Probability: Two-Way Tables, Venn Diagrams & Tree Diagrams

Statistics & Probability Worksheet · Grade 9–12

Name: _____ Date: _____

Learning Objectives

- Organize data into a two-way table and use it to calculate probabilities
- Apply the Addition Rule using Venn diagrams to find the probability of a union of events
- Use tree diagrams to find probabilities of compound events

Problems

1. A survey of 178 college students found that 19 males had ear piercings and 84 females had ear piercings. Complete the two-way table below, then find the total number of students surveyed.

	Ear Piercing	No Ear Piercing	Total
Male	19	71	90
Female	84	4	88
Total	103	75	178

2. Using the completed two-way table from Problem 1, find the probability that a randomly selected student is a male with ear piercings. Express your answer as a decimal rounded to four places.

$$P(\text{Male with ear piercing}) = \frac{19}{178}$$

3. Using the two-way table from Problem 1, find the probability that a randomly selected student is female with no ear piercings. Express your answer as a decimal rounded to four places.

$$P(\text{Female, no ear piercing}) = \frac{4}{178}$$

4. Using the two-way table from Problem 1, find the probability that a randomly selected student is female OR has ear piercings. Use the Addition Rule and express your answer as a decimal rounded to four places.

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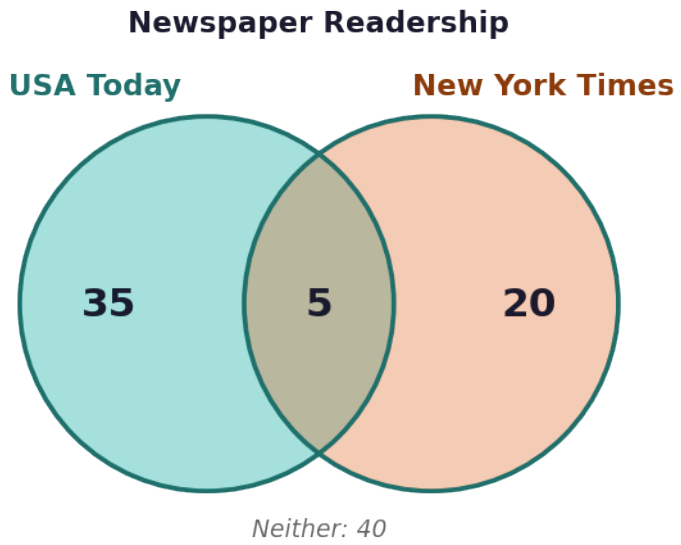
$$P(\text{Female} \cup \text{Ear Piercing}) = \frac{88 + 103 - 84}{178}$$

5. In an apartment complex, 40% of residents read USA Today, 25% read the New York Times, and 5% read both. Construct a Venn diagram that represents these percentages.



6. Using the newspaper readership data from Problem 5, find the probability that a randomly selected resident reads USA Today or the New York Times (or both). Use the Addition Rule.

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

7. A bag contains 3 red marbles and 2 blue marbles. A marble is drawn, its color recorded, and then replaced. A second marble is drawn. Use a tree diagram to list all possible outcomes and find the probability of drawing two red marbles.

$$P(RR) = \frac{3}{5} \times \frac{3}{5}$$

8. A class has 15 boys and 10 girls. Two students are selected at random without replacement. Use the multiplication rule to find the probability that both students selected are girls. Round to four decimal places.

$$P(\text{Girl}_1 \cap \text{Girl}_2) = \frac{10}{25} \times \frac{9}{24}$$

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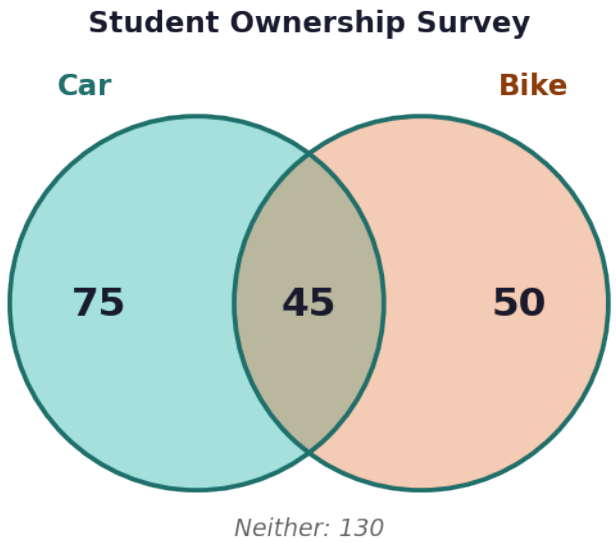
9. A survey of 200 students asked whether they play sports and whether they play a musical instrument. The results are shown in the table. Fill in the missing values and find the probability that a randomly selected student plays sports but does NOT play an instrument.

	Plays Instrument	No Instrument	Total
Plays Sports	30		110
No Sports	20		90
Total	50		200

10. A survey of 300 college students found: 120 own a car, 95 own a bike, and 45 own both. Using the Addition Rule and a Venn diagram, find the probability that a randomly selected student owns a car or a bike but NOT both. Express your answer as a decimal rounded to four places.



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Probability: Two-Way Tables, Venn Diagrams & Tree Diagrams — Answer Key

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Answer Key

1. Answer: Total students surveyed = 178

	Ear Piercing	No Ear Piercing	Total
Male	19	71	90
Female	84	4	88
Total	103	75	178

- Males without ear piercings: 90 – 19 = 71
- Females without ear piercings: 88 – 84 = 4
- Total with ear piercings: 19 + 84 = 103
- Total without ear piercings: 71 + 4 = 75
- Grand total: 90 + 88 = 178

2. Answer: P ≈ 0.1067

- Number of males with ear piercings = 19
- Total students = 178
- P(Male with ear piercing) = 19 ÷ 178 ≈ 0.1067
- There is approximately a 10.67% chance the selected student is a male with ear piercings

3. Answer: P ≈ 0.0225

- Number of females with no ear piercings = 4
- Total students = 178
- P = 4 ÷ 178 ≈ 0.0225
- There is approximately a 2.25% chance

4. Answer: P ≈ 0.6011

- P(Female) = 88/178
- P(Ear Piercing) = 103/178
- P(Female AND Ear Piercing) = 84/178
- P(Female OR Ear Piercing) = (88 + 103 – 84) / 178 = 107/178 ≈ 0.6011

5. Answer: USA Today only: 35%, NYT only: 20%, Both: 5%, Neither: 40%

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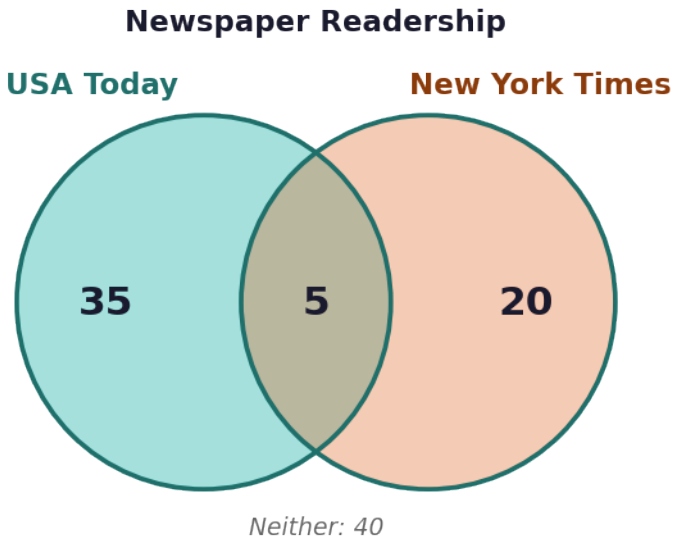

- USA Today only = 40% – 5% = 35%
- New York Times only = 25% – 5% = 20%
- Both = 5%
- Neither = 100% – (35% + 20% + 5%) = 40%

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6. Answer: P(A ∪ B) = 0.60 or 60%

- P(USA Today) = 0.40
- P(New York Times) = 0.25
- P(Both) = 0.05
- P(USA Today OR New York Times) = 0.40 + 0.25 – 0.05 = 0.60
- There is a 60% chance the resident reads at least one of the two papers

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7. Answer: P(RR) = 9/25 = 0.36

- First draw: P(Red) = 3/5, P(Blue) = 2/5
- Second draw (with replacement): same probabilities apply
- Outcomes: RR, RB, BR, BB
- P(RR) = (3/5) × (3/5) = 9/25 = 0.36

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8. Answer: P ≈ 0.1500

- Total students = 15 + 10 = 25
- P(first is a girl) = 10/25
- P(second is a girl | first was a girl) = 9/24 (no replacement)
- P(both girls) = (10/25) × (9/24) = 90/600 = 3/20 = 0.15

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9. Answer: P(Sports, No Instrument) = 80/200 = 0.40

	Plays Instrument	No Instrument	Total
Plays Sports	30	80	110

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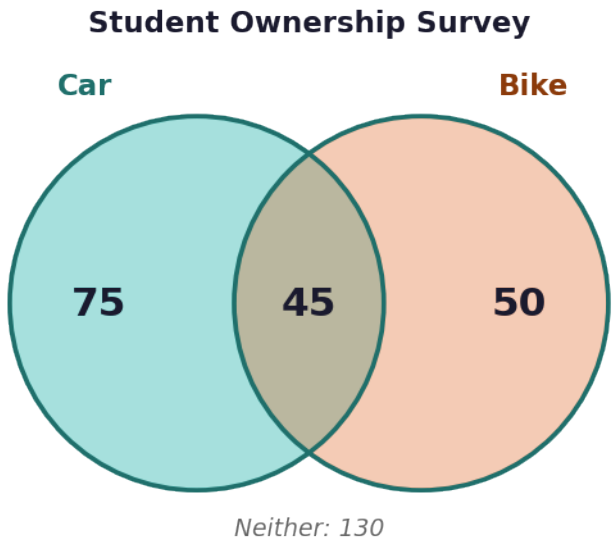
	Plays Instrument	No Instrument	Total
No Sports	20	70	90
Total	50	150	200

- Plays Sports, No Instrument = 110 – 30 = 80
- No Sports, No Instrument = 90 – 20 = 70
- Total No Instrument = 80 + 70 = 150
- P(Sports, No Instrument) = 80/200 = 0.40 or 40%

10. Answer: P ≈ 0.4167



- Car only = 120 – 45 = 75
- Bike only = 95 – 45 = 50
- Students who own car or bike but NOT both = 75 + 50 = 125
- Neither = 300 – (75 + 50 + 45) = 130
- P(Car only OR Bike only) = 125/300 ≈ 0.4167 or about 41.67%

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