**Unit 8: Probability**

**By the end of the unit students will be able to:**

* List sample spaces, find intersections of unions of sets, with and without Venn diagrams, find probabilities of simple events.
* Find probabilities of independent and dependent events using General Multiplication Rule.
* Find probabilities of mutually exclusive and inclusive events using addition rules.
* Find conditional probabilities using Venn diagrams, two-way frequency tables, and use conditional probability to determine if events are independent.
* Find probabilities using permutations and combinations.
* Understand the difference between theoretical and experimental probability and find experimental probabilities using simulations.

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| --- | --- | --- | --- |
| **Day** | **Date** | **Lesson** | **Assignment** |
| 1 | Thurs  May 12 | Counting Principle / Permutations | Homework 8-1 |
| 2 | Fri  May 13 | Combinations | Homework 8-2 |
| 3 | Mon  May 16 | **Quiz: Days 1-2**  Basic Probability | Homework 8-3 |
| 4 | Tuesday  May 17 | Basic Probability (And/Or) | Homework 8-4 |
|  | Wed  May 18 | Mid-Unit Review |  |
| 6 | Thurs  May 19 | Conditional Probability | Homework 8-5 |
| 7 | Fri  May 20 | Conditional Probability | Homework 8-6 |
| 8 | Mon  May 23 | **Quiz: Days 3-7**  Theoretical vs. Experimental | HW 8-7 |
| 9 | Tues  May 24 | Review | Finish Review Sheet |
| 10 | Wed  May 25 | Test |  |

HW 8-1

**Fundamental Counting Principle and Permutations**

1. How many different pairs of shoes can you get from a store that has eight different styles in three colors and 8 sizes?

2. How many 3-digit numbers can be formed by rearranging the digits in the number 916?

3. How many 6 figure codes can be created if the first set of 3 figures are letters and the second set of 3 figures are numbers 0 – 9? (assume letters/numbers can repeat)

4. Refer to question #3. Find the number of codes if the letters/numbers can NOT repeat.

5. How many four-letter sequences can be made from the letters in the word UPHOLD?

6. If you can get 3 kinds of pens in 2 ink colors, how many different pens are available? Draw a tree diagram of the situation.

7. How many ways can I choose 4 people from a class of 28 to go to the office for me?

8. How many ways can I rearrange the letters of the word MATHEMATICS?

**HW 8-2**

**Fundamental Counting Principle, Permutations and Combinations**

**Solve.**

**1.** _5P_2 **2.** _9P_4 **3.** _{11}P_5

**4.** _8C_4 **5.** _{11}C_5 **6.**  _{20}C_2

**Determine if the following is a Permutation or a Combination. Then solve**.

**7.** How many ways can you plant a rose bush, a lavender bush and a hydrangea bush in a row?

**8.** If there is a randomly generated 3-letter arrangement of the letters in the word SPIN, how many outcomes end with the letter N?

**9.** In how many ways can 3 pizza toppings be selected from a group of 12 toppings?

**10.** How many ways can you line up 5 people out of a class or 32 if each person gets a different reward?

**11.** Mrs. Miller owns 3 pairs of pants, 8 shirts, and 2 sweaters. In how many ways can she choose 2 of the pairs of pants, 4 of the shirts, and 1 of the sweaters?

**12.** In a primary election, there are four candidates for mayor, ﬁve candidates for city treasurer,

and two candidates for county attorney. In how many ways may voters mark their ballots:

1. if they vote in all three of the races?

b) if they exercise their right not to vote in any or all of the races?

**HW 8-3**

1) There are 35 people in a class that won a pizza party. 21 like cheese pizza, 15 like peperoni and 7 like both. Draw a Venn Diagram.

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1. What is the probability that if the teacher selects 1 student they will like cheese?
2. What is the probability that if one student is selected that they won’t like either?

2) Suppose you have a standard deck of 52 cards. Let: & A: {\text{draw a 7}} & B: {\text{draw a Diamond}}

a. Describe A \cup B for this experiment, and find the probability of A \cup B.

b. Describe A \cap B for this experiment, and find the probability of A \cap B

*3.* Suppose you have a jar of candies: 4 red, 5 purple and 7 green. Find the following probabilities of the following events:

1. Selecting a red candy.
2. Selecting a purple candy.
3. Selecting a green or red candy.
4. Selecting a yellow candy.
5. Selecting any color except a green candy.
6. Find the odds of selecting a red candy

4) A coin and a die are tossed. Calculate the probability of getting tails and a 5.

5) In Tania's homeroom class, 9% of the students were born in March and 40% of the students have a blood type of O+. What is the probability of a student chosen at random from Tania's homeroom class being born in March and having a blood type of O+?

6) 2 cards are chosen from a deck of cards. The first card is replaced before choosing the second card. What is the probability that they both will be clubs?

7) 2 cards are chosen from a deck of cards. The first card is replaced before choosing the second card. What is the probability that they both will be face cards?

8) If the probability of receiving at least 1 piece of mail on any particular day is 22%, what is the probability of *not* receiving any mail for 3 days in a row?

9) You need to wrap a present for your friend’s birthday. You have to choose between 3 different wrapping papers, 4 types of bows and 2 cards. How many different ways can you wrap the present?

10) A teacher decides to give a 5 question multiple choice test. There are answer choices A, B, C, D and E for each question.

* 1. How many different ways could you select answers for the quiz?
  2. If you guess at random what is the probability that you will get them all correct?

**HW 8-4**

1. A card is chosen at random from a standard deck of cards. What is the probability that the card chosen is a heart **or** a face card?
2. What is the probability of choosing a number from 1 to 10 that is greater than 5 **or** even?
3. 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 letters in the word ENGLISH on it or randomly choosing a tile with a vowel on it?
4. What is the probability of choosing one card and having it be an Ace **or** a red card?
5. What is the probability of selecting **a** card from a deck and having it be a face card **and** black?
6. What is the probability of selecting **a** card that is a heart **and** less than 5 if aces are low?
7. A prepaid telephone calling card comes with a randomly selected 4-digit PIN, using the digits 1 through 9 without repeating any digits. What is the probability that the PIN for a card chosen at random does not contain the number 7?
8. What is the probability of selecting a card from a deck that is a diamond **or** a face card?
9. What is the probability of selecting a card that is black **or** an ace?
10. What is the probability of selecting a card from a deck and having it be:
    1. P(black and face) b. P(Diamond and not face card)

c. P(red or <9) d. P(red or Ace)

**Mid Unit Review**

1. In a High School of 1200 students, 900 students passed Math A, 700 students passed Math B, and 500 passed both Math A and Math B.
   1. How many students did not pass either Math A or Math B?
   2. What probability of choosing a student who only passed Math A only?
2. In a house made up of 9 rooms, 6 rooms have painted walls, 2 rooms have ceramic tiled walls, and 1 room has both painted and ceramic tiled walls.
   1. What is the probability of going into a room with painted walls only?
   2. What is the percentage of rooms that do not have painted or ceramic tiled walls?

3. In a standard deck of 52 cards, what is the probability of picking a red card or a 5?

4. When a fair die is tossed, what is the probability of getting a number divisible by both 2 and 3?

5. A newspaper poll was taken to determine the probable winner in an election for mayor. The probability that Andrews will win is 0.4, while the probability that Egan will win is 0.3. What is the probability that either Andrews or Egan will win?

6. Sal has a small bag of candy containing three green candies and two red candies. While waiting for the bus, he ate two candies out of the bag, one after another, without looking. What is the probability that both candies were the same color?

7: A license plate has 6 places and is made using the digits 0-9 and 26 letters of the alphabet A-Z.

1. How many license plates can be made if it must consist of 3 digits followed by 3 letters if **repetition is allowed?**
2. How many can be made the same way if **no repetition** is allowed?

8. The Freshman class obtains a 6 digit student ID number the first day. Dr. Savage is afraid there won’t be enough different possible student numbers available for next year’s Freshman. The anticipated enrollment is 340 students. The student ID number must begin with the digits 123. The only other problem is that the computer will not acknowledge the 4th digit if it is divisible by 5. Are there enough #s?

9. If 2 cards are selected at random without replacement what is the probability of selecting 2 face cards?

10. Pat goes to the store to buy a gift for her friend. She has 5 books, 10 albums, and 3 posters to choose from. She decides to buy a book or a poster and an album. How many different gifts could Pat choose from?

11. There are 7 rap CD’s, 5 jazz CD’s, and 9 country CD’s in a box. What is the probability that when selecting a CD at random from the box, it will either be a rap or jazz CD?

12. A locker combination can only use the digits 1, 2, 3, 4, 8, 9. How many different 3 digit combinations can be formed that are greater than 400?

13. There are 1200 people working in an office building. 750 people get to work by using an automobile, 900 people get to work using public transportation, and 650 people get to work by using both an automobile and public transportation. What is the probability people get to work without

using an automobile or public transportation?

14. Two cards are drawn from a deck of cards.

1. P(2 hearts) b. P(Jack then a 5) c. P(2Aces)

15. If a card is drawn from a deck of cards, what is the probability of getting a King or a Spade?

16. A group of 12 seniors, 14 Juniors and 14 sophomores are in a club. If a team of 6 students need to be selected, answer the following.

a) Ways that 2 seniors and 4 Juniors can be selected b. Ways 3 sophomores and 3 Juniors

c) Probability that all seniors will be selected. d) Probability that 2 Juniors and 4 seniors?

e) Probability that no sophomores are selected.

**HW 8-5**

**Conditional Probability**

1. Compete the following table using sums from rolling two dice. Us e the table to answer questions 2-5.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 |  |  |  |  |  |  |
| 2 |  |  |  |  |  |  |
| 3 |  |  |  |  |  |  |
| 4 |  |  |  |  |  |  |
| 5 |  |  |  |  |  |  |
| 6 |  |  |  |  |  |  |

1. 2 fair dice are rolled. What is the probability that the sum is even given that the first die rolled is a 2?
2. 2 fair dice are rolled. What is the probability that the sum is greater than 7, given that the first die rolled is a 5?
3. 2 fair dice are rolled. What is the probability that the sum is less than 10, given that the first die rolled is a 5?

|  |  |  |  |
| --- | --- | --- | --- |
|  | Freshman | Sophomores | Total |
| Bus riders | 132 | 112 |  |
| Carpool | 238 | 252 |  |
| Total |  |  |  |

1. In the table below what is the probability that a student picked at random is a:
   1. Bus rider and a freshman? b. Sophomore that carpools?

c. freshman given they are in carpool? d. bus rider given they are a sophomore?

1. At a local high school, the probability that a student speaks English and French is 15%. The probability that a student speaks French is 45%. What is the probability that a student speaks English, given that the student speaks French?

**HW 8-6 More Conditional probability**

1) A pair of dice is thrown. Find the probability that he numbers on the dice match given that their sum is greater than 7.

2) A pair of dice is thrown. Find the probability that their sum is greater than 7 if the numbers match.

3) A pair of dice are thrown. If their sum is greater than 5, find the probability that the dice match.

4) Bill has 7 red marbles and 5 white marbles. Mike has 4 red marbles and 3 white marbles. All of the marbles are placed in a box and one is selected at random. What is the probability the marble is white if it was one of Bills’ marbles?

5) Bill has 7 red marbles and 5 white marbles. Mike has 4 red marbles and 3 white marbles. All of the marbles are placed in a box and one is selected at random. If the marble is white, what is the probability the marble is one of Bills’?

6) In Congress, 70 % of the senators have brown hair, 40 % have blue eyes, and 30 % have both brown hair and blue eyes. If a senator has brown hair, what is the probability they will have blue eyes?

7) In Congress, 70 % of the senators have brown hair, 40 % have blue eyes, and 30 % have both brown hair and blue eyes. What is the probability a senator has brown hair if they will have blue eyes?

8) In a game played with a standard deck of cards, each face card has a value of 10, each ace has a value of 11 and each number card has a value equal to the number. Two cards are drawn. If one of the cards is the king of clubs, what is the probability the sum of the cards is greater than 19?

9) Three coins are tossed. What is the probability they are all heads if at least one is a heads?

**HW 7 Experimental vs. Theoretical**

1. A baseball collector checked 350 cards in case on the shelf and found that 85 of them were damaged. Find the experimental probability of the cards being damaged.
2. Jimmy rolls a number cube 30 times. He records that the number 6 was rolled 9 times. According to Jimmy's records, what is the experimental probability of rolling a 6?
3. John, Phil, and Mike are going to a bowling match. Suppose the boys randomly sit in the 3 seats next to each other and one of the seats is next to an aisle. What is the probability that John will sit in the seat next to the aisle?
4. In Mrs. Johnson's class there are 12 boys and 16 girls. If Mrs. Johnson draws a name at random, what is the probability that the name will be that of a boy?
5. Antonia has 9 pairs of white socks and 7 pairs of black socks. Without looking, she pulls a black sock from the drawer. What is the probability that the next sock she pulls out will also be black?
6. Lenny tosses a nickel 50 times. It lands heads up 32 times and tails 18 times. What is the experimental probability that the nickel lands tails?
7. A car manufacturer randomly selected 5,000 cars from their production line and found that 85 had some defects. If 100,000 cars are produced by this manufacturer, how many cars can be expected to have defects?



1. According to the ad, what is the probability that a dentist chosen at random does not agree that chewing DentaGum after meals reduces the risk of tooth decay?
2. Is this probability theoretical or experimental? How do you know?
3. Do you think that the this advertisement is trying to influence the consumer to buy DentaGum? Why or why not?
4. What could be done to make this advertisement more believable?