



Probability of Independent and Dependent Events

Warm Up

Problem of the Day

Lesson Presentation

Lesson Quizzes

Probability of Independent and Dependent Events

Write each answer as a fraction, as a decimal, and as a percent.

A 1–6 number cube is rolled.

1. What is the probability that an even number will result?

$\frac{1}{2}$, 0.5, 50%

2. What is the probability that the number will be prime?

$\frac{1}{2}$, 0.5, 50%

Problem of the Day

I have two coins in my pocket that total 30 cents. One of the coins is not a nickel. What are the coins?

a quarter and a nickel (One of the coins is not a nickel, but the other one is.)



Probability of Independent and Dependent Events

Learn to find the probability of independent and dependent events.

Vocabulary

independent events

dependent events

Probability of Independent and Dependent Events

Raji and Kara must each choose a topic from a list of topics to research for their class. If Raji's choice has no effect on Kara's choice and vice versa, the events are *independent*. For **independent events**, the occurrence of one event has no effect on the probability that a second event will occur.

If once Raji chooses a topic, Kara must choose from the remaining topics, then the events are *dependent*. For **dependent events**, the occurrence of one event *does* have an effect on the probability that a second event will occur.

Probability of Independent and Dependent Events

Additional Example 1A: Determining Whether Events Are Independent or Dependent

Decide whether the set of events are dependent or independent. Explain your answer.

Kathi draws a 4 from a set of cards numbered 1–10 and rolls a 2 on a number cube.

Since the outcome of drawing the card does not affect the outcome of rolling the cube, the events are independent.

Probability of Independent and Dependent Events

Additional Example 1B: Determining Whether Events Are Independent or Dependent

Decide whether the set of events are dependent or independent. Explain your answer.

Yuki chooses a book from the shelf to read, and then Janette chooses a book from the books that remain.

Since Janette cannot pick the same book that Yuki picked, and since there are fewer books for Janette to choose from after Yuki chooses, the events are dependent.

Probability of Independent and Dependent Events

Check It Out: Example 1A

Decide whether the set of events are dependent or independent. Explain your answer.

Joann flips a coin and gets a head. Then she rolls a 6 on a number cube.

Since flipping the coin does not affect the outcome of rolling the number cube, the events are independent.



Probability of Independent and Dependent Events

Check It Out: Example 1B

Decide whether the set of events are dependent or independent. Explain your answer.

Annabelle chooses a blue marble from a set of three, each of different colors, and then Louise chooses a second marble from the remaining two marbles.

Since they are picking from the same set of three marbles, they cannot pick the same color marble. The events are dependent.

Probability of Independent and Dependent Events

To find the probability that two independent events will happen, multiply the probabilities of the two events.

Probability of Two Independent Events

$$P(A \text{ and } B) = P(A) \cdot P(B)$$

Probability of both events

Probability of first event

Probability of second event

Probability of Independent and Dependent Events

Additional Example 2: Finding the Probability of Independent Events

Find the probability of choosing a green marble at random from a bag containing 5 green and 10 white marbles and then flipping a coin and getting tails.

The outcome of choosing the marble does not affect the outcome of flipping the coin, so the events are independent.

$$\begin{aligned} P(\text{green and tails}) &= P(\text{green}) \cdot P(\text{tails}) \\ &= \frac{1}{3} \cdot \frac{1}{2} \end{aligned}$$

The probability of choosing a green marble and a coin landing on tails is $\frac{1}{6}$.

Probability of Independent and Dependent Events

Check It Out: Example 2

Find the probability of choosing a red marble at random from a bag containing 5 red and 5 white marbles and then flipping a coin and getting heads.

The outcome of choosing the marble does not affect the outcome of flipping the coin, so the events are independent.

$$\begin{aligned}P(\text{red and heads}) &= P(\text{red}) \cdot P(\text{heads}) \\ &= \frac{1}{2} \cdot \frac{1}{2}\end{aligned}$$

The probability of choosing a red marble and a coin landing on heads is $\frac{1}{4}$.

Probability of Independent and Dependent Events

To find the probability of two dependent events, you must determine the effect that the first event has on the probability of the second event.

Probability of Two Dependent Events

$$P(A \text{ and } B) = P(A) \cdot P(B \text{ after } A)$$


*Probability of
both events*


*Probability of
first event*


*Probability of
second event*

Probability of Independent and Dependent Events

Additional Example 3: Finding the Probability of Dependent Events

A reading list contains 5 historical books and 3 science-fiction books. What is the probability that Juan will randomly choose a historical book for his first report and a science-fiction book for his second?

The first choice changes the number of books left, and may change the number of science-fiction books left, so the events are dependent.

Probability of Independent and Dependent Events

Additional Example 3 Continued

$P(\text{historical}) = \frac{5}{8}$ *There are 5 historical books out of 8 books.*

$P(\text{science-fiction}) = \frac{3}{7}$ *There are 3 science-fiction books left out of 7 books.*

$$\begin{aligned} P(\text{historical and then science-fiction}) &= P(A) \cdot P(B \text{ after } A) \\ &= \frac{5}{8} \cdot \frac{3}{7} \\ &= \frac{15}{56} \text{ *Multiply.*} \end{aligned}$$

The probability of Juan choosing a historical book and then choosing a science-fiction book is $\frac{15}{56}$.

Probability of Independent and Dependent Events

Check It Out: Example 3

Alice was dealt a hand of cards consisting of 4 black and 3 red cards. Without seeing the cards, what is the probability that the first card will be black and the second card will be red?

The first choice changes the total number of cards left, and may change the number of red cards left, so the events are dependent.

Probability of Independent and Dependent Events

Check It Out: Example 3 Continued

$$P(\text{black}) = \frac{4}{7} \quad \text{There are 4 black cards out of 7 cards.}$$

$$P(\text{red}) = \frac{3}{6} \quad \text{There are 3 red cards left out of 6 cards.}$$

$$\begin{aligned} P(\text{black and then red card}) &= P(A) \cdot P(B \text{ after } A) \\ &= \frac{4}{7} \cdot \frac{3}{6} \\ &= \frac{12}{42} \text{ or } \frac{2}{7} \quad \text{Multiply.} \end{aligned}$$

The probability of Alice selecting a black card and then choosing a red card is $\frac{2}{7}$.

Lesson Quizzes

Standard Lesson Quiz

Lesson Quiz for Student Response Systems

Probability of Independent and Dependent Events

Lesson Quiz: Part I

Decide whether each event is independent or dependent. Explain.

1. Mary chooses a game piece from a board game, and then Jason chooses a game piece from three remaining pieces. **Dependent; Jason has fewer pieces from which to choose.**

2. Find the probability of spinning an evenly divided spinner numbered 1–8 and getting a composite number on one spin and getting an odd number on a second spin.

$$\frac{3}{16}$$

Probability of Independent and Dependent Events

Lesson Quiz: Part II

3. Sarah picks 2 hats at random from 5 bill caps and 3 beanies. What is the probability that both are bill caps?

$$\frac{5}{14}$$

Probability of Independent and Dependent Events

Lesson Quiz for Student Response Systems

1. Decide whether the given event is independent or dependent, and then explain. Regina flips tails on a coin and rolls 5 on a number cube.

- A.** independent; the outcome of tossing a coin does not affect the out come of rolling a number cube.
- B.** independent; the outcome of tossing a coin affects the out come of rolling a number cube.
- C.** dependent; the outcome of tossing a coin does not affect the out come of rolling a number cube.
- D.** dependent; the outcome of tossing a coin affects the out come of rolling a number cube.

Probability of Independent and Dependent Events

Lesson Quiz for Student Response Systems

2. What is the probability that Lupe will choose 2 apples from a bin of 10 apples, 8 bananas, and 7 oranges?

A. $\frac{2}{25}$

B. $\frac{3}{20}$

C. $\frac{11}{25}$

D. $\frac{18}{25}$