7-5 Operations with Matrices

I. **Matrices**: Let us take a look at page 504.

Ex 1) $\begin{bmatrix} x+4 & 8 & -3 \\ 2y & z+2 & 7 \end{bmatrix} = \begin{bmatrix} 2x+9 & 8 & -3 \\ 1 & 11 & 7 \end{bmatrix}$ **Solve for x, y, and z.**

2 X 3 2 X 3

$x+4=2x+9$
$-x \quad -x$
$4=x+9$
$-9 \quad -9$
$-5=x$

$2y=1$
$y=\frac{1}{2}$

$z+2=11$
$z=9$

Ex 2) Given $A = \begin{bmatrix} 8 & -1 \\ 2 & 3 \\ -4 & 5 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 6 \\ -1 & -5 \\ 1 & 10 \end{bmatrix}$ find the following.

3X2 3X2

A + B = $\begin{bmatrix} 8+1 & -1+6 \\ 2+-1 & 3+-5 \\ -4+1 & 5+10 \end{bmatrix} = \begin{bmatrix} 9 & 5 \\ 1 & -2 \\ -3 & 15 \end{bmatrix}$

3A = $3\begin{bmatrix} 8 & -1 \\ 2 & 3 \\ -4 & 5 \end{bmatrix} = \begin{bmatrix} 24 & -3 \\ 6 & 9 \\ -12 & 15 \end{bmatrix}$

2A - 3B =

II. **Multiplication**: $A_{mxn} \times B_{nxp} = AB_{mxp}$

inner

outer

In order to multiply, the inner dimensions must be equal. The outer dimensions determine the new product's size.

Multiply.

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

2x3 3x3

$-2+0+-3$ $4+0+3$ $2+0+-3$

$1(-2)+0(1)+3(-1)$ $1(4)+0(0)+3(1)$ $1(2)+0(0)+3(-1)$

$2(-2)+-1(1)+-2(-1)$ $2(4)+-1(0)+-2(1)$ $4+0+2$

$-4-1+2$ $8+0-2$ 6

$= \begin{bmatrix} -5 & 7 & -1 \\ -3 & 6 & 6 \end{bmatrix}$

Ex 4) $\begin{bmatrix} 3 & 4 \\ -2 & 5 \end{bmatrix} \begin{bmatrix} 2 & -1 \\ 3 & 6 \end{bmatrix} = \begin{bmatrix} 6+12 & -3+24 \\ -4+15 & 2+30 \end{bmatrix}$

2x2 2x2

$= \begin{bmatrix} 18 & 21 \\ 11 & 32 \end{bmatrix}$

Ex 5) $\begin{bmatrix} 2 \\ -1 \\ 1 \end{bmatrix} \begin{bmatrix} 1 & -2 & -3 \end{bmatrix} = \begin{bmatrix} 2 & -4 & -6 \\ -1 & 2 & 3 \\ 1 & -2 & -3 \end{bmatrix}$

$3 \times 1 \quad 1 \times 3$

Ex 6) $\begin{bmatrix} 1 & -2 & -3 \end{bmatrix} \begin{bmatrix} 2 \\ -1 \\ 1 \end{bmatrix} = [2+2-3] = [1]$

$1 \times 3 \quad 3 \times 1$

You can do this on your calculator too!!