Honors Advanced Algebra

Name: _____

Period: _____ Date: _____

13.5 Probability Models

Target 8.B. Use the rules of probability to compute probabilities of compound events in a uniform probability model.

A ***two-way frequency table***, or a contingency table, displays the frequency of data in two different categories. You can use two-way frequency tables to organize data and identify sample spaces to approximate probabilities.

Using a Two-Way Frequency Table

1. The table shows data about student involvement in extracurricular activities at a local high school.

	Involved in Activities	Not Involved in Activities	Totals
Male	112	145	257
Female	139	120	259
Totals	251	265	516

Total population

a. What is the probability that a randomly chosen student is a female who is not involved in extracurricular activities? To find prob., calculate relative frequency

Relative freq = $\frac{\text{female not involved}}{\text{total \# of students}} = \frac{120}{512} \approx 0.233$ or 23.3%

b. What is the probability that a randomly chosen student is a male who is involved in extracurricular activities?

Same idea ... $\frac{112}{516} \approx 0.217$ or 21.7%

2. The two-way table below shows the number of male and female students by grade level on the prom committee.

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	Male	Female	Totals
Juniors	3	4	7
Seniors	3	2	5
Totals	6	6	12

Total pop on prom committee

a. What is the probability that a member of the prom committee is a male who is a junior?

$\frac{3}{12} = \frac{1}{4}$

b. What is the probability that a member of the prom committee is a female who is not a junior?

this a female senior $\frac{2}{12} = \frac{1}{6}$

3. Attendance at Soccer Camp

	6th graders	7th graders	8th graders	Total
Boys	7	6	10	23
Girls	8	7	12	27
Totals	15	13	22	50

Total students

a. P(8th grade boy) $= \frac{10}{50} = \frac{1}{5} = 0.20$ or 20%

b. P(6th grade girl) $= \frac{8}{50} = 0.16$ or 16%

The probability that an event will occur, given that another event has already occurred, is called a ***conditional probability***. You can write the conditional probability of event B, given that A has already occurred, as P(B|A). You read P(B|A) as "the probability of event B, given event A."

Finding a Probability

4. Respondents of a poll were asked whether they were for, against, or had no opinion about a bill before the state legislature that would increase the minimum wage.

column column column

Age Group	For	Against	No Opinion	Totals
18-29	310	50	20	380
30-45	200	30	10	240
45-60	120	20	30	170
Over 60	150	20	40	210
Totals	780	120	100	1000

row →

a. What is the probability that a randomly selected person is over 60 years old, given that the person had no opinion on the state bill?

$P(\text{over 60} \mid \text{no opinion}) = \frac{40}{100} = \frac{2}{5} = 0.4$ or 40%

(no opinion: column)

b. What is the probability that a randomly selected person is against the state bill, given that they are 45-60 years old?

$P(\text{against} \mid \text{45-60 yrs old}) = \frac{20}{170} = \frac{2}{17} \approx 0.12$ or 12%

(45-60 yrs old: row)

c. What is the probability that a randomly selected person is 18-29 years old, given that they are against the state bill?

$P(\text{18-29 yrs old} \mid \text{against}) = \frac{50}{120} = \frac{5}{12} \approx 41.6\%$

(against: column)

d. What is the probability that a randomly selected person is not 18-29 years old, given that the person is in favor of the state bill?

$P(\text{not 18-29 yrs} \mid \text{favor}) = \frac{200+120+150}{780} \approx 60\%$

(favor: column)

5. Use the "Attendance at Soccer Camp" two-way frequency table to find each probability.

   a. P(6th grade | boy) = $\frac{7}{23}$ (row)

   b. P(8th grade | girl) = $\frac{12}{27} \approx 0.44$ (row)

Using Relative Frequencies

6. A company has 150 sales representatives. Two months after a sales seminar, the company vice-president made the table below based on sales results.

	Attended Seminar	*Did not Attend Seminar*	*Totals*
Increased Sales	0.48	0.02	0.5
No Increase in Sales	0.32	0.18	0.5
Totals	0.8	0.2	1

   a. What is the probability that someone who attended the seminar had increased sales?

   So what is prob. of increased sales given you attended?

   P(increased sales | attended) = $\frac{0.48}{0.8} = 0.6$ or 60% (column)

   b. What is the probability that a randomly selected sales representative, who did not attend the seminar, did not see an increase in sales?

   P(did not increase | did not attend) = $\frac{0.18}{0.2} = 0.9$ or 90% (column)

7. Treatments Given by Veterinarian in One Week

	Shots Only	Shots and Checkup	Totals
Dogs	0.31	0.23	0.54
Cats	0.26	0.20	0.46
Totals	0.57	0.43	1

   a. P(Cat | shots only) = $\frac{0.26}{0.57} \approx 0.456$ or 45.6%

   b. P(shots and checkup | dog) = $\frac{0.23}{0.54} \approx 0.426$ or 42.6%