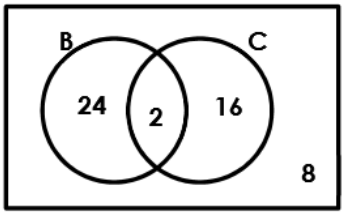
Probability Test Review **Name** _____

Using Venn Diagrams

If the Venn Diagram below shows the number of people in a fine arts club who are in band (B) and choir (C), make the following determinates:



50 1. How many people are in the club?

$\frac{26}{50}$ = .52 2. Find P(B)

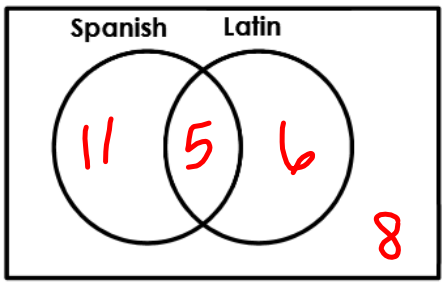
$\frac{2}{50}$ = .04 3. Find P(B ∩ C)

$\frac{42}{50}$ = .84 4. Find P(B ∪ C)

$\frac{24}{50}$ = .48 5. Find P($\bar{B}$)

A guidance counselor is planning schedules for 30 students. 16 want to take Spanish and 11 want to take Latin. 5 Say they want to take both. Display this information on the Venn Diagram below.

6.



$\frac{5}{30}$ = .17 7. Find P(S ∩ L)

$\frac{11}{30}$ = .37 8. Find P(L)

$\frac{22}{30}$ = .73 9. What is the probability that a student studies at least one subject? P(S ∪ L)

$\frac{17}{30}$ = .57 10. What is the probability that a student studies exactly one subject?

.27 11. What is the probability that a student studies neither subject? P($\overline{S \cup L}$)

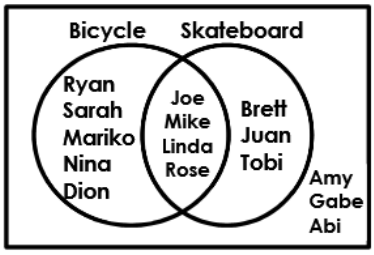
$\frac{5}{11}$ = .45 12. What is the probability that a student studied Spanish if it is known that the student studies Latin?

Mr. Leary's Class: Use the Venn Diagram showing the number of kids owning bicycles (A) and skateboards (B) to find the following probabilities.

$\frac{4}{15} = .27$ 13. Find P(A ∩ B) and describe what this probability represents?

$\frac{12}{15} = .8$ 14. Find P(A ∪ B) and describe what this probability represents?

.2 15. Find P($\overline{A \cup B}$) and describe what this probability represents?



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Conditional Probability

1. A random survey was taken to gather information about grade level and car ownership status of students at a school. This table shows the results of the survey.

Car Ownership by Grade

	Owns a Car	Does Not Own a Car
Junior	6	10
Senior	12	8
TOTAL	18	18

a) Find the probability that a randomly selected student will be a junior, given that the student owns a car.

$\frac{6}{18} = .33$

b) Find the probability that a randomly selected student will own a car, given that the student is a senior.

$\frac{12}{20} = .6$

2. The table below shows numbers of registered voters by age in the United States in 2004 based on the census. Find each probability in decimal form.
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Age	Registered Voters (in thousands)	Not Registered to Vote (in thousands)	Total
18–24	14,334	13,474	27808
25–44	49,371	32,763	82134
45–64	51,659	19,355	71014
65 and over	26,706	8,033	34739
Total	142070	73625	215695

a) Find the probability that a randomly selected person is registered to vote, given that the person is between the ages of 18 and 24.

$\frac{14334}{27808} = .52$

b) Find the probability that a randomly selected person is not registered to vote, given that they are 65 and over.

$\frac{8033}{34739} = .23$

c) Find the probability that a randomly selected person is between the ages of 45 and 64 and is not registered to vote.

$\frac{19355}{215695} = .09$

3. A faculty advisor at Ridge High School surveyed 100 students about their preference for a social event. Of the 100 students surveyed, 50 were tenth graders and 50 were eleventh graders. Of the tenth graders, 30 chose a bowling party and 20 chose a dance. Of the eleventh graders, 20 chose a bowling party and 30 chose a dance.

a) Make a two way frequency table to represent the data.

	Bowling Party	Dance	Total
10th	30	20	50
11th	20	30	50
Total	50	50	100

b) Let T = 10th graders, E = 11th graders, B = Bowling, and D = Dance

Find P(B). $\frac{50}{100} = .5$

Find P(B|T). $\frac{30}{50} = \frac{3}{5} = .6$

4. The table below shows data about 108 pizzas sold in a pizzeria. Each pizza was sold with one topping.

Pizza shape	Pizza topping				
	Pepperoni	Mushroom	Onion	Chicken	
Round	20	10	15	15	60
Square	16	8	18	6	48
	36	18	33	21	108

Consider the following events.

R: A round pizza is sold. S: A square pizza is sold. O: An onion pizza is sold.

P: A pepperoni pizza is sold. C: A chicken pizza is sold.

$P(A \cap B) = P(A) + P(B)$ or $P(A|B) = P(A)$ and $P(B|A) = P(B)$

Which pair of events is independent?

a) S and C

$P(S) = \frac{48}{108} = .444$ $P(C) = \frac{21}{108} = .194$ $P(S \cap C) = \frac{6}{108} = .055$ NO

b) R and O

$P(R) = .556$ $P(O) = .306$ $P(R|O) = \frac{15}{33} = .455$ NO

c) S and O

$P(S) = .44$ $P(S|O) = .55$ NO

d) R and M

$P(R) = .56$ $P(R|M) = .56$ $P(M) = .17$ $P(M|R) = .17$ yes

Independent Events

- The probability of event *A* occurring does not affect the probability of *B* occurring.
- ***"AND"*** means to multiply
- $P(A \cap B) = P(A) \cdot P(B)$

Examples:

1. A coin is tossed and a 6-sided die is rolled. Find the probability of landing on the head side of the coin and rolling a 3 on the die. P(Head and 3)

$\frac{1}{2} \cdot \frac{1}{6} = \frac{1}{12} = .083$

2. A jar contains 3 red, 5 green, 2 blue and 6 yellow marbles. A marble is chosen at random from the jar. After replacing it, a second marble is chosen. What is the probability of choosing a green and a yellow marble? P(Green and Yellow)

16 total

$\frac{5}{16} \cdot \frac{6}{16} = \frac{30}{256} = .12$

3. A school survey found that 9 out of 10 students like pizza. If three students are chosen at random with replacement, what is the probability that all three students like pizza? P(Like and Like and Like)

$\frac{9}{10} \cdot \frac{9}{10} \cdot \frac{9}{10} = \frac{729}{1000} = .729$

4. What is the probability of tossing a coin three times and landing on tails every time? P(tails and tails and tails)

$\left(\frac{1}{2}\right)^3 = \frac{1}{8} = .125$

Dependent Events

- The probability of event *A* occurring before the probability of *B* occurring.
- Usually see the words without replacement
- $P(A \cap B) = \text{P(A)} \cdot \text{P(B|A)}$

Examples:

1. A jar contains 3 red, 5 green, 2 blue and 6 yellow marbles. A marble is chosen at random from the jar. A second marble is chosen **without** replacing the first one. What is the probability of choosing a green and a yellow marble? P(Green and Yellow)

$\frac{5}{16} \cdot \frac{6}{15} = \frac{30}{240} = \frac{1}{8} = .125$

2. An aquarium contains 6 male goldfish and 4 female goldfish. You randomly select a fish from the tank, **do not** replace it, and then randomly select a second fish. What is the probability that both fish are male? P(Male and Male)

$\frac{6}{10} \cdot \frac{5}{9} = \frac{30}{90} = \frac{1}{3} = .33$

3. A random sample of parts coming off a machine is done by an inspector. He found that 5 out of 100 parts are bad on average. If he were to do a new sample, what is the probability that he picks a bad part and then, picks another bad part if he **doesn't** replace the first? P(Bad and Bad)

$\frac{5}{100} \cdot \frac{4}{99} = \frac{20}{9900} = .002$

Determining if Two Events are Independent

$$P(A \cap B) = P(A) \bullet P(B)$$

1. Let event M = taking a math class. Let event S = taking a science class. Then, M and S = taking a math class and a science class. Are M and S independent?
   Suppose P(M) = 0.6, P(S) = 0.5, and P(M and S) = 0.3.

$.6(.5) = .3$
$.3 = .3$ ✓

yes. Independent

2. In a college class, 60% of the students are female. 50% of all students in the class have long hair. 45% of the students are female and have long hair. Let F be the event that the student is female. Let L be the event that the student has long hair. One student is picked randomly. Are the events of being female and having long hair independent?

$P(F) = .6$ $P(LH) = .5$ $P(F \cap LH) = .45$

$.6(.5) = .45$
$.3 \neq .45$

NOT Independent

1. A miniature golf course offers a free game to golfers who make a hole-in-one on the last hole. Last week, 40 out of 282 golfers made a hole-in-one on the last hole. Find the experimental probability that a golfer makes a hole-in-one on the last hole. Round your answer to two decimal places.

$\frac{40}{282} = .14$

2. You and your friends designed T-shirts with silk screened emblems, and you are selling the T-shirts you have in each design. A student chooses a T-shirt at random. What is the probability that the student chooses a green T-shirt? Write your answer as a simplified improper fraction.

	Gold emblem	Silver emblem	
Green T-shirt	4	6	10
Red T-shirt	12	18	30
	16	24	40

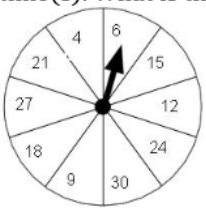
$\frac{10}{40} = \frac{1}{4} = .25$

3. You toss a coin and roll a number cube. What is the probability that the coin shows tails and the number cube shows a number less than 5?

multiply

$\frac{1}{2} \cdot \frac{4}{6} = \frac{4}{12} = \frac{1}{3} = .33$

4. Each section of the spinner shown has the same area. You spin the spinner 18 times. It stops on 6 six time(s). What is the experimental probability of stopping on 6?



$\frac{6}{18} = \frac{1}{3} = .33$

5. Forty tickets are sold for a raffle. You buy 2 tickets, and your friend buys 3 tickets. One ticket is randomly chosen as the winning ticket. What is the probability that you or your friend wins the raffle? Express your answer as a reduced fraction.

$\frac{2}{40} + \frac{3}{40} = \frac{5}{40} = \frac{1}{8} = .125$

6. You roll a number cube. Find the probability that you roll a number less than 4 or an odd number.

1 2 3

$\frac{3}{6} + \frac{3}{6} - \frac{2}{6} = \frac{4}{6} = \frac{2}{3} = .67$

7. Tell whether the following events are independent or dependent.
   You roll a number cube. You roll a number cube again.

8. Tell whether the following events are independent or dependent.
   A teacher is randomly assigning you, your friend, and five other students to nine different seats.
   Event A: You are assigned the first seat.
   Event B: Your friend is assigned the second seat.

$P(A) = \frac{1}{9}$ $P(B) = \frac{1}{9}$ $P(B|A) = \frac{1}{8}$ Not independent

9. Selecting from 8 different digits, a computer randomly generates 4–digit passwords. Each digit can be used more than once. Assuming that 9 is one of the digits from which the computer selects, what is the probability that the first two digits in your password are both 9?

$\frac{1}{8} \cdot \frac{1}{8} = \frac{1}{64} = .016$

10. You roll a number cube. Tell whether the events A and B are mutually exclusive or overlapping. Then find $P(A \text{ or } B)$.
    Event A: Roll a 2
    Event B: Roll a prime number

$P(A \text{ or } B) = \frac{1}{6} + \frac{4}{6} - \frac{1}{6} = \frac{4}{6} = \frac{2}{3} = .67$

11. A bag contains 5 red, 5 green, and 6 blue marbles. You randomly draw 2 marbles one at a time. Find the probability that both are red if you replace the first marble. Round your answer to the nearest tenth of a percent.

$\frac{5}{16} \cdot \frac{5}{16} = \frac{25}{256} = .1$

12. A jar of jelly beans contains 58 red jelly beans, 35 yellow jelly beans, and 28 green jelly beans. You reach into the jar and randomly select a jelly bean, then select another without putting the first jelly bean back. What is the probability that you draw two yellow beans? Round your answer to the nearest percent.

121 total

$\frac{35}{121} \cdot \frac{34}{120} = \frac{1190}{14520} = .082 = 8\%$

13. You and your friend each purchased a ticket in a raffle in which 50 tickets were sold. The owner of the first ticket drawn wins the grand prize and is removed from the drawing. The owner of the second ticket drawn wins the runner-up prize. Find the probability that you win the grand prize and your friend wins the runner-up prize.

$\frac{1}{50} \cdot \frac{1}{49} = \frac{1}{2450} = .0004$

14. Tell whether the events A and B are independent or dependent. Then find P(A and B).
A box contains two milk chocolates, two white chocolates, and three dark chocolates. You choose a chocolate at random, eat it, and then choose a second chocolate at random.

Event A: You choose a dark chocolate.
Event B: You choose a dark chocolate.

$\frac{3}{7} \cdot \frac{2}{7} = \frac{6}{49} = .12$

15. Events A and B are independent events. Find the indicated probability. Express your answer as a decimal and as a percent.
$P(A) = 0.2$
$P(B) = 0.3$
$P(A \text{ and } B) =$

$P(A \cap B) = .2\,(.3)$
$P(A \cap B) = .06 = 6\%$

16. You randomly select 2 cards from a standard deck of 52 cards. What is the probability that the first card is not a club and the second card is a club if you do not replace the first card? Express your answer rounded to the nearest thousandths place and as a percentage rounded to the nearest whole percent.
Event A: Not a club
Event B: Club

$P(A) \cdot P(B)$
$\frac{3}{4} \cdot \frac{39}{51} = \frac{117}{204} = .574 = 57\%$

17. At Georgetown County High School the Senior Class has 102 Varsity Athletes who are also on the honor roll. The breakdown of the other senior class members is shown in the table. Using the data in the table, compute the stated probabilities. Use proper notation, and state answers as fractions, decimals and percents.

	Varsity Athletes (VA)	Non-Varsity Athletes	
Honor Roll Students (H)	102	75	177
Non-Honor Roll Students	88	25	113
	190	100	290

a. $P(H) =$ .61
b. $P(\overline{H}) =$ .39
c. $P(VA) =$ .66
d. $P(\overline{VA}) =$ .34
e. $P(H \cap VA) =$ .35
f. $P(\overline{VA} \cap \overline{H}) =$ .09
g. $P(\overline{VA} \cap H) =$ .26
h. $P(VA \cap \overline{H}) =$ .30
i. $P(H \cup VA) =$ .91
j. $P(\overline{VA} \cup \overline{H}) =$ .74

18. You randomly select 2 cards from a standard deck of 52 cards. What is the probability that the first card is not a club and the second card is a heart if you do replace the first card? Express your answer rounded to the nearest thousandths place and as a percentage rounded to the nearest whole percent.
Event A: Not a club
Event B: Heart

$\frac{39}{52} \cdot \frac{13}{52} = \frac{507}{2704} = .1875 = 19\%$

19. On April 15, 1912, the Titanic struck an iceberg and rapidly sank with only 710 of her 2,204 passengers and crew surviving. Regarding the sinking of the Titanic, some believe that the rescue procedures favored the wealthier first class passengers. Others believe that the survival rates can be explained by the "women and children first" policy. Data on survival of passengers are summarized in the table below. (Data source: http:www.encyclopedia-titanica.org/titanic-statistics.html)

	Survived (S)	Did not survive	Total
Children in first class (CFC)	4	1	5
Women in first class (WFC)	139	4	143
Men in first class (MFC)	58	118	176
Children in second class (CSC)	22	0	22
Women in second class (WSC)	83	12	95
Men in second class (MSC)	13	154	167
Children in third class (CTC)	30	50	80
Women in third class (WTC)	91	88	179
Men in third class (MTC)	60	390	450
Total passengers	500	817	1317

201 123 324
118 166 284
181 528 709

Find the indicated probabilities using proper notation. State your answer in fraction form, as a decimal rounded to the nearest thousandth, and as a percent rounded to the nearest tenth. Also, interpret each result.

a. $P(S|TC) =$

$\frac{181}{709} = .255 = 25.5\%$

b. $P(\bar{S}|FC) =$

$.38 = 38\%$

c. $P(S|WSC) =$

$.874 = 87.4\%$

d. $P(\overline{FC}|\bar{S}) =$

$.849 = 84.9\%$

e. $P(W \cap \bar{S}) =$

$.079 = 7.9\%$

f. $P(C \cap \bar{S}) =$

$.039 = 3.9\%$