EXAMPLE 2 Find probability of three independent events

RACING In a BMX meet, each heat consists of 8 competitors who are randomly assigned lanes from 1 to 8. What is the probability that a racer will draw lane 8 in the 3 heats in which the racer participates?

Solution

Let events A, B, and C be drawing lane 8 in the **first**, **second**, and **third** heats, respectively. The three events are independent. So, the probability is:

$$P(A \text{ and } B \text{ and } C) = P(A) \cdot P(B) \cdot P(C) = \frac{1}{8} \cdot \frac{1}{8} \cdot \frac{1}{8} = \frac{1}{512} \approx 0.00195$$

EXAMPLE 3 Use a complement to find a probability

MUSIC While you are riding to school, your portable CD player randomly plays 4 different songs from a CD with 16 songs on it. What is the probability that you will hear your favorite song on the CD at least once during the week (5 days)?

Solution

For one day, the probability of *not* hearing your favorite song is:

$$P(\text{not hearing song}) = \frac{{}_{15}C_4}{{}_{16}C_4}$$

Hearing or not hearing your favorite song on Monday, on Tuesday, and so on are independent events. So, the probability of hearing the song at least once is:

$$P(\text{hearing song}) = 1 - [P(\text{not hearing song})]^5 = 1 - \left(\frac{{}_{15}C_4}{{}_{16}C_4}\right)^5 \approx 0.763$$

✓ GUIDED PRACTICE for Examples 2 and 3

2. **SPINNER** A spinner is divided into ten equal regions numbered 1 to 10. What is the probability that 3 consecutive spins result in perfect squares?

3. **WHAT IF?** In Example 3, how does your answer change if the CD has only 12 songs on it?

CONDITIONAL PROBABILITIES

The conditional probability of B given A can be greater than, less than, or equal to the probability of B.

DEPENDENT EVENTS Two events A and B are **dependent events** if the occurrence of one affects the occurrence of the other. The probability that B will occur given that A has occurred is called the **conditional probability** of B given A and is written as $P(B \mid A)$.

KEY CONCEPT *For Your Notebook*

Probability of Dependent Events

If A and B are dependent events, then the probability that both A and B occur is:

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