EXAMPLE 6 Find permutations with repetition

Find the number of distinguishable permutations of the letters in (a) MIAMI and (b) TALLAHASSEE.

Solution

a. MIAMI has 5 letters of which M and I are each repeated 2 times. So, the number of distinguishable permutations is $\frac{5!}{2! \cdot 2!} = \frac{120}{2 \cdot 2} = 30$.

b. TALLAHASSEE has 11 letters of which A is repeated 3 times, and L, S, and E are each repeated 2 times. So, the number of distinguishable permutations is $\frac{11!}{3! \cdot 2! \cdot 2! \cdot 2!} = \frac{39{,}916{,}800}{6 \cdot 2 \cdot 2 \cdot 2} = 831{,}600$.

✓ GUIDED PRACTICE for Example 6

Find the number of distinguishable permutations of the letters in the word.

8. MALL **9.** KAYAK **10.** CINCINNATI

10.1 EXERCISES

HOMEWORK KEY

○ = **WORKED-OUT SOLUTIONS** on p. WS1 for Exs. 13, 35, and 65

= **TAKS PRACTICE AND REASONING** Exs. 17, 42, 55, 57, 68, 72, and 73

SKILL PRACTICE

1. VOCABULARY What is a permutation of n objects?

2. WRITING Simplify the formula for ${}_nP_r$ when $r = 0$. *Explain* why this result makes sense.

EXAMPLE 1 on p. 682 for Exs. 3–6

TREE DIAGRAMS **An object has an attribute from each list. Make a tree diagram that shows the number of different objects that can be created.**

3.

T-Shirts
Size: M, L, XL
Type: long-sleeved, short-sleeved

4.

Toast
Bread: white, wheat
Spread: jam, margarine

5.

Meal
Entrée: chicken, fish, pasta
Side: corn, green beans, potato

6.

Furniture
Wood: cherry, mahogany, oak, pine
Finish: stained, painted, unfinished

EXAMPLE 2 on p. 683 for Exs. 7–10

FUNDAMENTAL COUNTING PRINCIPLE **Each event can occur in the given number of ways. Find the number of ways all of the events can occur.**

7. Event A: 2 ways; Event B: 4 ways

8. Event A: 5 ways; Event B: 2 ways

9. Event A: 4 ways; Event B: 3 ways; Event C: 5 ways

10. Event A: 3 ways; Event B: 6 ways; Event C: 5 ways; Event D: 2 ways