Geometry

Name ____

Date _____________________________ Period __________

Chapter 12 Probability

12.1 Sample Spaces and Probability

Outcome: ____

Event: ____

Sample Space: ____

Example: Flip a coin twice.

Tree Diagram

First Toss

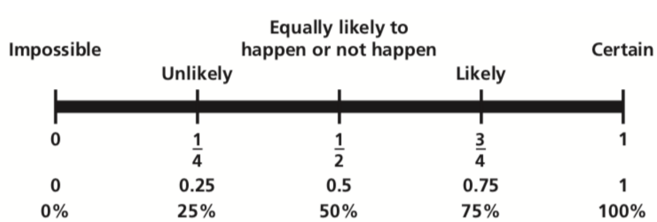
Second Toss

Third Toss

Experiment: Roll two 6-sided dice

Possible Sums		First Die					
		⚀	⚁	⚂	⚃	⚄	⚅
Second Die	⚀						
	⚁						
	⚂						
	⚃						
	⚄						
	⚅						

Probability of an Event: ____



Calculating Probability

Theoretical Probability = ___________________________________

Experiment: A student guesses on four true/false questions. What is the probability the student will make exactly two correct guesses?

Build a Model - The table below represents incorrect (I) and correct (C) answers.

Number correct	Outcome
0	
1	
2	
3	
4	

The Complement of an Event $P(\overline{A}) =$

For example, we found the probability of getting exactly two correct answers was ________________________

The probability of getting exactly zero, one, three, or four correct (not exactly two) is ___________________________________

Example: Roll two 6-sided dice Solve for the following probabilities.

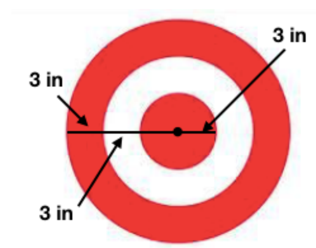
a) The sum is not 6.

b) The sum is less than or equal to 9.

Geometric Probability: ____

Example: Event A = ____

Calculate P(A)



Experimental Probability: ____

Success: ___________________________________

Experimental Probability = ______________________________

Example: Repeated spins of the color spinner produced the following results.

Find experimental probabilities of the colors. e.g. P(red), etc.

Spinner Results			
red	green	blue	yellow

12.2 Independent and Dependent Events

Independent Events: ____

Dependent Events: ____

Example: Independent or Dependent?

a) Rolling two dice.

b) Picking two numbered slips from a bag without putting any back.

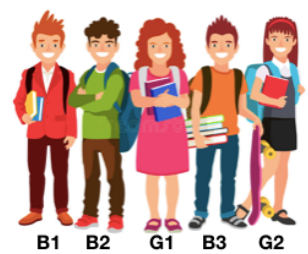
Probability of Independent Events: ____

P(A and B) =

Example: Rolling two 6-sided dice. What is the probability of rolling two sixes?

Example - Independent or Dependent?

A group of ___________ students include _________ boys and _______ girls. Mr Greenstein randomly selects one to be the _______________ and a different student to be the ________________. Determine whether randomly selecting a boy first and randomly selecting a different boy second are independent.



Conditional Probability: ____

P(B | A)

Example: What is the probability of choosing G1 given you already chose G2 as speaker? In other words: P(G1 | G2)?

Example: A quality-control inspector checks for defective parts. The table shows the results of the inspector's work. Find (a) the probability that a defective part "passes," and (b) the probability that a non-defective part "fails."

	Pass	Fail
Defective	3	36
Non-defective	450	11

Probability of Dependent Events: ____

P(A and B) =

Example:

Picking two numbered slips randomly from a bag of numbered slips without putting any back.
What is the probability of choosing 2 and then 3?

What is the probability of choosing 1 or 4 and then 5?

Revisiting Conditional Probability

Start with the probability of dependent events: P(A and B) =

Using algebra, divide each side by P(A). P(B | A) =

Example: Picking two numbered slips randomly from a bag of numbered slips without putting any back.
What is the probability of choosing 2 and then 3?

What is the probability of choosing 1 or 4 and then 5?

Example: You randomly select 3 cards from a standard deck of 52 playing cards. What are the chances they are all hearts when:

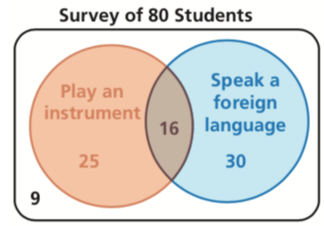
a) you place the cards back into the deck before you choose again?

b) you do not place the cards back into the deck before choosing again?

12.3 Two-Way Tables and Probability

Two-Way Table Example

The Venn diagram on the right shows the results of a survey of 80 students. Using the information in the diagram, fill in the table below.



	Play an Instrument	Do Not Play an Instrument	Total
Speak a Foreign Language			
Do Not Speak a Foreign Language			
Total			

Two-Way Table: ____

Joint Frequency: ____

____

Marginal Frequency: ____

____

		Attendance		
		Attending	Not Attending	Total
Class	Junior	42	64	106
	Senior	77	37	114
	Total	119	101	220

Joint Relative Frequency: ____

Marginal Relative Frequency: ____

____

		Attendance		
		Attending	Not Attending	Total
Class	Junior	$\frac{42}{220} \approx 0.191$	$\frac{64}{220} \approx 0.291$	0.482
	Senior	$\frac{77}{220} = 0.35$	$\frac{37}{220} \approx 0.168$	0.518
	Total	0.541	0.459	1

Conditional relative frequencies: ____

____

		Attendance	
		Attending	Not Attending
Class	Junior	$\frac{0.191}{0.482} \approx 0.396$	$\frac{0.291}{0.482} \approx 0.604$
	Senior	$\frac{0.35}{0.518} \approx 0.676$	$\frac{0.168}{0.518} \approx 0.324$

Example:

A satellite TV provider surveys customers in three cities. The survey asks whether they would recommend the TV provider to a friend. The results, given as joint relative frequencies, are shown in the two-way table.

a) What is the probability that a randomly selected customer who is located in Glendale will recommend the provider?

		Location		
		Glendale	Santa Monica	Long Beach
Response	Yes	0.29	0.27	0.32
	No	0.05	0.03	0.04

b) What is the probability that a randomly selected customer who will not recommend the provider is located in Long Beach?

c) Determine whether recommending the provider to a friend and living in Long Beach are independent events?

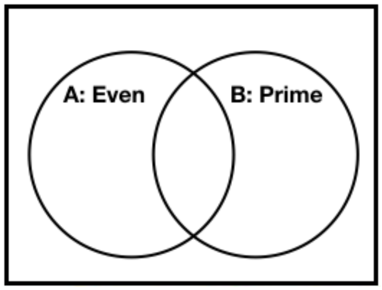
12.4 Probability of Disjoint and Overlapping Events

Compound Events: More than one event in an experiment.

Example 1: Roll a 6-side die. The table shows the numbered side of the die and the number of trials the number appeared.

Event A: The result is an even number.
Event B: The result is a prime number

Side Num	1	2	3	4	5	6	Total
# Trials	16	13	21	18	12	20	100

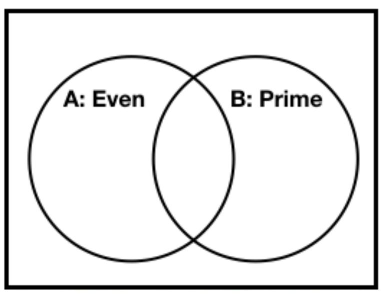


	Even	Odd	Total
Prime			
Not Prime			
Total			

Example 2: Same as above except different events.

Event A: The result is 2 or 4.
Event B: The result is an odd number

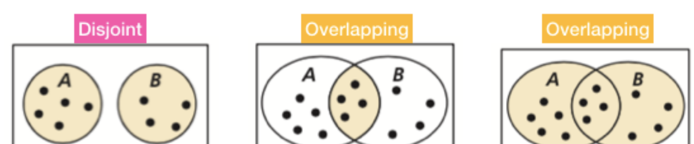
Side Num	1	2	3	4	5	6	Total
# Trials	16	13	21	18	12	20	100



	Even	Odd	Total
Prime			
Not Prime			
Total			

Disjoint (Mutually Exclusive) Events: ____

Overlapping Events: ____



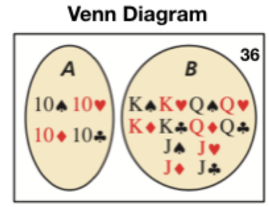
Intersection of *A* and *B* is empty. | Intersection of *A* and *B* | Union of *A* and *B*

Intersection: ____

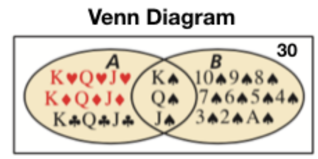
Union: ____

Probability of Compound Events P(A or B) =

Example of Disjoint Events: A card is randomly selected from a standard deck of 52 playing cards. What is the probability that it is a 10 or a face card?



Example of Overlapping Events: A card is randomly selected from a standard deck of 52 playing cards. What is the probability that it is a face card or a spade?



Example: Using formula to find P(A and B)

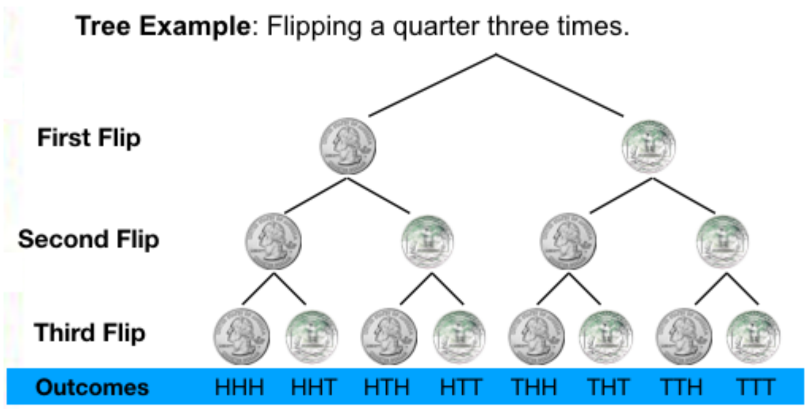
Out of 200 students in a senior class, 113 students are either varsity athletes or on the honor roll. There are 74 seniors who are varsity athletes and 51 seniors who are on the honor roll. What is the probability that a randomly selected senior is both a varsity athlete and on the honor roll?

Probability Tree Diagram

Example problem: The American Diabetes Association estimates that 8.3% of people in the United States have diabetes. Suppose that a medical lab has developed a simple diagnostic test for diabetes that is 98% accurate for people who have the disease and 95% accurate for people who do not have it. The medical lab gives the test to a randomly selected person. What is the probability that the diagnosis is correct?

12.5 Permutations and Combinations

Fundamental Counting Principal: ____



Permutations: ____

Example 1: The permutations of the letters in the word JULY.

Example 2: The permutations of 2 of the letters in the word JULY.

Factorial: ____

n! =

0! =

Permutations Formulas

1. The number of permutations of n objects is given by: $_{n}P_{n} =$

2. The number of permutations of n objects taken r at a time, where $r \leq n$, is given by:

$$_{n}P_{r} =$$

Example: Ten horses are running in a race. In how many ways can the horses finish first, second, and third? (Assume no ties.)

Problem 1: There are 12 school floats in a parade. In how many ways can the floats be ordered in the parade?

Problem 2: The floats will be judged and the 1st, 2nd, 3rd, and 4th place finishers will be given prizes. How many ways can the floats place?

Problem 3: Suppose your float represents the math club and your friend's float represents the swim club. What is the probability that your float will take 1st place in the parade and your friend's float takes 2nd?

Combinations: ____

Combination Formula: The number of combinations of n objects taken r at a time, where $r \leq n$, is given by:

$$_{n}C_{r} =$$

Example 1: The combinations of 2 letters in the word JULY.

Example 2: The combinations of all the letters in the word JULY.

Example: You order a sandwich at a restaurant. You can choose 2 side dishes from a list of 8. How many combinations of side dishes are possible?

12.6 Binomial Distributions

Probability Distribution: ____

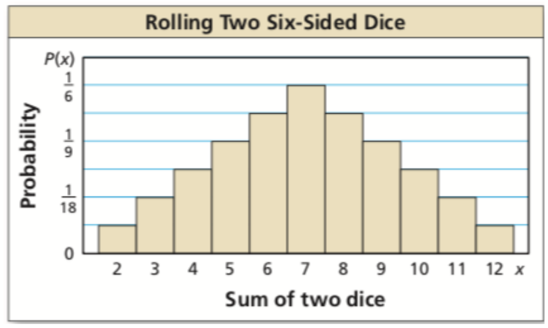
Experiment: The sum when rolling two 6-sided dice.

x (sum)	2	3	4	5	6	7	8	9	10	11	12
Outcomes	1	2	3	4	5	6	5	4	3	2	1
P(x)											

Random Variable x: ____

a) What is the most likely sum?

b) What is the probability that the sum will be at least 10?



Binomial Distribution: ____

Binomial Experiment

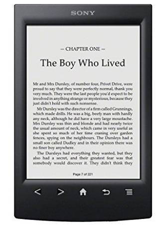
- There are ________________________________
- Each ___________ has only two possible outcomes: ________________ and ________________.
- The probability of success is ____________________________. This probability is denoted by p. The probability of failure is ________________.

For a binomial experiment, the probability of exactly k successes in n trials is:

P(k successes) =

Constructing a Binomial Distribution

Experiment: According to a survey, about 33% of people ages 16 and older in the U.S. own an electronic book reading device, or e-reader. You ask 6 randomly chosen people (ages 16 and older) whether they own an e-reader. Draw a histogram of the binomial distribution for your survey.



P(K = 0) =

P(K = 1) =

P(K = 2) =

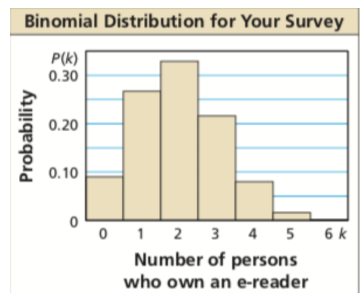
P(K = 3) =

P(K = 4) =

P(K = 5) =

P(K = 6) =

a) What is the most likely outcome of the survey?



b) What is the probability that at most 2 people own e-readers?