

12-4 Study Guide and Intervention

Multiplying Probabilities

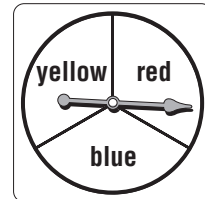
Probability of Independent Events

Probability of Two Independent Events

If two events, A and B , are independent, then the probability of both occurring is $P(A \text{ and } B) = P(A) \cdot P(B)$.

Example

In a board game each player has 3 different-colored markers. To move around the board the player first spins a spinner to determine which piece can be moved. He or she then rolls a die to determine how many spaces that colored piece should move. On a given turn what is the probability that a player will be able to move the yellow piece more than 2 spaces?



Let A be the event that the spinner lands on yellow, and let B be the event that the die shows a number greater than 2. The probability of A is $\frac{1}{3}$, and the probability of B is $\frac{2}{3}$.

$$\begin{aligned} P(A \text{ and } B) &= P(A) \cdot P(B) && \text{Probability of independent events} \\ &= \frac{1}{3} \cdot \frac{2}{3} \text{ or } \frac{2}{9} && \text{Substitute and multiply.} \end{aligned}$$

The probability that the player can move the yellow piece more than 2 spaces is $\frac{2}{9}$.

Exercises

A die is rolled 3 times. Find the probability of each event.

- a 1 is rolled, then a 2, then a 3
- a 1 or a 2 is rolled, then a 3, then a 5 or a 6
- 2 odd numbers are rolled, then a 6
- a number less than 3 is rolled, then a 3, then a number greater than 3
- A box contains 5 triangles, 6 circles, and 4 squares. If a figure is removed, replaced, and a second figure is picked, what is the probability that a triangle and then a circle will be picked?
- A bag contains 5 red marbles and 4 white marbles. A marble is selected from the bag, then replaced, and a second selection is made. What is the probability of selecting 2 red marbles?
- A jar contains 7 lemon jawbreakers, 3 cherry jawbreakers, and 8 rainbow jawbreakers. What is the probability of selecting 2 lemon jawbreakers in succession providing the jawbreaker drawn first is then replaced before the second is drawn?

12-4 Study Guide and Intervention *(continued)***Multiplying Probabilities****Probability of Dependent Events****Probability of Two Dependent Events**

If two events, A and B , are dependent, then the probability of both events occurring is $P(A \text{ and } B) = P(A) \cdot P(B \text{ following } A)$.

Example 1

There are 7 dimes and 9 pennies in a wallet. Suppose two coins are to be selected at random, without replacing the first one. Find the probability of picking a penny and then a dime.

Because the coin is not replaced, the events are dependent.

Thus, $P(A \text{ and } B) = P(A) \cdot P(B \text{ following } A)$.

$P(\text{penny, then dime}) = P(\text{penny}) \cdot P(\text{dime following penny})$

$$\frac{9}{16} \cdot \frac{7}{15} = \frac{21}{80}$$

The probability is $\frac{21}{80}$ or about 0.26

Example 2

What is the probability of drawing, without replacement, 3 hearts, then a spade from a standard deck of cards?

Since the cards are not replaced, the events are dependent. Let H represent a heart and S represent a spade.

$$\begin{aligned} P(H, H, H, S) &= P(H) \cdot P(H \text{ following } H) \cdot P(H \text{ following } 2 \text{ Hs}) \cdot P(S \text{ following } 3 \text{ Hs}) \\ &= \frac{13}{52} \cdot \frac{12}{51} \cdot \frac{11}{50} \cdot \frac{13}{49} \text{ or about } 0.003 \end{aligned}$$

The probability is about 0.003 of drawing 3 hearts, then a spade.

Exercises

Find each probability.

- The cup on Sophie's desk holds 4 red pens and 7 black pens. What is the probability of her selecting first a black pen, then a red one?
- What is the probability of drawing two cards showing odd numbers from a set of cards that show the first 20 counting numbers if the first card is not replaced before the second is chosen?
- There are 3 quarters, 4 dimes, and 7 nickels in a change purse. Suppose 3 coins are selected without replacement. What is the probability of selecting a quarter, then a dime, and then a nickel?
- A basket contains 4 plums, 6 peaches, and 5 oranges. What is the probability of picking 2 oranges, then a peach if 3 pieces of fruit are selected at random?
- A photographer has taken 8 black and white photographs and 10 color photographs for a brochure. If 4 photographs are selected at random, what is the probability of picking first 2 black and white photographs, then 2 color photographs?