KEY CONCEPT — For Your Notebook

Permutations of n Objects Taken r at a Time

The number of permutations of r objects taken from a group of n distinct objects is denoted by ${}_nP_r$ and is given by this formula:

$${}_nP_r = \frac{n!}{(n-r)!}$$

EXAMPLE 5 Find permutations of n objects taken r at a time

MUSIC You are burning a demo CD for your band. Your band has 12 songs stored on your computer. However, you want to put only 4 songs on the demo CD. In how many orders can you burn 4 of the 12 songs onto the CD?

EVALUATE PERMUTATIONS
Most scientific and graphing calculators have a key or menu item for evaluating ${}_nP_r$.

Solution

Find the number of permutations of 12 objects taken 4 at a time.

$${}_{12}P_4 = \frac{12!}{(12-4)!} = \frac{12!}{8!} = \frac{479{,}001{,}600}{40{,}320} = 11{,}880$$

▶ You can burn 4 of the 12 songs in 11,880 different orders.

✓ GUIDED PRACTICE for Example 5

Find the number of permutations.

4. ${}_5P_3$ **5.** ${}_4P_1$ **6.** ${}_8P_5$ **7.** ${}_{12}P_7$

PERMUTATIONS WITH REPETITION If you consider the letters E and E to be *distinct*, there are six permutations of the letters E, E, and Y:

EEY EYE YEE
EEY EYE YEE

However, if the two occurrences of E are considered interchangeable, then there are only three distinguishable permutations:

EEY EYE YEE

Each of these permutations corresponds to two of the original six permutations because there are 2!, or 2, permutations of E and E. So, the number of permutations of **E**, **E**, and **Y** can be written as $\frac{3!}{2!} = \frac{6}{2} = 3$.

KEY CONCEPT — For Your Notebook

Permutations with Repetition

The number of distinguishable permutations of n objects where one object is repeated s_1 times, another is repeated s_2 times, and so on, is:

$$\frac{n!}{s_1! \cdot s_2! \cdot \ldots \cdot s_k!}$$