Probability Rules, Events & Operations

Probability Worksheet · Grade 9–11

Name: _____ Date: _____

Learning Objectives

- Apply the three basic probability properties including range, sum, and complement rules
- Distinguish between independent and dependent events and calculate their probabilities
- Use the addition and multiplication rules for independent events

Problems

1. A student calculates the probability of winning a game and gets a value of 1.3. Is this a valid probability? Explain why or why not.

2. A spinner has four sections labeled 1, 2, 3, and 4. The probabilities for sections 1, 2, and 3 are 0.20, 0.35, and 0.25 respectively. Find the probability of landing on section 4.

$$P(1) = 0.20, \quad P(2) = 0.35, \quad P(3) = 0.25, \quad P(4) = ?$$

3. The probability that it will rain tomorrow is 0.65. Using the complement rule, find the probability that it will NOT rain tomorrow.

$$P(A) = 0.65, \quad P(A') = ?$$

4. A jar contains 4 green, 3 yellow, and 5 purple marbles. A marble is drawn and then replaced before the second draw. Are the two draws independent or dependent events? Explain.

5. A bag contains 6 red and 4 blue balls. Two balls are drawn WITHOUT replacement. Is this situation an example of independent or dependent events? Find the probability of drawing a red ball on the first draw.

$$P(\text{1st red}) = \frac{?}{?}$$

6. A coin is flipped twice. Using the multiplication rule for independent events, find the probability of getting heads on both flips.

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$$P(H \cap H) = P(H) \times P(H)$$

7. A single fair die is rolled. Using the addition rule for independent events, find the probability of rolling a 2 OR a 5.

$$P(2 \cup 5) = P(2) + P(5)$$

8. A jar has 5 red and 2 blue marbles. Two marbles are drawn WITHOUT replacement. Complete the table below to show the sample space sizes and number of red marbles available for each draw, then find the probability of drawing two red marbles in a row.

Draw	Total Marbles in Jar	Number of Red Marbles	P(Red)
1st Draw	7	5	5/7
2nd Draw			

9. A card is drawn from a standard 52-card deck and replaced, then a second card is drawn. Find the probability that BOTH cards drawn are Aces. Then find the probability that AT LEAST ONE card is NOT an Ace using the complement rule.

$P(\text{both Aces}) = P(A) \times P(A), \quad P(\text{at least one non-Ace}) = 1 - P(\text{both Aces})$

10. A bag contains 8 marbles: 3 red, 3 blue, and 2 green. Three marbles are drawn WITHOUT replacement. Find the probability of drawing a red marble first, then a blue marble second, and then a green marble third.

$$P(R \to B \to G) = \frac{3}{8} \times \frac{3}{7} \times \frac{2}{6}$$

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Probability Rules, Events & Operations — Answer Key

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Answer Key

1. Answer: No. All probability values must be between 0 and 1 inclusive. A value of 1.3 is greater than 1, so it is an error.

- Recall Property 1: For any event A, $0 \leq P(A) \leq 1$.
- Since $1.3 > 1$, the value falls outside the valid range.
- Therefore, 1.3 is NOT a valid probability — it indicates a calculation error.

2. Answer: P(4) = 0.20

- Recall Property 2: The sum of all probabilities in a sample space equals 1.
- P(1) + P(2) + P(3) + P(4) = 1
- 0.20 + 0.35 + 0.25 + P(4) = 1
- 0.80 + P(4) = 1
- P(4) = 1 – 0.80 = 0.20

3. Answer: P(A') = 0.35

- Recall Property 3 (Complement Rule): P(A') = 1 – P(A)
- P(rain') = 1 – P(rain)
- P(rain') = 1 – 0.65
- P(rain') = 0.35

4. Answer: Independent. Because the marble is replaced, the sample space remains the same for each draw, so the second draw is not affected by the first.

- With replacement: after each draw the marble is returned to the jar.
- The total number of marbles stays at 4 + 3 + 5 = 12 for every draw.
- Since the outcome of the first draw does not change the sample space for the second draw, the events are INDEPENDENT.

5. Answer: Dependent events. P(1st red) = 6/10 = 3/5

- Without replacement means the ball is not put back, so the sample space shrinks after each draw.
- Therefore the events are DEPENDENT.
- Total marbles = 6 + 4 = 10.
- P(1st red) = 6/10 = 3/5.

6. Answer: P(H and H) = 1/4 = 0.25

- Each flip is independent because the outcome of the first flip does not affect the second.
- P(H) = 1/2 for each flip.
- Multiplication Rule (independent): $P(A \cap B) = P(A) \times P(B)$
- P(H and H) = (1/2) × (1/2) = 1/4 = 0.25

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7. Answer: P(2 or 5) = 1/3 ≈ 0.333

- A fair die has 6 equally likely outcomes: {1, 2, 3, 4, 5, 6}.
- P(2) = 1/6 and P(5) = 1/6.
- Rolling a 2 and rolling a 5 are mutually exclusive (cannot happen simultaneously).
- Addition Rule: P(2 or 5) = P(2) + P(5) = 1/6 + 1/6 = 2/6 = 1/3 ≈ 0.333

8. Answer: P(two red) = 20/42 = 10/21 ≈ 0.476

Draw	Total Marbles in Jar	Number of Red Marbles	P(Red)
1st Draw	7	5	5/7
2nd Draw	6	4	4/6

- After the 1st red marble is drawn and NOT replaced, total marbles = 7 – 1 = 6.
- Red marbles remaining = 5 – 1 = 4.
- P(2nd red | 1st red) = 4/6.
- P(two red) = P(1st red) × P(2nd red | 1st red) = (5/7) × (4/6) = 20/42 = 10/21 ≈ 0.476.

9. Answer: P(both Aces) = 1/169 ≈ 0.0059; P(at least one non-Ace) = 168/169 ≈ 0.9941

- There are 4 Aces in a 52-card deck, so P(Ace) = 4/52 = 1/13.
- Since the card is replaced, the two draws are INDEPENDENT.
- P(both Aces) = P(Ace) × P(Ace) = (1/13) × (1/13) = 1/169 ≈ 0.0059.
- Complement Rule: P(at least one non-Ace) = 1 – P(both Aces) = 1 – 1/169 = 168/169 ≈ 0.9941.

10. Answer: P(R then B then G) = 18/336 = 3/56 ≈ 0.054

- These are DEPENDENT events because marbles are drawn without replacement.
- P(1st = Red) = 3/8 (3 red out of 8 total).
- After removing 1 red marble: 7 marbles remain, 3 are blue. P(2nd = Blue) = 3/7.
- After removing 1 blue marble: 6 marbles remain, 2 are green. P(3rd = Green) = 2/6 = 1/3.
- P(R then B then G) = (3/8) × (3/7) × (2/6) = 18/336 = 3/56 ≈ 0.054.

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