Name:	Date:
Topic:	Class:

Main Ideas/Questions	Notes/Examples
EXPERIMENT	An investigation or a procedure with varying results. **Example:** Flipping a coin
OUTCOME	A possible result from the experiment. **Example:** Heads
SAMPLE SPACE	The set of all possible outcomes. **Example:** { Heads, Tails }

Examples

Give the sample space and number of outcomes for each experiement:

1. A state that begins with the letter O is chosen.	# of Outcomes
{ Ohio, Oklahoma, Oregon }	3

2. A day of the week is chosen.	# of Outcomes
{ Sun, Mon, Tues, Wed, Thurs, Fri, Sat }	7

PROBABILITY

- A measure of the __chance__ of a specific __event__ occuring, noted as $P(E)$.

- Expressed as a __ratio__ of __favorable__ outcomes to the __total__ number of outcomes. This ratio can be written as a __fraction__, __decimal__ or a __percent__.

- The sum of all probabilities in a sample space is equal to __1__.

Examples

Give each probability as a fraction (in simplest form), a decimal, and a percent.

3. The spinner below is used in a game. If it is spun once, find each probability.

a) $P(9)$ $\frac{1}{16}$; 0.0625 ; 6.25%

b) P(at least 12) $\frac{5}{16}$; 0.3125 ; 31.25%

c) P(perfect square) $\frac{4}{16} = \frac{1}{4}$; 0.25 ; 25%

d) P(not shaded) $\frac{7}{16}$; 0.4375 ; 43.75%

e) P(2 or 11) $\frac{2}{16} = \frac{1}{8}$; 0.125 ; 12.5%

f) P(multiple of 5) $\frac{3}{16}$; 0.1875 ; 18.75%

4. A month of the year is chosen at random. Find each probability.	**a)** P(starts with J) $\frac{3}{12} = \frac{1}{4}$; 0.25; 25%
	c) P(starts with T) $\frac{0}{12} = 0$; 0.0 ; 0%
	d) P(has at most 30 days) $\frac{5}{12}$; 0.4167; 41.67%
5. A letter from the word **PROBABILITY** is chosen at random. Find each probability.	**a)** P(B) $\frac{2}{11}$; 0.1818 ; 18.18%
	b) P(a vowel) $\frac{4}{11}$; 0.3636 ; 36.36%
	c) P(Y) $\frac{1}{11}$; 0.0909 ; 9.09%
6. A pencil box contains five red, six yellow, eight blue, three orange, and two purple colored pencils. If one is chosen at random, find each probability.	**a)** P(yellow) $\frac{6}{24} = \frac{1}{4}$; 0.25; 25%
	b) P(blue or purple) $\frac{10}{24} = \frac{5}{12}$; 0.417; 41.7%
	c) P(not orange) $\frac{21}{24} = \frac{7}{8}$; 0.875; 87.5%
7. If a card is chosen at random find a standard deck of cards, find each probability.	**a)** P(queen) $\frac{4}{52} = \frac{1}{13}$; 0.0769 ; 7.69%
	b) P(red three) $\frac{2}{52} = \frac{1}{26}$; 0.0385 ; 3.85%
	c) P(spade) $\frac{13}{52} = \frac{1}{4}$; 0.25 ; 25%

COMPLEMENT *of an event*	The complement of an event is the probability of the event ___not___ occuring. Since the sum of all probabilities in a sample space is ___1___, the probability of an event not occuring is $P(\sim E) =$ ___$1 - P(E)$___.

8. If the probability that it will rain tomorrow is 3/8, what is the probability that it will not rain? $1 - \frac{3}{8} = \frac{5}{8}$; 0.625 ; 62.5%	**9.** If the probability that someone will win a game at the carnival is 1/24, what is the probability that they will not win? $1 - \frac{1}{24} = \frac{23}{24}$; 0.9583 ; 95.83%
10. A number from 1-20 is chosen at random. What is the probability that it is not prime? $1 - \frac{8}{20} = \frac{12}{20} = \frac{6}{10}$; 0.60; 60%	**11.** If a state is chosen at random, what is the probability that it does not begin with the letter M? $1 - \frac{8}{50} = \frac{42}{50} = \frac{21}{25}$; 0.84 ; 84%

Simple Probability Maze!

Directions: Read each problem carefully and give the probability as a fraction in simplest form. Use your solutions to navigate through the maze. **Staple all work to this paper!**

Start!

A month of the year is chosen at random. What is the probability that it has 31 days?

A basketball team has 2 freshmen, 5 sophomores, 3 juniors, and 4 seniors. If a captain is chosen at random, what is the probability that it's not a senior? $\frac{5}{7}$

A jar contains 16 quarters, 6 dimes, 7 nickels, and 11 pennies. If one coin is selected at random, what is the probability it is worth more than 5 cents? $\frac{22}{40}$

In a 12-hour period of time, a drawbridge opens 8 times, holding traffic for 15 minutes each time. If a car approaches the bridge during this 12-hour time, find the probability that the bridge is open. $\frac{2}{12}$

If a letter in the word below is chosen at random, what is the probability that it has a vertical line of symmetry? CALCULATOR $\frac{5}{10}$

$\frac{5}{12}$ $\frac{3}{4}$ $\left(\frac{1}{5}\right)$ $\frac{29}{40}$ $\frac{1}{4}$ $\frac{1}{3}$ $\left(\frac{1}{2}\right)$ $\left(\frac{11}{20}\right)$ $\left(\frac{1}{6}\right)$

$\frac{1}{2}$

A bag of 60 skittles has an equal amount of red, orange, yellow, green, and purple. What is the probability of choosing a green? $\frac{12}{60}$

A date in September is chosen at random. What is the probability of choosing an even number or a multiple of 5? $\frac{18}{30}$

End! ☺

$\left(\frac{7}{12}\right)$ $\frac{2}{3}$ $\frac{1}{12}$ $\frac{1}{3}$ $\left(\frac{3}{5}\right)$ $\frac{2}{5}$ $\left(\frac{13}{14}\right)$ $\frac{1}{26}$ $\frac{4}{13}$

If the spinner below is spun once, what is the probability that it lands on a shaded space or a letter? $\frac{6}{8}$

There are fifteen girls and three boys in a dance class. If a leader is chosen at random, what is the probability a boy is chosen? $\frac{3}{18}$

The probability of a certain player making a three-point shot is 1/14. What is the probability he does not make his next shot? $\frac{13}{14}$

A card is chosen at random from a standard deck of cards. What is the probability that it is an ace or a king? $\frac{8}{52} = \frac{2}{13}$

$\frac{3}{4}$ $\frac{1}{2}$ $\frac{5}{8}$ $\frac{4}{7}$ $\left(\frac{1}{6}\right)$ $\frac{5}{6}$ $\frac{1}{14}$ $\left(\frac{2}{13}\right)$ $\frac{9}{20}$ $\left(\frac{7}{10}\right)$

A box contains six bags of pretzels, ten bags of chips, and four bags of peanuts. If one bag is chosen at random, find the probability of choosing a bag of chips. $\frac{10}{20}$

A day of the week is chosen at random. What is the probability it starts with an S or T?

A bag contains balls numbered 1 - 20. If one is chosen at random, what is the probability that it is prime? $\frac{8}{20}$

There is a 30% chance of rain tomorrow. What is the probability it will not rain tomorrow? $1 - \frac{3}{10} = \frac{7}{10}$

$\frac{3}{10}$ $\frac{3}{7}$ $\left(\frac{2}{5}\right)$

Name: _____   **Unit 9:** Probability & Statistics

Date: _____ **Per:** _____   **Homework 1:** Simple Probability

** This is a 2-page document! **

Directions: Give each probability as a simplified fraction, decimal, and percent.		
1. A bean bag is randomly tossed onto the board below. Find each probability.	**a)** $P(4)$ $\frac{1}{25}$; 0.04 ; 4%	**b)** $P(\text{odd number})$ $\frac{13}{25}$; 0.52 ; 52%
	c) $P(\text{shaded})$ $\frac{15}{25} = \frac{3}{5}$; 0.60; 60%	**d)** $P(\text{prime number})$ $\frac{9}{25}$; 0.36 ; 36%
	e) $P(\text{at least 14})$ $\frac{12}{25}$; 0.48 ; 48%	**f)** $P(\text{unshaded or even})$ $\frac{19}{25}$; 0.76 ; 76%
2. A card is randomly chosen from a standard deck of cards. Find each probability.	**a)** $P(\text{2 of spades})$ $\frac{1}{52}$; 0.0192 ; 1.92%	**b)** $P(\text{heart})$ $\frac{13}{52} = \frac{1}{4}$; 0.25 ; 25%
	c) $P(\text{7 or jack})$ $\frac{8}{52} = \frac{2}{13}$; 0.1538; 15.38%	**d)** $P(\text{face card})$ $\frac{12}{52} = \frac{3}{13}$; 0.2308 ; 23.08%
	e) $P(\text{black 10})$ $\frac{2}{52} = \frac{1}{26}$; 0.0385 ; 3.85%	**f)** $P(\text{red or ace})$ $\frac{28}{52} = \frac{7}{13}$; 0.5385 ; 53.85%
3. A cookie jar contains four oatmeal raisin, one sugar, nine chocolate chip, and six peanut butter cookies. If one is chosen at random, find each probability.	**a)** $P(\text{oatmeal raisin})$ $\frac{4}{20} = \frac{1}{5}$; 0.20; 20%	**b)** $P(\text{sugar or chocolate chip})$ $\frac{10}{20} = \frac{1}{2}$; 0.50; 50%
	c) $P(\text{not peanut butter})$ $\frac{14}{20} = \frac{7}{10}$; 0.70 ; 70%	**d)** $P(\text{M\&M cookie})$ $\frac{0}{20} = 0$; 0.0 ; 0%
4. A letter from the word below is chosen at random. Find each probability. **PHOTOSYNTHESIS**	**a)** $P(N)$ $\frac{1}{14}$; 0.0714 ; 7.14%	**b)** $P(O)$ $\frac{2}{14} = \frac{1}{7}$; 0.1429 ; 14.29%
	c) $P(\text{a vowel})$ $\frac{4}{14} = \frac{2}{7}$; 0.2857; 28.57%	**d)** $P(\text{H or S})$ $\frac{5}{14}$; 0.3571 ; 35.71%
	e) $P(\text{a letter with at least one line of symmetry})$ $\frac{9}{14}$; 0.6429 ; 64.29%	
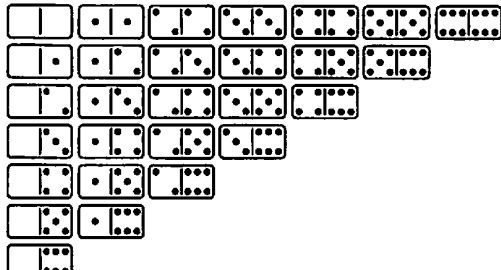
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5. A standard set of dominoes is shown below. If one is chosen at random, find each probability related to the total number of dots on the domino.	**a)** P(odd number of dots) $\frac{12}{28} = \frac{3}{7}$; 0.4286 ; 42.86%	**b)** P(2 dots) $\frac{2}{28} = \frac{1}{14}$; 0.0714 ; 7.14%
	c) P(not 7 dots) $\frac{25}{28}$; 0.8929 ; 89.29%	**d)** P(at most 8 dots) $\frac{22}{28} = \frac{11}{14}$; 0.7857 ; 78.57%
	e) P(greater than 10 dots) $\frac{2}{28} = \frac{1}{14}$; 0.0714 ; 7.14%	**f)** P(multiple of 4 dots) $\frac{7}{28} = \frac{1}{4}$; 0.25 ; 25%

6. A day of the week is randomly chosen. Find each probability.	**a)** P(Wednesday) $\frac{1}{7}$; 0.1429 ; 14.29%	**b)** P(Monday or Friday) $\frac{2}{7}$; 0.2857 ; 28.57%
	c) P(starts with T) $\frac{2}{7}$; 0.2857 ; 28.57%	**d)** P(not Saturday) $\frac{6}{7}$; 0.8571 ; 85.71%

7. A jar contains 6 pennies, 14 nickels, 16 dimes, and 4 quarters. If one coin is chosen at random, find each probability.	**a)** P(quarter) $\frac{4}{40} = \frac{1}{10}$; 0.10 ; 10%	**b)** P(penny) $\frac{6}{40} = \frac{3}{20}$; 0.15 ; 15%
	c) P(nickel or dime) $\frac{30}{40} = \frac{3}{4}$; 0.75 ; 75%	**d)** P(silver coin) $\frac{34}{40} = \frac{17}{20}$; 0.85 ; 85%
	e) P(worth at least 5 cents) $\frac{34}{40} = \frac{17}{20}$; 0.85 ; 85%	**f)** P(not a dime) $\frac{24}{40} = \frac{3}{5}$; 0.60 ; 60%

8. If the probability of a basketball player making a shot is 5/12, what is the probability of him not making the shot?

$1 - \frac{5}{12} = \frac{7}{12}$; 0.5833 ; 58.33%

9. If the probability of a spinner landing on blue in a game is 1/8, what is the probability of it not landing on blue? Give your answer as a percent.

$1 - \frac{1}{8} = \frac{7}{8}$; $\boxed{87.5\%}$

10. If a standard dice is rolled, what is the probability that it does not land on 4?

$1 - \frac{1}{6} = \frac{5}{6}$; 0.8333 ; 83.33%

11. A traffic light is green for 2 minutes, red for 40 seconds, and yellow for 10 seconds. When a car approaches the light, what is the probability that it is not red?

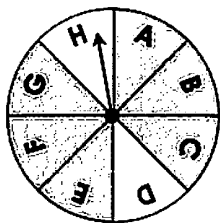$1 - \frac{40}{170} = \frac{130}{170} = \frac{13}{17}$; 0.7647 ; 76.47%

Name:	Date:
Topic:	Class:

Main Ideas/Questions	Notes/Examples
Theoretical Probability	<u>What should happen in an experiment Example: If you toss a coin 100 times, you would expect 50% heads.</u>
Experimental Probability	<u>What actually happens after an experiment of many trials.</u>

Theoretical vs. Experimental Probability

Use the game "Rock, Paper, Scissors" as an example to compare theoretical probability to experimental probability.

Rock   Paper   Scissors

Theoretical Probability

Complete the table below showing who would win the game under the different combinations.

		Player A		
		Rock	Paper	Scissors
Player B	Rock	—	A	B
	Paper	B	—	A
	Scissors	A	B	—

1. What is the probability of Player A winning? $\frac{3}{9} = \frac{1}{3}$

2. What is the probability of Player B winning? $\frac{3}{9} = \frac{1}{3}$

3. What is the probability of a tie? $\frac{3}{9} = \frac{1}{3}$

Experimental Probability

Play 25 trials of "Rock, Paper, Scissors" with your partner. Tally how many times Partner A wins, Partner B wins, and the number of ties.

Player A Wins	Player B Wins	Tie
卌 卌 IIII	卌 卌 II	卌 卌 IIII
Total: 9	Total: 7	Total: 9

4. What percent of the trials did Partner A win? $\frac{9}{25}$; 36%

5. What percent of the trials did Partner B win? $\frac{7}{25}$; 28%

6. What percent of the trials resulted in a tie? $\frac{9}{25}$; 36%

7. Do the theoretical results match the experimental results?

No – A's wins were higher, B's wins were lower, and the ties were higher than expected

8. How could the experimental results get closer to the theoretical results?

More trials and the results will get closer to the theoretical results.

More Examples	**9.** The table below shows the results of rolling a standard die 50 times.	**a)** What is the theoretical probability of rolling a 4?

More Examples	9.	

9. The table below shows the results of rolling a standard die 50 times.

Result	Frequency
1	4
2	10
3	9
4	5
5	12
6	10

a) What is the theoretical probability of rolling a 4?

$$\frac{1}{6}$$

b) What is the experimental probability of rolling a 4? Compare this to the theoretical probability.

$$\frac{5}{50} = \frac{1}{10} \; ; \; \text{lower than expected}$$

10. The results of spinning the spinner to the left 75 times are shown below.

Result	Frequency
A	5
B	12
C	10
D	7
E	11
F	13
G	9
H	8

a) What is the theoretical probability of spinning a shaded letter?

$$\frac{3}{4}$$

b) What is the experimental probability of spinning a shaded letter? Compare this to the theoretical probability.

$$\frac{60}{75} = \frac{4}{5} \; ; \; \text{higher than expected}$$

Using Samples to Predict

11. The table below shows the results of tossing a coin 100 times.

Result	Frequency
Heads	58
Tails	42

a) Theoretically, how many heads would you expect to occur in 300 tosses?

$$\frac{1}{2} = \frac{x}{300} \qquad \frac{2x}{2} = \frac{300}{2}$$

$$\boxed{x = 150}$$

b) Based on the experiment, how many heads would you expect to occur in 300 tosses?

$$\frac{58}{100} = \frac{x}{300} \qquad \frac{100x}{100} = \frac{17400}{100}$$

$$\boxed{x = 174}$$

12. The table below shows the results of randomly selecting a letter of the word **RHOMBUS** 80 times.

Result	Frequency
R	15
H	10
O	6
M	11
B	8
U	18
S	12

a) Theoretically, if a letter is randomly selected 500 times, how many vowels would you expect?

$$\frac{2}{7} = \frac{x}{500} \qquad \frac{7x}{7} = \frac{1000}{7}$$

$$\boxed{x \approx 143}$$

b) Based on the experiment, if a letter is randomly selected 500 times, how many vowels would you expect?

$$\frac{24}{80} = \frac{x}{500} \qquad \frac{80x}{80} = \frac{12000}{80}$$
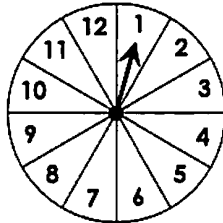
$$\boxed{x = 150}$$

Name: _____ Unit 9: Probability & Statistics

Date: _____ Per: _____ Homework 2: Theoretical vs. Experimental
Probability

** This is a 2-page document! **

Give each probability as a simplified fraction, decimal, and percent.

1. If the spinner below is spun once, find each probability.

a) $P(4)$

$\frac{1}{12}$; 0.0833 ; 8.33%

b) $P(\text{a number less than 10})$

$\frac{9}{12} = \frac{3}{4}$; 0.75 ; 75%

c) $P(\text{a prime number})$

$\frac{5}{12}$; 0.4167 ; 41.67%

2. The table below shows the results of an experiment in which the spinner above was spun 60 times. Find each probability based on the experiment and compare to the theoretical probability.

Result	Frequency	Result	Frequency
1	HHT I	7	HHT III
2	IIII	8	III
3	HHT II	9	IIII
4	III	10	HHT
5	HHT	11	HHT I
6	HHT II	12	II

a) $P(4)$

$\frac{3}{60} = \frac{1}{20}$; 0.05 ; 5%

lower than expected

b) $P(\text{a number less than 10})$

$\frac{47}{60}$; 0.7833 ; 78.33%

higher than expected

c) $P(\text{a prime number})$

$\frac{30}{60} = \frac{1}{2}$; 0.50 ; 50%

higher than expected

3. Theoretically, if the spinner is spun 150 times, how many times would you expect to get an even number?

$\frac{6}{12} = \frac{X}{150}$ $\frac{12X}{12} = \frac{900}{12}$

$\boxed{X = 75}$

4. Based on the experiment, if the spinner is spun 150 times, how many times would you expect to get an even number?

$\frac{24}{60} = \frac{X}{150}$ $\frac{60X}{60} = \frac{3600}{60}$

$\boxed{X = 60}$

5. If the spinner below is spun once, find each probability.
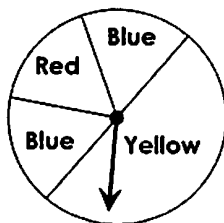
a) $P(\text{red})$

$\frac{1}{6}$; 0.1667 ; 16.67%

b) $P(\text{yellow or blue})$

$\frac{5}{6}$; 0.8333 ; 83.33%

c) $P(\text{not blue})$

$\frac{4}{6} = \frac{2}{3}$; 0.6667 ; 66.67%

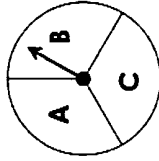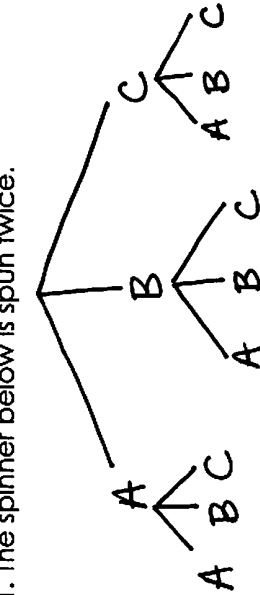|	
6. The table below shows the results of an experiment in which the spinner above was spun 50 times. Find each probability based on the experiment and compare to the theoretical probability. <table><tr><td>**Result**</td><td>red</td><td>yellow</td><td>blue</td></tr><tr><td>**Frequency**</td><td>8</td><td>24</td><td>18</td></tr></table>	**a)** $P(\text{red})$ $\dfrac{8}{50}$; 0.16 ; 16% Lower than expected <hr> **b)** $P(\text{yellow or blue})$ $\dfrac{42}{50} = \dfrac{21}{25}$; 0.84 ; 84% higher than expected <hr> **c)** $P(\text{not blue})$ $\dfrac{32}{50} = \dfrac{16}{25}$; 0.64 ; 64% lower than expected
7. Theoretically, if the spinner is spun 400 times, how many times would you expect to get blue? $\dfrac{2}{6} = \dfrac{X}{400}$ $\qquad$ $\dfrac{6X}{6} = \dfrac{800}{6}$ $\boxed{X \approx 133}$	**8.** Based on the experiment, if the spinner is spun 400 times, how many times would you expect to get blue? $\dfrac{18}{50} = \dfrac{X}{400}$ $\qquad$ $\dfrac{50X}{50} = \dfrac{7200}{50}$ $\boxed{X = 144}$
9. A card is drawn from a standard deck of cards. Find each probability.	**a)** $P(\text{club})$ $\dfrac{13}{52} = \dfrac{1}{4}$; 0.25 ; 25% <hr> **b)** $P(\text{red card})$ $\dfrac{26}{52} = \dfrac{1}{2}$; 0.50 ; 50% <hr> **c)** $P(\text{not a heart})$ $\dfrac{39}{52} = \dfrac{3}{4}$; 0.75 ; 75%
10. The table below shows the results of an experiment in which a card was drawn at random 30 times. Find each probability based on the experiment and compare to the theoretical probability. <table><tr><td>**Result**</td><td>**Frequency**</td></tr><tr><td>Heart</td><td>3</td></tr><tr><td>Diamond</td><td>10</td></tr><tr><td>Club</td><td>5</td></tr><tr><td>Spade</td><td>12</td></tr></table>	**a)** $P(\text{club})$ $\dfrac{5}{30} = \dfrac{1}{6}$; 0.1667 ; 16.67% lower than expected <hr> **b)** $P(\text{red card})$ $\dfrac{13}{30}$; 0.4333 ; 43.33% lower than expected <hr> **c)** $P(\text{not a heart})$ $\dfrac{27}{30} = \dfrac{9}{10}$; 0.90 ; 90% higher than expected
11. Theoretically, if a card is drawn at random 500 times, how many times would you expect to get a spade? $\dfrac{13}{52} = \dfrac{X}{500}$ $\qquad$ $\dfrac{52X}{52} = \dfrac{6500}{52}$ $\boxed{X = 125}$	**12.** Based on the experiment, if a card is drawn at random 500 times, how many times would you expect to get a spade? $\dfrac{12}{30} = \dfrac{X}{500}$ $\qquad$ $\dfrac{30X}{30} = \dfrac{6000}{30}$ $\boxed{X = 200}$

TREE DIAGRAMS

In many cases, there is more than one action or choice, which results in several outcomes.
Tree diagrams are a useful tool to organize and show all the possible outcomes.
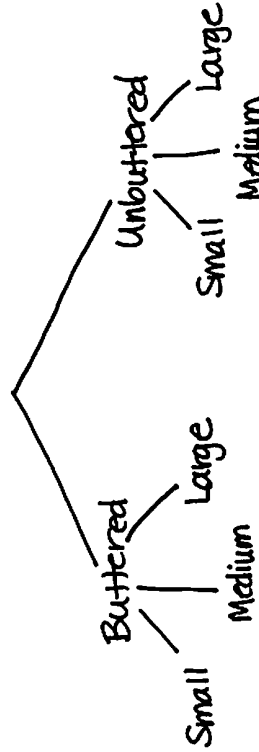
Tree Diagram	Sample Space	Probability Questions
1. The spinner below is spun twice.	$\{AA, AB, AC,$ $BA, BB, BC,$ $CA, CB, CC\}$	a) P(B twice) $\boxed{\dfrac{1}{9}}$ b) P(at least one A) $\boxed{\dfrac{5}{9}}$ c) P(no C) $\boxed{\dfrac{4}{9}}$
2. The popcorn stand offers buttered or unbuttered popcorn in three sizes: small, medium, and large.	$\{ BS, BM, BL,$ $US, UM, UL\}$	a) P(buttered) $\dfrac{3}{6} = \boxed{\dfrac{1}{2}}$ b) P(large) $\dfrac{2}{6} = \boxed{\dfrac{1}{3}}$ c) P(small with no butter) $\boxed{\dfrac{1}{6}}$
3. You have a choice of vanilla or chocolate ice cream, topped with sprinkles, peanuts, granola, or M&M's.	$\{ VS, VP, VG,$ $VM, CS, CP,$ $CG, CM \}$	a) P(chocolate) $\dfrac{4}{8} = \boxed{\dfrac{1}{2}}$ b) P(M&M's) $\dfrac{2}{8} = \boxed{\dfrac{1}{4}}$ c) P(vanilla with sprinkles) $\boxed{\dfrac{1}{8}}$
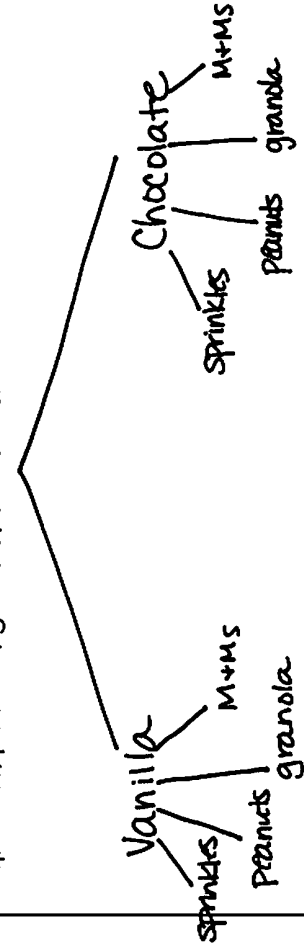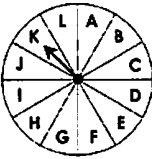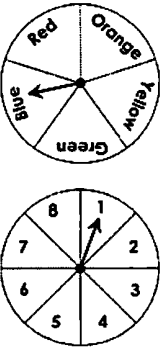
4. A day of the week is chosen at random, then a coin is tossed.

{ SH, ST, MH, MT, TH, TT, WH, WT, RH, RT, FH, FT, SH, ST }

a) P(tails) $\dfrac{7}{14} = \dfrac{1}{2}$

b) P(a day that starts with T) $\dfrac{4}{14} = \dfrac{2}{7}$

c) P(Friday, then heads) $\dfrac{1}{14}$

5. The spinner below is spun, then a letter from the word MATH is chosen at random.

{ SM, SA, ST, SH, TM, TA, TT, TH, PM, PA, PT, PH, RM, RA, RT, RH, RhM, RhA, RhT, RhH }

a) P(letter M) $\dfrac{5}{20} = \dfrac{1}{4}$

b) P(a shape with four congruent sides) $\dfrac{8}{20} = \dfrac{2}{5}$

c) P(a trapezoid, then not A) $\dfrac{3}{20}$

6. A standard die is rolled, then the spinner below is spun.

{ 1R, 1Y, 1B, 2R, 2Y, 2B, 3R, 3Y, 3B, 4R, 4Y, 4B, 5R, 5Y, 5B, 6R, 6Y, 6B }

a) P(prime number) $\dfrac{9}{18} = \dfrac{1}{2}$

b) P(red) $\dfrac{6}{18} = \dfrac{1}{3}$

c) P(at least 3, then yellow) $\dfrac{4}{18} = \dfrac{2}{9}$

Name:	Date:
Topic:	Class:

Main Ideas/Questions	Notes/Examples
Fundamental **COUNTING PRINCIPLE**	**You can use the counting principle to find the total number of outcomes:** If one activity can occur in __m__ ways and another activity can occur in __n__ ways, then both activities can occur in __m · n__ ways.

Examples	Example	# of Outcomes
	1. To leave her office, Karen can choose between three sets of stairs and seven doors. How many ways can she leave her office?	$3 \cdot 7 =$ $\boxed{21}$
	2. A sweater comes in four sizes and eight colors. How many diffferent sweaters are possible?	$4 \cdot 8 =$ $\boxed{32}$
	3. A class has 11 boys and 16 girls. How many ways can the teacher choose one boy and one girl?	$11 \cdot 16 =$ $\boxed{176}$
	4. A dinner menu consists of 5 appetizers, 12 entrées, and 3 desserts. How many ways can someone order one appetizer, one entrée, and one dessert?	$5 \cdot 12 \cdot 3 =$ $\boxed{180}$
	5. A card is chosen from a standard deck, then a die is rolled. How many outcomes are possible?	$52 \cdot 6 =$ $\boxed{312}$
	6. A quarter is tossed, then a letter from the word SNOWFLAKE is chosen. How many outcomes are possible?	$2 \cdot 9 =$ $\boxed{18}$
	7. A day of the week is chosen, then the spinner to the left is spun twice. How many outcomes are possible?	$7 \cdot 12 \cdot 12 =$ $\boxed{1,008}$
	8. How many ways can someone randomly dial a 7-digit phone number? $10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10$	$10^7 =$ $\boxed{10,000,000}$
	9. A quiz contains five multiple choice questions. Each question has four answer choices. How many ways can the questions be answered?	$4^5 =$ $\boxed{1,024}$
	10. The library codes their books using two letters followed by a digit 0-9. How many different codes are possible?	$26 \cdot 26 \cdot 10 =$ $\boxed{6,760}$

11. Patrick is buying a new car. He can choose the body style, color, and engine type. If there are 54 ways he can select a car, with three body styles and two engine choices, how many colors are available?

$3 \cdot x \cdot 2 = 54$
$6x = 54$
$x = 9$

$\boxed{9 \text{ colors}}$

12. At the school cafeteria, you can choose one sandwich, one snack, and one drink. The number of drink options is equal to the number of snack options. If there are 63 ways to choose your lunch, with seven different sandwhich options, how many drink options do you have?

$7 \cdot x \cdot x = 63$
$7x^2 = 63 \rightarrow x^2 = 9 \rightarrow x = 3$

$\boxed{3 \text{ drink options}}$

PROBABILITY
Examples

13. A coin is tossed three times. What is the probability of getting heads just once?

Possible outcomes:
$2 \cdot 2 \cdot 2 = 8$
Favorable outcomes:
HTT, THT, TTH

$\boxed{\dfrac{3}{8}}$

14. A month is chosen at random, then a standard die is rolled. What is the probability of getting February, then a number less than 5?

Possible outcomes:
$12 \cdot 6 = 72$
Favorable outcomes:
F1, F2, F3, F4

$\dfrac{4}{72} = \boxed{\dfrac{1}{18}}$

15. A card from a standard deck is chosen at random, then a coin is tossed. What is the probability of getting an ace and tails?

Possible outcomes:
$52 \cdot 2 = 104$
Favorable Outcomes:
Ace (Heart) + T,
Ace (Diamond) + T,
Ace (spade) + T,
Ace (Club) + T

$\dfrac{4}{104} = \boxed{\dfrac{1}{26}}$

16. A standard die is rolled two times. What is the probability that it lands on 1 both times?

Possible outcomes:
$6 \cdot 6 = 36$
Favorable outcomes:
1, 1

$\boxed{\dfrac{1}{36}}$

Use for questions 17 and 18: Each spinner to the left is spun once.

17. What is the probability of getting yellow and an even number?

Possible outcomes:
$5 \cdot 8 = 40$

Favorable outcomes:
Y2, Y4, Y6, Y8

$\dfrac{4}{40} = \boxed{\dfrac{1}{10}}$

18. What is the probability of getting orange or blue and a multiple of 3?

Possible outcomes:
$5 \cdot 8 = 40$

Favorable outcomes:
O3, O6, B3, B6

$\dfrac{4}{40} = \boxed{\dfrac{1}{10}}$

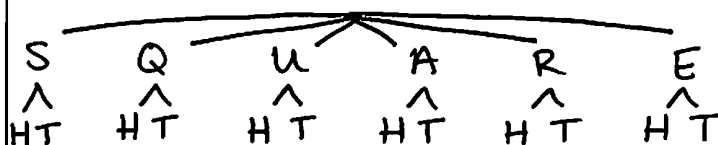**Name:** _____   **Unit 9:** Probability & Statistics

Date: _____ **Per:** _____   **Homework 3:** Counting Outcomes

** This is a 2-page document! **

Directions: Draw a tree diagram to show all the possible outcomes, write out the sample space, then answer the probability questions.

1. A letter from the word SQUARE is chosen, then a coin is tossed.

S   Q   U   A   R   E
/\   /\   /\   /\   /\   /\
H T H T H T H T H T H T

Sample Space:
{SH, ST, QH, QT, UH, UT, AH, AT, RH, RT, EH, ET}

a) $P(Q)$

$\frac{2}{12} = \boxed{\frac{1}{6}}$

b) $P(\text{heads})$

$\frac{6}{12} = \boxed{\frac{1}{2}}$

c) $P(\text{vowel, then tails})$

$\frac{3}{12} = \boxed{\frac{1}{4}}$

2. Each spinner below is spun once.

```
    ,-Fall
1 <-- Winter
    <-Spring
    `Summer

    ,Fall
2 <--Winter
    <-Spring
    `Summer

    ,Fall
3 <--Winter
    <-Spring
    `Summer
```

Sample Space:
{1F, 1W, 1Sp, 1S, 2F, 2W, 2Sp, 2S, 3F, 3W, 3Sp, 3S}
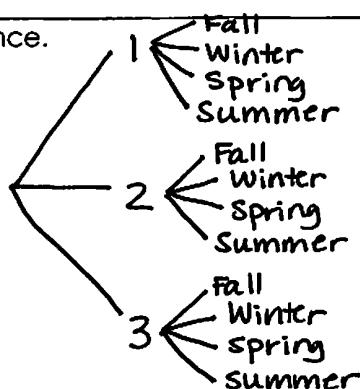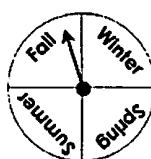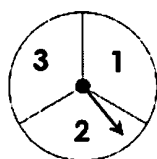
a) $P(2)$

$\frac{4}{12} = \boxed{\frac{1}{3}}$

b) $P(\text{winter or summer})$

$\frac{6}{12} = \boxed{\frac{1}{2}}$

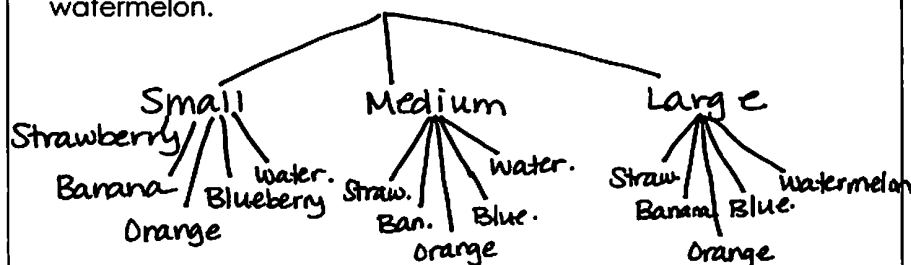**c)** $P(\text{fall and odd})$

$\frac{2}{12} = \boxed{\frac{1}{6}}$

3. A smoothie comes in three sizes- small, medium, and large, and five flavors- strawberry, banana, orange, blueberry, and watermelon.

Small — Strawberry, Banana, Blueberry, Water., Orange

Medium — Straw., Ban., Blue., Water., Orange

Large — Straw., Banana, Blue., Watermelon, Orange

Sample Space:
{SmS, SmB, SmO, SmBl, SmW, MS, MB, MO, MBl, MW, LS, LB, LO, LBl, LW}

a) $P(\text{medium})$

$\frac{5}{15} = \boxed{\frac{1}{3}}$

b) $P(\text{banana})$

$\frac{3}{15} = \boxed{\frac{1}{5}}$

c) $P(\text{large or blueberry})$

$\boxed{\frac{7}{15}}$

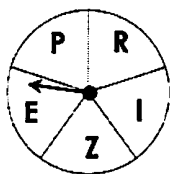| **Use the counting to find the number of outcomes.**	
4. Runners in a marathon are randomly assigned to one of ten corrals to start, and each given a green, blue, or red shirt to wear. $10 \cdot 3 = \boxed{30}$	**5.** How many ways can Mark create a 4-digit code for his garage door opener? $10^4 = \boxed{10,000}$

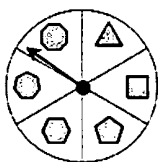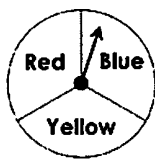| **Use the counting principle to find each probability.**	
6. The spinner below is spun twice. Find the probability of getting Z both times. Possible : $5 \cdot 5 = 25$ Favorable: Z Z $\boxed{\dfrac{1}{25}}$	**7.** A coin is tossed three times. Find the probability of getting all heads or all tails. Possible : $2 \cdot 2 \cdot 2 = 8$ Favorable: H H H , T T T $\dfrac{2}{8} = \boxed{\dfrac{1}{4}}$
8. A card is chosen from a standard deck, then a month of the year is chosen. Find the probability of getting a face card and June. Possible: $52 \cdot 12 = 624$ Favorable: JJ, QJ, KJ (Heart, Spade, Club, Diamond) $\dfrac{12}{624} = \boxed{\dfrac{1}{52}}$	**9.** A letter of the alphabet is chosen, then a digit from 1-9 is chosen. Find the probability of getting X, then a prime number. Possible: $26 \cdot 9 = 234$ Favorable: X2, X3, X5, X7 $\dfrac{4}{234} = \boxed{\dfrac{2}{117}}$
10. The spinner below is spun once, then a coin is tossed. Find the probability of getting a shape with at least four sides, then tails. Possible: $6 \cdot 2 = 12$ Favorable: Sq T, Pent T, Hex T, Hept T, Oct T $\boxed{\dfrac{5}{12}}$	**11.** One of the 50 states is chosen at random, then a die is rolled. Find the probabilty of getting a state that starts with the letter A, then a number less than 3. Possible : $50 \cdot 6 = 300$ Favorable: AL1, AL2, AK1, AK2, AZ1, AZ2, AR1, AR2 $\dfrac{8}{300} = \boxed{\dfrac{2}{75}}$
12. A date in March is chosen at random, then the spinner below is spun once. Find the probability of an odd number, then blue. Possible : $31 \cdot 3 = 93$ Favorable : 1B, 3B, 5B, 7B, 9B, 11B, 13B, 15B, 17B, 19B, 21B, 23B, 25B, 27B, 29B, 31B $\boxed{\dfrac{16}{93}}$	**13.** A multiple choice test contains questions with four options each: A, B, C, or D. If Natalie randomly guesses on the last three questions, what is the probability that she gets all three correct? Possible: $4 \cdot 4 \cdot 4 = 64$ Favorable: Unknown- only 1 set of correct answers $\boxed{\dfrac{1}{64}}$

Name: _____   **Pre-Algebra**
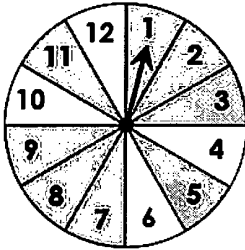
Date: _____ **Per:** _____   **Unit 9:** Probability & Statistics

Quiz 9-1: Simple Probability, Counting Outcomes, Compound Probability

* Give all probability answers as fractions in simplest form. *

For questions 1-5: If the spinner below is spun once, find each probability.

1. $P(6)$ $\frac{1}{12}$

2. $P(\text{shaded})$ $\frac{8}{12}$

3. $P(\text{prime number})$ $\frac{5}{12}$

4. $P(\text{odd or unshaded})$ $\frac{10}{12}$

5. $P(\text{multiple of 3 and even})$ $\frac{2}{12}$

6. If a letter from the word **ADMINISTRATION** is selected at random, what is the probability that it is not a vowel?
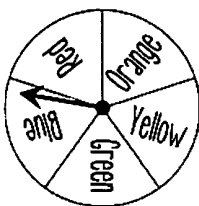
$$\frac{8}{14}$$

7. If the probability of picking a pink jelly bean out of a bag is 4/15, what is the probability of not picking a pink jelly jean? $1 - \frac{4}{15}$

1.	$\frac{1}{12}$
2.	$\frac{2}{3}$
3.	$\frac{5}{12}$
4.	$\frac{5}{6}$
5.	$\frac{1}{6}$
6.	$\frac{4}{7}$
7.	$\frac{11}{15}$

For questions 8-11: The spinner below is spun 40 times. Results are shown in the table.

8. Theoretically, what is the probability of the spinner landing on green or yellow on a single spin? $\dfrac{2}{5}$

9. Based on this experiment, what is the probability of the spinner landing on green or yellow on a single spin? $\dfrac{18}{40} = \dfrac{9}{20}$

10. Theoretically, if the spinner is spun 500 times, how many times would you expect it to land on orange?

$$\frac{1}{5} = \frac{X}{500} \qquad \frac{5X}{5} = \frac{500}{5} \qquad X = 100$$

11. Based on this experiment, if the spinner is spun 500 times, how many times would you expect it to land on orange?

$$\frac{5}{40} = \frac{X}{500} \qquad \frac{40X}{40} = \frac{2500}{40} \qquad X = 62.5$$

8.	$\frac{2}{5}$
9.	$\frac{9}{20}$
10.	100 times
11.	≈ 63 times

Result	Frequency
Red	7
Orange	5
Yellow	12
Green	6
Blue	10

12. A penny is tossed, then a standard die is rolled.

a) Draw a tree diagram to show all possible outcomes.
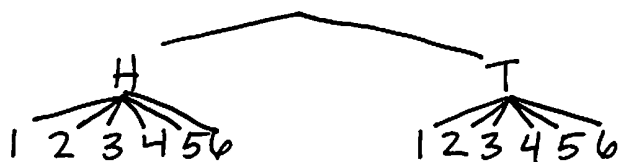
b) Write out the sample space: $\{H1, H2, H3, H4, H5, H6, T1, T2, T3, T4,$ $T5, T6\}$

c) How many outcomes are possible? __12__   **d)** Find P(tails and less than 5): $\frac{4}{12} = \frac{1}{3}$

For questions 13-14, use the counting principle.

13. A card is selected from a standard deck, then a day of the week is is chosen at random. How many outcomes are possible?
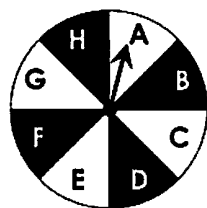
$52 \cdot 7$

14. How many 5-digit zip codes are possible?

$10 \cdot 10 \cdot 10 \cdot 10 \cdot 10$

13.	364
14.	100,000

For questions 15-17: The spinner below is spun twice.

15. How many outcomes are possible?

$8 \cdot 8 = 64$

16. Find P(F both times)
POSSible: $8 \cdot 8 = 64$
Favorable: FF $\frac{1}{64}$

17. Find P(D, then a vowel)
Possible: $8 \cdot 8 = 64$
Favorable: DA, DE $\frac{2}{64}$

15.	64
16.	$\frac{1}{64}$
17.	$\frac{1}{32}$

For questions 18-20: The spinner below is spun once, then a month of the year is selected.
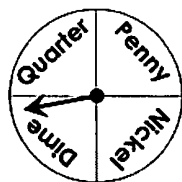
18. How many outcomes are possible?

$4 \cdot 12 = 48$

19. Find P(dime, then a month with no more than 30 days)
Possible: $4 \cdot 12 = 48$
Favorable: 4Feb, 4Apr, 4June, 4Sept, 4Nov $\frac{5}{48}$

20. Find P(a coin worth at least 5¢, then September or October)
Possible: $4 \cdot 12 = 48$
Favorable: N Sept, N Oct, DSept, DOct, QSept, QOct $\frac{6}{48}$

18.	48
19.	$\frac{5}{48}$
20.	$\frac{1}{8}$

Name:	Date:
Topic:	Class:

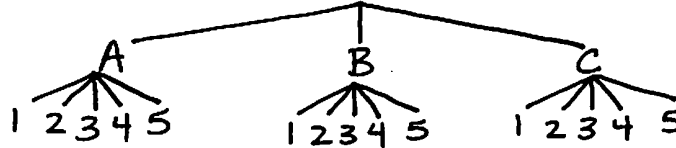| Main Ideas/Questions	Notes/Examples
Warm-Up **Race Starting Line Assignments** Waves | A, B, C Corrals | 1, 2, 3, 4, 5	A marathon has three scattered starting times, each called a "wave". Each wave then has five starting areas, called "corrals", that runners are grouped into. Draw a tree diagram that shows the possible waves and corrals a runner could be assigned to. A: 1 2 3 4 5 B: 1 2 3 4 5 C: 1 2 3 4 5 **a)** How many different wave and corral assignments are there? __15__ **b)** If waves and corrals are randomly assigned, find P(wave B, corral 5): __$\frac{1}{15}$__
Compound Events	The probability of two or more simple events
Independent Events	• In independent events, the outcome of one event **does not affect** the outcome of the other event. • The probability of two independent events is found by **multiplying** the probability of the first event by the probability of the second event.

Examples

1. What is the probability of rolling a standard die twice and getting an even number, then 5? $\frac{3}{6} \cdot \frac{1}{6} = \frac{3}{36} = \boxed{\frac{1}{12}}$	2. What is the probability of tossing a coin three times and getting tails each time? $\frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} = \boxed{\frac{1}{8}}$

3. If each spinner to the left is spun once, find each probability.

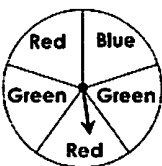| **a)** P(11, then red) $\frac{1}{12} \cdot \frac{2}{5} = \frac{2}{60} = \boxed{\frac{1}{30}}$	**b)** P(unshaded, then green) $\frac{8}{12} \cdot \frac{2}{5} = \frac{16}{60} = \boxed{\frac{4}{15}}$
c) P(at least 3, then blue) $\frac{10}{12} \cdot \frac{1}{5} = \frac{10}{60} = \boxed{\frac{1}{6}}$	**d)** P(even and shaded, then not red) $\frac{2}{12} \cdot \frac{3}{5} = \frac{6}{60} = \boxed{\frac{1}{10}}$

4. A card is randomly drawn from a standard deck, then a date in the month of June is chosen at random.

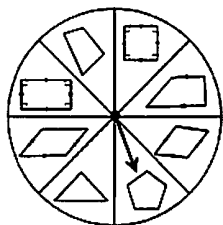| **a)** P(ace, then odd) $\frac{4}{52} \cdot \frac{15}{30} = \frac{60}{1560} = \boxed{\frac{1}{26}}$	**b)** P(spade, then a multiple of 4) $\frac{13}{52} \cdot \frac{7}{30} = \frac{91}{1560} = \boxed{\frac{7}{120}}$

	5. The spinner to the left is spun once, then a standard die is rolled. Find each probability.

5. The spinner to the left is spun once, then a standard die is rolled. Find each probability.

a) P(quadrilateral, then 6)	**b)** P(triangle, then odd)
$\dfrac{6}{8} \cdot \dfrac{1}{6} = \dfrac{6}{48} = \boxed{\dfrac{1}{8}}$	$\dfrac{1}{8} \cdot \dfrac{3}{6} = \dfrac{3}{48} = \boxed{\dfrac{1}{16}}$
c) P(square, then at most 2)	**d)** P(parallelogram, then prime)
$\dfrac{1}{8} \cdot \dfrac{2}{6} = \dfrac{2}{48} = \boxed{\dfrac{1}{24}}$	$\dfrac{4}{8} \cdot \dfrac{3}{6} = \dfrac{12}{48} = \boxed{\dfrac{1}{4}}$

6. There are 5 red marbles, 1 orange marble, 2 green marbles, and 4 purple marbles in a bag. A marble is drawn, replaced, then another marble is drawn. Find each probability.

a) P(orange, then purple)	**b)** P(purple, then green)
$\dfrac{1}{12} \cdot \dfrac{4}{12} = \dfrac{4}{144} = \boxed{\dfrac{1}{36}}$	$\dfrac{4}{12} \cdot \dfrac{2}{12} = \dfrac{8}{144} = \boxed{\dfrac{1}{18}}$
c) P(both orange)	**d)** P(both red)
$\dfrac{1}{12} \cdot \dfrac{1}{12} = \boxed{\dfrac{1}{144}}$	$\dfrac{5}{12} \cdot \dfrac{5}{12} = \boxed{\dfrac{25}{144}}$

Dependent Events	• In dependent events, the outcome of one event **affects** the outcome of the other event. • The probability of two dependent events is found by **multiplying** the probability of the first event the probability of the second event after the first event has already occurred.

Examples

7. There are 3 green markers, 6 yellow markers, 4 red marker, and 12 blue markers in a pencil box. A marker is drawn, not replaced, then another marker is drawn. Find each probability.

a) P(red, then blue)	**b)** P(yellow, then green)
$\dfrac{4}{25} \cdot \dfrac{12}{24} = \dfrac{48}{600} = \boxed{\dfrac{2}{25}}$	$\dfrac{6}{25} \cdot \dfrac{3}{24} = \dfrac{18}{600} = \boxed{\dfrac{3}{100}}$
c) P(both blue)	**d)** P(both yellow)
$\dfrac{12}{25} \cdot \dfrac{11}{24} = \dfrac{132}{600} = \boxed{\dfrac{11}{50}}$	$\dfrac{6}{25} \cdot \dfrac{5}{24} = \dfrac{30}{600} = \boxed{\dfrac{1}{20}}$

8. A bag contains 16 lottery balls, numbered 1-16. A ball is drawn, not replaced, then another is drawn. Find each probability.

a) P(even, then odd)	**b)** P(10, then even)
$\dfrac{8}{16} \cdot \dfrac{8}{15} = \dfrac{64}{240} = \boxed{\dfrac{4}{15}}$	$\dfrac{1}{16} \cdot \dfrac{7}{15} = \boxed{\dfrac{7}{240}}$
c) P(less than 13, then 16)	**d)** P(both multiples of 5)
$\dfrac{12}{16} \cdot \dfrac{1}{15} = \dfrac{12}{240} = \boxed{\dfrac{1}{20}}$	$\dfrac{3}{16} \cdot \dfrac{2}{15} = \dfrac{6}{240} = \boxed{\dfrac{1}{40}}$

Compound Probability Maze!

Directions: Read each problem carefully and give the probability as a fraction in simplest form. Use your solutions to navigate through the maze.

A quiz contains five true or false questions. If Mason guesses, what is the probability that he gets all five correct? $\frac{1}{2}\cdot\frac{1}{2}\cdot\frac{1}{2}\cdot\frac{1}{2}\cdot\frac{1}{2}$
(1/32)

A jar contains 9 pennies, 10 nickels, 12 dimes, and 5 quarters. A coin is chosen, not replaced, then another is chosen. What is the probability of getting a nickel, then a dime? $\frac{10}{36}\cdot\frac{12}{35}$
(2/21)

A card is drawn from a standard deck of cards, not replaced, then another is drawn. What is the probability that both cards are hearts? $\frac{13}{52}\cdot\frac{12}{51}$
(1/17)

Of the two lights on Dexter Street, the probability of the lights being red is 20% for the first light and 30% for the second light. If a car is driving down Dexter Street, what is the probability that it does not get stopped at either light? $\frac{8}{10}\cdot\frac{7}{10}$
(14/25)

If the spinner below is spun twice, find the probability that it lands on an odd number, then a shaded number. $\frac{6}{12}\cdot\frac{10}{12}$

A date in the month of June is selected, then a letter from the word SUPERSTAR is chosen. What is the probability of getting a multiple of 8, then an S?

A bag contains 2 Snicker bars, 8 Trix bars, and 5 Crunch bars. A candy bar is chosen, replaced, then another is chosen. What is the probability of choosing a Trix bar, then a Crunch bar? $\frac{8}{15}\cdot\frac{5}{15}$ $\frac{13}{29}$

End! ☺

If one of the 50 states is chosen at random, then a standard die is rolled. Find the probability of getting a state that starts with the letter N, then a number that is at least 2. $\frac{8}{50}\cdot\frac{5}{6}$

A card is drawn from a standard deck of cards, then a month of the year is chosen. What is the probability of getting a diamond or a 7, then November? $\frac{16}{52}\cdot\frac{1}{12}$

A coin is tossed, then a letter from the word INCREDIBLE is chosen at random. What is the probability of getting heads, then a vowel? $\frac{1}{2}\cdot\frac{4}{10}$

If a standard die is rolled twice, what is the probability of getting a perfect square, then a number that is less than 5? $\frac{2}{6}\cdot\frac{4}{6}$
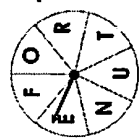
The Duck Pond game at the carnival has a pool with 75 toy ducks. Twenty-five of these ducks are marked underneath as winners. To play, you pick up a duck, do not replace it, then pick up another. What is the probability that both ducks picked are winners? $\frac{25}{75}\cdot\frac{24}{74}$

While bowling, Sarah made 5 strikes out of her last 18 frames. David made 9 strikes out of his last 25 frames. What is the probability that they both get a strike on their next frame? $\frac{5}{18}\cdot\frac{9}{25}$

If the spinner below is spun twice, find the probability that it lands on N, then a vowel. $\frac{1}{7}\cdot\frac{3}{7}$

If a coin is tossed twice, what is the probability of getting heads both times?

Start!

Path values: 5/12, 7/12, 5/39, 3/20, 1/16, 7/30, 14/25, 10/12, 2/3, 1/54, 2/15, 1/26, 17/624, 4/21, 8/45, 2/9, 7/12, 13/29, 4/37, 1/9, 1/39, 3/14, 4/49, 3/49, 1/2, 5/18, 3/28, 1/10, 1/12, 4/14

Name: _____ **Unit 9:** Probability & Statistics

Date: _____ **Per:** _____ **Homework 4:** Compound Probability

** This is a 2-page document! **

Directions: Give each probability as a simplified fraction.

1. If a standard die is rolled twice, find each probability.	**a)** P(odd both times)	**b)** P(both perfect squares)
	$\frac{3}{6} \cdot \frac{3}{6} = \frac{9}{36} = \boxed{\frac{1}{4}}$	$\frac{2}{6} \cdot \frac{2}{6} = \frac{4}{36} = \boxed{\frac{1}{9}}$
	c) P(even, then less than 5)	**d)** P(prime, then 6)
	$\frac{3}{6} \cdot \frac{4}{6} = \frac{12}{36} = \boxed{\frac{1}{3}}$	$\frac{3}{6} \cdot \frac{1}{6} = \frac{3}{36} = \boxed{\frac{1}{12}}$
	e) P(the same number both times)	**f)** P(at least 4 both times)
	$\frac{6}{6} \cdot \frac{1}{6} = \frac{6}{36} = \boxed{\frac{1}{6}}$	$\frac{3}{6} \cdot \frac{3}{6} = \frac{9}{36} = \boxed{\frac{1}{4}}$

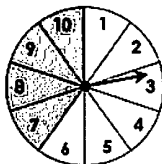| 2. A coin is tossed, then a letter from the word INDIANAPOLIS is selected at random. Find each probability.	**a)** P(heads, then P)	**b)** P(tails, then a vowel)
	$\frac{1}{2} \cdot \frac{1}{12} = \boxed{\frac{1}{24}}$	$\frac{1}{2} \cdot \frac{6}{12} = \frac{6}{24} = \boxed{\frac{1}{4}}$
	c) P(tails, then N)	**d)** P(heads, then D or I)
	$\frac{1}{2} \cdot \frac{2}{12} = \frac{2}{24} = \boxed{\frac{1}{12}}$	$\frac{1}{2} \cdot \frac{4}{12} = \frac{4}{24} = \boxed{\frac{1}{6}}$

| 3. The spinner below is spun, then a month of the year or randomly selected. Find each probability.

a) P(at most 7, then February)	**b)** P(4, then a month that starts with the letter J)
	$\frac{7}{10} \cdot \frac{1}{12} = \boxed{\frac{7}{120}}$	$\frac{1}{10} \cdot \frac{3}{12} = \frac{3}{120} = \boxed{\frac{1}{40}}$
	c) P(unshaded, then a month that starts with the letter A)	**d)** P(multiple of 3, then a month with exactly 30 days)
	$\frac{6}{10} \cdot \frac{2}{12} = \frac{12}{120} = \boxed{\frac{1}{10}}$	$\frac{3}{10} \cdot \frac{4}{12} = \frac{12}{120} = \boxed{\frac{1}{10}}$

4. A jar contains 8 green, 4 blue, 10 red, and 2 yellow Skittles. A Skittle is randomly drawn, **replaced**, then another is drawn. Find each probability.	**a)** P(red, then yellow)	**b)** P(blue, then green)
	$\frac{10}{24} \cdot \frac{2}{24} = \frac{20}{576} = \boxed{\frac{5}{144}}$	$\frac{4}{24} \cdot \frac{8}{24} = \frac{32}{576} = \boxed{\frac{1}{18}}$
	c) P(both blue)	**d)** P(both red)
	$\frac{4}{24} \cdot \frac{4}{24} = \frac{16}{576} = \boxed{\frac{1}{36}}$	$\frac{10}{24} \cdot \frac{10}{24} = \frac{100}{576} = \boxed{\frac{25}{144}}$

5. A piggy bank contains 4 quarters, 18 dimes, 10 nickels, and 8 pennies. A coin is chosen at random, **not replaced**, then another is chosen. Find each probability.	**a)** P(penny, then dime) $\dfrac{8}{40} \cdot \dfrac{18}{39} = \dfrac{144}{1560} = \boxed{\dfrac{6}{65}}$	**b)** P(quarter, then nickel) $\dfrac{4}{40} \cdot \dfrac{10}{39} = \dfrac{40}{1560} = \boxed{\dfrac{1}{39}}$
	c) P(silver coin, then penny) $\dfrac{32}{40} \cdot \dfrac{8}{39} = \dfrac{256}{1560} = \boxed{\dfrac{32}{195}}$	**d)** P(both pennies) $\dfrac{8}{40} \cdot \dfrac{7}{39} = \dfrac{56}{1560} = \boxed{\dfrac{7}{195}}$
	e) P(both dimes) $\dfrac{18}{40} \cdot \dfrac{17}{39} = \dfrac{306}{1560} = \boxed{\dfrac{51}{260}}$	**f)** P(worth at least 10¢, then penny) $\dfrac{22}{40} \cdot \dfrac{8}{39} = \dfrac{176}{1560} = \boxed{\dfrac{22}{195}}$

6. A math class is playing a game with 16 questions that uses the board below. Once a question is called, it is not called again. Find the probability of the first two questions called.	**a)** P(1, then an even number) $\dfrac{1}{16} \cdot \dfrac{8}{15} = \dfrac{8}{240} = \boxed{\dfrac{1}{30}}$	**b)** P(both odd) $\dfrac{8}{16} \cdot \dfrac{7}{15} = \dfrac{56}{240} = \boxed{\dfrac{7}{30}}$
	c) P(both in column A) $\dfrac{4}{16} \cdot \dfrac{3}{15} = \dfrac{12}{240} = \boxed{\dfrac{1}{20}}$	**d)** P(row H, then row Z) $\dfrac{4}{16} \cdot \dfrac{4}{15} = \dfrac{16}{240} = \boxed{\dfrac{1}{15}}$
	e) P(13, then less than 10) $\dfrac{1}{16} \cdot \dfrac{9}{15} = \dfrac{9}{240} = \boxed{\dfrac{3}{80}}$	**f)** P(row W, then a multiple of 5) $\dfrac{4}{16} \cdot \dfrac{3}{15} = \dfrac{12}{240} = \boxed{\dfrac{1}{20}}$

	M	**A**	**T**	**H**
W	1	2	3	4
H	5	6	7	8
I	9	10	11	12
Z	13	14	15	16

7. If a coin is tossed seven times, what is the probability of it landing on heads each time? $\dfrac{1}{2} \cdot \dfrac{1}{2} \cdot \dfrac{1}{2} \cdot \dfrac{1}{2} \cdot \dfrac{1}{2} \cdot \dfrac{1}{2} \cdot \dfrac{1}{2} = \boxed{\dfrac{1}{128}}$	8. While golfing, Kevin made 16 out of his last 21 putts. His friend Mike made 9 out of his last 14 putts. What is the probability that they both make their next putt? $\dfrac{16}{21} \cdot \dfrac{9}{14} = \dfrac{144}{294} = \boxed{\dfrac{24}{49}}$
9. If the probability that it will snow on Monday is 8/9 and the probability that it will snow on Tuesday is 3/16, find the probability that it does not snow either day. $\dfrac{1}{9} \cdot \dfrac{13}{16} = \boxed{\dfrac{13}{144}}$	10. A pop quiz contains five questions: two multiple choice questions with four options each and three true-false questions. If Brad randomly guesses, what is the probability that he gets all five answers correct? $\dfrac{1}{4} \cdot \dfrac{1}{4} \cdot \dfrac{1}{2} \cdot \dfrac{1}{2} \cdot \dfrac{1}{2} = \boxed{\dfrac{1}{128}}$

Name:	Date:

Topic:	Class:

Main Ideas/Questions	Notes/Examples
Population	A population is an entire group of people or objects **Example:** The residents of Florida.
Sample	A sample is part of the population. **Example:** The residents of Florida.
Unbiased Sample	**An unbiased sample is:** • Representative of the larger population. • Selected at random. • Large enough to provide accurate data.
Biased Sample	A sample is not representative of the larger population and favors certain parts of the population.
Examples	**Determine whether each sample is biased or unbiased. Explain.** **1.** To estimate the number of students in your school who play a sport outside of school, you decide to survey the players on the boys' baseball team. Biased; since players on the baseball team already play a sport, it is more likely that they play a sport outside of school. **2.** Katy would like to approximate the number of students in her school that own a pet. She decides to survey five students in her homeroom. Biased; sample is not large enough. **3.** The Yearbook Committee must choose among three different themes for this year's yearbook. To help make their decision, they survey 100 random students during lunch. Unbiased; Sample represents the population, is large enough, + random. **4.** The New England Patriots and the Atlanta Falcons played in the 51st Super Bowl. To determine team was the favorite to win, a New York City newspaper surveyed 500 residents. Biased; This targets a certain area, and New York City residents are not generally Patriots fans!

Predicting Outcomes	The results of an **unbiased sample** are **proportional** to the results of a population. You can use unbiased sample results to **make predictions** about the population. Biased sample results should not be used to make predictions about the population.
Examples	**5.** Members of the Marching Band plan to sell cookie dough to raise money for new uniforms. They survey 60 students at random to determine their favorite type of cookie. The results are shown in the table below.

5. (continued)

Flavor	Number
Chocolate Chip	21
Peanut Butter	12
Oatmeal Raisin	9
Sugar	18

a) What percent of the students prefer sugar cookies?

$\frac{18}{60} = \frac{3}{10}$; $\boxed{30\%}$

b) What percent of the students prefer chocolate chip or peanut butter cookies?

$\frac{33}{60} = \frac{11}{20}$; $\boxed{55\%}$

c) If the band orders 500 tubs of cookie dough, how many tubs of sugar cookie dough should they order?

$\frac{18}{60} = \frac{X}{500}$ $\frac{60X}{60} = \frac{9000}{60}$ $\boxed{X = 150 \text{ tubs}}$

6. Seventy-five random 8th grade students were surveyed to see how many text messages they send each day. The results are shown in the table below.

Text Messages	Number
0-25	4
26-50	14
51-75	25
76 or more	32

a) What percent of the students send 51-75 text messages each day?

$\frac{25}{75} = \frac{1}{3}$; $\boxed{33.33\%}$

b) What percent of the students send no more than 50 text messages each day?

$\frac{18}{75} = \frac{6}{25}$; $\boxed{24\%}$

c) If there are 450 total students in the 8th grade, how many would you expect to send at least 76 text messages a day?

$\frac{32}{75} = \frac{X}{450}$ $\frac{75X}{75} = \frac{14400}{75}$ $\boxed{X = 192 \text{ students}}$

7. A group of middle school students were randomly chosen and asked about whether they are going to attend the school carnival. Of these students, 65% said yes.

a) If 52 students responded yes, how many students were surveyed?

$\frac{65}{100} = \frac{52}{X}$ $\frac{65X}{65} = \frac{5200}{65}$ $\boxed{X = 80}$

b) If there are 1600 students in the school, predict the number of students who will attend the carnival.

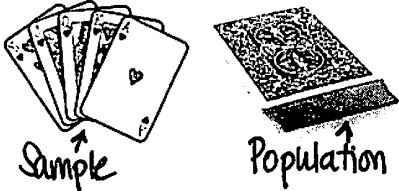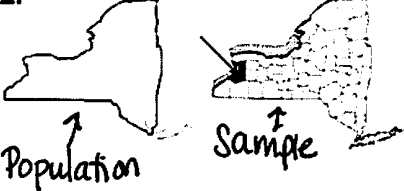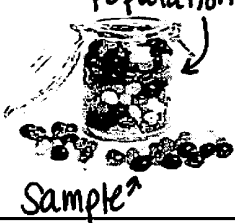$\frac{65}{100} = \frac{X}{1600}$ $\frac{100X}{100} = \frac{104000}{100}$ $\boxed{X = 1040}$

Name: _____ Unit 9: Probability & Statistics

Date: _____ Per: _____ Homework 5: Using Samples to Predict

** This is a 2-page document! **

Identify the population and the sample.

1.

Sample   Population

2.

Population   Sample

3.

Population

Sample

Determine whether the sample is biased or unbiased. Explain.

4. A restaurant would like to evaluate the efficiency of its workers, so they observe the workers during the second shift.

Biased; They are only observing one shift.

5. At the end of the year, a math teacher decides to survey his students to determine what they liked best about his class. He uses his first period class as his sample.

Biased; One class is not enough, and the sample is not random

6. An airport randomly inspects every 8th suitcase that goes through security.

Unbiased; the sample is random.

7. Mark would like to determine their exercise habits of students in his school. He surveys people on his track team.

Biased; the track team actively exercises, so the sample is not representative.

8. To determine how many students plan to attend the school musical, Kaitlyn surveys 100 random people in the hallway.

Unbiased; the sample is random + representative of the population.

9. To track the movement of sharks along the east coast, one shark is chosen at random and tagged.

Biased; the sample is not large enough

10. To determine how many homes in his neighborhood plan to hand out candy on Halloween, Jack chooses one street at random and surveys each household on that street.

Biased; Jack's sample only consists of one street.

11. To check lightbulbs for defects, 500 random bulbs from a certain production line are checked.

Biased; one line is not a large enough sample.

12. Suppose you would like to determine how many students have a cell phone at your school. Give an example of a biased sample and an unbiased sample.

* Answers may vary *

Biased - Asking my 15 teammates on the softball team

Unbiased - Asking every third student in the lunch line.

13. A bake shop surveyed a group of their customers to determine their favorite type of pie. Results are shown in the table below.

Pie	Frequency
Apple	35
Pumpkin	15
Pecan	8
Cherry	28
Raspberry	25
Blueberry	14

a) What percent reported pumpkin pie as their favorite?

$\frac{15}{125} = \frac{3}{25}$; $\boxed{12\%}$

b) What percent reported pecan pie as their favorite?

$\frac{8}{125}$; $\boxed{6.4\%}$

c) What percent did not report raspberry as their favorite type of pie?

$\frac{100}{125} = \frac{4}{5}$; $\boxed{80\%}$

d) Out of 600 people, how many would you expect to say their favorite pie is apple or blueberry?

$\frac{49}{125} = \frac{X}{600}$ $\frac{125X}{125} = \frac{29400}{125}$

$\boxed{X \approx 235 \text{ people}}$

---

14. Bayview Middle School wants to change their school mascot. They came up with five mascot names and survey a group of random students to determine their favorite. Results are shown in the table below.

Pie	Frequency
Penguins	5
Marlins	12
Seahawks	9
Dolphins	14
Sharks	20

a) What percent favor the Marlins as their new mascot?

$\frac{12}{60} = \frac{1}{5}$; $\boxed{20\%}$

b) What percent did not report the Dolphins as their favorite?

$\frac{46}{60} = \frac{23}{30}$; $\boxed{76.67\%}$

c) What percent favor the Seahawks or the Sharks as their new mascot?

$\frac{29}{60}$; $\boxed{48.33\%}$

d) If there are 1,400 students in the school, how many would you expect to choose the Penguins as their favorite mascot?

$\frac{5}{60} = \frac{X}{1400}$ $\frac{60X}{60} = \frac{7000}{60}$

$\boxed{X \approx 117 \text{ students}}$

---

15. The library surveyed a group of random people to find out their favorite book genre. Results are shown in the table below.

Genre	Frequency
Action	8
Comedy	4
Drama	16
Mystery	7
Romance	10
Science Fiction	6
Biography	3
History	12
Other	9

a) What percent reported science fiction as their favorite genre?

$\frac{6}{75} = \frac{2}{25}$; $\boxed{8\%}$

b) Out of 500 people, how many would you expect to report mystery as their favorite genre?

$\frac{7}{75} = \frac{X}{500}$ $\frac{75X}{75} = \frac{3500}{75}$

$\boxed{X \approx 47 \text{ people}}$

c) Out of 1,600 people, how many would you expect to report drama, history, or romance as their favorite genres?
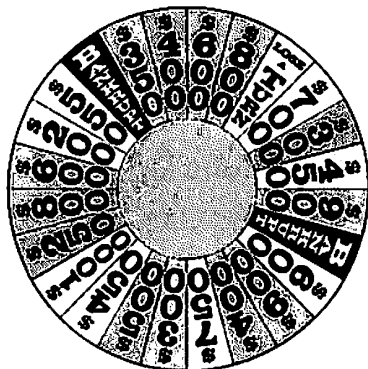
$\frac{38}{75} = \frac{X}{1600}$ $\frac{75X}{75} = \frac{60800}{75}$

$\boxed{X \approx 811 \text{ people}}$

PROBABILITY REVIEW

SIMPLE PROBABILITY

1. If the spinner below is spun once, find each probability.

a) P(bankrupt)

$\frac{2}{24} = \frac{1}{12}$; 0.0833 ; 8.33%

b) P(at least $500)

$\frac{12}{24} = \frac{1}{2}$; 0.50 ; 50%

c) P($800 or $1,000)

$\frac{3}{24} = \frac{1}{8}$; 0.125 ; 12.5%

d) P(a maximum of $700)

$\frac{15}{24} = \frac{5}{8}$; 0.625 ; 62.5%

e) P(less than $400)

$\frac{5}{24}$; 0.2083 ; 20.83%

f) P(lose a turn)

$\frac{1}{24}$; 0.0417 ; 4.17%

2. A bucket contains a set of magnetic alphabet letters. If a letter is drawn at random, what is the probability that it is a letter in the word FIRECRACKER?

$\frac{7}{26}$; 0.2692 ; 26.92%

3. Sarah has been late for work 9 out of the last 30 days. Based on this, what is the probability that she will be on time for work on any given day?

$1 - \frac{9}{30} = \frac{21}{30} = \frac{7}{10}$; 0.70 ; 70%

THEORETICAL VS. EXPERIMENTAL PROBABILITY

4. A day of the week was chosen at random 60 times. Results of this experiment are shown in the table below.

Result	Sun	Mon	Tues	Weds	Thurs	Fri	Sat
Frequency	14	6	5	10	12	9	4

a) What is the theoretical probability of the selecting a day that starts with the letter S?

$\frac{2}{7}$; 0.2857 ; 28.57%

b) Based on this experiment, what is the probability of selecting a day that starts with the letter S?

$\frac{18}{60} = \frac{3}{10}$; 0.30 ; 30%

c) Theoretically, if a day is chosen at random 300 times, about many times would you expect Monday to be chosen?

$\frac{1}{7} = \frac{x}{300}$ $\frac{7x}{7} = \frac{300}{7}$

$\boxed{x \approx 43 \text{ times}}$

d) Based on this experiment, if a day is chosen at random 300 times, about many times would you expect Monday to be chosen?

$\frac{6}{60} = \frac{x}{300}$ $60x =$

COUNTING PRINCIPLE

5. How many ways can Mason make his elective schedule if he can choose from photography, journalism, art, or marketing as his first elective and keyboarding or chorus as his second elective?

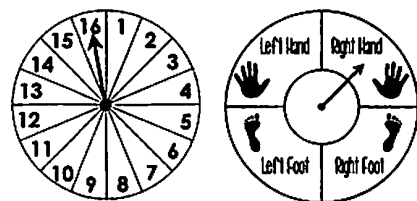$4 \cdot 2 = \boxed{8 \text{ ways}}$

6. To access their grades in the gradebook, each student is given a unique code that contains three letters followed by one digit. How many codes are possible?

$26 \cdot 26 \cdot 26 \cdot 10 = \boxed{175,760}$

COMPOUND PROBABILITY

7. If each spinner is spun once, find each probability.

a) P(multiple of 3, then right side)

$$\frac{5}{16} \cdot \frac{2}{4} = \frac{10}{64} = \boxed{\frac{5}{32}}$$

b) P(less than 3, then left foot)

$$\frac{2}{16} \cdot \frac{1}{4} = \frac{2}{64} = \boxed{\frac{1}{32}}$$

c) P(at least 7, then left hand)

$$\frac{10}{16} \cdot \frac{1}{4} = \frac{10}{64} = \boxed{\frac{5}{32}}$$

d) P(prime, then not right foot)

$$\frac{6}{16} \cdot \frac{3}{4} = \frac{18}{64} = \boxed{\frac{9}{32}}$$

8. A letter from the word CONFIDENCE is chosen at random, then a card is drawn from a standard deck. What is the probability of getting a consonant, then a red card or an ace?

$$\frac{6}{10} \cdot \frac{28}{52} = \frac{168}{520} = \boxed{\frac{21}{65}}$$

9. In the last 10 presidential elections, the democratic candidate has won six times in Michigan and four times in Ohio. What is the probability that the democratic candidate wins both Michigan and Ohio in the next presidential election?

$$\frac{6}{10} \cdot \frac{4}{10} = \frac{24}{100} = \boxed{\frac{6}{25}}$$

10. Each homeroom must send two student representatives to each student council meeting. Mrs. Lincoln has 15 girls and 10 boys in her homeroom. If she randomly selects two students to attend the next meeting, find each probability.

a) P(one girl and one boy)

$$\frac{15}{25} \cdot \frac{10}{24} = \frac{150}{600} = \boxed{\frac{1}{4}}$$

b) P(both boys)

$$\frac{10}{25} \cdot \frac{9}{24} = \frac{90}{600} = \boxed{\frac{3}{20}}$$

USING SAMPLES TO PREDICT

11. A sporting goods store would like to conduct a survey to determine their customers' favorite sport. They will then run a sale on all equipment related to this sport. Determine whether the samples below would be biased or unbiased. Explain.

A: 200 random members of their rewards program	B: every 5th person who enters the store on Super Bowl Sunday	C: setting up a booth and asking people at a little league game
Biased - targets only rewards program members, not representative of the whole population	Biased - that day is geared towards football fans and doesn't represent the whole population.	Biased - baseball players are likely to be baseball fans, again not representative of the whole population.

12. A certain airport offers service for JetBlue, Southwest, American Airlines, Delta, and United. They conducted a survey of 120 people to determine which airline is their favorite. Results are shown below.

Airline	Frequency
JetBlue	25
Southwest	42
American	15
Delta	20
United	18

a) What percent reported United as their favorite airline?

$$\frac{18}{120} = \frac{3}{20} \; ; \quad 15\%$$

b) What percent reported JetBlue or Southwest as their favorite airline?

$$\frac{67}{120} \; ; \quad 55.83\%$$

c) Out of 1,500 people, how many would you expect to say their favorite airline is not American Airlines?

$$120X = 157,500$$

$$\frac{105}{120} = \frac{X}{1500}$$

$$\boxed{X = 1,312.5 \text{ people}}$$

Name: _____ **Unit 9:** Probability & Statistics

Date: _____ **Per:** _____ **Homework 6:** Probability Review

** This is a 2-page document! **

Give all probability answers as fractions in simplest form.

1. A date in the month below is chosen at random. Find each probability.

SEPTEMBER 2017

	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

a) P(the 14ᵗʰ)

$$\boxed{\frac{1}{30}}$$

b) P(Wednesday)

$$\frac{4}{30} = \boxed{\frac{2}{15}}$$

c) P(Saturday or Sunday)

$$\frac{9}{30} = \boxed{\frac{3}{10}}$$

d) P(a perfect square)

$$\frac{5}{30} = \boxed{\frac{1}{6}}$$

e) P(divisible by 4)

$$\boxed{\frac{1}{30}}$$

f) P(before the 13ᵗʰ)

$$\frac{12}{30} = \boxed{\frac{2}{5}}$$

2. A card is chosen at random from a standard deck of cards. What is the probability that it is club or a face card?

$$\frac{22}{52} = \boxed{\frac{11}{26}}$$

3. Curt is playing darts. He hit the bullseye eight out of his last thirty throws. What is the probability that he does not make a bullseye on his next throw?

$$1 - \frac{8}{30} = \frac{22}{30} = \boxed{\frac{11}{15}}$$

4. The spinner below is spun 50 times. The results are shown in the table below.
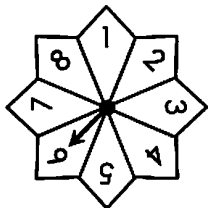
Result	1	2	3	4	5	6	7	8
Frequency	9	5	7	10	2	8	6	3

a) What is the theoretical probability of the spinner landing on a number greater than 6?

$$\frac{2}{8} = \boxed{\frac{1}{4}}$$

b) Based on this experiment, what is the probability of the spinner landing on a number greater than 6?

$$\boxed{\frac{9}{50}}$$

c) Theoretically, if the spinner is spun 500 times, how many times would you expect it to land on 1?

$$\frac{1}{8} = \frac{x}{500} \qquad \frac{8x = 500}{8 \quad 8}$$

$$\boxed{X \approx 63 \text{ times}}$$

d) Based on this experiment, if the spinner is spun 500 times, how many times would you expect it to land on 1?

$$\frac{9}{50} = \frac{x}{500} \qquad \frac{50x = 4500}{50 \quad 50}$$

$$\boxed{X = 90 \text{ times}}$$

Use the counting principle for questions 5-6.

5. A sandwich shop has three kinds of bread, seven types of meat, and four types of cheese. How many different sandwiches can be made using one type of bread, one meat, and one cheese?

$$3 \cdot 7 \cdot 4 = \boxed{84 \text{ sandwiches}}$$

6. A standard die is rolled two times, then a letter of the alphabet is chosen. How many outcomes are possible?

$$6 \cdot 6 \cdot 26 = \boxed{936 \text{ outcomes}}$$

7. If the spinner below is spun twice, find each probability.
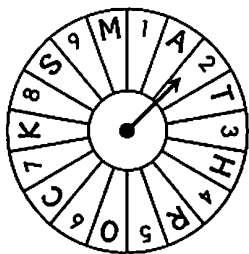
a) P(a number both times)

$$\frac{9}{18} \cdot \frac{9}{18} = \frac{81}{324} = \boxed{\frac{1}{4}}$$

b) P(odd number, then a letter)

$$\frac{5}{18} \cdot \frac{9}{18} = \frac{45}{324} = \boxed{\frac{5}{36}}$$

c) P(M, then a number less than 7)

$$\frac{1}{18} \cdot \frac{6}{18} = \frac{6}{324} = \boxed{\frac{1}{54}}$$

c) P(vowel, then a perfect square)

$$\frac{2}{18} \cdot \frac{3}{18} = \frac{6}{324} = \boxed{\frac{1}{54}}$$

8. One of the 50 states is chosen at random, then a standard die is rolled. What is the probability of choosing a state begins with the letter C, then rolling a number that is at most 5?

$$\frac{3}{50} \cdot \frac{5}{6} = \frac{15}{300} = \boxed{\frac{1}{20}}$$

9. Jack and Tommy work at the sub shop. Jack has worked 3 out of the last 7 days. Tommy has worked 14 out of the last 15 days. Based on this, what is the probability that they will both be working on the same day?

$$\frac{3}{7} \cdot \frac{14}{15} = \frac{42}{105} = \boxed{\frac{2}{5}}$$

10. A bag contains twelve green, sixteen red, four yellow, and eight blue game pieces. If a game piece is selected at random, not replaced, then another is drawn, find each probability.

a) P(blue, then green)

$$\frac{8}{40} \cdot \frac{12}{39} = \frac{96}{1560} = \boxed{\frac{4}{65}}$$

b) P(red both times)

$$\frac{16}{40} \cdot \frac{15}{39} = \frac{240}{1560} = \boxed{\frac{2}{13}}$$

11. The manager of the zoo would like to survey its visitors to determine their favorite exhibit. Determine whether the following samples are biased or unbiased. Explain.

a) every 10th person who enters the zoo

Unbiased

b) 20 random people in the food court

Biased - the sample size is too small

c) 50 random people at the tiger exhibit

Biased - People at the tiger exhibit are more likely to choose tigers.

12. A survey of 150 people was conducted to determine their favorite social media platform. Results are shown in the table below.

Social Media	Frequency
Facebook	60
Twitter	16
Instagram	26
Snapchat	48

a) What percent reported Twitter as their favorite platform?

$$\frac{16}{150} = \frac{8}{75} ; \boxed{10.67\%}$$

b) What percent reported Instagram or Snapchat as their favorite platform?

$$\frac{74}{150} = \frac{37}{75} ; \boxed{49.33\%}$$

c) Out of 800 people, how many would you expect to say their favorite platform is not Facebook?

$$\frac{90}{150} = \frac{x}{800} \qquad \frac{150x}{150} = \frac{72000}{150}$$

$$\boxed{x = 480 \text{ people}}$$

Quiz 9-2: Probability (All Topics)

* Give all probability answers as fractions in simplest form. *

1. If the spinner to the right is spun once, what is the probability that it lands on a star or a shaded region?

$$\frac{12}{16}$$
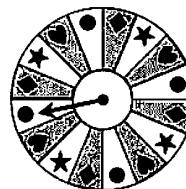
2. A card is drawn at random from a standard deck of playing cards. What is the probability that it is a red face card?

$$\frac{6}{52}$$

3. A box contains six red popsicles, two blue popsicles, and eight orange popsicles. If a popsicle is drawn at random, what is the probability that it is not blue?

$$\frac{14}{16}$$

For questions 4-7: A spinner has four equal sections, each labeled with a letter of the word MATH. The spinner is spun 80 times and the results are shown in the table below. Find each probability based on the experiment.

Result	Frequency
M	15
A	25
T	28
H	12

4. $P(A \text{ or } H)$

$$\frac{37}{80}$$

5. $P(\text{not } T)$

$$\frac{52}{80}$$

6. Theoretically, if the spinner is spun 200 times, how many times would you expect it to land on M?

$$\frac{1}{4} = \frac{X}{200} \qquad \frac{4X}{4} = \frac{200}{4}$$
$$X = 50$$

7. Based on the experiment, if the spinner is spun 200 times, how many times would you expect it to land on M?

$$\frac{15}{80} = \frac{X}{200} \qquad \frac{80X}{80} = \frac{3000}{80}$$
$$X \approx 38 \text{ times}$$

Use the counting principle for questions 8 and 9.

8. A restaurant offers a "Make Your Own Pasta Bowl" special. How many different pasta bowls can be made using one pasta, one sauce, and one meat?

MAKE YOUR OWN PASTA BOWL!	
Pasta	Rigatoni, Spaghetti, Linguini, Penne, Farfelle
Sauce	Marinara, Alfredo
Meat	Chicken, Meatballs, Shrimp, Sausage

$$5 \cdot 2 \cdot 4 = 40$$

9. A person's initials are created using the first letter of their first name, middle name, and last name. How many initials are possible?

$$26 \cdot 26 \cdot 26 = 17576$$

Answers:

1. $\frac{3}{4}$

2. $\frac{3}{26}$

3. $\frac{7}{8}$

4. $\frac{37}{80}$

5. $\frac{13}{20}$

6. 50 times

7. ≈ 38 times

8. 40 bowls

9. 17,576 initials

10. If a standard die is rolled twice, what is the probability that it lands on a number greater than 4 both times?

$$\frac{2}{6} \cdot \frac{2}{6} = \frac{4}{36}$$

11. A coin is tossed, then a letter in the word **ACCOMPLISHMENT** is chosen at random. Find the probability of heads, then a vowel.

$$\frac{1}{2} \cdot \frac{4}{14} = \frac{4}{28}$$

12. Out of the last 15 school days, Allie's math teacher has assigned homework 12 times and her science teacher has assigned homework 9 days. Based on this, what is the probability that Allie will have both math and science homework on any given school day?

$$\frac{12}{15} \cdot \frac{9}{15} = \frac{108}{225}$$

13. A chess game comes with two kings, two queens, four rooks, four bishops, four knights, and sixteen pawns. A game piece is randomly selected, replaced, then another is chosen. Find the probability of selecting a king or queen, then a pawn.

$$\frac{4}{32} \cdot \frac{16}{32} = \frac{64}{1024}$$

14. A bag contains five Snicker bars, nine Milky Way bars, two Crunch bars, and twelve Twix bars. If Jack randomly selects a candy bar, eats it, then randomly selects another, find the probability that both candy bars were Milky Way.

$$\frac{9}{28} \cdot \frac{8}{27} = \frac{72}{756}$$

15. To determine their favorite country artist, a radio station randomly surveyed 100 people at a Luke Bryan concert. Determine whether this sample is biased or unbiased. Explain.

Biased- People at a Luke Bryan concert are likely to favor Luke Bryan.

For questions 16-18: A group of random middle school students were surveyed to determine how they get to school each day. Results are shown in the table below.

Result	Frequency
school bus	32
parent drop off	10
walk or ride bike	8

16. What percent of the students get dropped off by their parent?

$$\frac{10}{50} = \frac{1}{5}$$

17. What percent of the students do not walk or ride their bike to school day?

$$\frac{42}{50} = \frac{21}{25}$$

18. If there are 1,500 total middle school students, how many would you expect to ride the bus to school?

$$\frac{32}{50} = \frac{x}{1500} \qquad \frac{50x}{50} = \frac{48000}{50} \qquad x = 960$$

Answer column:

10. $\frac{1}{9}$

11. $\frac{1}{7}$

12. $\frac{12}{25}$

13. $\frac{1}{16}$

14. $\frac{2}{21}$

16. 20%

17. 84%

18. 960 students

Name:		Date:
Topic: .		**Class:**

Main Ideas/Questions	Notes/Examples
Measures of **CENTRAL TENDENCY**	A value that describes the center or middle of a data set. **Mean:** The average of the values. $\left(mean = \frac{sum}{Total \#}\right)$ **Median:** The middle value. (must be small → large order) **Mode(s):** The most occurring value(s).
RANGE	
EXAMPLES	**Directions:** Find the mean, median, mode(s), and range of each data set. Round to the nearest tenth when necessary.

1. The daily high temperature for the past two weeks in Orlando: {89, 90, 88, 91, 82, 90, 88, 88, 86, 90, 92, 87, 89, 86}

Mean = $\frac{1236}{14}$

Median: 82, 86, 86, 87, 88, 88, 88, 89, 89, 90, 90, 90, 91, 92

Mean: __88.3__
Median: __88.5__
Mode(s): __88, 90__
Range: __10__

2. The number of points scored by a football team during their 16-game season: {7, 31, 33, 16, 30, 45, 25, 25, 25, 16, 28, 24, 20, 33, 31, 10}

Mean = $\frac{399}{16}$

Median = 7, 10, 16, 16, 20, 24, 25, 25, 25, 28, 30, 31, 31, 33, 33, 45

Mean: __24.9__
Median: __25__
Mode(s): __25__
Range: __38__

3. Jenna's math quiz grades in the second quarter: {78, 90, 95, 84, 80, 82, 87, 98, 72}

Mean = $\frac{766}{9}$

Median = 72, 78, 80, 82, 84, 87, 90, 95, 98

Mean: __85.1__
Median: __84__
Mode(s): __none__
Range: __26__

4. The amount of money in Dave's checking account for the first week of June: {$618, $575, $520, $378, $244, $794, $702}

Mean = $\frac{3831}{7}$

Median = 244, 378, 520, 575, 618, 702, 794

Mean: __547.3__
Median: __575__
Mode(s): __none__
Range: __550__

5. Trevon has four grades in science class so far: 97, 78, 89, and 94. If he has a test coming up, what grade would he need so his overall average is at least 90?

$$\frac{97 + 78 + 89 + 94 + X}{5} \geq 90$$

$$\frac{358 + X}{5} \geq 90$$

$$358 + X \geq 450$$

$$\boxed{X \geq 92}$$

400-Meter Dash	
Attempt	**Time (s)**
1	63.5
2	67.9
3	64.3
4	63.6
5	65.4
6	64.7

6. Melanie ran the 400-meter dash six times during track practice. Her times are shown in the table to the left. If she drops her slowest time, which measure of center is affected the most, mean or median? Explain.

Mean = 64.9
Med = 64.5
- - - - -
Mean = 64.3
Med = 64.3

The mean is most affected since her slowest time is used in the calculation.

OUTLIER

A data value that is much smaller or much larger than the others.

Choosing the BEST CENTER

Circumstances within the data set determine which measure of central tendency would be the most appropriate.

Measure	Most Useful When...
Mean	• There are no outliers.
Median	• There are outliers. • The middle of the data contains no big gaps.
Mode	• The data has many repeated values.

EXAMPLES

Directions: Determine which measure of center best represents the data. Justify your selection, then find the measure of center.

7. The number of wins by a hockey team in the last 8 years: {56, 45, 26, 48, 54, 52, 49, 38}

26, 38, 45, 48, 49, 52, 54, 56

☐ Mean
☑ Median — 26 is an outlier.
☐ Mode

$$\boxed{Med = 48.5}$$

8. The number of minutes that Ariana spent exercising each day for the past week: {35, 38, 32, 40, 45, 42, 36}

☑ Mean — No outliers
☐ Median
☐ Mode

$$Mean = \frac{268}{7} = \boxed{38.3}$$

9. The scores on a math quiz: {80, 50, 70, 80, 80, 90, 100, 80, 100, 60, 80, 50, 80, 80, 80, 70, 90, 90, 80, 100}

☐ Mean
☐ Median
☑ Mode — lots of repetition

$$\boxed{Mode = 80}$$

** This is a 2-page document! **

Find the mean, median, and mode(s) of each data set. Round to the nearest tenth if necessary.

1. Annual inches of rainfall in the last 5 years:
{29.3, 31.7, 46.3, 32.4, 48.9}

Mean = $\dfrac{188.6}{5}$

Median = 29.3, 31.7, 32.4, 46.3, 48.9

Mean	Median	Mode(s)	Range
37.7	32.4	none	19.6

2. The number of games a baseball team has won in each of the last ten seasons: {89, 81, 96, 85, 93, 70, 66, 64, 68, 70}

Mean = $\dfrac{782}{10}$

Median = 64, 66, 68, 70, 70, 81, 85, 89, 93, 96

Mean	Median	Mode(s)	Range
78.2	75.5	70	32

3. The speed of 15 cars on the highway: {72, 80, 68, 65, 62, 72, 70, 79, 66, 62, 72, 68, 63, 70, 68}

Mean = $\dfrac{1037}{15}$

Median = 62, 62, 63, 65, 66, 68, 68, 68, 70, 70, 72, 72, 72, 79, 80

Mean	Median	Mode(s)	Range
69.1	68	68, 72	18

4. The total number of medals won by the United States in the following summer Olympics:

Mean = $\dfrac{629}{6}$

Year	Medals
1996	101
2000	93
2004	101
2008	110
2012	103
2016	121

Median = 93, 101, 101, 103, 110, 121

Mean	Median	Mode(s)	Range
104.8	102	101	28

5. The value of a home (in thousands) in the last 10 years: {213, 228, 246, 274, 297, 305, 313, 292, 270, 272}

Mean = $\dfrac{2710}{10}$

Med = 213, 228, 246, 270, 272, 274, 292, 297, 305, 313

Mean	Median	Mode(s)	Range
271	273	none	100

6. The average high temperature each month for the last year: {31, 36, 42, 55, 67, 75, 80, 78, 71, 59, 48, 36}

Mean = $\dfrac{678}{12}$

Med = 31, 36, 36, 42, 48, 55, 59, 67, 71, 75, 78, 80

Mean	Median	Mode(s)	Range
56.5	57	36	49

7. Rick's scores in his last 15 rounds of golf are 72, 80, 75, 84, 78, 72, 75, 68, 81, 74, 79, 70, 77, 83, and 72. If he scores an 80 on each of the next three rounds, which measure of center would increase more, the mean or median? Justify your answer.

Mean = 76 | Mean = 76.6

Median = 75 | Median = 77.5

The median would move more because you're choosing a new center when you add in more values.

8. Jordan and Ben exercise at the same gym. The table below shows the number of calories they burned in each of their last five workouts. How many calories would Ben need to burn in his next workout to have the same average as Jordan?

← Mean = 705

Jordan	850	674	729	658	614
Ben	716	635	802	687	630

$$\frac{716 + 635 + 802 + 687 + 630 + X}{6} = 705$$

$$\frac{3470 + X}{6} = 705$$

$$3470 + X = 4230 \qquad \boxed{X = 760 \text{cal}}$$

9. The average price of a gallon of gas from 2011-2014 is shown in the table below. In 2015, the average price of a gallon dropped 28% from 2014. Find the 5-year average from 2011-2015.

Year	2011	2012	2013	2014
$ per gal	$3.75	$3.80	$3.62	$3.40

2015 = $2.45

$$\frac{17.02}{5} = \boxed{\$3.40}$$

Directions: Determine which measure of center best represents the data. Justify your selection, then find the measure of center.

10. The number of students in each 8th grade math class at Oakville Middle School: {27, 30, 30, 32, 25, 30, 30, 30, 28, 30, 21, 30}

Mode = $\boxed{30}$

☐ Mean
☐ Median
☑ Mode – 30 is repeated

11. The square footage of 8 homes in a new neighborhood: {2980, 2816, 2648, 2305, 2766, 3072, 2832, 3476}

$$\text{Mean} = \frac{22895}{8} = \boxed{2861.9}$$

☑ Mean – No outliers
☐ Median
☐ Mode

12. SAT test scores of a group of students: {1250, 1490, 720, 1180, 1350, 1090, 1380, 1270, 1560, 1320}

Median = 720, 1090, 1180, 1250, 1270, 1320, 1350, 1380, 1490, 1560

☐ Mean
☑ Median – 720 is an outlier
☐ Mode

= $\boxed{1295}$

Name:	Date:
Topic:	Class:

Main Ideas/Questions	Notes/Examples
Mean Absolute Deviation	A measure that gives the average distance of each data value to the mean.
Steps to Find	❶ Find the mean. ❷ Find the distance of each value from the mean. ❸ Average these distances.

Examples	**Directions:** Find the mean absolute deviation of data sets A, B, and C. Round to the nearest tenth if necessary.

Data Set A	Data Set B	Data Set C
{1, 3, 5, 14, 17}	{5, 6, 8, 9, 12}	{8, 8, 8, 8, 8}
$= \dfrac{7+5+3+6+9}{5}$	$= \dfrac{3+2+0+1+4}{5}$	$= \dfrac{0+0+0+0+0}{5}$
$= \dfrac{30}{5} = 6$	$= \dfrac{10}{5} = 2$	$= \dfrac{0}{5} = 0$
Mean = 8	**Mean =** 8	**Mean =** 8
MAD = 6	**MAD =** 2	**MAD =** 0

Interpreting MAD	The closer MAD is to 0, the less variation there is in the data. Data values are clustered around the mean.
	How do outliers affect mean absolute deviation? they raise it.

Examples	**Directions:** Find the mean absolute deviation of each data set. Round answers to the nearest tenth if necessary.

1. The speed, in miles per hour, of Will's last 6 pitches:
{71, 78, 75, 74, 80, 72}

Mean $= \dfrac{450}{6}$

$= 75$

MAD $= \dfrac{4+3+0+1+5+3}{6} = \dfrac{16}{6}$

MAD $= 2.7$

2. Nora's science grades: {100, 52, 80, 96, 90, 74, 86, 94}

Mean $= \dfrac{672}{8}$

$= 84$

MAD $= \dfrac{16+32+4+12+6+10+2+10}{8}$

$= \dfrac{92}{8}$

MAD $= 11.5$

3. Weight, in ounces, of packages on a mail truck: {5, 24, 15, 35, 9, 14}

Mean = $\dfrac{102}{6}$

= 17

MAD = $\dfrac{12+7+2+18+8+3}{6}$

= $\dfrac{50}{6}$

MAD = 8.3

---

4. Number of push-ups completed in one minute by a group of students: {4, 7, 10, 22, 25, 26, 32, 37, 42, 45}

Mean = $\dfrac{250}{10}$

= 25

MAD = $\dfrac{21 + 18 + 15 + 3 + 0 + 1 + 7 + 12 + 17 + 20}{10}$

= $\dfrac{114}{10}$

MAD = 11.4

---

5. Ages of players on a hockey team: {25, 32, 28, 31, 21, 20, 21, 39, 24, 23, 27, 21}

Mean = $\dfrac{312}{12}$

= 26

MAD = $\dfrac{1+6+2+5+5+6+5+13+2+3+1+5}{12}$

MAD = $\dfrac{54}{12}$

MAD = 4.5

---

6. Bowling scores in the last round of a tournament: {105, 77, 92, 83, 101, 90, 88, 79, 93, 81, 75, 86}

Mean = $\dfrac{1050}{12}$

= 87.5

MAD = $\dfrac{17.5 + 10.5 + 4.5 + 4.5 + 13.5 + 2.5 + 0.5 + 8.5 + 5.5 + 6.5 + 12.5 + 1.5}{12}$

= $\dfrac{88}{12}$

MAD = 7.3

---

7. Birth weight, in pounds, of babies born on the same day at a hospital: {7.5, 6.0, 8.4, 5.2, 9.2, 6.4, 7.1, 7.8}

Mean = $\dfrac{57.6}{8}$

= 7.2

MAD = $\dfrac{0.3 + 1.2 + 1.2 + 2 + 2 + 0.8 + 0.1 + 0.6}{8}$

= $\dfrac{8.2}{8}$

MAD = 1.0

---

8. The prices of six packages of cookies: {$3.99, $2.59, $2.99, $3.09, $3.49, $4.19}

Mean = $\dfrac{20.34}{6}$

= 3.39

MAD = $\dfrac{0.6 + 0.8 + 0.4 + 0.3 + 0.1 + 0.8}{6}$

= $\dfrac{3}{6}$

MAD = 0.5
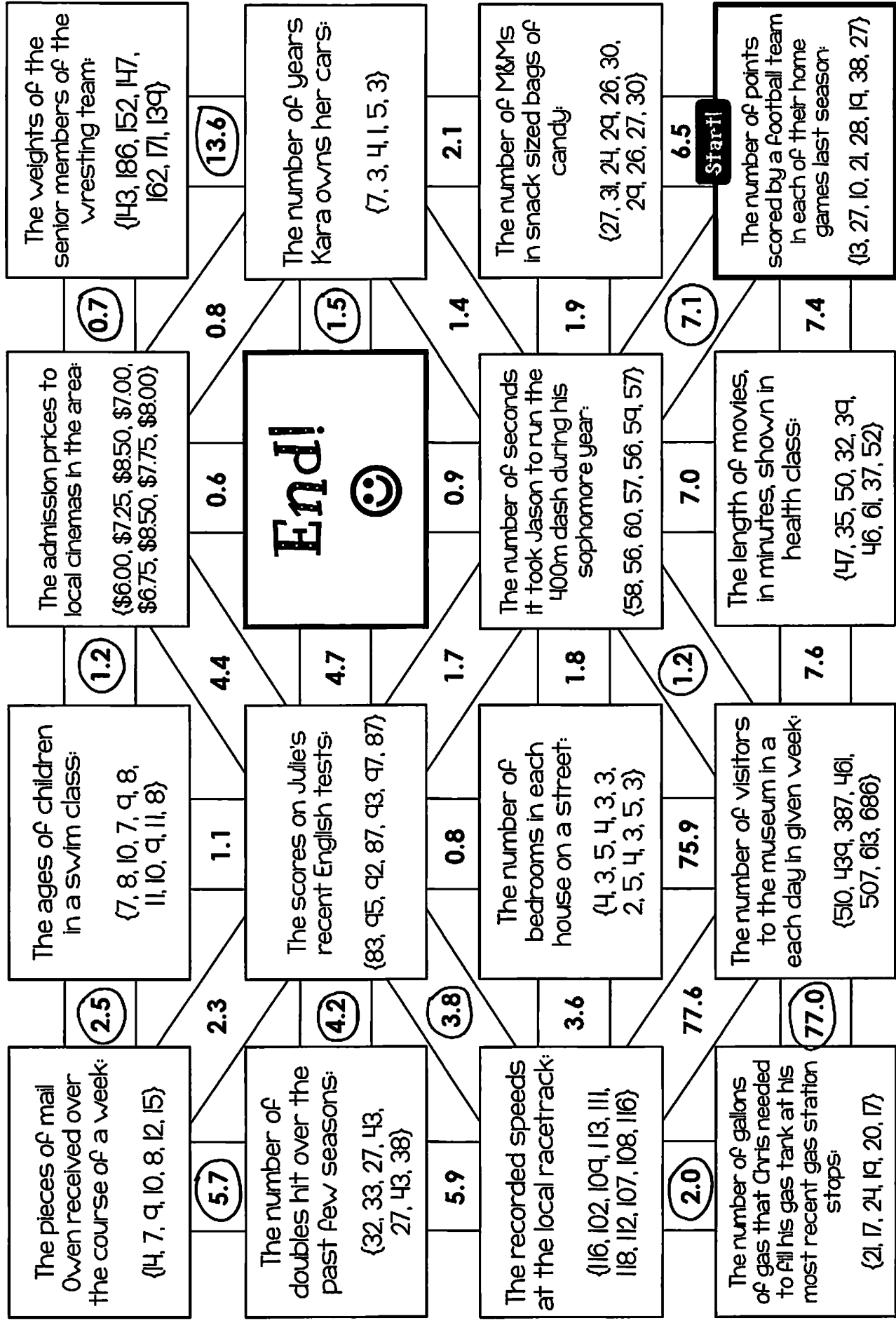

Quick-Write

9. Which is a better measure of the variation of data, range or mean absolute deviation? Explain.

MAD is a better measure of variation since it takes all values and their distance from the mean into account. The range only uses the the highest and lowest values, not looking into any others or how they are "clustered."

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Mean Absolute Deviation Maze!

Directions: Find the mean absolute deviation of each data set. Round all answers to the nearest tenth. Use your solutions to navigate through the maze. **"STAPLE ALL WORK TO THIS PAPER!"**

The weights of the senior members of the wrestling team: {143, 186, 152, 147, 162, 171, 139}

The number of years Kara owns her cars: {7, 3, 4, 1, 5, 3}

The number of M&Ms in snack sized bags of candy: {27, 31, 24, 29, 26, 30, 29, 26, 27, 30}

Start! The number of points scored by a football team in each of their home games last season: {13, 27, 10, 21, 28, 19, 38, 27}

The admission prices to local cinemas in the area: {$6.00, $7.25, $8.50, $7.00, $6.75, $8.50, $7.75, $8.00}

End! ☺

The number of seconds it took Jason to run the 400m dash during his sophomore year: {58, 56, 60, 57, 56, 59, 57}

The length of movies, in minutes, shown in health class: {47, 35, 50, 32, 39, 46, 61, 37, 52}

The ages of children in a swim class: {7, 8, 10, 7, 9, 8, 11, 10, 9, 11, 8}

The scores on Julie's recent English tests: {83, 95, 92, 87, 93, 97, 87}

The number of bedrooms in each house on a street: {4, 3, 5, 4, 3, 3, 2, 5, 4, 3, 5, 3}

The number of visitors to the museum in a each day in given week: {510, 439, 387, 461, 507, 63, 686}

The pieces of mail Owen received over the course of a week: {14, 7, 9, 10, 8, 12, 15}

The number of doubles hit over the past few seasons: {32, 33, 27, 43, 27, 43, 38}

The recorded speeds at the local racetrack: {116, 102, 109, 113, 111, 118, 112, 107, 108, 116}

The number of gallons of gas that Chris needed to fill his gas tank at his most recent gas station stops: {21, 17, 24, 19, 20, 17}

Answer paths: 13.6, 0.7, 0.8, 1.5, 1.4, 1.9, 2.1, 7.1, 6.5, 7.4, 1.2, 0.6, 4.4, 4.7, 1.7, 1.8, 0.9, 7.0, 1.2, 7.6, 2.5, 2.3, 4.2, 3.8, 1.1, 0.8, 75.9, 77.6, 5.7, 5.9, 3.6, 2.0, 77.0

Name: _____   **Unit 9:** Probability & Statistics

Date: _____ **Per:** _____   **Homework 8:** Mean Absolute Deviation

---

1. Comparing a city's daily high temperature over the course of a year to the daily high temperature over the course of a month, how would the mean absolute deviation differ?

The MAD would be lower when comparing temperatures over a month since the temperatures are more clustered together.

Find the mean absolute deviation of each data set. Round to the nearest tenth if necessary.

2. The maximum speed, in miles per hour, of the five fastest cars in the world: {270, 265, 261, 256, 248}

Mean $= \dfrac{1300}{5} = 260$

MAD $= \dfrac{10+5+1+4+12}{5} = \dfrac{32}{5} = \boxed{6.4}$

3. The number of home runs by a team in the last six seasons: {215, 177, 125, 130, 139, 108}

Mean $= \dfrac{894}{6} = 149$

MAD $= \dfrac{66+28+24+19+10+41}{6}$
$= \dfrac{188}{6} = \boxed{31.3}$

4. The number of text messages that Allyson sent each day last week.

Sun	18
Mon	27
Tues	21
Weds	33
Thurs	37
Fri	62
Sat	54

Mean $= \dfrac{252}{7} = 36$

MAD $= \dfrac{18+9+15+3+1+26+18}{7}$
$= \dfrac{90}{7} = \boxed{12.9}$

5. The wait time, in minutes, of eight rides at the amusement park: {25, 48, 32, 64, 20, 12, 74, 5}

Mean $= \dfrac{280}{8} = 35$

MAD $= \dfrac{10+13+3+29+15+23+39+30}{8}$
$= \dfrac{162}{8} = \boxed{20.3}$

6. The scores on a math test: {94, 82, 86, 60, 52, 100, 74, 98, 88, 92, 84, 64, 72, 88, 96}

Mean $= \dfrac{1230}{15} = 82$

MAD $= \dfrac{12+0+4+22+30+18+8+16+6+10+2+18+10+6+14}{15}$
$= \dfrac{176}{15} = \boxed{11.7}$

7. The height, in feet, of five Massachusetts lighthouses.

Highland	170
Cape Ann	166
Nauset Beach	120
Plymouth	102
Chatham	80

Mean $= \dfrac{638}{5} = 127.6$

MAD $= \dfrac{42.4+38.4+7.6+25.6+47.6}{5}$
$= \dfrac{161.6}{5} = \boxed{32.3}$

8. The running time, in minutes, of each Star Wars movie: {121, 131, 133, 133, 142, 140, 135, 133}
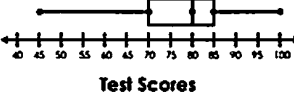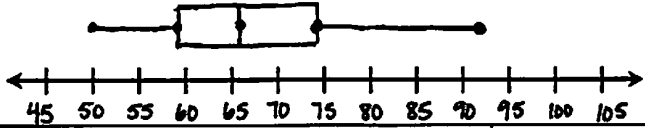
Mean $= \dfrac{1068}{8} = 133.5$

MAD $= \dfrac{12.5+2.5+0.5+0.5+8.5+6.5+1.5+0.5}{8}$
$= \dfrac{33}{8} = \boxed{4.1}$

9. The cost per gallon of gas at six gas stations: {$2.17, $2.09, $2.15, $2.05, $2.03, $2.11}

Mean $= \dfrac{12.6}{6} = 2.10$

MAD $= \dfrac{0.07+0.01+0.05+0.05+0.07+0.01}{6}$
$= \dfrac{0.26}{6} = \boxed{0.04}$

Name:	Date:
Topic:	Class:

Main Ideas/Questions	Notes/Examples
BOX-AND-WHISKER *Plot*	A way to display data on a number line by organizing it into 4 sections. **Test Scores**
FIVE-NUMBER SUMMARY	The values used to create the box-and-whisker plot: • Minimum Value: the smallest value • Lower Quartile: the median of the lower half • Median: the middle value (small → large order) • Upper Quartile: the median of the upper half • Maximum Value: the largest value
QUARTILES	The four sections that make up the box plot. Each quartile represents 25% of the data.
INTERQUARTILE RANGE	The range between the lower and upper quartile, or the length of the box.

Drawing BOX-AND-WHISKER *Plots*

1. The resting heart rates, in beats per minute (bpm), of a group of people are given below. Find the five-number summary, draw the box-and-whisker plot, then answer the questions that follow.

{55, 72, 64, 58, 50, 62, 70, 84, 92, 76, 68, 60}

{50, 55, 58, 60, 62, 64, 68, 70, 72, 76, 84, 92}

LQ (59)   Med (66)   UQ (74)

Minimum: $\underline{50}$
Lower Quartile: $\underline{59}$
Median: $\underline{66}$
Upper Quartile: $\underline{74}$
Maximum: $\underline{92}$

45 50 55 60 65 70 75 80 85 90 95 100 105

a) What is the range?

92 − 50 = $\boxed{42}$

b) What is the interquartile range?

74 − 59 = $\boxed{15}$

c) What percent have a resting heart less than 66 bpm?

50%

d) What percent have a resting heart rate of no more than 74 bpm?

75%

e) What percent have a resting heart rate between 50 and 59 bpm?

25%

f) What percent have a resting heart rate between 66 and 92 bpm?

50%

Directions: Draw the box-and-whisker plot and give the five-number summary for each data set.

2. Number of games won by the Detroit Lions in their last 10 seasons:

{9, 7, 11, 7, 4, 10, 6, 2, 0, 7}

{0, 2, 4, 6, 7, 7, 7, 9, 10, 11}
↑ LQ(4)   ↑ Med(7)   ↑ UQ(9)
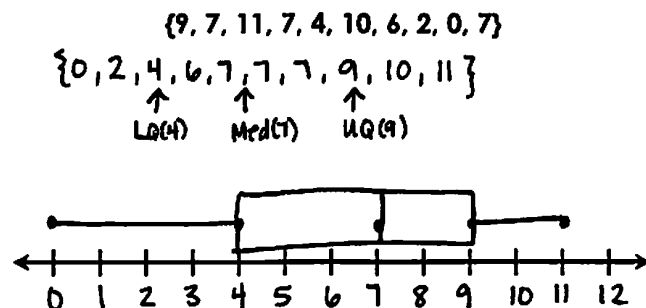
Minimum: 0

Lower Quartile: 4

Median: 7

Upper Quartile: 9

Maximum: 11

3. The speed of 9 cars on the highway:

{62, 77, 80, 54, 65, 67, 58, 63, 70}

{54, 58, 62, 63, 65, 67, 70, 77, 80}
↑ LQ(60)   ↑ Med(65)   ↑ UQ(73.5)
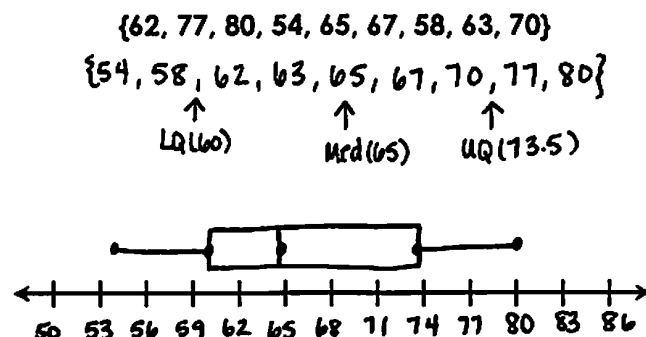
Minimum: 54

Lower Quartile: 60

Median: 65

Upper Quartile: 73.5

Maximum: 80

4. The high temperature in the last 15 days:

{58, 67, 80, 72, 69, 59, 59, 75, 83, 84, 84, 76, 64, 64, 71}

{58, 59, 59, 64, 64, 67, 69, 71, 72, 75, 76, 80, 83, 84, 84}
↑ LQ(64)   ↑ Med(71)   ↑ UQ(80)
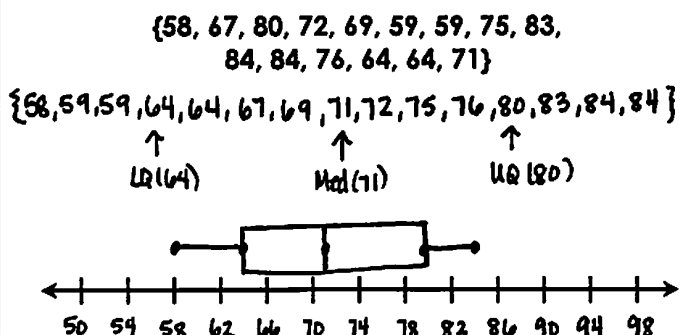
Minimum: 58

Lower Quartile: 64

Median: 71

Upper Quartile: 80

Maximum: 84

Analyzing **BOX-AND-WHISKER** *Plots*

5. The box-and-whisker plot below shows the test scores for a group of 24 students.

Test Scores
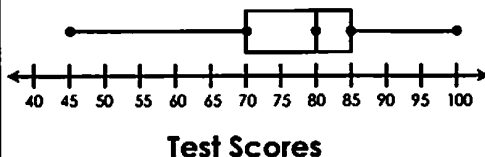
a) What is the median score?

80

b) What percent of the students scored between 70 and 85?

50%

c) How many students scored between 45 and 85?

75%

d) If Kate got an 87, how did she do compared to the class?

An 87 would place Kate in the upper 25% of her class, scoring better than 75% of her classmates.

	6. The fuel efficiency, in miles per gallon, of a group of cars is shown below. ![Fuel Efficiency box plot] 14 16 18 20 22 24 26 28 30 32 34 36 38 **Fuel Efficiency**	**a)** What is the interquartile range? $30 - 20 = \boxed{10}$
		b) What percent of the cars have a fuel efficiency greater than 20 mpg? 75%
		c) What percent of the cars have a fuel efficiency less than 26 mpg? 50%
	7. The battery life, in hours, of a group of 16 laptops is shown below. ![Battery Life box plot] 2 2.5 3 3.5 4 4.5 5 5.5 6 6.5 7 7.5 8 **Battery Life**	**a)** Identify the lower and upper quartiles. LQ = 3.5 , UQ = 6
		b) What percent of the laptops have a battery life of at least 6 hours? 25%
		c) How many laptops have a battery life less than 4.5 hours? 8
	8. Fifty golfers are competing in a golf tournament. The scores in the first round are shown below. ![Golf Scores box plot] 68 69 70 71 72 73 74 75 76 77 78 79 80 **Golf Scores**	**a)** Identify the minimum and maximum values. Min = 68, Max = 79
		b) What percent of the golfers had a score greater than 70? 75%
		c) In order to advance to the next round, golfers can not score above 72. How many are not moving on? 25%(50) ≈ $\boxed{13\ golfers}$
Comparing **BOX-AND-WHISKER** *Plots*	**9.** Mr. Athens and Mrs. Gillman gave the same test to their math classes. The scores of each class are shown below. **Mr. Athens' Class** ![Mr. Athens and Mrs. Gillman box plots] 40 45 50 55 60 65 70 75 80 85 90 95 100 **Mrs. Gillman's Class**	**a)** What is the difference in the median score? 80-75 = $\boxed{5}$
		b) Which class had the greater range of scores? Mr. Athens' Class
		c) Which class do you feel did better overall? Explain. * Answers may vary * Mrs. Gillman's class did better. Her minimum score was 60, where Mr. Athens' class only had 75% score 60 or higher.
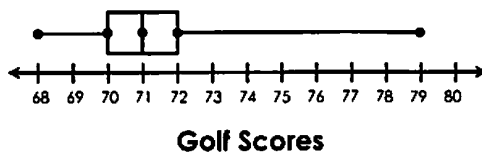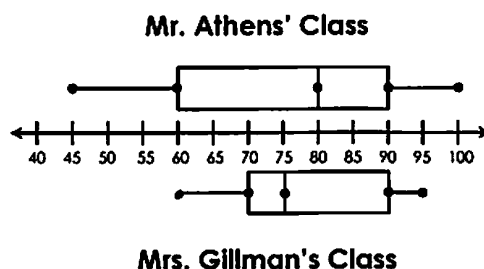
** This is a 2-page document! **

Directions: Draw the box-and-whisker plot and give the five-number summary for each data set.
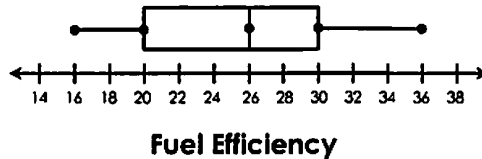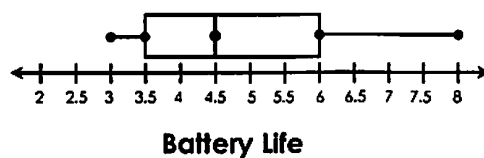
1. The number of days each month that Mr. Wilkerson gave homework to his students:

{12, 18, 15, 10, 20, 16, 22, 14, 9, 5}

{5, 9, 10, 12, 14, 15, 16, 18, 20, 22}
   ↑ LQ(10)   ↑ Med (14.5)   ↑ UQ(18)

0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30

Minimum: **5**

Lower Quartile: **10**

Median: **14.5**

Upper Quartile: **18**

Maximum: **22**

2. The number of electoral votes won by the republican candidate in presidential elections from 1960-2016:

{306, 206, 173, 286, 271, 159, 168, 426, 525, 489, 240, 520, 301, 52, 219}

{52, 159, 168, 173, 206, 219, 240, 271, 286, 301, 306, 426, 489, 520, 525}
   ↑ LQ (173)   ↑ Med (271)   ↑ UQ (426)

0 40 80 120 160 200 240 280 320 360 400 440 480 520 560 600

Minimum: **52**

Lower Quartile: **173**

Median: **271**

Upper Quartile: **426**

Maximum: **525**

3. The number of calories in each sandwich listed on the menu at a fast food restaurant:

{320, 420, 580, 270, 320, 380, 360, 270, 320, 310, 440, 470}

{270, 270, 310, 320, 320, 320, 360, 380, 420, 440, 470, 580}
   ↑ LQ (315)   ↑ Med (340)   ↑ UQ (430)

200 230 260 290 320 350 380 410 440 470 500 530 560 590 620 650

Minimum: **270**

Lower Quartile: **315**

Median: **340**

Upper Quartile: **430**

Maximum: **580**

4. The speed, in miles per hour, of the first 20 pitches thrown in a baseball game:

{66, 74, 80, 70, 72, 74, 63, 82, 72, 78,
75, 84, 73, 65, 76, 80, 65, 81, 73, 78}

{63, 65, 65, 66, 70, 72, 72, 73, 73, 74, 74, 75, 76, 78, 78, 80, 80, 81, 82, 84}
   ↑ LQ(71)   ↑ Med(74)   ↑ UQ(79)

60 62 64 66 68 70 72 74 76 78 80 82 84 86 88 90

Minimum: **63**

Lower Quartile: **71**

Median: **74**

Upper Quartile: **79**

Maximum: **84**

Directions: Use the box-and-whisker plot to answer the quations.

5. The box-and-whisker plot below shows the ages of the 36 players on the 2016-2017 Buffalo Sabres hockey team.

Ages
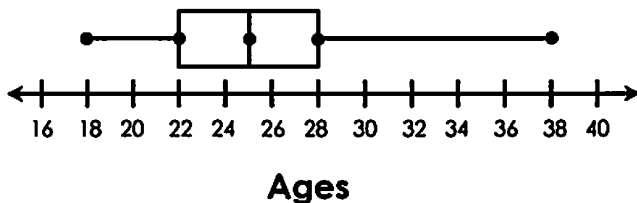
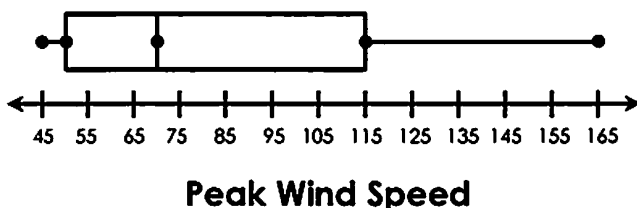**a)** What is the interquartile range?

$28 - 22 = \boxed{6}$

b) About what percent of the players are at least 25 years old?

50%

c) About how many players are no more than 28 years old?

$36 (.75) = \boxed{27 \text{ players}}$

6. The box-and-whisker plot below shows the the peak wind speeds, in miles per hour, for each of the 15 named storms that formed in the North Atlantic in 2016.

Peak Wind Speed

a) About what percent of the storms had a wind speed between 70 and 115 mph?

25%

b) About how many storms had a wind speed of at least 50 mph? $15 (0.75) \approx$

75%; $\boxed{11 \text{ storms}}$

c) If Hurricane Nicole had a peak wind speed of 115 mph, what can you conclude?

The peak wind speed was higher than 75% of the named storms.

7. Mr. Whitman gave a test to his 32 math students. He felt the results were low, so he retested them one week later. The results of the original and retake test are shown below.

Original Test Grades
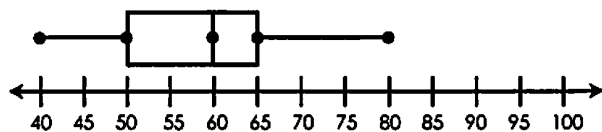
Retake Test Grades

a) What is the difference in the median grade?

$80 - 60 = \boxed{20}$

b) Compare the percent of students who got at least a 60 on the original test to those that got at least a 60 on the retake.

Only 50% scored at least a 60 on the original test, but everyone scored a 60 or higher on the retest.

c) If students need a 65 in order to pass the test, how many more passed the retake?

$32(.75) = 24$
$32 (.25) = 8$

16 more passed the retake.

d) If Jenna scored a 65 on the original test and 80 on the retake, would you consider this an improvement when looking at the class data? If not, what score would she need to show the same improvement as her classmates? Explain.   ✳ Answers may vary ✳

No. Jenna scored 65 on the original, scoring higher than 75% of her classmates, but her 80 on the retake was only higher than 50% of her classmates. In order to maintain her status of scoring higher than 75% of the class, Jenna would've needed an 85.

Quiz 9-3: Measures of Center, MAD, Box-and-Whisker Plots

Use the following data for questions 1-4: {26, 21, 28, 31, 9, 28, 16, 18, 21, 23, 29, 24, 19, 22, 25, 28}

1. Find the mean. $\dfrac{368}{16}$

2. Find the median. 9, 16, 18, 19, 21, 21, 22, 23, 24, 25, 26, 28, 28, 28, 29, 31

3. Find the mode(s).

4. Find the range. 31-9

1.	23
2.	23.5
3.	28
4.	22

5. Given data sets A and B below, which statements are true? Check all that apply.

Set A	{152, 155, 147, 149, 176, 184, 164}
Set B	{172, 156, 145, 161, 164, 156}

☐ The mean of Set A is less than the median of Set B.

☑ The range of Set A is greater than the range of Set B.

☑ The median of Set A is less than the mode of Set B.

6. If the data sets in the question above are combined, how will it affect the median of Set A? Circle your answer.

   A. It will decrease

   B. It will increase.

   C. It will remain the same.

7. Erika's first and second quarter grades are shown below. What grade does she need in math in order to have an overall average equivalent to the first quarter? Write your answer in the box.

	English	Math	Science	History	Art	Chorus	PE
Q1	86	83	92	88	95	99	94
Q2	81	95	90	84	94	95	98

$\dfrac{637}{7} = 91$

$\dfrac{542+x}{7} = 91$

$542+x = 637$

8. The number of years each employee has been employed by a company is given below. The company plans to find the center of the data and give a 5% raise to the employees who have been employed for at least those number of years. Find the mean and median, and explain which would be better from the employees' perspective.

{11, 6, 32, 7, 18, 4, 9, 1, 15, 9, 5, 27} → {1, 4, 5, 6, 7, 9, 9, 11, 15, 18, 27, 32}

Mean = $\dfrac{144}{12}$ = 12   Median = 9

The median is a better center, since 7 of the employees have been employed for at least 9 years. Had the company used the mean, only 4 employees would be eligible for the raise.

9. The number of calories in each 6" sub at SubZone is given below. Find the mean absolute deviation. Round to the nearest tenth if necessary.

9. __67.6__

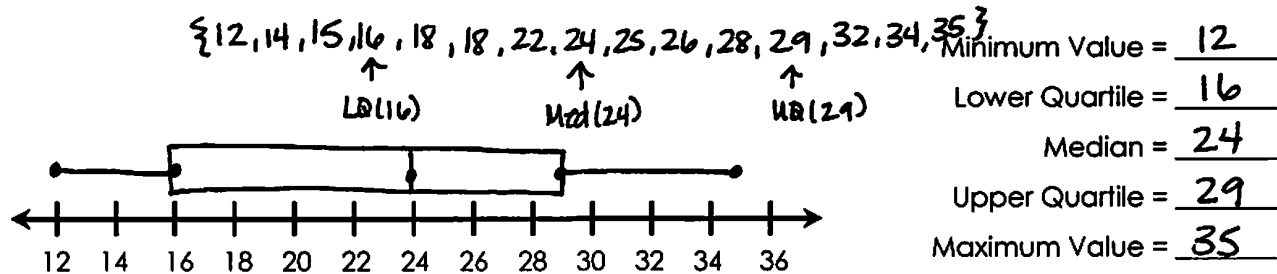{290, 320, 320, 310, 280, 230, 410, 380, 480, 460}

$$Mean = \frac{3480}{10} = 348$$

$$MAD = \frac{58 + 28 + 28 + 38 + 68 + 118 + 62 + 32 + 132 + 112}{10} = \frac{676}{10}$$

10. Which situation likely has the least mean absolute deviation? Circle your answer.

   A. The number of travelers at an airport each day.

   B. The daily balance of a bank account.

   (C.) The number of players on an NFL football team each year.

   D. The guesses for the number of jelly beans in a jar.

11. The following data represents the number of 8th grade students absent from Edenton Middle School each day for the past 15 days. Give the five-number summary and draw the box-and-whisker plot. {18, 28, 16, 32, 15, 25, 29, 34, 12, 18, 26, 14, 35, 22, 24}

{12,14,15,16, 18, 18, 22, 24, 25, 26, 28, 29, 32, 34, 35}
         ↑   ↑   ↑
      LQ(16)   Med(24)   UQ(29)

Minimum Value = __12__

Lower Quartile = __16__

Median = __24__

Upper Quartile = __29__

Maximum Value = __35__

12 14 16 18 20 22 24 26 28 30 32 34 36

Use for questions 12-15: The Lucky Strikes and Alley Cats are two teams in a bowling league. The box-and-whisker plot shows the scores from their last game. There are 12 bowlers on each team, and each bowler scored a different number of points.

Lucky Strikes

120 130 140 150 160 170 180 190 200 210 220 230 240
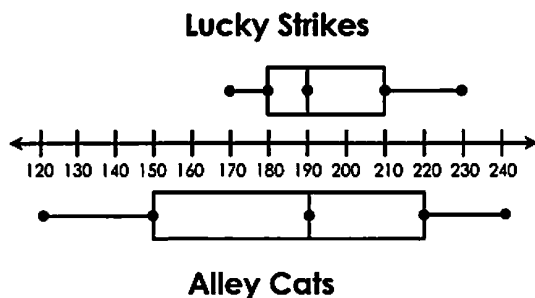
Alley Cats

12. What is the difference in the upper quartile between the two teams?
   220 - 210

12. __10__

13. What percent of the bowlers on the Lucky Strikes scored less than 210?

13. __75%__

14. How many bowlers on the Alley Cats scored at least 220?
   12 (.25)

14. __3__

15. Overall, which would you choose as the stronger team of bowlers, the Lucky Strikes or the Alley Cats? Explain.

The Lucky Strikes has a stronger team of bowlers. Their whole team scored at least 170 points, where only 75% of the Alley Cats were scoring 150 or higher.

Name:	Date:

Topic:	Class:

Main Ideas/Questions	Notes/Examples
Scatter Plot	A graph that shows the relationship between two sets of data.
Types of Relationships	 **Positive** | **Negative** | **None** **Determine the type of relationship most likely shown by the data.** 1. The size of a home versus the size of its lot. None 2. Number of passengers on a plane versus number of suitcases. Positive 3. Number of days into fall versus number of leaves on the trees. Negative

Drawing Scatter Plots

Relationship:

4. Positive

5. None

Draw the scatter plot and identify the relationship shown.

4. The number of hours a student studied for a test and their grade:

Hours	Grade
3	80
5	90
2	45
6	85
8	95
1	55
2	60
7	100
4	75
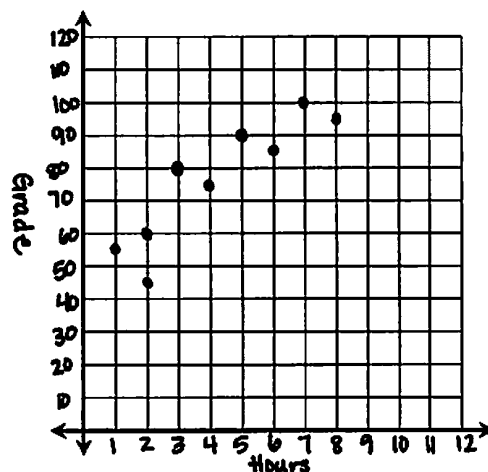
5. The number of hours a person spent in the mall and the amount of money they spent:

Hours	Dollars
1	40
8	25
7	30
5	70
9	95
2	40
3	115
5	15
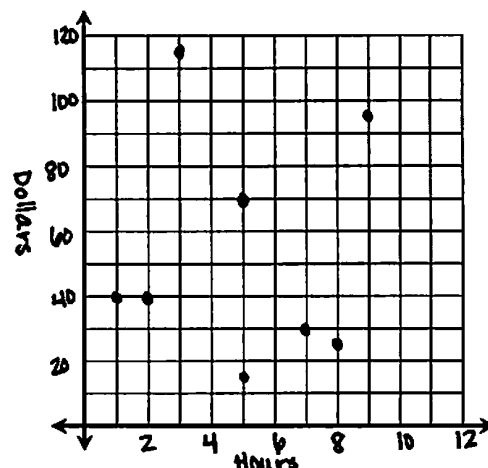
Relationship:

6. _Negative_

7. _Positive_

6. The percent of households in a city with a landline telephone:

Year	% of homes with a landline
2000	84
2002	80
2004	73
2006	68
2008	65
2010	55
2012	51
2014	47
2016	42
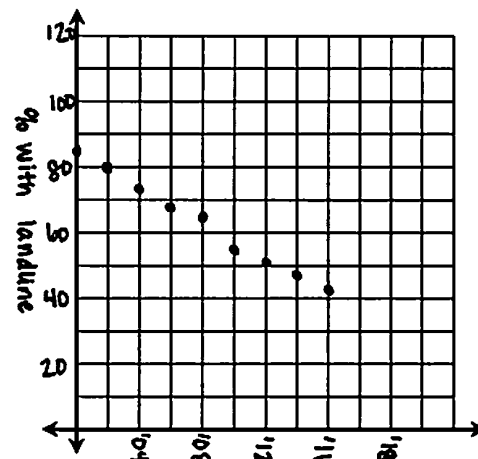
7. The toll to drive on a section of highway each year since the toll began:

Year	Dollars
2009	$0.70
2010	$0.85
2011	$0.85
2012	$0.90
2013	$0.95
2014	$1.05
2015	$1.15
2016	$1.15
2017	$1.20
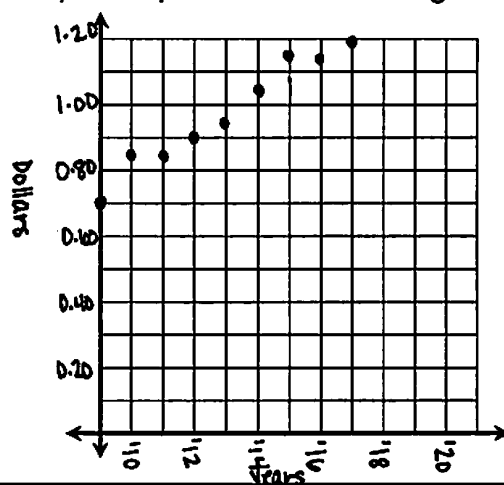
Reading Scatter Plots

8. A company's stock price since it launched in 2006 is shown below.
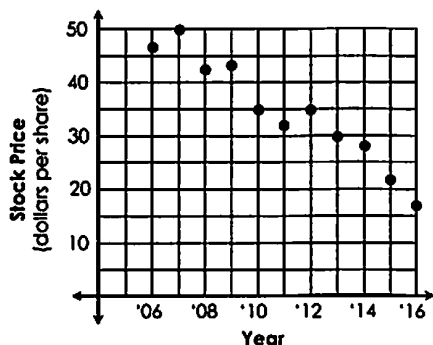
a) What is the approximate stock price in 2015? $22

b) In what year was the stock price $35 per share? 2010 + 2012

c) What is the relationship? Negative

9. Olivia bought a used car in April. The graph below shows the odometer reading each month after she bought the car.
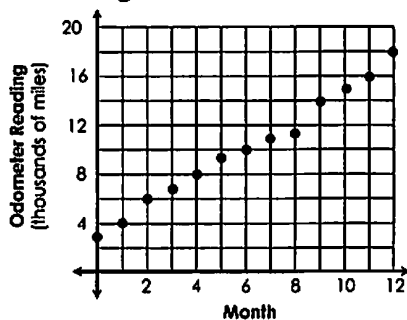
a) Approximately how many miles were on the car when she bought it? 3,000 miles

b) Approximately how many miles were on the car in July? 6,800 miles

c) In what month did the car reach 14,000 miles? January

Name:	Date:
Topic:	Class:

Main Ideas/Questions	Notes/Examples
Line of Best Fit	A line drawn on a scatterplot that is close to most of the data points. Can be used to estimate data **Example:** The graph below shows the relationship between minutes spent studying and the test scores for a math class. Which line best represents the data? Graph each line to justify your answer. **Line A:** $y = \frac{2}{3}x + 50$ **Line B:** $y = \frac{3}{2}x + 50$ **Line C:** $y = \frac{2}{3}x + 55$ **Line D:** $y = \frac{3}{2}x + 55$
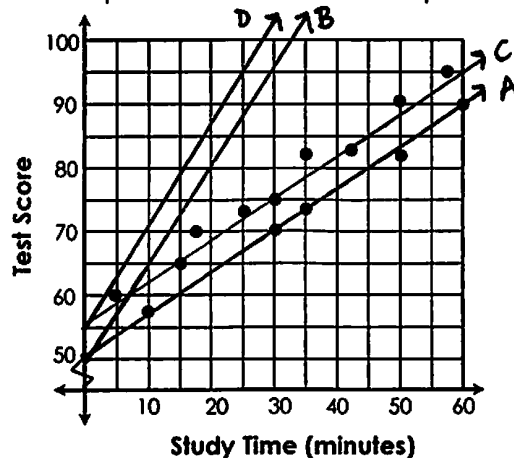
Finding the Line of Best Fit

① **Draw a line** that is close to most data points. It should "split" the data.

② Find the **slope** between any two points on the line. (Use the slope formula!)

③ Identify the **y-intercept**, the point where the line intersects the y-axis.

④ Write the equation in **slope-intercept form** ($y = mx + b$) where m is the is the slope and b is the y-intercept.

Examples

1. The graph below shows the ages and weights of twelve babies.
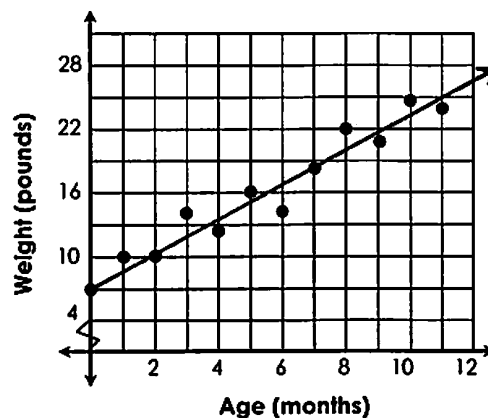
a) Write an equation for the line of best fit.

$(0, 7)$ and $(7, 18)$

$m = \frac{18 - 7}{7 - 0} = \frac{11}{7}$; $b = 7$

$$y = \frac{11}{7}x + 7$$

✱ Answers may vary ✱

b) Estimate the weight of a baby that is 12 months old. ($x = 12$)

$y = \frac{11}{7}(12) + 7 \approx \boxed{26 \text{ lb}}$

2. Beth started a new bank account. The graph below shows the monthly balance of the account in its first year.

Account Balance ($) vs Months
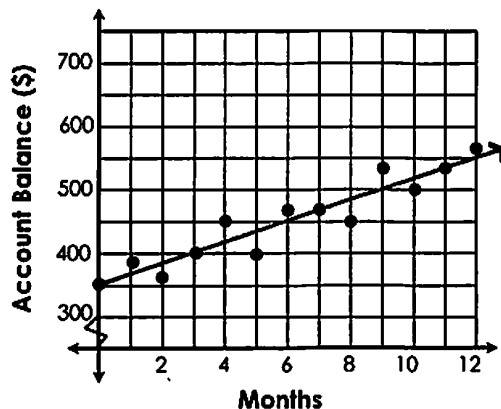
a) Write an equation for the line of best fit.

$(0, 350)$ and $(7, 470)$

$m = \dfrac{470 - 350}{7 - 0} = \dfrac{120}{7}$; $b = 350$

$\boxed{y = \dfrac{120}{7} x + 350}$

Answers may vary

b) Estimate the balance of the account after two years. $(x = 24)$

$y = \dfrac{120}{7}(24) + 350 \approx \boxed{\$761.43}$

---

3. A 10-inch tall candle is lit. The graph below shows its height after each hour.

Height of Candle vs Hours
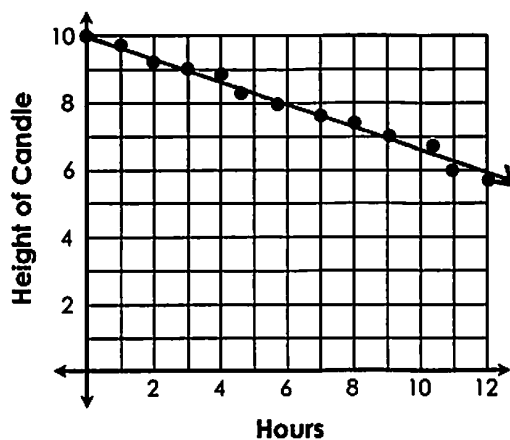
a) Write an equation for the line of best fit.

$(0, 10)$ and $(3, 9)$

$m = \dfrac{9 - 10}{3 - 0} = \dfrac{-1}{3}$; $b = 10$

$\boxed{y = -\dfrac{1}{3} x + 10}$

Answers may vary

b) Estimate the height of the candle after 15 hours. $(x = 15)$

$y = -\dfrac{1}{3}(15) + 10 = \boxed{5 \text{ in}}$

---

4. The table to the left shows Nick's weight each week into his diet. Make a scatter plot of this data.

Time (weeks)	Weight (lbs)
1	238
2	235
3	233
4	231
5	228
6	227
7	225
8	222
9	220
10	217

Weight (lbs) vs Time (weeks)
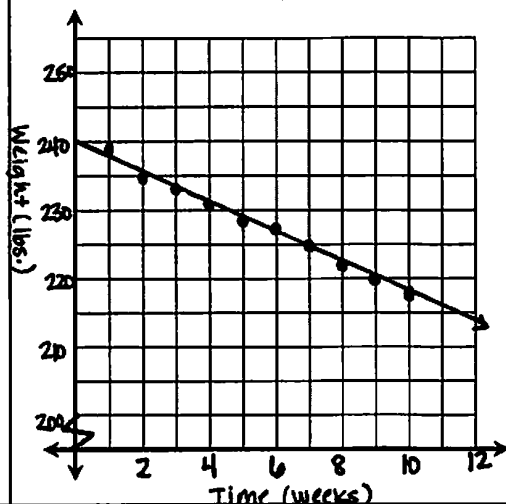
a) Write an equation for the line of best fit.

$(3, 233)$ and $(7, 225)$

$m = \dfrac{225 - 233}{7 - 3} = \dfrac{-8}{4} = -2$

$b = 240$

$y = -2x + 240$

b) Estimate Nick's weight after 24 weeks. $(x = 24)$

$y = -2(24) + 240 = \boxed{192 \text{ lb}}$

Name: _____ **Unit 9:** Probability & Statistics

Date: _____ **Per:** _____ **Homework 10:** Scatter Plots & Line of Best Fit

** This is a 2-page document! **

Directions: Determine whether the relationship has a positive, negative, or no relationship.

1. Running speed versus time to complete a marathon. *Negative*	**2.** Birth year versus birth weight. *None*
3. Population of a state versus number of seats in the House of Representatives. *Positive*	**4.** Latitude versus average annual temperature. *Negative*

For questions 5 and 6, graph the data on the grids provided below, then indicate the type of relationship shown.

5. A student's birth month and their score on a recent science test:

Birth Month	7	4	12	9	3	9	10	8	1	5	2	11
Test Score	95	80	100	75	60	90	55	65	100	60	70	75

6. The weight of each person in a spin class and the number of calories they burned during the class:

Weight	115	200	184	190	144	128	172	210	135	167	155	196
Calories	450	738	670	705	510	468	639	750	495	610	548	728

Graph for #5:

Birth Month

Relationship: *None*

Graph for #6:

Weight

Relationship: *Positive*
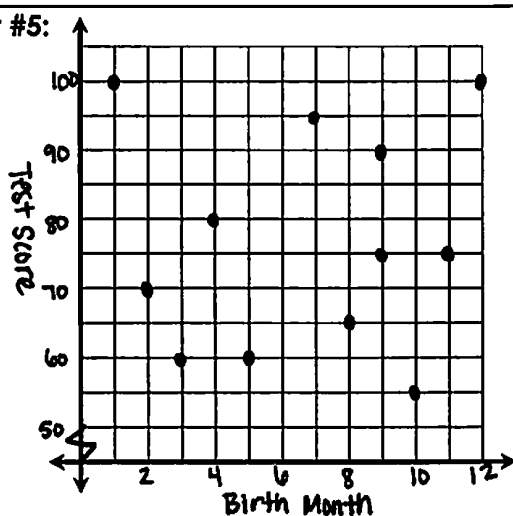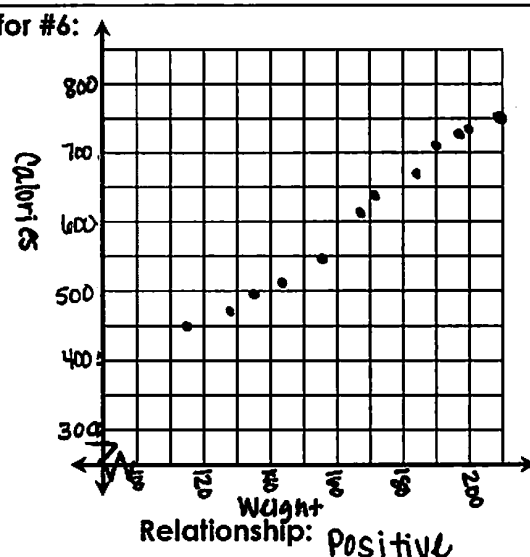
7. The graph below shows the number of households in a town that subscribe to a newspaper delivery service each year since 1992. Use the graph to answer the questions.
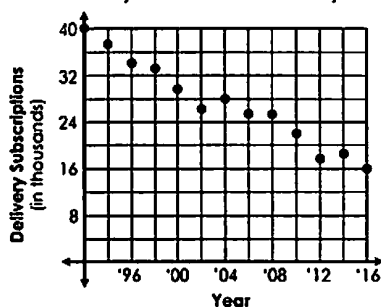
a) In what year were there 28,000 newspaper delivery subscriptions? *2004*

b) About how many newspaper delivery subscriptions were there in 1996? *34,000*

c) What relationship is shown by the data? *Negative*

8. The graph to the right shows the salary each employee at a company along with their years of experience. Which line best represents this data?

Line A: $y = \frac{5}{6}x + 40$

Line B: $y = \frac{5}{6}x + 35$

Line C: $y = \frac{6}{5}x + 40$

Line D: $y = \frac{6}{5}x + 35$
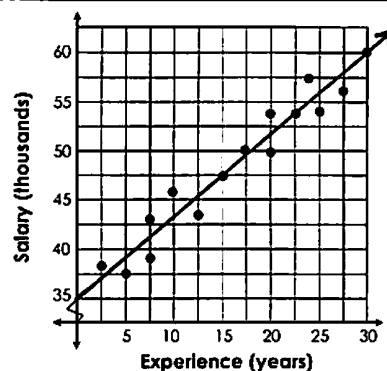
9. The graph below shows the ages of a group of people along with their maximum heart rates in beats per minute.
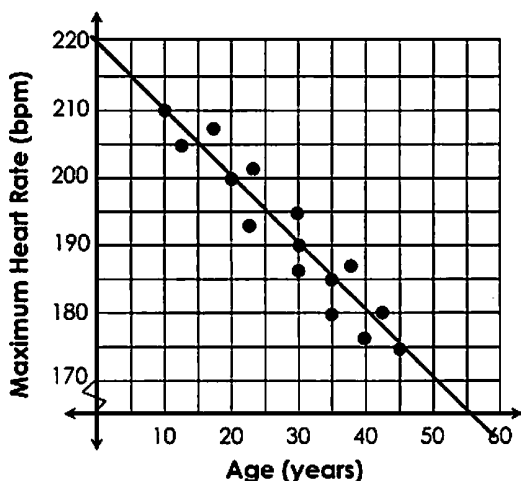
a) Write an equation for the line of best fit.

$(10, 210)$ and $(30, 190)$

$m = \dfrac{190 - 210}{30 - 10} = \dfrac{-20}{20} = -1$

$b = 220$

$$y = -x + 220$$

b) Estimate the maximum heart rate of someone who is 75 years old. $(x = 75)$

$y = -75 + 220$

$$y = 145 \text{ bpm}$$

10. The table below shows the value of a baseball card each year since it was issued.

Year	0	1	2	3	4	5	6	7	8	9	10	11	12
Value ($)	3	7	9	14	15	18	20	25	27	32	35	38	42

a) Draw a scatter plot to show the relationship.
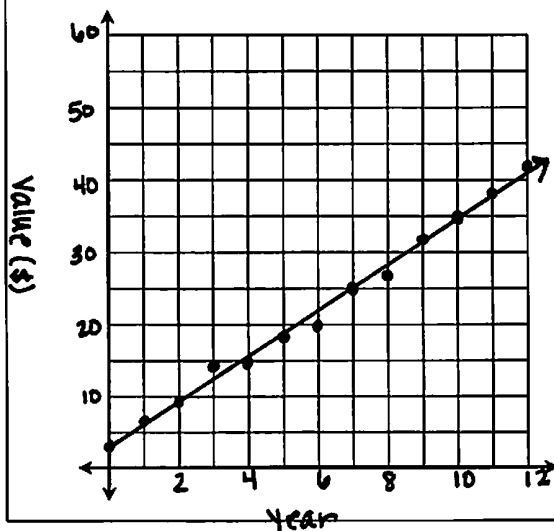
a) Write an equation for the line of best fit.

$(0, 3)$ and $(10, 35)$

$m = \dfrac{35 - 3}{10 - 0} = \dfrac{32}{10} = \dfrac{16}{5}$

$b = 3$

$y = \dfrac{16}{5}x + 3$

b) Estimate the value of the card 25 years after it was issued.

$y = \dfrac{16}{5}(25) + 3 = \boxed{\$83}$

Name:	Date:
Topic:	Class:

Main Ideas/Questions	Notes/Examples
Two-Way Table	A table that displays two categories of data collected from the same source.
Example	1. The table below shows the results from a survey where students were asked if they play an instrument and if they play a sport. Find the sum of each row and column, then answer the questions that follow. <table><tr><td></td><td>Plays a Sport</td><td>Does Not Play a Sport</td><td>Total</td></tr><tr><td>Plays an Instrument</td><td>9</td><td>14</td><td>23</td></tr><tr><td>Does Not Play an Instrument</td><td>33</td><td>19</td><td>52</td></tr><tr><td>Total</td><td>42</td><td>33</td><td>75</td></tr></table> a) How many students play an instrument? __23__ b) How many students play an instrument and play a sport? __9__ c) How many students do not play a sport? __33__ d) How many students play a sport but do not play an instrument? __33__ e) How many total students were surveyed? __75__
Constructing **Two-Way Tables**	**Use the information to construct the two-way table, then answer the questions that follow.** 2. Sydney randomly surveyed students at her school and found that 72 students ride the school bus and 37 of those students buy lunch from the cafeteria. There are 19 students that do not ride the bus, but buy lunch from the cafeteria. Nine students do not ride the bus or buy lunch from the cafeteria. <table><tr><td></td><td>Rides the Bus</td><td>Does Not Ride the Bus</td><td>Total</td></tr><tr><td>Buys Lunch from the Cafeteria</td><td>37</td><td>19</td><td>56</td></tr><tr><td>Does Not Buy Lunch from the Cafeteria</td><td>35</td><td>9</td><td>44</td></tr><tr><td>Total</td><td>72</td><td>28</td><td>100</td></tr></table> a) How many students buy their lunch? __56__ b) How many students ride the bus but do not buy their lunch? __35__ c) How many students students do not ride the bus? __28__ d) How many students do not buy their lunch? __44__ e) How many total students were surveyed? __100__

3. Adam surveyed 120 random students in his middle school and asked them if they plan to attend the school musical. Of the 80 students who responded that they are attending the musical, 15 are seventh graders. Of the 40 sixth grade students surveyed, 13 said they do not plan on going. Only 10 eighth graders surveyed do not plan on attending the musical.

	Going to the Musical	Not going to the Musical	Total
6th Grade	27	13	40
7th Grade	15	17	32
8th Grade	38	10	48
Total	80	40	120

a) How many 8th graders plan to attend the musical? __38__

b) How many 7th graders were surveyed? __32__

c) How many 6th graders plan to attend the musical? __27__

Relative Frequency

The values in each category divided by the total number of values

Examples

4. Find the relative frequencies using the data in question #3. Round to the nearest hundredth if necessary.

	Going to the Musical	Not going to the Musical	Total
6th Grade	0.23	0.11	0.34
7th Grade	0.13	0.14	0.27
8th Grade	0.32	0.08	0.40
Total	0.68	0.33	1

a) What percent of the students surveyed were 8th graders? __40%__

b) What percent of the students are 6th graders going to the musical? __23%__

c) What percent of the students are 7h graders not going to the musical? __14%__

5. The data below shows the results of a survey in which a group of high school seniors were asked if they have a part time job and if they have their driver's license. Complete the second table by finding the relative frequencies. Round to the nearest hundredth if necessary.

	Part-Time Job	No Part-Time Job	Total
Driver's License	25	17	42
No Driver's License	8	10	18
Total	33	27	60

	Part-Time Job	No Part-Time Job	Total
Driver's License	0.42	0.28	0.7
No Driver's License	0.13	0.17	0.3
Total	0.55	0.45	1

a) What percent do not have a part-time job? __45%__

b) What percent have a part-time job but do not have their license? __13%__

c) If there are 400 seniors total, how many would you expect to have their license and a part-time job? __168__ $(400)(0.42) = 168$

Name: _____   **Unit 9:** Probability & Statistics

Date: _____ **Per:** _____   **Homework 11:** Two-Way Tables

** This is a 2-page document! **

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1. A group of students who took the same math test were surveyed and asked if they studied for at least one hour and if they passed the test. Complete the table, then answer the questions that follow.

	Studied < 1 Hour	Studied ≥ 1 Hour	Total
Passed	14	50	64
Did Not Pass	9	2	11
Total	23	52	75

a) How many students studied for less than one hour? **23**

b) How many students studied for at least one hour but did not pass? **2**

c) How many students studied for less than one hour and passed? **14**

---

2. Complete the relative frequency table using the data from question 1. Round to the nearest hundredth if necessary. Then answer the questions that follow.

	Studied < 1 Hour	Studied ≥ 1 Hour	Total
Passed	0.19	0.67	0.85
Did Not Pass	0.12	0.03	0.15
Total	0.31	0.69	1

a) What percent of the students studied for at least one hour? **69%**

b) What percent of the students did not pass? **15%**

c) What percent of the students studied for less than one hour and did not pass? **12%**

---

3. A random group of high school students were surveyed and asked if they plan to attend the homecoming football game. Complete the table, then answer the questions that follow.

	Going	Not Going	Total
Freshman	9	12	21
Sophomore	12	15	27
Junior	25	10	35
Senior	28	14	42
Total	74	51	125

a) How many seniors are not going to the game? **14**

b) How many sophomores are going to the game? **12**

c) How many students were surveyed? **125**

---

4. Complete the relative frequency table using the data from question 3. Round to the nearest hundredth if necessary. Then answer the questions that follow.

	Going	Not Going	Total
Freshman	0.07	0.10	0.17
Sophomore	0.10	0.12	0.22
Junior	0.20	0.08	0.28
Senior	0.22	0.11	0.34
Total	0.59	0.41	1

a) What percent of the students are sophomores? **22%**

b) What percent of the students are freshman and not going to the game? **10%**

c) What percent of the students are going to the game? **59%**

5. A group of 100 random students were surveyed and asked which season their birthday is in. Of the 58 girls surveyed, 8 have a birthday in the winter and 18 have a birthday in the fall. Of the boys surveyed, 5 have a birthday in the spring and 12 have a birthday in the summer. Of all the students surveyed, 34 have birthdays in the fall and 21 have birthdays in the summer. Complete the table, then answer the equations that follow.

	Girl	Boy	Total
Winter	8	9	17
Spring	23	5	28
Summer	9	12	21
Fall	18	16	34
Total	58	42	100

a) How many students have a birthday in the winter?

17

b) How many boys have a birthday in the fall?

16

c) How many girls have a birthday in the summer?

9

6. Complete the relative frequency table using the data from question 5. Round to the nearest hundredth if necessary. Then answer the questions that follow.

	Girl	Boy	Total
Winter	0.08	0.09	0.17
Spring	0.23	0.05	0.28
Summer	0.09	0.12	0.21
Fall	0.18	0.16	0.34
Total	0.58	0.42	1

a) What percent of the students are boys?

42%

b) What percent of the students have a birthday in the spring?

28%

c) What percent of the students are boys and have a birthday in the winter?

9%

7. A group of random 8th graders were surveyed and asked if they have a Facebook profile and if they have a SnapChat profile. Results are shown in the Venn diagram below.

Facebook   SnapChat

6 | 16 | 20

8
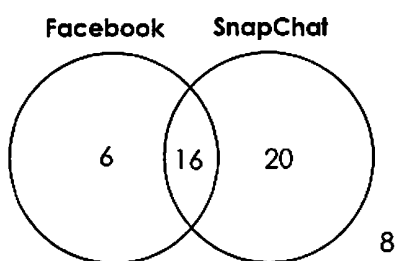
a) Complete the two-way table using the data in the Venn diagram.

	Facebook	No Facebook	Total
SnapChat	16	20	36
No SnapChat	6	8	14
Total	22	28	50

b) How many of the students surveyed have SnapChat?

36

c) How many of the students surveyed do not have Facebook?

28

8. Complete the relative frequency table using the data from question 7. Round to the nearest hundredth if necessary. Then answer the questions that follow.

	Facebook	No Facebook	Total
SnapChat	0.32	0.40	0.72
No SnapChat	0.12	0.16	0.28
Total	0.44	0.56	1

a) If there are 380 total eighth graders, approximately how many have Facebook? $380(.44) \approx 167$

b) If there are 380 total eighth graders, approximately how many do not have Facebook or SnapChat?
$380(0.16) \approx 61$

Unit 9 Test Study Guide
(Probability & Statistics)

Name: _____

Date: _____ Per: _____

Topic 1: Simple Probability

1. If the spinner below is spun once, find each probability. Give each answer as a fraction in simplest form.

a) P(shaded space)
$$\frac{6}{16} = \boxed{\frac{3}{8}}$$

b) P(a number greater than 8)
$$\frac{2}{16} = \boxed{\frac{1}{8}}$$

c) P(a multiple of 3 or a vowel)
$$\boxed{\frac{5}{16}}$$

d) P(a perfect square)
$$\boxed{\frac{3}{16}}$$

2. A card is drawn at random from a standard deck. What is the probability that it is a club or a red face card?
(13)   (6)
$$\boxed{\frac{19}{52}}$$
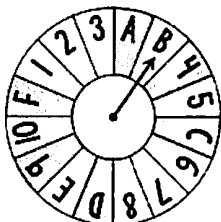
3. A soda pop company is running a bottle cap contest where "WINNER" is printed underneath random bottle caps. If the probability of getting a winning bottle cap is 6 in 40, what is the probability of not winning?

$$1 - \frac{6}{40} = \frac{34}{40} = \boxed{\frac{17}{20}}$$

Topic 2: Theoretical vs. Experimental Probability

4. The 12-sided die to the right is rolled 75 times. The results are shown in the table.

Result	1	2	3	4	5	6	7	8	9	10	11	12
Frequency	4	7	10	2	9	3	5	4	4	12	7	8

a) What is the theoretical probability of the spinner landing on a prime number?
$$\boxed{\frac{5}{12}} \quad (41.7\%)$$

b) Based on this experiment, what is the probability of the spinner landing on a prime number?
$$\boxed{\frac{38}{75}} \quad (50.7\% - \text{more than expected})$$

c) Theoretically, if the spinner is spun 400 times, how many times would you expect it to land on a number that is at least 5?
$$\frac{8}{12} = \frac{2}{3} \qquad \frac{2}{3} = \frac{x}{400}$$
$$3x = 800$$
$$\boxed{x \approx 267 \text{ times}}$$

d) Based on this experiment, if the spinner is spun 400 times, how many times would you expect it to land on a number that is at least 5?
$$\frac{52}{75} = \frac{x}{400} \qquad 75x = 20800$$
$$\boxed{x \approx 277 \text{ times}}$$

Topic 3: Counting Principle

5. How many different outfits consisting of a pair of pants, a shirt, and a tie can be made from four pairs of pants, seven shirts, and five ties?
$$4 \cdot 7 \cdot 5 = \boxed{140 \text{ outfits}}$$

6. A two-story mall has seven entrances on the first floor. Inside, it has four escalators, nine sets of stairs, and two elevators for customers to travel between floors. If a customer is on the second floor, how many ways can they leave the mall?
$$7 \cdot 15 = \boxed{105 \text{ ways}}$$

| 7. A standard die is rolled twice, then a card is chosen at random from a standard deck. How many outcomes are possible?

$6 \cdot 6 \cdot 52 = \boxed{1872}$ | 8. A company gives each client a unique account number containing four letters followed by three digits. How many account numbers are possible?

$26 \cdot 26 \cdot 26 \cdot 26 \cdot 10 \cdot 10 \cdot 10 =$

$\boxed{456,976,000}$ |

Topic 4: Compound Probability

9. A Magic 8-Ball is an advice seeking and fortune-telling toy. After asking the ball a yes-no question, the user turns the ball upside down to reveal one of the following unique 20 answers. Answers with a white background are positive, answers with a light gray background are undecided, and answers with a dark gray background are negative.

It is certain	It is decidedly so	Without a doubt	Yes definitely
You may rely on it	As I see it, yes	Most likely	Outlook good
Yes	Signs point to yes	Reply hazy try again	Ask again later
Better not tell you now	Cannot predict now	Concentrate and ask again	Don't count on it
My reply is no	My sources say no	Outlook not so good	Very doubtful

If Tessa asks the Magic 8-ball two questions, find each probability:

| a) P(positive both times)

$\dfrac{10}{20} \cdot \dfrac{10}{20} = \dfrac{100}{400} = \boxed{\dfrac{1}{4}}$ | b) P(undecided both times)

$\dfrac{5}{20} \cdot \dfrac{5}{20} = \dfrac{25}{400} = \dfrac{1}{16}$ |
| c) P(positive, then negative)

$\dfrac{10}{20} \cdot \dfrac{5}{20} = \dfrac{50}{400} = \boxed{\dfrac{1}{8}}$ | d) P("Don't count on it", then positive)

$\dfrac{1}{20} \cdot \dfrac{10}{20} = \dfrac{10}{400} = \boxed{\dfrac{1}{40}}$ |

| 10. If a die is rolled three times, what is the probability of getting a 2 on the first roll, an odd number on the second roll, and a number less than 5 on the third roll?

$\dfrac{1}{6} \cdot \dfrac{3}{6} \cdot \dfrac{4}{6} = \dfrac{12}{216} = \boxed{\dfrac{1}{18}}$ | 11. A pop-quiz contains five true or false questions. If Emily guesses, what is the probability that she gets all five correct?

$\dfrac{1}{2} \cdot \dfrac{1}{2} \cdot \dfrac{1}{2} \cdot \dfrac{1}{2} \cdot \dfrac{1}{2} = \boxed{\dfrac{1}{32}}$ |

| 12. A bag contains the letters of the word PENNSYLVANIA. A letter is drawn, replaced, then another is drawn. What is the probability that the first letter is an N or A and the second letter has a vertical line of symmetry?

$\dfrac{5}{12} \cdot \dfrac{5}{12} = \boxed{\dfrac{25}{144}}$ | 13. The varsity baseball team has won 15 out of their last 16 games. The junior varsity team has won 6 out of their last 10 games. What is the probability that both teams win their next game?

$\dfrac{15}{16} \cdot \dfrac{6}{10} = \dfrac{90}{160} = \boxed{\dfrac{9}{16}}$ |

| 14. A box contains 2 red crayons, 6 blue crayons, 5 green crayons, and 9 yellow crayons, and 3 purple crayons. A crayon is drawn at random, not replaced, then another is drawn. Find each probability. | a) P(yellow, then green)

$\dfrac{9}{25} \cdot \dfrac{5}{24} = \dfrac{45}{600} = \boxed{\dfrac{3}{40}}$ |
| | b) P(both blue)

$\dfrac{6}{25} \cdot \dfrac{5}{24} = \dfrac{30}{600} = \boxed{\dfrac{1}{20}}$ |

Topic 5: Using Samples to Predict

15. A high school is conducting a survey to see how many students have part-time jobs. Determine whether the samples are biased or unbiased. Explain.

a) five random students in each homeroom	**b)** every 10th student that enters a school football game	**c)** 100 random students in the school parking lot
Unbiased - random + varied ages	Biased- only asking 10th graders	Biased- only asking those likely to drive

16. A bake shop surveyed a random group of customers to determine their favorite type of cheesecake. Results are shown below.

Cheesecake	Frequency
Strawberry	21
Red Velvet	16
Chocolate Fudge	28
Raspberry Truffle	12
Cookies & Cream	25
Peanut Butter Fudge	18

a) What percent reported Raspberry Truffle as their favorite?

$\frac{12}{120} = \frac{1}{10}$; $\boxed{10\%}$

b) What percent reported Red Velvet or Peanut Butter Fudge as their favorite?

$\frac{34}{120} = \frac{17}{60}$; $\boxed{28.3\%}$

c) Out of 800 people, how many would you expect to say their favorite cheesecake is Cookies & Cream?

$\frac{25}{120} = \frac{X}{800}$

$120X = 20000$

$\boxed{X \approx 167 \text{ people}}$

Topic 6: Measures of Central Tendency & Range

Find the mean, median, mode(s), and range for each of the following data sets. Round to the nearest tenth if necessary.

17. The number of yards ran by a running back in each game of a season: {58, 59, 110, 70, 150, 140, 76, 85, 33, 103, 130, 27, 153, 128, 64}

Mean = $\frac{1386}{15}$

Range = 153 - 27

18. The length of time, in minutes, it took each student in a class to complete a test: {42, 28, 31, 55, 42, 25, 48, 42, 36, 24, 36, 51, 58, 39, 30, 47}

Mean = $\frac{634}{16}$

Range = 58 - 24

Mean	Median	Mode(s)	Range	Mean	Median	Mode(s)	Range
92.4	85	none	126	39.6	40.5	42	34

19. Bella and Isaac take a weekly quiz in their math class. Their grades on each of the ten first quarter quizzes are shown below. Find the difference in their mean score.

Bella	Grade	Isaac
ℍ⊩	100	III
II	90	I
	80	IIII
II	70	
I	60	
	50	II

Bella: $\frac{880}{10} = 88$

Isaac: $\frac{810}{10} = 81$

$88 - 81 = \boxed{7}$

20. Rick ran 7.1 miles on Monday, 3.5 miles on Tuesday, 9 miles on Wednesday, and 5.8 miles on Thursday. How many miles does he need to run on Friday to average 6 miles per run?

$\frac{7.1 + 3.5 + 9 + 5.8 + X}{5} = 6$

$25.4 + X = 30$

$X = \boxed{4.6 \text{ miles}}$

Topic 7: Mean Absolute Deviation

Find the mean absolute deviation of each data set. Round to the nearest tenth if necessary.

21. The age of each employee at a company:
{22, 52, 24, 29, 40, 58, 36, 32, 45, 39, 42, 25}

$Mean = \frac{444}{12} = 37$

$MAD = \dfrac{15 + 15 + 13 + 8 + 3 + 21 + 1 + 5 + 8 + 2 + 5 + 12}{12}$

$= \dfrac{108}{12} = \boxed{9}$

22. The height, in feet, of five bridges in California:

$Mean = \dfrac{2963}{5}$

$= 592.6$

Foresthill	730
Pine Valley Creek	440
Cold Spring Canyon	420
Bidwell Bar	627
Golden Gate	746

$MAD = \dfrac{137.4 + 152.6 + 172.6 + 34.4 + 153.4}{5} = \boxed{130.1}$

23. Would the number of minutes of daylight each day of a month or the number of minutes of daylight each day of a year have a greater mean absolute deviation? Explain.

The MAD would be greater over a year since the daylight varies more.

Topic 8: Box-and-Whisker Plots

Find the five-number summary and construct the box-and-whisker plot for each data set.

24. The number of boxes of cookies sold by each girl in a girl scout troop: {26, 32, 12, 27, 16, 38, 61, 28, 42, 30, 57, 24}

{ 12, 16, 24, 26, 27, 28, 30, 32, 38, 42, 57, 61 }

LQ(25)   Med(29)   UQ(40)
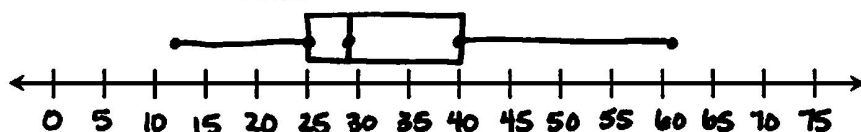
Minimum: 12
Lower Quartile: 25
Median: 29
Upper Quartile: 40
Maximum: 61

25. The distance, in yards, of the last 15 field goals successfully made by a kicker: {50, 52, 53, 43, 31, 39, 50, 49, 40, 46, 57, 55, 50, 30, 46}

{ 30, 31, 39, 40, 43, 46, 46, 49, 50, 50, 50, 52, 53, 55, 57 }

LQ(40)   Med(49)   UQ(52)
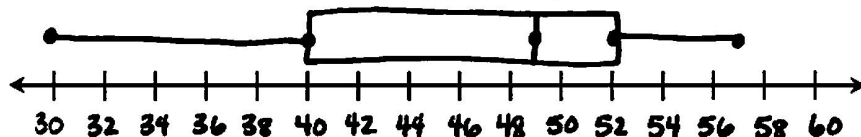
Minimum: 30
Lower Quartile: 40
Median: 49
Upper Quartile: 52
Maximum: 57

26. The running time, in minutes, of 20 movies, each with a different running time, is shown to the right.

Running Time
(minutes)
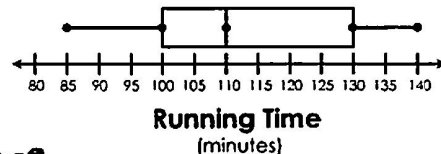
a) What is the interquartile range? 30

b) What percent of the movies are at least 130 minutes? 25%

c) What percent of the movies are between 100 and 140 minutes? 75%

d) How many movies are less than 110 minutes? 10 ← .5(20)

e) How many movies are between 100 and 110 minutes? 5 ← .25(20)

27. The number of points scored by two football teams in each of their 12 games is shown below. Both teams scored a different number of points in each of their games.

Spartans

0 3 6 9 12 15 18 21 24 27 30 33 36 39 40
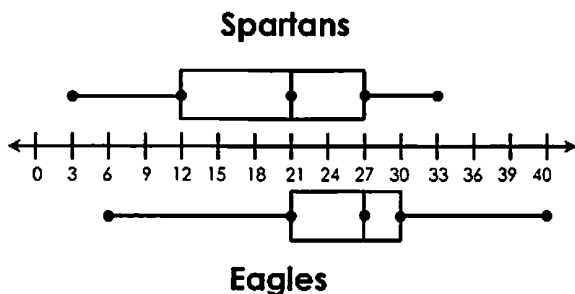
Eagles

a) Which team had a greater range?

S: 33-3 = 30

E: 40-6 = 34

[Eagles]

b) What is the difference in their maximum score?

40 - 33 = [7 points]

c) What is the total number of games that the Spartans and the Eagles scored at least 21 points?

S: .5(12) = 6
E: .75(12) = 9

[15 games]

Topic 9: Scatter Plots & Line of Best Fit

Determine whether the data would have a positive, negative, or no relationship.

28. The number of songs on an iPod versus its remaining storage.	**29.** The age of a car versus its odometer reading.	**30.** The height of a high school student versus their SAT score.
Negative	Positive	None

31. The graph below shows the average price of a new home in a certain city each year since 2004. Use the graph to answer the questions.
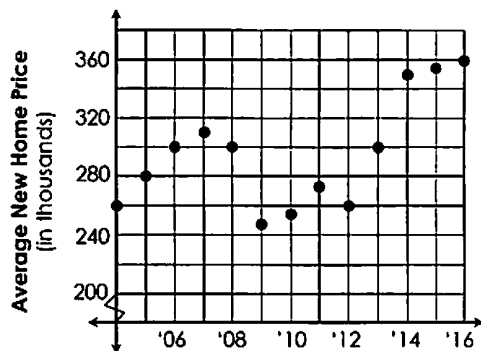
a) In what year(s) was the average new home price $300,000?

2006, 2008, 2013

b) What was the approximate average new home price in 2014?

$350,000

c) Describe the change in the average new home price from 2008 to 2009.

$50,000 loss

32. Ashley measured the total snow in her yard every 30 minutes after a snowstorm started. The graph below shows her findings:
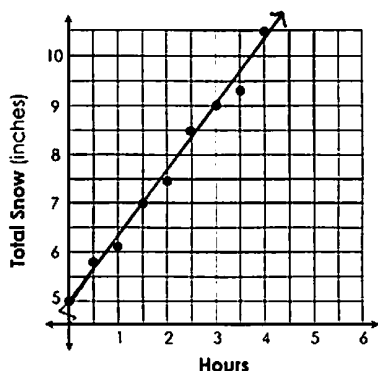
a) Which line best represents this data?

A) $y = -\frac{3}{4}x + 5$ B) $y = \frac{3}{4}x + 5$

B) $y = -\frac{4}{3}x + 5$ (D) $y = \frac{4}{3}x + 5$

b) Using the line of best fit from part a, predict the total amount of snow after six hours.

$y = \frac{4}{3}(6) + 5$

$y = $ [13 in]

33. The table below shows the temperature of a lake at certain depths.

Depth (ft)	0	8	18	25	30	36	40	47	55	60
Temperature (°F)	84	81.5	79	76.5	75	73	72	70	67.5	66

a) Draw a scatter plot to show the relationship.
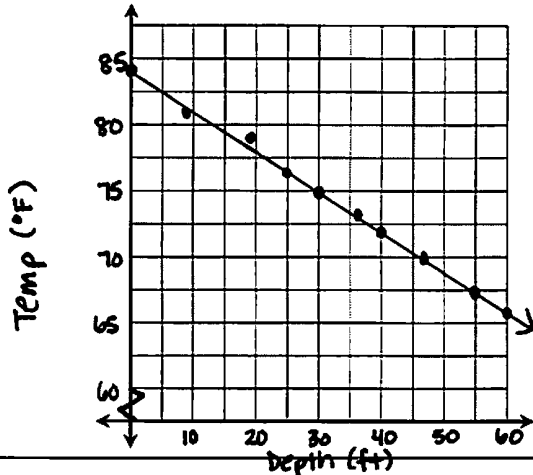
a) Write an equation for the line of best fit.

$(0,84)$ and $(30,75)$

$m = \dfrac{75-84}{30-0} = \dfrac{-9}{30} = \dfrac{-3}{10}$

$b = 84$

$$y = \dfrac{-3}{10}x + 84$$

b) Estimate the temperature of the lake at 90 feet.

$y = \dfrac{-3}{10}(90) + 84$

$y = 57$ degrees

Topic 10: Two-Way Tables & Relative Frequency

34. The Venn diagram below shows the results of a survey in which a group of students were asked if they have a dog and if they have a cat. Complete the two-way table.

Dog   Cat

16 12 22

10
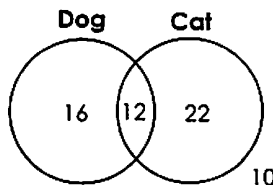
	Cat	No Cat	Total
Dog	12	16	28
No Dog	22	10	32
Total	34	26	60

35. The partial table below shows the number of medals won in mens, womens, and mixed team events by the United States in the 2016 Summer Olympics. Complete the table, then answer the questions that follow.

	Gold	Silver	Bronze	Total
Men	18	18	19	55
Women	27	17	17	61
Mixed	1	2	2	5
Total	46	37	38	121

a) How many bronze medals did the United States win in women's events?

17

b) How many total medals were won?

121

36. Complete the relative frequency table using the data from question 35. Round to the nearest hundredth if necessary. Then answer the questions that follow.

	Gold	Silver	Bronze	Total
Men	0.15	0.15	0.16	0.45
Women	0.22	0.14	0.14	0.5
Mixed	0.01	0.02	0.02	0.04
Total	0.38	0.31	0.31	1

a) What percent of the medals won were in men's events?

45%

b) What percent of the medals won were women's event gold medals?

22%

For questions 1-2: If the spinner below is spun once, find each probability. Write each answer as a fraction in simplest form.
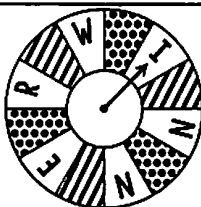
	1. P(dots)	**2.** P(stripes or a letter)
	$\dfrac{3}{12}$ $\boxed{\dfrac{1}{4}}$	$\dfrac{9}{12}$ $\boxed{\dfrac{3}{4}}$

For questions 3-4: A bag contains 40 tickets, each numbered 1-40. If a ticket is drawn at random, find each probability.

3. P(odd or less than 26)

A. $\dfrac{3}{5}$ C. $\dfrac{17}{20}$

B. $\dfrac{33}{40}$ D. $\dfrac{4}{5}$ $\boxed{D}$

4. P(prime number)

$$\dfrac{12}{40}$$

A. $\dfrac{3}{10}$ C. $\dfrac{13}{40}$

B. $\dfrac{1}{5}$ D. $\dfrac{3}{20}$ $\boxed{A}$

5. A card is drawn at random from a standard deck. What is the probability that it is a black card and a king?

$$\dfrac{2}{52}$$

A. $\dfrac{15}{26}$ C. $\dfrac{7}{13}$

B. $\dfrac{1}{26}$ D. $\dfrac{2}{13}$ $\boxed{B}$

6. It rained nine days in the month of April. Based on this, what is the probability that it does not rain on the first day of May?

$$1 - \dfrac{9}{30} = \dfrac{21}{30}$$

A. $\dfrac{22}{31}$ C. $\dfrac{2}{15}$

B. $\dfrac{3}{10}$ D. $\dfrac{7}{10}$ $\boxed{D}$

For questions 7-8: A standard die is rolled 100 times. The results from the experiment are shown in the table below.

Result	1	2	3	4	5	6
Frequency	14	23	15	12	20	16

7. Which correctly gives the theoretical and experimental probability of rolling a number greater than 4? $\dfrac{2}{6} = \dfrac{1}{3}$ (T)

A. Theoretical: $\dfrac{1}{2}$; Experimental: $\dfrac{12}{25}$ $\dfrac{36}{100} = \dfrac{9}{25}$ (E)

B. Theoretical: $\dfrac{12}{25}$; Experimental: $\dfrac{1}{2}$

C. Theoretical: $\dfrac{1}{3}$; Experimental: $\dfrac{9}{25}$

D. Theoretical: $\dfrac{9}{25}$; Experimental: $\dfrac{1}{3}$ $\boxed{C}$

8. If the die is rolled 750 times, which statement is true regarding the number of times you would expect it to land on 1 based on this experiment?

A. 125 times; less than theoretically expected

B. 125 times; more than theoretically expected

C. 105 times; less than theoretically expected

D. 105 times; more than theoretically expected

$\dfrac{14}{100} = \dfrac{x}{750}$ $100x = 10500$
$x = 105$

T: 16.6%   E: 14% $\boxed{C}$

9. A letter in the word TRANSFORMATION is chosen at random, then a coin is tossed three times. How many outcomes are possible?

$$14 \cdot 2 \cdot 2 \cdot 2$$

$$\boxed{112}$$

10. At the Dream Cone ice cream shop, there are 540 ways to make an ice cream sundae consisting of one flavor of ice cream, one topping, and one type of syrup. If there are 9 ice cream flavors and 5 types of syrup, how many toppings are there?

$$540 = 9 \cdot 5 \cdot x$$
$$540 = 45x$$
$$12 = x$$

$$\boxed{12}$$

For questions 11-12: If the spinner below is spun twice, find each probability. Write each answer as a fraction in simplest form.

11. P(shaded, then a multiple of 4)

$$\frac{10}{16} \cdot \frac{4}{16} = \frac{40}{256}$$

$$\boxed{\dfrac{5}{32}}$$

12. P(at least 5 both times)

$$\frac{12}{16} \cdot \frac{12}{16} = \frac{144}{256}$$

$$\boxed{\dfrac{9}{16}}$$

---

13. A month of the year then a day of the week is selected at random. Find the probability of selecting a month that starts with the letter J, then selecting Friday.

$$\frac{3}{12} \cdot \frac{1}{7} = \frac{3}{84}$$

A. $\dfrac{4}{19}$ C. $\dfrac{2}{19}$

B. $\dfrac{1}{28}$ D. $\dfrac{1}{42}$

$$\boxed{B}$$

14. Of the 28 students in Mrs. Lehman's math class, 12 are girls. Mr. Smith has 18 girls and 14 boys in his math class. If both teachers choose one student at random to represent the class in a math competiiton, what is the probability that both students are boys?

$$\frac{16}{28} \cdot \frac{14}{32} = \frac{224}{896}$$

A. $\dfrac{3}{16}$ C. $\dfrac{2}{7}$

B. $\dfrac{1}{4}$ D. $\dfrac{9}{28}$

$$\boxed{B}$$

For questions 15-16: A bucket contains fifteen white, eight pink, three yellow, and ten blue golf balls. A golf ball is chosen at random, not replaced, then another is chosen at random. Find each probability.

15. P(blue, then pink)

$$\frac{10}{36} \cdot \frac{8}{35} = \frac{80}{1260}$$

A. $\dfrac{3}{5}$ C. $\dfrac{5}{81}$

B. $\dfrac{8}{119}$ D. $\dfrac{4}{63}$

$$\boxed{D}$$

16. P(both white)

$$\frac{15}{36} \cdot \frac{14}{35} = \frac{210}{1260}$$

A. $\dfrac{35}{216}$ C. $\dfrac{1}{6}$

B. $\dfrac{25}{144}$ D. $\dfrac{5}{28}$

$$\boxed{C}$$

---

17. The cafeteria manager at a local middle school would like to survey students to get their opinion on the new lunch menu. Which of the following sampling methods would be most effficient in reducing bias?

A. Select one class at random, then survey each student in that class.

B. Obtain an alphabetical list of all students that attend the school, then survey every 10th student.

C. Have each eighth grader complete a survey during homeroom.

D. Randomly survey 10 students in the cafeteria.

$$\boxed{B}$$

For questions 18-20: An airline is considering making changes to their drink menu. They decided to survey a group of random passengers and ask them about their favorite type of juice. Results of the survey are shown below.

Juice	Apple	Grapefruit	Orange	Cranberry	Tomato	Grape
Frequency	18	3	15	8	6	10

18. What percent of the people surveyed said orange or tomato juice was their favorite?

$$\frac{21}{60} = 0.35$$

$$\boxed{35\%}$$

19. What percent of the people surveyed did not say grapefruit juice was their favorite?

$$\frac{57}{60} = 0.95$$

$$\boxed{95\%}$$

20. Out of 1,500 people, how many would you expect to say cranberry juice is their favorite?

$$\frac{x}{1500} = \frac{8}{60}$$

$$60x = 12000$$

$$x = 200$$

$$\boxed{200}$$

21. Given the data set below, which measure is the greatest?

$$\{14, 29, 16, 32, 25, 38, 25, 42, 27, 22\}$$

Mean $= \frac{270}{10} = 27$ Mode $= 25$

Med $= 26$ Range $= 28$

A. Mean

B. Median

C. Mode

D. Range

$$\boxed{D}$$

22. Jack and Clint are running backs on rival college football teams. The table below shows the number of yards they have ran in each of their first five games of a season. How many yards would Clint need to run in his next game to average the same number of yards as Jack?

$$\frac{88+101+96+92+84+x}{6} = 98$$

Jack	Clint
123	88
87	101
108	96
80	92
92	84
(98)	

$$461 + x = 688$$

$$x = 127$$

$$\boxed{127}$$

23. So far this quarter, Samantha's quiz grades in her math class are as follows: 68, 86, 94, 95, 82, 100, 95, and 84. If she gets an 89 on her next quiz, which statement is true?

A. Both the median and mean increased.

B. Both the median and mean decreased.

C. The median increased and the mean decreased.

D. The mean increased and the median decreased.

Mean $= 88$ Mean $= 88.1$

Med $= 90$ Med $= 89$

$$\boxed{D}$$

24. The number of points scored by a football team in each of their home games is listed below. Find the mean absolute deviation.

$$\{31, 33, 42, 25, 28, 21, 38, 30\}$$

(Mean $= 31$) $\frac{0+2+11+6+3+10+7+1}{8} = \frac{40}{8}$

A. 5

B. 5.25

C. 5.5

D. 6

$$\boxed{A}$$

25. Which data set is likely to have the least mean absolute deviation?
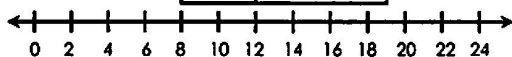
A. The number of books checked out by each person that visits the library on a given day.

B. The speed of each car on a section of highway.

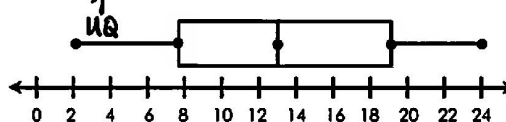C. The ages of students in a middle school.

D. The population of each state.

$$\boxed{C}$$

26. Which box-and-whisker plot correctly displays the data set given below?

{2, 5, 7, 9, 10, 12, 14, 18, 20, 21, 24}

A. [box-and-whisker plot with number line 0–24]

B. [box-and-whisker plot with number line 0–24]

C. [box-and-whisker plot with number line 0–24]
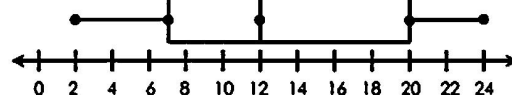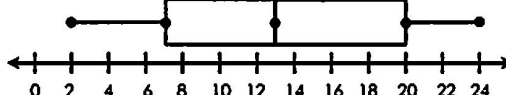
D. [box-and-whisker plot with number line 0–24]

B

For questions 27-28: The following data shows the average high temperature of a city each month in 2016. {31, 33, 42, 55, 67, 75, 80, 78, 71, 59, 48, 36}

27. Which statement is true?

A. The range is 50.

B. The upper quartile is 80.

C. The median is 58.

D. The lower quartile is 39.
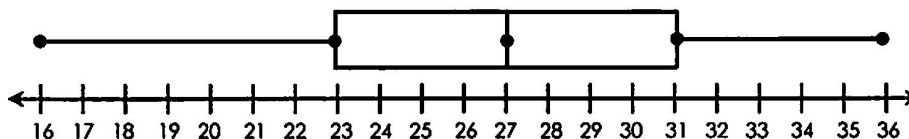
D

28. What is the interquartile range?

LQ = 39
UQ = 73

73 - 39 = 34

34

For questions 29-31: The box-and-whisker plot below shows the number of students in each of the twelve 8th grade math classes at Oakland Middle School. Each class has a different number of students.

[box-and-whisker plot with number line 16–36]

Class Sizes

29. What percent of the classes have at least 23 students?

75%

**30.** How many classes have between 27 and 31 students?

3

---

31. If the school decides to divide the largest class into two smaller classes of equal size, how will it affect the box-and-whisker plot?

A. The minimum will decrease.

B. The median will increase.

C. The lower quartile will increase.

D. The range will decrease.

D

For questions 32-34: The Hot Shots and Rising Suns are two competing basketball teams. The heights, in inches, of the players on each team is shown on the box-and-whisker plot below. There are 20 players on each team and no two players on the same team are the same height.

Hot Shots

70 71 72 73 74 75 76 77 78 79 80 81 82 83 84
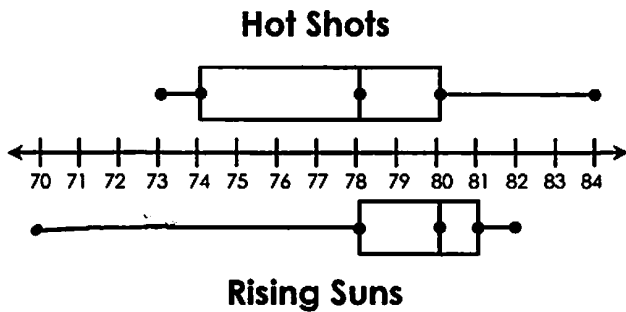
Rising Suns

32. What is the difference in the median heights between the teams?

A. 0 inches   **C.** 2 inches

B. 1 inch   **D.** 3 inches

$\boxed{C}$

33. How many total players on both teams are at least 78 inches tall?

HS: .5(20) = 10

RS: .75(20) = 15

$\boxed{25}$

34. Which statement is false?

A. The Rising Suns have a lesser range.

B. The Hot Shots have a lesser median.

C. The Hot Shots have a greater maximum.

**D.** The Rising Suns have a greater lower quartile.

$\boxed{A}$

35. Which data would most likely show a negative relationship when graphed on a scatterplot?

A. Miles driven versus amount of gas used.

B. The number of visitors to an amusement park versus the wait time for each ride.

C. Outside temperature versus a heating bill.

**D.** A student's height versus their grade on a test.

$\boxed{C}$

36. The scatterplot below shows the population of a city in the years since 2006. Which line best represents this data shown on the graph?
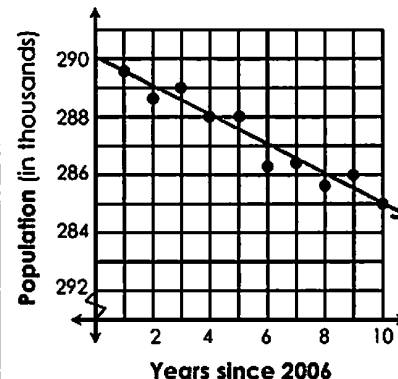
A. $y = -2x + 289$

B. $y = -\frac{1}{2}x + 289$

C. $y = -2x + 290$

D. $y = -\frac{1}{2}x + 290$

Population (in thousands)

Years since 2006

$\boxed{D}$

For questions 37-38: Landon opened a new credit card to purchase a $500 television. The graph below shows the balance on the card each month after purchasing for the first nine months, along with a best-fitting line.

Balance ($)

Months
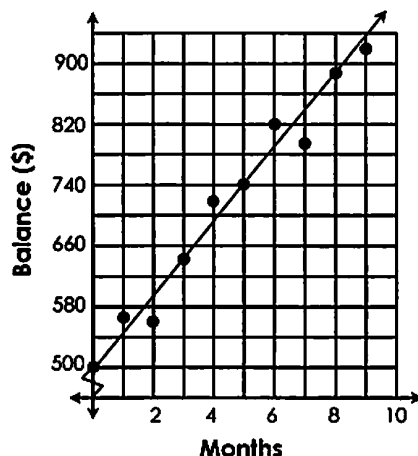
37. Use the points (0, 500) and (5, 740) to write an equation for the line of best fit.

$m = \dfrac{740 - 500}{5 - 0} = \dfrac{240}{5} = 48$

$b = 500$

$\boxed{y = 48x + 500}$

38. If this trend continues, estimate the balance on the card after three years. (X = 36 mo)

$y = 48(36) + 500 = 2228$

$\boxed{\$2228}$

Use for questions 39-40: A random group of 7th and 8th grade math students were surveyed and asked if he or she spent less than 5 hours doing homework last week, or 5 or more hours last week. The survey found that:

- Of the 84 grade 7 students surveyed, 33 said they spent 5 or more hours doing homework last week.
- A total of 80 grade 7 and grade 8 students said they spent less than 5 hours doing homework last week.
- Of the grade 8 students surveyed, 62 said they spent 5 or more hours doing homework last week.

39. Using the information below, complete the two-way table.

	Less than 5 hours	5 or more hours	Total
Grade 7 Students	51	33	84
Grade 8 Students	29	62	91
Total	80	95	175

40. Which statements are true? Check all that apply.

- ☐ More grade 7 students were surveyed than grade 8 students.
- ☑ A total of 175 students were surveyed.
- ☑ A greater percentage of grade 8 students spent 5 or more hours doing homework last week than grade 7 students did.
- ☑ Of all students surveyed, 95 reported that they spent 5 or more hours doing homework last week.
- ☐ Over half of the students surveyed spent less than 5 hours doing homework last week.

For questions 41-42: A group of students were surveyed and asked if they have a cell phone and if they use social media. Results are shown in the Venn diagram below.

Cell Phone   Social Media

28 (21) 7

14
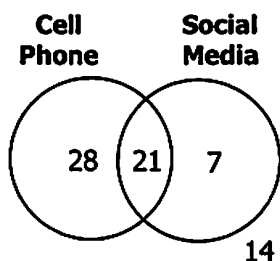
41. Complete the frequency table by filling in the missing row and column titles.

	Cell Phone	No Cell Phone	Total
Social Media	0.3	0.1	0.4
No Social Media	0.4	0.2	0.6
Total	0.7	0.3	1

42. What percent of the students surveyed use social media but do not have a cell phone?

10%

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