Notes - Intro to Probability

Name: _____

Probability	Outcome
A number (0 to 1) that measures the likelihood, or _____ that an event will _____.	The _____ result of an experiment.
Event	**Sample Space**
An _____ or a collection of outcomes. (ex: rolling an odd #).	The _____ of all _____ outcomes.

Probability of an Event

P(event) = _____

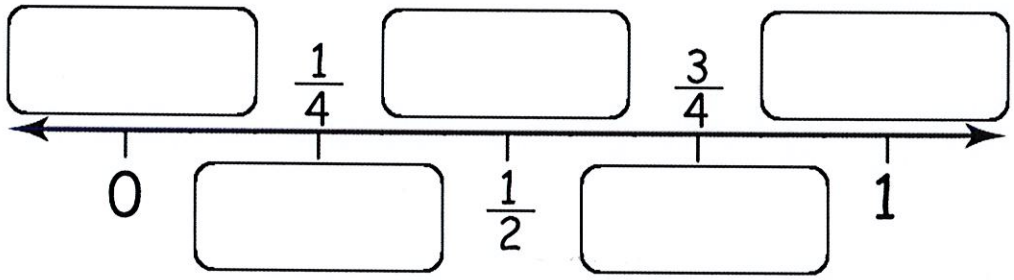
Probabilities are expressed as a number between _____ and _____.

The closer the probability is to _____, the more likely the event will happen

The sum of all possible outcomes is _____.

Describing Probabilities

Can be written as a _____, _____ or _____.



Determine the likelihood and find the probability for one roll of a fair number cube (1-6).

P(rolling a 2)	P(rolling an odd number)	P(rolling at least a 5)
P(rolling an integer)	P(rolling less than 3)	P (rolling a negative number)

Find the probability of the missing outcome.

There are three choices of soda - Coke, Sprite and Dr. Pepper. The probability of getting a Coke is 3/10 and the probability of getting Sprite is 1/5. Find the probability of getting a Dr. Pepper.	You sold the most for your school's fundraiser so you get to enter the cash vault. There are $1, $5, $10 and $20 bills. The probability of picking a $1 bill is 48%, a $5 bill is 26%, a $20 bill is 10%. What is the probability of picking a $10 bill?

Theoretical Probability

Based on _____ and calculating all of the _____outcomes of an experiment.

What _____ happen.

P(event) = _____

Experimental Probability

Based on _____ repeated _____ of an experiment.

What _____ happened.

P(event) = _____

Example:
If you flip a coin, what is the theoretical probability that you will land on tails?

If a coin is flipped 20 times, how often should you land on tails?

Example:
Below are the results of choosing a card from a deck of cards, recording the suit and then replacing the card.

Hearts	Diamonds	Clubs	Spades
6	10	7	5

What is the probability of choosing a diamond?

Theoretical or Experimental?	I rolled the die 30 times and it landed with a 6 face up ten times.	16 airheads in a bag; 4 cherry, 7 orange, 5 apple. Probability of picking cherry: $\frac{1}{4}$.

Roll a dice 20 times & record the outcomes:

Number Rolled	Number of Times
1	
2	
3	
4	
5	
6	

Use the information from the experiment for questions 1-5.

1. **P(4)**
   Theoretical: Experimental:
2. **P(even number)**
   Theoretical: Experimental:
3. **P(factor of 3)**
   Theoretical: Experimental:
4. Are the probabilities the same or different? Why do you think that is?
5. If the theoretical & experimental probabilities of a trial are far apart, what does that tell you about the experiment?

Find the theoretical probability of the following events.

6. What is the probability of choosing a Jack from a standard deck of cards?
7. What is the probability of rolling a composite number on a fair number cube?
8. What is the probability of picking a vowel from the word "MATHEMATICS"?

Practice - Intro to Probability
Theoretical vs. Experimental

Name: _____

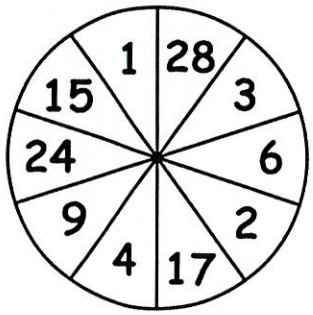
Explain the meaning of each probability. Describe a scenario for each probability.	1. A probability of 0:	2. A probability of 25%:
3. A probability of 0.5:	4. A probability of $\frac{3}{4}$:	5. A probability of 1:

Consider the letters in the state of NORTH CAROLINA. Suppose you took each letter of the word and put them into a bag. Find the probability of picking out the following at random.

6. P(choosing an A)	7. P(choosing a consonant)	8. P(choosing a letter)
9. P(choosing a K)	10. P(choosing an O or R)	11. P(choosing a vowel)

Use the spinner on the left to answer questions 12 - 20.
Write your answer as a fraction, decimal and a percent.

12. P(even number)	13. P(negative number)	14. P(odd number)
15. P(multiple of 3)	16. P(factor of 24)	17. P(prime number)



ALL SECTIONS ARE EQUAL

You spin the spinner 50 times. It landed on 24 ten times.

18. According to the result of the experiment, find the experimental probability of landing on 24.	19. According to the theoretical probability, how many times should the spinner have landed on 24?	20. Compare the theoretical and experimental probabilities.

The following question was asked to survey 6th graders at a Wake County middle school: What college in North Carolina do you want to attend? Below are the results.

NC State	Duke	North Carolina	East Carolina
95 students	60 students	45 students	50 students

21. Find the probability of a student choosing NC State.

22. Find the probability of a student choosing either East Carolina or Duke.

23. Find the probability of a student choosing a college that does not have a shade of blue as their school color.

24. Find the probability of a student choosing a college that is located in the triangle.

Find the probability of the missing outcome.

25. There are three choices of pets to pick out at Pick-A-Pet. You can choose from a dog, cat or hamster. The probability of getting a dog is 3/8 and the probability of getting a cat is 1/4. Find the probability of getting a hamster.

26. There are four types of candy in a bag - starbursts, jolly ranchers, snickers and milky ways. At random, the probability of picking a starburst is 2/5, a jolly rancher is 18% and a milky way is 0.2. What is the probability of picking a snickers at random?

Describe a bag of M&M's in which each of the following probabilities exists.

27. $P(\text{yellow}) = \frac{3}{8}$ $P(\text{brown}) = \frac{1}{2}$ $P(\text{green}) = \frac{1}{8}$

yellow: brown: green: total:

28. $P(\text{red}) = \frac{1}{6}$ $P(\text{red or orange}) = \frac{5}{6}$ $P(\text{blue}) = \frac{1}{6}$

red: orange: blue: total:

Determine the likelihood and write a ratio to represent each probability (if possible).

29. I am going to have math homework tomorrow night.

30. It is going to rain tomorrow.

31. I will pick a "S" or a "T" from the word "Skittles".

32. I will choose a quarter from a bag that has only 7 quarters.

Probability Practice

A spinner is labeled 1-11. What is the probability of spinning a number less than 7? Write as a percent.

If you spin the same spinner, what is the probability of spinning a number that is at least 8?

In 400 spins, how many times would you expect to get a number at least 8?

There are 8 red marbles, 3 black marbles, and 5 yellow marbles in a bag. What is the probability of picking a black marble?

If you picked a marble out of this bag 500 different times, how many times would you expect to get a yellow marble?

There are red, yellow, green, and blue marbles in a bag. The probability of picking a yellow marble is 1/8. A green marble is 1/5, and a blue marble is 1/3. What is the probability of picking a red marble?

Shayla, Noelle, and Olivia are having a race. The probability that Noelle wins the race is 1/5. The probability that Shayla wins the race is 3/7. What is the probability that Olivia wins the race?

If you roll a number cube 200 times, how many times would you expect to roll a number less than 3?

A fisherman caught 5 carp, 8 salmon, and 7 catfish. If he picked one of his fish at random, what is the probability that he picks a catfish?

If he picked a fish randomly 500 different times, how many times would he expect to pick a carp.

There are 12 girls and 15 boys in the class. What is the probability that I randomly select a girl?

Sarah rolled a number cube 80 times. She landed on number six 10 of those times. Compare her experimental probability with her Theoretical Probability.

There are 4 spaces on the spinner. The probability of landing on space 1 is 15%, space 2 is 24%, space 3 is 32%. What is the probability of landing on space 4?

List the sample space of shooting a free throw.

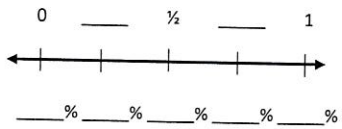
Steven spun a spinner labeled 1-8. What is the probability that he lands on a prime number?

Name:_____

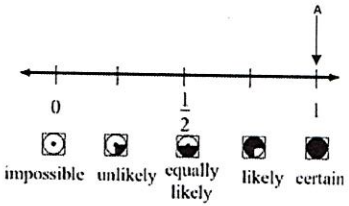
Date:_____Period:____

Probability is the measure of how likely an event is to happen. It is possible to have a 100% probability of the event which makes it "certain" to happen. It is also possible to have a zero percent chance which would make the event "impossible". You are going to look at some situations and determine how likely it is that they would happen.

For the following number line, fill in each blank.



We can describe these probabilities using the categories shown below depending on where they would fall on a number line. NOTE: *EVERYTHING between equally likely and certain is determined "likely" and EVERYTHING between equally likely and impossible is determined "unlikely". Sometimes "likely" is called "as likely as not" and "unlikely" is called "as unlikely as not".*



If possible, write a ratio to represent each probability below and then list the given letter above the number line. Problem A is done for you to use as an example. Next, determine if each event is impossible, unlikely, equally likely, likely, or certain. It will not be able to have a ratio represent each scenario but you CAN determine the likelihood of the event using the categories shown on the number line.

A. If you roll a die you will get a number less than 7.

$\frac{6}{6} = 100\%$: certain

B. If you roll a die you will get an odd number.

_____ : _____

C. Jodl has dance rehearsals on Tuesday afternoons. How likely is it that Jodi is at the mall on a Tuesday afternoon?

_____ : _____

D. A bag contains 12 pennies and 12 dimes. How likely is it that you will draw a dime from the bag?

_____ : _____

E. You must be 15 years old to obtain a learner's permit to drive. Emily is 13 years old. How likely is it that Emily has her learner's permit?

_____ : _____

F. The club volleyball team is made up of 7 boys and 4 girls. How likely is it that the first player chosen at random will be a girl?

_____ : _____

G. Card numbered 1-8 are in a box. How likely is it that you will pull out a number greater than 2?

_____ : _____

H. How likely is it that the card you will pull out in problem G will be a number less than 4?

_____ : _____

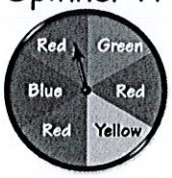
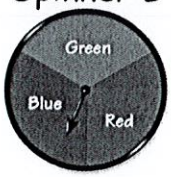
Notes – Finding all Outcomes Name: _____

Tree Diagrams, Lists, Area Models, FCP

<u>Sample Space</u> – **The set of all possible outcomes of a probability experiment.**

Use the different methods to find the sample space and the total number of outcomes.		
Tree Diagrams	You choose one item from each category: Soup: Tomato and Chicken Noodle Sandwich: Turkey, Ham or BLT	
Lists	You draw a card from a set of 3 cards labeled "A", "B", "C" and then roll a die.	
Area Models	You roll two fair number cubes (1-6) and find the sum of the two results. What is the probability that you will have a sum greater than or equal to 5?	

Use any method above to model the sample space and determine the number of outcomes.

1. Flipping three coins.	2. Flipping a coin and rolling a fair number cube.	3. Spinner A  Spinner B 

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FCP - Fundamental Counting Principle

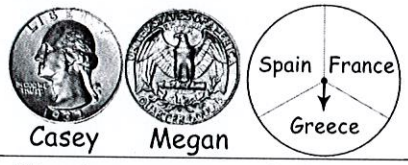
- If you want to perform a series of tasks and the first task can be done in x ways, the second can be done in y ways, the third can be done in z ways, and so on, then all the tasks can be done in x • y • z • ... ways.

1. Starbucks has 14 different flavors of coffee. Each coffee comes in tall, grande, or venti size. How many different kinds of coffees are there?	2. A computer store sells 6 different computers, 4 different monitors, 5 different printers, and 3 different multimedia packages. How many different computer systems are available?
3. Picking a month of the year and a day of the week.	4. A store offers 32 different T-shirt designs in 11 different colors. The store advertises "A T-shirt for EVERY DAY of the year!" Is the advertisement true?
5. You are ordering a case for your iPod. You can choose any of 20 colors for the main shell, any of 28 colors for the protective band, and any of the 150 decals for the back screen. How many different cases can you select from?	6. Sam is setting the combination lock on his briefcase. If he can choose any digit 0-9 for each of the 6 digits in the combination, how many possible combinations are there?
7. The standard configuration for a North Carolina license plate is 3 letters followed by 4 numbers.	
a) How many different license plates are possible if the digits and letters can be repeated?	b) How many different license plates are possible if the digits and letters cannot be repeated?

Practice – Finding all Outcomes Name: _____

Tree Diagrams, Lists, Area Models, FCP

Use any method to model the sample space and determine the number of outcomes for each event.

1. A café has a lunch special consisting of an egg or a ham sandwich; milk, juice, or coffee; and yogurt or pie for dessert.	
2. You are planning a summer vacation for you and a friend. You will flip a coin to decide which friend you are bringing and spin a spinner for the location. 	
3. Rachel is flipping a coin and then spinning a spinner with the colors red, blue, green and yellow. What is the probability that she will flip heads and then spin a blue or a green on the spinner?	
4. What is the probability of a family consisting of 3 children having at least one boy?	
5. Ricky is rolling a fair number cube (1-6) and then spinning a spinner with the numbers 5, 10, 15, 20. He then finds the sum of the number cube and spinner result. What is the probability that his result will be an even number?	

6. The math club is electing new officers. There are 3 candidates for president, 4 candidates for vice-president, 4 candidates for secretary, and 2 candidates for treasurer. How many different combinations of officers are possible?	
7. You go to Best Buy to purchase a new television. You have the following choices: LCD or plasma; screen size 42", 46", 50", 55", 60", 65", or 70" and manufacturer Samsung, Sony, LG or Panasonic. How many different televisions does the store have to offer?	
8. A website requires users to set up an account that is password protected. If the password format is four letters followed by a single digit number, how many different passwords are possible?	
9. You roll a dice and then draw a card from a set of 3 cars "A", "B", and "C". How many possible outcomes are there? Find the probability that you will select "C" and roll a 4?	
10. A bicycle license plate consists of 2 letters followed by 3 numbers. a. If the same letter or number can be repeated, how many can be made? b. If the same letter CANNOT be repeated, how many can be made?	

1. A spinner is labeled 1-8. What is the probability of an even number on the spinner, then flipping heads on a coin?

2. What is the probability of rolling a number greater than 4 on a die, then randomly picking a queen out of a deck of cards?

3. Students are surveyed on their favorite sport to watch. 15 students said basketball, 12 soccer and 18 football. What is the probability that a person randomly selected likes football?

   3a. Based on this survey, if 500 students were surveyed, how many of them would like soccer?

4. If you toss a coin and roll a die, what is the probability of flipping heads, and rolling the number 6?

4a. If you did this experiment 100 times, how many times would you expect to get this result?

5. A spinner is labeled 1-7. What is the probability of spinning a number less than 4, then rolling the number 5 on a number cube?

6. What is the probability of rolling a number greater than 3 on a die, two times in a row? 3 times in a row?

7. Susan rolled a die 200 times, she landed on the number six 42 times. Compare the experimental probability to the theoretical probability?

8. A bag has 5 blue marbles and 3 red marbles. What is the probability of picking a blue marble, then putting it back in the bag, then picking a red marble?

   8a. If we did this trial 300 times, how many times would we expect to get these results?

9. A bag has 2 yellow, 3 blue, 2 green, and 5 black marbles in it. What is the probability of picking a green marble, keeping it, then picking a yellow marble, keeping it, then picking a black marble?

   9a. If we did this trial 200 times how many times would we expect to get these results?

10. A bag has 7 yellow, 8 orange and 3 green marbles in it. What is the probability of picking a yellow, keeping it, then picking another yellow?

    10a. If we did this trial 500 times, how many times would we expect to get these results?

11. What is the probability of flipping tails, rolling a multiple of 2 on the die, then spinning an even number on a spinner labeled 1-7?

12. What is the probability of flipping heads twice in a row, then rolling a number greater than 4, then rolling a number less than 3?

A spinner is labeled 1-5. What is the probability of spinning a 3, then rolling an even number on a number cube?

Spinner 1 is labeled A-C. Spinner 2 is labeled 1-4. What is the probability of spinning an A on spinner 1, and spinning a number greater than 2 on spinner 2?

You are flipping a coin then rolling a number cube. What is the probability of flipping heads, and spinning a number less than 5?

You are flipping a coin 3 times in a row. What is the probability of flipping heads 3 straight times?

You are rolling two number cubes at the same time. What is the probability of rolling a sum greater than 8?

There are 5 red marbles 2 green marbles and 6 yellow marbles in a bag. What is the probability of picking a green marble, keeping it, then picking a red marble?

There are 4 marbles in a bag. The probability of picking red is 0.45, the probability of picking blue is 0.15 and the probability of picking green is 0.08. What is the probability of picking a blue marble?

Notes - Independent vs. Dependent Events

Name: _____

In your own words, describe what the word "independent" means to you.	In your own words, describe what the word "dependent" means to you.

Simple Event - an event that results in just _____ outcome Ex:

Compound Event - consists of _____ or more _____ events Ex:

Independent Event	Dependent Event
The _____ of one event _____ affect the outcome of the _____ event. Ex: spinning a spinner and picking a card P(A and B) = _____	The outcome of the _____ event _____ the outcome of the _____ event. Ex: picking a flower and then another flower P(A and B) = _____
Example: A bag contains 5 pink, 3 green, 4 orange, and 8 yellow gumballs. Find the probability of randomly selecting a green gumball, and then a yellow gumball if the first gumball is replaced.	**Example:** Eight cards numbered 1 - 8 are placed in a bag. One card is selected at random and not replaced. Another card is randomly selected. Find the probability that both cards are greater than 5?

Tell whether each event is independent or dependent.

1. Luis choosing one card from a deck then choosing a second card without replacing the first.	2. Adriana picks a flower out of a big bouquet. She doesn't like the one she picked, so she put it back and picked again.
3. Ivy's mother lays out 6 shirts and 4 skirts for Ivy to choose from. Ivy picks a shirt at random and then picks a skirt at random.	4. You are making your class schedule. You pick one core class for 1st period and then another core class for 2nd period.
5. One student in your class is chosen for a project. Then another student in the class is chosen.	6. Ryan spins a spinner and rolls a number cube.

A fun sized bag of M&M's contains the following twelve candies of different colors.

y g r b b b
y g r r b b

Find the probability for each event if the M&M candy is replaced.	Find the probability for each event if the M&M candy is not replaced.
a) Red candy twice	a) Red candy twice
b) Yellow candy then a green candy	b) Yellow candy then a green candy
c) Blue candy twice	c) Blue candy twice
d) Green candy followed by a blue candy	d) Green candy followed by a blue candy

A bag contains 12 airheads: 2 apple, 4 cherry, and 6 mystery. Katey picks one airhead, replaces it, and then picks a second airhead. Find the probability of the following.

P(apple, cherry)	P(cherry, mystery)	P(not cherry, mystery)	P(cherry, not cherry)
P(apple, mystery)	P(mystery, mystery)	P(apple, not mystery)	P(not apple, not apple)

Fredrick places the eleven cards below into a bag. He draws one card, does not replace it, and then draws another card. Find the probability of each event.

M A T H E M A T I C S

P(M, M)	P(C, S)	P(T, H)	P(A, M)
P(E, R)	P(A, not H)	P(I, M, S)	P(T, S, not A)

Explain the difference between an independent and dependent event.

Practice – Independent vs. Dependent Events Name: _____

Provide an example of each type of probability.	
1. Independent Event:	2. Dependent Event:
Classify each event as independent or dependent. Explain why.	
3. You select a card randomly from a standard deck of 52 cards. Without putting the card back, you select another card from the deck.	4. You pick a piece of candy from a bag containing 20 pieces. You replace the candy to choose a different one and select a second candy.
5. You roll a dice and then spin a spinner.	6. You pick a piece of fruit from the fruit bowl, eat it and then pick a second piece.
7. Choosing a member of the track team to run in the state relay race and then choosing another member to run the mile.	8. You pick a shoe for your left foot and a shoe for your right foot.
Find the probability of each event and then classify as independent or dependent.	
9. You throw a die twice. What is the probability of throwing a number less than four and then a six?	10. Aiden pulls a King from a deck of regular playing cards. He does not replace the card. What is the probability of pulling out a second King?
11. You have a bag of candy filled with pieces which are all the same size and shape. Four are snickers and six are milky ways. You draw a milky way out, decide you don't like it, put it back, and select another piece of candy. What is the probability of selecting another milky way?	12. Tyler has a box of blocks with eight alphabet blocks and four plain orange blocks. He gave an alphabet block to his friend. What is the probability his next selection will be another alphabet block?

Find the probability of each event.

13. What is the probability of drawing the ACE of diamonds from a deck of cards, putting it back in deck, shuffling the deck, and then drawing the ACE of clubs?	14. You have tiles numbered 1 - 9 in a bag. What is the probability of drawing the number 2, putting it aside, and then drawing the number 5?
15. What is the probability of drawing a Jack from a deck of cards, putting it aside, and then drawing another Jack?	16. What is the probability that a coin will land on heads and then a coin will land on tails?
17. What is the probability of rolling a 3 on a 6-sided number cube and then NOT rolling a 3 on a 6-sided number cube?	18. A classroom consists of 12 boys and 16 girls. Find the probability that a teacher randomly selects a girl and then a boy.
19. You have a bag of 17 skittles. Four are purple, 6 are green, 2 are red, and the others are yellow. What is the probability of drawing a red skittle, eating it, and then drawing a green skittle?	20. You have a bag of 17 skittles. Four are purple, 6 are green, 2 are red, and the others are yellow. What is the probability of drawing a purple skittle, replacing it, and then drawing a yellow skittle?
21. A test includes several multiple-choice questions, each with 4 choices. Suppose you don't know the answers for three of these questions, so you guess. What is the probability of getting all three correct?	22. There are six apples, five oranges, and one pear in John's basket. His friend takes three pieces of fruit at random without replacement. Determine the probability that *all three* fruits taken are apples.

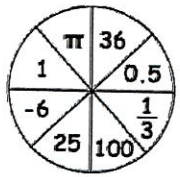
23. Why would the example of drawing a card from a deck keeping it out and drawing again be an example of a dependent event?

Probability Unit Review

Name: _____

Section I: Theoretical vs. Experimental

Find the theoretical probability using the spinner below.



1. P(integer)
2. P(perfect square)
3. P(irrational number)
4. P(composite number)
5. P(not a whole number)
6. P(even, rational)

A survey asked 500 teens what formats of music they listen to in the past two months. The results are: Pandora – 180 and iTunes – 320

7. What is the experimental probability that a teen listened to Pandora in the past two months?
8. What is the experimental probability that a teen listen to their iTunes library in the past two months?

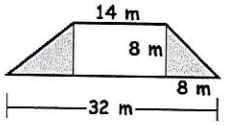
9. Two hundred twenty-five 6th graders were asked to name their favorite cafeteria lunch. One hundred thirty-five students named pizza as their favorite. If an additional 80 6th graders were asked, how many would be expected to choose pizza?

10. In her last 30 serves, Megan served the ball over the net 18 times. Based on this, how many of the next 50 serves should she expect to go over the net?

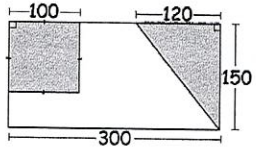
Section II: Geometric Probability

Find the geometric probability that…

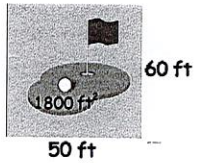
11. A dart thrown will land in the shaded region.



12. An object will land in the white region.



13. A golf ball will land on the green.



Section III: Modeling Outcomes

14. Make an organized list to determine the number of one-bread and one-beverage outcomes using the breakfast choices listed.

    *Toast, muffin, bagel *Coffee, milk, juice

15. A family of three plays bingo at home every night. Each night, the chance that Denise, Kemp or Ashley will win is 1/3. Draw a tree diagram that shows the possible outcomes for two consecutive nights of play.

    Is the probability that "Kemp wins both nights" the same as the probability that "Denise wins the first night & Ashley wins the second night"?

16. Draw an area model to find the sample space:

    A spinner with equal sections labeled A, B, and C is spun and a number cube is rolled.

    a) Find the probability of spinning a B and rolling a 3.

    b) Find the probability of spinning a vowel and rolling an even number.

Section IV: Fundamental Counting Principle "FCP"

17. Regina has three necklaces, three pairs of earrings, and two bracelets. How many combinations of the three types of jewelry are possible?

18. Julie is getting ready for school. She can choose from three pairs of jeans and five blouses. How many outfits can Julie create if all of the combinations coordinate?

19. Bryan has homework in math, science, reading, and art. If he plans on doing math homework first, list the number of ways in which he can complete the four homework assignments.

20. Five band members play the flute. In how many ways can these members be chosen for the first, second, and third chairs of the flute section?

Section V: Independent vs. Dependent Events

21. If you have a standard deck of cards, what is the probability of picking a diamond, replacing the card & then picking a 2, 5, 9?	22. When using a 6-sided number cube, what is the probability of rolling a 3, then not rolling a 3, and then rolling an even number?
23. Channing has ten cards numbered 1 to 10. What is the probability of picking two even-numbered cards one after another, if the first card picked is replaced?	24. A bag contains 4 red, 20 blue, and 6 green candies. Omar picks one at random and keeps it. Then Jade picks a candy. What is the probability that they each select a red candy?
25. A basket of candy contains 2 grape, 3 orange, and 5 cherry candies. The candy is not replaced once selected. Find each probability. a) P(two orange) b) P(grape then cherry) c) P(orange then grape)	26. Ms. Louis cut up the letters in the word Missouri and placed them in a bag. Suppose you do not replace the first letter before drawing the second. What is the probability of drawing an **M** and then drawing an **I**?

Section VI: Probability

27. Andi 20 tangram pieces in a bag. ▪ 1/5 of the tiles are rectangles, 40% of the tiles are trapezoids, the rest are triangles. Andi chooses one triangle tile from the bag and then gives the bag to her friend Amy. If Amy takes one tile from the bag without looking, what is the probability that the tile she chooses will be a quadrilateral?	
28. Marcus placed 8 blue tiles and 12 red tiles in a container. He plans to draw a tile, record its color and replace it in the container before drawing another. If he does this 50 times, how many times should he expect to draw a red tile?	29. Claire tosses a coin and rolls a number cube 100 times. How many times should she expect to have the coin show heads and roll a 1 or a 2?