

3.5 Perform Basic Matrix Operations

Matrix- 2-dim. array of #'s

	Cell	T.V.
Bob	5	6
Jane	1	2

→

$$\begin{bmatrix} 5 & 6 \\ 1 & 2 \end{bmatrix}$$

2 × 2

$$\begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$$

3 × 1

EXAMPLE 1 Add and subtract matrices

Perform the indicated operation, if possible.

a.
$$\begin{bmatrix} 3 & 0 \\ -5 & -1 \end{bmatrix} + \begin{bmatrix} -1 & 4 \\ 2 & 0 \end{bmatrix}$$

$$\begin{array}{cc} 3+(-1) & 0+4 \\ -5+2 & -1+0 \end{array}$$
$$\begin{bmatrix} 2 & 4 \\ -3 & -1 \end{bmatrix}$$

b.
$$\begin{bmatrix} 7 & 4 \\ 0 & -2 \\ -1 & 6 \end{bmatrix} - \begin{bmatrix} -2 & 5 \\ 3 & -10 \\ -3 & 1 \end{bmatrix}$$

$$\begin{array}{cc} 7+2 & 4-5 \\ 0-3 & -2+10 \\ -1+3 & 6-1 \end{array}$$
$$\begin{bmatrix} 9 & -1 \\ -3 & 8 \\ 2 & 5 \end{bmatrix}$$

Scalar- a # that has mag. but no direction
(normal)

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

EXAMPLE 2 Multiply a matrix by a scalar

Perform the indicated operation, if possible.

a. $-2 \begin{bmatrix} 4 & -1 \\ 1 & 0 \\ 2 & 7 \end{bmatrix}$

$$\begin{bmatrix} -8 & 2 \\ -2 & 0 \\ -4 & -14 \end{bmatrix}$$

b. $4 \begin{bmatrix} -2 & -8 \\ 5 & 0 \end{bmatrix} + \begin{bmatrix} -3 & 8 \\ 6 & -5 \end{bmatrix}$

$$\begin{bmatrix} 4(-2) + (-3) & 4(-8) + 8 \\ 4(5) + 6 & 4(0) - 5 \end{bmatrix}$$
$$\begin{bmatrix} -11 & -24 \\ 26 & -5 \end{bmatrix}$$

EXAMPLE 4 Solve a matrix equationSolve the matrix equation for x and y .

$$3 \left(\begin{matrix} \overset{A}{\left[\begin{array}{cc} 5x & -2 \\ 6 & -4 \end{array} \right]} + \begin{matrix} \overset{B}{\left[\begin{array}{cc} 3 & 7 \\ -5 & -y \end{array} \right]} \end{matrix} \right) = \begin{matrix} \overset{C}{\left[\begin{array}{cc} -21 & 15 \\ 3 & -24 \end{array} \right]} \end{matrix}$$

$$3(A+B) = C$$

$$3 \left(\begin{matrix} \left[\begin{array}{cc} 5x+3 & 5 \\ 1 & -y-4 \end{array} \right] \end{matrix} \right) = \begin{matrix} \left[\begin{array}{cc} -21 & 15 \\ 3 & -24 \end{array} \right] \end{matrix}$$

$$\begin{matrix} \left[\begin{array}{cc} 15x+9 & 15 \\ 3 & -3y-12 \end{array} \right] \end{matrix} = \begin{matrix} \left[\begin{array}{cc} -21 & 15 \\ 3 & -24 \end{array} \right] \end{matrix}$$

$$15x+9 = -21$$

$$15x = -30$$

$$\boxed{x = -2}$$

$$-3y-12 = -24$$

$$-3y = -12$$

$$\boxed{y = 4}$$

ADDING AND SUBTRACTING MATRICES Perform the indicated operation, if possible. If not possible, state the reason.

6. $\begin{bmatrix} 4 & -5 \\ 8 & 1 \end{bmatrix} - \begin{bmatrix} 2 \\ -1 \end{bmatrix}$

no; not the same dim.

MATRIX OPERATIONS Use matrices A , B , C , and D to evaluate the matrix expression.

$$A = \begin{bmatrix} 5 & -4 \\ 3 & -1 \end{bmatrix} \quad B = \begin{bmatrix} 18 & -12 \\ -6 & 0 \end{bmatrix} \quad C = \begin{bmatrix} 1.8 & -1.5 & 10.6 \\ -8.8 & 3.4 & 0 \end{bmatrix} \quad D = \begin{bmatrix} 7.2 & 0 & -5.4 \\ 2.1 & -1.9 & 3.3 \end{bmatrix}$$

21. $C + 3D$

$$\begin{bmatrix} 1.8 & -1.5 & 10.6 \\ -8.8 & 3.4 & 0 \end{bmatrix} + 3 \begin{bmatrix} 7.2 & 0 & -5.4 \\ 2.1 & -1.9 & 3.3 \end{bmatrix}$$

$$\begin{bmatrix} 1.8 + 3(7.2) & -1.5 + 3(0) & 10.6 + 3(-5.4) \\ -8.8 + 3(2.1) & 3.4 + 3(-1.9) & 0 + 3(3.3) \end{bmatrix}$$

$$\begin{bmatrix} 23.4 & -1.5 & -5.6 \\ -2.5 & -2.3 & 9.9 \end{bmatrix}$$

SOLVING MATRIX EQUATIONS Solve the matrix equation for x and y .

$$25. \begin{bmatrix} -2x & 6 \\ 1 & -8 \end{bmatrix} + 2 \begin{bmatrix} 5 & -1 \\ -7 & 6 \end{bmatrix} = \begin{bmatrix} -9 & 4 \\ -13 & y \end{bmatrix}$$

$$-2x + 2(5) = -9$$

$$-2x = -19$$

$$x = \frac{19}{2}$$

$$-8 + 2(6) = y$$

$$y = 4$$