

Vocabulary:

Events are **dependent events** if _____

To find the probability of dependent events, you can use **conditional probability**, $P(B | A)$, _____

Probability of Dependent Events:

If A and B are dependent events, then _____

where _____

Examples:

1. A bag of marbles contains 5 red marbles, 2 green marbles, 3 blue marbles, and 1 yellow marble. When marbles are taken from the bag they are not replaced.

A. What is the probability of picking a red marble and then picking a yellow marble?

B. What is the probability of picking a blue marble and then picking another blue marble?

2. An IRS auditor randomly selects 3 tax returns (without replacement) from 43 returns of which 8 contain errors. What is the probability that she selects none of those containing errors?

Remember: A standard card deck contains 4 suits of 13 cards each. The face cards are the jacks, queens and kings.

3. Two cards are drawn from a deck of 52. Determine whether the events are independent or dependent. Find the probability.

A. selecting two hearts when the first card is replaced

B. selecting two hearts when the first card is not replaced

C. a queen is drawn, is not replaced, and then a king is drawn

4. A drawer contains 8 blue socks, 8 black socks, and 4 white socks. Socks are picked at random. Explain why the events picking a blue sock and then another blue sock are dependent. Then find the probability.

5. Two number cubes are rolled – one red and one blue. Explain why the events are dependent. Then find the indicated probability.

A. The red cube shows a 1, and the sum is less than 4.

Practice

1) Two cards are drawn from a deck of 52. **Determine whether the events are independent or dependent. Find the probability.**

- a. selecting two aces when the first card is replaced

- b. selecting a face card and then a 7 when the first card is not replaced

2) A bag contains 10 beads – 2 black, 3 white, and 5 red. A bead is selected at random. **Determine whether the events are independent or dependent. Find the indicated probability.**

- a. selecting a white bead, replacing it, and then selecting a red bead

- b. selecting a white bead, not replacing it, and then selecting a red bead

- c. selecting 3 non-red beads without replacement

3) **Determine whether the events are independent or dependent. Find the indicated probability.**

- a. rolling a 1 and then another 1 when a number cube is rolled twice

- b. a coin landing tails up on every toss when it is tossed 4 times

4) A bag contains 20 checkers – 10 red and 10 black. **Determine whether the events are independent or dependent. Find the indicated probability.**

- a. selecting 2 black checkers when they are chosen at random with replacement

- b. selecting 2 black checkers when they are chosen at random without replacement

5) In your own words, explain the difference between independent and dependent events.

Vocabulary:

Events are **dependent events** if the occurrence of one event affects the probability of the other

To find the probability of dependent events, you can use **conditional probability**, $P(B|A)$, the probability of event B, given that A has occurred

Probability of Dependent Events:

If A and B are dependent events, then $P(A \text{ and } B) = P(A) \cdot P(B|A)$
 where $P(B|A)$ is the probability of B, given that A has occurred

Examples:

1. A bag of marbles contains 5 red marbles, 2 green marbles, 3 blue marbles, and 1 yellow marble. When marbles are taken from the bag they are not replaced.

A. What is the probability of picking a red marble and then picking a yellow marble?

$$\frac{5}{11} \cdot \frac{1}{10} = \frac{5}{110}$$

B. What is the probability of picking a blue marble and then picking another blue marble?

$$\frac{3}{11} \cdot \frac{2}{10} = \frac{6}{110}$$

2. An IRS auditor randomly selects 3 tax returns (without replacement) from 43 returns of which 8 contain errors. What is the probability that she selects none of those containing errors?

* 35 don't contain errors
 * 43 total

$$\frac{35}{43} \cdot \frac{34}{42} \cdot \frac{33}{41} = \frac{39270}{74040} = 0.53$$

Remember: A standard card deck contains 4 suits of 13 cards each. The face cards are the jacks, queens and kings.

3. Two cards are drawn from a deck of 52. Determine whether the events are independent or dependent. Find the probability.

A. selecting two hearts when the first card is replaced **Independent**

$$\frac{13}{52} \cdot \frac{13}{52} = \frac{169}{2704}$$

B. selecting two hearts when the first card is not replaced **dependent**

$$\frac{13}{52} \cdot \frac{12}{51} = \frac{156}{2704}$$

C. a queen is drawn, is not replaced, and then a king is drawn **dependent**

$$\frac{4}{52} \cdot \frac{4}{51} = \frac{16}{2652}$$

4. A drawer contains 8 blue socks, 8 black socks, and 4 white socks. Socks are picked at random. Explain why the events picking a blue sock and then another blue sock are dependent. Then find the probability.

once a blue sock is picked, the total number of socks changes from 20 to 19, therefore changing the probability of selecting another blue sock.

$$\frac{8}{20} \cdot \frac{7}{19} = \frac{56}{380}$$

5. Two number cubes are rolled – one red and one blue. Explain why the events are dependent. Then find the indicated probability.

A. The red cube shows a 1, and the sum is less than 4.

$$P(\text{red}=1) = \frac{1}{6}$$

$$P(\text{sum less than 4}) = \frac{2}{6}$$

- 1+1=2
- 1+2=3
- 1+3=4
- 1+4=5
- 1+5=6
- 1+6=7

$$\frac{1}{6} \cdot \frac{2}{6} = \frac{2}{36}$$

because the 2nd event (getting a sum less than 4) depends on the other number cube

Practice

1) Two cards are drawn from a deck of 52. Determine whether the events are independent or dependent. Find the probability.

- a. selecting two aces when the first card is replaced **I**

$$\frac{4}{52} \cdot \frac{4}{52} = \frac{16}{2704}$$

- b. selecting a face card and then a 7 when the first card is not replaced **D**

$$\frac{12}{52} \cdot \frac{4}{51} = \frac{48}{2652}$$

2) A bag contains 10 beads – 2 black, 3 white, and 5 red. A bead is selected at random. Determine whether the events are independent or dependent. Find the indicated probability.

- a. selecting a white bead, replacing it, and then selecting a red bead **I**

$$\frac{3}{10} \cdot \frac{5}{10} = \frac{15}{100}$$

- b. selecting a white bead, not replacing it, and then selecting a red bead **D**

$$\frac{3}{10} \cdot \frac{5}{9} = \frac{15}{90}$$

- c. selecting 3 non-red beads without replacement **D**

$$\frac{5}{10} \cdot \frac{4}{9} \cdot \frac{3}{8} = \frac{60}{720}$$

3) Determine whether the events are independent or dependent. Find the indicated probability.

- a. rolling a 1 and then another 1 when a number cube is rolled twice **I**

$$\frac{1}{6} \cdot \frac{1}{6} = \frac{1}{36}$$

- b. a coin landing tails up on every toss when it is tossed 4 times **I**

$$\frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} = \frac{1}{16}$$

4) A bag contains 20 checkers – 10 red and 10 black. Determine whether the events are independent or dependent. Find the indicated probability.

- a. selecting 2 black checkers when they are chosen at random with replacement **I**

$$\frac{10}{20} \cdot \frac{10}{20} = \frac{100}{400}$$

- b. selecting 2 black checkers when they are chosen at random without replacement **D**

$$\frac{10}{20} \cdot \frac{9}{19} = \frac{90}{380}$$

5) In your own words, explain the difference between independent and dependent events.

Independent: the occurrence of one event does NOT effect the probability of the other event
dependent: the occurrence of one event DOES effect the probability of the other event