cars the family owns.
   b.) Causation Statement: *Therefore, the more people there are in a family determines how many cars a family owns.*

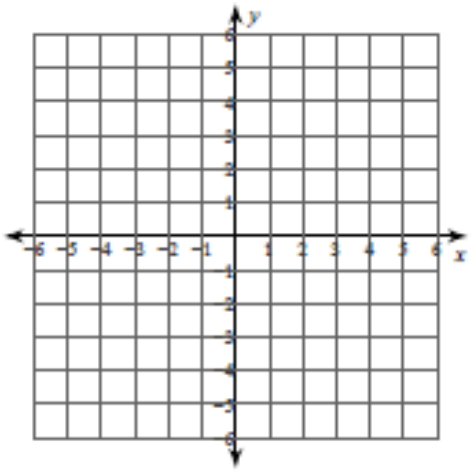
7. a.) The average speed cars travel from Philadelphia to New York on the turnpike vs. the average amount of times it takes.
   b.) Causation Statement: *Therefore, the speed cars travel from Philadelphia to New York determines the time it takes to go between them.*

Graphing Absolute Value Functions

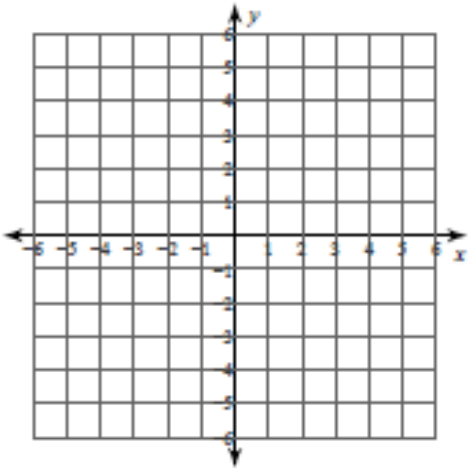
1) $y = |x - 2| - 4$



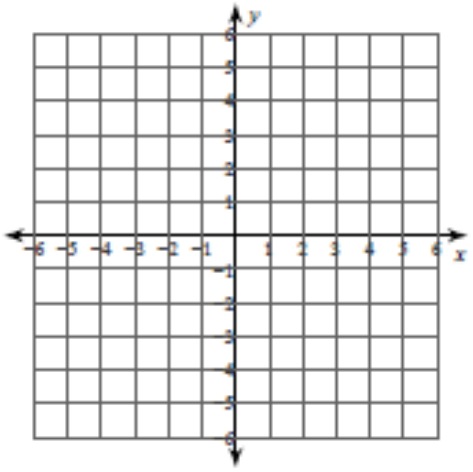
2) $y = |x + 1|$



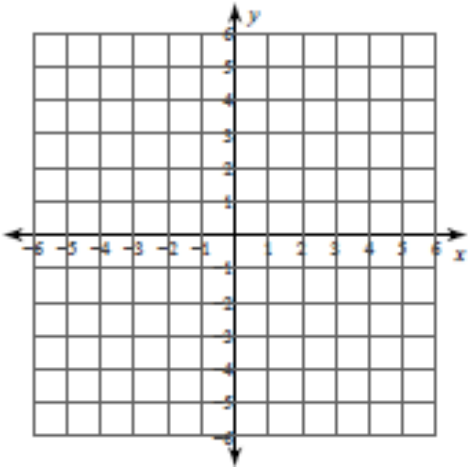
3) $y = |x| + 1$



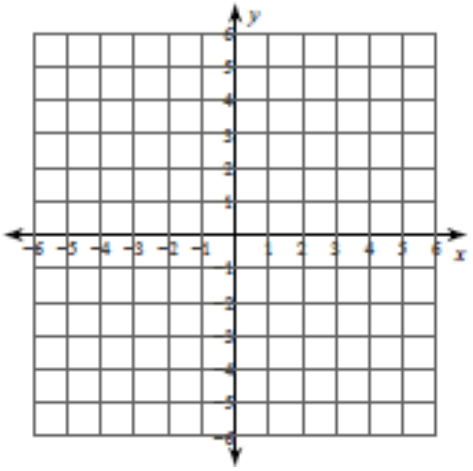
4) $y = |x| + 2$



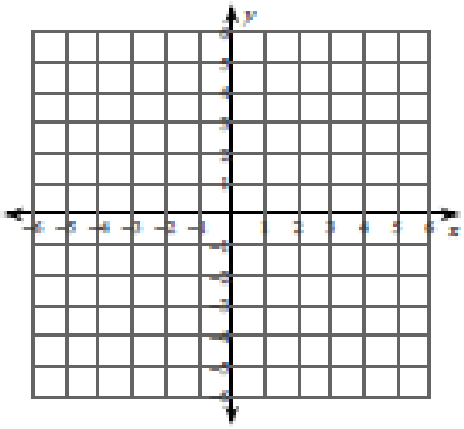
5) $y = |x + 2|$



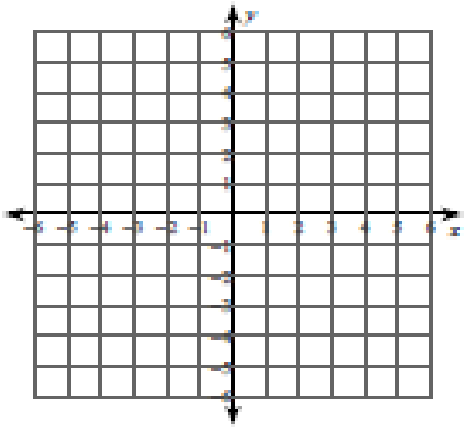
6) $y = |x + 1| + 3$



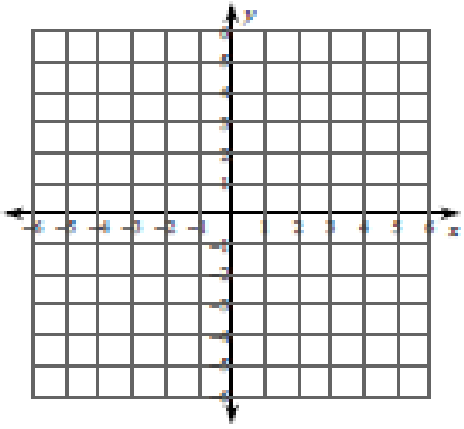
7) $y = -|x-2| - 2$



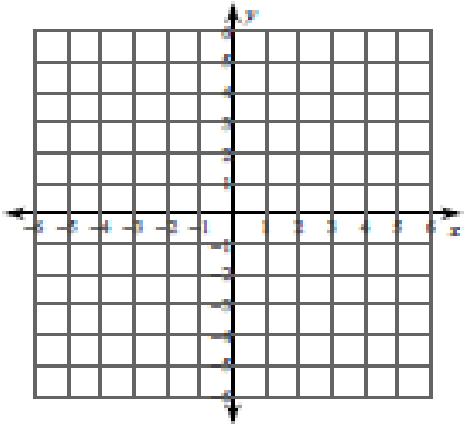
8) $y = -|x+1| + 4$



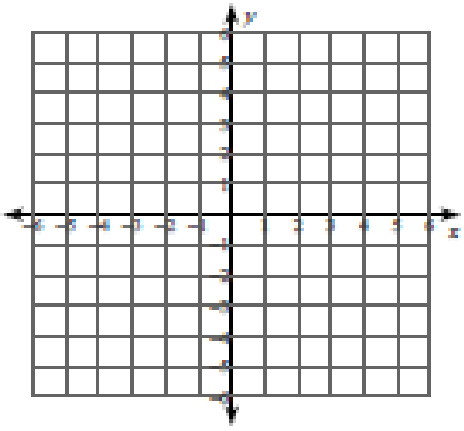
9) $y = -|x+4| + 2$



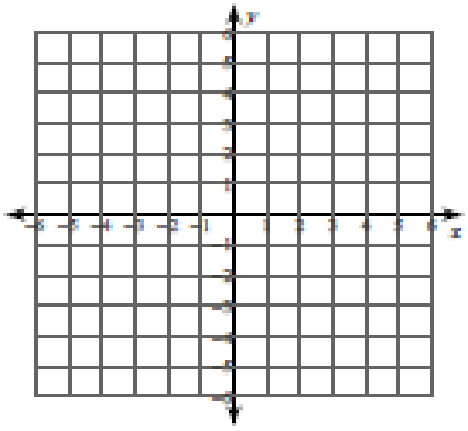
10) $y = -|x-1| + 1$



11) $y = -|x-2| + 4$

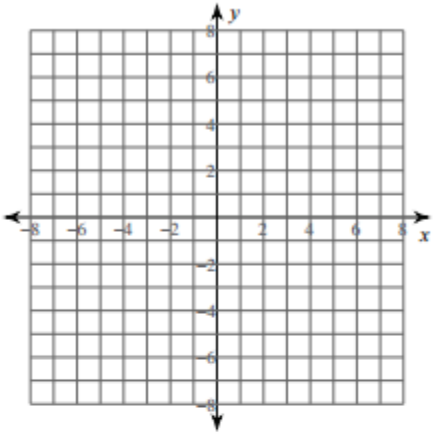


12) $y = -|x-1| - 1$

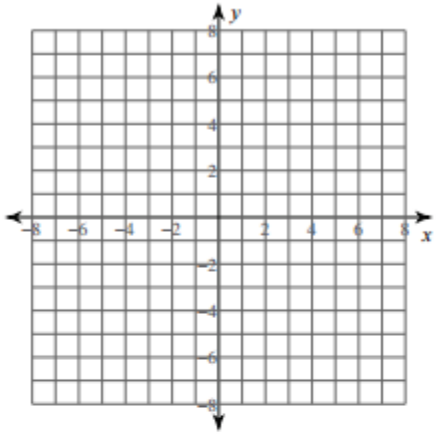


Graphing Square Root Functions

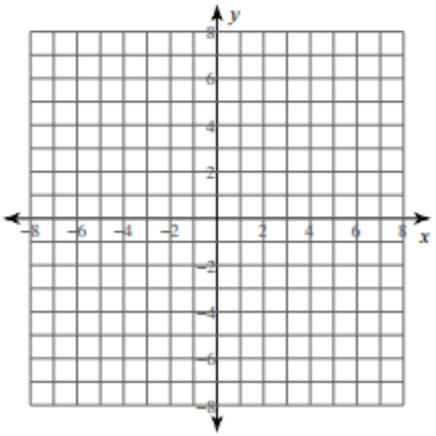
1) $y = -2\sqrt{x+1}$



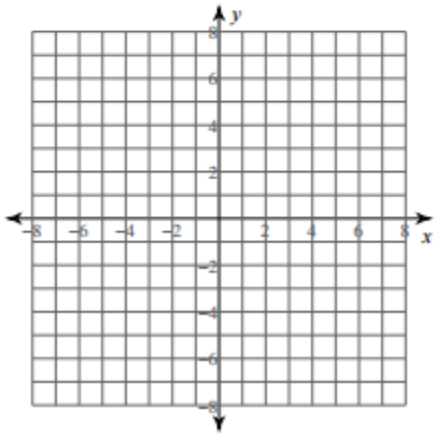
2) $y = -2\sqrt{x}$



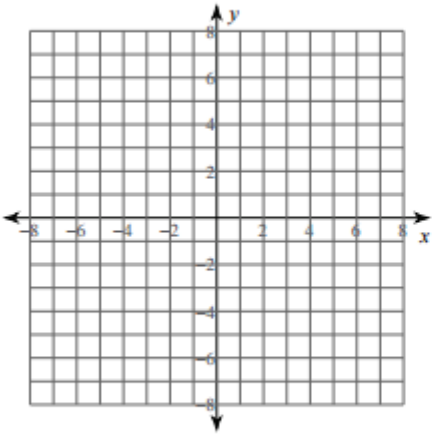
3) $y = 2\sqrt{x+2} - 3$



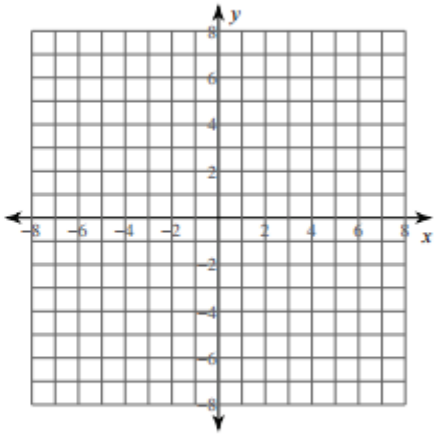
4) $y = 3\sqrt{x}$



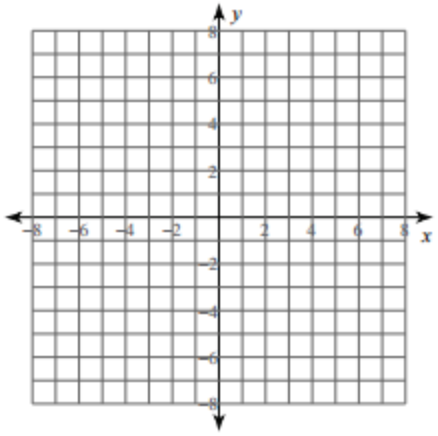
5) $y = \sqrt{x-1}$



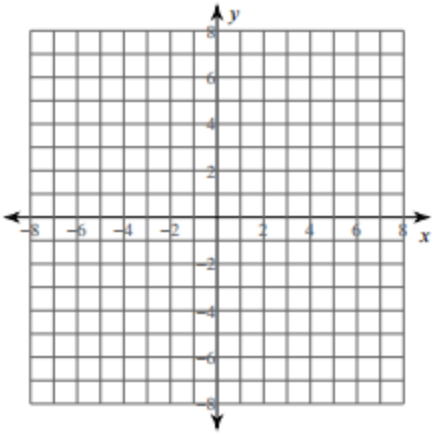
6) $y = \sqrt{x} + 3$



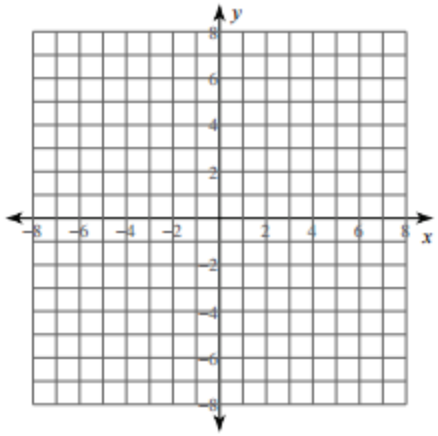
7) $y = \sqrt{x} + 2$



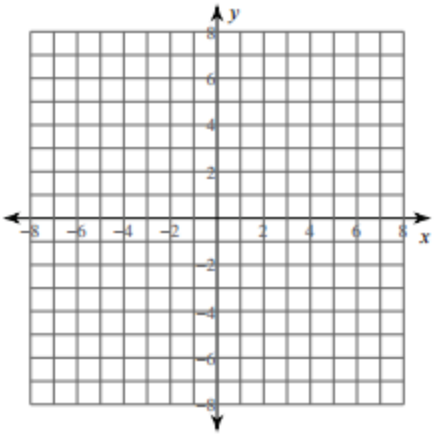
8) $y = \sqrt{x - 3}$



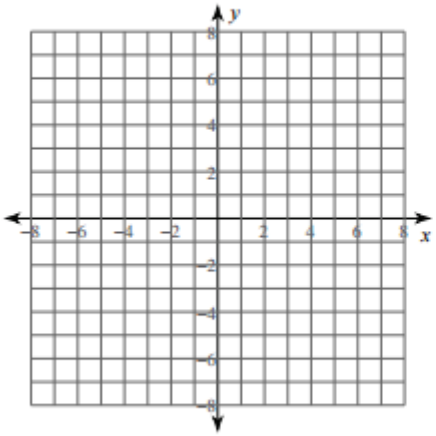
9) $y = \sqrt{x + 6}$



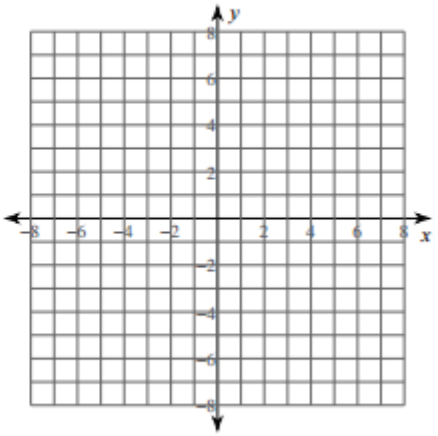
10) $y = 3\sqrt{x - 4}$



11) $y = \sqrt{x}$

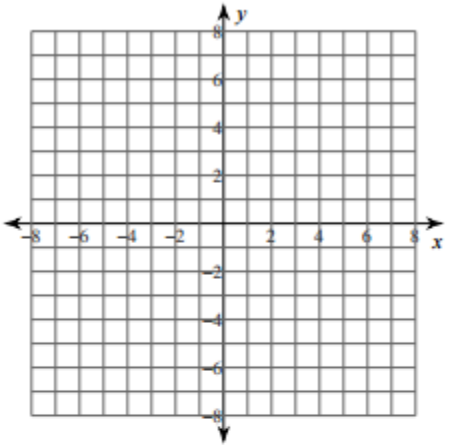


12) $y = \sqrt{x} - 4$

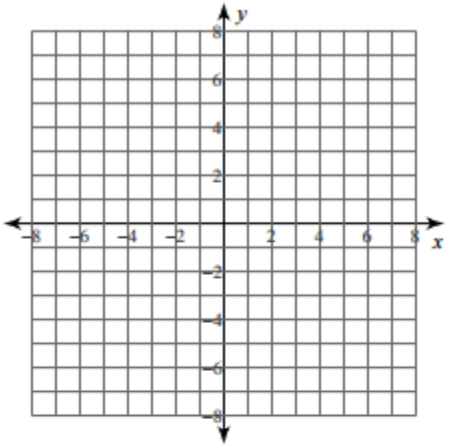


Graphing Cube Root Graphs

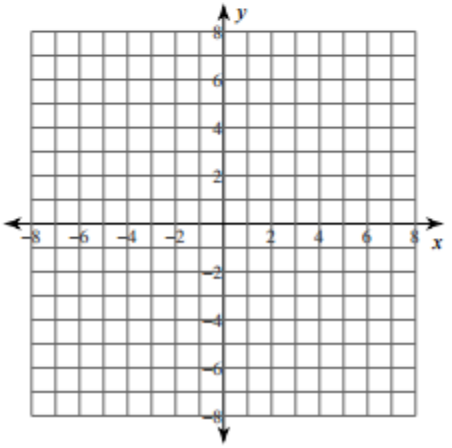
1) $y = 2\sqrt[3]{x} + 3$



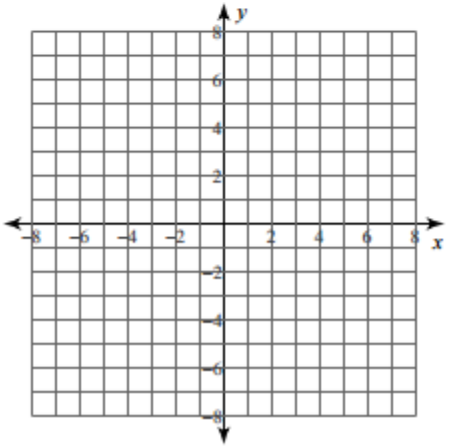
2) $y = -3\sqrt[3]{x-3}$



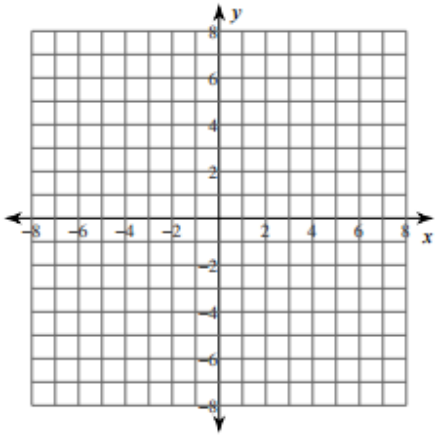
3) $y = -2\sqrt[3]{x-2}$



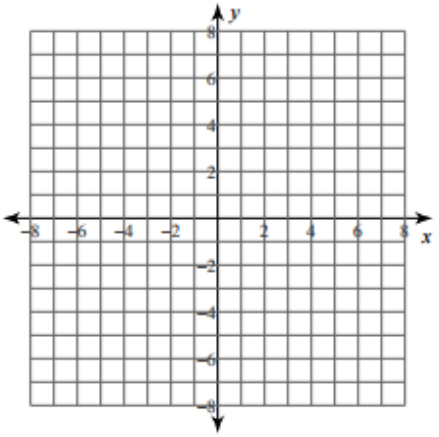
4) $y = \sqrt[3]{x} - 1$



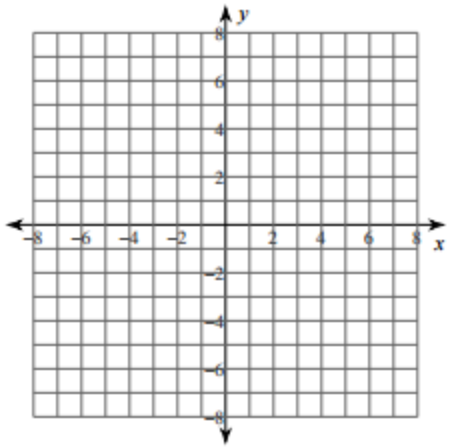
5) $y = -3\sqrt[3]{x+2}$



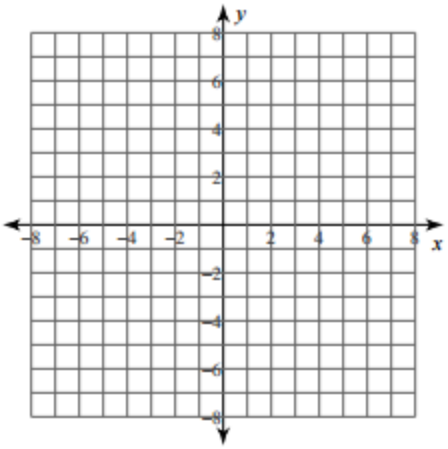
6) $y = \sqrt[3]{x}$



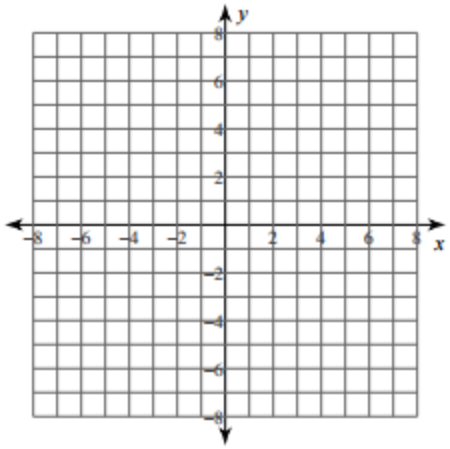
7) $y = -3\sqrt[3]{x-2}$



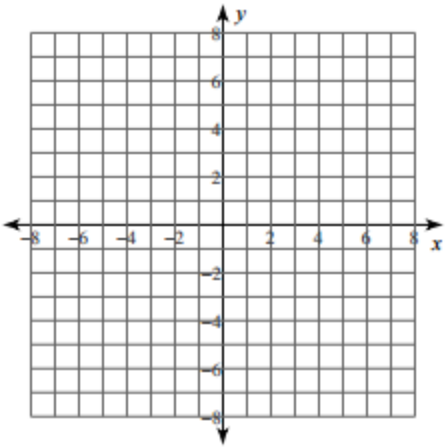
8) $y = 2\sqrt[3]{x+1}$



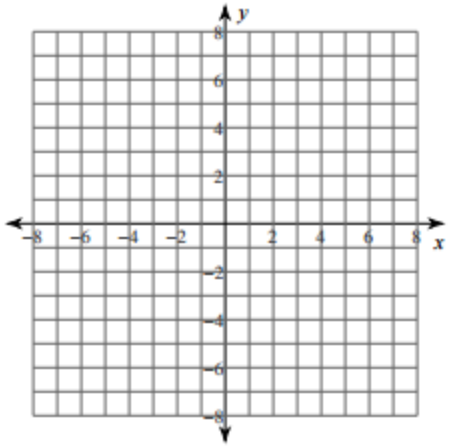
9) $y = -3 + \sqrt[3]{x-4}$



10) $y = 3 - 3\sqrt[3]{x+3}$



11) $y = \sqrt[3]{x-3}$



12) $y = \sqrt[3]{x} - 3$