

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.

$2 \times 3$                    $2 \times 3$

$$\begin{array}{r} x+4 = 2x+9 \\ -x \quad -x \\ \hline 4 = x+9 \\ -9 \quad -9 \\ \hline -5 = -x \end{array}$$

$$2y = 1$$

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

$$z+2 = 11$$

$$z = 9$$

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.

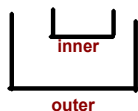
$3 \times 2$                    $3 \times 2$

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

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

$2A - 3B =$

II. **Multiplication:**  $A_{m \times n} \times B_{n \times p} = AB_{m \times p}$



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

**Multiply.**

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

*Handwritten notes:*  
 - Dimensions:  $2 \times 3$  and  $3 \times 3$   
 - Row 1 calculations:  $-2 + 0 + -3$ ,  $1(-2) + 0(1) + 3(-1)$ ,  $4 + 0 + 3$ ,  $2 + 0 + -3$   
 - Row 2 calculations:  $2(-2) + (-1)(1) + (-2)(-1)$ ,  $2(-2) + (-1)(0) + (-2)(-1)$ ,  $8 + 0 + -2$ ,  $4 + 0 + 2$   
 - Final result:  $\begin{bmatrix} -5 & 7 & -1 \\ -3 & 6 & 6 \end{bmatrix}$

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

*Handwritten notes:*  
 - Dimensions:  $2 \times 2$  and  $2 \times 2$   
 - Row 1 calculations:  $6 + 12$ ,  $-3 + 24$   
 - Row 2 calculations:  $-4 + 15$ ,  $2 + 30$   
 - Final result:  $\begin{bmatrix} 18 & 21 \\ 11 & 32 \end{bmatrix}$

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

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

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

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

You can do this on your calculator too!

