<u>12.1 Probability and Measurement</u>

Learning Targets:

- I can use lists, tables, and tree diagrams to represent sample spaces.
- I can use the Fundamental Counting Principle to count outcomes.

	Term/ Concept	**Definition/Example**
Vocabulary	**Experiment**	A situation involving ________________ that leads to results called _______________________.
	Outcomes	The ___________________ of a single performance or ___________________ of an experiment.
	Event	One or more ___________________ of an ________________.
	Sample Space	The set of all _____________________ ________________________.
	Tree Diagram	A way to represent the __________________________ of an experiment.
Instruction	***Example 1:*** A coin is tossed twice. Represent the sample space for this experiment by making a tree diagram.	

Your Turn	*Your Turn:* A coin is tossed and a six-sided die is rolled. Represent the sample space for this experiment by making a tree diagram.

Vocabulary	**Fundamental Counting Principle**	If there are N_1 ways to perform step one and N_2 ways to perform step 2 (etc.), then the total number of outcomes for the experiment is ______________________________.

Instruction

Example 3:

Haley has selected a size and overall style for her class ring. Now she must choose from the ring options shown in the table. How many different rings could Haley create in her chosen style and size.

Ring Options	Number of Choices
Metals	10
Finishes	2
Stone Colors	12
Stone Cuts	5
Side 1 Activity Logo	20
Side 2 Activity Logo	20
Band Styles	2

Your Turn	***Example 4:*** A pizza shop offers 4 different sizes, 3 types of crust, 2 types of sauce and 14 toppings. How many different one-topping pizzas can you order?
	Example 5: How many passwords can you make if each password must contain 4 letters followed by 2 digits? Assume that letters and digits may be repeated.
	Example 6: How many passwords can you make if each password must contain 4 letters followed by 2 digits? Assume that letters and digits may be not be repeated.
	Your turn: A combination lock consists of 4 digits, 0 – 9. How many different combinations are possible?
	Your turn: How many different license plates are possible if each plate has 3 letters followed by 3 digits? Letters may not be repeated but digits may be repeated.

<u>12.2 Probability with Permutations and Combinations</u>

Learning Targets:

- I can use permutations with probability.
- I can use combinations with probability.

<table>
<tr><td rowspan="2">Vocabulary</td><td>Term/ Concept</td><td>Definition/Example</td></tr>
<tr><td>Factorial</td><td>The factorial of a positive integer n, written ______ is the product of the positive integers less than or equal to n.

Ex) 4! =</td></tr>
<tr><td>Instruction</td><td colspan="2">Example 1:
You have 10 new songs on your iPod. How many ways are there to arrange a playlist with all 10 songs?</td></tr>
<tr><td>Your Turn</td><td colspan="2">Your Turn:
You have 5 button down shirts on hangers. How many ways are there to arrange the hangers in your closet?</td></tr>
<tr><td rowspan="2">Vocabulary</td><td>Term/ Concept</td><td>Definition/Example</td></tr>
<tr><td>Permutation</td><td>A permutation is an arrangement of objects in which ________________ is important. The number of permutations of n objects taken r at a time is denoted by ____________ and given by ______________.</td></tr>
<tr><td>Instruction</td><td colspan="2">Example 2:
Find the number of permutations of 5 objects taken 2 at a time.</td></tr>
<tr><td>Your Turn</td><td colspan="2">Your turn:
Find the number of permutations of 6 objects taken 4 at a time.</td></tr>
</table>

Instruction	***Example 3:*** You have 10 new songs on your iPod. How many ways are there to arrange 4 out of the 10 songs to make a playlist?
Your Turn	***Your Turn:*** You have 8 new books, but there is only room for 3 on your bookshelf. How many ways are there to arrange 3 out of the 8 books on the shelf?

Vocabulary	Term/ Concept	Definition/Example
	Combination	A combination is an arrangement of objects in which _________________ is **not** important. The number of combinations of *n* objects taken *r* at a time is denoted by _____________ and given by _______________.

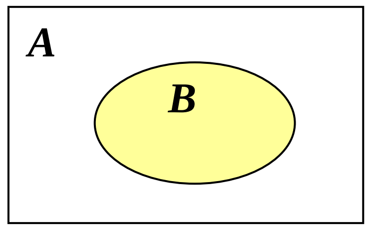
Instruction	***Example 4:*** You have 10 new songs on your iPod. How many ways are there to choose 4 songs to delete from your device?
Your Turn	***Your Turn:*** While cleaning out your closet, you count that you have 5 black sweaters. How many ways are there to choose 2 to donate?

Review!	***Your Turn:*** State whether you would use a Permutation or a Combination for each of the following scenarios: a) Eight people enter the Best Picture contest. How many ways can blue, red, and green ribbons be awarded? b) Five cousins at a family reunion decide that three of them will go to pick up a pizza. How many ways can they choose three people to go? c) Sixty people are on a school's football team. Five people are chosen randomly for drug testing. How many ways could a person be chosen for drug testing? d) Twenty students are running for the four representative positions for your class in the Student Senate. In how many different ways can these positions be filled? e) There are four sprinters on the high school track team. How many ways can these four athletes be arranged to form a relay team?
Instruction	***Example 5:*** Kevin can invite 6 of his 20 friends to a bowling party. If he chooses to invite friends at random, what is the probability that his friends Alan, Bob, Chris, Daniel, Ellen, and Frank are chosen?
Instruction	***Example 6:*** Kristy and Laura are on the school's lacrosse team. If the 20 girls on the team are each assigned a jersey number from 1 – 20 at random, what is the probability that Kristy's number is 1 and Laura's number is 2.

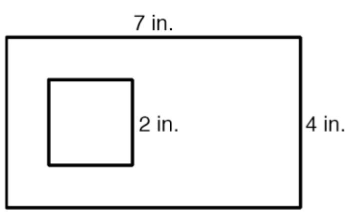
12.3 Geometric Probability

Learning Targets:

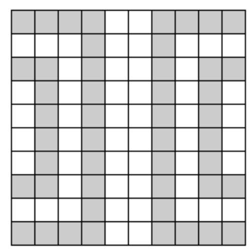
- I can solve problems involving geometric probability.
- I can solve problems involving sectors and segments of circles.

Instruction	**Term/ Concept**	**Definition/Example**	**Picture**
	Probability Involving Area	If a point in region *A* is chosen at random, then the probability *P*(*B*) that the point chosen is in region *b* is ***P*(*B*) =** ______________________________ 	

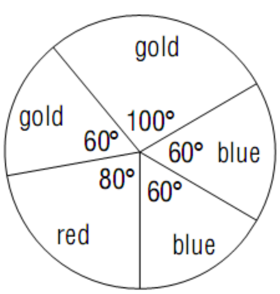
Example 1: Find the probability that a point randomly chosen inside the rectangle lies inside the square.



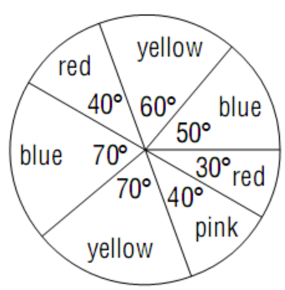
Example 2: Find the probability that a randomly chosen point lies inside the shaded region.

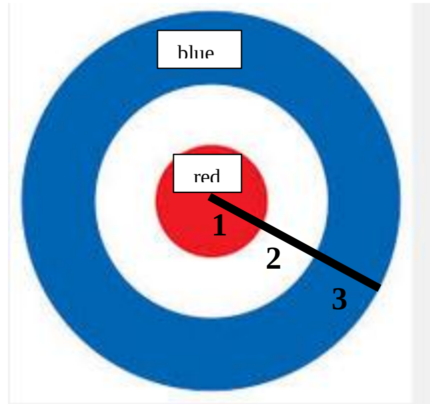


Example 3:
Find the probability of a spinner landing in the red sector in the region below.



Your Turn:
Find the probability of a spinner landing in a blue sector in the region below.



Example 4: Find the probability that a point randomly chosen lies inside the white region of the target below.  1	***Your Turn:*** Find the probability that an arrow lands in the blue section of the target below. 

<u>**12.4 Finding Probabilities of Independent and Dependent Events**</u>

Learning Targets:

- I can find the probabilities of independent and dependent events.
- I can find probabilities of events given the occurrence of other events.

<table>
<tr><td rowspan="4">Vocabulary</td><td>Term/ Concept</td><td>Definition/Example</td></tr>
<tr><td>Compound Events</td><td>A compound event consists of ____________________ simple events.</td></tr>
<tr><td>Independent Events</td><td>Events A and B are independent events if the probability that A occurs
__________ _________ affect the probability that B occurs.</td></tr>
<tr><td>Dependent Events</td><td>Events A and B are dependent events if the probability that A occurs
in some way _____________ the probability that B occurs.</td></tr>
<tr><td>Instruction</td><td colspan="2">Example 1:
Determine whether the events are independent or dependent.

a) One coin is tossed, and then a second coin is tossed.

b) When choosing the order to present a classroom project, a teacher chooses one student’s name without replacing it, and then a second name is chosen.

c) Wednesday’s lottery numbers and Saturday’s lottery numbers.</td></tr>
<tr><td>Your Turn</td><td colspan="2">Your turn:
Determine whether the events are independent or dependent.

a) A card is selected from a deck of cards and put back. Then a second card is selected.

b) Andrea selects a shirt from her closet to wear on Monday and then a different shirt to wear on Tuesday.</td></tr>
</table>

Vocabulary	**Term/ Concept**	**Definition/Example**
	Multiplication Rule	The probability of event *A* **<u>and</u>** event *B* occurring is ____ (This rule only applies if *A* and *B* are independent events.)

Instruction

Example 2:
Suppose you roll two dice (one black, one white). Some events are defined below:

A: Roll a 2 on the black die
B: Roll a 2 on the white die

a. Find P(A)

b. Find P(B)

c. Find P(A and B)

Example 3:
Suppose you roll a fair die 4 times. What is the probability you roll a "6" on all 4 rolls?

Your Turn

Your turn:
You take a 5-question true/false quiz. What is the probability that you correctly guess all 5 answers/

Vocabulary	**Term/ Concept**	**Definition/Example**
	Multiplication Rule – Part 2	The probability of event *A* **<u>and</u>** event *B* occurring if *A* and *B* are dependent events is the product of the probability of *A* and the probability of *B* following *A*, written _____________________.

Instruction	***Example 4***: At a picnic Julio reaches into an ice-filled cooler containing 8 regular and 5 diet soft drinks. Jennifer then decides to grab a drink as well. What is the probability that both people select a regular soft drink if Julio does **NOT** put his drink back into the cooler?
Your Turn	***Your Turn:*** The host of a game show is drawing chips from a bag to determine prizes. Of the 10 chips in the bag, 6 show TV, 3 show VACATION, and 1 shows CAR. If the host draws the chips at random without replacement, find the probabilities: a) P(a vacation and then a car) b) P(two TVs)

12.5 Probabilities of Mutually Exclusive Events

Learning Targets:

- I can find probabilities of events that are mutually exclusive and events that are not mutually exclusive.

	Term/ Concept	Definition/Example
Vocabulary	**Mutually Exclusive**	If two events cannot happen at the same time, they are ___________________ ____________________. (These events have no outcomes in common).

Instruction

Example 1:

At Wayside High School, freshmen, sophomores, juniors, and seniors can all run for Student Council president. Determine whether the following events are mutually exclusive or not mutually exclusive.

a) A junior winning the election or a senior winning the election.

b) A sophomore winning the election or a female winning the election.

c) A freshmen winning the election or a male winning the election.

Your Turn

Your turn:

Determine whether the following events are mutually exclusive or not mutually exclusive.

a) Drawing an ace or a club from a standard deck of cards.

b) Selecting a number at random from the integers from 1 to 100 and getting a number divisible by 5 or a number divisible by 10.

c) Drawing a card from a standard deck and getting a 5 or a heart.

d) Getting a sum of 6 or 7 when two dice are rolled.

	Term/ Concept	Definition/Example
Vocabulary	**Addition Rule**	If two events cannot happen at the same time, then the probability of *A* or *B* occurring is __________________________________.

Instruction

Example 2:

Ramon makes a playlist that consists of songs from three different albums by his favorite artist. If he lets his digital media player select the songs from this list at random, what is the probability that the first song played is from Album 1 or Album 2?

Album	# of songs
1	10
2	12
3	13

Example 3:

If you draw an M&M candy at random from a bag of the candies, the candy you draw will have one of 6 colors. The table below gives the probability of each color for a randomly chosen milk chocolate M&M.

Color	Brown	Red	Yellow	Green	Orange	Blue
Probability	0.13	0.13	0.14	0.16	0.20	

a. What is the probability of drawing a blue M&M?

b. What is the probability of drawing an M&M that is not green?

c. What is the probability of drawing an M&M that is green, yellow, or blue?

d. What is the probability that of drawing an M&M that is not yellow or red?

Your Turn:

If you win the ring toss game at a certain carnival, you receive a stuffed animal. If the stuffed animal is selected at random from among 15 puppies, 16 kittens, 14 frogs, 25 snakes, and 10 unicorns, what is the probability that a winner receives a puppy, a kitten, or a unicorn?

<table>
<tr><td rowspan="2">Vocabulary</td><td>Term/ Concept</td><td>Definition/Example</td></tr>
<tr><td>Addition Rule, Part 2</td><td>If two events are NOT mutually exclusive (can happen at the same time), then the probability of A or B occurring is the sum of the probability of A and the probability of B minus the probability of both occurring, denoted

________________________________.</td></tr>
<tr><td rowspan="2">Instruction</td><td colspan="2">Example 4:
One card is drawn from a standard deck. What is the probability of getting a heart or a king?</td></tr>
<tr><td colspan="2">Example 5:
One card is drawn from a standard deck. What is the probability of getting a red card or an ace?</td></tr>
<tr><td></td><td colspan="2">Your turn:
One card is drawn from a standard deck. What is the probability of getting a club or a face card?</td></tr>
</table>

12.6 Two-Way Frequency Tables

Learning Targets:

- I can find the probabilities of events using two-way frequency tables.

Instruction

Example 1:

A statistics class is made up of 11^{th} and 12^{th} grade students, some male and some female. The class distribution is shown in the table below.

	11^{th} grade	**12^{th} grade**	**Total**
Male	**8**	**12**	
Female	**4**	**6**	
Total			

Suppose that the teacher randomly picks a student from the class. Some events are defined below:

A: Student is male
B: Student is female
C: Student is in 11^{th} grade
D: Student is in 12^{th} grade

a. Find P(A)

b. Find P(B)

c. Find P(C)

d. Find P(D)

e. What is the probability that the student is a girl if we know she is in 11^{th} grade?

f. What is the probability that the student is in 12^{th} grade if we know she is a female?

g. What is the probability that the student is a male if we know he is in 12^{th} grade?

h. What is the probability that the student is male if we know the student is female?

Your Turn

Your Turn:
Michael asks a random sample of 160 upperclassmen at his high school whether or not they plan to attend the prom. He finds that 44 seniors and 32 juniors plan to attend the prom, while 25 seniors and 59 juniors do not plan to attend. Organize these responses into a two-way frequency table. Then, use the table to answer some questions below.

	Attending	**Not Attending**	**Total**
Seniors			
Juniors			
Total			

a. How many seniors were surveyed?

b. How many of the students that were surveyed plan to attend the prom?

c. What is the probability that a student is a senior?

d. What is the probability that a student is planning to attend the prom?

e. What is the probability that a student is a senior if we know he/she plans to attend the prom?

f. What is the probability that the student plans to attend prom if we know he/she is a senior?