MATRIX OPERATIONS

$$\begin{bmatrix} 2 & 3 & 7 & 1 \\ 0 & -2.2 & 5 & 8 \end{bmatrix}$$

2 rows

4 columns

element

A matrix is a rectangular array of numbers.

An element is a single entry.

This matrix is a 2×4 matrix.

(row x column)

An elements position is defined by a_{mn}, where m is the row position and n is the column position.

a_{12} ← Row 1, column 2

$= 3$

$a_{24} = 8$

Matrices are equal when dimensions and elements are equal.

$$\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} \neq \begin{bmatrix} 4 & 3 \\ 2 & 1 \end{bmatrix}$$

Adding/Subtracting Matrices

- The matrices must have the same dimensions.
- Add/subtract corresponding elements.

Ex. $A=\begin{bmatrix} 8 & 3 \\ -5 & 14 \end{bmatrix}$ $B=\begin{bmatrix} 12 & -7 \\ 6 & -23 \end{bmatrix}$ $C=\begin{bmatrix} 2 \\ 9 \end{bmatrix}$

$$A+B=\begin{bmatrix} 8 & 3 \\ -5 & 14 \end{bmatrix}+\begin{bmatrix} 12 & -7 \\ 6 & -23 \end{bmatrix}$$

Same dimensions; add corresponding elements

$$=\begin{bmatrix} 20 & -4 \\ 1 & -9 \end{bmatrix}$$

$B-C$ – Not possible because of differing dimensions

Scalar Multiplication

$$a\begin{bmatrix} e & f \\ g & h \end{bmatrix} = \begin{bmatrix} ae & af \\ ag & ah \end{bmatrix}$$

Scalar ↗

Ex. $$-4\begin{bmatrix} 2 & -9 \\ 7 & 3 \\ -11 & 4 \end{bmatrix} = \begin{bmatrix} -8 & 36 \\ -28 & -12 \\ 44 & -16 \end{bmatrix}$$

Note: $\dfrac{\begin{bmatrix} 2 & 0 \\ 8 & -5 \end{bmatrix}}{3}$ } Don't divide by a scalar

$\dfrac{1}{3}\begin{bmatrix} 2 & 0 \\ 8 & -5 \end{bmatrix}$ } Multiply by fractions!

Solving Matrix Equations

Ex. Given $A=\begin{bmatrix}-9 & 15 & 4\\ 2 & -10 & -5\end{bmatrix}$ and $B=\begin{bmatrix}5 & -7 & 8\\ 14 & 10 & -3\end{bmatrix}$, solve $4X-B=A$ for X.

1st) Get X by itself in the equation.

$$4X-B=A$$

$$+B \quad +B$$

$$\frac{1}{4}\cdot 4X=(A+B)\frac{1}{4}$$

$$X=\frac{1}{4}(A+B)$$

2nd) Substitute the matrices to solve for the matrix X.

$$X=\frac{1}{4}\left(\begin{bmatrix}-9 & 15 & 4\\ 2 & -10 & -5\end{bmatrix}+\begin{bmatrix}5 & -7 & 8\\ 14 & 10 & -3\end{bmatrix}\right)$$

(A)

$$=\frac{1}{4}\begin{bmatrix}-4 & 8 & 12\\ 16 & 0 & -8\end{bmatrix}$$

$$\boxed{X=\begin{bmatrix}-1 & 2 & 3\\ 4 & 0 & -2\end{bmatrix}}$$