9-4 Compound Events

CONTENT STANDARDS
7.SP.8, 7.SP.8.a, 7.SP.8.b

What You'll Learn

To find the probability of independent and dependent events

New Vocabulary compound event, independent events, dependent events

[redacted]

[redacted]

Check Skills You'll Need

1. Vocabulary Review Use the terms *numerator* and *denominator* to describe how to multiply two rational numbers written as fractions.

Find each product.

2. $\frac{3}{4} \cdot \frac{3}{4}$ **3.** $\frac{3}{5} \cdot \left(-\frac{2}{5}\right)$

4. $\frac{1}{5} \cdot \frac{1}{4}$ **5.** $-\frac{3}{7} \cdot \left(-\frac{2}{7}\right)$

Why Learn This?

You can find the probability of more than one event, such as winning a game twice.

A **compound event** consists of two or more events. Two events are **independent events** if the occurrence of one event does not affect the probability of the occurrence of the other.

KEY CONCEPTS **Probability of Independent Events**

If A and B are independent events, then $P(A, \text{then } B) = P(A) \times P(B)$.

EXAMPLE Probability of Independent Events

① **Multiple Choice** You and a friend play a game twice. What is the probability that you win both games? Assume $P(\text{win})$ is $\frac{1}{2}$.

Ⓐ $\frac{1}{2}$ Ⓑ $\frac{4}{9}$ Ⓒ $\frac{1}{4}$ Ⓓ $\frac{1}{8}$

$$P(\text{win, then win}) = P(\text{win}) \times P(\text{win}) \leftarrow \text{Winning is the first and second event.}$$

$$= \frac{1}{2} \times \frac{1}{2} \leftarrow \text{Substitute } \tfrac{1}{2} \text{ for } P(\text{win}).$$

$$= \frac{1}{4} \leftarrow \text{Multiply.}$$

The probability of winning both games is $\frac{1}{4}$. The correct answer is C.

Quick Check

1. Find $P(\text{win, then lose})$ [redacted]

Examples

❶ **Probability of Independent Events** A spinner has equal sections labeled 1 to 10. Suppose you spin twice. Find $P(2, \text{then } 5)$.

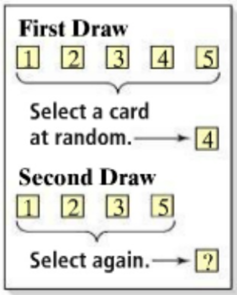
A. $\frac{1}{10}$ **B.** $\frac{1}{5}$ **C.** $\frac{1}{40}$ **D.** $\frac{1}{100}$

The two events are independent. There are [redacted] possibilities on each spin.

$P(2, \text{then } 5) = P(2) \times$ [redacted] ← **Spinning 2 is the first event. Spinning 5 is the second event.**

$= \frac{1}{10} \times$ [redacted] $=$ [redacted] ← **Substitute. Then multiply.**

The probability that you will spin a 2 and then a 5 is [redacted]. The correct answer is choice [redacted].



Suppose you play a game with cards numbered 1–5. You draw two cards at random. You draw the first card and do not replace it. The probability in the second draw depends on the result of the first draw.

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

KEY CONCEPTS Probability of Dependent Events

If event B depends on event A, then
$P(A, \text{then } B) = P(A) \times P(B \text{ after } A)$.

EXAMPLES Probability of Dependent Events

② You select a card at random from those below. The card has the letter M. Without replacing the M card, you select a second card. Find the probability that you select a card with the letter A after you select M.

M	A	T	H	E	M	A	T	I	C	S

There are 10 cards remaining after you select an M card.

$$P(A) = \frac{2}{10} \begin{array}{l} \leftarrow \text{number of cards with the letter A} \\ \leftarrow \text{number of cards remaining} \end{array}$$

$$= \frac{1}{5} \quad \leftarrow \text{Simplify.}$$

The probability of selecting an A for the second card is $\frac{1}{5}$.

② **Probability of Dependent Events** You select two cards at random from those with the letters on them as shown below. The two cards do not show vowels. Without replacing the two cards, you select a third card. Find the probability that you select a card with a vowel after you select the two cards without vowels.

P R O B A B I L I T Y

There are [redacted] remaining after you select the first two cards.

$P(\text{vowel}) = \frac{[redacted]}{[redacted]}$

← **number of remaining cards with vowels**

← **total number of remaining cards**

The probability of selecting a vowel for the third card is [redacted].

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③ You select a card from a bucket that contains 26 cards lettered A–Z without looking. Without replacing the first card, you select a second one. Find the probability of choosing C and then M.

The events are dependent. After the first selection, 25 letters remain.

$$P(\text{C, then M}) = P(\text{C}) \times P(\text{M after C})$$

← **Use the formula for dependent events.**

$$= \frac{1}{26} \times \frac{1}{25}$$

← **Substitute.**

$$= \frac{1}{650}$$

← **Multiply.**

The probability of choosing C and then M is $\frac{1}{650}$.

3 **Probability of Dependent Events** A bag contains 3 red marbles, 4 white marbles, and 1 blue marble. You draw one marble. Without replacing it, you draw a second marble. What is the probability that the two marbles you draw are red followed by white?

The two events are dependent. After the first selection, there are [redacted] marbles to choose from.

$P(\text{red, then white}) = P(\text{red}) \times$ [redacted] ← **Use the formula for dependent events.**

$= \frac{3}{8} \times$ [redacted] / [redacted] ← **Substitute.**

$=$ [redacted] / [redacted] $=$ [redacted] / [redacted] ← **Multiply. Then simplify.**

The probability that the two marbles are red and then white is [redacted].

More Than One Way

You toss a coin three times. What is the probability of getting three heads?

Brianna's Method

Each toss of a coin is an independent event. The probability of getting heads for one coin toss is $\frac{1}{2}$. I can multiply the probabilities of the three coin tosses.

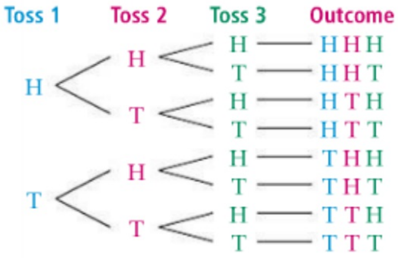
$P(\text{three heads}) = \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \frac{1}{8}$

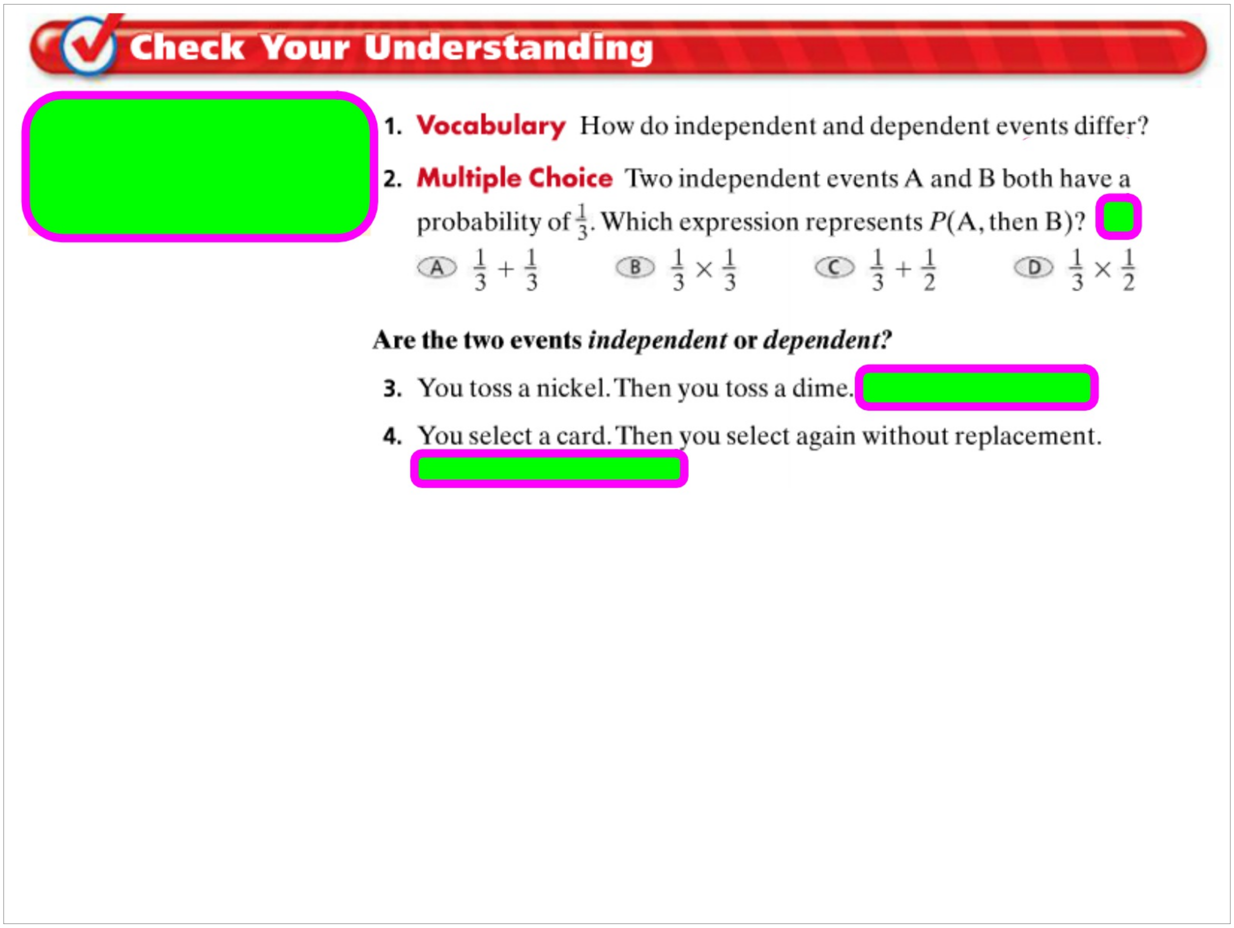
The probability of three heads is $\frac{1}{8}$.

Chris's Method

I can make a tree diagram for the coin tosses. A favorable outcome is one with 3 heads.

The tree diagram shows 1 favorable outcome out of 8 possible outcomes. The probability of three heads is $\frac{1}{8}$.





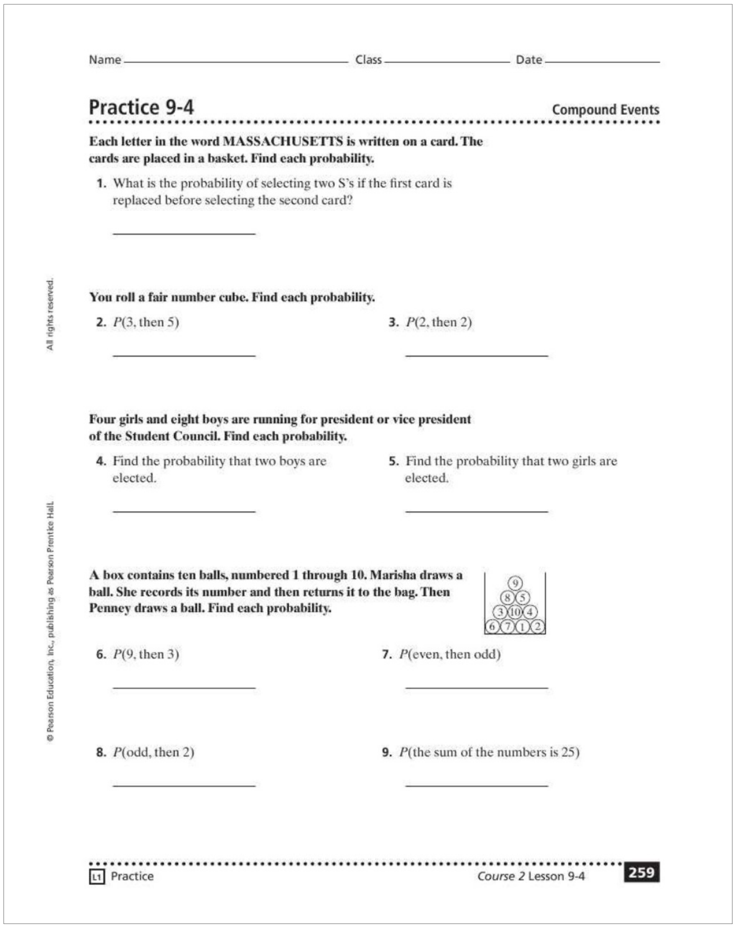
Check Your Understanding

1. **Vocabulary** How do independent and dependent events differ?
2. **Multiple Choice** Two independent events A and B both have a probability of $\frac{1}{3}$. Which expression represents $P(\text{A, then B})$?

   Ⓐ $\frac{1}{3}+\frac{1}{3}$ Ⓑ $\frac{1}{3}\times\frac{1}{3}$ Ⓒ $\frac{1}{3}+\frac{1}{2}$ Ⓓ $\frac{1}{3}\times\frac{1}{2}$

Are the two events *independent* or *dependent?*

3. You toss a nickel. Then you toss a dime.
4. You select a card. Then you select again without replacement.



Name ______________ Class ______________ Date ______________

Practice 9-4

Compound Events

Each letter in the word MASSACHUSETTS is written on a card. The cards are placed in a basket. Find each probability.

1. What is the probability of selecting two S's if the first card is replaced before selecting the second card?

   ____

You roll a fair number cube. Find each probability.

2. $P(3, \text{then } 5)$ ______________
3. $P(2, \text{then } 2)$ ______________

Four girls and eight boys are running for president or vice president of the Student Council. Find each probability.

4. Find the probability that two boys are elected. ______________
5. Find the probability that two girls are elected. ______________

A box contains ten balls, numbered 1 through 10. Marisha draws a ball. She records its number and then returns it to the bag. Then Penney draws a ball. Find each probability.

6. $P(9, \text{then } 3)$ ______________
7. $P(\text{even, then odd})$ ______________
8. $P(\text{odd, then } 2)$ ______________
9. $P(\text{the sum of the numbers is } 25)$ ______________