

Lesson 8-6

Example 1

TICKET SALES Multiply the two matrices given to find the total receipts from ticket sales for a theme park.

number of tickets
 $\begin{bmatrix} 210 & 400 & 378 \end{bmatrix}$
 adult student child

cost per ticket
 $\begin{bmatrix} \$16 \\ \$12 \\ \$6 \end{bmatrix}$ adult
 student
 child

Solution

The first matrix is a 1×3 matrix and the second is a 3×1 matrix. So the product will be a 1×1 matrix. Use row-by-column multiplication.

$$\begin{aligned} \begin{bmatrix} 210 & 400 & 378 \end{bmatrix} \cdot \begin{bmatrix} 16 \\ 12 \\ 6 \end{bmatrix} &= 210 \cdot 16 + 400 \cdot 12 + 378 \cdot 6 \\ &= 3360 + 4800 + 2268 \\ &= 10,428 \end{aligned}$$

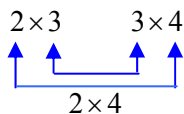
The total receipts equal \$10,428.

Example 2

Let $M = \begin{bmatrix} 2 & -4 & 7 \\ 3 & 5 & 9 \end{bmatrix}$ and $N = \begin{bmatrix} 2 & 1 & 0 & -1 \\ 6 & 4 & -3 & 7 \\ 3 & -4 & 0 & 8 \end{bmatrix}$. Find the dimensions of MN .

Solution

Because M is a 2×3 matrix and N is a 3×4 matrix, MN is a 2×4 matrix.



Example 3

ENCRYPTION A business uses a coding matrix to encrypt customer account numbers. Matrix A includes the last four digits of a customer's account number. Matrix B is the coding matrix.

$$\text{Let } A = \begin{bmatrix} 2 & 1 \\ 4 & -3 \end{bmatrix} \text{ and } B = \begin{bmatrix} 5 & 9 & 4 \\ 0 & 3 & 7 \end{bmatrix}. \text{ Find } AB.$$

Solution

Because A is a 2×2 matrix and B is a 2×3 matrix, the product is a 2×3 matrix. The product of row 1 and column 1 is $2(5) + 1(0) = 10$. Write 10 in row 1 and column 1 of the product matrix.

$$\begin{bmatrix} \boxed{2} & 1 \\ 4 & -3 \end{bmatrix} \begin{bmatrix} \boxed{5} & 9 & 4 \\ 0 & 3 & 7 \end{bmatrix} = \begin{bmatrix} 10 & _ & _ \\ _ & _ & _ \end{bmatrix}$$

The product of row 1 of A and row 2 of B is $2(9) + 1(3) = 21$. Write 21 in row 1 and column 2 of the product.

$$\begin{bmatrix} \boxed{2} & 1 \\ 4 & -3 \end{bmatrix} \begin{bmatrix} 5 & \boxed{9} & 4 \\ 0 & 3 & 7 \end{bmatrix} = \begin{bmatrix} 10 & 21 & _ \\ _ & _ & _ \end{bmatrix}$$

The other elements in the product are formed by using this row by column pattern.

$$\begin{bmatrix} 2 & 1 \\ 4 & -3 \end{bmatrix} \begin{bmatrix} 5 & 9 & 4 \\ 0 & 3 & 7 \end{bmatrix} = \begin{bmatrix} 10 & 21 & 15 \\ 20 & 27 & -5 \end{bmatrix}$$