

## Unit 8, Activity 1, Vocabulary Self-Awareness Chart

Vocabulary Self-Awareness Chart

WORD	+	$\sqrt{\quad}$	?	EXAMPLE	DEFINITION
Central Tendency					
Mean					
Median					
Mode					
Range					
Quartile					
Interquartile Range					
Standard deviation					
Stem and Leaf Diagram					
Dot Plot					
Histogram					
Box Plot					
Line Plot					
Odds					
Experimental Probability					
Theoretical Probability					

### ***Unit 8, Activity 1, Vocabulary Self-Awareness Chart***

Geometric Probability					
Permutations					
Combinations					
Sample Space					
Independent Event					
Dependent Event					

Procedure:

1. Examine the list of words you have written in the first column.
2. Put a + next to each word you know well and for which you can write an accurate example and definition. Your definition and example must relate to the unit of study.
3. Place a ☒ next to any words for which you can write either a definition or an example, but not both.
4. Put a – next to words that are new to you.

This chart will be used throughout the unit. By the end of the unit you should have the entire chart completed. Because you will be revising this chart, write in pencil.

## ***Unit 8, Activity 1, Measures of Central Tendency***

1) The basketball coach wants to compare the attendance at basketball games with other schools in the area. She collected the following numbers for attendance at games:

100, 107, 98, 110, 115, 90, 62, 50, 97, 101, 100

Construct a line plot of the data.



Find the mean, median, and mode of the attendance at basketball games.

Mean\_\_\_\_\_

Median\_\_\_\_\_

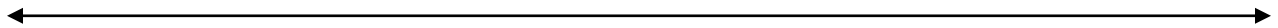
Mode\_\_\_\_\_

Mark the mean, median, and mode on the line plot.

Which measure of central tendency is the most appropriate to use to represent the data? Why?

2) Alajuan Motor Vehicles monitors their sales monthly. The company sold 34, 35, 29, 31, 34, 30, 32, 35, 34, 31, 29, and 33 vehicles over the last year.

Construct a line plot of the data.



Find the mean, median, and mode of the monthly vehicle sales.

Mean\_\_\_\_\_

Median\_\_\_\_\_

Mode\_\_\_\_\_

Mark the mean, median, and mode on the line plot.

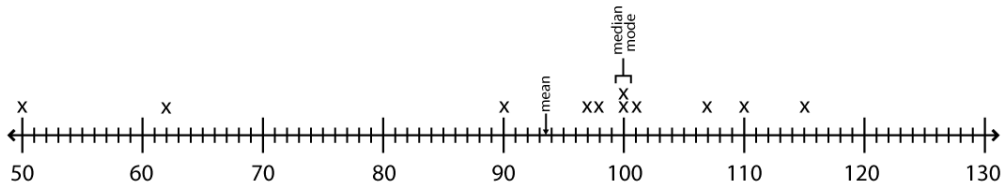
Which measure of central tendency is the most appropriate to use to represent the data? Why?

## Unit 8, Activity 1, Measures of Central Tendency

1) The basketball coach wants to compare the attendance at basketball games with other schools in the area. She collected the following numbers for attendance at games:

100, 107, 98, 110, 115, 90, 62, 50, 97, 101, 100

Construct a line plot of the data.



Find the mean, median, and mode of the attendance at basketball games.

Mean 93.6

Median 100

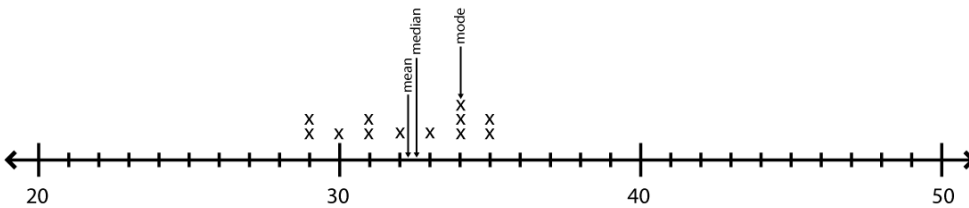
Mode 100

Mark the mean, median, and mode on the line plot.

Which measure of central tendency is the most appropriate to use to represent the data? Why?  
*In this set of data, the median is the most appropriate measure because 50 and 62 are outliers.*

2) Alajuan Motor Vehicles monitors their sales monthly. The company sold 34, 35, 29, 31, 34, 30, 32, 35, 34, 31, 29, and 33 vehicles over the last year.

Construct a line plot of the data.



Find the mean, median, and mode of the monthly vehicle sales.

Mean 32.25

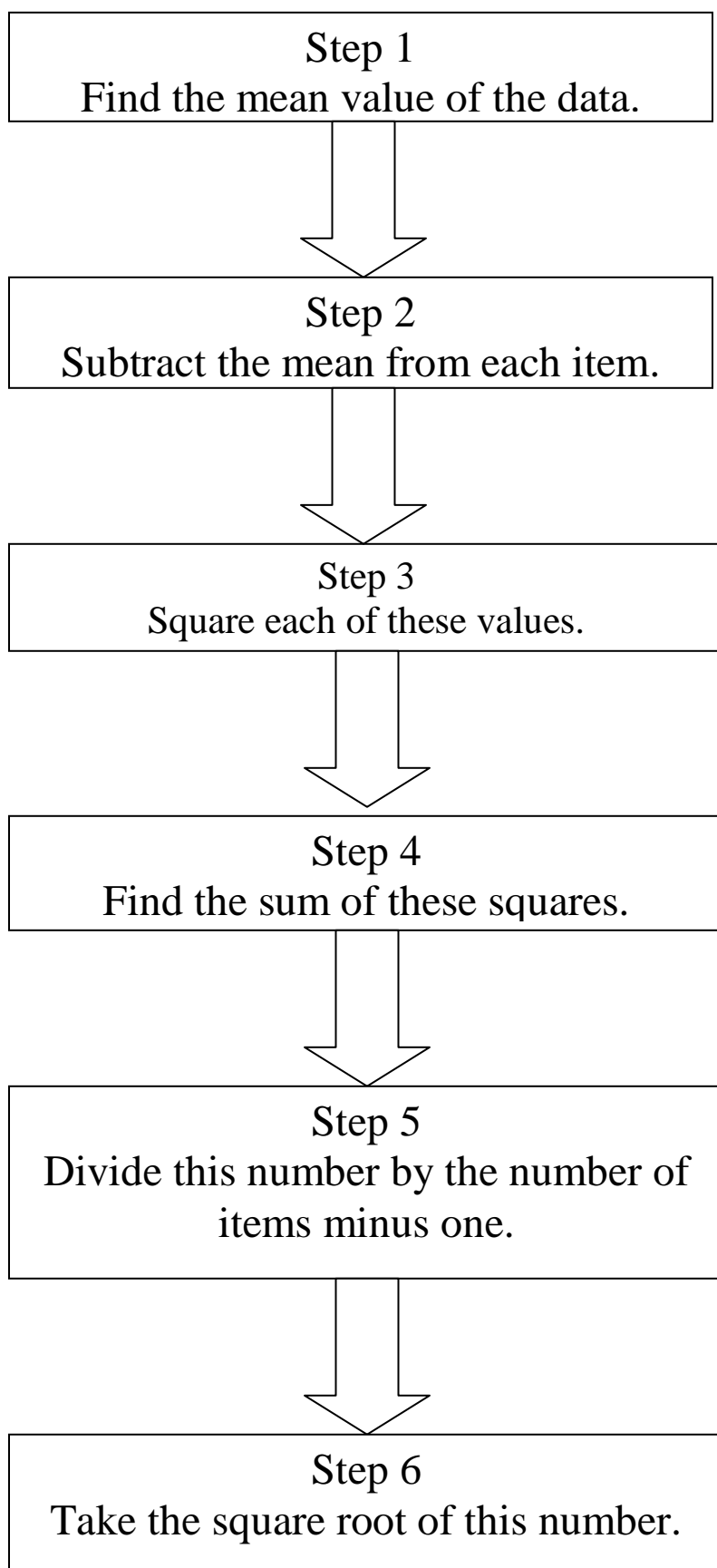
Median 32.5

Mode 34

Mark the mean, median, and mode on the line plot.

Which measure of central tendency is the most appropriate to use to represent the data? Why?  
*The mean is the most appropriate measure because there are no outliers*

*Unit 8, Activity 2, Standard Deviation Graphic Organizer*



## ***Unit 8, Activity 2, Statistics***

A teacher recorded the test scores of class of students. The following data shows students' percentages on the test:

89, 77, 100, 92, 79, 86, 95, 70, 89, 87, 78

What is the sum of all test scores?

How many students took the test?

Mean/Quartile 2: What is the average test score?

Put the items in numerical order.

\_\_\_\_\_  
Median: Which score falls in the middle of this list?

Rewrite the numbers to the left of the middle number.

\_\_\_\_\_  
Quartile 1: What is number falls in the middle of this list?

Rewrite the number to the right of the middle number.

\_\_\_\_\_  
Quartile 3: What is number falls in the middle of this list?

Interquartile Range: What is the difference between quartile 3 and quartile 1?

Mode: Out of the original list, which number appears the most?

Out of the original list, which test score is the least?

Out of the original list, which test score is the greatest?

Range: What is the difference between the greatest and the least score?

Standard deviation:

Step 1 answer

Step 2 answer

Step 3 answer

Step 4 answer

Step 5 answer

Step 6 answer

## Unit 8, Activity 2, Statistics with Answers

A teacher recorded the test scores of class of students. The following data shows students' percentages on the test:

89, 77, 100, 92, 79, 86, 95, 70, 89, 87, 78

What is the sum of all test scores?

942

How many students took the test? 11

Mean/Quartile 2: What is the average test score?

85.63636364

Put the items in numerical order.

70   77   78   79   86   87   89   89   92   95  
100

Median: Which score falls in the middle of this list?

87

Rewrite the numbers to the left of the middle number.

70   77   78   79   86

Quartile 1: What is number falls in the middle of this list?

78

Rewrite the number to the right of the middle number.

89   89   92   95   100

Quartile 3: What is number falls in the middle of this list?

92

Interquartile Range: What is the difference between quartile 3 and quartile 1?

14

Mode: Out of the original list, which number appears the most?

89

Out of the original list, which test score is the least?

70

Out of the original list, which test score is the greatest?

100

Range: What is the difference between the greatest and the least score?

30

Standard deviation:

Step 1 answer

Mean=85.63636364

Step 2 answer

-15.636364, -8.636364, -7.636364, -6.636364, .363636, 1.363636, 3.363636, 3.363636,  
6.363636, 9.363636, 14.363636

Step 3 answer

244.4959, 74.5868, 58.3140, 44.0413, 0.1322, 1.8595, 11.3140, 40.4959, 40.4959, 87.6777,  
206.3140

Step 4 answer

809.7272

Step 5 answer

80.9727

Step 6 answer  
8.9985

## ***Unit 8, Activity 2, Music Scoring***

Students from two high schools went to a band competition. Each student gave a solo performance and was rated by the judges. The possible scores ranged from 3 (one point from each judge) to 21 (seven points from each judge). The data show the scores of two groups of students.

**Westlake Student Scores:** 8, 10, 15, 21, 3, 15, 10, 21, 15, 20

**Northshore Student Scores:** 5, 6, 19, 10, 12, 10, 12, 9, 20, 8

- a. Find the mean and the range of the data for the Westlake High School students and for the Northshore High School students.
  
  
  
  
  
  
  
  
  
  
- b. Find the standard deviation for each set of data. Round to the nearest tenth.
  
  
  
  
  
  
  
  
  
  
- c. Draw a box and whisker plot.
  
  
  
  
  
  
  
  
  
  
- d. Use your results from parts **a** and **b** to compare the scores of the students from the two high schools.

## Unit 8, Activity 2, Music Scoring with Answers

Students from two high schools went to a band competition. Each student gave a solo performance and was rated by the judges. The possible scores ranged from 3 (one point from each judge) to 21 (seven points from each judge). The data show the scores of two groups of students.

**Westlake Student Scores:** 8, 10, 15, 21, 3, 15, 10, 21, 15, 20

**Northshore Student Scores:** 5, 6, 19, 10, 12, 10, 12, 9, 20, 8

- a. Find the mean and the range of the data for the Westlake High School students and for the Northshore High School students.

*Westlake mean = 13.8, range = 18*

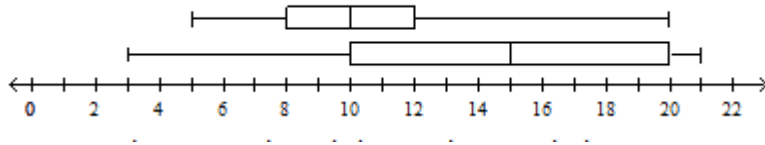
*Northshore mean = 11.1, range = 15*

- b. Find the standard deviation for each set of data. Round to the nearest tenth.

*Westlake standard deviation = 5.7*

*Northshore standard deviation = 4.7*

- c. Draw a box and whisker plot.



- d. Use your results from parts **a** and **b** to compare the scores of the students from the two high schools.

*Sample: The Westlake students had a higher mean score and a larger amount of variation in the scores, as shown by the larger range and standard deviation. The Northshore students had a lower mean score and less variation.*

## Unit 8, Activity 7, It's Conditional

Determine whether the events are dependent or independent. Explain your answer,

1. Toss a penny and a nickel
2. Draw a name from a hat; without replacement, select another name
3. A basket contains orange and green balls. Select one, then return it and pick again.

Explain the difference between independent and dependent events. Provide an example of each.

4. Suppose you chose a letter tile from a bag containing 2 As, 3 Bs and 4 Cs. Replace the first tile chosen and choose again. Determine the probability.  
A.  $P(A \text{ and } A)$  \_\_\_\_\_ B.  $P(B \text{ and } C)$  \_\_\_\_\_ C.  $P(C \text{ and } C)$  \_\_\_\_\_
5. Write the letters in the word "*PROBABILITY*," one letter on each index card. Select one card; without replacing the card, select another. Determine each probability. For this example "Y" is a vowel.  
A.  $P(\text{vowel then vowel})$  \_\_\_\_\_ B.  $P(\text{consonant then vowel})$  \_\_\_\_\_  
C.  $P(I \text{ then } I)$  \_\_\_\_\_ D.  $P(A \text{ then } A)$  \_\_\_\_\_
6. Two letters are chosen from the alphabet randomly without replacement. Find the probability of choosing a vowel followed by a second vowel.  $P(\text{vowel then vowel}) =$  \_\_\_\_\_
7. Two letters of the alphabet are selected at random without replacement. What is the probability of selecting a consonant followed by another consonant.  $P(\text{consonant then consonant}) =$  \_\_\_\_\_
8. Write four probability problems, two involving independent events and two involving dependent events or conditional probability. Mix them up. Find a partner and exchange problems. Determine each of the probabilities.

*Answers vary. Check student problems for logical situations and correct calculation of probabilities.*

## Unit 8, Activity 7, It's Conditional with answers

Determine whether the events are dependent or independent. Explain your answer,

1. Toss a penny and a nickel Independent because you still have 2 in the sample space for each coin
2. Draw a name from a hat; without replacement, select another name Dependent because with one name gone, the sample space has changed.
3. A basket contains orange and green balls. Select one, then return it and pick again. Independent because the sample space has not changed.

Explain the difference between independent and dependent events. Provide an example of each. Answers will vary. Check student work for appropriate examples.

4. Suppose you chose a letter tile from a bag containing 2 As, 3 Bs and 4 Cs. Replace the first tile chosen and choose again. Determine the probability.

A.  $P(\text{A and A}) = \frac{4}{81}$

B.  $P(\text{B and C}) = \frac{4}{27}$

C.  $P(\text{C and C}) = \frac{16}{81}$

5. Write the letters in the word “PROBABILITY,” one letter on each index card. Select one card; without replacing the card, select another. Determine each probability. For this example “Y “ is a vowel.

A.  $P(\text{vowel then vowel}) = \frac{9}{110}$

B.  $P(\text{consonant then vowel}) = \frac{3}{11}$

C.  $P(\text{I then I}) = \frac{1}{55}$

D.  $P(\text{A then A}) = 0$

6. Two letters are chosen from the alphabet randomly without replacement. Find the probability of choosing a vowel followed by a second vowel.  $P(\text{vowel then vowel}) = \frac{2}{65}$
7. Two letters of the alphabet are selected at random without replacement. What is the probability of selecting a consonant followed by another consonant.  $P(\text{consonant then consonant}) = \frac{42}{65}$
8. Write four probability problems, two involving independent events and two involving dependent events or conditional probability. Mix them up. Find a partner and exchange problems. Determine each of the probabilities.

*Answers vary. Check student problems for logical situations and correct calculation of probabilities.*

## Unit 8, Activity 8, Permutation and Combinations

### Permutations and Combinations

1. Factorial: The expression  $6!$  is read “6 factorial.” It means the product of all the whole numbers from 6 to 1.  $6! = 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 720$ . The factorial can be used to calculate the number of different batting orders that can be made with 9 baseball players. There are 9 choices for the first position, 8 for the next position, 7 for the next, and so on. There are  $9!$  possible batting orders  $9! = 362,880$  possible batting orders
  - a. The swimming pool at the park has 8 lanes. In how many ways can 8 swimmers be assigned to the swimming lanes for a race. \_\_\_\_\_
  - b. There are 10 skaters preparing for the finals in a competition. How many different orders are possible for the final program? \_\_\_\_\_
2. Permutation: A factorial is a special arrangement in which selections are made one at a time. It is a special type of permutation. A permutation is a counting problem which determines the number of possible arrangement of objects in a set. Each of the arrangements is a permutation. A permutation is an arrangement of objects in a specific order.

The expression  ${}_nP_r$  represents the number of permutations of  $n$  objects arranged  $r$  at a time.

$n$  will be the first factor

$${}_nP_r = n(n-1)(n-2) \dots$$

Stop when you have  $r$  factors....

${}_8P_3$  means 8 players chosen 3 at a time, or  $8(7)(6) = 336$ .

This expression could be used to solve a problem such as 8 students are running a race. In how many arrangements can they finish in 1st, 2nd, and 3rd places?

A.  ${}_7P_4 =$  \_\_\_\_\_

B.  ${}_9P_3 =$  \_\_\_\_\_

C.  ${}_7P_3 =$  \_\_\_\_\_

d. At a track meet, 42 students have entered the 100 m race. In how many ways can 1st, 2nd, 3rd and 4th places be awarded? \_\_\_\_\_

e. A car dealer has 35 cars to sell. Each day 3 cars are chosen for advertising specials. One car appears in a newspaper ad, one appears in a television commercial, and one appears in an online ad. In how many ways can the 3 cars be chosen? \_\_\_\_\_

3. Combinations: A combination is a collection of objects not regarding the order of the objects. For example, the toppings on a pizza can be placed in any order without changing the pizza. The expression  ${}_nC_r$  represents the number of combinations of  $n$  objects arranged  $r$  at the time.

$${}_nC_r = \frac{1}{r!} \cdot {}nP_r = \frac{n(n-1)(n-2) \dots}{r(r-1)(r-2) \dots}$$

## Unit 8, Activity 8, Permutation and Combinations

The numerator consists of  $r$  factors starting with  $n$ ; the denominator consists of  $r$  factors, beginning with  $r$ . The expression  ${}_4C_3 = \frac{4(3)(2)}{3(2)(1)} = 4$ . The expression could represent the number of 3-topping pizza combinations that can be made from 4 possible toppings.

A.  ${}_4C_2 = \underline{\hspace{2cm}}$       B.  ${}_7C_3 = \underline{\hspace{2cm}}$       C.  ${}_{10}C_4 = \underline{\hspace{2cm}}$

D. If twenty people report for jury duty, how many different ways can a twelve person jury be seated?

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4. Determine whether each situation is a combination or permutation, then determine the number of arrangements represented by the situation.

a. At a party there are 12 people present. Each person at the party will shake hands with every other person at the party exactly one time. How many handshakes occur?

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b. A roller coaster has room for 10 people, all sitting single file, one behind the other. How many different arrangements for the 10 passengers are possible?

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c. In how many ways can a president, a vice president, a secretary, and a treasurer be chosen from a group of 25 running for office? 

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d. Fifteen students from the freshman class have volunteered to be on a committee to organize the spring dance. In how many ways can 5 students be chosen for the committee?

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E. From fifty entries in the talent show, how many ways can five semi-finalists be chosen?

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## Unit 8, Activity 8, Permutations and Combinations with Answers

### Permutations and Combinations

- Factorial: The expression  $6!$  is read “6 factorial.” It means the product of all the whole numbers from 6 to 1.  $6! = 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 720$ . The factorial can be used to calculate the number of different batting orders that can be made with 9 baseball players. There are 9 choices for the first position, 8 for the next position, 7 for the next, and so on. There are  $9!$  possible batting orders  $9! = 362,880$  possible batting orders
  - The swimming pool at the park has 8 lanes. In how many ways can 8 swimmers be assigned to the swimming lanes for a race.  $8! = 40,320$  ways
  - There are 10 skaters preparing for the finals in a competition. How many different orders are possible for the final program?  $10! = 3,628,800$  orders for final performances
- Permutation: A factorial is a special arrangement in which selections are made one at a time. It is a special type of permutation. A permutation is a counting problem which determines the number of possible arrangement of objects in a set. Each of the arrangements is a permutation. A permutation is an arrangement of objects in a specific order.

The expression  ${}_nP_r$  represents the number of permutations of  $n$  objects arranged  $r$  at a time.

$n$  will be the first factor

$${}_nP_r = n(n-1)(n-2)\dots$$

Stop when you have  $r$  factors....

${}_8P_3$  means 8 players chosen 3 at a time, or  $8(7)(6) = 336$ .

This expression could be used to solve a problem such as 8 students are running a race. In how many arrangements can they finish in 1st, 2nd, and 3rd places?

A.  ${}_7P_4 = \underline{840}$

B.  ${}_9P_3 = \underline{504}$

C.  ${}_7P_3 = \underline{210}$

d. At a track meet 42 students have entered the 100 m race. In how many ways can 1<sup>st</sup>, 2nd, 3rd and 4th places be awarded?  ${}_{42}P_4 = \underline{2,686,320}$

e. A car dealer has 35 cars to sell. Each day 3 cars are chosen for advertising specials. One car appears in a newspaper ad, one appears in a television commercial, and one appears in an online ad. In how many ways can the 3 cars be chosen?  ${}_{35}P_3 = \underline{50,616}$  ways

- Combinations: A combination is a collection of objects not regarding the order of the objects. For example, the toppings on a pizza can be placed in any order without changing the pizza. The expression  ${}_nC_r$  represents the number of combinations of  $n$  objects arranged  $r$  at the time.

## Unit 8, Activity 8, Permutations and Combinations with Answers

$${}_nC_r = \frac{1}{r!} \cdot {}_nP_n = \frac{n(n-1)(n-2)\dots}{r(r-1)(r-2)\dots}$$

The numerator consists of  $r$  factors starting with  $n$ ; the denominator consists of  $r$  factors, beginning with  $r$ . The expression  ${}_4C_3 = \frac{4(3)(2)}{3(2)(1)} = 4$ . The expression could represent the number of 3-topping pizza combinations that can be made from 4 possible toppings.

A.  ${}_4C_2 = \underline{6}$       B.  ${}_7C_3 = \underline{35}$       C.  ${}_{10}C_4 = \underline{210}$

D. If twenty people report for jury duty, how many different ways can a twelve person jury be seated.  ${}_{20}C_{12} = \underline{125,970 \text{ twelve person juries}}$

4. Determine whether each situation is a combination or permutation, then determine the number of arrangements represented by the situation.
  - a. At a party there are 12 people present. Each person at the party will shake hands with every other person at the party exactly one time. How many handshakes occur? Combination; 66 handshakes
  - b. A roller coaster has room for 10 people, all sitting single file, one behind the other. How many different arrangements for the 10 passengers are possible? Permutation; 3,628,800 possible seating arrangements
  - c. In how many ways can a president, a vice president, secretary, treasurer can be chosen from a group of 25 running for office? Permutation; 303,600 possible ways to fill the offices
  - d. Fifteen students from the freshman class have volunteered to be on a committee to organize the spring dance. In how many ways can 5 students be chosen for the committee? Combination; 3,003 possible ways
  - e. From fifty entries in the talent show, how many ways can five semi-finalists be chosen? Combination; 2, 118,760 possible ways