Math I Name _____

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

2) Roll a die: get a prime number and get an odd number

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

4) Select a student in the classroom: student has blond hair and blue eyes

5) Select a student at UGA: student is a sophomore and the student is a business major

6) Select any high school course: the course is calculus and the course is English

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.

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.

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.

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.

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
b) a male nurse
c) a male nurse with a bachelor's degree
d) based on your answer to a, b, and c, explain which is most likely to occur. Why?

12) The probability that s 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?

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:
a) P(a junior or a female)

b) P(a senior or a female)

c) P(a junior or a senior)

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.

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
Married	8	12	3
Not married	5	15	2

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

a) The employee is a stock clerk or married.
b) The employee is not married
c) The employee is a cashier or is not married.

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

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

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 the exercise regularly.

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.

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)

b) P(Red card and 4 of spades)

c) P(Spade and Ace of hearts)

d) P(2 Aces)

e) P(Queen of hearts and King)

f) P(2 of the same card)

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.

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.

22) A bag contains 8 white marbles, 4 green marbles and 3 blue marbles. 2 marbles are selected at random with out replacement, find the following probabilities:

a) P(both are green)
b) P(blue marble and white marble)
c) P(white marble and green marble)

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.

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.

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.

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
Sophomore	23	5	2

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

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

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

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

COUNTRY	GOLD	SILVER	BRONZE
United States	39	25	33
Russia	32	28	28
China	28	16	15
Australia	16	25	17

Find these probabilities:

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

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

Math I

Name Key

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} {1,2}

2) Roll a die: get a prime number and get an odd number NO
{1,3,5} {1,3,5}

3) Roll a die: get a number greater than 3 and get a number less than 3 YES
{4,5,6} {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(Sept) + P(Oct)

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

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(lifeguard) + P(manager)

17 total people.

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

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.

19 total

P(Math) + P(Sci) = $\frac{7}{19} + \frac{4}{19} = \boxed{\frac{11}{19}}$

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.

810 total.

P(romance) + P(comedy)

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

$(5p+9)(p-2)$

	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 56/200 or 7/25

b) a male nurse 75/200 or 3/8

c) a male nurse with a bachelor's degree 34/200 or 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 s 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(car or computer) = P(car) + P(computer) − P(both)

.65 + .82 − .55 = .92

P(does not own) = 1 − P(car or computer) = 1 − .92 = .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	18
6	4	10
12	16	28

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(basketball) + P(football) − P(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(stock) + P(married) − P(both) $27/45 + 23/45 - 12/45 = 38/45$

b) The employee is not married 22/45

c) The employee is a cashier or is not married.

P(cashier) + P(not married) − P(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 [redacted]. - IND. arguable!

d) Driving on ice and having an accident [redacted]. 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 [redacted]. 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 the exercise regularly.

EXERCISE 37
DO NOT EXERCISE 63
100

$(.37)(.37)(.37)(.37)(.37) = \boxed{6.93 \times 10^{-3}}$

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 25
ARE 75

$(.25)(.25) = \frac{1}{16}$ OR $\boxed{.0625}$

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) $\frac{13}{52} \cdot \frac{13}{52} = \boxed{\frac{1}{16}}$

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

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

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

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

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

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

b. $\frac{26}{52} \cdot \frac{1}{5} = \boxed{\frac{1}{10}}$

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

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

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

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

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.

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

22) A bag contains 8 white marbles, 4 green marbles and 3 blue marbles. 2 marbles are selected at random with out replacement find the following probabilities: 15 total.

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

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

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

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.

$$P(\text{calculus} \mid \text{deans list}) = \frac{P(\text{cal \& deans})}{P(\text{deans})} = \frac{.042}{.21} = \boxed{1/5}$$

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.

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

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.

$$P(\text{swims} \mid \text{plays bridge}) = \frac{P(\text{swims \& plays bridge})}{P(\text{plays bridge})} = \frac{.73}{.82} = \boxed{\frac{73}{82}}$$

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.

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

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

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

~~Q3~~ 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
	115			302 total.

Find these probabilities:

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

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

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

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