## Math 1313 Section 3.3 Section 3.3: Matrix Operations

## **Addition and Subtraction of Matrices**

If A and B are two matrices of the same size,

- 1. A + B is the matrix obtained by adding the corresponding entries in the two matrices.
- 2. A B is the matrix obtained by subtracting the corresponding entries in B from A.

## Laws for Matrix Addition

If A, B, and C are matrices of the same dimension, then

- 1. A + B = B + A
- 2. (A + B) + C = A + (B + C)

Example 1: Refer to the following matrices: If possible,

$$A = \begin{bmatrix} 8 & -3 & 1 \\ 0 & -9 & -4 \\ 9 & 6 & 7 \end{bmatrix}, B = \begin{bmatrix} -5 & 4 & -1 \\ 8 & 4 & 8 \\ 10 & 15 & -2 \end{bmatrix}, C = \begin{bmatrix} 10 & -8 & 3 \\ 5 & -4 & 2 \end{bmatrix}, D = \begin{bmatrix} 4 & 1 & 3 \\ 8 & 5 & 1 \end{bmatrix}$$

a. compute A – B

b. compute B + C.

c. compute D + C.

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#### **Scalar Multiplication**

A scalar is a real number.

**Scalar multiplication** is the product of a scalar and a matrix. To perform scalar multiplication, each element in the matrix is multiplied by the scalar; hence, it "scales" the elements in the matrix

**Example 2:** Let 
$$A = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}, B = \begin{pmatrix} -1 & 4 \\ -7 & 9 \end{pmatrix}$$
, and  $C = \begin{pmatrix} 1 & 2 & 3 \\ -6 & -9 & 1 \end{pmatrix}$  find, if possible,  
a. -3C

 $b. \ -2B-A$ 

c. 3B + 2C

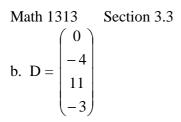
### **Transpose of a Matrix**

If A is an m x n matrix with elements  $a_{ij}$ , then the **transpose** of A is the n x m matrix A<sup>T</sup> with elements  $a_{ji}$ .

$$\mathbf{A} = \begin{bmatrix} 2 & 5 & 50 \\ 1 & 3 & 27 \\ 16 & 45 & 1 \end{bmatrix} \qquad \qquad \mathbf{A}^{\mathrm{T}} = \begin{bmatrix} 2 & 1 & 16 \\ 5 & 3 & 45 \\ 50 & 27 & 1 \end{bmatrix}$$

**Example 3:** Given the following matrices, find their transpose.

a.  $B = \begin{pmatrix} -3 & 0 & 6 \\ 10 & 100 & 3 \end{pmatrix}$ 



# **Equality of Matrices**

Two matrices are equal if they have the same dimension and their corresponding entries are equal.

**Example 4:** Solve the following matrix equation for w, x, y, and z.

w + 6	x	_	[-2	0
_ y - 2	z	=	1	4

**Example 5:** Solve for the variables in the matrix equation.

$$-\begin{bmatrix} 1 & -2\\ 4 & 3 \end{bmatrix} + 9\begin{bmatrix} u-6 & 2z+5\\ y & -\frac{1}{3} \end{bmatrix} = -2\begin{bmatrix} 3 & -8\\ 1 & v \end{bmatrix}$$