EXAMPLE 2 **Use permutations or combinations**

ENTERTAINMENT A community center hosts a talent contest for local musicians. On a given evening, 7 musicians are scheduled to perform. The order in which the musicians perform is randomly selected during the show.

a. What is the probability that the musicians perform in alphabetical order by their last names? (Assume that no two musicians have the same last name.)

b. You are friends with 4 of the musicians. What is the probability that the first 2 performers are your friends?

Solution

a. There are **7**! different *permutations* of the **7** musicians. Of these, only **1** is in alphabetical order by last name. So, the probability is:

$$P(\text{alphabetical order}) = \frac{1}{7!} = \frac{1}{5040} \approx 0.000198$$

b. There are $_7C_2$ different *combinations* of 2 musicians. Of these, $_4C_2$ are 2 of your friends. So, the probability is:

$$P(\text{first 2 performers are your friends}) = \frac{_4C_2}{_7C_2} = \frac{6}{21} = \frac{2}{7} \approx 0.286$$

✓ **GUIDED PRACTICE** **for Examples 1 and 2**

You have an equally likely chance of choosing any integer from 1 through 20. Find the probability of the given event.

1. A perfect square is chosen.   **2.** A factor of 30 is chosen.

3. WHAT IF? In Example 2, how do your answers to parts (a) and (b) change if there are 9 musicians scheduled to perform?

ODDS You can also use **odds** to measure the likelihood that an event will occur. Odds measure the chances in *favor* of an event occurring or the chances *against* an event occurring.

KEY CONCEPT *For Your Notebook*

Odds in Favor of or Odds Against an Event

When all outcomes are equally likely, the odds in favor of an event A and the odds against an event A are defined as follows:

$$\text{Odds in favor of event } A = \frac{\text{Number of outcomes in } A}{\text{Number of outcomes not in } A}$$

$$\text{Odds against event } A = \frac{\text{Number of outcomes not in } A}{\text{Number of outcomes in } A}$$

You can write the odds in favor of or against an event in the form $\frac{a}{b}$ or in the form $a : b$.