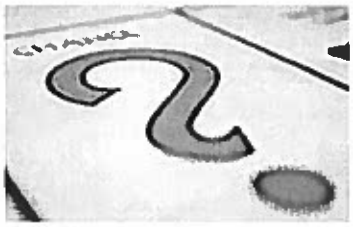
Name: _____ Hour: _____ Date: _____

Lesson 4.1: What's the probability of getting an odd product from two dice?



We're going to play a game to answer this question. You and your partner must decide who will be "Odds" and who will be "Evens". Then you will roll two dice and multiply the numbers. If the product is odd, the odd person wins and vice versa for evens. Play 20 times, keeping track of how many wins each person has.

1. How many times did the odds win? _____ Write this as a fraction out of 20 and turn it to a percentage.

Maybe the odds just had a run of bad luck. Let's see how the rest of the class did with odds. Write the number of odds wins for your group in the table on the board.

2. Find the total percent of rolls that were odd products for the whole class. How does this compare to your group's results?

3. To determine the true probability of rolling an odd product, we should list out all possible products that we could get. Complete the table below to show all possible products.

4. Use your table to find the probability of rolling an odd product.

5. Which was closer to the percentage you found in #4, your group data or the classroom data? Why do you think that is?

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

6. Explain what the probability of rolling odds means in this setting.

Name: _____ Hour: _____ Date: _____

Lesson 4.1– Randomness, Probability and Simulation

Important ideas from the text:

Application 4.1 Will the train arrive on time?

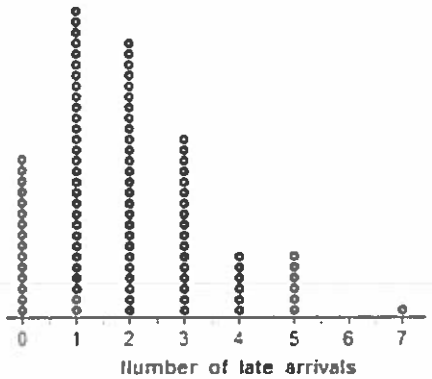
New Jersey Transit claims that its 8:00 a.m. train from Princeton to New York has probability 0.9 of arriving on time. Assume for now that this claim is true.

1. Explain what probability 0.9 means in this setting.

2. The 8:00 a.m. train has arrived on time 5 days in a row. What's the probability that it will arrive on time tomorrow? Explain.

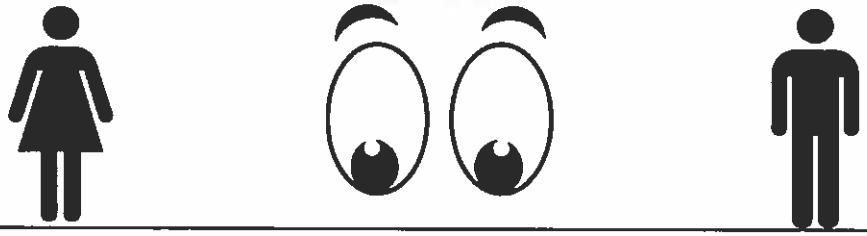
3. A businessman takes the 8:00 a.m. train to work on 20 days in a month. He is surprised when the train arrives late in New York on 3 of the 20 days. Should he be surprised? Describe how you would carry out a simulation to estimate the probability that the train would arrive late on 3 or more of 20 days if New Jersey Transit's claim is true. Do not perform the simulation.

4. The dotplot below shows the number of days on which the train arrived late in 100 repetitions of the simulation. What is the resulting estimate of the probability described in Question 3? Should the businessman be surprised?



Name: _____ Hour: _____ Date: _____

Lesson 4.2: What is the probability of being a male student with blue eyes?



To answer today's question we will randomly select 10 students to come up front. Use those students' information to answer the following questions.

1. In any given class, there are males and females who have blue, brown or green eyes. Create a table or tree diagram that shows all possible combinations of gender with eye color.

2. Using the 10 students chosen, find each of the following probabilities:

   P(Male) = P(Blue Eyes) =

   P(Female) = P(Brown Eyes) =

   P(Green Eyes) =

3. Find each of the following probabilities and explain why your answer makes sense.

   P(Male or Female) = P(Blue or Brown Eyes) =

4. Find each of the following probabilities and explain why your answer makes sense.

   P(Male or Blue Eyes) = P(Female or Brown Eyes) =

5. Find each of the following probabilities and explain why your answer makes sense.

   P(Not Green Eyes) = P(Not Male) =

Name: _____ Hour: _____ Date: _____

Lesson 4.2 – Basic Probability Rules

Important ideas from the text:

Application 4.2 How prevalent is high cholesterol?

Choose an American adult at random. Define two events:

A = the person has a cholesterol level of 240 milligrams per deciliter of blood (mg/dl) or above (high cholesterol)
B = the person has a cholesterol level of 200 to <240 mg/dl (borderline high cholesterol)

According to the American Heart Association, $P(A) = 0.16$ and $P(B) = 0.29$.

1. Explain why events A and B are mutually exclusive.

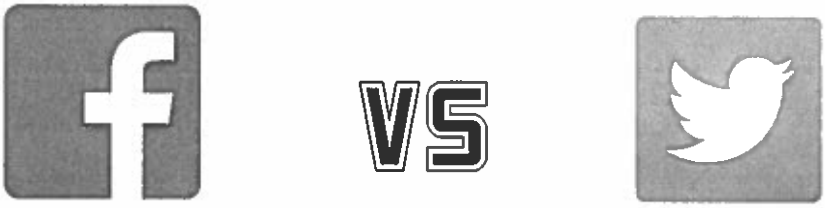
2. Say in plain language what the event "A or B" is.

Find $P(A \text{ or } B)$.

3. Let C be the event that the person chosen has normal cholesterol (below 200 mg/dl). Find $P(C)$.

Name: _____ Hour: _____ Date: _____

Lesson 4.3: Facebook or Twitter?



What is the probability that a randomly selected person from the class uses Facebook? Uses Twitter? Uses both? None?

1. Collect class data to fill in the following two-way table.

	Twitter	No Twitter	Total
Facebook			
No Facebook			
Total			

2. Suppose that we randomly choose a student from class. Find the following probabilities.

P(Facebook) = P(Twitter) =

P(no Facebook) = P(no Twitter) =

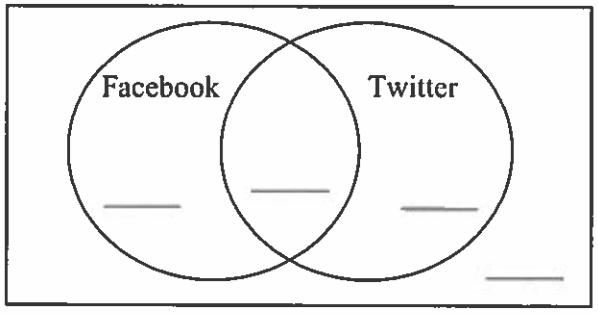
3. Now we will find some probabilities for two events occurring.

P(Facebook AND Twitter) = P(Twitter AND no Facebook) =

P(Facebook AND no Twitter) = P(no Facebook AND no Twitter) =

4. Is P(Facebook OR Twitter) = P(Facebook) + P(Twitter)? Why or why not?

5. Take the values from the two-way table and put them in the following Venn Diagram.



a. Where is "Twitter AND Facebook"

b. Where is "Twitter OR Facebook"

Name: _____ Hour: _____ Date: _____

Lesson 4.3 – Two-Way Tables and Venn Diagrams

Important ideas from the text:

Application 4.3 Who owns a home?

What is the relationship between educational achievement and home ownership? A random sample of 500 U.S. adults was selected. Each member of the sample was identified as a high school graduate (or not) and as a homeowner (or not). The two-way table displays the data. Suppose we choose a member of the sample at random. Define events G: is a high school graduate and H: is a homeowner.

	High school graduate	Not a high school graduate
Homeowner	221	119
Not a homeowner	89	71

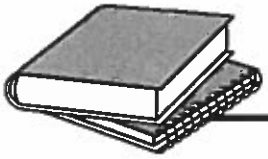
1. Explain why $P(\text{G or H}) \neq P(\text{G}) + P(\text{H})$. Then find $P(\text{G or H})$.

2. Make a Venn diagram to display the sample space of this chance process.

3. Write the event "is not a high school graduate but is a homeowner" in symbolic form.

Name: _____ Hour: _____ Date: _____

Lesson 4.4: Do you prefer English or Math?



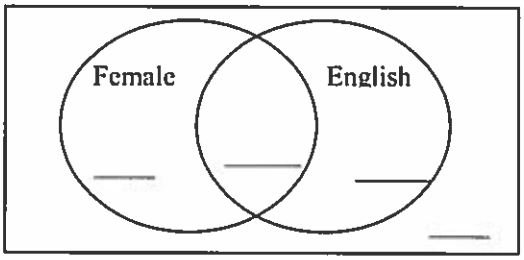
English VS

Definition: Two events are **independent** if knowing whether or not one event has occurred does not change the probability that the other event will occur.

Are the events "Female" and "prefers English" independent?

1. Collect class data to fill in the following two-way table and Venn Diagram.

	English	Math	Total
Female			
Male			
Total			



2. Suppose that we randomly choose a student from class. Find the following probabilities.

P(Female) = P(English) =

P(no Female) = P(no English) =

P(Female AND English) = P(English AND no Female) =

P(Female AND no English) = P(no Female AND no English) =

3. Find P(Female OR English).

4. What is the probability that a student prefers English, given that they are a female? Write as a percent.

5. What is the probability that a student prefers English, given that they are a male? Write as a percent.

6. Are the events "Female" and "prefers English" independent? Explain.

Name: _____ Hour: _____ Date: _____

Lesson 4.4 – Conditional Probability and Independence

Important ideas from the text:

Application 4.4 Who earns As in college?

Students at the University of New Hampshire received 10,000 course grades in a recent semester. The two-way table below breaks down these grades by which school of the university taught the course. The schools are Liberal Arts, Engineering and Physical Sciences (EPS), and Health and Human Services.

	Grade Level		
School	A	B	Below B
Liberal Arts	2,142	1,890	2,268
Engineering and Physical Sciences	368	432	800
Health and Human Services	882	630	588

Choose a University of New Hampshire course grade at random. Define a low grade as one that is below a B.

1. Find *P*(low grade | Engineering). Interpret this probability in context.

2. Find P(low grade | Liberal Arts). Interpret this probability in context.

3. Are events "low grade" and "engineering" independent? Justify your answer.

4.4 Venn Diagram Practice

1. A 2013 survey suggests that 76% of U.S. teenagers use Facebook, 24% use Twitter, and 15% do both. Suppose we select a U.S. teenager at random and learn that the student uses Facebook. Find the probability that the student uses Twitter.

   a. Make a Venn diagram or table to model the situation.

   b. Find the probability that the student uses Facebook or Twitter.

   c. Given the student uses Facebook, what is the probability that they use Twitter?

2. A recent census at a major university revealed that 60% of its students mainly used Macintosh computers (Macs) and 80% used PCs. In the census, 43% used both types of computers. Suppose we select a student at random from among those polled.

   a. Make a Venn diagram or table to model the situation.

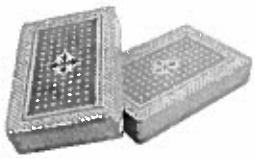
   b. Find the probability that a person uses a Mac and not a PC.

   c. What is the probability that a student does not use a Mac or a PC?

   d. Given the student does use a computer, what is the probability that they use a PC?

Name: _____ Hour: _____ Date: _____

Lesson 4.5: Can you get a pair of Aces or a pair of Kings?


Rules of the game. Start with five cards total: two aces and three Kings. The player chooses their first card and records the results, and then chooses their second card and records the result. **The player wins if they get a pair of Aces or a pair of Kings.**

1. Choose one person who is the dealer and one who is the player. Play the game 10 times.

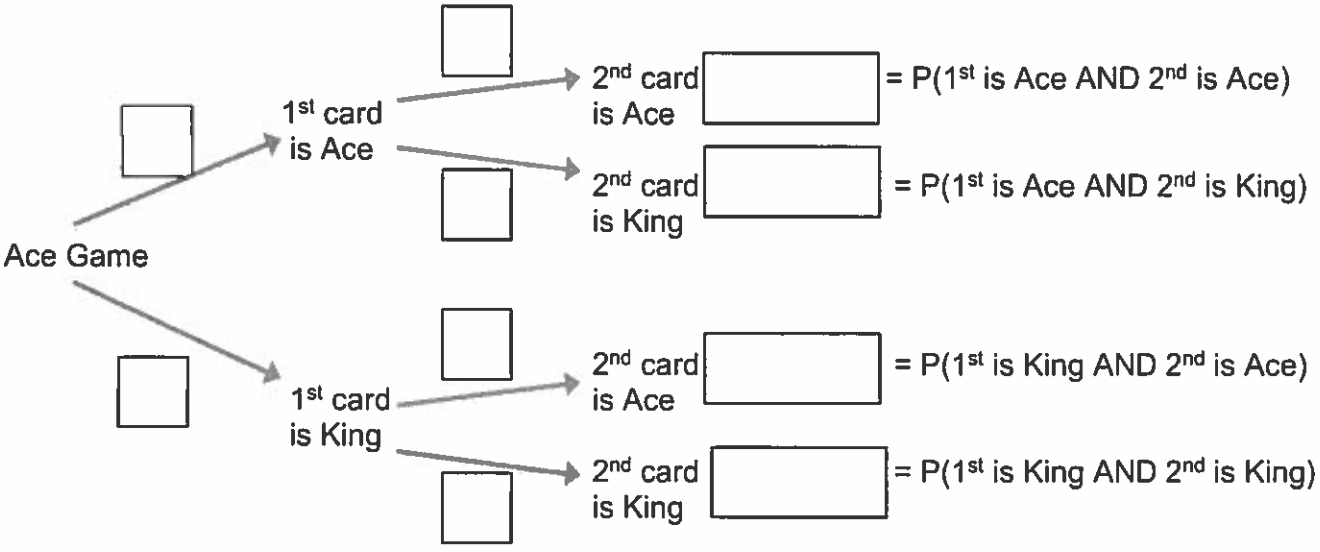
First card										
Second card										
Winner?										

Based on your 10 games, what is the probability of winning this game? _____

2. Go to the front of room to record the number of wins in 10 games.

Based on the whole class data, what is the probability of winning this game? _____

3. Let's try to use a Tree Diagram to calculate the theoretical probability. Fill in the blank boxes with the correct probabilities.



4. Find the theoretical probability of winning the game. _____

5. What is the probability that the 1st card was a King, given that the person won the game?

Name: _____ Hour: _____ Date: _____

Lesson 4.5 – Conditional Probability and Independence

Important ideas from the text:

Application 4.5 Not milk?

Lactose intolerance causes difficulty in digesting dairy products that contain lactose (milk sugar). It is particularly common among people of African and Asian ancestry. In the United States (not including other groups and people who consider themselves to belong to more than one race), 82% of the population is white, 14% is black, and 4% is Asian. Moreover, 15% of whites, 70% of blacks, and 90% of Asians are lactose intolerant. Suppose we select a U.S. person at random.

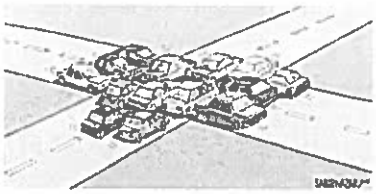
1. Construct a tree diagram to represent this situation.

2. Find the probability that the person is lactose intolerant.

3. Given that the chosen person is lactose intolerant, what is the probability that he or she is Asian?

Name: _____ Hour: _____ Date: _____

Lesson 4.6: Can we predict traffic jams and snow days?



LOCAL **NEWS**

A local news station recently added a "Traffic Jam Calculator" and a "Snow Day Calculator" to their website.

Traffic Jam Calculator for next week

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
Probability	0.4	0.2	0.3	0.5	0.7

1. Find P(Thursday traffic jam):_____ Interpret:_____

2. Find P(Friday traffic jam): _____ Interpret:_____

3. Are the events "Thursday traffic jam" and "Friday traffic jam" independent? Explain.

4. Find P(Thursday traffic jam AND Friday traffic jam):_____

5. Find P(traffic jam every day of the week):_____

6. Find P(no traffic jams all week):_____

7. What is the complement of "at least 1 traffic jam this week"? _____

8. Find P(at least 1 traffic jam this week):_____

Snow Day Calculator for next week

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
Probability	0.1	0	0.2	0.7	0.6

1. Find P(Thursday snow day):_____ Interpret:_____

2. Find P(Friday snow day): _____ Interpret:_____

3. Are the events "Thursday snow day" and "Friday snow day" independent? Explain.

4. Find P(Thursday snow day AND Friday snow day):_____

Name: _____ Hour: _____ Date: _____

Lesson 4.6 – The Multiplication Rule for Independent Events

Important ideas from the text:

Application 4.6 How to interpret genetic screening?

The First Trimester Screen is a test given during the first trimester of pregnancy to determine if there are specific chromosomal abnormalities in the fetus. According to a study published in the *New England Journal of Medicine*, approximately 5% of normal pregnancies will receive a positive result.

1. Suppose that two unrelated women who are having normal pregnancies, Devondra and Miranda, are given the First Trimester Screen. What is the probability that Devondra gets a positive result and Miranda gets a negative result?

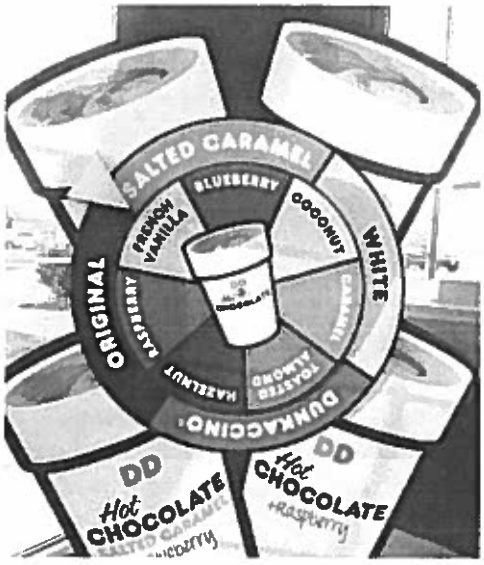
2. If 100 unrelated women with normal pregnancies are tested with the First Trimester Screen, what is the probability that at least 1 woman will receive a positive result?

3. Refer to Question 1. If Devondra takes the test twice, explain why we can't say that the probability she will get a positive result both times is (0.05)(0.05) = 0.0025.

Name: _____ Hour: _____ Date: _____

Lesson 4.7: Too Many Choices, Too Early in the Morning

This morning I stopped at Dunkin' Donuts for a coffee. They sell coffee in small, medium, large and extra-large. There are four kinds of coffee. They also offer 7 different kinds of flavor shots. How many different ways could I order my coffee?



1. Use a table, tree diagram or some other strategy to find the total number of ways I could order my coffee. (Keep in mind that you do not have to add a flavor shot.)

2. I finally made my decision and the barista asked me if I would like to add whipped cream, chocolate syrup or caramel syrup. AAaaaaahhhh!!! How many total ways could I have ordered the coffee now?

3. As I went to pay for my coffee, I saw a sign saying, "Win free coffee for a year! Choose 4 different digits from 1 to 9 to create a 4-digit passcode. Enter your passcode online and if you match our secret passcode, you'll win free coffee for a year!" How many different passcodes could I choose?

4. Dunkin' Donuts is thinking about offering a promotion to win free coffee for life. For this contest the customer will have to use all the digits from 1 to 9 to create a nine digit passcode. How many ways can this be done?

Name: _____ Hour: _____ Date: _____

Lesson 4.7 – The Multiplication Counting Principle and Permutations

Important ideas from the text:

Application 4.7 Do you scream for ice cream?

The local ice cream shop in Dontrelle's town is called 21 Choices. Why? Because they offer 21 different flavors of ice cream. Dontrelle likes all but three of the flavors that 21 Choices offers: bubble gum, butter pecan, and pistachio.

1. A 21 Choices "basic sundae" comes in three sizes—small, medium, or large—and includes one flavor of ice cream and one of 12 toppings. Dontrelle has enough money for a small or medium basic sundae. How many different sundaes could Dontrelle order that include only flavors that he likes?

2. Dontrelle could order a cone with three scoops of ice cream instead of a sundae. He prefers to have three different flavors (for variety) and he considers the order of the flavors on his cone to be important. How many three-scoop cones with three different flavors that Dontrelle likes are possible at 21 Choices? Give your answer as a number and using *nPk* notation.

Name: _____ Hour: _____ Date: _____

Lesson 4.8: How many ways can you order a hamburger?

In 2009, Wendy's had a take-out bag which said, "We figured out that there are 256 ways to personalize a Wendy's hamburger. Luckily someone was paying attention in math class." Is this correct?

1. Does the order of the toppings matter? For example, is ketchup then mustard the same as mustard then ketchup? Explain.

2. Wendy's offers 9 topping options for their hamburgers. Choose your three favorite toppings and list all possible ways they can be put in order below. How many possible ways can you put the toppings in order?

3. How many ways can you order a hamburger with 3 toppings if the order of toppings does not matter?

4. To figure out the total number of ways we can order a hamburger we need to find the number of ways to order 0, 1, 2…8, and 9 toppings. Complete the table below.

# of Toppings	Total Ways to Order	# of Toppings	Total Ways to Order
0		5	
1		6	
2		7	
3		8	
4		9	

5. How many ways can you order a hamburger?

Name: _____ Hour: _____ Date: _____

Lesson 4.8 – Combinations and Probability

Important ideas from the text:

Application 4.8 How many ways can you set up an iPod play list?

Janine wants to set up a play list with 8 songs on her iPod. She has 50 songs to choose from, including 15 songs by One Direction. Janine's iPod won't allow any song to appear more than once in a play list.

1. How many different sets of 8 songs are possible for Janine's play list? Assume that the order of the songs doesn't matter.

2. How many 8-song play lists contain no songs by One Direction? Suppose Janine decides to let her iPod select an 8-song play list at random.

3. What's the probability that none of the 8 songs is by One Direction?

4. Find the probability that exactly two of the songs on the play list are by One Direction.

Intro Stats Chapter 4 Big Ideas

Concept	Which Lesson?	Definition or Interpret
Probability		Definition: Interpret:
Law of Large Numbers		
Complement		Definition: Formula:
Mutually Exclusive		
General Addition Rule		
Conditional Probability		
Independent		
General Multiplication Rule		
Tree Diagram		
P(at least 1)		
Permutations		
Combinations		

The FRAME Routine

Key Topic

Is about...

Main Idea

Main Idea

Essential Ideas

Essential Ideas

So What? (What's important to understand about this?)