3.6 Multiply Matrices

Before	You added and subtracted matrices.
Now	You will multiply matrices.
Why?	So you can calculate the cost of sports equipment, as in Example 4.

Key Vocabulary
- **matrix,** *p. 187*
- **dimensions,** *p. 187*
- **elements,** *p. 187*

The product of two matrices *A* and *B* is defined provided the number of columns in *A* is equal to the number of rows in *B*.

If *A* is an $m \times n$ matrix and *B* is an $n \times p$ matrix, then the product *AB* is an $m \times p$ matrix.

$$A \quad \cdot \quad B \quad = \quad AB$$
$$m \times n \quad n \times p \quad m \times p$$
equal
dimensions of *AB*

EXAMPLE 1   Describe matrix products

State whether the product AB is defined. If so, give the dimensions of AB.

a. $A: 4 \times 3, B: 3 \times 2$ **b.** $A: 3 \times 4, B: 3 \times 2$

Solution

a. Because *A* is a 4×3 matrix and *B* is a 3×2 matrix, the product *AB* is defined and is a 4×2 matrix.

b. Because the number of columns in *A* (four) does not equal the number of rows in *B* (three), the product *AB* is not defined.

✓ **GUIDED PRACTICE**   for Example 1

State whether the product AB is defined. If so, give the dimensions of AB.

1. $A: 5 \times 2, B: 2 \times 2$ **2.** $A: 3 \times 2, B: 3 \times 2$

KEY CONCEPT   *For Your Notebook*

Multiplying Matrices

Words   To find the element in the *i*th row and *j*th column of the product matrix *AB*, multiply each element in the *i*th row of *A* by the corresponding element in the *j*th column of *B*, then add the products.

Algebra
$$A \qquad B \qquad AB$$
$$\begin{bmatrix} a & b \\ c & d \end{bmatrix} \cdot \begin{bmatrix} e & f \\ g & h \end{bmatrix} = \begin{bmatrix} ae + bg & af + bh \\ ce + dg & cf + dh \end{bmatrix}$$