Conditional Probability Using Tables

Probability Worksheet · Grade 7–10

Name: _____ Date: _____

Learning Objectives

- Identify the correct sample space from a two-way frequency table based on the wording of a conditional probability question
- Apply the conditional probability formula P(B|A) = P(A and B) / P(A) using table values
- Interpret 'given that' language to restrict the sample space and compute accurate conditional probabilities

Problems

1. A survey of 200 students asked whether they prefer cats or dogs. Use the table below. What is the probability of randomly selecting a student who prefers dogs?

	Prefers Cats	Prefers Dogs	Total
Boys	40	60	100
Girls	50	50	100
Total	90	110	200

2. Using the same table from Problem 1, what is the probability of randomly selecting a student who is a girl?

	Prefers Cats	Prefers Dogs	Total
Boys	40	60	100
Girls	50	50	100
Total	90	110	200

3. A group of 300 people were asked about their preferred exercise. Use the table below. What is the probability of selecting a person who prefers running, given that the person is a woman?

	Running	Swimming	Cycling	Total
Men	45	30	55	130
Women	60	50	60	170

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	Running	Swimming	Cycling	Total
Total	105	80	115	300

4. Using the table from Problem 3, what is the probability of selecting a person who prefers swimming, given that the person is a man?

	Running	Swimming	Cycling	Total
Men	45	30	55	130
Women	60	50	60	170
Total	105	80	115	300

5. A school of 400 students was surveyed about their favorite school subject. Use the table below. What is the probability that a randomly selected student is in Grade 9, given that the student's favorite subject is Math?

	Math	Science	English	Total
Grade 9	55	40	35	130
Grade 10	65	50	45	160
Grade 11	40	35	35	110
Total	160	125	115	400

6. Using the table from Problem 5, what is the probability that a student prefers Science or English, given that the student is in Grade 11?

	Math	Science	English	Total
Grade 9	55	40	35	130
Grade 10	65	50	45	160
Grade 11	40	35	35	110
Total	160	125	115	400

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7. A sample of 500 adults was surveyed about their commute method and age group. Use the table below. Given that a person drives to work, what is the probability that the person is under 40 years old?

	Drives	Takes Transit	Walks/Bikes	Total
Under 40	110	80	50	240
40 and Over	140	75	45	260
Total	250	155	95	500

8. Using the table from Problem 7, use the conditional probability formula to verify: what is the probability that a randomly selected adult takes transit AND is 40 and over? Then find the probability that a person is 40 and over, given that the person takes transit.

$$P(B \mid A) = \frac{P(A \cap B)}{P(A)}$$

9. A hospital recorded patient data for 600 patients. Use the table below. A patient is selected at random. Given that the patient is female, what is the probability that the patient has Type B blood? Then, given that the patient has Type O blood, what is the probability that the patient is male? Write both answers as simplified fractions.

	Type A	Type B	Type O	Type AB	Total
Male	70	55	90	35	250
Female	80	60	130	80	350
Total	150	115	220	115	600

10. A city surveyed 800 residents about their age group and whether they voted in the last election. The incomplete table is shown below. First, fill in the missing totals. Then find: (a) P(voted), (b) P(voted | age 18–35), (c) P(age 36–55 | did not vote), and (d) determine whether voting and being age 56 and over appear to be independent events. Show all work.

	Voted	Did Not Vote	Total
Age 18–35	120	130	250
Age 36–55	180	70	250
Age 56 and Over	210	90	300

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	Voted	Did Not Vote	Total
Total			800

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Conditional Probability Using Tables — Answer Key

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Answer Key

1. Answer: 110/200 = 11/20

- Identify the total sample space: 200 students surveyed.
- Find the total number of students who prefer dogs: 110.
- P(prefers dogs) = 110/200 = 11/20.

2. Answer: 100/200 = 1/2

- The total sample space is all 200 students.
- The total number of girls is 100.
- P(girl) = 100/200 = 1/2.

3. Answer: 60/170 = 6/17

- The condition 'given that the person is a woman' restricts the sample space to women only: 170.
- Among women, the number who prefer running is 60.
- P(running | woman) = 60/170 = 6/17.

4. Answer: 30/130 = 3/13

- The condition 'given that the person is a man' restricts the sample space to 130 men.
- Among men, 30 prefer swimming.
- P(swimming | man) = 30/130 = 3/13.

5. Answer: 55/160 = 11/32

- The condition 'given that the student's favorite subject is Math' restricts the sample space to the 160 students who prefer Math.
- Among those, 55 are in Grade 9.
- P(Grade 9 | Math) = 55/160 = 11/32.

6. Answer: 70/110 = 7/11

- The condition restricts the sample space to Grade 11 students: 110 total.
- Grade 11 students who prefer Science: 35. Grade 11 students who prefer English: 35.
- Total who prefer Science or English = 35 + 35 = 70.
- P(Science or English | Grade 11) = 70/110 = 7/11.

7. Answer: 110/250 = 11/25

- The condition 'given that the person drives' restricts the sample space to 250 drivers.
- Among drivers, 110 are under 40.
- P(under 40 | drives) = 110/250 = 11/25.

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8. Answer: P(transit AND 40+) = 75/500 = 3/20; P(40+ | transit) = 75/155 = 15/31

- P(transit AND 40+) = 75/500 = 3/20.
- P(takes transit) = 155/500 = 31/100.
- Using the formula: P(40+ | transit) = P(transit AND 40+) / P(transit) = (75/500) / (155/500) = 75/155 = 15/31.

9. Answer: P(Type B | Female) = 60/350 = 6/35; P(Male | Type O) = 90/220 = 9/22

- For the first part: given the patient is female, restrict the sample space to 350 female patients. Among females, 60 have Type B blood. P(Type B | female) = 60/350 = 6/35.
- For the second part: given Type O blood, restrict the sample space to 220 patients with Type O. Among those, 90 are male. P(male | Type O) = 90/220 = 9/22.

10. Answer: Totals: Voted=510, Did Not Vote=290, Total=800; (a) 510/800=51/80; (b) 120/250=12/25; (c) 70/290=7/29; (d) Not independent

	Voted	Did Not Vote	Total
Age 18–35	120	130	250
Age 36–55	180	70	250
Age 56 and Over	210	90	300
Total	510	290	800

- Fill in totals: Voted = 120+180+210 = 510; Did Not Vote = 130+70+90 = 290; Grand total = 800.
- (a) P(voted) = 510/800 = 51/80.
- (b) P(voted | age 18–35): sample space = 250 (age 18–35 total); voted in that group = 120. P = 120/250 = 12/25.
- (c) P(age 36–55 | did not vote): sample space = 290 (did not vote total); age 36–55 who did not vote = 70. P = 70/290 = 7/29.
- (d) Check independence: P(voted) = 510/800 = 0.6375. P(voted | age 56+) = 210/300 = 0.70. Since 0.70 ≠ 0.6375, the events are NOT independent.

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