WAKE COUNTY PUBLIC SCHOOL SYSTEM

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Transforming Mathematics Education

SECONDARY MATH TWO

An Integrated Approach

WCPSS MATH 2 UNIT 9: MVP MODULE 9
Probability

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MODULE 9 - TABLE OF CONTENTS

PROBABILITY

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9.1 TB or Not TB?

A Develop Understanding Task

Tuberculosis (TB) can be tested in a variety of ways, including a skin test. If a person has turberculosis antibodies, then they are considered to have TB. Below is a tree diagram representing data based on 1,000 people who have been given a skin test for turberculosis.
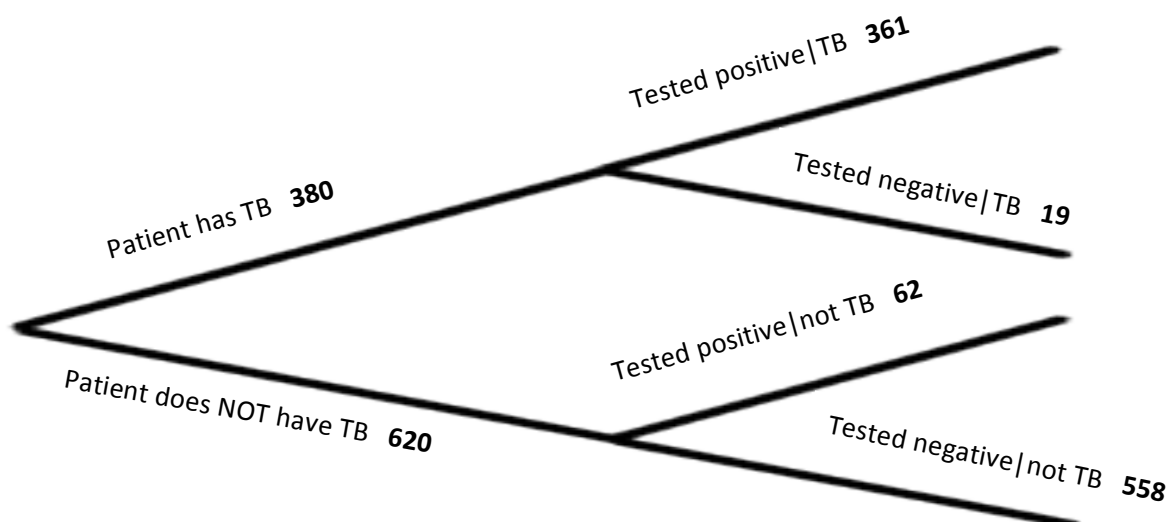
1. What observations do you notice about TB tests based on the tree diagram?

2. You may have noticed that 380 patients have TB, yet not all 380 patients with TB tested positive. In statistics, the notation: "Tested negative | TB" means '*the number of patients who tested negative, given that they have TB'.* Determine the probability that a person who has TB could receive a negative result compared to others who have TB. What does this mean?

   This is an example of **conditional probability**, which is the measure of an event, given that another event has occurred.

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3. Write several other probability and conditional probability statements based on the tree diagram.

Part of understanding the world around us is being able to analyze data and explain it to others.

4. Based on the probability statements from the tree diagram, what would you say to a friend regarding the validity of their results if they are testing for TB using a skin test and the result came back positive?

5. In this situation, explain the consequences of errors (having a test with incorrect results).

6. If a health test is not 100% certain, why might it be beneficial to have the results lean more toward a false positive?

7. Is a sample space of 200 enough to indicate whether or not this is true for an entire population?

READY

Topic: Venn Diagrams, how to create and read.

For each Venn Diagram provided answer the questions.
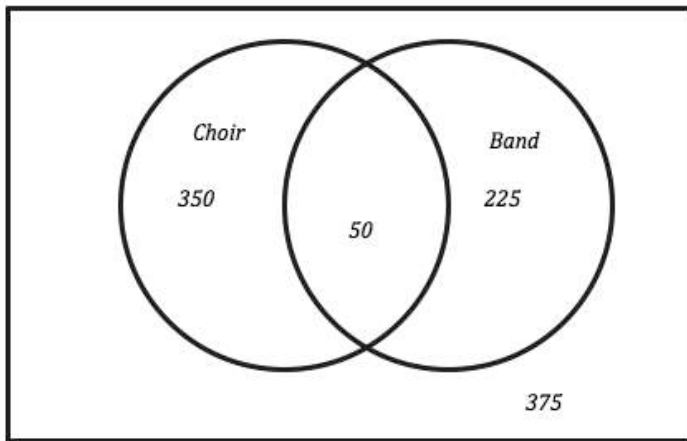
1. How many students were surveyed?

2. What were the students asked?

3. How many students are in both choir and band?

4. How many students are not in either choir or band?

5. What is the probability that a randomly selected student would be in band?
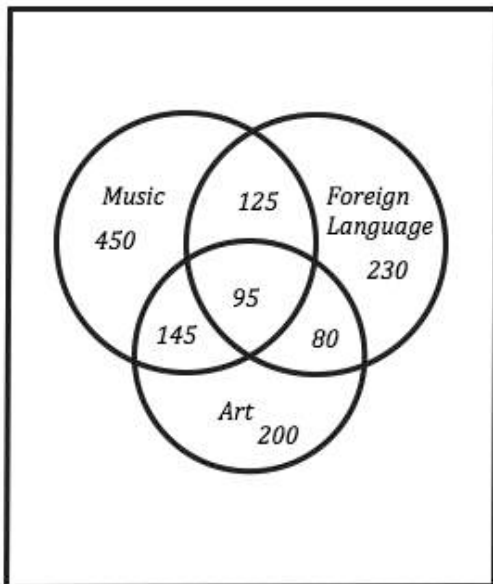
This Venn Diagram represents enrollment in some of the elective courses.

6. What does the 95 in the center tell you?

7. What does the 145 tell you?

8. How many total students are represented in the diagram?

9. Which elective class has the least number of students enrolled?

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SET

Topic: Interpreting a tree diagram to determine probability

Given the tree diagram below answer the questions and determine the probabilities. The diagram represents the number of plate appearances during the first month of a minor league baseball season.
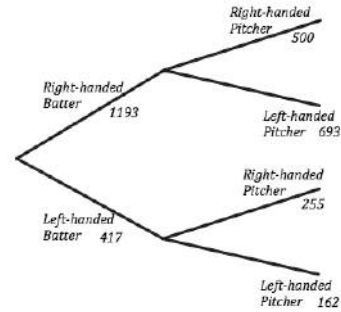
10. How many times did a batter come to the plate during this time period?

11. Based on this data, if you are a left-handed batter what is the probability that you will face a right-handed pitcher?

12. Based on this data, if you are a right-handed batter what is the probability that you will face a left-handed pitcher?

13. What is the probability that a left-handed pitcher will be throwing for any given plate appearance?

14. What is the probability that a left-handed batter would be at the plate for any given plate appearance?

What observations do you make about the data? Is there any amount that seems to be overly abundant? What might account for this?

GO

Topic: Basic Probability

Find the probability of achieving success with each of the events below.

15. Rolling an even number on standard six-sided die.

16. Drawing a black card from a standard deck of cards.

17. Flipping a coin and getting Heads three times in a row.

18. Rolling a die and getting a four.

19. Drawing an ace from a deck of cards.

20. Rolling a die twice in a row and getting two threes.

21. From a bag containing 3 blue, 2 red, and 5 white marbles. Pulling out a red marble.

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9.2 Chocolate versus Vanilla

A Solidify Understanding Task

Danielle loves chocolate ice cream much more than vanilla and was explaining to her best friend Raquel that so does most of the world. Raquel disagreed and thought vanilla is much better. To settle the argument, they created a survey asking people to choose their favorite ice cream flavor between chocolate and vanilla. After completing the survey, the following results came back:

- There were 8,756 females and 6,010 males who responded.
- Out of all the males, 59.7% chose vanilla over chocolate.
- 4,732 females chose chocolate.

1. Upon first observations, which flavor do you think "won"? _____. Write a sentence describing what you see at 'first glance' that makes you think this.

2. Raquel started to organize the data in the following two-way table. See if you can help complete this (using counts and not percentages):

	Chocolate	Vanilla	Total
Female			8,756
Male			6,010
Total			

3. Organize the same data in a Venn diagram and a tree diagram.
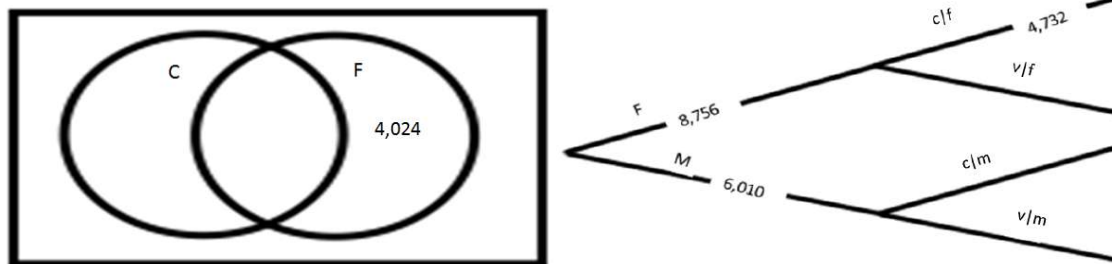
4. Using your organized data representations, write probabilities that help support your claim regarding the preferred flavor of ice cream. For each probability, write a complete statement as well as the corresponding probability notation.

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5. Looking over the three representations (tree diagram, two-way table, and Venn diagram), what probabilities seem to be easier to see in each? What probabilities are hidden or hard to see?

Highlighted (easier to see)	Hidden
Tree diagram	Tree diagram
Two-way table	Two-way table
Venn diagram	Venn diagram

6. Getting back to ice cream. Do you think this is enough information to proclaim the statement that one ice cream is favored over another? Explain.

READY

Topic: Analyzing data given in a Venn Diagram.
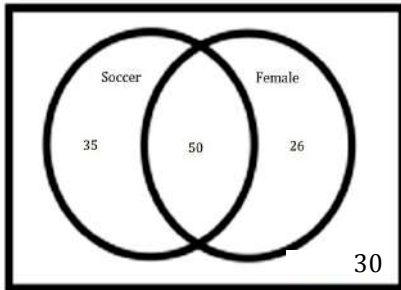
Use the Venn Diagrams below to answer the following questions. (Hint: you may use the same data provided in the two-way table from question 3 on the next page to help make sense of the Venn Diagram)

The following Venn Diagram represents the relationship between favorite sport (Soccer or Baseball) and gender (Female or Male).

Soccer   Female

35   50   26

30

1. How many people said soccer is their favorite sport?

2. How many females are in the data?

3. How many males chose baseball?

4. What is the probability that a person would say soccer is their favorite sport? P(soccer) =

5. What is the probability that a female would say soccer is their favorite sport? ("Out of all females, ___% say soccer is their favorite sport") P(soccer | female) =

The following Venn Diagram represents the relationship between favorite subject (Math or Science) and grade level (Ninth or Tenth). Using this data, answer the following questions.

Math   Ninth

65   40   35

25
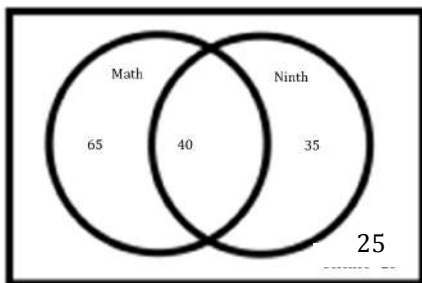
6. How many people said math is their favorite subject?

7. How many tenth graders are in the data?

8. How many ninth graders chose science?

9. What is the probability that a person would say science is their favorite subject?   P(s) =

10. What is the probability that a tenth grader would say science is their favorite subject?   ("If you are a tenth grader, then the probability of science being your favorite subject is ____ %") P(science | tenth)=

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Topic: Writing conditional statements from two-way tables

11. Complete the table and write three conditional statements.

	Soccer	Baseball	Total
Male		30	
Female	50		76
Total	85		

12. Complete the table about preferred genre of reading and write three conditional statements.

	Fiction	Non-Fiction	Total
Male		10	
Female	50		60
Total	85		

13. Complete the table about favorite color of M&M's and write three conditional statements.

	Blue	Green	Red	Other	Total
Male	15	20	15		60
Female	30	20		10	
Total	45				130

14. Use the information provided to make a tree diagram, a two-way table and a Venn Diagram.

- Data was collected at the movie theater last fall. Not about movies but clothes.
- 6,525 people were observed.
- 3,123 had on shorts and the rest had on pants
- 45% of those wearing shorts were denim.
- Of those wearing pants 88% were denim.

GO

Topic: Basic Probability

Find the desired values.

15. What is half of one-third?

16. What is one-third of two-fifths?

17. What is one-fourth of four-sevenths?

18. What percent is $\frac{5}{8}$?

19. What is 35% of 50?

20. Seventy is 60% of what number?

21. Write $\frac{7}{12}$ as a percent.

22. Write $\frac{1}{6}$ as a percent.

23. What is 52% of 1,200?

24. What percent is 32 of 160?

25. Sixty is what percent of 250?

26. What percent of 350 is 50?

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9.3 Fried Freddy's
A Solidify Understanding Task

Danielle was surprised by the results of the survey to determine the 'favorite ice cream' between chocolate and vanilla (See task 9.2 *Chocolate vs. Vanilla*). The reason, she explains, is that she had asked several of her friends and the results were as follows:

	Chocolate	Vanilla	Total
Female	23	10	33
Male	6	8	14
Total	29	18	47

1. In this situation, chocolate is most preferred. How would you explain to her that this data may be less 'valid' compared to the data from the previous survey?

Using a sufficiently large number of trials helps us estimate the probability of an event happening. If the sample is large enough, we can say that we have an estimated probability outcome for the probability of an event happening. If the sample is not randomly selected (only asking your friends) or not large enough (collecting four data points is not enough information to estimate long run probabilities), then one should not estimate large scale probabilities. Sometimes, our sample increases in size over time. Below is an example of data that is collected over time, so the estimated probability outcome becomes more precise as the sample increases over time.

Freddy loves fried food. His passion for the perfect fried food recipes led to him opening the restaurant, "Fried Freddies." His two main dishes are focused around fish or chicken. Knowing he also had to open up his menu to people who prefer to have their food grilled instead of fried, he created the following menu board:

Fried Freddy's

$7.95

Choose dish: Chicken or Fish

Choose cooking preference: Grilled or Fried

After being open for six months, Freddy realized he was having more food waste than he should because he was not predicting how much of each he should prepare in advance. His business friend, Tyrell, said he could help.

2. What information do you think Tyrell would need?

Luckily, Freddy uses a computer to take orders each day so Tyrell had lots of data to pull from. After determining the average number of customers Freddy serves each day, Tyrell created the following Venn diagram to show Freddy the food preference of his customers:
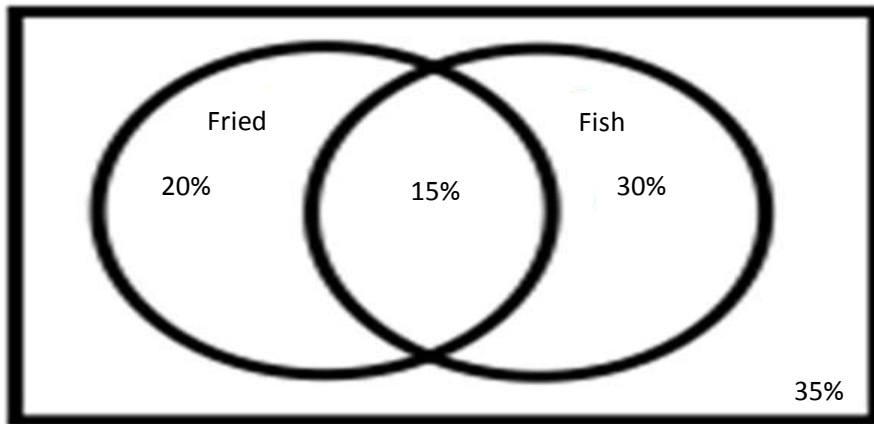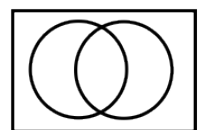

To make sense of the diagram, Freddy computed the following probability statements:

3. What is the probability that a randomly selected customer would order fish?
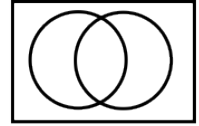
    P(fish) =

    Shade the part of the diagram that models this solution.

4. What is the probability that a randomly selected customer would order fried fish?

    P(fried ∩ fish) = P(fried and fish) =

    Shade the part of the diagram that models this solution.

5. What is the probability that a person prefers fried chicken?

    P(fried∩chicken) = P(fried and chicken) =

    Shade the part of the diagram that models this solution.
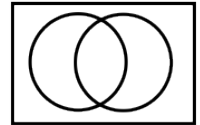
6. What is the estimated probability that a randomly selected customer would want their fish grilled?

    P(grilled and fish) = P(_____) =

    Shade the part of the diagram that models this solution.

7. If Freddy serves 100 meals at lunch on a particular day, how many orders of fish should he prepare with his famous fried recipe?

8. What is the probability that a randomly selected person would choose fish or fried?

    P(fried∪fish) = P(fried or fish) =
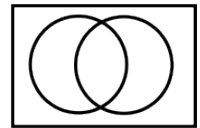
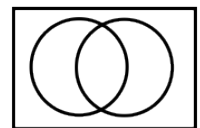   Shade the part of the diagram that models this solution.
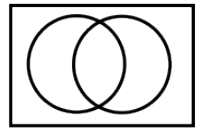
9. What is the probability that a randomly selected person would NOT choose fish or fried?

    Shade the part of the diagram that models this solution.

READY

Topic: Independent and Dependent Events

In some of the situations described below the first event effects the subsequent event (dependent events). In others each of the events is completely independent of the others (independent events). Determine which situations are dependent and which are independent.

1.   A coin is flipped twice. The first event is the first flip and the second event is the next flip.

2.   A bag of marbles contains 3 blue marbles, 6 red marbles and 2 yellow marbles. Two of the marbles are drawn out of the bag. The first event is the first marble taken out the second event is the second marble taken out.

3.   An attempt to find the probability of there being a right-handed or a left-handed batter at the plate in a baseball game. The first event is the 1st batter to come to the plate. The second event is the second player to come up to the plate.

4.   A standard die is rolled twice. The first event is the first roll and the second event is the second roll.

5.   Two cards are drawn from a standard deck of cards. The first event is the first card that is drawn the second event is the second card that is drawn.

SET
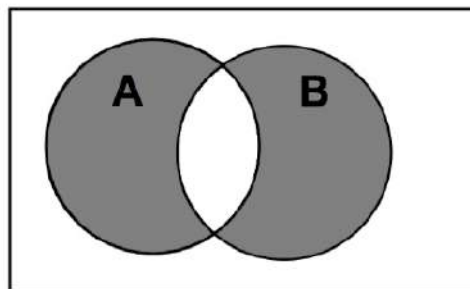Topic: Addition Rule, Interpreting a Venn Diagram

6. Sally was assigned to create a Venn diagram to represent $P(A \text{ or } B)$. Sally first writes

$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$, what does this mean? Explain each part.

7. Sally then creates the following diagram.

   Sally's Venn diagram is incorrect. Why?

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The Venn diagram to the right shows the data collected at a sandwich shop for the last six months with respect to the type of bread people ordered (sourdough or wheat) and whether or not they got cheese on their sandwich. Use this data to create a two-way frequency table and answer the questions.
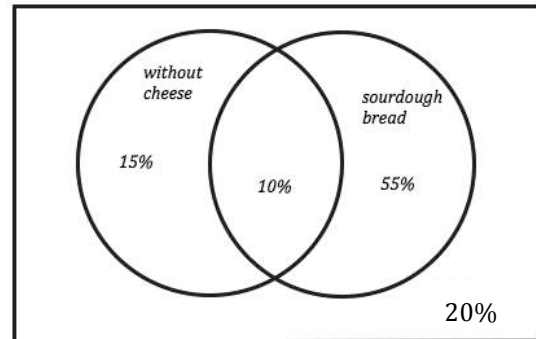
8. Two-way frequency table

9. What is the probability that a randomly selected customer would order sourdough bread?
    P(sourdough bread) =

10. What is the probability that a randomly selected customer would order sourdough bread without cheese?
    P(sourdough ∩ no cheese) = P(sourdough and no cheese) =

11. What is the probability that a person prefers wheat bread without cheese?
    P(wheat ∩ no cheese) = P(wheat and no cheese) =

12. What is the estimated probability that a randomly selected customer would want their sandwich with cheese?
    P(sourdough cheese and wheat cheese) = P(_____) =

13. If they serve 100 sandwiches at lunch on a particular day, how many orders with sourdough should be prepared without cheese?

14. What is the probability that a randomly selected person would choose sourdough or without cheese?
    P(sourdough ∪ no cheese) = P(sourdough or no cheese) =

15. What is the probability that a randomly selected person would NOT choose sourdourgh or no cheese?

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GO

Topic: Equivalent Ratios and Proportions

Use the given ratio to set up a proportion and find the desired value.

16. If 3 out of 5 students eat school lunch then how many students would be expected to eat school lunch at a school with 750 students?

17. In a well developed and carried out survey it was found that 4 out of 10 students have a pair of sunglasses. How many students would you expect to have a pair of sunglasses out of a group of 45 students?

18. Data collected at a local mall indicted that 7 out of 20 men observed were wearing a hat. How many would you expect to have been wearing hats if 7500 men were to be at the mall on a similar day?

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9.4 Visualizing with Venn

A Solidify Understanding Task

One of the attributes of Venn diagram's is that it can be easy to see the relationships within the data. In this task, we will create multiple Venn diagrams using data and determine the events that create diagrams to either have an intersection or for them to be mutually exclusive.

1. The following data represents the number of men and women passengers aboard the Titanic and whether or not they survived. Fill in the blanks for this table:

	Survived	Did not survive	Total
Men		659	805
Women	296		
Total	442	765	1207

2. Using the data above, create a Venn diagram for each of the following:
   a. Men vs Women
   b. Women vs Survived
   c. You choose the conditions
3. Create two probability statements using each of your Venn diagrams from question 2.

4. Create and label three different Venn diagrams using the following data. Create at least one that is mutually exclusive and at least one that has an intersection.
   Sample size: 100

   $P(\text{girl}) = \frac{42}{100}$

   $P(\text{girl or art}) = (\frac{42}{100} + \frac{30}{100}) - \frac{12}{100}$

   $P(\text{art}) = \frac{30}{100}$

   $P(\text{not art}) =$

   $P(\text{boy}) =$

5. Describe the conditions that create mutually exclusive Venn diagrams and those that create intersections.

6. What conjecture can you make regarding the best way to create a Venn diagram from data to highlight probabilities?

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READY

Topic: Products of probabilities, multiplying and dividing fractions

Find the products or quotients below.

1. $\dfrac{1}{2} \cdot \dfrac{2}{3}$

2. $\dfrac{3}{5} \cdot \dfrac{1}{3}$

3. $\dfrac{7}{10} \cdot \dfrac{2}{5}$

4. $\dfrac{8}{7} \cdot \dfrac{3}{4}$

5. $\dfrac{\frac{1}{3}}{\frac{1}{2}}$

6. $\dfrac{2}{5} \div \dfrac{2}{3}$

7. $P(A) = \dfrac{3}{4}$ $P(B) = \dfrac{1}{2}$

   $P(A) * P(B) =$

8. $P(A) = \dfrac{1}{6}$ $P(B) = \dfrac{1}{3}$

   $P(A) * P(B) =$

SET

Topic: Connecting representations of events for probability

For each situation, one of the representations (two-way table, Venn diagram, tree diagram, context or probability notation) is provided. Use the provided information to complete the remaining representations.
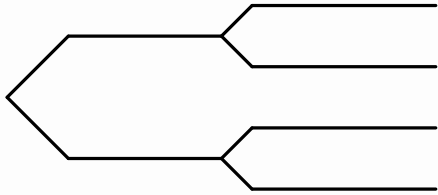
9. Are you Blue?

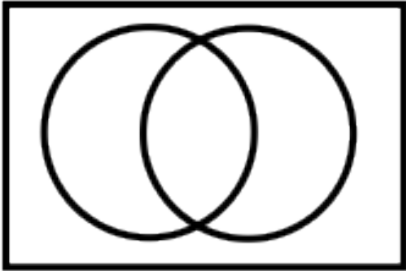| Notation	2-way Table			
Key: Male = M Female = F Blue = B Not Blue = N Sample size = 200 P(B) = 84/200 P(M) = 64/200 P(F|B) = 48/84 P(B|F) = P(M∩B) = P(M∪B) =		Blue	Not Blue	Total
	Male			
	Female			
	Total			
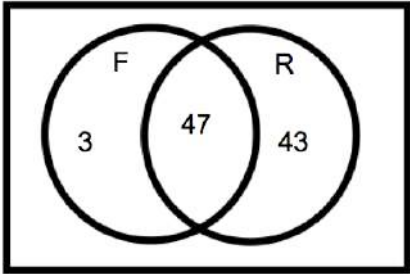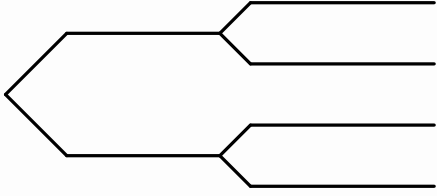
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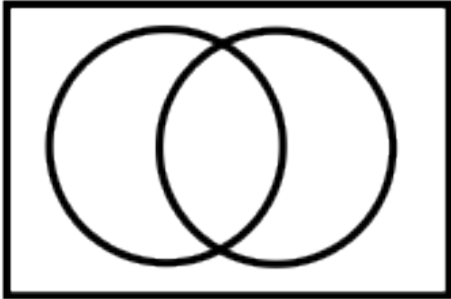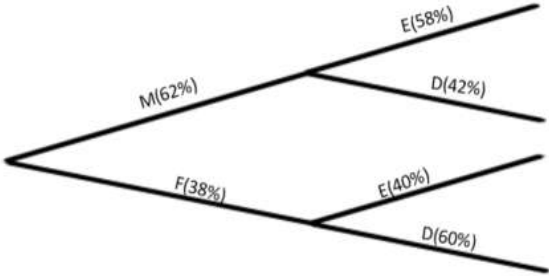
Venn Diagram	Tree Diagram

Write three observations you can make about this data.

10. Right and left handedness of a group.

Notation	2-way Table

Key:
Male = M   Female = F
Lefty = L   Righty = R

Sample size = 100 people

P(L) =   P(M) =

P(F) =   P(L|F) =

P(L|M) =

	Lefty	Righty	Total
Male			
Female			
Total			

Venn Diagram	Tree Diagram

F   R

3   47   43

Write three conditional statements regarding this data.

11. The most important meal of the day.

Notation	2-way Table
Key: Male = M Female = F Eats Breakfast = E Doesn't Eat Breakfast = D Sample size = P(E) = P(E|M) = P(E∩M)= P(E|F) = P(E∩F) =	(2-way table below)

	Eats	Doesn't	Total
Male			
Female			
Total			685

Venn Diagram	Tree Diagram

M(62%) E(58%) D(42%)

F(38%) E(40%) D(60%)

Does this data surprise you? Why or why not.

GO

Topic: Writing conditional statements from two-way tables

12. Complete the table and write three conditional statements.

	Biking	Swimming	Total
Male		50	
Female	35		76
Total	85		

13. Complete the table about preferred genre of reading and write three conditional statements.

	Ice Cream	Cake	Total
Male		20	
Female	10		60
Total	85		

14. Complete the table about eye color and write three conditional statements.

	Blue	Green	Brown	Other	Total
Male	55	20	15		100
Female		20		10	
Total			75		230

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9.5 Freddy Revisited
A Solidify Understanding Task

In task 9.3 *Fried Freddy's,* Tyrell helped Freddy in determining the amount and type of food Freddy should prepare each day for his restaurant. As a result, Freddy's food waste decreased dramatically. As time went by, Freddy noticed that another factor he needed to consider was the day of the week. He noticed that he was overpreparing during the week and sometimes underpreparing on the weekend. Tyrell and Freddy worked together and started collecting data to find the average number of orders he received of chicken and fish on a weekday and compared it to the average number of orders he received of each on the weekend. After two months, they had enough information to create the two way table below:

	Fish	Chicken	Total
Weekday	65	79	144
Weekend	88	107	195
Total	153	186	339

1. What observations can be made from the table (include probability statements)?

2. What do you notice about the probability statements?

3. Based on the data, if Freddy had a sales promotion and anticipated 500 orders in a given week, how many of each (chicken and fish) should he order?

READY

Topic: Quadratic functions

Find the x-intercepts, y-intercept, line of symmetry and vertex for the quadratic functions.

1. $f(x) = x^2 + 8x - 9$

2. $g(x) = x^2 - 3x - 5$

3. $h(x) = 2x^2 + 5x - 3$

4. $k(x) = x^2 + 6x - 9$

5. $p(x) = (x + 5)^2 - 2$

6. $q(x) = (x + 7)(x - 5)$

SET

Topic: Independence

Determining the independence of events can sometimes be done by becoming familiar with the context in which the events occur and the nature of the events. There are also some ways of determining independence of events based on equivalent probabilities.

- *Two events, A and B, are independent if $P(A \text{ and } B) = P(A) \cdot P(B)$*
- *Additionally, two events, A and B, are independent if $P(A|B) = \frac{P(A \text{ and } B)}{P(B)} = P(A)$*

Use these two ways of determining independent events to determine independence in the problems below and answer the questions.

7. P (A and B) = $\frac{3}{5}$

   P (A) = $\frac{1}{2}$

   P (B) = $\frac{3}{10}$

8. P (A) = $\frac{1}{5}$

   P (A and B) = $\frac{1}{6}$

   P (B) = $\frac{1}{3}$

9. P (A) = $\frac{1}{2}$

   P (A and B) = $\frac{1}{5}$

   P (B) = $\frac{2}{5}$

10. P (A and B) = $\frac{2}{5}$

    P (A) = $\frac{1}{4}$

    P (B) = $\frac{4}{5}$

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GO

Topic: Find Probabilities from a two-way table

The following data represents the number of men and women passengers aboard the titanic and whether or not they survived.

	Survived	**Did not survive**	**Total**
Men	146	659	805
Women	296	106	402
Total	442	765	1207

11. P(w) =

12. P(s) =

13. P(s|w) =

14. P(w or s) =

15. P(w or m) =

16. P(ns|w) =

17. P(m ∩ ns) =

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9.6 Striving for Independence

A Practice Understanding Task

Answer the questions below using your knowledge of conditional probability (the probability of *A* given *B* as *P(A and B)/P(B)*) as well as the definition of independence. Two events (A and B) are said to be independent if $P(A|B) = P(A)$ and $P(B|A) = P(B)$. Keep track of how you are determining independence for each type of representation.

1. Out of the 2000 students who attend a certain high school, 1400 students own cell phones, 1000 own a tablet, and 800 have both. Create a Venn diagram model for this situation. Use proper probability notation as you answer the questions below.

    a) What is the probability that a randomly selected student owns a cell phone?

    b) What is the probability that a randomly selected students owns both a cell phone and a tablet?

    c) If a randomly selected student owns a cell phone, what is the probability that this student also owns a tablet?

    d) How are questions b and c different?

    e) Are the outcomes, *owns a cell phone* and *owns a tablet,* independent? Explain.

2. Below is a partially completed tree diagram from the task *Chocolate vs Vanilla.*

    a) Circle the parts of the diagram that would be used to determine if choosing chocolate is independent of being a male or female.

    b) Complete the diagram so that choosing chocolate is independent of being male or female.
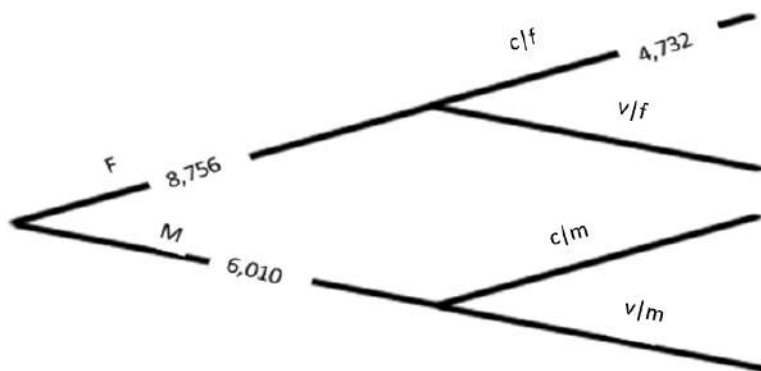
3. Use the data from the Titantic below to answer the following questions.

	Survived	Did not survive	Total
Men	146	659	805
Women	296	106	402
Total	442	765	1207

a) Determine if survival is independent of being male for this data. Explain or show why or why not. If it is not independent determine how many men would need to survive in order to make it independent.

4. Determine whether the second scenario would be dependent or independent of the first scenario. Explain.
    a) Rolling a six-sided die, then drawing a card from a deck of 52 cards.
    b) Drawing a card from a deck of 52 cards, then drawing another card from the same deck.
    c) Rolling a six-sided die, then rolling it again.
    d) Pulling a marble out of a bag, replacing it, then pulling a marble out of the same bag.
    e) Having 20 treats in five different flavors for a soccer team, with each player taking a treat.

READY

Topic: Solving quadratics

Solve each of the quadratics below using an appropriate method.

1. $m^2 + 15m + 56 = 0$

2. $5x^2 - 3x + 7 = 0$

3. $x^2 - 10x + 21 = 0$

4. $6x^2 + 7x - 5 = 0$

SET

Topic: Representing Independent Events in Venn Diagrams

In each of the Venn Diagrams the number of outcomes for each event are given, use the provided information to determine the conditional probabilities or independence. The numbers in the Venn Diagram indicate the number of outcomes in that part of the sample space.

5.
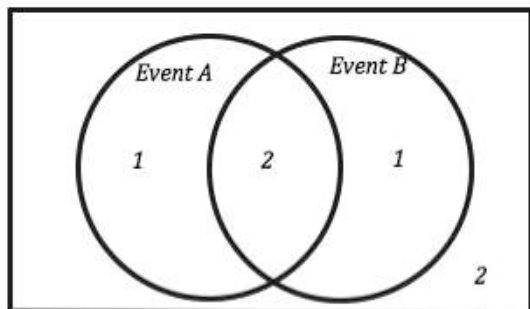
a. How many total outcomes are possible?

b. P(A) =

c. P(B) =

d. P(A∩B) =

e. P(A|B) =

f. Are events A and B independent events? Why or why not?

6.
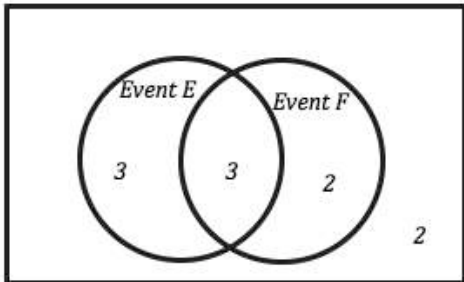
a. How many total outcomes are possible?

b. P(E) =

c. P(F) =

d. P(E∩F) =

e. P(E|F) =

f. Are events E and F independent events? Why or why not?

7.

a. How many total outcomes are possible?

b. P(X) =

c. P(Y) =

d. P(X∩Y) =

e. P(X|Y) =

f. Are events X and Y independent events? Why or why not?

8.

a. How many total outcomes are possible?

b. P(K) =

c. P(L) =

d. P(K∩L) =

e. P(K|L) =

f. Are events K and L independent events? Why or why not?

GO

Topic: Conditional Probability and Independence

Data gathered on the shopping patterns during the months of April and May of high school students from Peanut Village revealed the following. 38% of students pur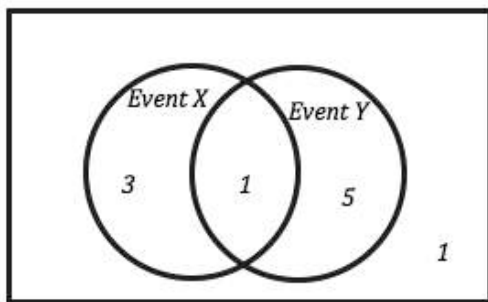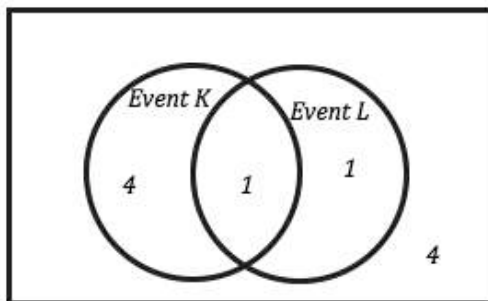chased a new pair of shorts (call this event H), 15% of students purchased a new pair of sunglasses (call this event G) and 6% of students purchased both a pair of short and a pair of sunglasses.

9. Find the probability that a student purchased a pair of sunglasses given that you know they purchased a pair of shorts. P (G|H) =

10. Find the probability that a student purchased a pair of shorts or purchased a new pair of sunglasses. P (H ∪ G) =

11. Given the condition that you know a student has purchased at least one of the items. What is the probability that they purchased only one of the items?

12. Are the two events H and G independent of one another? Why or Why not?

Given the data collected from 200 individuals concerning whether or not to extend the length of the school year in the table below answer the questions.

	For	Against	No Opinion	
Youth (5 to 19)	7	35	12	
Adults (20 to 55)	30	27	20	
Seniors (55 +)	25	16	28	
				200

13. Given that condition that a person is an adult what is the probability that they are in favor of extending the school year? P(For|Adult) =

14. Given the condition that a person is against extending the school year what is the probability they are a Senior? P (Senior|Against) =

15. What is the probability that a person has no opinion given that they are a youth?
P (no opinion| youth) =

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S-CP False Positive Test Results

Task

A certain test for mononucleosis has a 99% chance of correctly diagnosing a patient with mononucleosis and a 5% chance of misdiagnosing a patient who does not have the infection. Suppose the test is given to a group where 1% of the people have mononucleosis. If a randomly selected patient's test result is positive, what is the probability that she has mononucleosis? Explain.

Probability: Compound Events

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

     a.) Selecting a red candy.   b.) Selecting a purple candy.

     c.) Selecting a green or red candy.   d.) Selecting any color except a green candy.

     f.) If you select one candy, put it back, and select again, what is the probability of pulling two purple candies?

     g.) If you select two candies, what is the probability that the first is red and the second is green?

     h.) If you select two candies, what is the probability that one is red and one is green? *(hint: be careful! Order does not matter!)*

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

3. 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+?

4. If a baseball player gets a hit in 31% of his at-bats, what it the probability that the baseball player will get a hit in 5 at-bats in a row?

5. Two 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?

6. 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?

7.   Assume you have 8 red beads and 12 blue beads in a bag and you will be drawing 3 beads from the bag one at a time without replacement. Make a tree diagram that represents this situation if you pulled three beads and label each branch with the probabilities of the outcomes.
 a) What is the probability of pulling three red beads?

 b) *Challenge!* What is the probability of pulling one red and two blue beads in any order? .

8. 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?

9. Steve will draw 2 cards one after the other from a standard deck of cards without replacement. What is the probability that his 2 cards will consist of a heart and a diamond?

10. A class consists of 12 girls and 8 boys. A group of three is picked for a committee. If the students are picked at random, what is the probability that they all will be boys?

11. A fair coin is flipped four times.
a) Find the probability that it will land up heads each time.
b) Find the probability that it land the same way each time. *(be careful! This is different than part a!)*

12. A bag of marbles contains 12 red marbles, 8 blue marbles, and 5 green marbles. If three marbles are pulled out, find each of the following probabilities.
a) Pulling out three green marbles without replacement
b) Pulling out three red marbles with replacement
c) Pulling out a red, a green, and a blue, in order, without replacement

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8.7 Slacker's Simulation
A Solidify Understanding Task

I know a student who forgot about the upcoming history test and did not study at all. To protect his identity, I'll just call him Slacker. When I reminded Slacker that we had a test in the next class, he said that he wasn't worried because the test has 10 true/false questions. Slacker said that he would totally guess on every question, and since he's always lucky, he thinks he will get at least 8 out of 10.

I'm skeptical, but Slacker said, "Hey, sometimes you flip a coin and it seems like you just keep getting heads. You may only have a 50/50 chance of getting heads, but you still might get heads several times in a row. I think this is just about the same thing. I could get lucky."

1. What do you think of Slacker's claim? Is it possible for him to get 8 out of 10 questions right? Explain.

I thought about it for a minute and said, "Slacker, I think you're on to something. I'm not sure that you will get 80% on the test, but I agree that the situation is just like a coin flip. It's either one way or the other and they are both equally likely if you're just guessing." My idea is to use a coin flip to simulate the T/F test situation. We can try it many times and see how often we get 8 out of 10 questions right. I'm going to say that if the coin lands on heads, then you guessed the problem correctly. If it lands on tails, then you got it wrong.

Try it a few times yourself. To save a little time, just flip 10 coins at once and count up the number of heads for each test.

	# Correct (Heads)	# Incorrect (Tails)	% Correct
Test 1			
Test 2			
Test 3			
Test 4			
Test 5			

Did you get 8 out of 10 correct in any of your trials?

Based on your trials, do you think Slacker has a good chance of getting 80% correct?

Use technology to 50 simulate more tests. Now what do you think of Slacker's chances of getting 80% correct. Explain why.

Ready, Set, Go!

Ready

Topic: Features of Histograms

1. Take a coin and flip it 5 times. Record the
number of times the coin landed with heads up.
Repeat this process 20 times either by hand or by simulation using technology,
http://www.rossmanchance.com/applets/CoinTossing/CoinToss.html
each time recording your results in the table below.

# Heads	% Heads	Frequency
0	0%	
1	20%	
2	40%	
3	60%	
4	80%	
5	100%	

2. Create a histogram of your results below. Describe the shape of the histogram (Shape, Center, Spread)
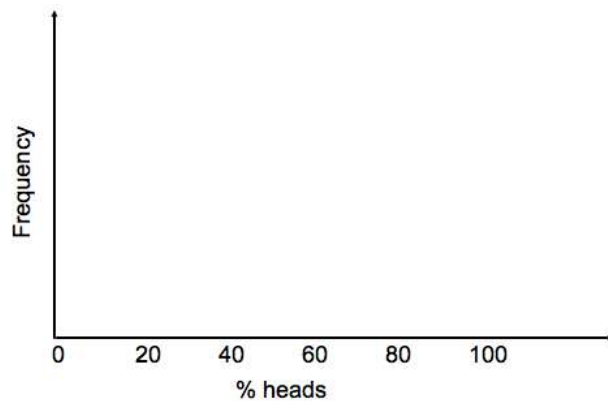
3. Flip a coin 5 times. Record the number of times heads lands side up. Repeat this process 20 times either by hand or by simulation using technology.
http://www.rossmanchance.com/applets/CoinTossing/CoinToss.html

Record your results in the table below.

# Heads	% Heads	Frequency	# Heads	% Heads	Frequency
0	0%		11	55%	
1	5%		12	60%	
2	10%		13	65%	
3	15%		14	70%	
4	20%		15	75%	
5	25%		16	80%	
6	30%		17	85%	
7	35%		18	90%	
8	40%		19	95%	
9	45%		20	100%	
10	50%				

4. Create a histogram of your results below. Describe the shape of the histogram (Shape, Center, Spread)
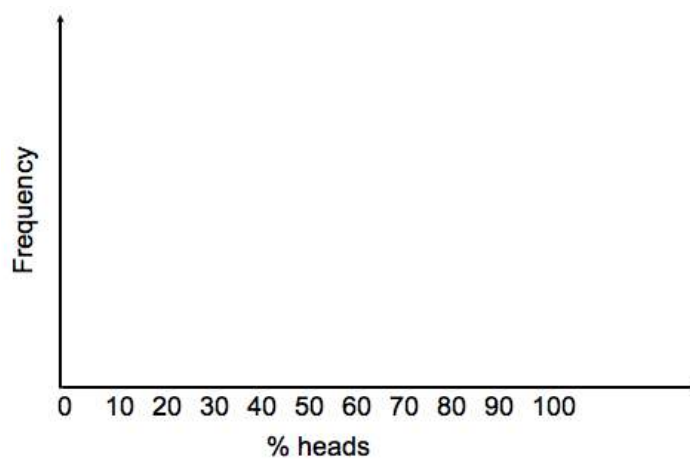
5. Compare the shape center and spread of each distribution. What do you notice?

6. If you repeated this process with 500 flips instead of 5 or 20, predict what would happen to the shape, spread, and center of the new histogram.

Set

In 1963, NBC started to host a game called _Let's Make a Deal!_ Contestants were given three doors to choose from. Behind one door was a prize. After selecting one door, the contestant was shown what was behind one of the doors they did not select. The contestant is then asked if they would like to stick with the door they first selected, or switch to the remaining one.

7. Which strategy do you think would result in the best chance of selecting the winning door? Should the contestant switch doors, or stick with the first one they chose?

Go to the following website: http://nlvm.usu.edu/en/nav/category_g_3_t_2.html

Select the applet stick or switch.

8. Play the game 20 times using the stick method and 20 times using the switch method. Record your wins and losses in the table below:

	Stick	Switch	Total
Win			
Lose			
Total			

9. Based on the simulation, what is $P(winning|stick) =$

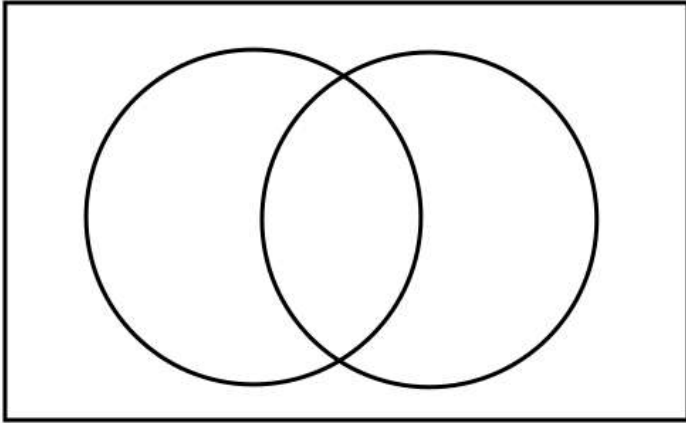10. Based on the simulation, what is $P(winning|switch) =$

11. Click on the multiple games tab. Simulate 100 games for each strategy. What is the probability of winning using each method?

Topic: Probability

12. For your two-way table in problem 8, create a Venn diagram and a tree diagram below.

13. $P(winning) =$

14. $P(winning \cap sticking) =$

15. $P(winning \cup sticking) =$

16. $P(loosing|sticking) =$

17. $P(winning \; or \; loosing) =$

18. Are the events winning and sticking independent of each other? Justify your answer using probabilities.