

Probability with Compound Events (Independent and Dependent)

Compound Events refer to 2 or more events occurring.

To find the probability of **compound events**, multiply the probability of each of the events together.

Ex. 1: Suppose you have a bag containing 2 black marbles and 3 red marbles. You reach into the bag, select a marble, see what color it is and replace it in the bag (Event #1). Then you repeat this process (Event #2). What is the probability of picking a red marble both times?

First you need to find the probability of picking a red marble the first time (or for the Event #1).

$$P(\text{red}) = \frac{3}{5} \quad \left(\frac{3 \text{ red marbles}}{5 \text{ total marbles}} \right)$$

Since the probability of picking a red marble once is $\frac{3}{5}$, the probability of picking a red marble the second time is again $\frac{3}{5}$.

Therefore, the probability of the **compound event** of picking a red marble both times is the product of the two event probabilities.

$$\frac{3}{5} \times \frac{3}{5} = \frac{9}{25}$$

Since the first marble was **replaced** back in the bag before the second marble was drawn, the probability of the second drawing is **independent** of the probability of the first drawing. These are referred to as **independent events** --- in other words, the outcome of one event does not affect the outcome of the other event.

Ex. 2: Suppose you have a bag containing 2 black marbles and 3 red marbles. You reach into the bag, select a marble, see what color it is but **do not replace it** in the bag (Event #1). Then you reach in and select another marble. (Event #2). What is the probability of picking a red marble both times?

The probability of picking a red marble the first time (or for the Event #1) is the same as it was in Ex. 1 ----- 3 out of 5.

$$P(\text{red}) = \frac{3}{5} \quad \left(\frac{3 \text{ red marbles}}{5 \text{ total marbles}} \right)$$

However, since the first marble was not replaced back in the bag, the probability of picking a red marble the second time is **dependent** on the outcome of the first drawing.

Suppose we did pick a red marble and did not put it back in the bag. Now there are only 2 red marbles and 2 black marbles in the bag, and the probability of picking a red marble the second time (Event #2) is

$$P(\text{red}) = \frac{2}{4} \quad \left(\frac{2 \text{ red marbles}}{4 \text{ total marbles}} \right)$$

Therefore, the probability of the **compound event** of picking a red marble both times is the product of the two **dependent event** probabilities.

$$\frac{3}{5} \times \frac{2}{4} = \frac{6}{20} = \frac{3}{10}$$

*** An **Independent Event** occurs with **replacement**.

A **Dependent Event** occurs **without replacement**.

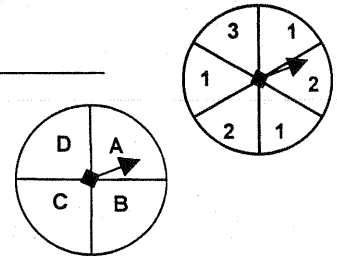
Probability with Compound Events (Independent and Dependent) Practice

Describe the events by writing **I** for *independent event* or **D** for *dependent event*.

- Ann draws a colored toothpick from a jar. Without replacing it, she draws a second toothpick. _____
- John rolls a six on a number cube and then flips a coin that comes up heads. _____
- Susie draws a card from a deck of cards and replaces it. She then draws a second card. _____
- Seth draws a colored tile from a bag, replaces it; draws a second tile from the bag, replaces it; and then draws a tile a third time from the bag. _____
- You draw a red marble from a bag, and then another red marble (without replacing the first marble)? _____

Using the two spinners, find each **compound** probability.

- $P(A \text{ and } 2)$ _____
- $P(D \text{ and } 1)$ _____
- $P(B \text{ and } 3)$ _____
- $P(A \text{ and not } 2)$ _____

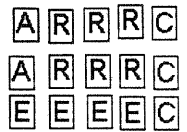


A box contains 3 red marbles, 6 blue marbles, and 1 white marble. The marbles are selected at random, one at a time, and are **not replaced**. Find each **compound** probability.

- $P(\text{blue and red})$ _____
- $P(\text{blue and blue})$ _____
- $P(\text{red and white and blue})$ _____
- $P(\text{red and red and red})$ _____
- $P(\text{white and red and white})$ _____

Suppose that two tiles are drawn from the collection shown at the right. The first tile is replaced before the second is drawn. Find each **compound** probability.

- $P(A \text{ and } A)$ _____
- $P(R \text{ and } C)$ _____
- $P(A \text{ and not } R)$ _____

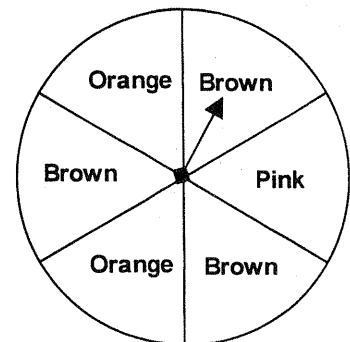


Suppose that two tiles are drawn from the same collection shown above. The first tile is **not** replaced before the second is drawn. Find each **compound** probability.

- $P(A \text{ and } A)$ _____
- $P(R \text{ and } C)$ _____
- $P(A \text{ and not } R)$ _____

Use the spinner to the right for the next two problems.

- If you spin the spinner twice, what is the probability of spinning orange then brown? _____
- If you spin the spinner twice, what is the probability of spinning brown both times? _____



- Kevin had 6 nickels and 4 dimes in his pocket. If he took out one coin and then a second coin without replacing the first coin ---
 - what is the probability that both coins were nickels? _____
 - what is the probability that both coins were dimes? _____
 - what is the probability that the first coin was a nickel and the second a dime? _____

ANSWERS

Probability with Compound Events (Independent and Dependent) Practice

1. D 2. I 3. I 4. I 5. D

6. $\frac{1}{2} \times \frac{2}{6} = \frac{1}{12}$

7. $\frac{1}{4} \times \frac{1}{2} = \frac{1}{8}$

8. $\frac{1}{4} \times \frac{1}{6} = \frac{1}{24}$

9. $\frac{1}{4} \times \frac{2}{3} = \frac{1}{6}$

10. $\frac{6}{10} \times \frac{3}{9} = \frac{1}{5}$

11. $\frac{6}{10} \times \frac{5}{9} = \frac{1}{3}$

12. $\frac{3}{10} \times \frac{1}{9} \times \frac{6}{8} = \frac{1}{40}$

13. $\frac{3}{10} \times \frac{2}{9} \times \frac{1}{8} = \frac{1}{120}$

14. $\frac{1}{10} \times \frac{3}{9} \times \frac{6}{8} = \frac{1}{40}$

15. $\frac{2}{15} \times \frac{2}{15} = \frac{4}{225}$

16. $\frac{6}{15} \times \frac{3}{15} = \frac{2}{25}$

17. $\frac{2}{15} \times \frac{9}{15} = \frac{2}{25}$

18. $\frac{2}{15} \times \frac{1}{14} = \frac{1}{105}$

19. $\frac{6}{15} \times \frac{3}{14} = \frac{3}{35}$

20. $\frac{2}{15} \times \frac{8}{14} = \frac{8}{105}$ ($\frac{8}{14}$ because A also now removed)

21. $\frac{2}{6} \times \frac{3}{6} = \frac{1}{6}$

22. $\frac{3}{6} \times \frac{3}{6} = \frac{1}{4}$

23. (a) $\frac{6}{10} \times \frac{5}{9} = \frac{1}{3}$

(b) $\frac{4}{10} \times \frac{3}{9} = \frac{2}{15}$

(c) $\frac{6}{10} \times \frac{4}{9} = \frac{4}{15}$