UNIT 11

THE HUNGER GAMES

PROBABILITY

CCM6+7+ 2015-16

Name: _____

Math Teacher: _____

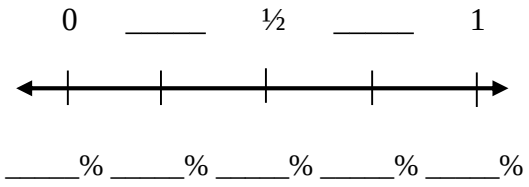
Projected Test Date: _____

Lesson 1: Probability Vocabulary

Probability	The chance that some event will happen
Outcome	One possible result of a probability event For example, 4 is an outcome when a die is rolled.
Event	A specific outcome or type of outcome
Sample Space	The set of all possible outcomes For example, rolling a die the sample space is {1,2,3,4,5,6}
Theoretical Probability	The ratio of the number of ways an event can occur to the number of possible outcomes
Experimental Probability	An estimated probability based on the relative frequency of outcomes occurring during an experiment.
Fundamental Counting Principle	States that you can find the total number of ways that two or more separate tasks can happen by **multiplying** the number of ways each task can happen separately
Independent Event	If the outcome of one event does not affect the outcome of a second event, the two events are independent
Dependent Event	If the outcome of one event affects the outcome of a second event, the events are dependent.

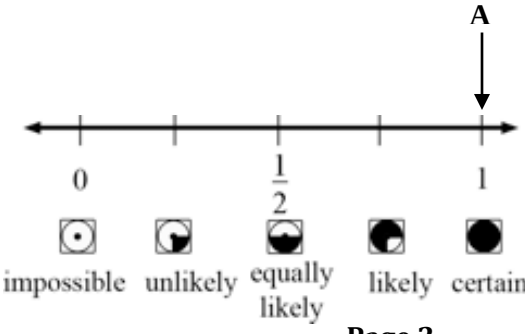
Probability is the measure of how likely an event is to happen. It is possible to have a 100% probability of the event which makes it "certain" to happen. It is also possible to have a zero percent chance which would make the event "impossible". You are going to look at some situations and determine how likely it is that they would happen.

For the following number line, fill in each blank.



Probability can be written as a _____, _____, or _____ and can only range from _____ to _____.

We can describe these probabilities using the categories shown below depending on where they would fall on a number line. NOTE: *EVERYTHING between equally likely and certain is determined "likely" and EVERYTHING between equally likely and impossible is determined "unlikely". Sometimes "likely" is called "as likely as not" and "unlikely" is called "as unlikely as not".*



If possible, write a ratio to represent each probability below and then list the given letter above the number line. Problem A is done for you to use as an example. Next, determine if each event is impossible, unlikely, equally likely, likely, or certain. It will not be able to have a ratio represent each scenario but you CAN determine the likelihood of the event using the categories shown on the number line.

A. If you roll a die you will get a number less than 7.

$\frac{6}{6} = 100\%$: **certain**

B. If you roll a die you will get an odd number.

_____ : _____

C. Jodi has dance rehearsals on Tuesday afternoons. How likely is it that Jodi is at the mall on a Tuesday afternoon?

_____ : _____

D. A bag contains 12 pennies and 12 dimes. How likely is it that you will draw a dime from the bag?

_____ : _____

E. You must be 15 years old to obtain a learner's permit to drive. Emily is 13 years old. How likely is it that Emily has her a learner's permit?

_____ : _____

F. The club volleyball team is made up of 7 boys and 4 girls. How likely is it that the first player chosen at random will be girl?

_____ : _____

G. Card numbered 1-8 are in a box. How likely is it that you will pull out a number greater than 2?

_____ : _____

H. How likely is it that the card you will pull out in problem will be a number less than 4?

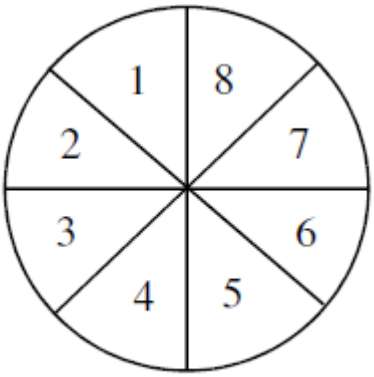
_____ : _____

The probability of an event is the ratio of the number of ways the event can occur to the number of possible outcomes.

$$P(event) = \frac{number\ of\ ways\ an\ event\ can\ occur}{number\ of\ possible\ outcomes}$$

Examples: On the spinner there are eight equally likely outcomes. Find the probability.

P(less than 3)	
P(greater than 10)	
P(less than 9)	

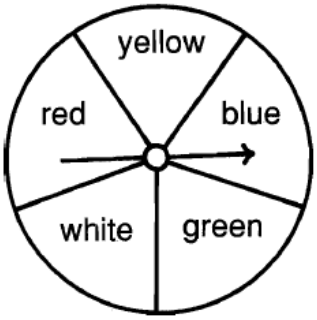


Why Did the King's Birthday Celebration Last So Long?

Do each exercise and find your answer in the Code Key. Notice the letter under it. Write this letter in the box containing the exercise number.

Code Key	$\frac{1}{100}$	$\frac{1}{5}$	$\frac{2}{5}$	$\frac{3}{5}$	$\frac{4}{5}$	1	$\frac{4}{13}$	$\frac{5}{13}$	$\frac{2}{7}$	$\frac{1}{8}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{7}{8}$
	R	T	S	N	I	K	P	E	W	Y	H	A	L	G

I. Find each probability if you spin the spinner once.



(1) P(red)

(2) P(green)

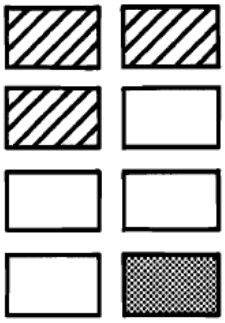
(3) P(blue or white)

(4) P(not yellow)

(5) P(not red)

(6) P(blue or red or yellow)

II. Find each probability if you choose one card at random.



(7) P(striped)

(8) P(white)

(9) P(shaded)

(10) P(white or shaded)

(11) P(striped or white)

(12) P(striped or shaded)

(13) P(not striped)

(14) P(not white)

(15) P(striped or white or shaded)

III. Solve.

(16) What is the probability of guessing the correct answer to a multiple choice question if there are 5 choices?

(17) What is the probability of guessing the correct answer to a true-false question?

(18) What is the probability that your birthday will fall on Saturday or Sunday?

(19) What is the probability of winning a raffle if 500 tickets are sold and you buy 5 of them?

(20) A class of 25 students has 15 girls and 10 boys. If one student is chosen at random, what is the probability it is a girl?

(21) There are 26 letters in the alphabet. What is the probability that a letter chosen at random is in the word MATHEMATICS?

5	1	18	8	3	14	6	17	13	10	15	20	4	11	7	16	21	12	19	2	9

Lesson 2: Simple Events – An event that consists of exactly one outcome or we can say that, a simple event is the event of a single outcome.

HEADLINES-"DISTRICT 12 REAPGIN BEING HELD TODAY"

May the odds be ever in your favor…will they be today???

In the book The Hunger Games, 24 contestants fight until only 1 is left standing. The contestants range from age 12 to age 18. In their country of Panem there are 12 districts. One boy and one girl from each district are chosen to attend the Hunger Games. They are called tributes.

Below is a summary of the tributes

District											
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
BOY	BOY	BOY	BOY	BOY	BOY	BOY	BOY	BOY	BOY	BOY	BOY
GIRL	GIRL	GIRL	GIRL	GIRL	GIRL	GIRL	GIRL	GIRL	GIRL	GIRL	GIRL

Use the table above to answer the following questions. Write the probabilities as simplified fractions. For #1-10, you choose one of the 24 contestants at random.

1	P(boy) [What is the probability you will choose a boy?]	
2	P(a person from district 12)	
3	P(a girl from district 11)	
4	P(a person not from district 2)	
5	P(either a boy or girl)	
6	P(a person from district 13)	
7	P(a girl from district 4, 5, or 6)	
8	P(a person from a district that is a multiple of 3)	
9	P(a person from an even numbered district)	
10	P(a boy from an even numbered district)	

Hunger Games Competition

The chart below shows how many tributes were left at the end of each day of the 74th Annual Hunger Games

	Tributes remaining		Tributes remaining		Tributes remaining
Start	24	**Day 6**	10	**Day 12**	5
End of Day 1	13	**Day 7**	10	**Day 13**	5
Day 2	12	**Day 8**	8	**Day 14**	4
Day 3	12	**Day 9**	6	**Day 15**	3
Day 4	12	**Day 10**	6	**Day 16**	3
Day 5	10	**Day 11**	6	**Day 17**	2

Assume that all of the contestants have equal abilities to win the Hunger Games. Use the table above to answer the following questions.

	Name	Fraction	Percent (nearest whole percent)
1.	Before the Hunger Games begin what is the probability that Katniss will win?		
2.	Before the Hunger Games begin what is the probability that Katniss won't win?		
3.	After day one, what is the probability that Katniss will win?		
4.	After day one, what is the probability that Katniss won't win?		
5.	At the end of day 5 what is the probability that Katniss will win?		
6.	At the end of day 8 what is the probability that Katniss will win?		
7.	At the end of day 14 what is the probability that Katniss will win?		
8.	At the end of day 16 what is the probability that Katniss will win?		
9.	At the end of day 16 what is the probability that Katniss won't win?		
10.	***Why does Katniss' probability become greater as she gets farther into the Hunger Games?***		

Lesson 3: Expected Outcomes

If the Hunger Games were played 84 times, about how many times would you expect a tribute from District 11 would win? [Assume equal chances for all districts.]

What is the probability that a tribute from District 11 would win?

Decimal	Fraction	Percent

Multiply the probability times the number of events. _____ · 84 =

OR

Set up a proportion $\frac{1}{12} = \frac{x}{84}$

Suppose 24 tributes compete in a Hunger Games simulation.		
1.	If there is one simulation, what is the probability of a tribute from District 12 winning?	
2.	If you run the simulation 96 times, about how many times would you expect the boy from District 1 to win?	
3.	If you run the simulation 120 times, about how many times would you expect a tribute from a prime district to win?	
4.	If you run the simulation 80 times, about how many times would you expect a girl tribute from district 4, 5, or 6 to win?	
In the Hunger Games simulation the final for tributes consist of two from District 12, one from District 2, and one from District 5.		
5.	If there is one simulation, what is the probability that district 12 will win?	
6.	If you run the simulation 9 2times, about how many times will district 2 win?	
7.	If you run the simulation 144 times, about how many times will district 5 **not** win?	
Cinna puts the following color cards in a bag for Katniss to choose one for her next dress: green, yellow, orange, red, purple		
8.	If Katniss draws 65 times, about how many draws would be green?	
9.	If Katniss draws 180 times, about how many draws would not be red?	
10.	If Katniss draws 640 times, about how many draws would be green, red, or purple?	

When the Boy Tire Maker Married the Girl Tire Maker, What Did Everyone Say?

Do each exercise and find your answer at the bottom of the page. Write the letter of the exercise in the box above the answer.

1. Suppose you roll a regular 6-faced die.

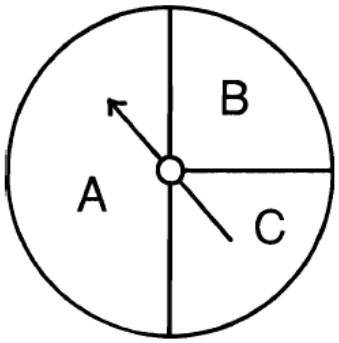
(A) How many equally likely outcomes are there?

(E) If you roll the die once, what is the probability of rolling a 3?

(H) If you roll the die 60 times, about how many times would you expect to get a 1?

(I) If you roll the die 300 times, about how many times would you expect to get a 5?

2. A spinner is shown at the right for which each outcome is **not** equally likely.



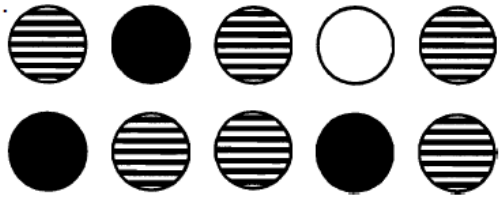
(E) If you spin the spinner once, what is the probability that it will stop on A?

(A) If you spin the spinner once, what is the probability that it will stop on B?

(T) If you spin the spinner 50 times, about how many times would you expect it to stop on A?

(Y) If you spin the spinner 80 times, about how many times would you expect it to stop on C?

3. Find each probability if you choose one marble at random.



(E) P(black)

(A) P(not black)

(R) P(black or white)

(S) P(striped)

(E) P(not white)

(M) P(yellow)

4. Solve.

(N) If you flip a coin 150 times, about how many times would you expect to get heads?

(C) The letters a, e, *i*, o, *u*, and y are vowels. If one letter of the alphabet is chosen at random, what is the probability it is a vowel?

(K) If you randomly pick a date in April, how many equally likely outcomes are there?

(P) A magician asks you to pick a card, any card, from a standard deck of 52 cards. What is the probability of picking an ace?

25	10	$\frac{9}{10}$	20	$\frac{1}{8}$	0	6	30	$\frac{1}{2}$	$\frac{2}{13}$	$\frac{7}{10}$	$\frac{1}{5}$	75	50	$\frac{3}{13}$	$\frac{1}{6}$	32	$\frac{3}{5}$	$\frac{1}{13}$	$\frac{1}{4}$	$\frac{2}{5}$	$\frac{3}{10}$

Lesson 4: Experimental & Theoretical Probability

Theoretical probability – determined mathematically
Experimental probability – determined by conducting an experiment

CELEBRITY HUNGER GAMES EXPERIMENT

Based on the book, a tribute has a bit more than a 50% chance of advancing to the next day. After the first day a tribute's chance of advancing any given day rises to about 85-90%.

Day 1: Roll two die. If you roll a 8, 9, 10, 11, or 12 the tribute is eliminated.
After day 1: Roll two dice. If you roll a 3, 11, or 12 the tribute is eliminated. If the final tributes are eliminated on the same day, re-roll for that day.

Simulate the 12 person Celebrity Hunger Games five times. In each column record the day the tribute was eliminated.

Player	1st Simulation	2nd Simulation	3rd Simulation	4th Simulation	5th Simulation
Lady Gaga					
Justin Bieber					
Selena Gomez					
Harry Potter					
Kermit the Frog					
Luke Skywalker					
Tony Romo					
Michael Jordan					
Shrek					
Mrs. Bailey					
Taylor Swift					
Katniss Everdeen					
WINNER					

1.	What was the theoretical probability Taylor Swift would win?	
2.	What was the experimental probability Taylor Swift would win?	
3.	What was the theoretical probability Kermit the Frog would not win?	
4.	What was the experimental probability Kermit the Frog would not win?	
5.	What was the theoretical probability a male (human) would win?	
6.	What was the experimental probability a male (human) would win?	
7.	Why are theoretical and experimental probabilities not necessarily the same?	

Lesson 5: Tree Diagrams, Lists, and Tables

There are several ways you can find probabilities of compound events using organized lists, tables, tree diagrams and simulation.

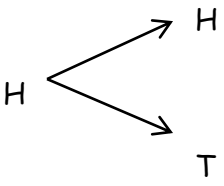
For example: What is the probability of flipping a coin and it landing on heads both times.

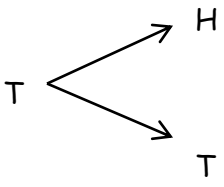
Table:

	H	T
H	HH	HT
T	TH	TT

HH = $\frac{1}{4}$

Tree Diagram:





HH = $\frac{1}{4}$

Organized List:

(H, T)

(H, H)

(T, H)

(T, H)

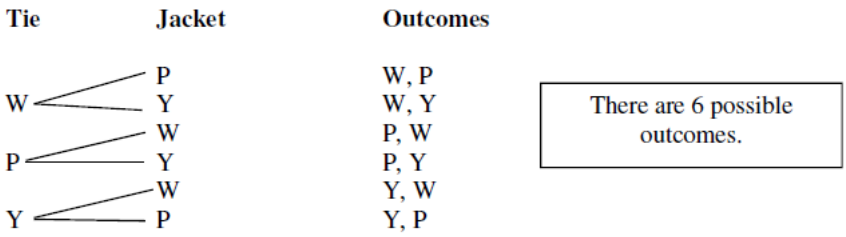
HH = $\frac{1}{4}$

After you use the diagrams you might notice a pattern to where you can multiply the probabilities together

$\frac{1}{2} \cdot \frac{1}{2} = \frac{1}{4}$

You can draw a tree diagram to find the number of possible combinations or outcomes.

Example Haymitch will wear either a white, purple, or yellow tie with a white, purple, or yellow jacket. The tie and jacket cannot be the same color. How many different choices does Haymitch have?



Create a tree diagram and give the total number of outcomes.

1. Flipping three coins	2. Flipping a Coin and Rolling a Number Cube	3. The product of rolling two dice
3. Katniss bought 3 pins: One with a star, a butterfly, and a mockingjay. She has a blue dress and a green dress. How many dress/pins combinations are possible?	4. Peeta has three different types of icing that are chocolate, cream cheese, and butter crème. His cake flavors are red velvet, birthday cake, and strawberry. How many possible cake-icing outcomes are there?	6. Katniss is choosing her last meal before the Hunger Games. She has 3 choices for entrée: soup, chicken, or beef. She can choose from 2 desserts and can drink water, tea, or milk. What are all the combinations she can make?

Lesson 6: Area Models

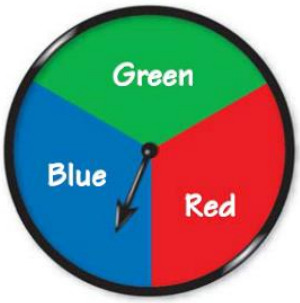
In the Red and Blue game, the goal is to choose a red and a blue marble in any order. You choose one marble from the first bucket, and then choose one marble from the second bucket. In bucket 1, you have one red and two green marbles. In bucket 2, you have one marble of each color: red, blue, yellow, and green. Let's use an area model to determine our theoretical probability of "winning" the Red and Blue game.

Bucket 1

Bucket 2

Now let's use an area model to analyze another game. Players spin each of the following spinners once. If the combination of the outcomes makes purple they win. Be sure to find the theoretical probability of a player making purple.

Spinner A



Spinner B

Spinner A

Spinner B

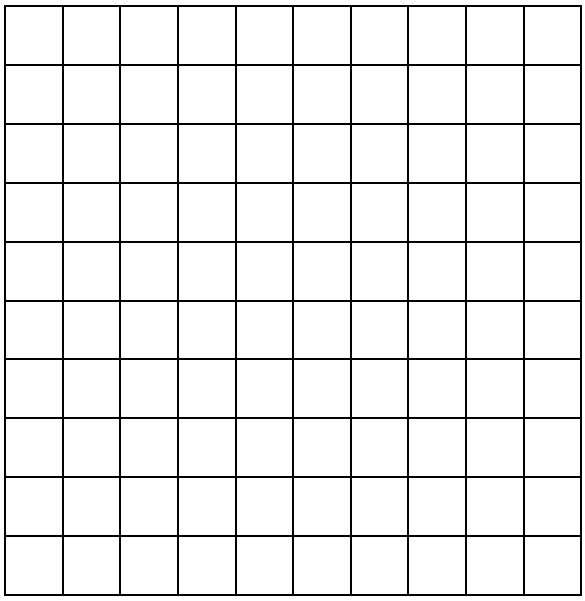
P(purple)

P(not purple)

Now, let's practice using an area model to check the accuracy of the local weather man. If he predicts 50% chance of showers today and 30% chance of showers tomorrow, what is the probability that it will rain on both days?

Day 1

Day 2



If it rains both days, do you think the weather man is dependable?

Lesson 7: Geometric Probability

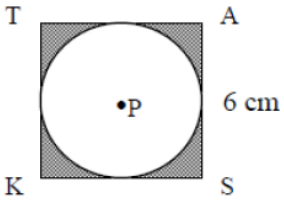
The probability of the event is: $\frac{\text{the area of the region of the event}}{\text{the area of the entire region}}$

Circle: $Area = \pi r^2$ **Triangle:** $A = \frac{1}{2}bh$

Square: $Area = s^2$ **Rectangle:** $A = lw$

Round to the nearest hundredth and use 3.14 for Pi.

1. a. Find the area of the circle.

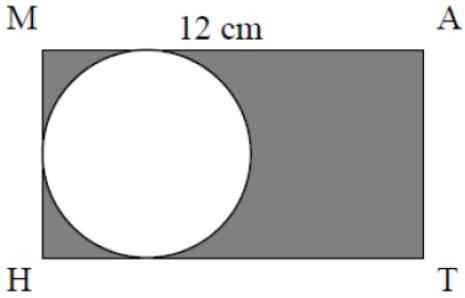


b. Find the area of the square.

c. Find the probability that a dart thrown randomly will hit the circle. Give your answer as a fraction, decimal and percent.

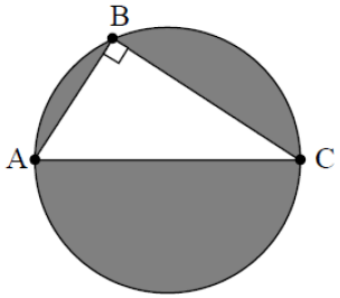
2. In the following diagram MATH is a rectangle with an inscribed circle. The circle has a diameter of 8 centimeters and the rectangle has a height of 12 centimeters (as shown).

Find the probability that a dart thrown randomly will hit the circle. Give your answer as a fraction, decimal and percent.



3. In the following diagram, right triangle ABC is inscribed in a circle. It is given that $AC = 26$, $BC = 24$, $AB=10$ and AC is the diameter of the circle.

   Find the probability that a dart thrown randomly will hit the triangle. Give your answer as a fraction, decimal and percent.



Use the picture at the right for Questions 4 – 8.

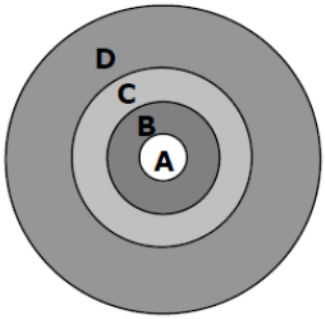
4. A rectangular field measures 27 feet by 15 feet. Find the area of the field.

5. A small shed is on the field. Its dimensions are 8 feet by 10 feet. What is its area?

6. What is the probability that a single drop of rain that lands in the field would hit the shed? Give your answer as a fraction, decimal and percent.

7. What is the probability that a single drop of rain that lands in the field would *not* hit the shed? Give your answer as a fraction, decimal and percent.

8. **CHALLENGE:** There is a large oak tree in one corner whose branches have a diameter of 20 feet. What is the probability that a single drop of rain that lands in the field would miss both the shed and the tree? (Assume the shed is not under the tree.)



Use the dartboard at the right for Questions 9 – 15.

A dartboard is made up of concentric circles with the following radii:

Circle A: r = 2 inches
Circle B: r = 4 inches
Circle C: r = 6 inches
Circle D: r = 10 inches

9. Find the area of circle *A*.

10. Find the area of circle *B* that is *not* covered by circle *A*

.

11. Find the area circle *C* that is *not* covered by circle *A* or *B*.

12. Find the area of the dartboard that is *not* covered by circles *A*, *B*, or *C*.

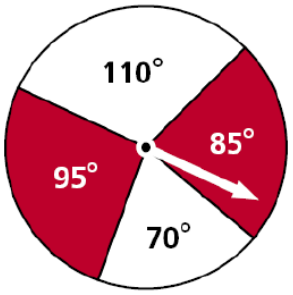
The circles on the dartboard are painted on a rectangular piece of corkboard that is 2 feet by 30 inches. Find the probability of each event, assuming the dart always lands on the corkboard.

13. A random dart lands on circle B or C.

14. A random dart lands just on circle B.

15. A random dart will make a bull's eye.

Use the spinner for Questions 16 – 20.



16. Find the probability that the spinner will land on the 95° region.

17. Find the probability that the spinner will land on the 110° region.

18. Find the probability that the spinner will land on the shaded region.

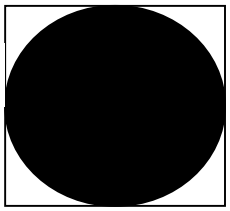
19. Find the probability that the spinner will land on the non-shaded region.

20. Find the probability that the spinner will land on a single region greater than 180°.

Your friend has an interesting collection of dartboards. If you throw a dart at random and it is guaranteed to hit the dartboard but you only get a point if it hits the shaded region, what is the probability that you will get a point on the dartboard below?

Determine the area of the entire dartboard.

18 in.



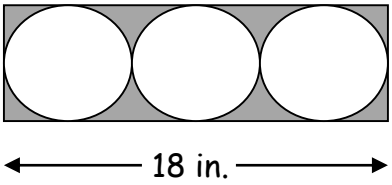
18 in.

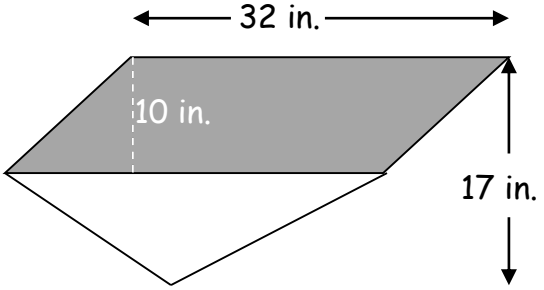
Determine the area of the shaded region.

Determine the probability by comparing the area of the shaded region to the area of the entire dartboard. Be sure to convert your probability to a percent.

$$\frac{area\ of\ the\ shaded\ region}{area\ of\ the\ entire\ dartboard}$$

Does your answer seem reasonable?





Area of the rectangle: _____

Area of one circle: _____

Area of three circles: _____

Area of shaded region: _____

$\frac{shaded\ area}{total\ area}$: _____

Probability: _____

Area of the parallelogram: _____

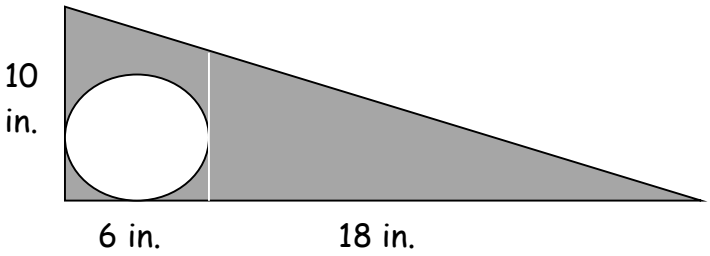
Area of triangle: _____

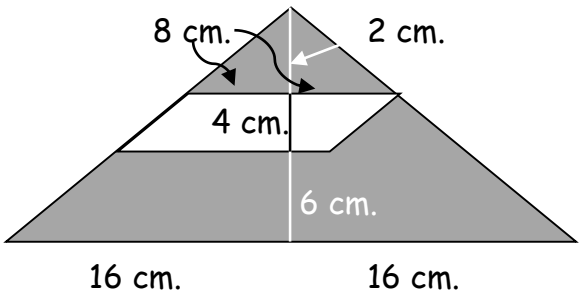
Area of total figure: _____

Area of shaded region: _____

$\frac{shaded\ area}{total\ area}$: _____

Probability: _____





Area of total figure: _____

Area of circle: _____

Area of shaded region: _____

$\frac{shaded\ area}{total\ area}$: _____

Probability: _____

Area of total figure: _____

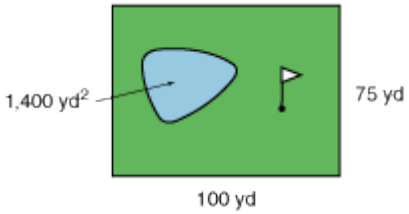
Area of parallelogram: _____

Area of shaded region: _____

$\frac{shaded\ area}{total\ area}$: _____

Probability: _____

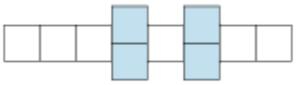
1. Find the probability that a golf ball will *not* land in the water shaded in the region below.



A. $\frac{14}{75}$ B. $\frac{61}{75}$

C. $\frac{4}{5}$ D. $\frac{21}{25}$

2. If someone throws a hopscotch stone onto a random square, what is the probability that it will land in the shaded region?



A. $\frac{2}{5}$ B. $\frac{1}{2}$

C. $\frac{1}{3}$ D. $\frac{4}{9}$

3. While you were riding in a hot-air balloon over a park, a sandbag fell off of the basket, but you don't know where in the park it fell. The entire park is 60,000 square feet. The playground in the park is 12,000 square feet. What is the probability that the sandbag is in the playground?

A. $\frac{1}{6}$ B. $\frac{2}{5}$

C. $\frac{1}{5}$ D. $\frac{1}{3}$

Lesson 8: The Counting Principle

The Counting Principle uses multiplication to find the number of possible outcomes.

Example: The Capitol's Best Pizza serves 11 different kinds of pizza with 3 choices of crust and in 4 different sizes. How many different selections are possible?

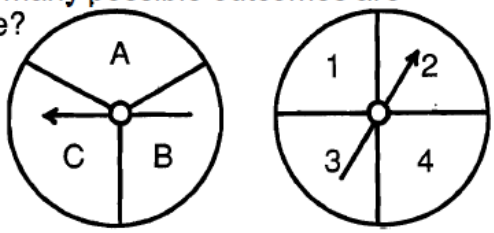
Apply the Counting Principle: $11 \cdot 3 \cdot 4 = 132$ 132 pizza selections

Use the Counting Principle to find the total number of outcomes in each situation.		
1.	The Hob nursery has 14 different colored tulip bulbs. Each color comes in dwarf, average, or giant size. How many different kinds of bulbs are there?	
2.	The type of bicycle Prim wants comes in 12 different colors of trim. There is also a choice of curved or straight handlebars. How many possible selections are there?	
3.	At a tribute banquet, guests were given a choice of 4 entrees, 3 vegetables, soup or salad, 4 beverages, and 4 deserts. How many different selections were possible?	
4.	Gale is setting the combination lock on his briefcase. If he can choose any digit 0-9 for each of the 6 digits in the combination, how many possible combinations are there?	
5.	Clove is flipping a penny, a nickel and a dime.	
6.	Rue choosing one of three appetizers, one of four main dishes, one of six desserts, and one of four soft drinks.	
7.	In how many different ways can Rue, Foxface, Clove, and Katniss place 1st, 2nd, and 3rd for a costume contest?	
8.	How many codes can Katniss make using 2 letters followed by a 1 digit number?	

Why Was Jesse James In the Hospital?

Find each answer in the code at the bottom of the page. Write the letter of the problem above the answer each time it appears.

(I) If you spin each of these spinners once, how many possible outcomes are there?



(E) The students at Melmac Middle School are trying to choose a school mascot and a school color. The suggestions for mascot are lion, bear, and porpoise. The suggestions for color are red, blue, and gold. How many different combinations are there?

(R) Mr. and Mrs. Quagmire are trying to decide on a name for their new baby girl. For a first name, they like either Melissa, Jennifer, Karen, Lisa, or Susan. For a middle name, they like either Anne or Jean. How many different choices do they have?

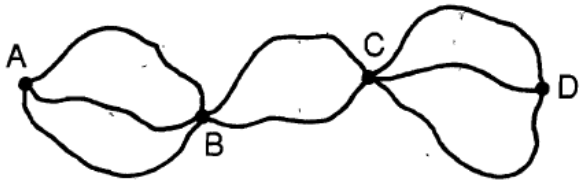
(A) Elmo decided to take two classes during summer school. For first period, he can choose either math or English. For second period, he can choose either art, music, drama, or cooking. How many different schedules of two classes are possible?

(C) If a baseball team has 5 pitchers and 3 catchers, how many different pitcher-catcher combinations can be used?

(H) Glitzy just bought 4 blouses, 5 skirts, and 2 blazers. If all the patterns and colors match, how many outfits can she make?

(T) Pizza Mind Pizza Parlor has 8 kinds of pizza, 3 kinds of salad, and 4 kinds of beverage. If you order one item from each category, how many different meals can be ordered?

(W) According to the map, how many different routes are there from A to D?



(O) Shoe World sells shoes in 20 different styles. Each style comes in 4 colors and 9 sizes. If the store manager wants to have every possible combination, how many pairs must he keep in stock?

(K) In Cornville, bicycle license plates have 2 letters followed by a 1-digit number. How many different license plates are possible?

(S) When you order a sandwich at Nelly's Deli, you can choose from 4 kinds of bread and 7 kinds of meat. On any sandwich, you can have mayonnaise or mustard or both or neither. How many different sandwiches can be ordered?

CODED ANSWER

40	9	92	18	8	112	880	8	24	112	12	15	6,760	6	112	40	720	720	96	9	10

Why Couldn't the Church Steeple Keep a Secret?

Solve each problem below and find your solution in the answer column. Write the letter of the answer in each box containing the number of the problem.

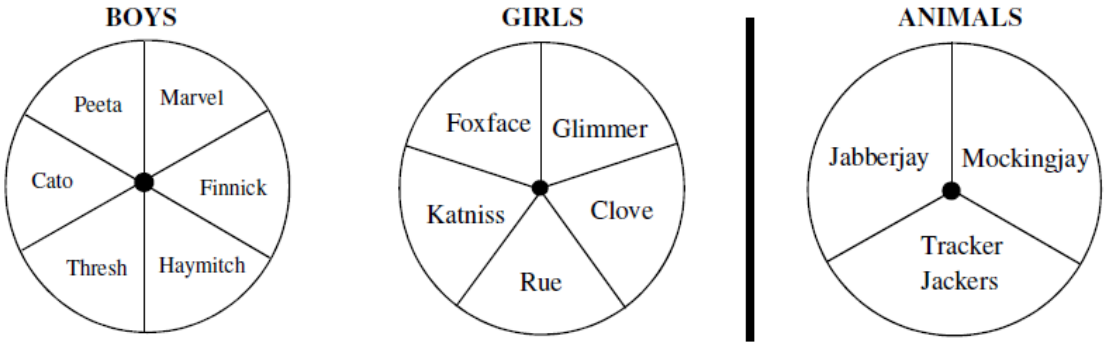
1. In how many ways can you arrange 6 things?
2. In how many ways can you arrange 6 things, 3 at a time?
3. Maria keeps her 4 stuffed bears lined up on a shelf over her bed. How many arrangements of the bears are possible?
4. How many different 2-letter arrangements can be selected from the 5 letters in the word CANDY?
5. Eleven people are competing in a sack race. There is a blue ribbon for first, a red ribbon for second, and a white ribbon for third. How many different first-second-third place finishes are possible?
6. David has decided he wants to call Jessica, Martha, and Eileen, but he hasn't decided in what order to call them. How many choices does he have?
7. The teacher plans to assign 8 students to 8 desks for a debate. How many different seating arrangements are possible?
8. In how many different ways can a president, vice-president, and secretary be elected from a class of 32 students?
9. If a school offers 9 different subjects, how many different schedules of 5 classes are possible?
10. Tak-Kee Plastic Company prints a 2-letter code on each of its products. How many different 2-letter codes can be formed using the 26 letters of the alphabet if the two letters must be different?
11. SureLock Lock Company makes combination locks with 50 numbers printed on the dial. Each lock combination is an arrangement of 3 different numbers. How many locks can the companymake without repeating a combination?

F	690
Y	15,120
H	20
K	8
W	40,320
N	110,200
S	720
R	14,830
T	29,760
O	24
L	117,600
G	36
A	990
E	120
B	650
P	41,150
D	6
C	27,360

8	4	2	10	2	11	11	5	11	7	5	9	1	8	3	11	11	2	6

Lesson 9: Independent Events

To find the probability of two or more independent events, **multiply** the probability of the first event times the probability of the second event.



For #1-6, the first two spinners above are spun. Find the probability of each event.					
1.	P(Peeta, Katniss)		2.	P(Cato, Clove)	
3.	P(boy, girl)		4.	P(Contains an E, starts with R)	
5.	P(ends with H, has 2 vowels)		6.	P(double letters, double letters)	
A third spinner is now added. Write the expression and find the probability of each event.					
7.	P(Peeta, Katniss, Mockingjay)		8.	P(marvel, Glimmer, ends with "jay")	
9.	P(not Thresh, not Rue, not tracker jackers)		10.	P(boy, girl, animal)	

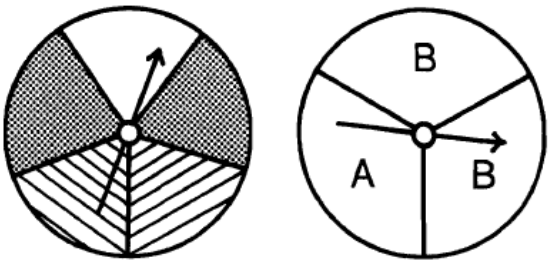
A quarter and a dime are tossed. Find the probability of each event.					
1.	P(H, T)		2.	P(both the same)	
3.	P(T,T)		4.	P(at least one head)	

A bag contains 6 marbles: 1 back, 2 white, and 3 striped. Prim picks one marble, replaces it, and then picks a second marble. Find the probability of the following.					
1.	P(black, white)		2.	P(black, striped)	
3.	P(white,striped)		4.	P(not white, striped)	
5.	P(black, black)		6.	P(striped, striped)	
7.	P(white, not white)		8.	P(not white, not white)	

What Do the Police Put On a Bad Pig?

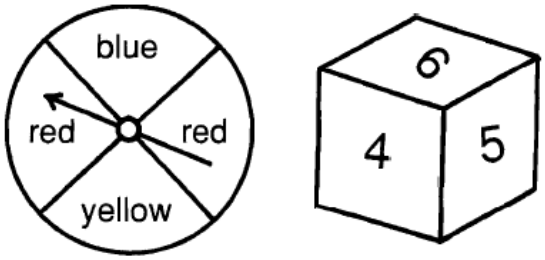
Cross out the box containing each correct answer. (If an answer appears more than once, it doesn't matter which one you cross out.) When you finish, write the letters from the remaining boxes in the spaces at the bottom of the page.

I. Find each probability if you spin both spinners.



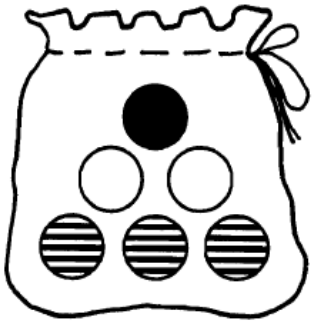
(1) P(white, A)
(2) P(white, B)
(3) P(striped, A)
(4) P(striped, B)
(5) P(not striped, A)
(6) P(not striped, B)
(7) P(not white, A)
(8) P(not white, B)

II. Find each probability if you spin the spinner and roll the number cube.



(9) P(blue, 2)
(10) P(blue, not 2)
(11) P(yellow, even)
(12) P(red, even)
(13) P(not blue, 5)
(14) P(not blue, odd)
(15) P(red, 4)
(16) P(red, not 4)

III. Find each probability if you pick one marble, replace it, then pick a second marble.



(17) P(black, white)
(18) P(black, striped)
(19) P(white, striped)
(20) P(not white, striped)
(21) P(black, black)
(22) P(striped, striped)
(23) P(white, not white)
(24) P(not white, not white)

IV. Solve.

(25) A test has two multiple choice questions, each with five choices. What is the probability of guessing the correct answer to both questions?

(26) One letter is randomly selected from the word MATH, and a second letter is randomly selected from the word JOKES. What is the probability that both letters are vowels?

A	T	T	N	O	H	E	E	A	T	P	P	I	M	G	C	O
$\frac{1}{3}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{5}$	$\frac{1}{6}$	$\frac{1}{7}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{9}$	$\frac{1}{10}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{15}$	$\frac{1}{16}$	$\frac{1}{18}$	$\frac{1}{20}$	$\frac{1}{24}$
T	H	O	U	G	S	S	L	F	A	E	E	F	A	T	S	E
$\frac{1}{25}$	$\frac{1}{36}$	$\frac{2}{5}$	$\frac{2}{7}$	$\frac{2}{9}$	$\frac{2}{15}$	$\frac{2}{15}$	$\frac{3}{8}$	$\frac{3}{10}$	$\frac{4}{9}$	$\frac{4}{15}$	$\frac{4}{15}$	$\frac{5}{8}$	$\frac{5}{12}$	$\frac{5}{24}$	$\frac{7}{15}$	$\frac{8}{15}$

Lesson 10: Dependent Events

To find the probability of two or more independent events, **multiply** the probability of the first event times the probability of the second event. To find the probability of the second event, you must assume the first event occurred.

Tell whether each event is independent or dependent.

1.	Haymitch (not good at fashion) selecting a sweater, selecting a shirt	
2.	Katniss choosing one card from a deck then choosing a second card without replacing the first.	
3.	Alma rolls two dice.	
4.	Katniss spins a spinner and rolls a number cube.	
5.	Gale's wallet contains two $5 bills, two $10 bills, and three $20 bills. Two bills are selected without the first being replaced.	

F I N N I C K

Mags places the seven cards above into a box. She draws one card, does not replace it, and then draws another card. Find the probability of each event.

1.	P(N, N)	F I N N I C K	
2.	P(C, F)	F I N N I C K	
3.	P(I, K)	F I N N I C K	
4.	P(N, I)	F I N N I C K	
5.	P(C, D)	F I N N I C K	
6.	P(N, not K)	F I N N I C K	

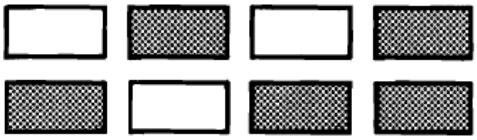
Annie draws three cards and does not replace them. Find the probability of each event.

7.	P(F, I, N)	F I N N I C K	
8.	P(N, I, not F)	F I N N I C K	

What Do You Get if a Bunch of Bad Guys Fall in the Ocean?

Cross out the box containing each correct answer. (If an answer appears more than once, it doesn't matter which one you cross out.) When you finish, write the letters from the remaining boxes in the spaces at the bottom of the page.

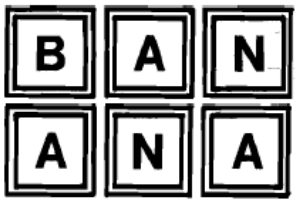
I. Find each probability if you pick a card, do *not* replace it, then pick a second card.



(1) P(black, then white) (2) P(black, then black)

(3) P(white, then black) (4) P(white, then white)

II. Each letter of the word ***BANANA*** is written on a card. Find each probability if you pick two cards without replacing the first.

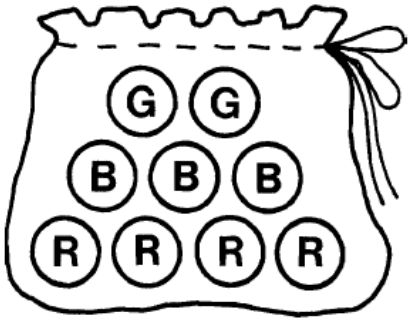


(5) P(B, then N) (6) P(B, then A) (7) P(N, then B)

(8) P(N, then A) (9) P(A, then B) (10) P(A, then N)

(11) P(N, then N) (12) P(A, then A) (13) P(B, then B)

III. Find each probability if you pick a marble, do not replace it, then pick a second marble. (R = red; B = blue; G = green)



(14) P(blue, then green) (15) P(green, then red)

(16) P(green, then green) (17) P(green, then not green)

(18) P(red, then blue) (19) P(red, then not blue)

(20) P(blue, then blue) (21) P(not blue, then not blue)

IV. Solve.

(22) There were 6 purple socks and 4 orange socks in a drawer. Zucky picked one sock without looking and then another without looking (or replacing the first). What is the probability that he picked 2 purple socks?

(23) There are 10 boxes in a grab bag. The boxes are identical except that 7 of them contain $20 bills. A contest winner gets to pick two boxes from the grab bag. What is the probability of getting two $20 bills?

TH	AN	IT	IT	IT	PL	AC	ES	EY	EY	ON	ON	RI	DE
0	$\frac{1}{3}$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{6}$	$\frac{1}{8}$	$\frac{1}{9}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{14}$	$\frac{1}{15}$
DE	DE	SO	ME	ET	WA	TE	AM	LL	RS	VE	RY	ST	ST
$\frac{1}{15}$	$\frac{1}{15}$	$\frac{1}{36}$	$\frac{2}{5}$	$\frac{3}{28}$	$\frac{4}{9}$	$\frac{5}{12}$	$\frac{5}{14}$	$\frac{5}{18}$	$\frac{7}{15}$	$\frac{7}{18}$	$\frac{7}{36}$	$\frac{15}{56}$	$\frac{15}{56}$

The Hunger Games Simulation

You received a piece of paper when you walked into class today.

+3	1

The first number (+1 to +6) represents how many years you are going to add to your current age for today's lesson.

My current age: _____ + my first number _____ = my age for this project _____

Members of my family : _____ (current members living you in your house including yourself)

The second number represents whether you received tesserae or note. In the Hunger games, tesserae represents additional food resources for families in need.

0 = you are not starving and you did not receive tesserae
1 = you are starving and your family has received tesserae each year since you were 12

Direction for determining your entries into the reaping

Part 1: AGE

Age	**12**	**13**	**14**	**15**	**16**	**17**	**18**
# of entries	1	2	3	4	5	6	7

Part 2: TESSERAE

You must add 1 extra entry for every family member (including yourself) that received tesserae. These extra entries are cumulative.

# of entries _____ X # of family members = _____ entries for tesserae

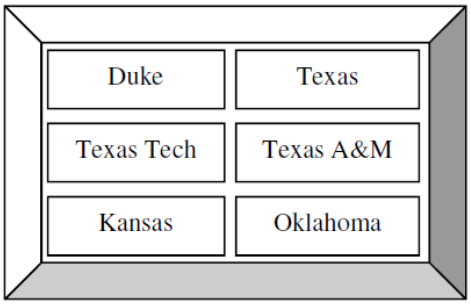
Part 3: TOTAL

# of entries for Age _____ + # of entries for Tesserae _____ = _____ total # of entries

Given the total number of entries in our district (class) for your gender, what is the probability your name will be selected? Express your answer as both a fraction and a percent.

UNIT 7 STUDY GUIDE

Suppose you choose one of the cards containing colleges shown below without looking. Find the probability of each event.



1.	P(Duke)		2.	P(Not Kansas)	
3.	P(Texas or Texas A&M)		4.	P(a school with a letter "E")	
5.	P(a college in Texas)		6.	P(a school not containing the letter "T")	

Mrs. Loewen has a collection of 30 hats. 12 are brown, 6 are blue, 8 are red, and 4 are white. She picks one out of her collection without looking. Find the probability of each event.

7.	P(White)		8.	P(Not White)	
9.	P(Brown OR Red)		10.	P(Brown OR Gray)	

11.	What is the probability that your birthday will be on a day of the week starting with the letter "T"?	
12.	There are 26 letters in the alphabet. What is the probability that a letter chosen at random is in the word "SURVIVOR"?	
13.	If you draw a card out of a normal deck (52 cards) 91 times (and always then return it), how many times would you expect to get a red 5, 6, 7, or 8?	
14.	If you roll a die 24 times, about how many times would you expect to get a number greater than 2?	

For each situation make a **tree diagram below** to show all of the possible outcomes.

		Number of outcomes
15.	Choosing oatmeal, chocolate chip, or peanut butter cookies and then taking 1 or 2 of them	
16.	Math, LA, SS, and Science: Choosing one as your favorite subject and one as your least favorite	

17-22. In Survivor everyone has an equal chance of winning. The last 50 times we have played, you have won 7 times. Use the Venn Diagram below to correctly place all of the items. You may just write the letter.

A. $\frac{7}{50}$

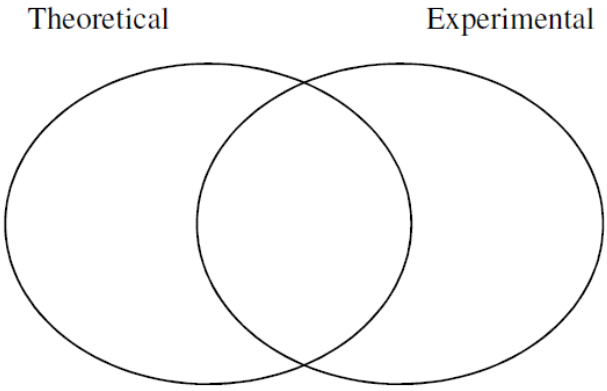
B. $\frac{1}{\text{people in your class}}$

C. a form of probability

D. best number to use to help predict how many times you will win in the next 1000 games

E. based on actual results from playing the game

F. less than 15%



Find the total number of possible outcomes in each situation. You may use either a tree diagram or The Counting Principle. ***Show your work as your notebook paper even if you think you can solve it in your head!***

23.	Choosing between 8 different flavors of potato chips which all come in small, medium, or large sizes.	
24.	Building Mr. Potato Head with a choice of 4 different ears, 6 eyes, 5 noses, and either a happy or a sad mouth.	
25.	Choosing a 4-digit password using the numbers 1 to 9 without repeating any digits.	
26.	Creating someone's face out of clay in art class and choosing between of 5 different types of ears, 3 types of eyes, 4 different noses, and either a happy or a sad mouth.	
27.	At McDonald's you have a choice of 5 different Kids' Meals that can come with 7 different sodas. In each meal you get one prize: a yo-yo, a car, or a pen.	
28.	Choosing out of 10 names a first, second, and third prize winner for a door prize.	

29.	There are 3 red marbles, 3 blue marbles, and 1 green marble in a bag. A marble is drawn at random and not replaced. Then a second marble is drawn. Which choice shows all the possible outcomes? A. red/blue, red/green, blue/red, blue/green, green/red, green/blue B. red/red, red/blue, red/green, blue/red, blue/blue, blue/green, green/red, green/blue, green/green C. red/blue, red/green, blue/red, blue/green, green/red, green/green D. red/red, red/blue, red/green, blue/red, blue/blue, blue/green, green/red, green/blue	

You flip a coin and role a regular six-sided die. Find the probability of each event.

1.	P(tails, 5)		2.	P(heads, not 3)	
3.	P(heads, even number)		4.	P(not tails, less than 7)	

The following cards are cut and placed in a box:

S	U	R	V	I	V	O	R	S

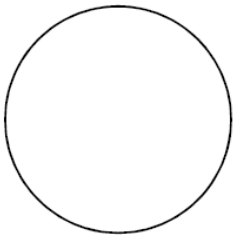
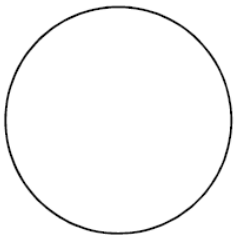
Mr. Mangham draws two or three cards and does not replace them. Find the probability of each event.

5.	P(V, V)		6.	P(S, R)	
7.	P(Vowel, Consonant)		8.	P(I, O)	
9.	P(S, I, S)		10.	P(U, I, O)	

11. When you spin the two spinners below your chance of spinning a "B" and then a "T" is exactly $\frac{1}{3}$.

Design the two spinners. Each spinner must have at least 5 equally likely outcomes and contain at least two different letters.

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

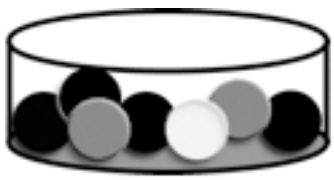
	
Probability:	Probability:

Example 1:

There are three choices of jellybeans – grape, cherry and orange. If the probability of getting a grape is $\frac{3}{10}$ and the probability of getting cherry is $\frac{1}{5}$, what is the probability of getting orange?

Example 2:

The container below contains 2 gray, 1 white, and 4 black marbles. Without looking, if Eric chooses a marble from the container, will the probability be closer to 0 or to 1 that Eric will select a white marble? A gray marble? A black marble? Justify each of your predictions.



Example 3:
Suppose we toss a coin 50 times and have 27 heads and 23 tails. We define a head as a success.

RELATIVE FREQUENCY – How often something happens divided by all outcomes.
Example: if your team has won 9 games from a total of 12 games played:
* the Frequency of winning is 9
* the Relative Frequency of winning is 9/12 = 75%

The relative frequency of heads is:

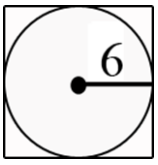
The theoretical frequency of heads is:

Example 4:

A bag contains 100 marbles, some red and some purple. Suppose a student, without looking, chooses a marble out of the bag, records the color, and then places that marble back in the bag. The student has recorded 9 red marbles and 11 purple marbles. Using these results, predict the number of red marbles in the bag.

Example 5:

If Mary chooses a point in the square, what is the probability that it is not in the circle?



Example 6:

Jason is tossing a fair coin. He tosses the coin ten times and it lands on heads eight times. If Jason tosses the coin an eleventh time, what is the probability that it will land on heads?

Example 7:

How many ways could the 3 students, Amy, Brenda, and Carla, come in 1^{st}, 2^{nd} and 3^{rd} place?

Example 8:

A fair coin will be tossed three times. What is the probability that two heads and one tail in any order will results?

Example 13:

Show all possible arrangements of the letters in the word FRED using a tree diagram. If each of the letters is on a tile and drawn at random, what is the probability of drawing the letters F-R-E-D in that order?

What is the probability that a "word" will have an F as the first letter?

How Black Is a Zebra?

Names _____

_____

Use a random-number table or the random-integer function on a calculator to generate pairs of numbers from 1 through 30. The first number designates the *x*-coordinate of a point, and the second number designates the *y*-coordinate of that point. Determine where each point is on the picture.

- If the point is not on the zebra at all, disregard it, and generate a new pair of random numbers.
- If the point is on the zebra, record the coordinates in the table below. Record ten pairs of coordinates.

Determine if the point is on a black part or a white part of the zebra.

- If it is on a black part, put an *X* in the last column of the table.
- If it is on a white part of the zebra, leave the last column blank.

	First Number (*x*-coordinate)	Second Number (*y*-coordinate)	Black?
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
		Total Number of Black "Hits"	

1. How many of the recorded points fall on a black part of the zebra? _____ What percent of the points are on a black part? _____
2. Estimate the percent of the zebra that is black. _____
3. How accurate do you think your estimate is? Explain your answer. _____

   _____

   _____

Generate more data points until 20 more points land on the zebra. Tally the number of the new points that "hit" black.

4. How many of the 20 points fell on black? _____ What percent of the points are on black? _____

How Black Is a Zebra? (continued)

Names _____

_____

5. Does your set of 20 data points help you make a more accurate estimate of the percent of black on the zebra than your set of 10 data points did? _____ Explain your answer. _____

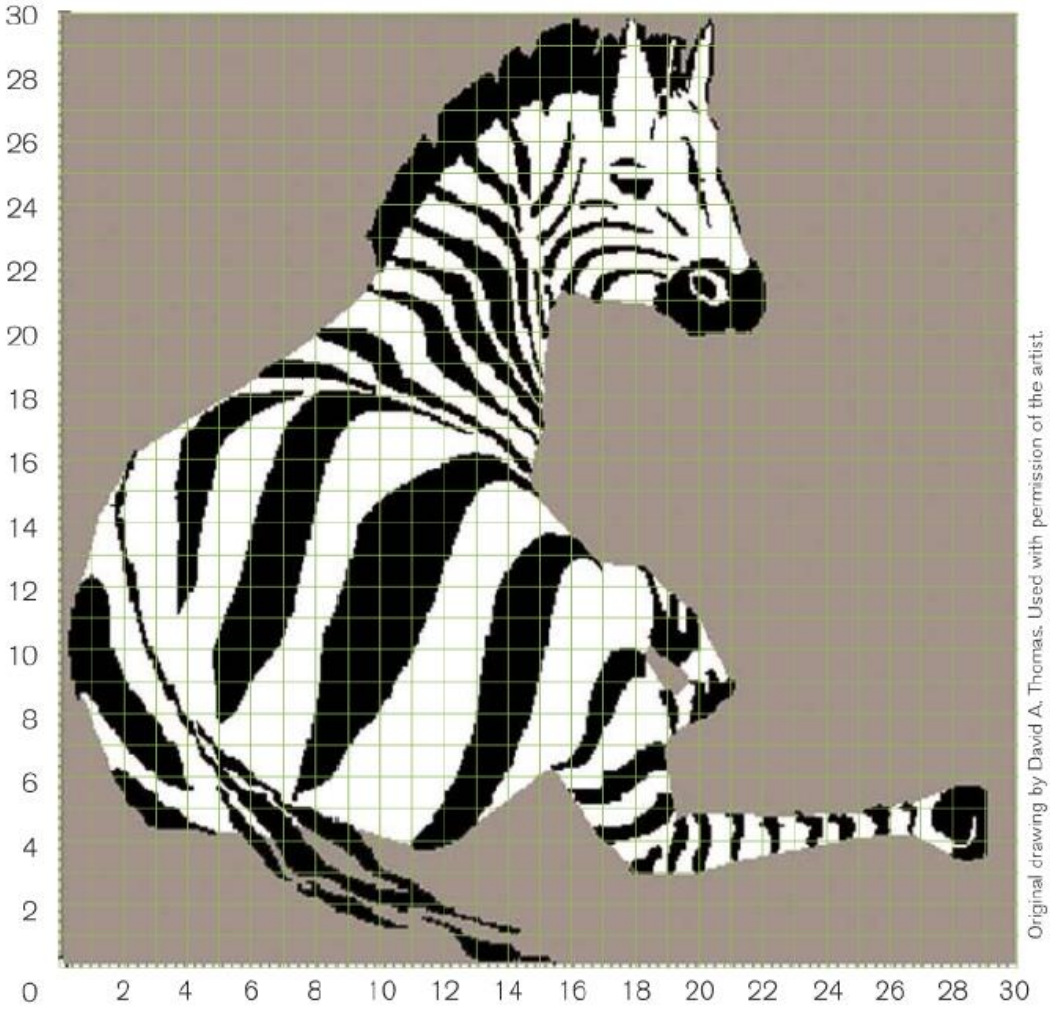
_____

_____

6. Would you be more confident making an estimate if you had recorded 50 points? _____ 100 points? _____ Explain your answer. _____

_____

_____



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