Conditional Probability – Notes
Geometry

Name: Key
Date: _____ Pd: ____

Use the table to answer the following:

	Made shot	Missed shot	TOTAL
Male	8	12	20
Female	7	6	13
Total	15	18	33

a) What is the probability that a shot was made?
P(shot made) = $15/33$

b) What is the probability that a shot taken was by a female?
P(female) = $13/33$

c) What is the probability a shot was made and the shooter was a female?
P(shot made and female) = $7/33$

d) What is the probability a shot was missed and the shooter was a male?
P(shot missed and male) = $12/33$

e) Given that a shot was made, what is the probability the shooter was female?
P(female | shot made) = $7/15$

f) Given that a shot was missed, what is the probability the shooter was female?
P(female | shot missed) = $6/18 = \frac{1}{3}$

g) Given that a female was the shooter, what is the probability the shot was made?
P(shot made | female) = $7/13$

Conditional probability is the probability that event A will happen under the condition that event B has already occurred.

$P(A \text{ given } B) = P(A|B)$

Conditional Probability Formula:

$$P(A|B) = \frac{P(A \text{ and } B)}{P(B)} \quad \text{or} \quad \frac{P(\text{both})}{P(\text{given})}$$

"given"

same

h) Using the formula, find the probability the shooter was female given that a shot was missed?

$$P(F|SM) = \frac{P(\text{female \& missed})}{P(\text{missed})} \qquad \frac{6/33}{18/33} = \frac{6}{18} = \frac{1}{3}$$

Example 1: Four friends cleaning out their math folders were too lazy to get up and throw the papers in the trash. Instead, they sat at their desks and took shots at the wastebasket. Together, they took a total of 188 shots. Only 89 of the shots actually made it in the wastebasket and, of those that went in, only 32 of them hit the rim before going in. Sixty-four shots missed the rim and the wastebasket completely.

a) What is the probability a shot hit the rim but did not go into the wastebasket?
P(hit the rim and missed) = $35/188$

b) What is the probability a shot went in the basket?
P(shot made) = $89/188$

c) What is the probability a shot went in if the shot hit the rim?
P(shot made | hit rim) = $32/67$

	Made shot	Missed shot	TOTAL
Hit the rim	32	35	67
Did not hit rim	57	64	121
Total	89	99	188

d) Given the shot was missed, what is the probability that the shot hit the rim?

$$P(\text{rim} \mid \text{missed}) = \frac{P(\text{both})}{P(\text{missed})} = \frac{35/188}{99/188} = \boxed{\frac{35}{99}}$$

e) What is the probability a shot was missed given it hit the rim?

$$P(\text{missed} \mid \text{rim}) = \boxed{35/67}$$

Example 3 A jar contains black and white marbles. Two marbles are chosen without replacement. The probability of selecting a black marble and then a white marble is 0.34, and the probability of selecting a black marble on the first draw is 0.47. What is the probability of selecting a white marble on the second draw, given that the first marble drawn was black?

$$P(W \mid B) \quad \frac{P(\text{both})}{P(\text{black})} = \frac{.34}{.47} = \boxed{.723}$$

Example 4 The probability that Janice uses a tanning bed is $3/10$. The probability that she uses a tanning bed and develops skin cancer is $4/15$. Find the probability that Janice develops skin cancer, given that she uses a tanning bed.

$$P(\text{cancer} \mid \text{tan}) = \frac{P(\text{both})}{P(\text{tan})} = \frac{4/15}{3/10} \quad \frac{4}{15} \cdot \frac{10}{3} = \frac{40}{45} = \boxed{8/9}$$

Example 5 The probability that Sue will go to Mexico in the winter and to France in the summer is 0.40. The probability that she will go to Mexico in the winter is 0.60. Find the probability that she will go to France this summer, given that she just returned from her winter vacation in Mexico.

$$P(\text{France} \mid \text{mexico}) = \frac{P(\text{both})}{P(\text{mexico})} = \frac{.40}{.60} = \boxed{.667}$$

Conditional Probability Homework
Geometry

Name Key
Date _____ Pd _____

1. The Titanic sank in 1912 without enough lifeboats for the passengers and crew. Almost 1500 people died, most of them men. Was that because a man was less likely than a woman to survive? Or did more men die simply because men outnumbered women by more than 3 to 1 on the Titanic?

Below is the Titanic Survival Data

	Male	Female	Total
Survived	367	344	711
Did not survive	1364	126	1490
Total	1731	470	2201

a. What is the probability of someone surviving? P(surviving) = 711/2201

b. What is the probability of being a female on the titanic? P(female) 470/2201

c. Given it was a female on the titanic, what is the probability that they survived? P(both) / P(given)

P(survived | female) = 344/470 → 172/235

2. Use the table below to compute the following probabilities.

Age Group	Full-Time	Part-Time	Unemployed	Total
0-17	24	164	371	559
18-25	185	203	148	536
26-34	348	67	27	442
35-49	581	179	104	864
50+	443	162	173	778
Total	1581	775	823	3179

a. If a person in this town is selected at random, find the probability that the individual is employed part-time, given that he or she is between the ages of 35 and 49.

P(part time | 35-49) = 179/864 P(both) / P(given)

b. If a person in the town is randomly selected, what is the probability that the individual is unemployed, given that he or she is over 50 years old?

P(unemployed | 50+) = 173/778 P(both) / P(given)

$\frac{P(\text{both})}{P(\text{given})}$

3. At Forestwood Middle School, the probability that a student takes Technology and Spanish is 0.087. The probability that a student takes Technology is 0.68. What is the probability that a student takes Spanish given that the student is taking Technology.

$\frac{.087}{.68} = .128$

$\frac{87}{680}$

4. In New York State, 48% of all teenagers own a skateboard and 39% of all teenagers own a skateboard and roller blades. What is the probability that a teenager owns roller blades given that the teenager owns a skateboard?

81.3%

$\frac{.39}{.48} = .813$

$\frac{13}{16}$

5. In the United States, 56% of all children get an allowance and 41% of all children get an allowance and do household chores. What percent of those children that get allowance also do household chores?

73.2%

$\frac{.41}{.56} = .732$

$\frac{41}{56}$

6. In a bag are an economics and a math book. Two books are chosen at random without replacement. The probability of selecting an economics book and then a math book is 0.42. The probability of selecting an economics book on the first draw is 0.62. What is probability selecting a math book on the second draw? Given that the first book was economic.

$\frac{.42}{.62} = .677$

$\frac{21}{31}$

7. In a box are a carton of dairy milk and Boonville chocolates. Two items are chosen at random from the box, without replacement. The probability of selecting dairy milk and then a Boonville chocolate is 0.47. The probability of selecting dairy milk on the first draw is 0.71. What is probability selecting a Boonville chocolate on the second draw. Given that the first chocolate drawn was dairy milk?

$\frac{.47}{.71} = .662$

$\frac{47}{71}$