

# Conditional Probability

Probability Worksheet · Grade 10–12

Name: \_\_\_\_\_

Date: \_\_\_\_\_

## Learning Objectives

- Apply the multiplication rule for dependent events to find the probability of two events both occurring
- Use the conditional probability formula  $P(B|A) = P(A \text{ and } B) / P(A)$  when probabilities are given
- Distinguish between independent and dependent events and choose the correct probability method

## Problems

1. A bag contains 5 red marbles and 3 blue marbles. You draw one marble and do NOT replace it. What is the probability that the first marble is red?

$$P(A) = \frac{5}{8}$$

2. A standard deck has 52 cards. You draw one card and do NOT replace it. Event A is drawing a heart. Given that event A occurred, what is the probability that the second card drawn is also a heart (event B given A)?

$$P(B | A) = \frac{12}{51}$$

3. Using the multiplication rule for dependent events, find the probability of drawing two aces in a row from a standard 52-card deck without replacement.

$$P(A \cap B) = \frac{4}{52} \times \frac{3}{51}$$

4. A bag has 6 green and 4 yellow marbles. Two marbles are drawn without replacement. Use the multiplication rule for dependent events to find the probability that both marbles are green.

$$P(A \cap B) = \frac{6}{10} \times \frac{5}{9}$$

5. In a class, 60% of students like math. Of those who like math, 40% also like science. Using the multiplication rule for dependent events, what percent of students like both math and science?

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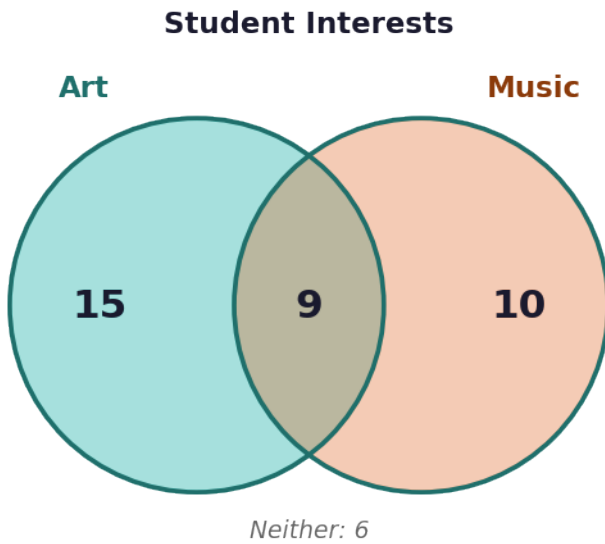


$$P(A \cap B) = 0.60 \times 0.40$$

6. Use the Type 2 conditional probability formula. In a survey, 80% of people exercise regularly. 48% exercise regularly AND eat healthy. What percent of those who exercise regularly also eat healthy?

$$P(B | A) = \frac{P(A \cap B)}{P(A)} = \frac{0.48}{0.80}$$

7. A school survey shows the following. Use the Venn diagram to answer: What is the probability that a randomly selected student who likes art also likes music?



8. From a standard deck of 52 cards, three cards are drawn without replacement. Use the multiplication rule for dependent events to find the probability that all three cards are kings. Round to 4 decimal places.

$$P = \frac{4}{52} \times \frac{3}{51} \times \frac{2}{50}$$

9. Use the table below and the Type 2 conditional probability formula to find the probability that a student chosen at random passed the final exam, given that they completed all homework assignments.

	Passed Exam	Did Not Pass Exam	Total
Completed Homework	45	5	50

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	Passed Exam	Did Not Pass Exam	Total
Did Not Complete Homework	10	40	50
Total	55	45	100

**10.** In a survey of 200 students, 110 play a sport, 90 play an instrument, and 45 play both a sport and an instrument. A student is selected at random. Find: (a) the probability that the student plays an instrument given that they play a sport, and (b) the probability that the student plays a sport given that they play an instrument. Are these two conditional probabilities equal? Explain.

$$P(B | A) = \frac{P(A \cap B)}{P(A)}, \quad P(A | B) = \frac{P(A \cap B)}{P(B)}$$

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# Conditional Probability — Answer Key

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## Answer Key

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### 1. Answer: $5/8$ or $0.625$

- There are 5 red marbles out of 8 total marbles.
- $P(\text{red}) = 5/8 = 0.625$

### 2. Answer: $12/51 \approx 0.235$

- After drawing one heart, 12 hearts remain out of 51 total cards.
- $P(B|A) = 12/51 \approx 0.235$

### 3. Answer: $12/2652 \approx 0.45\%$

- $P(\text{first ace}) = 4/52$
- $P(\text{second ace} | \text{first ace}) = 3/51$
- $P(A \text{ and } B) = (4/52) \times (3/51) = 12/2652 \approx 0.0045$  or about 0.45%

### 4. Answer: $30/90 = 1/3 \approx 33.3\%$

- $P(\text{first green}) = 6/10$
- $P(\text{second green} | \text{first green}) = 5/9$
- $P(\text{both green}) = (6/10) \times (5/9) = 30/90 = 1/3 \approx 33.3\%$

### 5. Answer: $24\%$

- $P(\text{math}) = 0.60$
- $P(\text{science} | \text{math}) = 0.40$
- $P(\text{math and science}) = 0.60 \times 0.40 = 0.24 = 24\%$

### 6. Answer: $60\%$

- $P(A) = 0.80$  (exercise regularly)
- $P(A \text{ and } B) = 0.48$  (exercise and eat healthy)
- $P(B|A) = 0.48 / 0.80 = 0.60 = 60\%$

### 7. Answer: $9/24 = 3/8 = 37.5\%$

- $P(A) = \text{students who like Art} = 15 + 9 = 24$
- $P(A \text{ and } B) = \text{students who like both} = 9$
- $P(B|A) = 9/24 = 3/8 = 0.375 = 37.5\%$

### 8. Answer: $24/132600 \approx 0.0002$ or $0.018\%$

- $P(1\text{st king}) = 4/52$
- $P(2\text{nd king} | 1\text{st king}) = 3/51$
- $P(3\text{rd king} | \text{first two kings}) = 2/50$
- $P(\text{all three kings}) = (4/52) \times (3/51) \times (2/50) = 24/132600 \approx 0.000181 \approx 0.018\%$

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**9. Answer:  $45/50 = 0.90 = 90\%$**

- Event A = completed all homework,  $P(A) = 50/100 = 0.50$
- Event A and B = completed homework AND passed exam,  $P(A \text{ and } B) = 45/100 = 0.45$
- $P(B|A) = P(A \text{ and } B) / P(A) = 0.45 / 0.50 = 0.90 = 90\%$

**10. Answer:  $P(\text{instrument} | \text{sport}) = 45/110 \approx 40.9\%$ ;  $P(\text{sport} | \text{instrument}) = 45/90 = 50\%$ ; They are NOT equal.**

- $P(A) = P(\text{sport}) = 110/200 = 0.55$
- $P(B) = P(\text{instrument}) = 90/200 = 0.45$
- $P(A \text{ and } B) = 45/200 = 0.225$
- $P(B|A) = 0.225 / 0.55 = 45/110 \approx 0.409 = 40.9\%$
- $P(A|B) = 0.225 / 0.45 = 45/90 = 0.50 = 50\%$
- The two conditional probabilities are NOT equal because the size of the conditioning event (sport vs instrument) differs.

