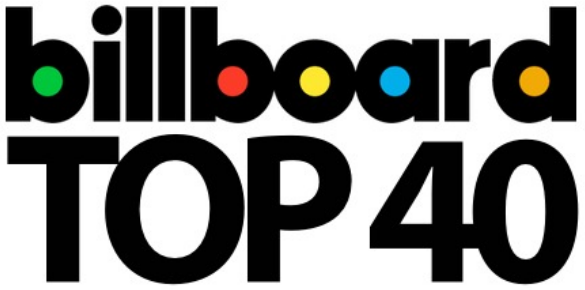
ACCELERATED MATHEMATICS: CHAPTER 8

MEASUREMENT AND STATISTICS



BATTLE OF THE NUMBER ONE HITS

MEASUREMENT & STATISTICS UNIT COVERING:

- Center of a Set of Data (Mean, Median, Mode)
- Spread of a Set of Data (Range, Quartiles, IQR, MAD)
- Box Plots
- Shape of a Set of Data (Symmetrical and Shew)
- Scatter Plots**,** Stem-and-Leaf, Venn diagrams
- Line, Bar, Double Bar, Circle, and Pictographs
- Line Plots, Dot Plots, Histograms, Scatter Plots, Frequency Tables
- Customary Units and Conversions
- Metric Units and Conversions
- Conversions Between Systems

#2 Hits of the 2010s (They just barely missed #1!)			
DANCING WITH A STRANGER	Sam Smith & Normani		
Chart Run: 29, 21, 16, 13, 11, 9, 9, 6, 5, 5, 3, 2, 3, 2, 2, 2, 2, 2, 2, 2, 5, 9, 13, 20, 26, 36	Top 40: 26	Top 10: 17	#2: 8
MEANT TO BE	Bebe Rexha f/ Florida Georgia Line		
Chart Run: 39, 32, 30, 27, 24, 18, 16, 16, 15, 15, 14, 14, 13, 12, 10, 8, 8, 6, 5, 5, 3, 3, 2, 2, 2, 9, 13, 20	Top 40: 28	Top 10: 12	#2: 3
WHATEVER IT TAKES	Imagine Dragons		
Chart Run: 34, 24, 20, 15, 13, 11, 9, 8, 7, 7, 6, 5, 5, 4, 3, 2, 3, 8, 12, 22, 33	Top 40: 21	Top 10: 12	#2: 1
ONE DANCE	Drake		
Chart Run: 24, 14, 11, 7, 5, 5, 4, 4, 3, 3, 3, 2, 2, 2, 3, 4, 7, 9, 11, 14, 31, 39	Top 40: 22	Top 10: 15	#2: 3
SHUT UP AND DANCE	Walk The Moon		
Chart Run: 39, 33, 30, 29, 25, 17, 14, 11, 10, 9, 6, 5, 3, 3, 3, 3, 3, 2, 2, 2, 4, 7, 10, 14, 27, 34	Top 40: 26	Top 10: 15	#2: 3
HO HEY	The Lumineers		
Chart Run: 40, 39, 33, 26, 20, 18, 14, 12, 10, 6, 6, 4, 3, 2, 2, 3, 3, 3, 6, 6, 7, 11, 13, 15, 23, 32	Top 40: 26	Top 10: 13	#2: 2
RADIOACTIVE	Imagine Dragons		
Chart Run: 38, 38, 38, 30, 23, 20, 16, 16, 21, 17, 11, 9, 8, 5, 5, 3, 3, 2, 2, 2, 2, 5, 8, 13, 22, 29	Top 40: 26	Top 10: 12	#2: 4
SOME NIGHTS	Fun.		
Chart Run: 35, 32, 27, 25, 21, 18, 17, 16, 14, 14, 13, 12, 9, 8, 8, 6, 4, 3, 3, 3, 2, 3, 6, 10, 15, 20, 25, 30	Top 40: 28	Top 10: 12	#2: 1

DESCRIBING A SET OF DATA
CENTER

One way to describe a set of data is by finding its center. The center of a set of data can be described with either the mean, median, or mode.

7 7 17 17 25

Mean – The average. Add up all of the numbers and divide by the quantity of numbers.

$$\text{MEAN} = \frac{7+7+17+17+25}{5} = 14.6$$

Median – The median is the middle number when the numbers are lined up from least to greatest. Half of the numbers are more than the median and half of the numbers are less than the median.

7 7 17 17 25

17 is the median of this set of numbers.

If two numbers are in the middle, the median is determined by averaging those two numbers.

Mode – The most common number in a set. If two or more numbers are the most common, all of those numbers are the modes. **If all numbers in a set are in equal amounts, then there is "*no mode*".**

The mode of the set of numbers above is **7 and 17**.

1.	{12, 8, 6, 14, 18, 8, 300} Why is the mean of the set above not a good representation of the set of numbers?	
2.	{2, 4, 4, 6, 84, 88, 92, 98} Why is the median of the set above not a good representation of the set of numbers?	
3.	{1, 1, 4, 5, 6, 7, 8, 9, 10, 90, 90} Why is the mode of the set above not a good representation of the set of numbers?	
4.	{3, 3, 6, 6, 9, 9} What is the mode of this set of numbers?	
5.	A set of 5 different positive integers has a mean of 33 and a median of 40. How large can the greatest number be?	
6.	Research the winning and losing scores of the last 11 Super Bowls. What is the median winning score and the median losing score?	

Activity 8-2: **Center of Data - Mean, Median, Mode** Name:

Use the song data provided at the beginning of this unit to answer the following questions. You may use a calculator for computation on this page only. If necessary, round numbers to the nearest tenth.

		Mean	Median	Mode
1.	What was the mean, median, and mode for the number of weeks the 8 songs were in the top 40?			
2.	What was the mean, median, and mode for the number of weeks the 8 songs were in the top 10?			
3.	What was the mean, median, and mode for the number of weeks the 8 songs were at number 2?			

Pick 4 songs from the list. Write the songs in the table below and calculate the centers of data using each song's entire *chart run*.

	Song Name	Mean	Median	Mode
4.				
5.				
6.				
7.				

8.	Which song(s) had the lowest mean? Interpret your result.	
9.	Which song(s) had the highest median? Interpret your result.	
10.	Which song(s) had the lowest mode? Interpret your result.	

DESCRIBING A SET OF DATA
SPREAD

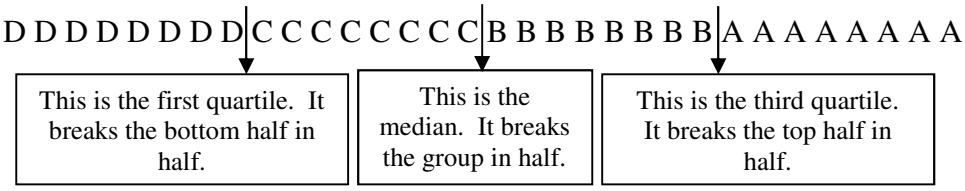
Another way to describe a set of data is by finding its spread. The spread of a set of data can be described with either the range, interquartile range (IQR), or mean absolute deviation (MAD).

Range – The range of a set of numbers is the difference between the smallest and largest numbers.

If the lowest number is 2 and the highest number is 27, then the range is 25.

With large sets of data it is often helpful to separate the data into four equal parts called **quartiles**. The quartiles are used to find another measure of spread called the **interquartile range**. This is the range of the middle half of the set of data.

Students in math class are divided into 4 groups with one-fourth getting the grade of a D, one-fourth C, one-fourth B, and the best one-fourth get an A.

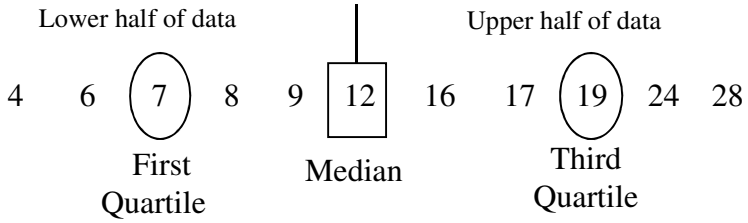


First (Lower) Quartile – The median of the lower half of the data.

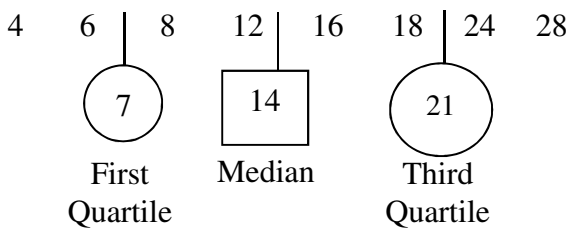
Third (Upper) Quartile – The median of the upper half of the data.

Interquartile Range – The difference between the third quartile and the first quartile.

Examples:



Interquartile Range = 19 – 7 = 12 So half of the numbers (approximately) are between 7 and 19.



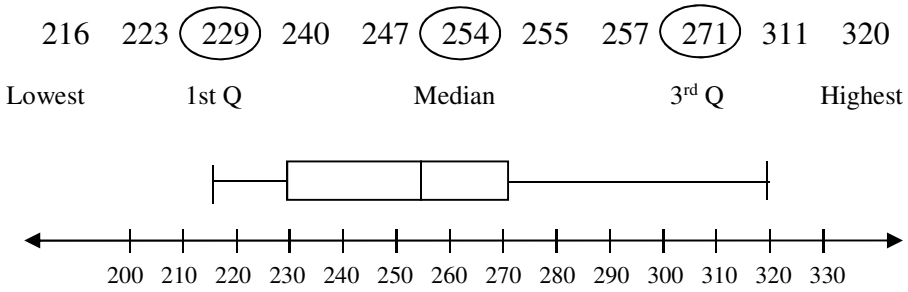
Interquartile Range = 21 – 7 = 14 So half of the numbers are between 7 and 21.

DESCRIBING A SET OF DATA
SPREAD

Box plot – A box plot summarizes the data using the median, the first and third quartiles, and the highest and lowest, or extreme values. Sometimes this is called a box-and-whisker plot.

Directions to construct a box plot:
1. Draw a number line at least as long as the range of the data.
2. Place vertical lines (or dots) above the number line to represent the **lowest value**, **first quartile**, **median**, **third quartile**, and **highest value**. The lowest and highest values are called the **extremes**.
3. Draw a box containing the quartile values. Draw a vertical line through the median. Extend the whiskers from each quartile to the extreme values.

Example:



Note that all the numbers on the line are evenly spaced.
This is very important for a box plot.

Taylor Swift shows up at DIS to play her brand new song. At the end of the performance she asks teachers to rate the new song on a scale of 1 to 10. Instead of looking at all the ratings, Mr. Mangham decides to make an estimate by taking a sample of 10 answers. Then, he can determine the mean score.

Population – All of the teachers at DIS.

Sample - This is the 10 scores that Mr. Mangham random chooses to get data from. You would say that the **sample size** is 10.

Mr. Mangham gets the following data: 3, 5, 6, 7, 8, 8, 9, 9, 10, 10

Variability – Another name for spread. The variability of data describes how spread out the data is.

DESCRIBING A SET OF DATA
SPREAD

Mean absolute deviation - The mean absolute deviation is the average of the absolute values of the differences of each data value from the mean. In other words, it is the average distance that each value is away from the mean.

Teacher Ratings of the new Taylor Swift song				
Data		**Mean**	**Absolute value of difference from mean**	**MAD**
3 5 6 7 8	8 9 9 10 10	$\text{Mean} = \frac{75}{10} = 7.5$	4.5 2.5 1.5 0.5 0.5	0.5 1.5 1.5 2.5 2.5	$\text{MAD} = \frac{18}{10} = 1.8$

If a data set has a small MAD, then this means that the data values are relatively close to the mean. If the MAD is large, then the values are spread out and far from the mean.

To find the MAD:

1. Find the mean
2. Subtract each data value from the mean and take the absolute value of each value.
3. Add up all values from step #2.
4. Divide by the number of data values to find the mean of the distances.

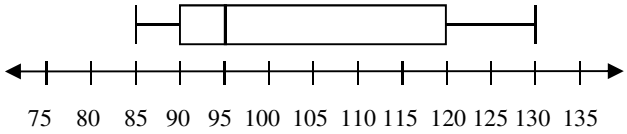
1.	Determine the range of the chart run for each of your 4 songs that you choose back on the last assignment.				

For the same 4 songs from above, complete the table below using each song's chart run.

	Song	Extreme Low Value	First Quartile	Median	Third Quartile	Extreme High Value	IQR
2.							
3.							
4.							
5.							

1.	Choose one of your four songs from the previous page and construct a box plot on a separate sheet of paper.
2.	Choose a second song and construct a second box plot using the same number line as the first.

Use the box plot below to answer each question.



3.	What is the median?		4.	What is the range?	
5.	What is the first quartile?		6.	What is the third quartile?	
7.	What is the interquartile range?		8.	What are the extremes?	

Use the data at the right to answer each question.

9.	What is the median?	
10.	What is the range?	
11.	What is the third quartile?	
12.	What is the first quartile?	
13.	What is the interquartile range?	
14.	What are the extremes?	
15.	Make a box plot of the data.	

FIGHT SONG – Rachel Patten

Chart run for the first 13 weeks:

40, 34, 26, 22, 19, 16, 14, 12, 11, 9, 7, 5, 5

Fight Song spent 21 total weeks on the chart.

16.	What does it mean if a box plot has one long whisker?	
17.	What does it mean if a box plot has a long box?	
18.	What does it mean if a boxplot has a median toward the left of the box?	

Activity 8-7: **Mean Absolute Deviation** Name:

For the 4 songs you choose previously record the first 10 weeks of the chart run in the table below. Then complete the table.

You may use a calculator for all problems on this page. If necessary, round to the nearest tenth.

		Sum	Mean	Distances from Mean	Sum of Distances from Mean	MAD
1.	Song 1 Chart Run (10 wks):					
2.	Song 2 Chart Run (10 wks):					
3.	Song 3 Chart Run (10 wks):					
4.	Song 4 Chart Run (10 wks):					
5.	What does a small MAD mean in terms of the songs and what does a large MAD mean in terms of the songs?					

Activity 8-8: **Mean Absolute Deviation** Name:

You may use a calculator for all problems on this page. If necessary, round to the nearest tenth.

1.	A song just entered the Hot 100 a few weeks ago and its chart run so far is: 93, 85, 79, 75, 68 What is the mean absolute deviation?
2.	A song was heading off the Hot 100 chart and in the final few weeks its chart run was: 15, 22, 31, 58, 75, 99 What is the mean absolute deviation?
3.	Song A and Song B were both analyzed for eight weeks on the chart. Their ranking are shown below. Which statement is correct about the variability of the two songs? Song A: 12, 8, 5, 3, 9, 16, 35, 40 Song B: 30, 7, 3, 1, 5, 6, 9, 35 A The variability is the same for both Song A and Song B because they have the same mean absolute deviation. B The variability for Song A is greater because the mean absolute deviation is greater for Song A. C The variability for Song B is greater because the mean absolute deviation is greater for Song B. D There is not enough information to determine the variability.

Use the following chart run to answer the questions below:

72, 66, 62, 58, 45, 54, 71, 100

4-5.	Mean = Median =
6-7.	IQR = MAD =
8.	Which measure of central tendency best describes the data (Mean, Median) and why?
9.	Which measure of variability describes the data best (IQR, MAD) and why?
10.	For the latest science test the mean score was 80 and the MAD was 8. Describe what MAD means in this situation?
11.	Justin Bieber and Justin Timberlake went bowling and bowled the following number of strikes in 10 games.

Bieber	4	9	8	2	1	9	7	8	5	7
Timberlake	4	6	5	4	5	4	7	4	5	6

What is the mean and the mean absolute deviation of the number of strikes of each bowler?

12.	What does the mean absolute deviation suggest about each bowler's consistency?

DESCRIBING A SET OF DATA
SHAPE

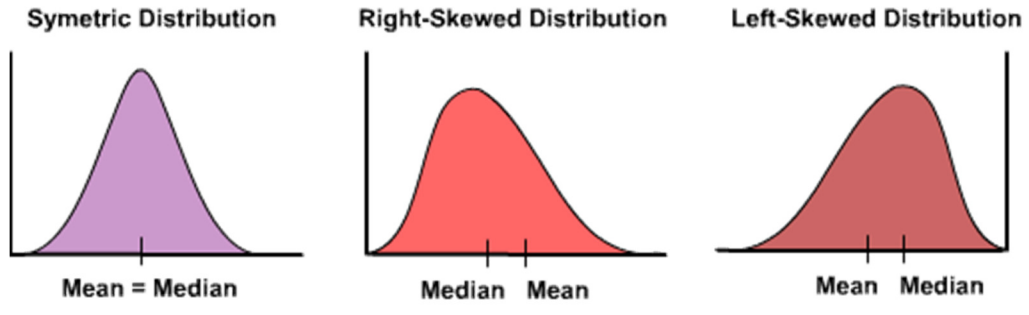
A final way to describe a set of data is its shape. When the data is graphed or plotted in some way how do all the numbers compare to all the other numbers? Are more towards the left or the right?

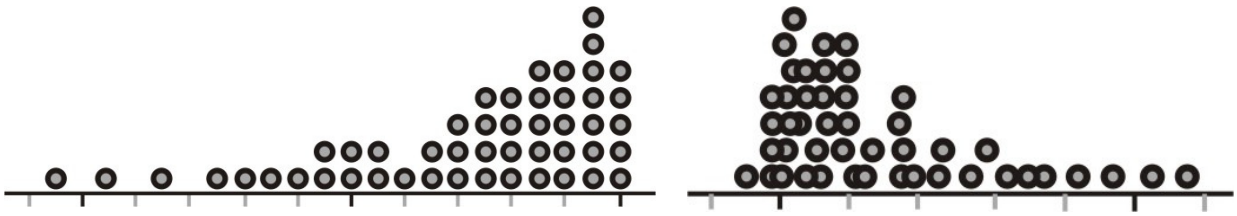
Skew - Skew means to distort.

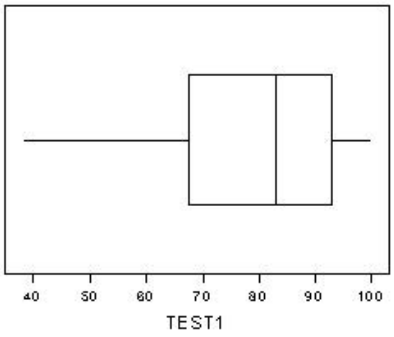
Symmetric – A symmetric graph typically has a high point or peak in the middle of the data set. The mean and median are or about equal.

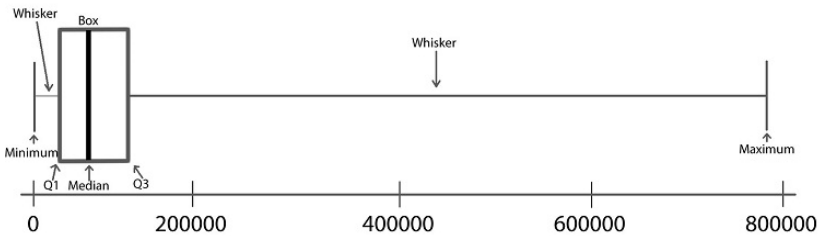
Skewed right – A right-skewed graph has much of its data to the left with only a few data values on the right. The mean of the data set is greater than the median.

Skewed left – A left-skewed graph has much of its data to the right with only a few data values on the left. The mean of the data set is less than the median.









Activity 8-10: **Graphs** Name:

CIRCLE GRAPHS – 1982 and 1978 Top 25 Songs of 1982 and 1978

1.	In the 1982 circle graph, how many songs stayed in the top 10 for 11 to 13 weeks?	
2.	What is the sum of the percentages on any circle graph?	
3.	In the 1978 circle graph, how many songs stayed in the top 10 for less than 14 weeks?	
4.	Did songs generally stay in top 10 longer in 1978 or 1982?	
5.	In the 1982 circle graph, which two categories make up $\frac{12}{25}$ of all the songs?	
6.	How many more songs stayed in the top 10 for 11 or more weeks in 1982 than in 1978?	

BAR GRAPH – Top 50 Songs of 1975, 1980, 1985

7.	Which year had the least number of songs stay in the top 40 for at least 14 weeks?	
8.	Which year generally had songs stay the longest in the top 40?	
9.	What percentage of 1975 songs stayed in the top 40 for at least 16 weeks?	
10.	How many more songs stayed in the top 40 at least 16 weeks in 1980 than in 1985?	
11.	What percentage of 1985 songs stayed in the top 40 for at least 14 weeks?	
12.	Which year do you think had more songs make the top 40 overall?	

BAR GRAPH – Top 50 Songs of 1960, 1965, 1970

13.	Which year had the least number of songs stay in the top 40 for at least 12 weeks?	
14.	Which year generally had songs stay the longest in the top 40?	
15.	What percentage of 1960 songs stayed in the top 40 for at least 16 weeks?	
16.	How many more songs stayed in the top 40 at least 14 weeks in 1960 than in 1970?	
17.	What percentage of 1965 songs stayed in the top 40 for at least 12 weeks?	
18.	Which year do you think had more songs make the top 40 overall?	

LINE GRAPH – Chart Run: Something Just Like This

19.	What position was Something Just Like This at its first week on the chart?	
20.	How many weeks was the song on the chart before it hit the top 10?	
21.	What is the mode of these first 9 weeks on the chart?	
22.	What is the range of these first 9 weeks on the chart?	
23.	What are the first and third quartiles of these first 9 weeks on the chart?	
24.	Based on the chart, do you think Something Just Like This hit number 1?	

Activity 8-11: **Graphs** Name:

SCATTER PLOT – #1 Songs Each Year 1964-1983

1.	Which year(s) had the most number 1 songs?	
2.	Which year(s) had about half as many number 1 songs as 1974?	
3.	Just looking at the graph, what would be a good estimate of the mean number of #1 songs during these years?	
4.	What is the median number of #1 songs during these years?	
5.	Find two years that combine to make a total of 40 number 1 songs.	
6.	Does the scatter plot show a positive, negative, or no relationship?	

HISTOGRAM – Weeks Spent in the Hot 100

7.	How many of the top 100 songs of 1982 spent at least 17 weeks in the Hot 100?		
8.	Would you describe the shape of the data as symmetrical, skewed left, or skewed right?		
9.	Did more songs spend between 14 and 19 weeks in the Hot 100 or between 23 and 31 weeks in the Hot 100?		
10.	What would be a good estimate of the median for the number of weeks spent in the Hot 100?		
11.	Create the frequency table for the histogram.		14-16 | 6

DOT PLOT – Length of Stay at #1 in 1972

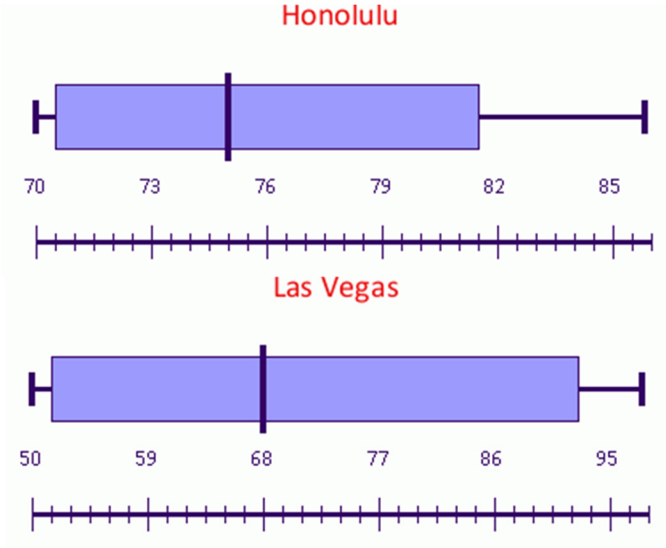
12.	What is the mode of the weeks at number 1?	
13.	What is the interquartile range of the weeks at number 1?	
14.	How many songs spent at least 3 weeks at number 1?	
15.	What is the range of the weeks spent at number 1?	
16.	The mean of the data is 2.4. What is the MAD for this set of data?	

VENN DIAGRAM – 1975 Song Comparison

17.	How many songs hit #1 in 1975?	
18.	How many songs spent at least 14 weeks in the Hot 100 in 1975?	
19.	How many songs hit #1 and spent at least 14 weeks in the Hot 100 in 1975?	

Activity 8-12: **Box Plots** Name:

Maroon 5 is trying to decide if they want their next concert in Honolulu or Las Vegas. The following box plots represent the average monthly temperatures in Honolulu and Las Vegas.

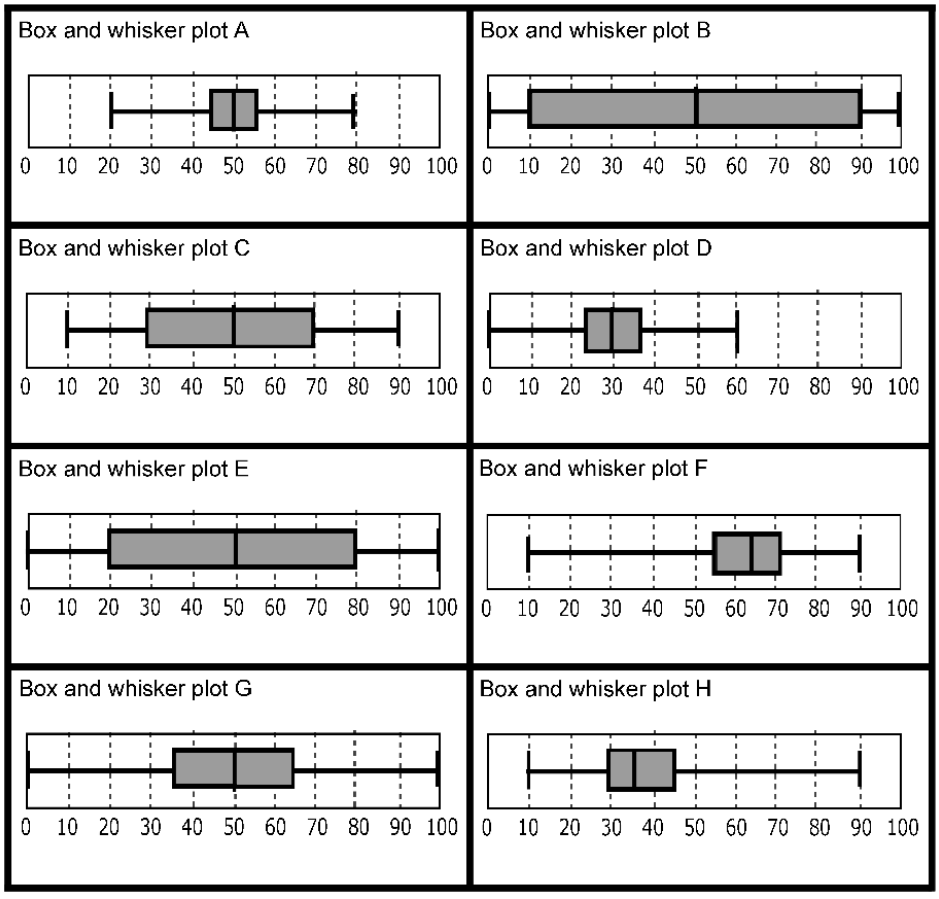


Agree or disagree?

1. The median temperatures for both cities are very close. There is less than a 10 degree difference between them.

2. Most months in Las Vegas have an average temperature between about 68 and 92 since the third quartile is the longest part of the box plot.

3. Honolulu has greater variability in temperature because its median is higher.



Activity 8-13: **Stem-and-Leaf Plots** Name:

Madonna has a lot of hit songs in the 1980s and the 1990s. Below is a stem-and-leaf plot showing where 10 of her hits each decade reached on the chart.

Madonna Hit Songs		
1980s Songs		**1990s Songs**
5 5 4 2 1 1	0	1 1 3 6 8
6 0	1	1 4
0	2	
2	3	6
	4	2 6

Key = 0 | 3 means the song peaked at #3

Complete the table below for Madonna's songs.

	1980s Song	**1990 Songs**
Biggest Hit (minimum number)		
First quartile (Q1)		
Median		
Third Quartile (Q3)		
Smallest Hit (Maximum number)		
IQR		
Calculator portion		
Mean (nearest tenth)		
MAD (nearest tenth)		

1.	Which decade would you say was better for Madonna?
2.	Compare the spread (or variability) of the stem-and-leaf plots for each year.
3.	Create a dot plot for each year to represent the data.
4.	How does the shape of the stem-and-leaf plot compare with the shape of the dot plot?
5.	Using a single number line, complete a box plot for each of the decades.
6.	How does the shape of the box plot compare with the shape of the stem-and-leaf plot?

Activity 8-14: **Stem-and-Leaf Plot/Dot Plot** Name:

Stem-and-Leaf Plot

1.	Create a stem-and-leaf plot for Wake Me Up (see earlier data page). Make sure to include a key.
2.	Create a stem-and-leaf plot for Call Me Maybe (see earlier data page). Make sure to include a key.
3.	{27, 12, 25, 20, 13 ,14, 23, 19, 22, 21, 26, 16, 15, 21, 17, 24, 16, 21, 13, 21} Create a dot plot of the above data on the number line below. 

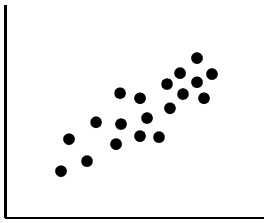
Activity 8-15: **Scatter Plots** Name:

When you graph two sets of data as ordered pairs, you form a **scatter plot**. A scatterplot is a graph that displays bivariate data on a coordinate plane and may be used to show a relationship between two variables.

If the points trend upward to the right, there is a positive relationship or positive association.

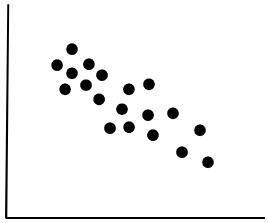
If the points trend downward to the right, there is a negative relationship or negative association.

If no trend is evident, there is no relationship.



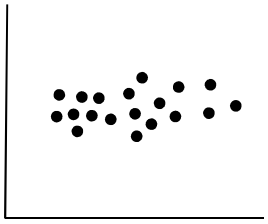
Positive relationship

For example, the more passes you throw the more yards you will get.



Negative relationship

For example, the more points you score the fewer games you will lose.



No relationship

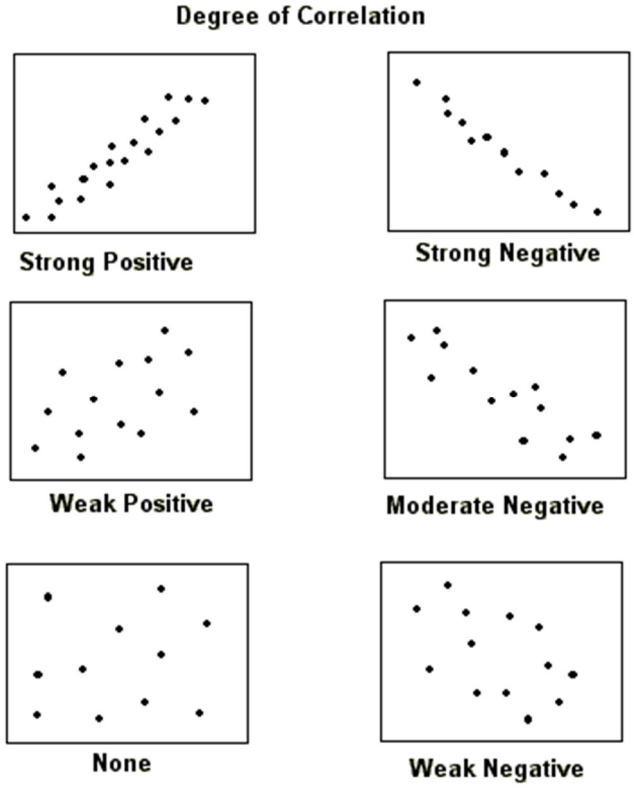
For example, the amount of times you win the coin flip does not affect how many games you win.

When a linear pattern, such as one of the form $y = mx + b$, describes the essential nature of the relationship between two variables, they have a **linear association**.

When a non-linear pattern, such as a curve, describes the essential nature of the relationship between two variables, they have a **non-linear association**.

When data points are not completely linear, a **trend line** is used to allow us to make predictions from the data. A trend line indicates the general course of data.

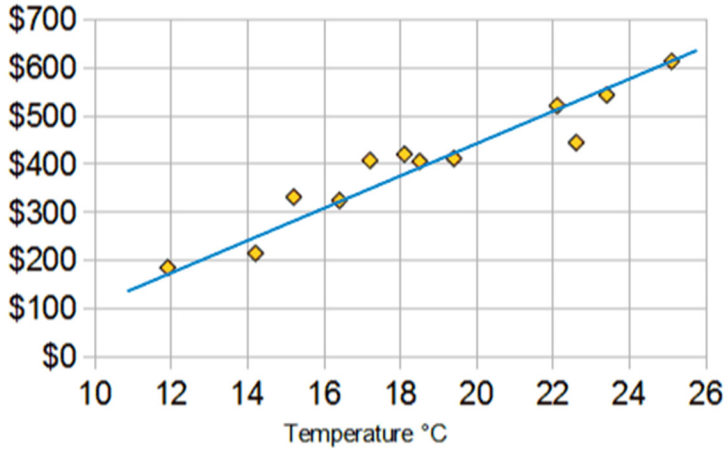
Bivariate data shows the relationship between two variables. Example: Ice cream sales versus the temperature on that day. The two variables are Ice Cream Sales and Temperature.

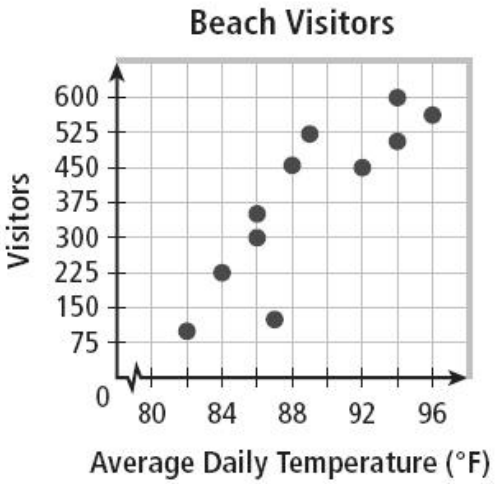


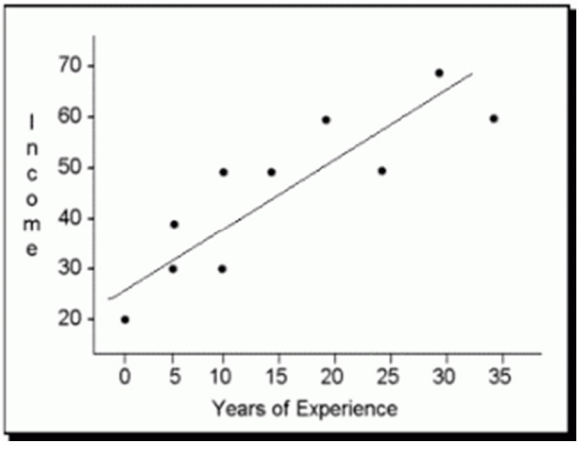
Activity 8-16: **Scatter Plots** Name:

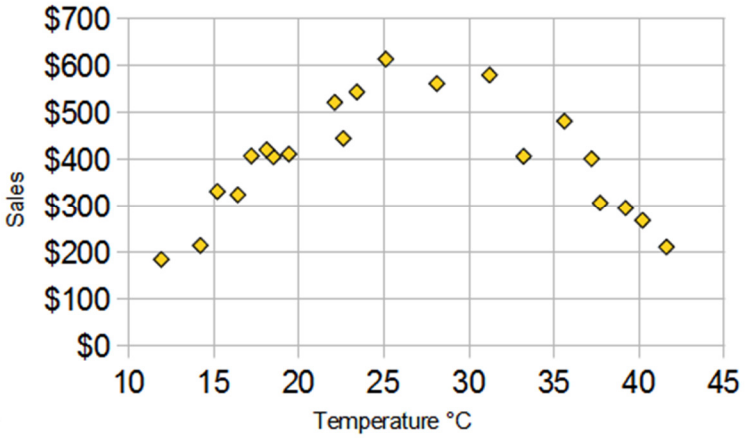
Determine whether a scatter plot of the data below would show a positive, negative, or no relationship (correlation).

1.	The selling price of a calculator and the number of advanced features it contains	
2.	The number of miles walked in a pair of shoes and the thickness of the heel	
3.	A child's age and the child's height	
4.	Hair color and how fast you can run a mile	
5.	The number of minutes a candle burns and the candle's height	







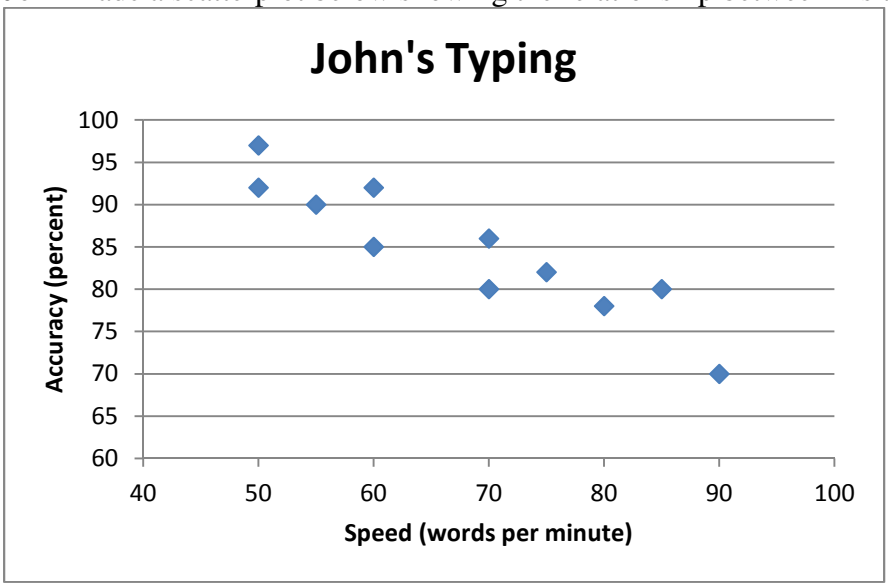


Activity 8-17: **Scatter Plots** Name:

Determine whether a scatter plot of the data below would show a positive, negative, or no relationship or correlation.

1.	The length of an Uber ride and the total cost	
2.	Gender and the year of your birth	
3.	How much you read and the number of words you know	
4.	How fast you type and how long it takes you to type a book report for LA class	
5.	The number of words written and amount of ink remaining in a pen	
6.	The number of letters in your first name and your height in centimeters	
7.	The outside temperature and cost of air conditioning	
8.	The number of pages you have read in a book and the number of pages remaining.	
9.	The day of the month and the wind speed.	
10.	The age of a car and its selling price.	
11.	The weight of a vehicle and its gas mileage.	
12.	The outside temperature and the number of people in attendance at the beach.	
13.	The month of the year and the number of birthdays in a certain month.	
14.	The population of a state and the number of senators.	
15.	The length of your hair and the number of days since your last haircut.	
16.	The number of hours spent studying and the test score received.	

John made a scatterplot below showing the relationship between his typing accuracy and his typing speed.



Which statement best describes the relationship shown in this scatterplot?

A. There is no relationship between John's typing speed and his typing accuracy.

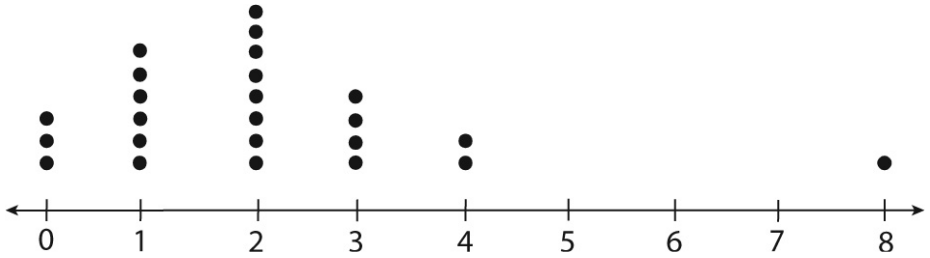
B. As John's typing speed increased, his accuracy remained constant.

C. As John's typing speed increased, his accuracy increased.

D. As John's typing speed increased, his accuracy decreased.

Activity 8-18: **Dot Plots** Name:

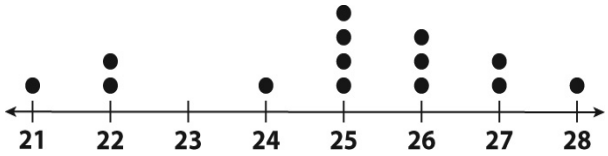
The number of pets owned by each seventh-grade student's family is shown in the dot plot.



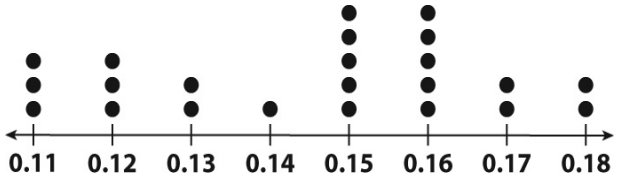
1.	What number of pets occurs most often?	
2.	What fraction of the class has the number of pets that occurs most often? Express your answer as a percent, too.	
3.	Why is the student's family that has 8 pets not representative of the class as a whole?	

Find the values for each dot plot.

4.

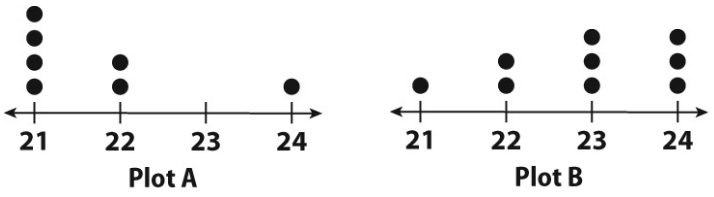


5.



4.	Range =	Median =	Mode =
5.	Range =	Median =	Mode =

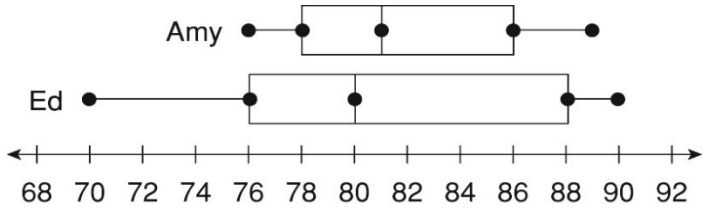
Compare the dot plots by answering the questions.



6.	How do the ranges compare?		
7.	Compare the number of elements.		
8.	How do the modes compare? How do the medians compare?		
9.	Describe the spread and shape of the dots in each plot.		

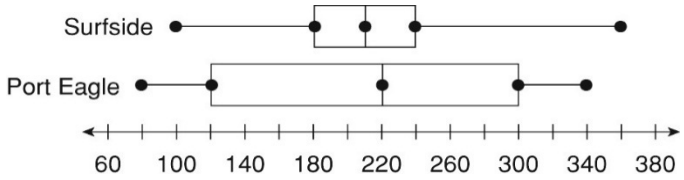
Activity 8-19: **Box Plots** Name:

The box-and-whisker plot shows the test scores of two students.



1.	Which student has the greater median test score?	
2.	Which student has the greater interquartile range of test scores?	
3.	Which student has the greater range of test scores?	
4.	Which student appears to have more predictable test scores? Explain your answer.	

Use the box-and-whisker plot for the exercises below.



The box-and-whisker plot shows prices of hotel rooms in two beach towns.

5.	Which town has the greater median room price?	
6.	Which town has the greater interquartile range of room prices?	
7.	Which town appears to have more predictable room prices? Explain your answer.	

Name the sampling method that will best represent the whole population in each situation. Explain your answer.

1. Student satisfaction with the middle school cafeteria.
   Method A: Survey 40 students in two seventh-grade math classes.
   Method B: Survey 65 students from a list of all students in the school.
   Method _____ best represents the whole population of the school because
   _____

2. Predicted winner in an election for town mayor.
   Method C: Telephone 100 randomly-chosen voters who live in the town.
   Method D: Telephone 70 people who have lived in the town for more than 25 years.
   Method _____ best represents the whole population of the town's voters because
   _____

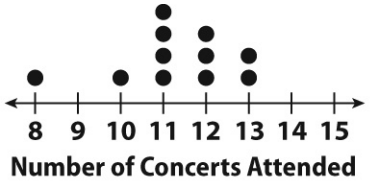
3. Which of these may be biased samples? Explain your answer.

A. A town official surveys 50 people in a library to decide if town residents want the library services and facilities expanded.
B. A cable television company randomly calls 200 customers and asks them if they are satisfied with their service.

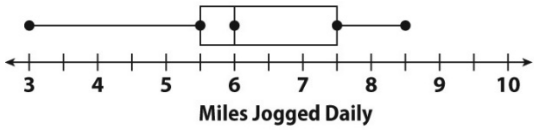
_____

What can you infer about the population from each data set represented below?

4.

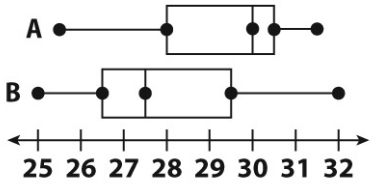


5.



_____ _____

The box plots show the distribution of grade-level test scores of 20 students in School A and 20 students in School B. Answer True or False for each statement.



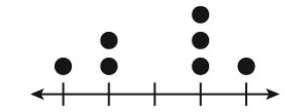
6.	The median score at School A is higher than school B.	
7.	The range of scores at School B is less than the range of scores at School A.	
8.	25% of the students at School A got a score greater than 25 but less than or equal to 28.	

Solve.

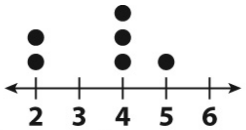
1.	A seventh-grade student chooses a random sample of 50 out of 400 students. He finds that 7 students have traveled outside the United States. The student claims that over 50 of the 400 students have likely traveled outside the United States. Is the student correct? Explain.	
2.	A metal-fabricating company produces 150,000 souvenir tokens each year. In a random sample of 400 tokens, 3 have stamping errors. Predict the total number of coins that will have stamping errors in a year.	

Use the description to complete the exercises below.

Students in two science classes were asked to write a research paper. The students used the Internet to find web sites related to their research topics. Answer the questions about the two classes' use of the Internet based on the samples in the dot plots.



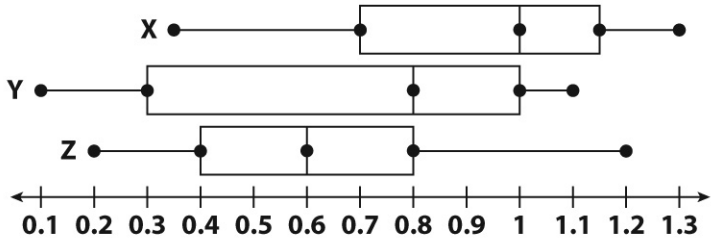
Class A Web Sites Visited



Class B Web Sites Visited

3.	How do the ranges of visits compare?	
4.	How do the medians compare?	
5.	Compare the two classes' usage of web sites. Include comments about the spread and shape of the data and which class has more "average" use of web sites.	

Use the box plots for the exercises below.



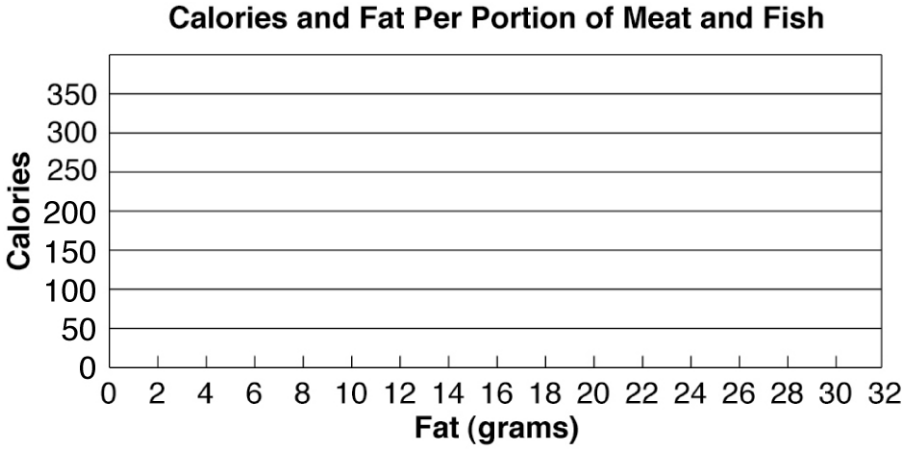
Optical Fiber Diameters, millimeters, 30 samples per batch

6.	Which batch of fibers has the smallest range of diameters among its samples?	
7.	In which batches are the median and third quartile the same?	
8.	Which batch of fibers has outliers?	
9.	In which batch are 75% of the samples no greater than 1 millimeter?	

1. Use the given data to make a scatter plot.

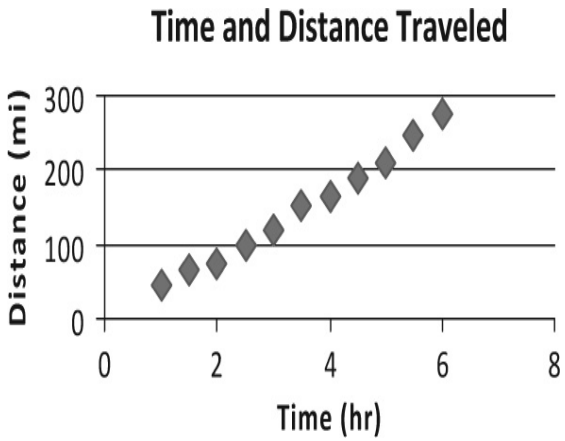
Calories and Fat Per Portion of Meat and Fish

Food (Meat or Fish)	Fat (grams)	Calories	Food (Meat or Fish)	Fat (grams)	Calories
Fish Sticks (breaded)	3	50	Ground beef (broiled)	10	185
Shrimp (fried)	9	190	Roast beef (relatively lean)	7	165
Tuna (canned in oil)	7	170	Ham (light cure, lean and fat)	19	245



Use the scatter plot for the questions below.

2. Does the pattern of association between time (number of hours traveled) and distance (number of miles traveled) appear to be linear or nonlinear? Explain.



3. Explain any clustering.

4. Identify any possible outliers.

5. Write an equation for the line of best fit.

6. What does the slope of the line of best fit represent?

7. What does the *y*-intercept of the line of best fit represent?

Accelerated Mathematics Formula Chart Name: _____

Linear Equations

Slope-intercept form	$y = mx + b$	Direct Variation	$y = kx$ (8th grade)
Constant of proportionality	$k = \frac{y}{x}$	Slope of a line	$m = \frac{y_2 - y_1}{x_2 - x_1}$ (8th grade)

Circumference Circle $C = 2\pi r$ or $C = \pi d$

Area

Rectangle	$A = bh$	Trapezoid	$A = \frac{1}{2}(b_1 + b_2)h$
Parallelogram	$A = bh$	Circle	$A = \pi r^2$
Triangle	$A = \frac{bh}{2}$ or $A = \frac{1}{2}bh$		

Surface Area (8th grade)	**Lateral**	**Total**
Prism	$S = Ph$	$S = Ph + 2B$
Cylinder	$S = 2\pi rh$	$S = 2\pi rh + 2\pi r^2$

Volume

Triangular prism	$V = Bh$	Cylinder	$V = Bh$ or $V = \pi r^2 h$ (8th grade)
Rectangular prism	$V = Bh$	Cone	$V = \frac{1}{3}Bh$ or $V = \frac{1}{3}\pi r^2 h$ (8th)
Pyramid	$V = \frac{1}{3}Bh$	Sphere	$V = \frac{4}{3}\pi r^3$ (8th grade)

Pi $\pi \approx 3.14$ or $\pi \approx \frac{22}{7}$

Distance	$d = rt$	**Compound Interest**	$A = P(1 + r)^t$
Simple Interest	$I = prt$	**Pythagorean Theorem**	$a^2 + b^2 = c^2$ (8th grade)

Customary – Length 1 mile = 1760 yards 1 yard = 3 feet 1 foot = 12 inches	***Customary – Volume/Capacity*** 1 pint = 2 cups 1 cup = 8 fluid ounces 1 quart = 2 pints 1 gallon = 4 quarts	***Customary – Mass/Weight*** 1 ton = 2,000 pounds 1 pound = 16 ounces
Metric – Length 1 kilometer = 1000 meters 1 meter = 100 centimeters 1 centimeter = 10 millimeters	***Metric – Volume/Capacity*** 1 liter = 1000 milliliters	***Metric – Mass/Weight*** 1 kilogram = 1000 grams 1 gram = 1000 milligrams

Created by Lance Mangham, 6th grade math, Carroll ISD

Name	Abbreviation	Approximate Comparison
inch	in	length of half a thumb length of a paper clip
foot	ft	length of an adult male foot
yard	yd	length from nose to outstretched fingertip
mile	mi	length of 14 football fields
ounce	oz	weight of a birthday card
pound	lb	weight of three apples
quart	qt	amount in a medium container of milk
gallon	gal	amount in a small bucket
kilometer	km	9 football fields a little more than half a mile
meter	m	half the height of a door a meter stick a little bit more than 3 feet the width of a door
centimeter	cm	length of a raisin the width of your pinky the width of an M&M the width of a paper clip
millimeter	mm	width of a period at the end of a sentence the width of a dime the point of a pencil
kilogram	kg	mass of a cantaloupe the mass of a few apples the mass of a hammer
gram	g	mass of a raisin the weight of a paperclip the weight of a Cheerio the weight of a marshmallow
milligram	mg	the weight of a grain of sand the weight of a grain of rice
liter	L	half of a large bottle of soda
milliliter	mL	half an eyedropper a raindrop

Activity 8-24: **Measurement Conversions** Name:

There are several different ways to convert between units of measurement. One very good way is to use proportions.

Example 14 gallons = x qt.
Use the fact that 1 gal = 4 qt.

$$\frac{1 \text{ gallon}}{4 \text{ quart}} = \frac{14 \text{ gallons}}{x \text{ quarts}}$$

$$1 \bullet q = 4 \bullet 14$$

$$q = 56 \text{ quarts}$$

Example #2 14 qt. = x gal.

$$\frac{1 \text{ gallon}}{4 \text{ quart}} = \frac{x \text{ gallons}}{14 \text{ quarts}}$$

$$\frac{1 \bullet 14}{4} = \frac{4x}{4}$$

$$3.5 \text{ gal} = x$$

Solve all problems with a proportion and show all steps.

1.	13 yd. = in.	2.	5 mi. = ft.	3.	10 c. = pt.
4.	5 c. = fl. oz.	5.	16 fl. oz. = c.	6.	12 pt. = qt.
7.	7 t. = lb.	8.	2400 oz. = lb.	9.	53 ft. = yd.
10.	2200 yd. = mi.	11.	12 qt. = pt.	12.	3.5 c. = fl. oz.
13.	The sign before a bridge says maximum weight 5 tons. Joe's truck weighs 7,350 pounds. Can the bridge support his weight?				
14.	Kroger is selling 16 ounces of cream cheese for $2.79. Costco is selling 4 pounds of cream cheese for $7.99. Which store has the best price on cream cheese?				
15.	Recipe: 1 quart apple juice, 2.75 cups of lemon-lime soda, 64 ounces pineapple juice, 2 quarts cold water, 0.25 cups lemon juice What is the smallest container that will hold all of this punch? 4, 5, 6, or 7 quart				
16.	How long will it take the students at DIS to drink 1,000,000 pints of milk?				
17.	If each saltwater fish needs about two pints of water in which to live, how many saltwater fish can live comfortably in a 40 gallon aquarium?				
18.	If freshwater fish require about 3 pints of water each, how many fish would fit into the 40 gallon aquarium?				

Activity 8-25: **Metric Measurement** Name:

Choose an appropriate metric unit of mass for each.

1.	a grain of rice		2.	a bag of groceries	
3.	a feather		4.	a cat	
5.	a leaf		6.	an eraser	

Choose an appropriate metric unit of capacity for each.

7.	a gasoline tank		8.	a coffee mug	
9.	6 raindrops		10.	a pitcher of juice	
11.	a swimming pool		12.	a can of paint	

State whether each of the following is best measured in terms of mass or capacity.

13.	a bag of potatoes		14.	water in a birdbath	
15.	an apple		16.	a puppy	
17.	a cup of hot cider		18.	the inside of the refrigerator	
19.	juice in a baby's bottle		20.	water in a fish tank	

Write true or false.

21.	The mass of a horse is about 400 kg.		22.	Jason drank 5.8 L of juice at breakfast.	
23.	A mug holds 250 mL of hot chocolate.		24.	A penny is about 3 kg.	
25.	A teaspoon holds about 5 L.		26.	A textbook is about 1 kg.	

Choose the most reasonable measurement.

27.	About how tall would your friend be?				
	A. 1.5 mm	B. 1,500 cm	C. 1.5 km	D. 1,500 mm	
28.	About how wide would your desk be?				
	A. 50 mm	B. 50 m	C. 5 m	D. 50 cm	
29.	A tree is about how tall?				
	A. 20 km	B. 20 m	C. 20 cm	D. 2 km	
30.	An envelope is about how long?				
	A. 24 cm	B. 2.4 cm	C. 24 mm	D. 2.4 m	
31.	the height of an office building				
	A. km	B. cm	C. m	D. mm	
32.	the length of an ant				
	A. km	B. cm	C. m	D. mm	
33.	the depth of a lake				
	A. km	B. cm	C. m	D. mm	

Activity 8-26: **Metric Measurement** Name:

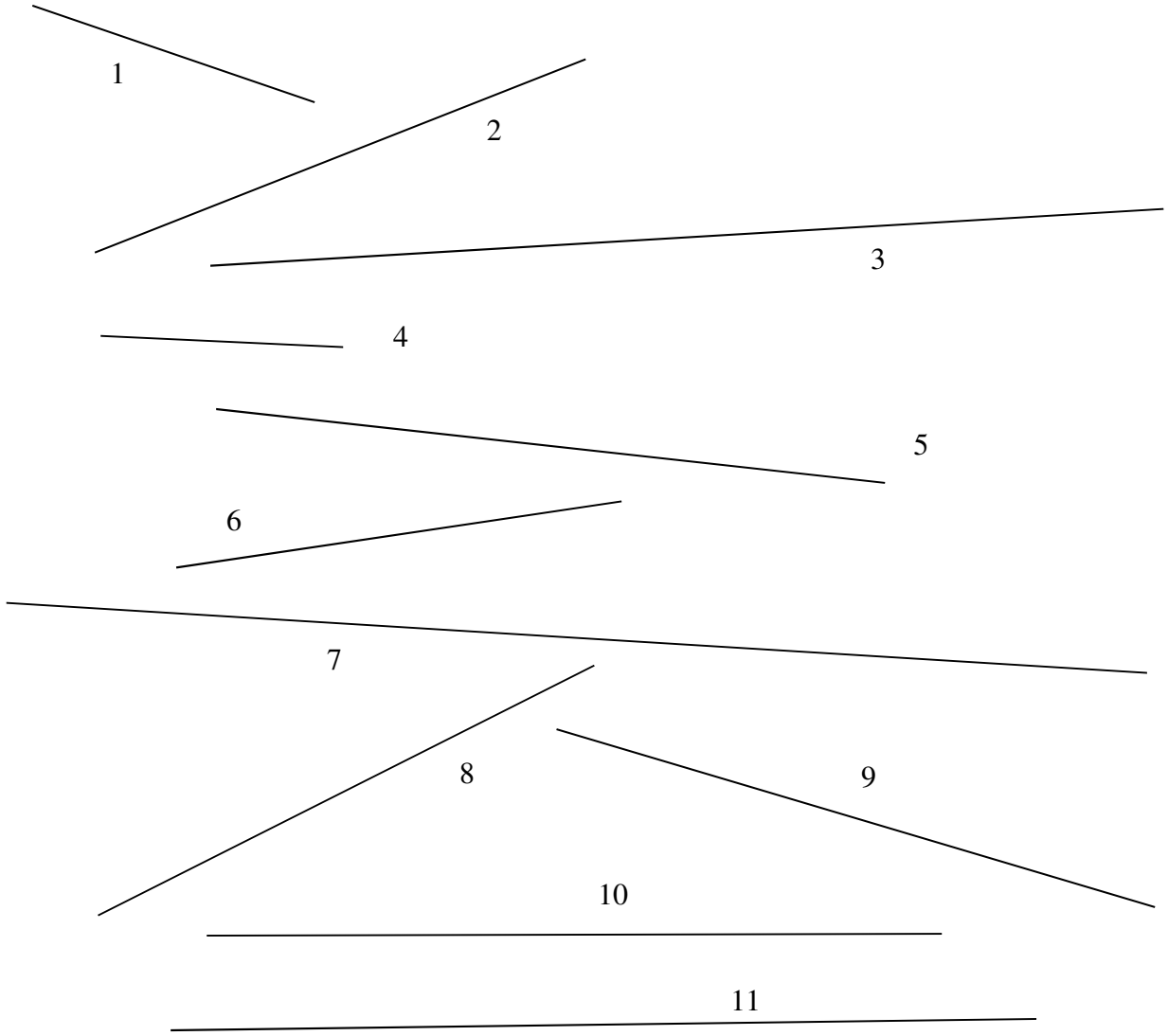
Solve all problems with proportions and show all steps.

1.	3.72 L =	mL	2.	9.75 m =	cm	3.	6.8 g =	kg
4.	0.018 kg =	g	5.	149 cm =	m	6.	524 cm =	m
7.	0.56 kg =	g	8.	3 mm =	cm	9.	14 L =	mL
10.	6.7 g =	mg	11.	9.3 L =	mL	12.	0.89 m =	cm
13.	0.085 g =	mg	14.	4,600 mm =	m	15.	3904 mL =	L

16.	Suzy wants to build a doghouse for Buster. She wants the doghouse to be 4 meters by 3 meters. When she arrives at the lumber store, the clerk tells her the lumber is measured in centimeters. What are the dimensions for Buster's doghouse in centimeters?
17.	Sammy needs to replace all the strings on his kite collection. George's Hobby Shop sells kite string for $15.00/meter. Hobby Depot sells kite string for $13.50/50 centimeters. Sammy needs 8 meters of kite string. How much would Sammy pay for the string at George's Hobby Shop? How much would Sammy pay for the string at Hobby Depot?
18.	Sarah is trying to determine which container to use for her leftovers. She has 2 liters of soup leftover. One of her containers can hold 1000 milliliters of a liquid and the other container can hold 0.01 kiloliters. Which container should she use?
19.	If a zilch is equal to 13 milches and a milch is equal to 23 pilches, would you accept 8000 pilches for 26 zilches?
20.	Alex can run the 50-yard dash in 17 seconds. Andy can run 600-feet in 49 seconds. Which runner is faster?
21.	Kim has 4 windows that are 22 inches long and 4 that are 5 feet long. The fabric store sells fabric by the yard. How many yards of fabric will Kim need if she makes all 8 window toppers?
22.	Jonathon wants to surprise his wife with ice cream. Georgia's Ice Cream Store sells his wife's favorite flavor in two different sizes. He can buy a pint for $5.17 or he can buy a half gallon for $16.00. Which ice cream should Jonathon buy?
23.	Kelli is having a party. She is serving 14 gallons of ice tea. At the party supply store, they have pitchers that can hold 2 quarts. How many pitchers should Kelli buy to serve her ice tea?
24.	Buster the dog weighs 5 kilograms. Last year he weighed 5,500 grams. Did he lose weight or gain weight this year? How much?
25.	Sally thinks she found the biggest rock; her rock weighs 23 grams. Bobby's rock weighs 2,300 milligrams. Which rock weighs the most?
26.	A jeweler bought 2 meters of silver chain. She used 20 centimeters for a bracelet and 60 centimeters for a necklace. How many meters of silver did she have left?

Activity 8-27: **Customary & Metric Measurement** Name:

Use a ruler to measure the following lines to the nearest **quarter of an inch, nearest centimeter, and the nearest millimeter**.



1.				2.				3.			
4.				5.				6.			
7.				8.				9.			
10.				11.							

Which weighs more: an ounce of water or an ounce of lead?
Surprise! The water weighs more because it is measured by volume, while lead is measured by weight. If you set a cup with a fluid ounce of water on a balance scale across from an ounce of lead in an identical cup, the scale will tip toward the water.

Activity 8-28: **Converting Between Systems** Name:

Length	Mass	Capacity
1 in ≈ 2.54 cm	1 oz ≈ 28.35 g	1 pt ≈ 0.47 L
1 cm ≈ 0.39 in	1 g ≈ 0.035 oz	1 L ≈ 2.11 pt
1 ft ≈ 30.48 cm	1 lb ≈ 0.45 kg	1 qt ≈ 0.95 L
1 m ≈ 3.28 ft	1 kg ≈ 2.2 lb	1 L ≈ 1.06 qt
1 mi ≈ 1.61 km		1 gal ≈ 3.79 L
1 km ≈ 0.62 mi		1 L ≈ 0.26 gal
1 m ≈ 39.37 in		
1 in ≈ 0.0254 m		
1 m ≈ 1.09 yd		

Use proportions to convert between measurement systems. Round to the nearest hundredth, if necessary.

1.	The length of the sheet of paper is 11 inches. What is the length in centimeters?	
2.	6 quarts equals how many liters?	
3.	255.6 grams equals how many ounces?	
4.	14 feet equals how many meters?	
5.	7 liters equals how many quarts?	
6.	45 feet is how many meters?	
7.	18 meters is how many feet?	
8.	A flower bed is 2 meters wide and 3 meters long. What is the area of the flower bed in square feet?	
9.	Kate ran 5 miles. How far did she run in kilometers?	
10.	Alex filled a 5-gallon jug with water. How many liters of water are in the container?	
11.	A ruler is 12 inches long. What is the length of the ruler in centimeters?	
12.	A kitten weighs 4 pounds. What is the approximate weight of the kitten in kilograms?	

Convert the following. If dividing, round to the nearest tenths place.

13.	20 yards ≈ _____ meters	14.	400 meters ≈ _____ yards
15.	5 quarts ≈ _____ liters	16.	137.25 meters ≈ _____ feet
17.	10 liters ≈ _____ gallons	18.	10,000 kilometers ≈ _____ miles
19.	12 ounces ≈ _____ grams	20.	60 inches ≈ _____ centimeters

Activity 8-29: **Converting Between Systems** Name: _____

Length	Mass	Capacity
1 in ≈ 2.54 cm	1 oz ≈ 28.35 g	1 pt ≈ 0.47 L
1 cm ≈ 0.39 in	1 g ≈ 0.035 oz	1 L ≈ 2.11 pt
1 ft ≈ 30.48 cm	1 lb ≈ 0.45 kg	1 qt ≈ 0.95 L
1 m ≈ 3.28 ft	1 kg ≈ 2.2 lb	1 L ≈ 1.06 qt
1 mi ≈ 1.61 km		1 gal ≈ 3.79 L
1 km ≈ 0.62 mi		1 L ≈ 0.26 gal
1 m ≈ 39.37 in		1 oz. ≈ 29.6 mL
1 in ≈ 0.0254 m		
1 m ≈ 1.09 yd		

Use proportions to convert between measurement systems. Round to the nearest thousandths, if necessary.

1.	5.5 inches ≈ _____ centimeters	2.	5.5 gallons ≈ _____ liters
3.	4.5 tons ≈ _____ kilograms	4.	23.3 liters ≈ _____ pints
5.	58,867 kilograms ≈ _____ pounds	6.	375.6 meters ≈ _____ yards
7.	$89\frac{4}{5}$ liters ≈ _____ quarts	8.	$34\frac{3}{4}$ feet ≈ _____ centimeters
9.	98 yards ≈ _____ meters	10.	95,376 grams ≈ _____ pounds
11.	24.35 centimeters ≈ _____ feet	12.	756.2 ounces ≈ _____ grams
13.	54 liters ≈ _____ cups	14.	74.5 kilometers ≈ _____ miles

15.	Kevin's mother made 385 pints of queso. If she uses one-fifth of the queso, how many liters of queso does she have left?	
16.	A sailboat was 13.5 meters long. What is its length in yards?	
17.	The cup held 56 fluid ounces of milk. How many milliliters would that be?	
18.	The truck weighed 4,836 kilograms. How many pounds did it weigh?	
19.	How many ounces are in 3 liters?	
20.	How many liters are in 1000 ounces?	

"Let's see how old you weigh. Hmm…five till."

Attributes That Can Be Measured

Time/Age
Weight/Mass
Temperature
Length – height, distance, depth, perimeter, circumference, width
Density
Capacity/Volume
Speed/Velocity
Area/Surface Area
Value/Money
Energy/Light/Heat
Economy
Central Tendency
Sound
Force
Acceleration
Momentum
Inertia
Viscosity
IQ
Pressure
Buoyancy
Probability
Gravity
Radiation
Strength
Acidity
Memory
Power/Work
Magnetism
Humidity
Angles
Solubility
Ductility
Malleability

Did you know: No measurement can be 100% accurate. It is impossible.
Did you know: Absolute zero is -459.67 degrees Fahrenheit.

Numbers are ADJECTIVES. The label (or the unit of measure) is the NOUN.

Activity 8-31: **Unfamiliar Units of Measure** Name:

1	cord	volume of firewood	8 ft. by 4 ft. by 4 ft. stack
2	hogshead	capacity of liquid	63 gallons
3	peck	volume of dry items	537.61 cu. in.
4	carat	weight of precious stones	one-fifth of a gram
5	karat	amount of gold	24k = 100%
6	watt	electric work capability	based on current, resistance
7	bolt	length of cloth or paper	varies
8	barrel	capacity, wet or dry	31.5 gallons
9	calorie	heat energy or fuel value-food	energy to raise temperature
10	rod	length – land	16.5 ft.
11	furlong	length – land	200 yd.
12	hand	length – horse height	about 4 in
13	acre	area – land	43,560 sq. ft.
14	board foot	volume – lumber	1 in. by 12 in. by 12 in.
15	ream	amount of paper	about 500 sheets
16	hertz	frequency –light wave	waves per second
17	gross tonnage	volume – ship	100 cu. ft.
18	Mach 1	speed – ships and planes	speed of sound
19	light year	length – space	about 6 trillion miles
20	jigger	capacity – liquid	2 mouthfuls
21	gill	capacity – liquid	one-fourth pint
22	Troy pound	weight – precious metals	12 oz.
23	knot	speed – ships and planes	1.852 mph
24	quire	amount of paper	25 sheets
25	gross	amount of items	12 dozen
26	bit	capacity – computer memory	8 bits
27	nose	length – horse racing	small distance
28	magnum	capacity – liquid	2 quarts
29	lux	illumination	light 1m from candle source
30	horsepower	work capability – engine	energy for one horse to life 33,000 lbs. 1 ft. in 1 min.

1. There are 12 coins that are numbered 1 through 12. Eleven weigh the same and one is either lighter or heavier than the others. Using just three weighings with a balance scale, devise a scheme that will find the counterfeit coin AND determine whether it is lighter or heavier.

2. A prison guard and his bloodhound are chasing an escaped prisoner. The prisoner has a 10 mile head start but the guard is walking 1 mph faster than the prisoner. The bloodhound is trained to run to the prisoner, run back to the guard, and then continue running back and forth between them. If the bloodhound runs 10 mph, how far does the bloodhound run before the guard finally catches up to the prisoner?

3. If one has already driven one mile at 30 mph, how fast must one drive the second mile so that the average speed for the trip equals 60 mph? (Hint: The answer is not 90 mph.)

Suppose you want to invent a metric clock using the system below.

1 day = 10 metric hours, 1 metric hour = 10 metric minutes

1 metric minutes = 10 metric seconds, 1 metric second = 10 metric miniseconds

If you start a standard clock and a metric clock together (midnight or metric 0), what is the time in our standard system when the metric clock registers 4 metric hours, 5 metric minutes, 6 metric seconds, and 7 metric miniseconds.

Suppose a metric calendar uses the system below.

1 day = 1 metric day, 1 metric week = 10 metric days

1 metric month = 10 metric weeks, 1 metric year = 10 metric months

If both calendars begin at 0 B.C., what was the metric calendar date on January 1, 2015?

Activity 8-33: **Pickles Will Kill You!** Name:

Numbers are all around us. People can use numbers in misleading ways. All of the numbers below are true, so does that mean pickles will kill you?

Every pickle you eat brings you nearer to death. Amazingly, the "thinking man" has failed to grasp the terrifying significance of the term "in a pickle." Although leading horticulturists have long known that Cucumis sativus possesses an indehiscent pepo, the pickle industry continues to expand.

Pickles are associated with all the major diseases of the body. Eating them breeds war and communism. They can be related to most airline tragedies. Auto accidents are caused by pickles. There exists a positive relationship between crime waves and consumption of this fruit of the cucurbit family.

For example ...

- Nearly all sick people have eaten pickles. The effects are obviously cumulative.
- 99.9% of all people who die from cancer have eaten pickles.
- 99.8% of all soldiers have eaten pickles.
- 96.8% of all communist sympathizers have eaten pickles.
- 99.7% of the people involved in air and auto accidents ate pickles within 14 days preceding the accident.
- 93.1% of all juvenile delinquents come from homes where pickles are served frequently.

Evidence points to the long-term effects of pickle eating:

- Of all the people born in 1869 who later dined on pickles, there has been a 100% mortality.
- All pickle eaters born between 1879 and 1899 have wrinkled skin, have lost most of their teeth, have brittle bones and failing eyesight -- if the ills of eating pickles have not already caused their death.

Even more convincing is the report of a noted team of medical specialists: rats force-fed with 20 pounds of pickles per day for 30 days developed bulging abdomens. Their appetites for wholesome food were destroyed.

In spite of all the evidence, pickle growers and packers continue to spread their evil. More than 120,000 acres of fertile U.S. soil are devoted to growing pickles.

Eat orchid petal soup. Practically no one has as many problems from eating orchid petal soup as they do with eating pickles.