

Probability Rules & Models

Statistics Worksheet · Grade 9–12

Name: _____

Date: _____

Learning Objectives

- Complete a probability model by finding a missing probability so that all probabilities sum to 1
- Apply the complement rule to find the probability that an event does NOT occur
- Use the addition rule to find the probability of combined events

Problems

1. A probability model for favorite sports is shown below. Find the missing probability for 'Other' so that the model is valid.

Sport	Soccer	Basketball	Baseball	Other
Probability	0.35	0.28	0.19	

2. Using the table below showing the probability of a randomly selected student's grade level, find the missing probability for 'Grade 12'.

Grade	Grade 9	Grade 10	Grade 11	Grade 12
Probability	0.27	0.25	0.24	

3. The probability that it rains on any given day in April is 0.45. What is the probability that it does NOT rain on a randomly selected day in April?

$$P(\text{no rain}) = 1 - P(\text{rain})$$

4. A survey asked Canadians about their first language. Use the probability model below to find the probability that a randomly selected Canadian's mother tongue is NOT French.

Language	English	French	Asia-Pacific	Other
Probability	0.62	0.22	0.06	0.10

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5. Using the same Canadian language survey table in Problem 4, find the probability that a randomly selected Canadian's mother tongue is a language other than English or French.

$$P(\text{not English or French}) = 1 - [P(\text{English}) + P(\text{French})]$$

6. A probability model for young adults' education level is shown below. Two values are missing. First, find the missing probability for 'Some College' given that 'Did Not Complete High School' = 0.13, 'High School Diploma' = 0.29, and 'Bachelor's Degree or Higher' = 0.30. Then complete the table.

Education Level	Did Not Complete HS	HS Diploma	Some College	Bachelor's or Higher
Probability	0.13	0.29		0.30

7. Using the education model from Problem 6, find the probability that a randomly chosen young adult has at least a high school diploma.

$$P(\text{at least HS diploma}) = P(\text{HS Diploma}) + P(\text{Some College}) + P(\text{Bachelor's or Higher})$$

8. Determine whether the following table represents a valid probability model. Explain your reasoning and correct it if necessary.

Outcome	A	B	C	D
Probability	0.25	0.35	0.30	0.15

9. A spinner has five colored sections. The probabilities for four colors are given. Find the missing probability for Green. Then find the probability that the spinner does NOT land on Blue or Yellow.

Color	Red	Blue	Yellow	Purple	Green
Probability	0.18	0.22	0.15	0.27	

10. A probability model for transportation methods used by students is shown. Two probabilities are missing. Find both missing values, then answer: What is the probability that a randomly chosen student uses public transit or bikes to school?

Method	Car	Bus	Bike	Walk	Other
Probability	0.38		0.12	0.18	0.07

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Probability Rules & Models — Answer Key

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Answer Key

1. Answer: 0.18

Sport	Soccer	Basketball	Baseball	Other
Probability	0.35	0.28	0.19	0.18

- All probabilities in a valid model must sum to 1.
- Add the known probabilities: $0.35 + 0.28 + 0.19 = 0.82$
- Subtract from 1: $1 - 0.82 = 0.18$
- The missing probability for 'Other' is 0.18.

2. Answer: 0.24

Grade	Grade 9	Grade 10	Grade 11	Grade 12
Probability	0.27	0.25	0.24	0.24

- Sum of all probabilities must equal 1.
- Add known values: $0.27 + 0.25 + 0.24 = 0.76$
- Missing probability = $1 - 0.76 = 0.24$

3. Answer: 0.55

- Use the complement rule: $P(\text{not } A) = 1 - P(A)$
- $P(\text{no rain}) = 1 - 0.45 = 0.55$

4. Answer: 0.78

- Use the complement rule: $P(\text{not French}) = 1 - P(\text{French})$
- $P(\text{not French}) = 1 - 0.22 = 0.78$

5. Answer: 0.16

- Find the combined probability of English or French: $0.62 + 0.22 = 0.84$
- Apply the complement rule: $1 - 0.84 = 0.16$
- The probability of a mother tongue other than English or French is 0.16.

6. Answer: 0.28

Education Level	Did Not Complete HS	HS Diploma	Some College	Bachelor's or Higher
Probability	0.13	0.29	0.28	0.30

- Sum of all probabilities must equal 1.
- Add known values: $0.13 + 0.29 + 0.30 = 0.72$

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- Missing probability = $1 - 0.72 = 0.28$
- The 'Some College' probability is 0.28.

7. Answer: 0.87

- 'At least a high school diploma' means HS Diploma, Some College, or Bachelor's or Higher.
- Add: $0.29 + 0.28 + 0.30 = 0.87$
- Alternatively, use the complement: $1 - P(\text{did not complete HS}) = 1 - 0.13 = 0.87$

8. Answer: Not valid; probabilities sum to 1.05. Reduce one value so total equals 1.

- Check: $0.25 + 0.35 + 0.30 + 0.15 = 1.05$
- A valid probability model requires all probabilities to sum to exactly 1.
- Since $1.05 \neq 1$, this is NOT a valid probability model.
- For example, reduce P(D) to 0.10 so the sum becomes 1.00.

9. Answer: P(Green) = 0.18; P(not Blue or Yellow) = 0.63

Color	Red	Blue	Yellow	Purple	Green
Probability	0.18	0.22	0.15	0.27	0.18

- Step 1 — Find P(Green): $0.18 + 0.22 + 0.15 + 0.27 = 0.82$, so $P(\text{Green}) = 1 - 0.82 = 0.18$
- Step 2 — Find P(Blue or Yellow): $0.22 + 0.15 = 0.37$
- Step 3 — Apply complement rule: $P(\text{not Blue or Yellow}) = 1 - 0.37 = 0.63$

10. Answer: P(Bus) = 0.25; P(Bus or Bike) = 0.37

Method	Car	Bus	Bike	Walk	Other
Probability	0.38	0.25	0.12	0.18	0.07

- Step 1 — Find P(Bus): Add known values: $0.38 + 0.12 + 0.18 + 0.07 = 0.75$
- $P(\text{Bus}) = 1 - 0.75 = 0.25$
- Step 2 — Find P(Bus or Bike): Since Bus and Bike are mutually exclusive, add their probabilities.
- $P(\text{Bus or Bike}) = 0.25 + 0.12 = 0.37$

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