

## Addition Rules and Multiplication Rules for Probability Worksheet

I. Determine whether these events are mutually exclusive.

1) Roll a die: get an even number and get a number less than 3 NO

$$\{2, 4, 6\} \quad \{1, 2\}$$

2) Roll a die: get a prime number and get an odd number NO

$$\{1, 3, 5\} \quad \{1, 3, 5\}$$

3) Roll a die: get a number greater than 3 and get a number less than 3 YES

$$\{4, 5, 6\} \quad \{1, 2\}$$

4) Select a student in the classroom: student has blond hair and blue eyes NO

could have both!

5) Select a student at UGA: student is a sophomore and the student is a business major NO

could be both!

6) Select any high school course: the course is calculus and the course is English YES  
a course cannot be both.

II. Find the following probabilities:

7) An automobile dealer decides to select a month for its annual sale. Find the probability that it will be September or October.  $P(\text{Sept}) + P(\text{Oct})$ 

$$\frac{1}{12} + \frac{1}{12} = \frac{1}{6}$$

8) At a community swimming pool there are 2 managers, 8 lifeguards, 3 concession stand clerks and 2 maintenance people. If a person is selected at random, find the probability that the person is either a lifeguard or a manager.  $P(\text{lifeguard}) + P(\text{manager})$   
17 total people.

$$\frac{8}{17} + \frac{2}{17} = \frac{10}{17}$$

9) At a convention there are 7 math instructors, 5 computer science instructors, 3 statistics instructors and 4 science instructors. If an instructor is selected at random, find the probability of selecting a math or science instructor.  $P(\text{math}) + P(\text{sci}) =$ 

$$\frac{7}{19} + \frac{4}{19} = \frac{11}{19}$$

10) Blockbuster rented the following number of movie titles in each of these categories: 170 horror, 230 drama, 120 mystery, 310 romance, and 150 comedies. If a person who rented one of the movies is selected at random, find the probability that a romance or comedy was rented.

$$P(\text{romance}) + P(\text{comedy})$$

$$\frac{310}{810} + \frac{150}{810} = \frac{460}{810} \text{ or } \frac{46}{81}$$

810 total.

	BS	no BS	Total
Male	34	41	75
female	56	69	125
	90	110	200

11) A recent study of 200 nurses found that of 125 female nurses, 56 had bachelor's degrees; and of 75 male nurses, 34 had bachelor's degrees. If a nurse is selected at random, find the probability that the nurse is

a) a female nurse with a bachelor's degree  $\frac{56}{200}$  or  $\frac{7}{25}$

b) a male nurse  $\frac{75}{200}$  or  $\frac{3}{8}$

c) a male nurse with a bachelor's degree  $\frac{34}{200}$  or  $\frac{17}{100}$

d) based on your answer to a, b, and c, explain which is most likely to occur. Why?  
 More likely a male nurse, there are 75

12) The probability that a student owns a car is 0.65 and the probability that a student owns a computer is 0.82. If the probability that a student owns both is 0.55, what is the probability that a randomly selected student owns a car or computer? What is the probability that a randomly selected student does not own a car or computer?

$$P(\text{car or computer}) = P(\text{car}) + P(\text{computer}) - P(\text{both})$$

$$= 0.65 + 0.82 - 0.55 = 0.92$$

$$P(\text{does not own}) = 1 - P(\text{car or computer}) = 1 - 0.92 = 0.08$$

13) In a statistics class there are 18 juniors and 10 seniors; 6 of the seniors are females and 12 of the juniors are males. If a student is selected at random, find the probability of selecting the following:

F	M
6	12
6	4

a) P(a junior or a female)  $\frac{18}{28} + \frac{12}{28} - \frac{6}{28} = \frac{24}{28}$  or  $\frac{6}{7}$

b) P(a senior or a female)  $\frac{10}{28} + \frac{12}{28} - \frac{6}{28} = \frac{16}{28}$  or  $\frac{4}{7}$

c) P(a junior or a senior)  $\frac{18}{28} + \frac{10}{28} = \frac{28}{28}$  A sure thing!

14) At a particular school with 200 male students, 58 play football, 40 play basketball and 8 play both. Find the probability that a randomly selected male student plays basketball or football. Find the probability that a randomly selected male student plays neither sport.

$$P(\text{basketball}) + P(\text{football}) - P(\text{both})$$

$$\frac{40}{200} + \frac{58}{200} - \frac{8}{200} = \frac{90}{200}$$
 or  $\frac{9}{20}$

15) A grocery store employs cashiers, stock clerks, and deli personnel. The distribution of employees according to marital status is shown here:

Marital status	Cashiers	Stock Clerks	Deli personnel	TOTALS
Married	8	12	3	= 23
Not married	5	15	2	= 22
	13	27	5	= 45

If an employee is selected at random, find the following probabilities:

a) The employee is a stock clerk or married  $P(\text{stock}) + P(\text{married}) - P(\text{both})$   
 $\frac{27}{45} + \frac{23}{45} - \frac{12}{45} = \frac{38}{45}$

b) The employee is not married  $\frac{22}{45}$

c) The employee is a cashier or is not married.  
 $P(\text{cashier}) + P(\text{not married}) - P(\text{both})$   
 $\frac{13}{45} + \frac{22}{45} - \frac{5}{45} = \frac{30}{45}$  or  $\frac{2}{3}$

16) State which events are independent and which are dependent.

- a) Tossing a coin and drawing a card from a deck IND.
- b) Drawing a ball from a bag, not replacing it and drawing a second ball DEP.
- c) Getting a raise in salary and purchasing a new car ~~IND.~~ - IND. arguable!
- d) Driving on ice and having an accident ~~IND.~~ IND.
- e) Having a large shoe size and having a high IQ IND.
- f) A father being left-handed and a daughter being left-handed ~~IND.~~ IND.

17) If 37% of high school students said that they exercise regularly, find the probability that 5 randomly selected high school students will say that they exercise regularly.

EXERCISE  $\frac{37}{100}$   $(.37)(.37)(.37)(.37)(.37) = 6.93 \times 10^{-3}$

18) If 25% of U.S. federal prison inmates are not U.S. citizens, find the probability that 2 randomly selected inmates will not be U.S. citizens.

NOT U.S. ARE  $\frac{25}{75}$   $(.25)(.25) = \frac{1}{16}$  OR  $.0625$

19) If 2 cards are selected from a standard deck of cards. The first card is placed back in the deck before the second card is drawn. Find the following probabilities:

a) P(Heart and club)  $\frac{13}{52} \cdot \frac{13}{52} = \frac{1}{16}$

d) P(2 Aces)  $\frac{4}{52} \cdot \frac{4}{52} = \frac{1}{169}$

b) P(Red card and 4 of spades)  $\frac{26}{52} \cdot \frac{1}{52} = \frac{1}{104}$

e) P(Queen of hearts and King)  $\frac{1}{52} \cdot \frac{4}{52} = \frac{1}{676}$

c) P(Spade and Ace of hearts)  $\frac{13}{52} \cdot \frac{1}{52} = \frac{1}{208}$

f) P(2 of the same card)  $\frac{52}{52} \cdot \frac{1}{52} = \frac{1}{52}$

20) Find the same probabilities for problem #19 but this time, the card is not placed back in the deck before the 2nd card is drawn.

a.  $\frac{13}{52} \cdot \frac{13}{51} = \frac{13}{204}$

c.  $\frac{13}{52} \cdot \frac{1}{51} = \frac{1}{204}$

e.  $\frac{1}{52} \cdot \frac{4}{51} = \frac{4}{2652}$

b.  $\frac{26}{52} \cdot \frac{1}{51} = \frac{1}{102}$

d.  $\frac{4}{52} \cdot \frac{3}{51} = \frac{1}{221}$

f.  $\frac{52}{52} \cdot \frac{0}{51} = 0$

21) A flashlight has 6 batteries, 2 of which are defective. If 2 are selected at random without replacement, find the probability that both are defective.

$\frac{2}{6} \cdot \frac{1}{5} = \frac{1}{15}$

22) A bag contains 8 white marbles, 4 green marbles and 3 blue marbles. 2 marbles are selected at random without replacement, find the following probabilities: 15 total.

a) P(both are green)  $\frac{4}{15} \cdot \frac{3}{14} = \frac{2}{35}$

b) P(blue marble and white marble)  $\frac{3}{15} \cdot \frac{8}{14} = \frac{4}{35}$

c) P(white marble and green marble)  $\frac{8}{15} \cdot \frac{4}{14} = \frac{16}{105}$

23) At a large university, the probability that a student takes calculus and is on the dean's list is 0.042. The probability that a student is on the dean's list is 0.21. Find the probability that a student takes calculus, given that he or she is on the dean's list.

$$P(\text{calculus} | \text{dean's list}) = \frac{P(\text{cal \& dean's})}{P(\text{dean's})} = \frac{0.042}{0.21} = \boxed{\frac{1}{5}}$$

24) A circuit to run a model railroad has 8 switches. Two are defective. If a person selects 2 switches at random and tests them, find the probability that the second one is defective, given the first one is defective.

$$P(2^{\text{nd}} \text{ def} | 1^{\text{st}} \text{ def}) = \frac{P(1 \& 2 \text{ def})}{P(1^{\text{st}} \text{ def})} = \frac{2/8 \cdot 1/7}{2/8} = \boxed{\frac{1}{7}}$$

25) At Athens Country Club, 73% of the members play bridge and swim, and 82% play bridge. If a member is selected at random, find the probability that the member swims, given that the member plays bridge.

$$P(\text{swims} | \text{plays bridge}) = \frac{P(\text{swims \& plays bridge})}{P(\text{plays bridge})} = \frac{0.73}{0.82} = \boxed{\frac{73}{82}}$$

26) Eighty students in a school cafeteria were asked if they favored a ban on smoking in the cafeteria. The results of the survey are shown in the table.

CLASS	FAVOR	OPPOSE	NO OPINION
Freshman	15	27	8 = 50
Sophomore	23	5	2 = 30

80 total.

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

a) Given that the student is a freshman, he or she opposes the ban.

$$P(\text{opposes} | \text{freshman}) = \frac{P(\text{opposes \& freshman})}{P(\text{freshman})} = \frac{27/80}{50/80} = \boxed{\frac{27}{50}}$$

b) Given that the student favors the ban, the student is a sophomore.

$$P(\text{sophomore} | \text{favors}) = \frac{P(\text{favors \& sophomore})}{P(\text{favors})} = \frac{23/80}{38/80} = \boxed{\frac{23}{38}}$$

26) The medal distribution from 2000 Summer Olympic Games is shown on the table.

COUNTRY	GOLD	SILVER	BRONZE
United States	39	25	33 = 97
Russia	32	28	28 = 88
China	28	16	15 = 59
Australia	16	25	17 = 58

Find these probabilities: 115

302 total.

a) Find the probability that the winner won the gold medal, given that the winner was from the US.

$$P(\text{gold} | \text{U.S.}) = \frac{P(\text{Gold \& U.S.})}{P(\text{U.S.})} = \frac{39/302}{97/302} = \boxed{\frac{39}{97}}$$

b) Find the probability that the winner was from the US, given that she or he won a gold medal.

$$P(\text{U.S.} | \text{gold}) = \frac{P(\text{Gold \& U.S.})}{P(\text{gold})} = \frac{39/302}{115/302} = \boxed{\frac{39}{115}}$$