

Geometry-Applications of Probability

MGSE9-12.S.CP.1-4 Set theory; independent probability; conditional probability; two-way tables

MGSE9-12.S.CP.5 Recognize & explain Conditional probability

MGSE9-12.S.CP.6-7 Probability of compound events

~~Friday, 29 April~~ **Tues April 26**
Probability

Dice Probabilities

(Theoretical vs. Experimental)

HW: Intro to Probability WS

~~Monday, 2 May~~ **Wed. April 27**
Probability

Rena's MP3 Task

(Independent vs. Dependent Events)

Counting Principals Outline

~~Tuesday, 3 May~~ **2 May**

Unit 1-Transformations in the coordinate plane.

~~Wednesday, 4 May~~

Unit 2-Similarity, Congruence and Proofs

~~Thursday, 5 May~~

Unit 3-Right Angle Trigonometry

~~Friday, 6 May~~

Unit 4- Circles and Volume

~~Monday, 9 May~~

Unit 5-Geometric and Algebraic Connections

~~Tuesday, 10 May~~

Unit 6-Applications of Probability

~~Wednesday, 11 May~~

EOC

~~Thursday, 12 May~~ **Thur April 28**
Probability

Table Properties Outline

Two-Way Frequency Tables Worksheet

~~Friday, 13 May~~ **Friday April 29**
Probability

Spinner Task 1

Spinner Task 2

HW: Probability WS 2

~~Monday, 16 May~~ **Thur. May 12**
Probability

Compound Events Vocabulary Outline

Compound Events Notes & Examples Outline

Probability Of Compound Events WS

~~Tuesday, 17 May~~ **Fr May 13**
Probability

Probability Quiz 1/CFA

Venn Diagrams Examples Outline

CW/HW: Compound Events WS

~~Wednesday, 18 May~~ **Mon. May 16**
Probability

go over Quiz

Review for Test

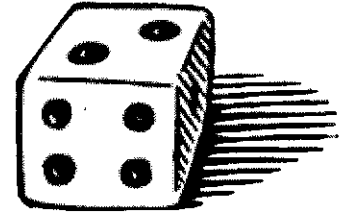
HW: study

~~Thursday, May 19~~ **Tues. May 17**
Probability

Test

Dice Probabilities

Rolling One Die



If you roll one die, what are the possible outcomes?

What are the probabilities of each outcome?

What is the probability of rolling a one or a two. (hint- add the probabilities)

What is the probability of rolling an even number?

What is the probability of rolling a number less than 3?

What is the probability of rolling a number more than 6? Less than 7?

Prediction: If you roll the die 48 times, how many 1's should you get?, 2's, 3's, 4's, 5's, 6's

Experiment: roll a die 48 times, then tally the results.

P(1)

P(2)

P(3)

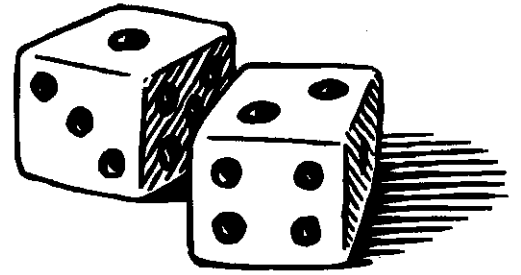
P(4)

P(5)

P(6)

Do your experimental values match your theoretical values?

Rolling Two Dice



Theoretical possibilities:

Complete the table by filling in the dice total for each combination.

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

How many possible outcomes are there for rolling two dice?

Find the theoretical probability of rolling each sum.

$P(1) =$

$P(2) =$

$P(3) =$

$P(4) =$

$P(5) =$

$P(6) =$

$P(7) =$

$P(8) =$

$P(9) =$

$P(10) =$

$P(11) =$

$P(12) =$

What is the probability of rolling a sum of

- a) less than 5
- b) greater than 6
- c) a 2 or a 5
- d) an even number
- e) a sum greater than 11
- f) a sum less than 2

Give all answers as reduced fractions.

Find the probability of each outcome if a die is rolled.

1. a 1
2. an odd number
3. an even number less than 6
4. a number less than 3
5. a number greater than 6
6. a number greater than 0

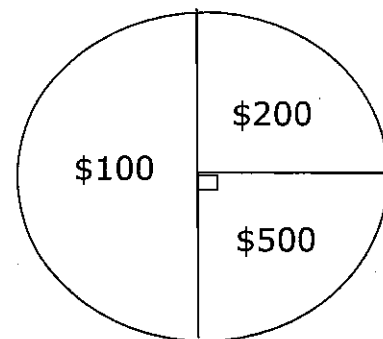
A **standard deck of 52 cards** has 4 suits (hearts and diamonds are red; clubs and spades are black). Each suit has 13 cards: Ace, 2, 3, 4, 5, 6, 7, 8, 9, 10, Jack, Queen, King. The Jack, Queen, and King are called "face cards."

A card is selected at random from a standard deck of 52 cards. What is the probability of selecting:

7. a red card.
8. an ace.
9. a red jack.
10. not a diamond.
11. an even club.

Using the spinner at the right. Find the probability of spinning:

12. \$100
13. \$200
14. less than \$300
15. more than \$500
16. more than \$100



Given a bag of 3 red marbles, 5 blue marbles and 4 green marbles. What is the probability of selecting:

17. a green marble

19. a blue or a red marble

18. not a blue marble

20. a blue, red or green marble

21. In a survey of 3630 college students, 1162 stated that they cheated on an exam. If one of these college students is randomly selected, find the probability that he or she cheated on an exam.

22. A Bureau of the Census survey of 600 persons in the 18-25 age bracket found that 237 of them smoke. If a person in that age bracket is randomly selected, find the approximate probability that he or she does not smoke.

The number of male and female doctors in Camron are listed by age in the table at the right. Use the data to answer the following questions.

23. How many doctors are in Cameron?

132

24. What is the probability that a doctor Chosen is a male under 35?

$\frac{29}{132}$

Camron Doctors		
Age	Male	Female
Under 35	<u>29</u>	18
35-44	36	8
45-54	19	3
55-64	17	2

25. What is the probability that a doctor Chosen is a male?

26. What is the probability that the doctor chosen is under 44?

27. What is the probability that the doctor chosen is at least 45?

Name _____

Independent & Dependent Events

Renae's MP3 Task

1. Renae's MP3 player can be programmed to randomly play songs from her playlist without repeating a single song. Currently, Renae's MP3 player has 5 songs loaded on it, which are listed at the right. As she walks between classes, she only has time to listen to one song.

- a. What is the probability that her MP3 player will select a country song?
- b. What is the probability that Renae will listen to a song with "Mama" in the title?
- c. What is the probability that she listens to a duet with Hank Tumbleweed?
- d. What is the probability that she listens to a song that is not R&B?

PLAYLIST

- a) **I Love My Mama** (country)
by The Strings of Heaven
- b) **Don't Call Me Mama** (country)
duet by Sapphire & Hank
Tumbleweed
- c) **Carefree and Blue** (R&B)
by Sapphire & Prism Escape
- d) **Go Back to Mama** (rock)
duet by Bjorn Free & Sapphire
- e) **Smashing Lollipops** (rock)
by Sapphire

2. While waiting for a bus after school, Renae programmed her MP3 player to randomly play two songs. Assume that the MP3 player will not play the same song twice.

- a. List all the combinations of two songs that Renae might hear (you can use the letters for each song instead of writing out the titles!). The order that she hears the songs does not matter for your list. How can you be sure that you listed all the possible song combinations?
- b. Find the probability that Renae will listen to two songs with the name "Mama" in the title.
- c. What is the probability that at least one of the songs will have the word "Mama" in the title?
- d. Why does it make sense that the probability in part (c) is higher than the probability in part (b)?

3. To get home, Renae can take one of four busses: #41, #28, #55, or #81. Once she is on the bus, she will randomly select one of the following equally likely activities: listening to her MP3 player, writing a letter, or reading a book.



a. List all the possible events to describe Renae's ride home. Use a tree diagram to make sure you find all the combinations of a bus number and an activity.

b. Use your tree diagram to find the following probabilities:

- (1) $P(\text{Renae takes an odd-numbered bus})$
- (2) $P(\text{Renae does not write a letter})$
- (3) $P(\text{Renae catches the \#28 bus and then reads a book})$

c. Does her activity depend on which bus she takes?

Counting Principles

The Multiplication Counting Principle:

independent events: $P(A \text{ and } B) =$

Ex1: Mrs. Mardis used to work at Starbucks. When her customers order coffee, they can choose from 6 flavors of syrup. They also decide if they want skim, 2%, or whole milk. How many different cups of coffee can Mrs. Mardis' make?

Ex2: How do you like your pizza? Papa Johns has thin crust, thick crust, regular crust and cheezy crust. The toppings they have are pineapple, pepperoni and peppers. If you only want one topping on your pizza, how many different types of pizza can you order? What if you want two toppings? What if you want three toppings?

Ex3: At a shoe store, shoes are available in 6 different styles. Each style is available in 3 different colors. How many choices does the shoe store offer?

Ex4: Two cards are to be randomly selected with replacement from a shuffled deck. Find the probability of getting a 10 on the first card and a club on the second card.

The Addition Counting Principle

mutually exclusive events: $P(A \text{ or } B) =$

overlapping events: $P(A \text{ or } B) =$

Ex5: A website produces a random 4 digit password to every user. The password can either be all letters or all numbers. How many possible passwords are there?

Ex6: What is the probability the password on the website has 4 matching numbers?

Table Probabilities

	Homicide	Robbery	Assault	Totals
Stranger	12	379	727	
Acquaintance or relative	39	106	642	
Unknown	18	20	57	
Totals				



1. How many crimes are represented in the table? (Complete the totals in the table above.)

*Events A and B are **mutually exclusive** if they cannot occur simultaneously.
Events A and B are **overlapping** if they can occur simultaneously.*

2. Use the table to find each probability.

a. $P(\text{crime was an assault or a robbery})$

b. $P(\text{crime was not committed by a stranger})$

c. $P(\text{victim was robbed or victimized by a stranger})$

d. $P(\text{crime was a robbery committed by an unknown assailant})$

Two-Way Frequency Tables Worksheet

Name: _____

1. Mr. Smith keeps track of his students' homework completion. He keeps track of how many boys and girls do not complete their homework. He puts students who don't complete their homework into two categories: first-time offenders and repeat offenders. He uses a table to keep track of the results.

	First-Time Offenders	Repeat Offenders	Total
Boys			
Girls			
Total			

- In one month 36 girls and 12 boys did not do their homework for the first time. 12 girls and 30 boys did not do their homework again. Put these figures in your table.
 - How many students did not complete all of their homework assignments this month?
 - What percentage of the students who did not complete their homework were boys who were First-Time Offenders?
 - Are boys or girls more likely to not complete their homework? Explain your reasoning.
2. Complete the two-way table for 9th Grader's school transportation survey:

	Male	Female	Total
Walk		46	
Car	28		45
Bus		12	27
Bike		17	69
Total	129	92	

- What percentage of 9th grade girls walk to school?
- What percentage of 9th graders are girls who walk to school?

3. Heather (a hairdresser) is making a record of all the customers she has had in the last month.

- a. Design and label a table that will show the number of male and female customers who are blond or brunette.

			Total
Total			

- b. In one month she has 40 blond females and only 5 blond males. Put these values in the table.

- c. How many blond customers does she have in total that month?

- d. She has 100 total customers and a total of 20 male customers during the same month. Use this information to finish filling in your table.

4. A large group of people was surveyed about their favorite movie genre. The participants had to give their age and choose their favorite genre from Action, Comedy, and Horror.

	Action	Comedy	Horror	Total
18-25 years old	238	450	312	1,000
25-49 years old	350	472	178	1,000
50+ years old	320	490	190	1,000
Total				

- a. A company that sells a product designed for young adults is looking to advertise before the movies of one of these genres. Which genre should they choose? Explain your reasoning.
- b. If you surveyed 12,000 people total, how many 18-25 year olds would you expect to choose Horror as their favorite genre?
- c. If you surveyed 24,000 people total, how many 25-49 year olds would you expect to choose Comedy as their favorite genre?

Conditional Probabilities Using Tables:

Ex 3: A recent survey asked 100 people if they liked ice cream more than pizza. The results of the survey are shown in the table.

Gender	Yes	No	Total
Male	32	18	50
Female	8	42	50
Total	40	60	100

- a. Find the probability that a person answers yes, given that the person is female.
- b. Find the probability that a person answers no, given that the person is male.

5. Eighty students in a high school cafeteria were asked if they favored assigned seats at lunch. The results of the survey are shown in the table.

	Favor	Oppose	No Opinion	Total
Freshman	15	27	8	
Sophomores	23	5	2	
Total				

If a student is selected at random, find these probabilities.

- a. Given a student is a freshman, he opposes assigned seats.
- b. Given a student is in favor of assigned seats, the student is a sophomore.

6. A study of graduates' average grades and degrees showed the following results.

Degree	C	B	A	Total
B.S.	5	8	15	
B.A.	7	12	8	
Total				

Conditional Probabilities Using Table (con't)

Example 3: A recent survey asked 100 people if they liked ice cream more than pizza.

1. What percent of the people are male? _____
2. What percent of the people are female? _____
3. What percent of the people answered yes? _____
4. What percent of the people answered no? _____
5. What percent of the people are female and answered yes? _____
6. What percent of the people answered yes, given they are female? _____
7. What percent of the people answered no, given they are male? _____
8. Find the probability of a person being male, given they answered yes. _____
9. Find the probability of a person being female, given they answered no. _____
10. Find the probability of a person answering yes and being male. _____

Example 5: Eighty students in a high school cafeteria were asked if they favored assigned seats at lunch.

11. What percent of the students are freshman? _____
12. What percent of the students favor assigned seats? _____
13. What percent of the students oppose and are freshman? _____
14. What percent of the sophomores had no opinion? (Hint: total sophomores is your denominator)

15. What percent of the students that favored assigned seats were freshman? _____
16. Find the probability that a person favors assigned seats, given they are a sophomore. _____
17. Find the probability that a student is a freshman and has no opinion? _____
18. Find the probability that a student opposes assigned seats. _____
19. Find the probability that a person is a sophomore, given they oppose assigned seats. _____
20. What percent of the students were sophomores or freshman? _____

Example 6: A study of graduates' average grades and degrees showed the following results.

21. Find the probability that a graduate is an A student. _____
22. What percent of the graduates are B students? _____
23. Find the probability that a graduate earned their B.A. _____
24. Find the probability that a graduate earned their B.S. given they were a C student. _____
25. What percent of the graduates were B students, given they earned their B.A.? _____
26. What percent of graduates earned their B.S.? _____
27. What percent of C students earned their B.A.? _____
28. What percent of graduates are a C student? _____
29. Find the probability that a graduate earned their B.S. and was an A student. _____
30. Find the probability that a graduate was a B student and earned a B.A. _____

Spinner Learning Tasks

Spinner Task 1

Calculate the following probabilities given one spin on the spinner below (assuming the spinner is fair).

1) $p(\$800) =$ _____

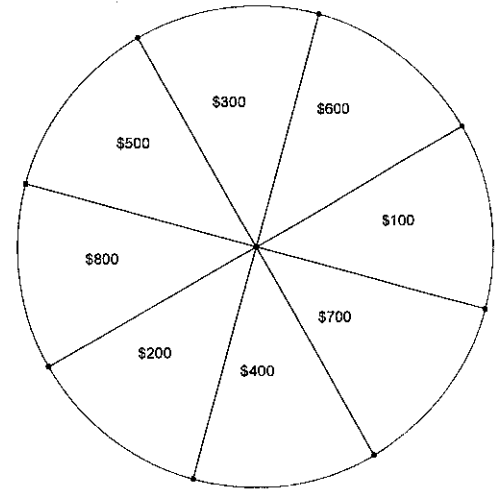
2) $p(\$400) =$ _____

3) Does $p(\$100) = p(\$800)$? _____ Why or why not?

4) $p(\text{at least } \$500) =$ _____

5) $p(\text{less than } \$200) =$ _____

6) $p(\text{at most } \$500) =$ _____



Calculate the following probabilities given two spins on the above spinner.

7) $p(\text{sum of } \$200) =$ _____

8) $p(\text{sum of at most } \$400) =$ _____

9) $p(\text{sum of at least } \$1500) =$ _____

10) $p(\text{sum of at least } \$300) =$ _____

11) $p(\text{sum of } \$200 \mid \text{first spin lands on } \$100) =$ _____

12) $p(\text{sum of at least } \$1000 \mid \text{first spin lands on } \$800) =$ _____

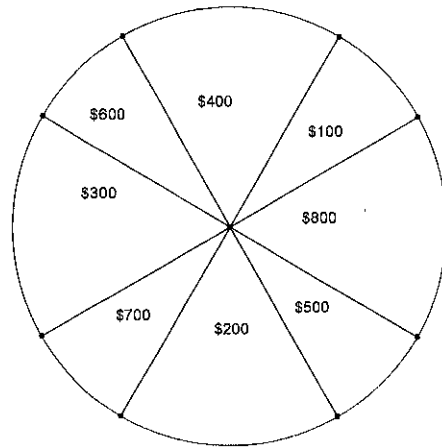
Spinner Task 2

Look at the spinner below. Determine the following probabilities if we assume the \$100, \$500, \$700 and \$600 regions are half the size of the \$800, \$200, \$300 and \$400 regions.

1) $p(\$800) =$ _____

2) $p(\$600) =$ _____

3) Does $p(\$100) = p(\$800)$? _____
Why or why not?



How does $p(\$100)$ compare to $p(\$800)$?

4) $p(\text{at least } \$500) =$ _____

5) $p(\text{less than } \$200) =$ _____

6) $p(\text{at most } \$500) =$ _____

Calculate the following probabilities given two spins on the above spinner.

7) $p(\text{sum of } \$200) =$ _____

8) $p(\text{sum of at most } \$400) =$ _____

9) $p(\text{sum of at least } \$1500) =$ _____

10) $p(\text{sum of } \$200 \mid \text{first spin lands on } \$100) =$ _____

11) $p(\text{sum of at least } \$1500 \mid \text{first spin lands on } \$800) =$ _____

12) Which spinner would you choose to use if you were trying to win the most money? Why?

Probability WS 2

Write answers as reduced fractions.

1. Write the probability of each event below:
 - a. You will have a conversation with someone today
 - b. The sun will set tonight
 - c. You will flip heads on a coin
 - d. A cat will fly by itself
 - e. You will watch a movie tonight
 - f. You will read a whole novel in one hour

2. A coin is tossed and a die is rolled at the same time.
 - a. What is the probability of throwing a head and rolling a 1, 2, or 3?
 - b. What is the probability of rolling a tail and an even number?
 - c. What is the probability of rolling a head a number larger than four?

3. A card is drawn from a normal 52 card deck. The card number and suit are noted then the card is replaced in the deck and another card is drawn. What is the probability that:
 - a. The first card was a queen and the second was a ten?
 - b. The first card was the queen of hearts and the second card was an eight?
 - c. Both cards were jacks?
 - d. Both cards were not face cards?
 - e. The first card was a five of spades and the second was the ace of hearts?

4. Three blue balls and one red ball are placed in a box. A ball is drawn and noted and then replaced and the second ball is drawn. What is the probability that:
 - a. Two blue balls are removed?
 - b. One red ball and one blue ball are removed?
 - c. No blue balls are removed?

5. You have three pieces of paper in an envelope. The pieces of paper are numbered one, two, and three. You draw and replace a piece of paper three times. What is the probability that the numbers you drew were:
 - a. 1,2,3 in that order?
 - b. 2,2,2 in that order?

6. If Shelby usually sinks 8 of 10 baskets she tries, how many baskets would expect her to sink in a game where she tries to sink the ball:
 - a. Three times?
 - b. Ten times?
 - c. Fifty times?
 - d. What is the pattern to solving this equation?

7. At a restaurant, you can choose from three different beverages (soda, juice, water) and two dinners (hamburger or spaghetti). Make a tree diagram to list all possible meal combinations.

8. The Funville Fair has three rides (waterslide, roller coaster, race track). You have time to take any two of the rides that you would like. List all possible ways of riding. (You may repeat a ride! I love roller coasters 😊)

9. Basic Bill, has the following choices for outdoor apparel: footwear (boots, sneakers), outerwear (parka, raincoat, jean jacket), and hat (baseball cap, beanie with pinwheel, and cowboy hat). How many possible outcomes are there for Bill if he must wear one of each item?

Compound Events

Vocabulary

Compound Event	
Mutually Exclusive Events	
Overlapping Events	
Independent Events	
Dependent Events	
Conditional Probability	

Compound Events

Notes / Examples

“OR”

“AND”

Example 1:

You randomly choose a card from a standard deck of 52 playing cards.
Find the probability that you will choose ...

- ... a Jack, Queen, or King.
- ... a Jack or a heart.
- ... an even number or a club.

Example 2:

You roll two number cubes.

- Are the events dependent or independent?

What is the probability that you roll ...

- ... a 1 and a 2?
- ... two evens numbers?

Example 3:

A jar contains 4 red marbles and 6 blue marbles. You chose one marble at random, do not replace it, then choose a second marble at random.

- Are the events dependent or independent?

What is the probability that you choose ...

- ... two blue marbles?
- ... one red and one blue?

Name _____

Date _____

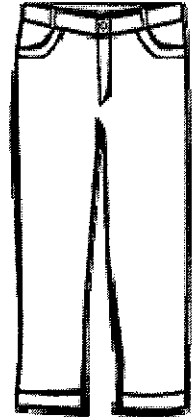
Probabilities of Compound Events - Independent Practice Worksheet

Complete all the problems.

1. Two coins are tossed, find the probability that only one coin lands on "heads".

2. There are 3 marbles (yellow, blue, and green). You pick a marble and flip a coin. How many outcomes are possible?

3. Paul has a white and blue shirt. He also has two trousers of brown and black. How many different outfits could he create?



4. Jamie has a cup holder that can hold 3 cups at a time. The cup holders are labeled a, b, and c. He has 3 different color cups (blue, green, purple). In how many ways can the cups be arranged in cup holders?

5. Ron has to color in three shapes (square, circle and triangle) with different colors (red, blue, green). In how many different ways can the shapes be colored?

6. Harry has three vehicles (bicycle, scooter, and car). He uses them to go to school, the garden, and the theatre. If he is out of the house, how many possible methods of transportation and places could he be?

7. Smith wants to rearrange all the letters of the word "OUT" in different ways. How possible ways could he do it?

8. Fred has two pens (red and green). He wants to write the word "YES" and "NO" with both pens. In how many ways can he write both words with both pens?

9. Anderson writes his name in English and Spanish language with chalk, pencil, and pen. How many ways did he write his name?

10. Thomas can go to school and ice cream parlor on the bus and his bicycle. In how many ways can he reach the school and parlor?



Venn Diagrams

Ex.1

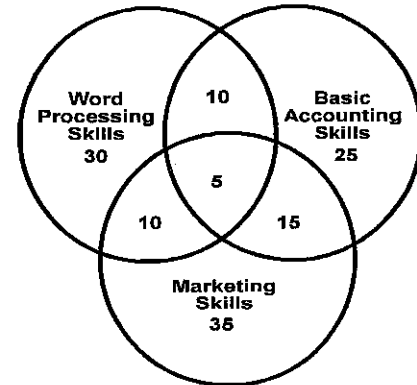
Mr. Mangione, the Director of Human Resources at Ace Chemical Industries, constructed a diagram to illustrate the skills of applicants for positions in the office of his company.

a. How many applicants possess word processing skills?

b. How many applicants possess only word processing skills?

c. How many applicants possess only word processing and marketing skills?

d. How many applicants possess word processing, basic accounting, and marketing skills?



e. What is the probability that a randomly selected candidate would possess all three skills?

Ex.2

A study was made of 200 students to determine what TV shows they watch.

- 22 students don't watch these cartoons.
- 9 students watch all three cartoons.
- 73 students watch only Tiny Toons.
- 136 students watch Tiny Toons.
- 14 students watch only Animaniacs and Pinky & the Brain.
- 31 students watch only Tiny Toons and Pinky & the Brain.
- 63 students watch Animaniacs.
- 135 students do not watch Pinky & the Brain.

What percent of the students watch only Animaniacs?

Name _____

Compound Events WS

1. A couple plans to have three children.

a) List the eight different possible outcomes according to the sex of each child.

Assume these outcomes are equally likely.

b) Find the probability of having two boys and one girl.

c) Find the probability of having all boys.

2. If four persons are chosen at random from a class containing 8 freshmen and 12 sophomores, what is the probability that 4 freshmen are chosen?

3. In a particular dormitory, there are 350 college freshmen. Of these, 312 are taken an English course and 108 are taking a mathematics course. If 95 of these freshmen are taking courses in both English and mathematics, how many are not taking a course in either?

4. In a sales effectiveness seminar, a group of sales representatives tried two approaches to selling a customer a new automobile: the aggressive approach and the passive approach. From 1160 customers, the following record was kept:

	Sale	No Sale	Row Total
Aggressive	270	310	580
Passive	416	164	580
Column Total	686	474	1160

Suppose that a customer is selected at random from the 1160 participating customers.

a) Compute $P(\text{sale})$, $P(\text{sale} | \text{aggressive approach})$, and $P(\text{sale} | \text{passive approach})$.

b) Compute $P(\text{aggressive and sale})$ and $P(\text{passive and sale})$

c) Compute $P(\text{no sale})$ and $P(\text{no sale} | \text{aggressive})$

d) Compute $P(\text{aggressive or sale})$