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			
[210	400	378]	
adult	student	child	

cost per ticket	
[\$16]	adult
\$12	student
\$6]	child

Solution

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

$$\begin{bmatrix}210 & 400 & 378\end{bmatrix} \cdot \begin{bmatrix}16\\12\\6\end{bmatrix} = 210 \cdot 16 + 400 \cdot 12 + 378 \cdot 6$$

$$= 3360 + 4800 + 2268$$
$$= 10{,}428$$

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.

$$\underset{2\times 4}{\underset{\uparrow\quad\quad\uparrow}{2\times 3 \quad\quad 3\times 4}}$$

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.

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

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

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.

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

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

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