Unit 5

Probability

Math 2 - Spring 2018

# Day 1 – Basic Probability, Experimental Probability

**Probability** is the chance or likelihood of an event occurring.

**Sample Space:** The set of all possible outcomes.

**Example 1**: List the sample space, S, for each of the following:

1. Tossing a coin: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Drawing a marble from a bag that contains two red, three blue, and one white marble:

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Rolling a six-sided die: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Rolling two 6-sided dice. In the following table, record the **sums** of the two rolls. This table represents every possible outcome.



 Find the following probabilities:

 P(a 1 and a 4) P(a 1, then a 4) P(sum of 8)

 P(sum of 12) P(doubles) P(sum of 15)

**You Try:**

1. **Determine the sample space by listing the elements of the sample space in set notation and then determine the number of possible outcomes in that sample space.**

|  |  |  |
| --- | --- | --- |
| a) Rolling an 8 sided die.  | b) The letters in the word, Golf.  | c) The factors of 12  |
|  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_   | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_   | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_   |
| d) The digits in the number: 13430 | e) The sum of two dice.  |   |
| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_   |  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_   |
|  |  |  |
|  |  |  |

**2. Determine the sample space from the diagram - list the elements of the sample space in set notation.**

a) the numbers on the spinner b) the marbles in the bag c) positions of the basketball team



 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

d) the different countries e) the types of phone carriers

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Basic Probability**

 **Probability of an Event: P(E) = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

We will study two types of probability, theoretical and experimental.

**Theoretical Probability**: the probability of an event is the ratio or the number of favorable outcomes to the total possible outcomes.

**Example 2**: An experiment consists of tossing three coins.

1. List the sample space for the outcomes of the experiment (There are 8 possibilities).

 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Find the following probabilities:

 i. P(all heads) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ii. P(no heads) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

iii. P(two tails) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ iv. P(at least one tail) \_\_\_\_\_\_\_\_\_\_\_\_\_

**You Try 2**:

A bag contains six red marbles, four blue marbles, two yellow marbles and 3 white marbles. One marble is drawn at random.

1. List the sample space for this experiment.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Find the following probabilities:
	1. P(red) \_\_\_\_\_\_\_\_\_\_\_\_
	2. P(blue or white) \_\_\_\_\_\_\_\_\_\_\_\_
	3. P(not yellow) \_\_\_\_\_\_\_\_\_\_\_\_

**You Try 3**: On Mr. Smith’s bookshelf there are 4 mystery novels, 6 biographies, 2 romance novels, 10 science fiction books, and 8 action novels.

 a. List the sample space for selecting one book at random

 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 b. Find the following probabilities:

* + 1. P(mystery) \_\_\_\_\_\_\_\_\_\_\_\_
		2. P(romance or science fiction) \_\_\_\_\_\_\_\_\_\_\_\_
		3. P(not action) \_\_\_\_\_\_\_\_\_\_\_\_
		4. P(not biography and not mystery) \_\_\_\_\_\_\_\_\_\_\_\_\_

**Experimental Probability:** the ratio of the number of times the event occurs to the total number of trials.

P(Event) = Number or times the event occurs \*\*\*What actually happens when you simulate!

 Total number of trials

1. Roll a six-sided die and record the number on the die. Repeat this 9 more times

Group:

|  |  |  |
| --- | --- | --- |
| **Number** **on Die** | **Tally** | **Frequency** |
| 1 |  |  |
| 2 |  |  |
| 3 |  |  |
| 4 |  |  |
| 5 |  |  |
| 6 |  |  |
| **Total** |  | 10 |

Based on your data, find the following experimental probabilities:

 P(2) \_\_\_\_\_\_\_\_\_ P(3 or 6)\_\_\_\_\_\_\_\_\_\_ P(odd)\_\_\_\_\_\_\_\_\_\_ P(not a 4) \_\_\_\_\_\_\_\_\_\_\_

\*How does the experimental probabilities compare to the theoretical probabilities in Part 1? Why do you think they are the same or different?

1. **Combine the frequencies of all the groups** in your class with your data and complete the following table:

|  |  |
| --- | --- |
| **Number** **on Die** | **Frequency** |
| 1 |  |
| 2 |  |
| 3 |  |
| 4 |  |
| 5 |  |
| 6 |  |
| **Total** |  |

Based on the whole class data, find the following experimental probabilities:

P(2) \_\_\_\_\_\_\_\_\_\_ P(3 or 6)\_\_\_\_\_\_\_\_\_\_\_ P(odd)\_\_\_\_\_\_\_\_\_\_\_ P(not a 4)\_\_\_\_\_\_\_\_\_\_

\*\*How do these compare to your group’s probabilities? How do these compare to the theoretical probabilities from Part 1?

\*\*\*What do you think would happen to the experimental probabilities if there were 200 trials? 500 trials? 1000 trials? 1,000,000 trials?

\*\*\*\*When would you expect the probability of an event occurring to be 1, or 100%? Describe an event whose probability of occurring is 1.

\*\*\*\*\*When would you expect the probability of an event occurring to be 0, or 0%? Describe an event whose probability of occurring is 0.

Practice:

1. 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?
2. 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?
3. 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?

## Day 1 Homework:

1. Suppose a box contains three balls, one red, one blue, and one white. One ball is selected, its color is observed, and then the ball is placed back in the box. The balls are scrambled, and again, a ball is selected and its color is observed. What is the sample space of the experiment?
2. Suppose you have a jar of candies: 4 red, 5 purple and 7 green. **Find the following probabilities** of the following events: Selecting a red candy.

Selecting a purple candy.

Selecting a green or red candy.

Selecting a yellow candy.

Selecting any color except a green candy.

1. A spinner for the new board game “Spinner of Awesomness” has 4 different colors. The colors are red, blue, yellow, green.
2. What is the sample space for a single spin of a spinner with red, blue, yellow and green sections spinner?
3. What is the sample space for 2 spins of the first spinner?
4. If the spinner is equally likely to land on each color, what is the probability of landing on red in one spin?
5. What is the probability of landing on a primary color in one spin?
6. What is the probability of landing on green both times in two spins?
7. 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? Show your work.
8. 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?
9. 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?

Day 2 – Basic Probability & Venn Diagrams

**Intersection of two sets (A ∩ B):** The set of elements that are **in common** from both sets A and B.

**Union of two sets (A ∪ B):** The set of **all elements** in set A or B.

**Example #1:**  Given the following sets, A = {1,3,5,7,9,11,13,15} B = {0,3,6,9,12,15}

 find A ∩ B and A ∪ B

 A ∩ B = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ A ∪ B = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**You Try:** Given the following sets, A: {2,4,6} B: {1,2,3}

 find A ∩ B and A ∪ B.

A ∩ B = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ A ∪ B = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Venn Diagram:** A visual representation of sets and their relationships to each other using overlapping circles.

**Example #2**: Use the Venn Diagram to answer the following questions:

* + 1. What are the elements of set A?

B: Factors of 16

A: Factors of 12

* + 1. What are the elements of set B?

 8 16

1

2

4

 3 6 12

* + 1. Why are 1, 2, and 4 in both sets?
		2. What is A ∩ B?
		3. What is A ∪ B?

**You Try**: 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.

1. Put this information into a Venn Diagram. If the sample space, S, is the set of all students in the class, let students in band be set B and students in chorus be set C.
2. What is B ∪ C? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. What is B ∩ C? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Answer Questions about the diagram below

### Fall Sports Winter Sports

 **Spring Sports**

 **Spring Sports**

1. How many students play sports year-round?
2. How many students play sports in the spring and fall?
3. How many students play sports in the winter and fall?
4. How many students play sports in the winter and spring?
5. How many students play only one sport?
6. How many students play at least two sports?

**Compliment of a set:** the set of all elements NOT in the set.

* Set P = {-3,-2,-1,0,1,2,3,4}

A = {-2,0,2,4}

If A is a subset of Set P, what is AC? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Example #3**: Use the Band/Chorus Venn Diagram to find the following: B: Band; C: Chorus

1. What is BC? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ CC? \_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. What is (B ∩ C)C? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\*\*Note that **P(AC)** is every outcome **except (or not)** A, so we can find P(AC) by finding\_\_\_\_1 - P(A)\_\_\_\_\*\*

**You Try:**

What is Ac ?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



What is Bc ? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1

2

4

A: Factors of 12

B: Factors of 16

 3 6 12

 8 16

What is (A ∩ C)C? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Odds -** compare the number of favorable and unfavorable outcomes. You **do not use** **the total number of outcomes**.

The **odds in favor** of an event occurring are equal to the ratio of $\frac{favorable outcomes}{unfavorable outcomes}$

The **odds against** of an event occurring are equal to the ratio of $\frac{unfavorable outcomes}{favorable outcomes}$

**Example #4**: The weather forecast for Saturday says there is a 75% chance of rain. What are the odds that it will rain

 on Saturday?

* What does the 75% in this problem mean?
* The favorable outcome in this problem is that it rains:
* Odds(rain) =
* Should you make outdoor plans for Saturday?

**You Try:**

What are the odds of rolling a 5 on a 6 sided dice?

 What are the odds against rolling a 3 on a 6 sided dice?

 What are the odds of choosing an even number from 1 – 15?

 What are the odds against choosing a vowel in the alphabet (do not count y as a vowel)?

Day 2 Homework:

1. Tyrion is rolling a die that has the numbers 1 through 15 on it. Assume we define the following events:

**Set A: 1, 3, 5, 7, 9, 11, 13, 15 Set B: 5, 6, 7, 8, 9, 10**

Create a Venn Diagram for the information above

1. Find the $P(A∪B)$ for the experiment \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. Find the $P(A∩B)$ for the experiment \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3. What are the odds of rolling an even number? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

4. What are the odds against rolling a multiple of 2? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

5. What is Ac ? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

6. What is Bc ? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

7. What is (A $∪B$)c ?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

8. What is $(A∩B)$c ?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

9. Suppose a box contains three balls, one red, one blue, and one white. One ball is selected, its color is observed, and then the ball is placed back in the box. The balls are scrambled, and again, a ball is selected and its color is observed. What is the sample space of the experiment? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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

Selecting a red candy. \_\_\_\_\_\_\_\_\_\_\_\_\_\_

Selecting a purple candy. \_\_\_\_\_\_\_\_\_\_\_\_

Selecting a green or red candy.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Selecting a yellow candy. \_\_\_\_\_\_\_\_\_\_\_\_\_\_

Selecting any color except a green candy.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Find the odds of selecting a red candy.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Find the odds of selecting a purple or green candy.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

# Day 3 – Independent vs Dependent Events

**Independent Events:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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

 Explain why these events are independent. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Dependent Events:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Probabilities of Dependent Events**

* For dependent events, the number of possible outcomes for later events changes. This means that you need to think about whether the numerator and/or denominator changes.

***Let’s look at an example of independent events that can be done with a sample space. Fill in the table below showing the possible outcomes of tossing a die and flipping a coin.***

**Example 1: Fill in the table to describe the sample space:**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Roll 1** | **Roll 2** | **Roll 3** | **Roll 4** | **Roll 5** | **Roll 6** |
| **Head** |  |  |  |  |  |  |
| **Tail** |  |  |  |  |  |  |

* How many outcomes are there for rolling the die? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* How many outcomes are there for tossing the coin? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* How many outcomes are there in the sample space of rolling the die and tossing the coin? \_\_\_\_\_\_\_\_\_\_\_\_

Because our events have only a few possibilities, our sample space is relatively small. But, what happens if we were to have more possibilities.

Easier way to find all the possibilities than to list out the sample space:

**Fundamental Counting Principle:** a math rule, **using multiplication**, that allows you to find the number of ways that a combination of events can occur.

**Example 1:** Determine the number of possible outcomes (the sample space) if you are trying to choose what to wear when you have 5 shirts and 6 pairs of pants to choose from.

**You Try 1:** You are picking classes for your fall semester schedule. There are 2 possible math classes, 3 possible science classes, 5 possible social studies classes, and 10 electives. If you have to have one of each, how many possibilities are there?

**Multiplication Rule of Probability**

* The probability of two independent events occurring can be found by the following formula:

 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Example 2:** Bobby and Mikey are picking marbles from a bag. In the bag there are 4 red marbles, 5 blue marbles, and 6 white marbles. Bobby picks first, puts his marbles back in the bag, then Mikey picks his marble.

1. What is the probability that Bobby picks red and Mikey picks blue?
2. What is the probability that Bobby picks blue and Mikey picks red?
3. What is the probability that Bobby and Mikey both pick red?

**Example 3:** Kyle and Erin were selected for the opportunity to reach into a bag pull out some money. In the bag there are 10 $1 bills, 5 $5 bills, and 3 $10 bills and 2 $20 bills.

1. What is the probability that Kyle picks a $5 bill and Erin picks a $20 bill?
2. What is the probability that Kyle picks a $10 bill and Erin picks a $5 bill?
3. What is the probability that Kyle and Erin each pick a $5 bill?

**You Try :** A box contains 5 red marbles and 5 purple marbles.

1. What is the probability of drawing 2 purple marbles and 1 red marble in succession *without replacement*?
2. What is the probability of drawing 2 red marbles and 1 purple marble in succession *without replacement*?
3. What is the probability of drawing 1 purple marbles and 1 red marble in succession *without replacement*?
4. What is the probability of drawing 2 purple marbles, then 1 red marble, then another purple marble in succession *without replacement*?
5. What is the probability of drawing 1 purple marble, then 2 red marbles, then another purple marble, then another red marble in succession *without replacement*?







Practice:

 

Day 3 Homework:

1. You download 6 songs. You randomly choose 4 of the songs to play. How many different combinations of the four

 songs are there?

2. You can take 5 friends to a concert. You have 9 friends who want to go. How many different combinations of friends

 can you take to the concert?

3. You have the letters A L G E B R A in a bag. You pull out an A and keep it out. What is the probability that the next

 letter you pull out is an L?

4. You have the letters A L G E B R A in a bag. What is the probability of pulling a G, replacing it and then pulling an A?

5. Rolling a 6 on the first die and rolling an odd number on the second die.

6. Flipping a tail on a coin and spinning a 5 on a spinner with equal sections labeled 1-5.

7. You have nine cards labeled 1-9. Find the probability of drawing a 1,2 or 3 , replacing the card, then drawing a

 7, 8 or 9.

8. There are 4 black marbles and 2 white marbles in a bag. What is the probability of choosing a black marble, not

 replacing it, then choosing a white marble?

9. A bag contains 6 black and 4 red checkers. Find the probability of drawing a black checker, replacing it, and drawing

 another black checker.

10. A jar contains 6 red balls, 3 green balls, 5 white balls and 7 yellow balls. Two balls are chosen from the jar, with

 replacement. What is the probability that both balls chosen are green?

11. A box contains a penny, nickel, and a dime. Find the probability of choosing a dime first, and then without replacing

 it, choosing a penny.

12. A coin is tossed and a single 6-sided die is rolled. Find the probability of landing on heads and rolling a 3.

13. The teacher of a class that contains 12 boys and 16 girls needs to pick 2 volunteers. She randomly selects one

 student, and then selects another student. Find the probability that

 a) she chooses a girl first, then a boy

 b) she chooses 2 boys

14. A bag contains 9 black checkers and 6 red. Find the probability of drawing a red, replacing it, then drawing another

 red.

## Day 4: Independent and Dependent Probability Practice

1. A coin and a die are tossed. Calculate the probability of getting tails and a 5. \_\_\_\_\_
2. In Tania's homeroom class, 15% of the students were born in March and 56% 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+? \_\_\_\_\_\_\_\_\_\_
3. Three coins are tossed one after the other.
	1. List the sample space for the three flipped coins \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	2. Find the probability getting **exactly** 2 heads. \_\_\_\_\_\_\_\_\_
	3. Find the probability getting **at least** 2 tails. \_\_\_\_\_\_\_\_\_\_
4. If the probability of receiving at least 1 piece of mail on any particular day is 45%, what is the probability of *not* receiving any mail for 4 days in a row? \_\_\_\_\_\_\_\_\_\_
5. What is the probability of drawing 2 face cards one after the other from a standard deck of cards *without replacement*?\_\_\_\_\_\_\_\_\_
6. Bobby needs 35 cents to pay for lunch. There are 3 quarters, 7 dimes, 13 nickels, and 27 pennies in Jonah's piggy bank. If Jonah chooses 2 of the coins at random one after the other, what is the probability that he will grab a quarter and then grab a dime? Assume that the first coin is not replaced.
7. A bag has 26 tiles (one for each letter of the alphabet).

a. What is the probability of reaching in the bag and choosing a tile with one of the first 4 letters of the alphabet OR a vowel?

b. What is the probability of reaching in the bag and choosing a tile with one of the first 4 letters of the alphabet AND a vowel?

1. Shannon did a survey of the students in her classes about whether they liked to get a brownie or a cookie as a special treat. She asked all 90 students in the class. 53 wanted a brownie, 21 wanted a cookie, and 11 wanted both. If Shannon were to select a student at random:

a) What is the probability that they wanted a brownie or a cookie?

b) What is the probability that they did not want either a brownie nor a cookie?

1. Preston has 20 PAIRS of white socks and 24 PAIRS of black socks. Without looking, he pulls a black sock from the drawer. What is the probability that the next sock (not socks) will be black also?
2. A coin and a die are tossed. What is the probability of getting a heads and a 3?
3. A card is chosen, replaced, then another is chosen. What is the probability of both cards being a Ten?
4. 2 cards are chosen. What is the probability that both are clubs, assuming the first card is not replaced?
5. What is the probability of choosing a club or a face card from a deck of cards (you are only drawing one card)?
6. If you choose a number 1-10, what is the probability of choosing an even number and a number greater than 8?
7. If you choose a number 1-10, what is the probability of choosing an even number or a number greater than 8?
8. Alan, Brooke, Candice, and Dylan are selected to participate in a game where they pick money out of a bag. The bag contains 20 $10 bills, 12 $20 bills, 6 $50 bills, and 2 $100 bills. After someone picks a bill, they keep that bill and do not put it back into the bag. (*Without Replacement*)
	1. What is the probability that Alan picks a $20 bill?
	2. What is the probability that Brooke picks a $50 bill and then Dylan picks a $10 bill?
	3. What is the probability that Alan picks a $100 bill, then Candice picks a $10 bill, then Brooke picks a $20 bill?
	4. What is the probability that Dylan, Alan, and Candice all pick $10 bills?

Day 4 Classwork Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Dr. Thomas has infected Captain Amazing with a combination of deadly viruses. Captain Amazing was able to find

 Dr. Thomas’ lab which was full of different vials and potions. There are 9 green vials, 6 purple vials, and 3 black vials.

 a) If there are 3 vials that could cure Captain Amazing, what is the probability that he is able to pick a vial that

 contains a cure?

 b) Dr. Thomas has cut the power to his lab to try and thwart Captain Amazing. Since he cannot see what he is

 grabbing due to the darkness,

 i. What is the probability that Captain Amazing grabs 1 green vial?

 ii. What is the probability that Captain Amazing grabs 1 purple vial?

 iii. What is the probability that Captain Amazing grabs 2 black vials?

* 1. What is the probability that Captain Amazing grabs 1 green vial, then grabs 1 purple vial

(w/o replacement)?

* 1. What is the probability that Captain Amazing grabs 1 black vial, then grabs 1 green vial, then grabs

another black vial (w/o replacement)?

 c) While the power was out 4 green vials and 2 purple vials were smashed. What is the probability that Captain

 Amazing is able to select a black vial from the remaining vials?

2. Nicholas loves his video games and has a huge collection of them. His collection has 10 Role-playing games,

 15 Shooter games, and 20 Sports games. Mickey comes over to borrow a video game. Mickey picks the games at

 random since he doesn’t care what games he gets to play.

 a) What is the probability that Mickey picks a shooter game?

 b) What is the probability that Mickey picks a sports game?

 c) What is the probability that Mickey picks a role playing game, then picks a shooter game (w/o replacement)?

 d) what is the probability that Mickey picks a sports game, then another sports game, then a third sports game

 (w/o replacement)?

3. Officer Smythe is trying to defuse a bomb that was set by Dr. Thomas to destroy Hero City. After opening the bomb,

 officer Smythe sees 4 red wires, 6 green wires, 3 black and 2 blue wires.

 a) What is the probability that Officer Smythe cuts a red wire to defuse the bomb?

 b) What is the probability that Officer Smythe cuts a red or a green wire to defuse the bomb?

 c) What is the probability that Officer Smythe cuts a wire that is not blue to defuse the bomb?

 d) What is the probability that Officer Smythe cuts a green wire, then cuts a blue wire, then a black wire?

 e) What is the probability that Officer Smythe cuts a red, then a green, then another red?

4. The Grinch has been raiding Whoville stealing things that remind him of Christmas. He has 4 ornaments, 3 stockings,

 2 christmas wreaths and a Christmas tree. You sneak into his dark cave to steal holiday items back from him.

 a) What is the probability that you steal 1 ornament?

 b) What is the probability that you steal 1 wreath?

 c) What is the probability that you steal 1 stocking and then 1 ornament?

 d) What is the probability that you steal 2 ornaments and 1 wreath?

 e) What is the probability that you do not steal the Christmas tree?

5. Dr. Thomas has used the chaos and is making Lady Justice play a deadly game. He has placed 5 red bombs and 5

 black bombs in a box. In each round you have to pick bombs and then place it back into the box.

 a) In round one, what is the probability that Lady Justice picks a red bomb and then a black bomb?

 b) In round two, what it he probability that Lady Justice picks a red and then another red?

 c) In round three, what is the probability that Lady Justice picks 3 black bombs in a row?

 d) In round four, what is the probability that Lady Justice picks 6 red bombs in a row?

## Day 4 Homework - Independent vs Dependent

1. A coin and a die are tossed. Calculate the probability of getting tails **and** a 5.
2. What is the probability of tossing 2 coins one after the other and getting 1 head and 1 tail?
3. Thomas bought a bag of jelly beans that contained 10 red jelly beans, 15 blue jelly beans, and 12 green jelly beans. What is the probability of Thomas reaching into the bag and pulling out a blue or green jelly bean and then reaching in again and pulling out a red jelly bean? Assume that the first jelly bean is not replaced.
4. For question 10, what if the order was reversed? In other words, what is the probability of Thomas reaching into the bag and pulling out a red jelly bean and then reaching in again and pulling out a blue or green jelly bean *without replacement*?
5. There are 3 quarters, 7 dimes, 13 nickels, and 27 pennies in Jonah's piggy bank. If Jonah chooses 2 of the coins at random one after the other, what is the probability that the first coin chosen is a nickel and the second coin chosen is a quarter? *Assume that the first coin is not replaced.*
6. For question 13, what is the probability that neither of the 2 coins that Jonah chooses are dimes? *Assume that the first coin is not replaced.*
7. Jenny bought a half-dozen doughnuts, and she plans to randomly select 1 doughnut each morning and eat it for breakfast until all the doughnuts are gone. If there are 3 glazed, 1 jelly, and 2 plain doughnuts, what is the probability that the last doughnut Jenny eats is a jelly doughnut?
8. Tara, Megan, and Sasha need to interview people to get quotes for the year book. They each decide to pick someone from Mr. Maestro’s first period because it has 3 freshman, 8 sophomores, 12 juniors, and 7 seniors. The people are not taken out of class and can be picked by more than one person. (*With Replacement*)
	1. What is the probability that Tara picks a senior from the class?
	2. What is the probability that Tara picks a junior and Megan picks a freshman?
	3. What is the probability that Megan and Sasha both pick sophomores from the class?

**Day 5 – Practice & Quiz 1**

1. Bag A contains 9 red marbles and 3 green marbles. Bag B contains 9 black marbles and 6 orange marbles.

 Find the probability of selecting a green marble from Bag A and one black marble from Bag B.

2. A box contains 5 purple marbles, 3 green marbles and 2 orange marbles. Two consecutive draws are made

 from the box **without replacement** of the first draw. Find the probability of each event.

 a) P(orange first, then green)

 b) P( both marbles are purple)

 c) P (purple first, then any color except purple)

3. Two seniors, one from each government class are randomly selected to travel to Washington DC. Wes is in a

 class of 18 students and Maureen is in a class of 20 students. Find the probability that both Wes and

 Maureen will be selected. Are these independent or dependent?

4. If there was only one government class, and Wes and Maureen were in that class of 38 students, what would

 be the probability that both Wes and Maureen would be selected as the two students to go to Washington?

 Is this an example of independent or dependent probabilities?

5. A 6-sided die is rolled and a spinner with the letters A-Z is spun.

 a) How many outcomes are there?

 b) P(1 and A)

 c) P (odd and B)

6. In a bag there are 2 red marbles, 3 white marbles and 5 blue marbles. Once a marble is selected, it is NOT

 replaced. Find the following probabilities.

 a) P (red, then white)

 b) P (blue, then red)

 c) P (red, red, red)

 d) P (blue, blue, white)

7. In a bag there are 2 red marbles, 3 white marbles and 5 blue marbles. Once a marble is selected, it IS

 replaced. Find the following probabilities.

 a) P (white, then blue)

 b) P (white, then white)

 c) P (blue, blue, blue)

 8. A bag contains 12 purple marbles and 8 blue marbles. You choose a marble at random.

 a) What is the probability of selecting a purple marble?

 b) You randomly select 2 marbles, one right after the other. What is the probability that you pick a purple

 marble, followed by a blue marble? The first marble was not replaced.

 c) With replacement,

9. A bucket contains 10 tennis balls labeled: A, A, B, C, C, C, C , D, E, E

 a) What is the probability of pulling a ball labeled with C?

 b) What is the probability of drawing a ball labeled with something other than a B?

 c) Sam reaches into the bucket and pulls out two tennis balls. She pulls out an A and does not return it.

 What is the probability that the second tennis ball will be another A?

 d) What is the probability of pulling an E, not replacing it, and then pulling a C?

 e) What is the probability of pulling an A or B?

10. The manager at a Mexican Restaurant tracked a random sample of customers so that he could order correctly for the upcoming week. The table shows the results of a random sample of 60 customers’ orders. The manager knows that on average, the restaurant serves 2500 meals per week.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Type of Meal** | **Chicken** | **Beef** | **Pork** | **Veggie** |
| **Burrito** | 11 | 9 | 6 | 5 |
| **Bowl** | 3 | 5 | 1 | 7 |
| **Salad** | 4 | 1 | 0 | 1 |
| **Tacos** | 2 | 3 | 2 | 0 |

a) Based on the results of the sample, how many chicken burritos should the manager have ordered for the next week?

 b) Based on the results of the sample, how many tacos should be ordered for next week?

c) If a customer were randomly chosen, what is the probability that that customer ordered a Beef Burrito?

d) If a customer were randomly chosen, what is the probability that that customer ordered a salad?

# Day 6 – Mutually Exclusive vs. Inclusive Events

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

* Can these both occur at the same time? Why or why not? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Mutually Exclusive Events:**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

To find the probability of one of two **mutually exclusive** events occurring, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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

Are these mutually exclusive events? Why or why not? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Complete the following statement: P(odd or even) = P(\_\_\_\_\_\_\_) + P(\_\_\_\_\_\_\_)

Now fill in with numbers:

P(odd or even) = \_\_\_\_\_\_\_\_\_ + \_\_\_\_\_\_\_\_\_\_ = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 Does this answer make sense?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Example 2:** If you randomly chose one of the integers from 1 to 10, what is the probability of choosing a number that is either less than 3 **or** bigger than 7?

**You Try 1:** Cassidy is looking for someone to take her to Homecoming this year. She has been asked by 3 freshmen, 5 sophomores, 10 juniors, and 22 seniors. What is the probability that she will choose to go with someone who is a sophomore **or** someone who is a junior?

**You Try 2:** The Football Championship can only be one by one team. There are 3 teams from the south, 4 teams from the Midwest, 2 teams from the west, and 1 team from the east how could win the title. What is the probability that the National Champion will be from either the Midwest or the west?

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

* Can these both occur at the same time? If so, when? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Mutually Inclusive Events: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Probability of the Union of Two Events: The Addition Rule:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**\*\*\*\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\*\*\***

**Example 3:** Here is a set of data for a school about the favorite sports:

|  |  |  |  |
| --- | --- | --- | --- |
|  | Football | Basketball | **Total** |
| North Carolina | 140 | 320 | 460 |
| Duke | 80 | 260 | 340 |
| **Total** | 220 | 580 | 800 |

1. How many people like Carolina?\_\_\_\_\_\_\_\_ What is the probability that someone surveyed likes Carolina?\_\_\_\_\_\_
2. How many people like basketball?\_\_\_\_\_\_\_\_ What is the probability that someone surveyed likes basketball?\_\_\_\_\_\_
3. How many people like both Carolina and basketball? \_\_\_\_\_\_\_\_\_\_\_ (This is the overlap)
4. What is the probability that someone surveyed likes Carolina **or** basketball? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Example 4:** 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?

**You Try 3:** If you randomly chose one of the integers from 1 to 10, what is the probability of choosing a number that is either even **or** bigger than 7?

**You Try 4:** 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?

## Probability Practice

1. There are 3 literature books, 4 algebra books, and 2 biology books on a shelf. If a book is randomly selected, what is the probability of selecting a literature book or an algebra book?
2. There are 8 girls and 8 boys on the student senate. Three of the students are seniors. What is the probability that a person selected from the student senate is not a senior?
3. A die is rolled. What is the probability of rolling a 5 or a number greater than 3?
4. Keisha has a stack of 8 baseball cards, 5 basketball cards, and 6 soccer cards. If she selects a card at random from the stack, what is the probability that it is a baseball or a soccer card?
5. In the Math Club, 7 of the 20 girls are seniors, and 4 of the 14 boys are seniors. What is the probability of randomly selecting a boy or a senior to represent the Math Club at a statewide math contest?
6. One tile with each letter of the alphabet is placed in a bag, and one is drawn at random. What is the probability of selecting a vowel or a letter from the word *equation*?
7. A die is rolled. What is the probability of rolling a 2 or a 6?

Sylvia has a stack of playing cards consisting of 10 hearts, 8 spades, and 7 clubs. If she selects a card at random from this stack, what is the probability that it is a heart or a club?

## Day 6 Homework - Mutually Exclusive and Inclusive Events

1. 2 dice are tossed. What is the probability of obtaining a sum equal to 6?
2. 2 dice are tossed. What is the probability of obtaining a sum less than 6?
3. 2 dice are tossed. What is the probability of obtaining a sum of at least 6?
4. Thomas bought a bag of jelly beans that contained 10 red jelly beans, 15 blue jelly beans, and 12 green jelly beans. What is the probability of Thomas reaching into the bag and pulling out a blue or green jelly bean?
5. 3 coins are tossed simultaneously. What is the probability of getting 3 heads or 3 tails? Are these events mutually exclusive?
6. In question 6, what is the probability of getting 3 heads *and* 3 tails when tossing the 3 coins simultaneously?
7. Are randomly choosing a person who is left-handed and randomly choosing a person who is right-handed mutually exclusive events? Explain your answer.
8. Suppose 2 events are mutually exclusive events. If one of the events is randomly choosing a boy from the freshman class of a high school, what could the other event be? Explain your answer.
9. Consider a sample set as . Event is the multiples of 4, while event is the multiples of 5. What is the probability that a number chosen at random will be from both and ?
10. What is the probability of choosing a number from 1 to 10 that is greater than 5 or even?
11. Are randomly choosing a teacher and randomly choosing a father mutually exclusive events? Explain your answer.

**Day 7: Mutually Exclusive and Inclusive Events cont.**

**Find each probability.**

1. There are 3 literature books, 4 algebra books, and 2 biology books on a shelf. If a book is randomly selected, what is the probability of selecting a literature book or an algebra book?

2. A die is rolled. What is the probability of rolling a 5 or a number greater than 3?

3. In the Math Club, 7 of the 20 girls are seniors, and 4 of the 14 boys are seniors. What is the probability of randomly selecting a boy or a senior to represent the Math Club at a statewide math contest?

4. One tile with each letter of the alphabet is placed in a bag, and one is drawn at random. What is the probability of selecting a vowel or a letter from the word *equation*?

5. Each of the numbers from 1 to 30 is written on a card and placed in a bag. If one card is drawn at random, what is the probability that the number is a multiple of 2 (2,4,6,8,….) or a multiple of 3 (3,6,9,12….)?

6. Keisha has a stack of 8 baseball cards, 5 basketball cards, and 6 soccer cards. If she selects a card at random from the stack, what is the probability that it is a baseball or a soccer card?

7. There are 8 girls and 8 boys on the student senate. Three of the students are seniors. What is the probability that a person selected from the student senate is not a senior?

8. A die is rolled. What is the probability of rolling a 2 or a 6?

9. Using a standard and fair six-sided die, what is the probability of rolling a 2 or a 5?

10. Using a standard and fair six-sided die, what is the probability of rolling an odd number or a

number greater than 4?

11. A bag contains 4 blue marbles, 3 red marbles, and 2 yellow marbles. If a marble is randomly

selected, what is the probability of selecting a red or a blue marble?

12. Using a standard and fair six-sided die, what is the probability of rolling at least a 2?

13. Using a standard and fair six-sided die, what is the probability of rolling an even number or a

number greater than 3?

14. There are 2400 subscribers to an Internet service provider. Of these, 1200 own Brand A

computers, 500 own Brand B, and 100 own both A and B. What is the probability that a

subscriber selected at random owns either Brand A or Brand B?

15. Below are the counts (in thousands) of earned degrees in the United States in a recent year, classified by level and by the sex of the degree recipient. **One person is selected at random**, find the following probabilities.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  **Bachelor’s**  | **Master’s**  | **Professional**  | **Doctorate**  | **Total**  |
| **Female**  | 616  | 194  | 30  | 16  | 856  |
| **Male**  | 529  | 171  | 44  | 26  | 770  |
| **Total**  | 1145  | 365  | 74  | 42  | 1626  |

 a. Probability of a female. b. Probability of having a master’s degree.

 c. Probability of a female and a doctorate. d. Probability of a male and bachelor’s.

 e. Probability of master’s or professional. f. Probability of female or bachelor’s.

 g. Probability of male or female. h. Probability of bachelor’s or male.

**For Problems # 16-18, five years after 650 high school seniors graduated, 400 had a college degree and 310 were married. 200 of the students with college degrees were married.**

 16. What is the probability that a student has a college degree or is married?

 17. What is the probability that a student has a college degree or is not married?

 18. What is the probability that a student does not have a college degree or is married?

Day 7 Homework:

 1. Jack is a student in Bluenose High School. He noticed that a lot of the students in his math class were also in his

 chemistry class. In fact, of the 60 students in his grade, 28 students were in his math class, 32 students were in his

 chemistry class, and 15 students were in both his math class and his chemistry class. He decided to calculate what

 the probability was of selecting a student at random who was either in his math class or his chemistry class, but

 not both. **Draw a Venn diagram** and help Jack with his calculation.

* 1. Are these events mutually exclusive?
	2. Find P(Math or Chemistry)
	3. Find P(Math and Chemistry)
	4. What is the difference between b. and c.?
1. Brenda did a survey of the students in her classes about whether they liked to get a candy bar or a new math pencil as their reward for positive behavior. She asked all 71 students she taught, and 32 said they would like a candy bar, 25 said they wanted a new pencil, and 4 said they wanted both.

Given this information, fill in the two-way table:

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Pencil** | **No Pencil** | **Total** |
| **Candy Bar** |  |  |  |
| **No Candy Bar** |  |  |  |
| **Total** |  |  |  |

If Brenda were to select a student at random from her classes, what is the probability that the student chosen would want:

* 1. a candy bar or a pencil?
	2. neither a candy bar nor a pencil?
1. A box contains different colors of ping pong balls. There are 7 red, 12 purple, 5 green, 3 yellow and 3 white balls.
2. What is the probability of reaching in the box and grabbing a purple ball?
3. What is the probability of reaching in the box and pulling out a red ball, then a green ball, without replacement?
4. What is the probability of reaching in the bag and pulling out a red ball, then another red ball, then a yellow ball, with replacement?
5. What is the probability of reaching in the bag and pulling out a red ball, then another red ball, then a yellow ball, without replacement?
6. What is the probability of reaching in the bag and pulling out a white ball or a green ball?

# Day 8: Probability Practice & Quiz 2

1. The Country of Transam is getting ready to select participants for the annual “Starving Games.” In District 24 there

 are a total of 2000 entries. Penny has 10 entries, Bernadette has 200 entries and Leonard has 400 entries.

 a) What is the probability that Penny’s entry will be selected?

 b) What is the probability that Penny’s entry will **not** be selected?

 c) What is the probability that either Bernadette’s entry or Leonard’s entry will be selected?

2. The table below shows the results of classes being asked for their favorite pet:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Dogs | Cats | Birds | Total |
| Boys | 46 | 24 | 10 | 80 |
| Girls | 30 | 42 | 8 | 80 |
| Total | 76 | 66 | 18 | 160 |

 a) What is the probability of selecting someone who likes dogs?

 b) What is the probability of selecting a girl who likes cats?

 c) What is the probability of selecting someone who likes cats or someone who likes birds?

 d) What is the probability of selecting a boy or someone who likes dogs?

 e) What is the probability of selecting a girl or someone who likes birds?

3. In Timmy’s school there are 300 people in the 11th grade. Currently 200 11th graders are taking English, 160 11th

 graders taking US History, and a total of 80 11th graders are taking both.

 a) What is the probability of selecting an 11th grader who is taking English?

 b) What is the probability of selecting an 11th grader who is taking either English or US History?

4. Three coins are tossed one after the other.

 a) List the sample space for the three flipped coins

 b) Find the probability getting **exactly** 2 heads

 c) Find the probability of getting **at least** 2 heads

5. Shannon did a survey of the students in her classes about whether they liked to get a brownie or a cookie as a special

 treat. She asked all 90 students in the class. 53 wanted a brownie, 21 wanted a cookie, and 11 wanted both. If

 Shannon were to select a student at random:

 a) What is the probability that they wanted a brownie or a cookie?

 b) What is the probability that they did not want either a brownie nor a cookie?

6. If you choose a number 1-10, what is the probability of choosing an even number and a number greater than 8?

7. If you choose a number 1-10, what is the probability of choosing an even number or a number greater than 8?

8. At Fowlerville High School there are a total of 36 people who are enrolled in English III, a total of 48 people who are

 enrolled in U.S. HIstory, 12 people who are enrolled in English III and U.S. History, and 15 people who are not enrolled

 in either English III or U.S. History. Fill in the venn diagram for the information that is given.

**On a bookcase there are 4 mystery books, 3 romance books, 2 sci-fi books, and 1 non-fiction book.**

9. List the sample space for drawing a marble from the bag.

10. What is the probability of picking a mystery book from the bookcase?

11. What is the probability of picking a sci-fi book from the bookcase?

12. What is the probability of picking a romance or a mystery book from the bookcase?

13. What is the probability of picking a book that is not a romance book?

Day 8 Homework:

1. In a bag there are 2 red marbles, 3 white marbles and 5 blue marbles. Once a marble is selected, it IS

 replaced. Find the following probabilities.

a) P (white, then blue)

b) P (white, then white)

c) P (blue, white, red)

d) P (blue, blue, blue)

2. Find the number of possible outcomes in the sample space.

a) You toss 4 coins.

b) You roll a six-sided die and toss 2 coins.

c) You have 5 shirts, 4 pairs of paints and 6 pairs of shoes. How many outfits could you make?

3. A bag contains 12 purple marbles and 8 blue marbles. You choose a marble at random.

a) What is the probability of selecting a purple marble?

b) You randomly select 2 marbles, one right after the other. What is the probability that you pick a purple marble, followed by a blue marble? The first marble was not replaced.

c) With replacement, what is the probability of pulling a purple marble, followed by another purple marble?

4. A bucket contains 10 tennis balls labeled: A, A, B, C, C, C, C , D, E, E

a) What is the probability of pulling a ball labeled with C?

b) What is the probability of drawing a ball labeled with something other than a B?

c) Sam reaches into the bucket and pulls out two tennis balls. She pulls out an A and does not return it. What is the probability that the second tennis ball will be another A?

d) What is the probability of pulling an E, not replacing it, and then pulling a C?

e) What is the probability of pulling an A or B?

5. The manager at a Mexican Restaurant tracked a random sample of customers so that he could order correctly for the upcoming week. The table shows the results of a random sample of 60 customers’ orders. The manager knows that on average, the restaurant serves 2500 meals per week.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Type of Meal** | **Chicken** | **Beef** | **Pork** | **Veggie** |
| **Burrito** | 11 | 9 | 6 | 5 |
| **Bowl** | 3 | 5 | 1 | 7 |
| **Salad** | 4 | 1 | 0 | 1 |
| **Tacos** | 2 | 3 | 2 | 0 |

a) Based on the results of the sample, how many chicken burritos should the manager have ordered for the next week?

b) Based on the results of the sample, how many tacos should be ordered for next week?

c) If a customer were randomly chosen, what is the probability that that customer ordered a Beef Burrito?

d) If a customer were randomly chosen, what is the probability that that customer ordered a salad?

# Day 9: Conditional Probability

**Conditional Probability: ­­­­­­­­­­­­­­­­­­­­\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

The conditional probability of A given B is expressed as \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Example #1**: 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.

**You Try #1**: Michelle’s purse is a mess. It has 3 packs of gum, 4 tubes of lipstick, 2 things of nail polish, 5 hair ties, and a candy bar. What is the probability that Michelle is able to pull out a pack of gum given that she has already taken out the candy bar?

**Example #2**: 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.

**You Try #2**: Out of 50 people polled, 30 owned an X-Box, 20 owned a Playstation, and 10 owned both an X-box and a Playstation. What is the probability of picking someone who owns a Playstation given that they own an X-Box?

**Example #3:** 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 student.

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

b. P(9th or 10th grader)

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

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

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

**You Try #3**: 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 |  |  |  |

1. Find P(vanilla|adult)
2. Find P(child|chocolate)

## Day 9 Homework – Conditional Probability

**Use the table below for problems 1 and 2:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **T-shirts** | **Tank Tops** | **Sweaters** | **Dresses** | **Total** |
| **Donna** | 15 | 10 | 4 | 6 | 35 |
| **Carol** | 12 | 8 | 8 | 18 | 46 |
| **Total** | 27 | 18 | 12 | 24 | 81 |

1. What is the probability that Carol wears a dress?
2. What is the probability that Donna wears a tank top?
3. Bobby is trying to get into his house but it is dark outside and he cannot see his keys. His key ring has 4 round keys, 3 square keys, and 5 trapezoid keys. What is the probability that he picks the house key given that it is a square key?

**Use the table below for problems 4-7:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Football** | **Hockey** | **Basketball** | **Baseball** | **Total** |
| **Boston** | 100 | 40 | 60 |  | 280 |
| **Detroit** | 60 | 50 |  | 50 | 200 |
| **Total** | 160 |  | 100 | 130 |  |

1. What is the probability that someone likes football given that they are from Detroit?
2. What is the probability that someone is from Boston given that they like basketball?
3. What is the probability that someone likes hockey given that they are from Boston?
4. What is the probability that someone is from Detroit given that they like baseball?
5. Kevin has 8 black socks, 10 white socks, 4 gray socks, and 4 tan socks in his dresser drawer. What is the probability that he is able to pull out a black sock given that he has already pulled out a black sock?

**Use the table below for problems 9-12:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Nuclear Bombs** | **Death Rays** | **Rocket Launchers** | **Killer Robots** | **Total** |
| **Active** |  | 5 | 12 |  | 61 |
| **Disabled** | 6 | 10 |  | 160 |  |
| **Total** | 10 |  | 30 | 200 | 255 |

1. What is the probability that it is disabled given that it is a Death Ray?
2. What is the probability that it is Rocket Launcher given that it is a disabled?
3. What is the probability that it is disabled given that it is a Nuclear Bomb?
4. What is the probability that it is Killer Robot given that it is active?

**Use the table below for problems 13-16:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Snakes** | **Dogs**  | **Cats**  | **Lizards** | **Total** |
| **North America** | 3 |  | 15 | 5 |  |
| **South America** |  |  |  | 10 | 37 |
| **Total** | 15 | 30 | 20 | 15 |  |

1. What is the probability that they are in North America given that they own a dog?
2. What is the probability that they own a snake given that they are in South America?
3. What is the probability that they own a lizard given that it is a North America?
4. What is the probability that they are in South America given that they own a cat?

# Day 11 : PROBABILITY STUDY GUIDE

**I. PROBABILITY OF A SINGLE EVENT**

 *# of favorable outcomes*

*# of total possible outcomes*

A. This is just BASIC probability. All you use here is the basic formula: *P(E) =*  

1. In a candy bowl, there are 5 strawberry candies, 2 orange candies, and 12 grape candies.
2. What is the probability that you pick an orange candy?
3. What is the probability that you pick an orange *or* a grape candy?
4. You roll a die. What is the probability that you roll a number that is a factor of 12?
5. The following table shows the number of different types of chocolate in a packet. Fill in the missing values

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Soft** | **Medium** | **Hard** | **Total** |
| **Dark** | **10** | **24** |  |  |
| **Light** |  | **14** | **9** |  |
| **Total** | **28** |  | **24** |  |

If you pick one chocolate from the packet, find the probability that…

1. The chocolate is dark.
2. The chocolate is hard and light.
3. The chocolate is not soft.
4. There are eleven marbles in a bag. Four are red, six are white, and seven are blue. **Find each probability if you select one marble from the bag.**
5. P (not white)
6. P (red)
7. P (blue or white)

B. Experimental Probability

 Know how to find the probability of a single event given a table of recorded data:

1. If you flip a coin 36 times and it comes up heads 20 times, what is the experimental probability of it coming up tails?

**II. Venn Diagrams**

1. Be familiar with the regions that represent UNIONS, INTERSECTIONS, and COMPLEMENTS of events:

2

A

B

C

B

A

1

1. In a class of 25 students, 5 do not study either art or drama. 13 students study art, 9 study drama, and
2 students study both art and drama.
2. Make a venn diagram for the information?

b) What is the probability of choosing a student at random that studies art only?

**III. PROBABILITY OF COMPOUND (ONE OR MORE) EVENTS “*AND”***

1. MORE COMMON Compound Events

These events will usually involve something along the line of “choosing two items.” Always assume that you choose one item at a time.

*If items are REPLACED, the events are considered independent*. How do you find the probability of these events?

 MULTIPLY!

*If items are NOT REPLACED, the events are considered dependent.*  How do you find the probability of these events? MULTIPLY!

1. Consider a jar of 3 red marbles, 4 yellow marbles, and 1 blue marble.

a) If you pick two marbles (without replacement), what is the probability that the first is blue and the second is yellow?

b) What is the probability that both are red (again, without replacement)?

c) Now imagine you pick two marbles and you DO replace the first marble in between picks. What is the probability that both marbles are blue?

1. For this example, refer to the chocolate table in Problem **3**.

 a) Jamie picks a chocolate and eats it. He then picks another one and eats that one, too. What is the probability that he ate two hard chocolates?

 b) Maria picks a chocolate and decides she doesn’t like it, so she puts it back. She then picks another chocolate. What is the probability that she picked a light, soft chocolate both times?

1. Suppose there are 12 marbles in a bag. Four are solid, six are multi-colored, and two are clear. **Find each probability if you reach in and select two marbles replacing them after each pick.**
2. P (clear then solid)
3. P (solid then solid)
4. P(multi, multi, then clear)

**IV. Mutually Inclusive and Mutually Exclusive Events (only one event) “*OR”***

 **P(A or B) = P(A) + P(B) – P(A and B)**

1. Julie has 10 blue pencils numbered 1-10 and 6 red pencils numbered 11-16 in her pencil case. What is the probability she picks a blue pencil or an even numbered pencil?
2. A pet store contains 35 light green parakeets (14 females and 21 males) and 44 sky blue parakeets (28 females and 16 males). Arrange this information in the two-way table.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Male | Female | Total |
| Light Green |  |  |  |
| Sky Blue |  |  |  |
| Total |  |  |  |

a) You randomly choose one of the parakeets. What is the probability that it is a female or a sky blue parakeet?

b) What is the probability that the randomly chosen parakeet is both green and male?

c) What is the probability that the randomly chosen parakeet is female, given that it is green?

1. John asked 100 people which type of music they enjoyed. The results are below.

One person is picked at random.

1. What is the probability that the person enjoys Classical?
2. Given that the person is a women, what is the probability that she likes Rock?
3. Given that the person is a man, what is the probability that they like Folk music?

**V. Conditional Probability** – the probability that an event will occur, given that a first event already occurred.

1. Dr. Nefarious has a total of 20 nuclear bombs and a total of 15 long range missiles. Four of the long range missiles are also nuclear bombs. What is the probability that if Dr. Nefarious launches a missile at Heroville that it will also be a nuclear bomb?
2. 1200 people were surveyed about their body image. The results are below.

If one person is picked at random.

1. Given that a male is selected, what is the probability that he thinks he is overweight?
2. Given that a female is selected, what is the probability that she thinks she is underweight?
3. Given that a female is selected, what is the probability that she thinks she is about right?
4. Of the people with black hair, 7 have brown eyes, 2 have blue eyes, 2 have hazel eyes, and 1 has green eyes. Of the people with brown hair, 12 have brown eyes, 5 have hazel eyes, 3 have green eyes, and 8 have blue eyes. Of the people with blonde hair, 9 have blue eyes, 1 has brown eyes, 1 has hazel eyes, and 2 have green eyes. Of the people with red hair, 1 has hazel eyes, 1 has green eyes, 2 have blue eyes, and 3 have brown eyes.

**Use the information from above to fill in the two-way frequency table below.**

|  |  |  |
| --- | --- | --- |
|  |  | Hair Color |
|  |  | Black | Brown | Red | Blonde | Total |
| Eye Color | Brown |  |  |  |  |  |
| Blue |  |  |  |  |  |
| Hazel |  |  |  |  |  |
| Green |  |  |  |  |  |
| Total |  |  |  |  |  |

a. Given that a member of the team has blue eyes, what is the probability that he/she has:

 Brown hair? Blonde hair?

 b. Given that a member of the team has brown hair, what is the probability that he/she has:

 Hazel eyes? Doesn’t have green eyes?

c. Given that a member of the team has black hair, what is the probability that he/she has:

 Blue eyes? Brown eyes?