3.5 Matrices and Data

Objective: Find sums, differences, and scalar products of matrices.

A matrix is a rectangular array of numbers enclosed in brackets.

We name matrices by Capital letters.

Matrices are described or classified by: their dimensions

The dimensions of a matrix are always written as: rows x columns or m x n

$$A = \begin{bmatrix} 16.781 & 16.29 & 17.318 \\ 16.206 & 16.606 & 17.668 \end{bmatrix} \begin{array}{l} \leftarrow \textbf{Row 1} \\ \leftarrow \textbf{Row 2} \end{array}$$

$$\begin{array}{ccc} \uparrow & \uparrow & \uparrow \\ \textbf{Column 1} & \textbf{Column 2} & \textbf{Column 3} \end{array}$$

Matrix A has two rows and three columns. A matrix with m rows and n columns has **dimensions** $m \times n$, read "m by n," and is called an $m \times n$ matrix. THE DIMENSIONS ARE ALWAYS ROWS BY COLUMNS!!!!

Examples: $M = \begin{bmatrix} 3 & 2 \\ -6 & 4 \\ -1 & -5 \end{bmatrix}$ $N = \begin{bmatrix} 5 \\ 6 \\ 7 \end{bmatrix}$ $D = \begin{bmatrix} 6 & -3 & 8 \end{bmatrix}$

3 x 2 3 x 1 1 x 3

The address of an entry is its location in the matrix. Addresses are expressed using: lower case letters & subscripts to identify row & column

What are the dimensions of the following matrix? $P = \begin{bmatrix} 3.95 & 5.95 \\ 3.75 & 5.60 \\ 3.50 & 5.25 \end{bmatrix}$ 3x2

What is the address of 5.60? P_{22}

What number has the address p_{12}?

5.95

Solve: $p_{21} + p_{32} =$ 3.75 + 5.25

= 9

Adding and Subtracting Matrices:

To add or subtract matrices, just add or subtract the corresponding entries.

**********You can add or subtract two matrices only if they have the *same* dimensions.**********

✔ Same Dimensions	✘ Different Dimensions
$\begin{bmatrix}1&2\\6&7\end{bmatrix}+\begin{bmatrix}2&1\\7&6\end{bmatrix}$ $\quad\begin{bmatrix}5\\6\\7\end{bmatrix}+\begin{bmatrix}2\\8\\1\end{bmatrix}$	$\begin{bmatrix}1&2\end{bmatrix}+\begin{bmatrix}5\\10\end{bmatrix}$ $\quad\begin{bmatrix}a_{11}&a_{12}\end{bmatrix}+\begin{bmatrix}b_{11}&b_{12}&b_{13}\end{bmatrix}$

Add or subtract if possible:

$$W=\begin{bmatrix}3&-2\\1&0\end{bmatrix},\quad X=\begin{bmatrix}4&7&2\\5&1&-1\end{bmatrix},\quad Y=\begin{bmatrix}1&4\\-2&3\end{bmatrix},\quad Z=\begin{bmatrix}2&-2&3\\1&0&4\end{bmatrix}$$

$2\times2 \qquad 2\times3 \qquad 2\times2 \qquad 2\times3$

W + Y =

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

X – Z =

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

You can multiply a matrix by a number, called a **scalar**. To find the product of a scalar and a matrix, or the *scalar product*, multiply each entry by the scalar.

Calculate 2W:

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

Calculate 3Z – Y: not possible!

Z = 2x3 matrix Y = 2x2 matrix

Calculate 3X + 4Z

$$3\begin{bmatrix}4&7&2\\5&1&-1\end{bmatrix}+4\begin{bmatrix}2&-2&3\\1&0&4\end{bmatrix}$$

$$=\begin{bmatrix}12&21&6\\15&3&-3\end{bmatrix}+\begin{bmatrix}8&-8&12\\4&0&16\end{bmatrix}$$

$$=\begin{bmatrix}20&13&18\\19&3&13\end{bmatrix}$$

Calculate 2W – 3Y

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

$$\begin{bmatrix}6&-4\\2&0\end{bmatrix}+\begin{bmatrix}-3&-12\\6&-9\end{bmatrix}$$

$$=\begin{bmatrix}3&-16\\8&-9\end{bmatrix}$$