

12-1 Reteaching

Adding and Subtracting Matrices

A matrix is like a table without the row and column labels.

To add or subtract matrices of the same size, combine the *corresponding elements*, the numbers in the same position in each matrix. The sum or difference of matrices will have the same *dimensions*, the number of rows and columns, as the matrices you combined.

To help you keep track of your work, draw lines between the rows and columns and cross off elements as you combine them.

Voting Records

	Yes	No
Brown	29	51
Montoya	45	35

Table

$$\begin{bmatrix} 29 & 51 \\ 45 & 35 \end{bmatrix}$$

Problem

What is $\begin{bmatrix} -3 & 5 \\ 9 & -2 \end{bmatrix} + \begin{bmatrix} 7 & -1 \\ 8 & -4 \end{bmatrix}$?

$$\begin{bmatrix} -3 & 5 \\ 9 & -2 \end{bmatrix} + \begin{bmatrix} 7 & -1 \\ 8 & -4 \end{bmatrix} = \begin{bmatrix} \square & \square \\ \square & \square \end{bmatrix}$$

The sum will be a 2×2 matrix.

$$\begin{bmatrix} \cancel{-3} & 5 \\ 9 & -2 \end{bmatrix} + \begin{bmatrix} \cancel{7} & -1 \\ 8 & -4 \end{bmatrix} = \begin{bmatrix} 4 & \square \\ \square & \square \end{bmatrix}$$

Add row 1, column 1 elements. Cross them off.

$$\begin{bmatrix} \cancel{-3} & \cancel{5} \\ 9 & -2 \end{bmatrix} + \begin{bmatrix} \cancel{7} & \cancel{-1} \\ 8 & -4 \end{bmatrix} = \begin{bmatrix} 4 & 4 \\ \square & \square \end{bmatrix}$$

Add row 1, column 2 elements. Cross them off.

$$\begin{bmatrix} \cancel{-3} & \cancel{5} \\ \cancel{9} & \cancel{-2} \end{bmatrix} + \begin{bmatrix} \cancel{7} & \cancel{-1} \\ \cancel{8} & \cancel{-4} \end{bmatrix} = \begin{bmatrix} 4 & 4 \\ 17 & -6 \end{bmatrix}$$

Repeat for the remaining matrix elements.

So, $\begin{bmatrix} -3 & 5 \\ 9 & -2 \end{bmatrix} + \begin{bmatrix} 7 & -1 \\ 8 & -4 \end{bmatrix} = \begin{bmatrix} 4 & 4 \\ 17 & -6 \end{bmatrix}$.

Exercises

Find each sum or difference.

1. $\begin{bmatrix} -3 & 8 \\ 9 & -2 \end{bmatrix} + \begin{bmatrix} 1 & -5 \\ 5 & 0 \end{bmatrix}$

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

3. $\begin{bmatrix} 1 & -2 \\ 0 & -6 \end{bmatrix} - \begin{bmatrix} 6 & -3 \\ -1 & -8 \end{bmatrix}$

4. $\begin{bmatrix} -9 & 2 & 0 \\ -1 & 0 & 3 \end{bmatrix} + \begin{bmatrix} -7 & -3 & -4 \\ 8 & -7 & -9 \end{bmatrix}$

12-1 **Reteaching** (continued)

Adding and Subtracting Matrices

Solving matrix equations is like solving other kinds of algebraic equations. Isolate the variable on one side of the equal sign, and then simplify the expression on the other side.

Problem

If $X = \begin{bmatrix} 5 & 3 & -1 & 8 \\ 2 & -4 & 9 & 0 \end{bmatrix}$, $Y = \begin{bmatrix} 6 & 7 & 2 & -2 \\ 8 & 0 & -1 & 4 \end{bmatrix}$, and $X + Z = Y$, what is Z ?

$$X + Z = Y$$

Write the equation.

$$Z = Y - X$$

Subtract X from both sides to isolate Z .

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

Substitute for X and Y .

$$Z = \begin{bmatrix} 6-5 & 7-3 & 2-(-1) & -2-8 \\ 8-2 & 0-(-4) & -1-9 & 4-0 \end{bmatrix}$$

Subtract corresponding elements.

$$Z = \begin{bmatrix} 1 & 4 & 3 & -10 \\ 6 & 4 & -10 & 4 \end{bmatrix}$$

Simplify.

Corresponding elements of equivalent matrices are equal. You can use this fact to find the value of unknown matrix elements.

Problem

What value of x makes $\begin{bmatrix} 3x-1 & 6 \\ 3 & -2 \end{bmatrix} = \begin{bmatrix} 5 & 6 \\ 3 & -2 \end{bmatrix}$ a true statement?

$$3x - 1 = 5 \quad \text{Corresponding elements of equivalent matrices are equal.}$$

$$3x = 6 \quad \text{Solve for } x.$$

$$x = 2$$

Exercises

Solve each matrix equation.

$$5. \begin{bmatrix} 1.5 & 0.5 \\ -2.5 & 2.5 \end{bmatrix} - A = \begin{bmatrix} 3 & 4 \\ 5 & 6 \end{bmatrix}$$

$$6. C + \begin{bmatrix} -1 & -4 \\ 0 & 5 \\ 9 & 0 \end{bmatrix} = \begin{bmatrix} -8 & -2 \\ 0 & -4 \\ -1 & 5 \end{bmatrix}$$

Find the value of each variable.

$$7. \begin{bmatrix} 4 & 2 \\ -4 & 9 \end{bmatrix} = \begin{bmatrix} 4 & 3a \\ -4 & 9 \end{bmatrix}$$

$$8. \begin{bmatrix} -3 & f & 2.4 \\ 3 & 0 & 1 \end{bmatrix} = \begin{bmatrix} 3g & 7 & 2.4 \\ 3 & 0 & h + 3 \end{bmatrix}$$