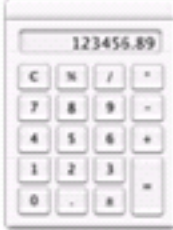


### 3.2 - Matrix Addition and Subtraction

You can perform matrix addition on matrices that have the same dimensions by adding the corresponding elements, which are elements in the same position in each matrix.

$$1. \begin{matrix} 2 \times 3 \\ \begin{bmatrix} 1 & -2 & 0 \\ 3 & -5 & 7 \end{bmatrix} \end{matrix} + \begin{matrix} 2 \times 3 \\ \begin{bmatrix} 3 & 9 & -3 \\ -9 & 6 & 12 \end{bmatrix} \end{matrix} = \begin{matrix} 2 \times 3 \\ \begin{bmatrix} 4 & 7 & -3 \\ -6 & 1 & 19 \end{bmatrix} \end{matrix}$$

$$2. \begin{matrix} 3 \times 2 \\ \begin{bmatrix} -12 & 24 \\ -3 & 5 \\ -1 & 10 \end{bmatrix} \end{matrix} + \begin{matrix} 3 \times 2 \\ \begin{bmatrix} -3 & 1 \\ 2 & -4 \\ -1 & 5 \end{bmatrix} \end{matrix} = \begin{matrix} 3 \times 2 \\ \begin{bmatrix} -15 & 25 \\ -1 & 1 \\ -2 & 15 \end{bmatrix} \end{matrix}$$



The additive identity matrix for the set of all  $m \times n$  matrices is the zero matrix  $0$ , whose elements are all zeroes. The opposite, or additive inverse, of an  $m \times n$  matrix  $A$  is  $-A$ .

$$3. \begin{bmatrix} 1 & 2 \\ 5 & -7 \end{bmatrix} + \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} = \begin{bmatrix} 1 & 2 \\ 5 & -7 \end{bmatrix}$$

$$4. \begin{matrix} A \\ \begin{bmatrix} 2 & 8 \\ -3 & 0 \end{bmatrix} \end{matrix} + \begin{matrix} -A \\ \begin{bmatrix} -2 & -8 \\ 3 & 0 \end{bmatrix} \end{matrix} = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$$



If two matrices, A and B, have the same dimensions, then  $A - B = A + (-B)$

5. 
$$\begin{matrix} 2 \times 3 \\ \begin{bmatrix} 3 & 2 & 4 \\ -1 & 4 & 0 \end{bmatrix} \end{matrix} - \begin{matrix} 2 \times 3 \\ \begin{bmatrix} 1 & 4 & 3 \\ -2 & 2 & 4 \end{bmatrix} \end{matrix} = \begin{matrix} 2 \times 3 \\ \begin{bmatrix} 2 & -2 & 1 \\ 1 & 2 & -4 \end{bmatrix} \end{matrix}$$

6. 
$$\begin{matrix} 2 \times 2 \\ \begin{bmatrix} -3 & 5 \\ -1 & 10 \end{bmatrix} \end{matrix} - \begin{matrix} 2 \times 2 \\ \begin{bmatrix} -3 & 5 \\ 2 & -4 \end{bmatrix} \end{matrix} = \begin{matrix} 2 \times 2 \\ \begin{bmatrix} 0 & 0 \\ -3 & 14 \end{bmatrix} \end{matrix}$$



A matrix equation is an equation in which the variable is a matrix. You can use the addition and subtraction properties of equality to solve matrix equations.

1. Solve  $x - \begin{bmatrix} 1 & 1 \\ 3 & 2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ 8 & 9 \end{bmatrix}$

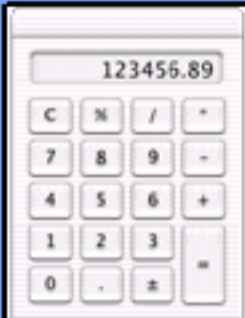
To determine whether matrices are equal, look at each pair of elements in the same positions. Matrices must be the same dimensions.

$$1. \quad A = \begin{bmatrix} -.75 & \frac{1}{5} \\ \frac{1}{2} & -2 \end{bmatrix} \quad B = \begin{bmatrix} -\frac{3}{4} & .2 \\ .5 & -2 \end{bmatrix}$$

Both A and B are  $2 \times 2$  matrices and their corresponding elements are equal. Therefore, A and B are equal matrices.

$$2. \quad X = \begin{bmatrix} 4 \\ 6 \\ 8 \end{bmatrix} \quad Y = \begin{bmatrix} \frac{8}{2} & \frac{18}{3} & \frac{16}{2} \end{bmatrix}$$

$$3. \quad \begin{bmatrix} -2 & 3 \\ 5 & 0 \end{bmatrix}, \quad \begin{bmatrix} -\frac{8}{4} & (6-3) \\ \frac{15}{3} & (4-4) \end{bmatrix}$$



2. Solve  $x + \begin{bmatrix} -1 & 0 \\ 2 & 5 \end{bmatrix} = \begin{bmatrix} 10 & 7 \\ -4 & -4 \end{bmatrix}$

Notes


Reset

1. Solve  $\begin{bmatrix} 2x-5 & 4 \\ 3 & 3y+12 \end{bmatrix} = \begin{bmatrix} 25 & 4 \\ 3 & y+18 \end{bmatrix}$

$$\begin{array}{r} 2x-5 = 25 \\ +5 \quad +5 \\ \hline 2x = 30 \\ \frac{2}{2} \\ \hline x = 15 \end{array} \quad \begin{array}{r} 3y+12 = y+18 \\ -y \quad -y \\ \hline 2y+12 = 18 \\ -12 \quad -12 \\ \hline 2y = 6 \\ \frac{2}{2} \\ \hline y = 3 \end{array}$$

2. Solve  $\begin{bmatrix} 3x & 4 \\ -9 & x+y \end{bmatrix} = \begin{bmatrix} -9 & x+y \end{bmatrix}$

$$\begin{array}{r} 3x = -9 \\ \frac{3}{3} \\ \hline x = -3 \end{array} \quad \begin{array}{r} 4 = x+y \\ 4 = -3+y \\ +3 \quad +3 \\ \hline 7 = y \end{array}$$

 Finding Unknown Matrix Elements:

$$\begin{array}{l} -3 = m+n \\ m+n = -3 \\ 4+n = -3 \\ \hline n = -7 \end{array}$$

3. Solve  $\begin{bmatrix} x+8 & -5 \\ 3 & -y \end{bmatrix} = \begin{bmatrix} 38 & -5 \\ 3 & 4y-10 \end{bmatrix}$

$$\begin{array}{r} x+8 = 38 \\ -8 \quad -8 \\ \hline x = 30 \end{array} \quad \begin{array}{r} -y = 4y-10 \\ -4y \quad -4y \\ \hline -5y = -10 \\ \frac{-1}{-5} \quad \frac{-1}{-5} \\ \hline y = 2 \end{array}$$

4. Solve  $\begin{bmatrix} 2m-n & -5 \\ 8 & -4m+2n \end{bmatrix} = \begin{bmatrix} 15 & m+n \\ 8 & -30 \end{bmatrix}$

$$\begin{array}{r} 2m-n = 15 \\ m+n = -3 \\ \hline 3m = 12 \\ \frac{3}{3} \quad \frac{3}{3} \\ \hline m = 4 \end{array}$$

$$\begin{bmatrix} 1 & 2 & 3 \\ 7 & 8 & 12 \\ -4 & -3 & 0 \end{bmatrix}_{3 \times 3} + \begin{bmatrix} 1 & 2 & 3 & 4 \end{bmatrix}_{1 \times 4} = \text{N.P.}$$

+ 0  
non-zero

$$\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} + \begin{bmatrix} 5 \\ 6 \\ 7 \\ 8 \end{bmatrix} - \begin{bmatrix} 9 & 10 \\ 11 & 12 \end{bmatrix} = \begin{bmatrix} -3 & -2 \\ -1 & 0 \end{bmatrix}$$

