Matrices

A **matrix** is a rectangular arrangement of numbers in rows and columns. For example, matrix A below has two rows and three columns. The **dimensions** of a matrix with m rows and n columns are $m \times n$ (read "m by n"). So, the dimensions of matrix A are 2×3. The numbers in a matrix are its **elements**.

$$A = \begin{bmatrix} 4 & -1 & 5 \\ 0 & 6 & 3 \end{bmatrix}$$

The element in the first row and third column is 5.

2 rows

3 columns

rows first

columns 2nd

Two matrices are **equal** if their dimensions are the same and the elements in corresponding positions are equal.

Solve:

$$\begin{bmatrix} 3x & -4 \\ -18 & 2y \end{bmatrix} = \begin{bmatrix} -18 & -4 \\ 3x & 2y \end{bmatrix}$$

$3x = -18$

$x = -6$

$-4 = 2y$

$-2 = y$

KEY CONCEPT *For Your Notebook*

Adding and Subtracting Matrices

To add or subtract two matrices, simply add or subtract elements in corresponding positions. You can add or subtract matrices only if they have the same dimensions.

Adding Matrices

$$\begin{bmatrix} a & b \\ c & d \end{bmatrix} + \begin{bmatrix} e & f \\ g & h \end{bmatrix} = \begin{bmatrix} a+e & b+f \\ c+g & d+h \end{bmatrix}$$

Subtracting Matrices

$$\begin{bmatrix} a & b \\ c & d \end{bmatrix} - \begin{bmatrix} e & f \\ g & h \end{bmatrix} = \begin{bmatrix} a-e & b-f \\ c-g & d-h \end{bmatrix}$$

$$A = \begin{bmatrix} 1 & 2 & 4 \\ 7 & 0 & 6 \end{bmatrix} \qquad B = \begin{bmatrix} 0 & 0 & 1 \\ 1 & 1 & 2 \end{bmatrix}$$

$$C = \begin{bmatrix} 5 & 6 \\ 7 & 8 \end{bmatrix} \qquad A + B = \begin{bmatrix} 1 & 2 & 5 \\ 8 & 1 & 8 \end{bmatrix}$$

$A + C =$ Cannot be added. Dimensions not the same.

SCALAR MULTIPLICATION In matrix algebra, a real number is often called a **scalar**. To multiply a matrix by a scalar, you multiply each element in the matrix by the scalar. This process is called **scalar multiplication**.

$$5 \cdot \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix} = \begin{bmatrix} 5 & 10 & 15 \\ 20 & 25 & 30 \end{bmatrix}$$