Unit 1 Day 1: Sample Spaces and Subsets

Students will be able to (SWBAT) describe events as subsets of sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events. (S-CP.1)

Define: Sample Space	

Example: List the sample space, S, for each of the following:

1. Tossing a coin:

2. Rolling a six-sided die:

3. Drawing a marble from a bag that contains two red, three blue, and one white marble:

Define: Intersection of two sets ($A \cap B$)	

Example:

4. Given the following sets, find $A \cap B$
   $A = \{1,3,5,7,9,11,13,15\}$ $B = \{0,3,6,9,12,15\}$

Define: Union of two sets ($A \cup B$)	

Example:

5. Given the following sets, find $A \cup B$
   $A = \{1,3,5,7,9,11,13,15\}$ $B = \{0,3,6,9,12,15\}$

Define: Venn Diagram	

Example: Use the Venn Diagram to answer the following questions

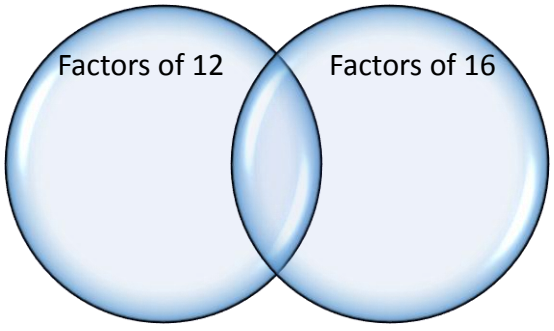
6. What are the elements of set A?

7. What are the elements of set B?

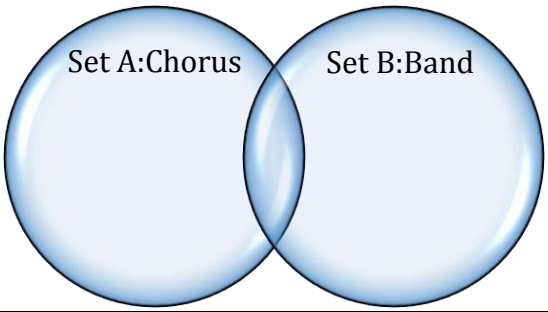
8. Why are 1, 2, and 4 in both sets?

9. What is $A \cap B$?

10. What is $A \cup B$?



Example: In a class of 60 students, 21 sign up for chorus, 29 sign up for band, and 5 take both. 15 students in the class are not enrolled in either band or chorus.



11. Put this information into a Venn Diagram.

12. What is A ∪ B? _____

13. What is A ∩ B? _____

Define: Complement of a Set (A^C)	

Example: S = {…,-3,-2,-1,0,1,2,3,4,…} and A = {…,-2,0,2,4,…}

14. If A is a subset of S, what is A^C?

Example: Use the Venn Diagram above (Chorus vs. Band) to find the following:

15. What is A^C?

16. B^C?

17. What is $(A \cap B)^C$?

18. What is $(A \cup B)^C$?

Unit 1 Day 1: Check your understanding (CYU)

SWBAT describe events as subsets of sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events. (S-CP.1)

1. Describe the sample space for picking a colored marble from a bag with red and black marbles. *Note: This may be modeled with set notation.*

2. Andrea is shopping for a new cellphone. She is either going to contract with Verizon or with Sprint. She must choose between an Android phone or an IPhone. Describe the sample space. *Note: This may be modeled with set notation.*

3. ***Use the following scenario for #3-7***. In a class of 50 students, 18 take Chorus, 26 take band, and 2 take both Chorus and Band. How many students are not enrolled in either Chorus or Band?

4. What is $(Chorus \cup Band)$?

5. What is $(Chorus \cap Band)$?

6. What is $(Chorus \cup Band)^C$?

7. What is $(Chorus \cap Band)^C$

Unit 1 Day 2: Basic Probability & Experimental Probability

Students will be able to (SWBAT) decide if a specified model is consistent with results from a given data-generating process (S-IC.2) and Evaluate reports based on data (S-IC.6).

Do Now:

1. Fill in the foldable and tape/glue into your notebook.
2. Complete the worksheet titled "Intersection and Union of Sets Using U Worksheet 1".
3. Turn it in to be checked when finished.

Theoretical Probability of Events $P(E)$	
$P(A^C)$	

Example: An experiment consists of tossing three coins.

1. List the sample space for the outcomes of the experiment.
2. Find the following probabilities, P(all heads)
3. P(two tails)
4. P(no heads)
5. P(at least one tail)
6. How could you use compliments to find #5?

Example: A bag contains six red marbles, four blue marbles, two yellow marbles and three white marbles. One marble is drawn at random.

7. List the sample space for this experiment.
8. Find the following probabilities P(red)
9. P(blue or white)
10. P(not yellow)

    Note that we could either count all the outcomes that are not yellow, or we could think of this as being 1-P(yellow). Why is this?

Example: A card is drawn at random from a standard deck of cards. Find each of the following:

11. P(heart)

12. P(black card)

13. P(2 or jack)

14. P(not a heart)

Experimental Probability

Example:

Number	1	2	3	4	5	6
Frequency	5	6	9	2	4	8

15. Based on the trials listed, what is P(rolling # < 3)?

Odds

Example: The weather forecast for Saturday says there is a 75% chance of rain. What are the odds that is will rain on Satuday?

16. What does the 75% in this problem mean in context of the situation?

17. What is the favorable outcome in this problem?

18. Should you make outdoor plans for Saturday?

Example:

19. What are the odds of drawing an ace at random from a standard deck of cards?

Unit 1 Day 2: Check your understanding (CYU)

Students will be able to (SWBAT) decide if a specified model is consistent with results from a given data-generating process (S-IC.2) and Evaluate reports based on data (S-IC.6).

Complete the Celebrity Hunger Games Experiment & turn in to be checked.

Unit 1 Day 3: Probability of Independent & Dependent Events

SWBAT Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use characteristics to determine if they are independent (S-CP.2) and apply the general multiplication rule in a uniform probability model, P(A and B)=P(A)P(B|A)=P(B)P(A|B), and interpret the answer in terms of the model. (S-CP.8)

Do Now:

1. The 4 aces are removed from a deck of cards. A coin is tossed and one of the aces is chosen. Describe the sample space. *Note: This may be modeled well with a table.*
2. Nelson has 3 cards and 2 chocolates. He chooses one card and one chocolate at random. How many outcomes are possible for which chocolate and card he picks?
3. A book shelf contains 6 history books, 9 mathematics books, and 4 accounting books. What is the probability of selecting a history book or accounting from the shelf?
4. Ray and Shan are playing football. Probability of Ray winning the football game is .36 So what is the probability of Shan winning?
5. A number between 30 and 50 is chosen at random. What's the probability that the number contains at least one 4?

Independent Events	
Dependent Events	

Example: Suppose a die is rolled and then a coin is tossed.

1. Explain why these events are independent

2. Fill in the table to describe the sample space.

	Roll 1	Roll 2	Roll 3	Roll 4	Roll 5	Roll 6
Head						
Tails						

3. How many outcomes are there for rolling the die?
4. How many outcomes are there for tossing the coin?
5. How many outcomes are there in the sample space of rolling the die and tossing the coin?
6. Is there another way to decide how many outcomes are in the sample space?

Example: A fast food restaurant offers 5 sandwiches and 3 sides.

7. How many different meals of a sandwich and side can you order?

8. Make a table to see if your prediction is correct.

	Sandwich 1	Sandwich 2	Sandwich 3	Sandwich 4	Sandwich 5
Side 1					
Side 2					
Side 3					

Fundamental Counting Principle

Example:

9. A student is to roll a die and flip a coin. How many possible outcomes will there be?

10. For a college interview, Robert has to choose what to wear from the following: 4 slacks, 3 shirts, 2 shoes and 5 ties. How many possible outfits does he have to choose from?

Probability of Independent Events

Example: Use the table from questions #1-6.

	Roll 1	Roll 2	Roll 3	Roll 4	Roll 5	Roll 6
Head						
Tails						

11. P(rolling a 3)

12. P(tails)

13. P(rolling a 3 AND getting tails)

14. P(rolling an even)

15. P(heads)

16. P(rolling an even AND getting heads)

Multiplication Rule of Probability

Example:

17. At City High School, 30% of students have part-time jobs and 25% of students are on the honor roll. What is the probability that a student chosen at random has a part-time job and is on the honor roll? Write your answer in context.

Example: The following table represents data collected from a grade 12 class in DEF High School

Plans after High School

Gender	University	Community College	Total
Males	28	56	84
Females	43	37	80
Total	71	93	164

Suppose 1 student was chosen at **random** from the grade 12 class.

18. What is the probability that the student is female?

19. What is the probability that the student is going to university?

Now suppose 2 people both randomly chose 1 student from the grade 12 class. Assume that it's possible for them to choose the same student.

20. What is the probability that the first person chooses a student who is female and the second person chooses a student who is going to university?

Example: Suppose a card is chosen at random from a deck of cards, replaced, and then a second card is chosen.

21. Would these events be independent? How do we know?

22. What is the probability that both cards are 7s?

Probability of Dependent Events

Determine whether the events are independent or dependent

23. Selecting a marble from a container and selecting a jack from a deck of cards.
24. Rolling a number less than 4 on a die and rolling a number that is even on a second die.
25. Choosing a jack from a deck of cards and choosing another jack, without replacement.
26. Creating a seating chart for your math class.

- We cannot use the multiplication rule for finding probabilities of dependent events because the one event affects the probability of the other event occurring.
- Instead, we need to think about how the occurrence of one event will affect the sample space of the second event to determine the probability of the second event occurring.
- Then we can multiply the new probabilities.

Example: Suppose a card is chosen at random from a deck, the card is NOT replaced, and then a second card is chosen from the same deck. What is the probability that both will be 7's?

27. This is similar to the earlier example, but these events are dependent! How do we know?

28. How does the first event affect the sample space of the second event?

29. Calculate the probability that both cards will be 7's

30. A box contains 5 red marbles and 5 purple marbles. What is the probability of drawing 2 purple marbles and 1 red marble in succession *without replacement*?

31. In Example 31, what is the probability of first drawing all 5 red marbles in succession and then drawing all 5 purple marbles in succession *without replacement*?

Unit 1 Day 3: Check your understanding (CYU)

SWBAT Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use characteristics to determine if they are independent (S-CP.2) and apply the general multiplication rule in a uniform probability model, P(A and B)=P(A)P(B|A)=P(B)P(A|B), and interpret the answer in terms of the model. (S-CP.8)

#1-3 When rolling two number cubes…

1. What is the probability of rolling a sum that is greater than 7?
2. What is the probability of rolling a sum that is odd?
3. Are the events, rolling a sum greater than 7, and rolling a sum that is odd, independent? Justify your response.

#4-6 Determine if the events are independent or not. Explain your reasoning.

4. Flipping a coin and getting heads and rolling a number cube and getting a 4
5. When rolling a pair of number cubes consider the events: getting a sum of 7 and getting doubles
6. From a standard deck of cards consider the events: draw a diamond, shuffling the deck then drawing a heart.

7. You have a box with 3 blue marbles, 2 red marbles, and 4 yellow marbles. You are going to pull out one marble, record its color, put it back in the box and draw another marble. What is the probability of pulling out a red marble followed by a blue marble?

8. Consider the same box of marbles as in the previous example. However in this case, we are going to pull out the first marble, leave it out, and then pull out another marble. What is the probability of pulling out a red marble followed by a blue marble?

Unit 1 Day 5: Probability of Mutually Exclusive & Inclusive Events

SWBAT Apply the addition rule P(A or B)=P(A)+P(B)-P(A and B), and interpret the answer in terms of the model. (S-CP.7)

Do Now:

1. Complete the probability review stations worksheet and be prepared to share your answers

Mutually Exclusive Events

Suppose you are rolling a six-sided die. What is the probability that you roll an odd number or you roll a 2?

1. Can these both occur at the same time? Why or why not?

Mutually Exclusive Events	
Addition Formula	

Example: If you randomly chose one of the integers 1 – 10, what is the probability of choosing either an odd number or an even number?

2. Are these mutually exclusive events? Why or why not?
3. P(odd)
4. P(even)
5. P(odd & even)
6. Calculate P(odd or even) using the formula
7. Does this answer make sense?

Examples: Two fair dice are rolled. What is the probability of getting a sum less than 7 or a sum equal to 10?

8. Are these events mutually exclusive? Why or why not?
9. Complete the following table using the sums of two dice.
10. P(getting a sum less than 7 OR sum of 10)
11. What does this mean?

	1	2	3	4	5	6
1						
2						
3						
4						
5						
6						

Mutually Inclusive Events

Suppose you are rolling a six-sided die. What is the probability that you roll an odd number or a number less than 4?

12. Can these both occur at the same time? Why or why not?

Mutually Inclusive Events	

Examples:

13. What is the probability of choosing a card from a deck of cards that is a club or a ten?
    P(choosing a club or a ten)

14. What is the probability of choosing a number from 1 to 10 that is less than 5 or odd?

15. A bag contains 26 tiles with a letter on each, one tile for each letter of the alphabet. What is the probability of reaching into the bag and randomly choosing a tile with one of the first 10 letters of the alphabet on it or randomly choosing a tile with a vowel on it?

16. A bag contains 26 tiles with a letter on each, one tile for each letter of the alphabet. What is the probability of reaching into the bag and randomly choosing a tile with one of the last 5 letters of the alphabet on it or randomly choosing a tile with a vowel on it?

Unit 1 Day 5: Check your understanding (CYU)

SWBAT Apply the addition rule P(A or B)=P(A)+P(B)-P(A and B), and interpret the answer in terms of the model. (S-CP.7)

Given the situation of drawing a card from a standard deck of cards, calculate the probability of the following:

1. Drawing a red card or a king
2. Drawing a ten or a spade
3. Drawing a four or a queen

4. In a math class of 32 students, 18 boys and 14 are girls. On a unit test, 5 boys and 7 girls made an A grade. If a student is chosen at random from the class, what is the probability of choosing a girl or an A student?

Unit 1 Day 6: Conditional Probability

SWBAT Understand the conditional probability of A given B as P(A and B)/P(B) (S-CP.3)
and construct and interpret two way frequency tables of data (S-CP.4)
and recognize and explain concepts of conditional probability in everyday language and situations (S-CP.5)
and find the conditional probability of A given B and interpret the answer in terms of the model (S-CP.6)

Do Now:

1. Explain how to determine if two events are independent or dependent.

2. Provide TWO examples of mutually exclusive events.

3. Provide TWO examples of mutually inclusive events.

4. In Ms. Plant's homeroom class, there are 27 students. 15 students who have brown eyes, 8 students who are left-handed, and 7 students who have neither brown eyes nor are left-handed. Draw a Venn diagram and find how many of the students have both brown eyes and are left handed.

Conditional Probability	
Examples:	
Formula for P(A|B)	

Examples:

1. You are playing a game of cards where the winner is determined by drawing two cards of the same suit. What is the probability of drawing clubs on the second draw if the first card drawn is a club?

2. A bag contains 6 blue marbles and 2 brown marbles. One marble is randomly drawn and discarded. Then a second marble is drawn. Find the probability that the second marble is brown given that the first marble drawn was blue.

3. In Mr. Jonas' homeroom, 70% of the students have brown hair, 25% have brown eyes, and 5% have both brown hair and brown eyes. A student is excused early to go to a doctor's appointment. If the student has brown hair, what is the probability that the student also has brown eyes?

Using Two-Way Frequency Tables to Compute Conditional Probabilities

Suppose we survey all the students at school and ask them how they get to school and also what grade they are in. The chart below gives the results. Complete the two-way frequency table.

	Bus	Walk	Car	Other	Total
9th or 10th	106	30	70	4	
11th or 12th	41	58	184	7	
Total					

Suppose we randomly select one students

4. What is the probability that the student walked to school?

5. P(9th or 10th grader)

6. P(rode the bus OR 11th or 12th grader)

7. What is the probability that a student is in 11th or 12th grade *given that* they rode in a car to school?

8. What is P(Walk|9th or 10th grade)?

Example: The manager of an ice cream shop is curious as to which customers are buying certain flavors of ice cream. He decides to track whether the customer is an adult or a child and whether they order vanilla ice cream or chocolate ice cream. He finds that of his 224 customers in one week that 146 ordered chocolate. He also finds that 52 of his 93 adult customers ordered vanilla. Build a two-way frequency table that tracks the type of customer and type of ice cream.

	Vanilla	Chocolate	Total
Adult			
Child			
Total			

9. Find P(vanilla|adult)

10. Find P(child|chocolate)

11. A survey asked students which types of music they listen to? Out of 200 students, 75 indicated pop music and 45 indicated country music with 22 of these students indicating they listened to both. Use a Venn diagram to find the probability that a randomly selected student listens to pop music given that they listen country music.

Unit 1 Day 6: Check your understanding (CYU)

SWBAT Understand the conditional probability of A given B as P(A and B)/P(B) (S-CP.3)
and construct and interpret two way frequency tables of data (S-CP.4)
and recognize and explain concepts of conditional probability in everyday language and situations (S-CP.5)
and find the conditional probability of A given B and interpret the answer in terms of the model (S-CP.6)

Complete the conditional probability worksheet and turn in to be checked.

Unit 1 Day 7: Permutations & Combinations

SWBAT Use permutations and combinations to computer probabilities of compound events and solve problems. (S-CP.9+)

Do Now:

Recall the Fundamental Counting Principle, how many outcomes are possible in each situation below.

1. roll a die and flip a coin

2. draw two cards from a standard deck of 52 cards without replacing the cards

3. a coin is tossed five times

4. You have 3 shirts, 4 pairs of shoes, 5 pants and 6 accessories, how many outfits can you make?

Permutation	

Examples:

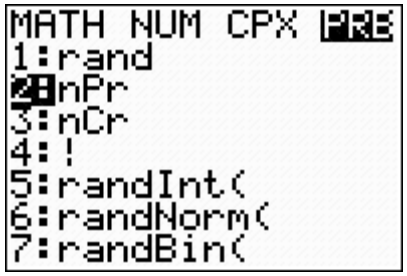
1. Find the number of ways to arrange the letters ABC

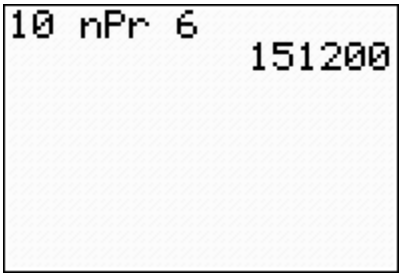
Permutation Formula	

Examples:

2. A combination lock will open when the right choice of three numbers (from 1 to 30, inclusive) is selected. How many different lock combinations are possible assuming no number is repeated?

Calculator Permutations





Examples:

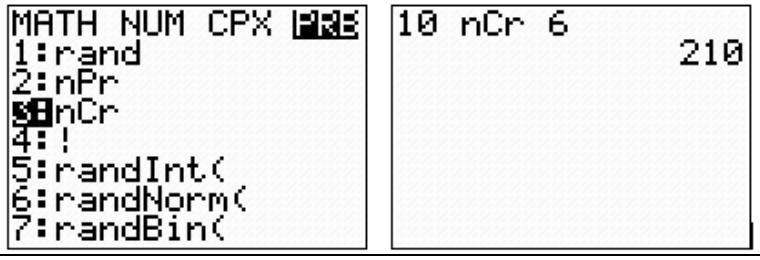
3. You've been assigned the task of creating a new seating chart for your math teacher who has a roster of 25 students. How many ways can you rearrange the seating chart?

4. From a club of 24 members, a President, Vice President, Secretary, Treasurer and Historian are to be elected. In how many ways can the offices be filled?

Combination	
Combination Formula	

Examples:

5. To play a particular card game, each player is dealt five cards from a standard deck of 52 cards. How many different hands are possible?

Calculator Combinations	

Examples:

6. A student must answer 3 out of 5 essay questions on a test. In how many different ways can the student select the questions?

7. A basketball team consists of two centers, five forwards, and four guards. In how many ways can the coach select a starting line up of one center, two forwards, and two guards

8. The 25-member senior class council is selecting officers for president, vice president and secretary. Emily would like to be president, David would like to be vice president, and Jenna would like to be secretary. If the offices are filled at random, beginning with president, what is the probability that they are selected for these offices?

9. The 25-member senior class council is selecting members for the prom committee. Stephen, Marcus and Sabrina want would like to be on this committee. If the members are selected at random, what is the probability that all three are selected for this committee?

Unit 1 Day 7: Check your understanding (CYU)

SWBAT Use permutations and combinations to computer probabilities of compound events and solve problems. (S-CP.9+)

Complete the Permutations & Combinations worksheet and turn in to be checked.