

# Probability of Compound Events

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

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

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## Q Quick Review

A **compound event** combines two or more simple events. To find its probability, first decide how the events relate. For **independent** events (one outcome does not affect the other, like separate coin flips), *multiply*:  $P(A \text{ and } B) = P(A) \cdot P(B)$ . For **dependent** events (the first outcome changes the second, like drawing without replacing), use the *updated* probability for the second event. You can also list the **sample space** — all possible outcomes — and count the favorable ones. A useful shortcut:  $P(\text{at least one}) = 1 - P(\text{none})$ .

◇ **Example:** A bag has 3 red and 5 blue marbles. Find the probability of drawing red, replacing it, then drawing red again.  
 ⇒ Because we *replace* the first marble, the bag is exactly the same for the second draw — the two draws are **independent**. On each draw,  $P(\text{red}) = \frac{3}{8}$  (3 red out of 8 marbles). Since the events are independent, we multiply:  $P(\text{red then red}) = \frac{3}{8} \cdot \frac{3}{8} = \frac{9}{64}$ . If we had *not* replaced the first marble, the second probability would change to  $\frac{2}{7}$  — so always check whether there is replacement!

**Answer:**  $P(\text{red, then red}) = \frac{9}{64}$

## PRACTICE

Find each compound probability. Write answers as reduced fractions.

- $P(\text{heads and heads on two coin flips})$  \_\_\_\_\_
- $P(\text{tails and a 3 on a die})$  \_\_\_\_\_
- $P(\text{a 6 and then a 6 on two die rolls})$  \_\_\_\_\_
- $P(\text{heads, heads, heads on three flips})$  \_\_\_\_\_
- $P(\text{even on a die and heads on a coin})$  \_\_\_\_\_
- $P(\text{a 1 then a 2 on two die rolls})$  \_\_\_\_\_
- $P(\text{spinner 1-4 lands on 3 twice})$  \_\_\_\_\_
- $P(\text{odd on a die and tails on a coin})$  \_\_\_\_\_
- $P(\text{two dice both show even})$  \_\_\_\_\_
- $P(\text{drawing red twice WITH replacement: 3 red, 5 blue})$  \_\_\_\_\_
- $P(\text{drawing blue twice WITH replacement: 3 red, 5 blue})$  \_\_\_\_\_
- $P(\text{drawing red then blue WITH replacement: 3 red, 5 blue})$  \_\_\_\_\_
- $P(\text{red then red WITHOUT replacement: 2 red, 3 blue})$  \_\_\_\_\_
- $P(\text{two dice both show 6})$  \_\_\_\_\_
- $P(\text{rolling two dice with a sum of 2})$  \_\_\_\_\_
- $P(\text{rolling two dice with a sum of 7})$  \_\_\_\_\_
- $P(\text{at least one head on two coin flips})$  \_\_\_\_\_
- $P(\text{coin heads and spinner 1-4 on 2})$  \_\_\_\_\_
- $P(\text{drawing green twice WITHOUT replacement: 3 green, 2 red})$  \_\_\_\_\_
- $P(\text{a 5 on a die, then heads, then a 5 again})$  \_\_\_\_\_

## ◆ Word Problems

- A spinner has 4 equal sections and a coin is flipped. What is the probability of landing on section 1 *and* getting heads?  
\_\_\_\_\_
- A drawer has 4 black socks and 6 white socks. You grab two socks without looking and without replacing the first. What is the probability both are black?  
\_\_\_\_\_
- You roll two fair dice. What is the probability that the sum is 7?  
\_\_\_\_\_
- A quiz has 3 true/false questions and you guess each one. What is the probability of guessing all 3 correctly?  
\_\_\_\_\_



## Answer Keys

- |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>1. <math>\frac{1}{4}</math></p> <p>2. <math>\frac{1}{12}</math></p> <p>3. <math>\frac{1}{36}</math></p> <p>4. <math>\frac{1}{8}</math></p> <p>5. <math>\frac{1}{4}</math></p> <p>6. <math>\frac{1}{36}</math></p> <p>7. <math>\frac{1}{16}</math></p> <p>8. <math>\frac{1}{4}</math></p> <p>9. <math>\frac{1}{4}</math></p> <p>10. <math>\frac{9}{64}</math></p> <p>11. <math>\frac{25}{64}</math></p> <p>12. <math>\frac{15}{64}</math></p> <p>13. <math>\frac{1}{10}</math></p> | <p>14. <math>\frac{1}{36}</math></p> <p>15. <math>\frac{1}{36}</math></p> <p>16. <math>\frac{1}{6}</math></p> <p>17. <math>\frac{3}{4}</math></p> <p>18. <math>\frac{1}{8}</math></p> <p>19. <math>\frac{3}{10}</math></p> <p>20. <math>\frac{1}{72}</math></p> <p>21. <math>\frac{1}{4} \cdot \frac{1}{2} = \frac{1}{8}</math></p> <p>22. <math>\frac{4}{10} \cdot \frac{3}{9} = \frac{2}{15}</math></p> <p>23. <math>\frac{6}{36} = \frac{1}{6}</math></p> <p>24. <math>\left(\frac{1}{2}\right)^3 = \frac{1}{8}</math></p> |
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### Step-by-Step Explanations

1. Independent flips:  $\frac{1}{2} \cdot \frac{1}{2} = \frac{1}{4}$ .
2. Independent:  $\frac{1}{2} \cdot \frac{1}{6} = \frac{1}{12}$ .
3. Independent rolls:  $\frac{1}{6} \cdot \frac{1}{6} = \frac{1}{36}$ .
4. Three independent flips:  $\frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} = \frac{1}{8}$ .
5. Independent:  $\frac{3}{6} \cdot \frac{1}{2} = \frac{1}{2} \cdot \frac{1}{2} = \frac{1}{4}$ .
6. Independent rolls:  $\frac{1}{6} \cdot \frac{1}{6} = \frac{1}{36}$ .
7. Independent spins:  $\frac{1}{4} \cdot \frac{1}{4} = \frac{1}{16}$ .
8. Independent:  $\frac{3}{6} \cdot \frac{1}{2} = \frac{1}{2} \cdot \frac{1}{2} = \frac{1}{4}$ .
9. Each die:  $P(\text{even}) = \frac{1}{2}$ , so  $\frac{1}{2} \cdot \frac{1}{2} = \frac{1}{4}$ .
10. With replacement the draws are independent:  $\frac{3}{8} \cdot \frac{3}{8} = \frac{9}{64}$ .
11. Independent draws:  $\frac{5}{8} \cdot \frac{5}{8} = \frac{25}{64}$ .
12. Independent:  $\frac{3}{8} \cdot \frac{5}{8} = \frac{15}{64}$ .
13. First:  $\frac{2}{5}$ . After removing a red,  $\frac{1}{4}$ . Multiply:  $\frac{2}{5} \cdot \frac{1}{4} = \frac{1}{10}$ .
14. Independent:  $\frac{1}{6} \cdot \frac{1}{6} = \frac{1}{36}$ .
15. Only 1 outcome out of 36 gives a sum of 2: (1, 1).
16. There are 6 ways to make 7 out of 36 outcomes:  $\frac{6}{36} = \frac{1}{6}$ .
17. Use the shortcut:  $1 - P(\text{no heads}) = 1 - \frac{1}{4} = \frac{3}{4}$ .
18. Independent:  $\frac{1}{2} \cdot \frac{1}{4} = \frac{1}{8}$ .
19. First:  $\frac{3}{5}$ . After removing a green,  $\frac{2}{4} = \frac{1}{2}$ . Multiply:  $\frac{3}{5} \cdot \frac{1}{2} = \frac{3}{10}$ .
20. All independent:  $\frac{1}{6} \cdot \frac{1}{2} \cdot \frac{1}{6} = \frac{1}{72}$ .
21. The spin and flip are independent.  $P(\text{section 1}) = \frac{1}{4}$  and  $P(\text{heads}) = \frac{1}{2}$ , so multiply:  $\frac{1}{4} \cdot \frac{1}{2} = \frac{1}{8}$ .
22. First sock black:  $\frac{4}{10}$ . Now 3 black of 9 remain, so the second is  $\frac{3}{9}$ . Multiply:  $\frac{4}{10} \cdot \frac{3}{9} = \frac{12}{90} = \frac{2}{15}$ .
23. There are 36 equally likely outcomes. The pairs that sum to 7 are (1, 6), (2, 5), (3, 4), (4, 3), (5, 2), (6, 1) — 6 of them — so  $\frac{6}{36} = \frac{1}{6}$ .
24. Each guess is independent with probability  $\frac{1}{2}$  of being right, so all three correct is  $\frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} = \frac{1}{8}$ .



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