Probability: Two-Way Tables & Venn Diagrams

Statistics Worksheet · Grade 9–12

Name: ______________________________ Date: __________________

Learning Objectives

- Organize and interpret data using two-way frequency tables
- Calculate simple and conditional probabilities from two-way tables
- Use Venn diagrams and the Addition Rule to find probabilities of compound events

Problems

1. A statistics teacher has 40 students: 23 females and 17 males. Use the two-way table below to find the total number of students who completed the assignment and those who did not, given that 19 females and 11 males completed it. Fill in the missing values.

	Completed	Not Completed	Total
Female	19		23
Male	11		17
Total			40

2. Using the completed two-way table from the class of 40 students (19 females and 11 males completed the assignment), find the probability that a randomly selected student has completed the assignment.

$$P(\text{Completed}) = \frac{?}{40}$$

3. Using the same class of 40 students, find the probability that a randomly selected student has NOT completed the assignment.

$$P(\text{Not Completed}) = \frac{?}{40}$$

4. Using the class of 40 students, find the probability that a randomly selected student is female and has NOT completed the assignment.

$$P(\text{Female and Not Completed}) = \frac{?}{40}$$

Scan to watch

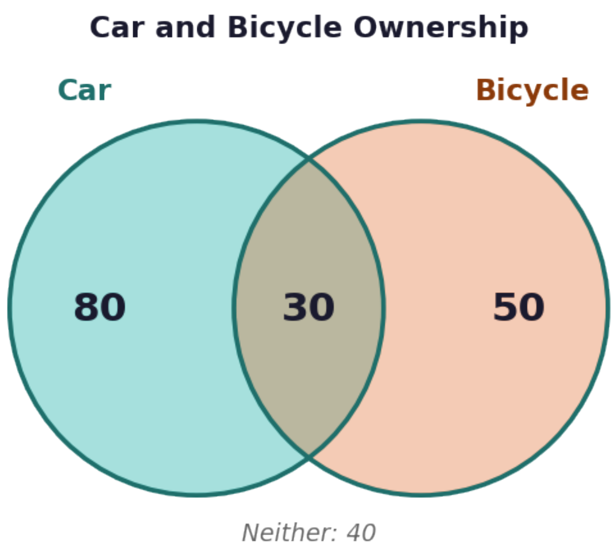
5. Using the class of 40 students, find the conditional probability that a student completed the assignment, GIVEN that the student is male.

$$P(\text{Completed} \mid \text{Male}) = \frac{?}{17}$$

6. Using the class of 40 students, find the conditional probability that a student completed the assignment, GIVEN that the student is female.

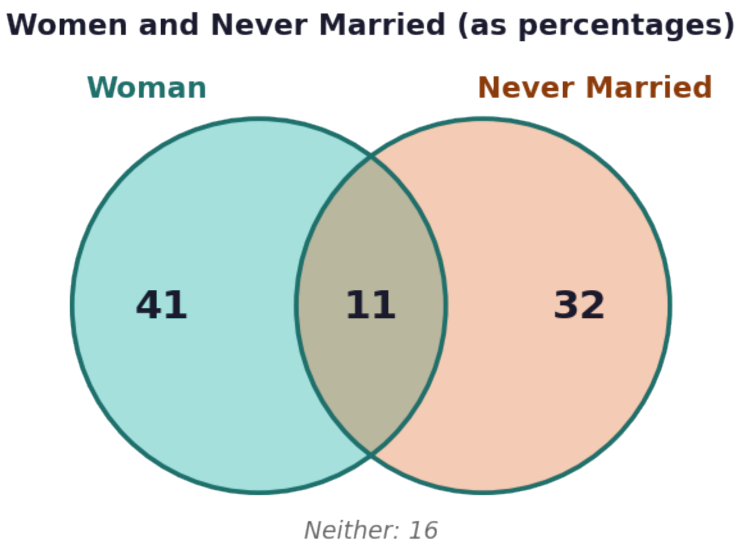
$$P(\text{Completed} \mid \text{Female}) = \frac{?}{23}$$

7. A survey of 200 adults found that 110 own a car, 80 own a bicycle, and 30 own both. Use a Venn diagram to organize this information, then find the probability that a randomly selected adult owns a car OR a bicycle.

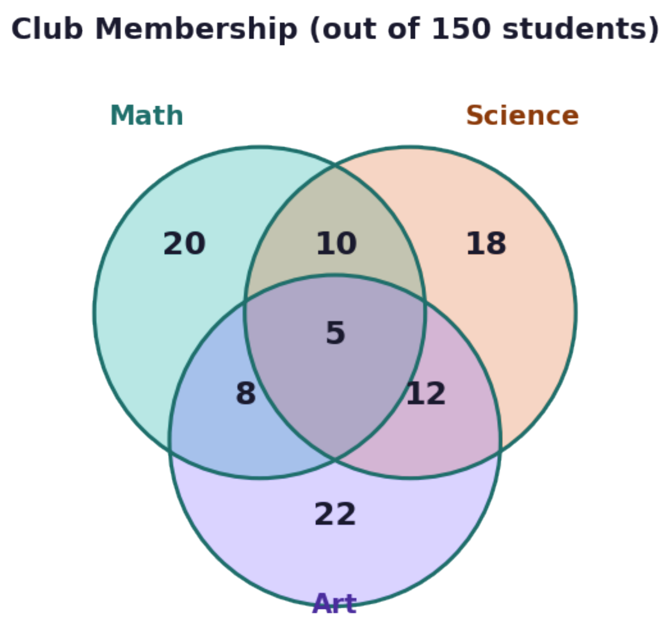


8. In a group of Americans aged 20–25, the probability of selecting a woman is 0.52, the probability of selecting someone who has never been married is 0.43, and the probability of selecting a woman who has never been married is 0.11. Draw a Venn diagram and find the probability of selecting a person who is a woman OR has never been married.

Scan to watch



9. A school surveyed 150 students about participation in Math Club, Science Club, and Art Club. The results are shown. Use the three-set Venn diagram to find the probability that a randomly selected student belongs to at least one club, and the probability they belong to exactly two clubs.



Scan to watch

10. A two-way table shows data on 500 college applicants by gender and admission status. Given the values in the table, find: (a) P(Admitted), (b) P(Admitted | Female), (c) P(Male | Not Admitted), and (d) determine whether gender and admission are independent events by checking if P(Admitted | Female) equals P(Admitted).

	Admitted	Not Admitted	Total
Female	135	65	200
Male	195	105	300
Total	330	170	500

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

Statistics Worksheet · Grade 9–12

Answer Key

1. Answer: Female Not Completed = 4; Male Not Completed = 6; Total Completed = 30; Total Not Completed = 10

	Completed	Not Completed	Total
Female	19	4	23
Male	11	6	17
Total	30	10	40

- Female Not Completed = 23 – 19 = 4
- Male Not Completed = 17 – 11 = 6
- Total Completed = 19 + 11 = 30
- Total Not Completed = 4 + 6 = 10
- Grand Total = 30 + 10 = 40 ✓

2. Answer: 30/40 = 3/4 = 0.75

- Total students who completed = 19 (female) + 11 (male) = 30
- Total students = 40
- P(Completed) = 30/40 = 3/4 = 0.75

3. Answer: 10/40 = 1/4 = 0.25

- Total not completed = 4 (female) + 6 (male) = 10
- Total students = 40
- P(Not Completed) = 10/40 = 1/4 = 0.25
- Check: P(Completed) + P(Not Completed) = 0.75 + 0.25 = 1 ✓

4. Answer: 4/40 = 1/10 = 0.10

- Identify the cell: Female row, Not Completed column = 4
- Total students = 40
- P(Female and Not Completed) = 4/40 = 1/10 = 0.10

5. Answer: 11/17 ≈ 0.647

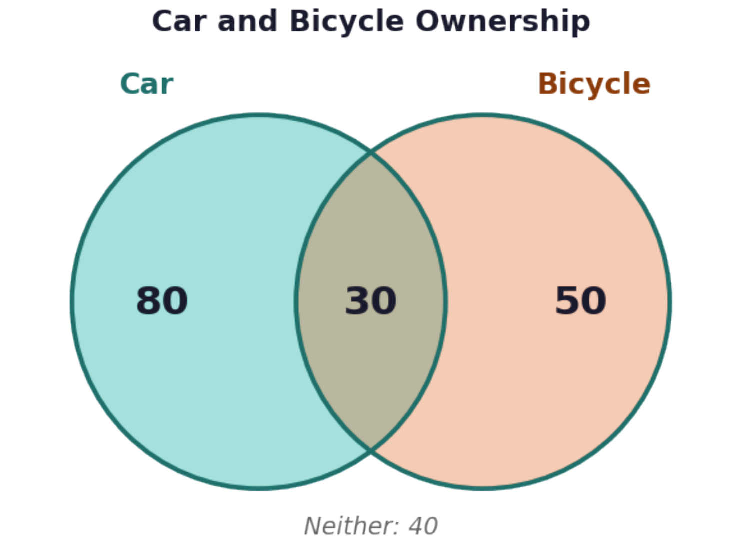
- The condition 'given male' restricts our sample space to 17 male students
- Males who completed the assignment = 11
- P(Completed | Male) = 11/17 ≈ 0.647

6. Answer: 19/23 ≈ 0.826

Scan to watch

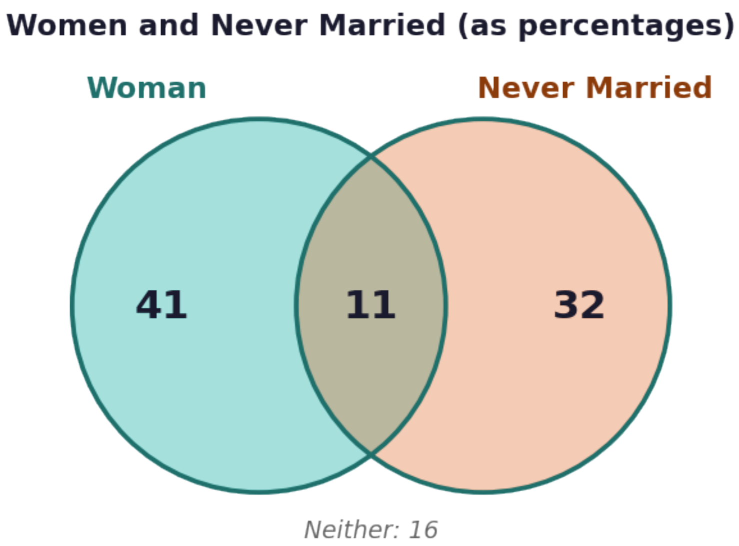
• The condition 'given female' restricts the sample space to 23 female students
• Females who completed = 19
• P(Completed | Female) = 19/23 ≈ 0.826

7. Answer: 160/200 = 4/5 = 0.80



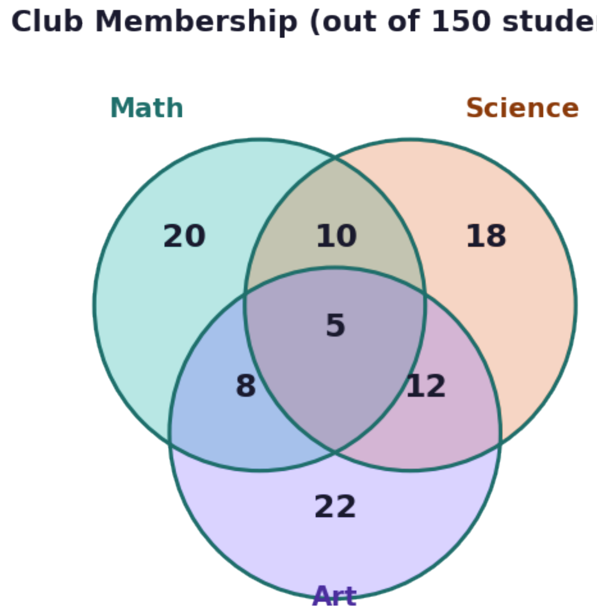
• P(Car) = 110/200 = 0.55
• P(Bicycle) = 80/200 = 0.40
• P(Car and Bicycle) = 30/200 = 0.15
• P(Car or Bicycle) = 0.55 + 0.40 – 0.15 = 0.80
• Or count directly: 80 + 30 + 50 = 160, so 160/200 = 0.80

8. Answer: P(W or M) = 0.84



- P(W) = 0.52, P(M) = 0.43, P(W and M) = 0.11
- Apply the Addition Rule: P(W or M) = P(W) + P(M) – P(W and M)
- P(W or M) = 0.52 + 0.43 – 0.11 = 0.84

9. Answer: P(at least one) = 95/150 ≈ 0.633; P(exactly two) = 30/150 = 1/5 = 0.20



- Count all students in at least one club: 20+18+22+10+8+12+5 = 95
- P(at least one club) = 95/150 ≈ 0.633
- Students in exactly two clubs (not all three): ab only = 10–5=5? Note: in a Venn diagram ab, ac, bc already exclude abc when drawn as regions. Here the values given are region values.
- Exactly two clubs regions: ab=10, ac=8, bc=12 → total = 30
- P(exactly two clubs) = 30/150 = 1/5 = 0.20

10. Answer: (a) 330/500 = 0.66; (b) 135/200 = 0.675; (c) 105/170 ≈ 0.618; (d) Not independent since 0.675 ≠ 0.66

- (a) P(Admitted) = 330/500 = 0.66
- (b) P(Admitted | Female) = 135/200 = 0.675
- (c) P(Male | Not Admitted) = 105/170 ≈ 0.618
- (d) Check independence: P(Admitted | Female) = 0.675 ≠ P(Admitted) = 0.66
- Since these are not equal, gender and admission status are NOT independent events

Scan to watch