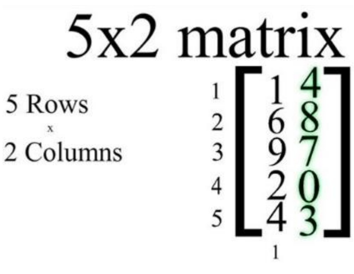
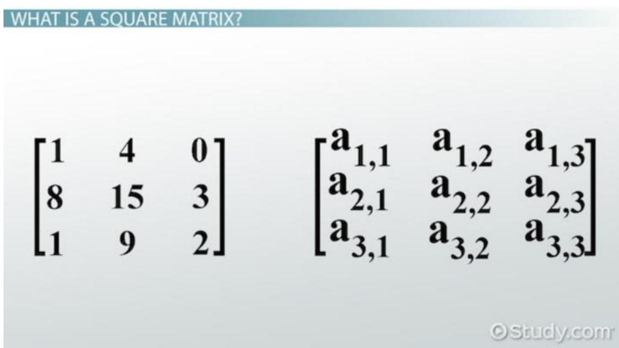
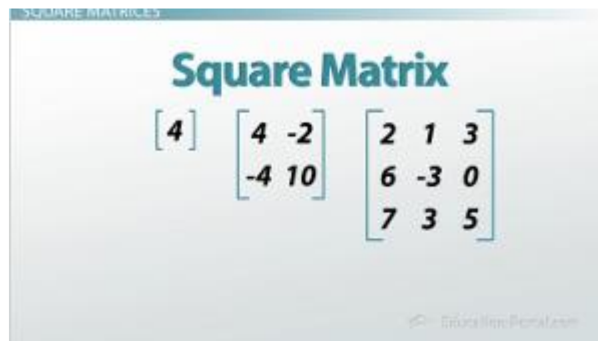
Lesson 2-3: Modeling Real – World Data with Matrices <u>I CAN model data using matrices. I CAN use a matrix to solve a system of linear equation. I CAN add, subtract, and multiply matrices.</u>
EQ: How is adding and subtracting matrices different than multiplying matrices?

A ***matrix*** is an array of numbers and is classified by its dimensions using the number of rows by the number of columns.



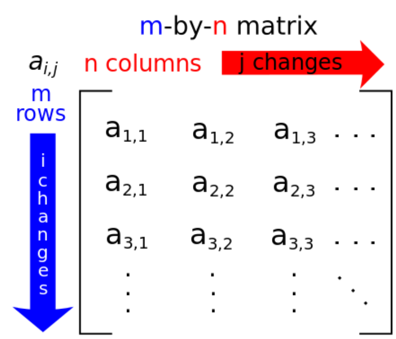
A ***square matrix*** has the same number of rows and columns.





Each ***element*** of a matrix is labeled according to its row and column position.

$$A=\begin{pmatrix} a_{11} & a_{12} & \cdots & a_{1m} \\ a_{21} & a_{22} & \cdots & a_{2m} \\ \vdots & \vdots & & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nm} \end{pmatrix}_{n \times m} = \left(a_{ij}\right)_{n \times m}$$



Lesson 2-3: Modeling Real – World Data with Matrices I CAN model data using matrices. I CAN use a matrix to solve a system of linear equation. I CAN add, subtract, and multiply matrices.

EQ: How is adding and subtracting matrices different than multiplying matrices?

Equal Matrices:

Two matrices are equal if and only if they have the same dimensions and are identical element by element.

$$\underset{\text{Matrix A}}{\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}} = \underset{\text{Matrix B}}{\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}}$$

EX.1 – FINDING DIMENSIONS AND IDENTIFYING ELEMENTS OF A MATRIX

Find the dimensions of each matrix and identify the indicated element.

a. The element a_{12},

$$A = \begin{bmatrix} 2 & 3 \\ -1 & 8 \end{bmatrix}$$

b. The element a_{31},

$$B = \begin{bmatrix} 3 & -1 & 8 & 3 \\ 2 & 0 & 1 & -4 \\ 5 & 6 & 0 & 9 \end{bmatrix}$$

c. The element a_{43}

$$V = \begin{bmatrix} 12 & 7 & 21 & 31 & 11 \\ 45 & -2 & 14 & 27 & 19 \\ -3 & 15 & 36 & 71 & 26 \\ 4 & -13 & 55 & 34 & 15 \end{bmatrix}$$

Short Summary #1

Lesson 2-3: Modeling Real – World Data with Matrices I CAN model data using matrices. I CAN use a matrix to solve a system of linear equation. I CAN add, subtract, and multiply matrices.

EQ: How is adding and subtracting matrices different than multiplying matrices?

EX 2 – USING MATRICES TO SOLVE A SYSTEM OF LINEAR EQUATIONS.

Find the value of x and y for which each matrix equation is true.

a. $[9 \;\; 13] = [x + 2y \quad 4x + 1]$

b. $\begin{matrix} -12 \\ 2 \\ 12y \end{matrix} = \begin{matrix} 6x \\ y + 1 \\ 10 - x \end{matrix}$

c. $\begin{matrix} x \\ 3y - 1 \end{matrix} = \begin{matrix} y - 4 \\ 5x - 9 \end{matrix}$

Short Summary #2:

EX.3 – ADDING AND SUBTRACTING MATRICES. (The sum and difference can only be found if the two matrices have the same dimension).

Addition of Matrices:

The sum of two m x n matrices is an m x n matrix in which the elements are the sum of the corresponding elements in the given matrices.

Subtraction of Matrices:

The difference of two m x n matrices A – B is equal to the sum of A + [- B], where – B represents the additive inverse of B.

3-4=-1

$$\begin{bmatrix} 3 & 8 \\ 4 & 6 \end{bmatrix} - \begin{bmatrix} 4 & 0 \\ 1 & -9 \end{bmatrix} = \begin{bmatrix} -1 & 8 \\ 3 & 15 \end{bmatrix}$$

$$\begin{bmatrix} -4 & 3 \\ 1 & 9 \end{bmatrix} + \begin{bmatrix} 6 & 1 \\ 8 & -2 \end{bmatrix} = \begin{bmatrix} -4+6 & 3+1 \\ 1+8 & 9+(-2) \end{bmatrix} = \boxed{\begin{bmatrix} 2 & 4 \\ 9 & 7 \end{bmatrix}}$$

final answer

Lesson 2-3: Modeling Real – World Data with Matrices I CAN model data using matrices. I CAN use a matrix to solve a system of linear equation. I CAN add, subtract, and multiply matrices.
EQ: How is adding and subtracting matrices different than multiplying matrices?

a. **Find A + B**

$$A=\begin{bmatrix}2 & -3\\ 1 & 5\end{bmatrix} \quad B=\begin{bmatrix}3 & -4\\ 8 & -7\end{bmatrix}$$

b. Find C + D

$$C=\begin{bmatrix}-3 & 4\\ 2 & 11\end{bmatrix} \qquad D=\begin{bmatrix}0 & -5\\ 7 & 9\end{bmatrix}$$

c. Find **A – B**

$$A=\begin{bmatrix}2 & -3\\ 1 & 5\end{bmatrix} \quad B=\begin{bmatrix}3 & -4\\ 8 & -7\end{bmatrix}$$

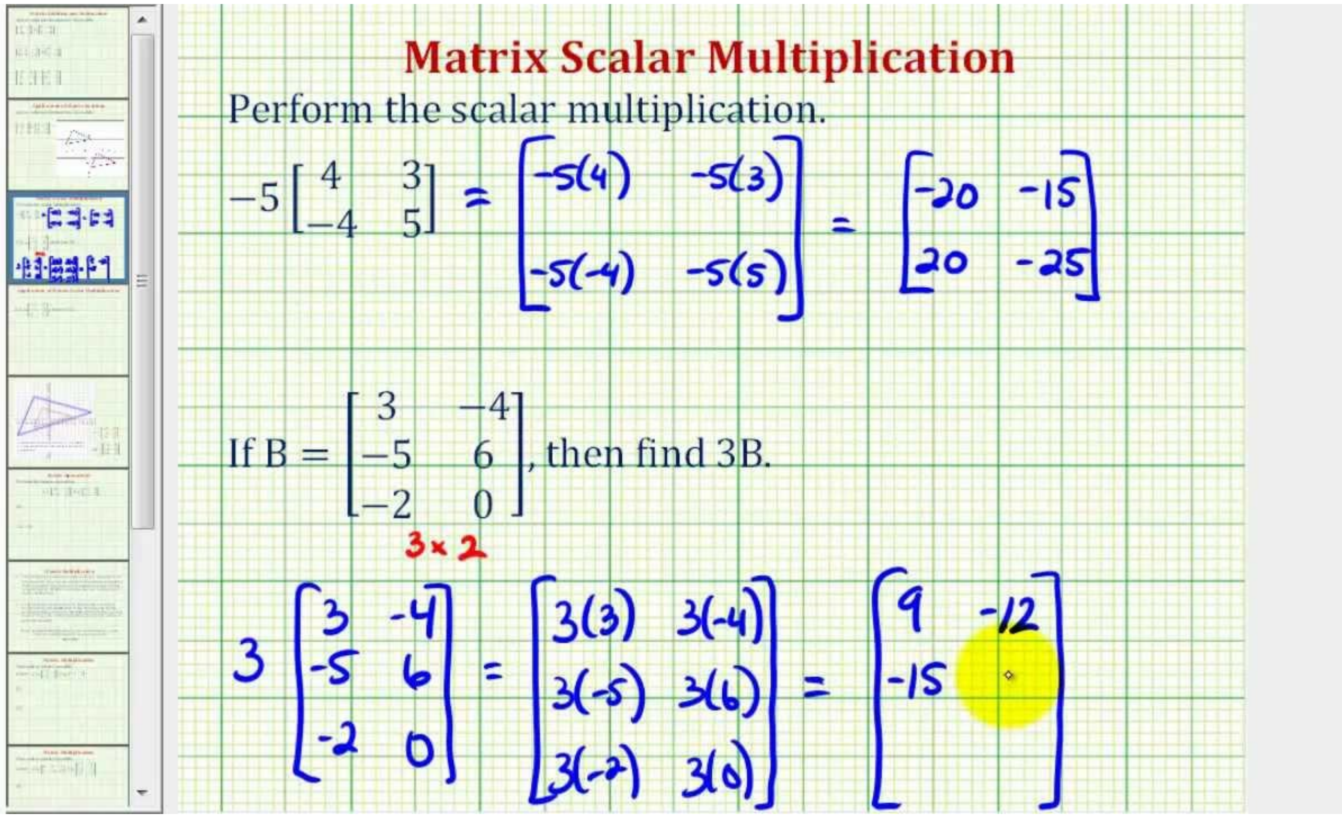
d. Find **B - A**

Short Summary # 3:

EQ: How is adding and subtracting matrices different than multiplying matrices?

EX.4 –SCALAR MULTIPLICATION OF MATRICES.

Scalar Product: The product of a scalar *k* and an *m x n* matrix *A* is an *m x n* matrix denoted by *k*A. Each element of *k*A equals *k* times the corresponding element of *A.*



Find the scalar product.

a. If $A = \begin{bmatrix} -4 & 1 & -1 \\ 3 & 7 & 0 \\ -3 & -1 & 8 \end{bmatrix}$, Find 3A

b. If $A = \begin{bmatrix} 5 & -2 \\ 3 & 8 \\ -1 & 9 \end{bmatrix}$, Find 4A

Short Summary #4:

EX. 5 – FINDING THE PRODUCT OF TWO MATRICES.

Product of Two Matrices:

The product of an m x n matrix **A** and an n x r matrix B is an m x r matrix **AB**. The ijth element in **AB** is the sum of the products of the corresponding elements in the ith row of **A** and the jth column of **B**.

(In order to multiply *AB,* the number of columns in *A* has to be the same as the number of rows in *B*. If they are not, then you cannot multiply because it is not possible and it is said to be undefined).

Lesson 2-3: Modeling Real – World Data with Matrices I CAN model data using matrices. I CAN use a matrix to solve a system of linear equation. I CAN add, subtract, and multiply matrices.
EQ: How is adding and subtracting matrices different than multiplying matrices?

Finding the Product of Two Matrices

Find the product. If it is not defined, state the reason.

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

1×3 $\quad$ 3×2

To multiply matrices, the number of columns in the first has to be the same as the number of rows in the second.

Then multiple row times column

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

$$\begin{bmatrix} -2+0+20 & 8+3+8 \end{bmatrix}$$

$$\begin{bmatrix} 18 & 19 \end{bmatrix}$$

1×2

Use the given matrices to find each product.

$$A = \begin{bmatrix} 2 & -3 \\ 1 & 5 \end{bmatrix} \quad B = \begin{bmatrix} 3 & -4 \\ 8 & -7 \end{bmatrix}$$

a. Find **AB**

Answer to Part a:

Multiply the first row in A by the first column in B. **2(3) + -3(8) = -18**

Multiply the first row in A by the second column in B. **2(-4) + -3(-7) = 13**

Multiply the second row in A by the first column in B. **1(3) + 5(8) = 43**

Multiply the second row in A by the second column in B. **1(-4) + 5(-7) = -39**

AB =

$$\begin{bmatrix} -18 & 13 \\ 43 & -39 \end{bmatrix}$$

b. Find **BA**

Short Summary #5:

EX.6 – USING A CALCULATOR WITH MATRICES

Calculator Steps:

Entering a matrix in the calculator.

Step 1: Turn **ON** the calculator

Step 2: **2^{nd}/x^{-1}** (**MATRX**)

Step 3: Use the right arrow to move to **EDIT,** press **1: [A]**

Step 4: Enter the dimensions of the matrix then enter the elements of the matrix, to move from element to element use the **ENTER key** or the **ARROW keys**. After entering the last element select **ENTER** and then press **2^{nd}/MODE**.

Step 5: To perform operations using the matrix press **2^{nd}/x^{-1}** then under **NAME** select the number which corresponds to the mane of the matrix.

Use the given matrices to perform each operation if possible.

$$A=\begin{bmatrix} 2 & 1 \\ -4 & 7 \end{bmatrix} \quad B=\begin{bmatrix} 6 & -5 \\ 2 & 8 \end{bmatrix}$$

$$C=\begin{bmatrix} 1 & -2 \\ 4 & 10 \\ 6 & 0 \end{bmatrix} \quad D=\begin{bmatrix} 3 & -2 & 0 \\ -1 & 4 & 9 \\ 5 & 2 & 12 \end{bmatrix}$$

a. A + B

b. 2A

c. A – B

d. AB

e. CD

f. CB

Lesson 2-3: Modeling Real – World Data with Matrices I CAN model data using matrices. I CAN use a matrix to solve a system of linear equation. I CAN add, subtract, and multiply matrices.

EQ: How is adding and subtracting matrices different than multiplying matrices?

Short Summary #6:

Independent Practice: **HW**

Sec. 2-3

P.83 #16-48 even

#16-26	**Ex. 2**
#28-46	**Ex. 3-6**

Lesson 2-3: Modeling Real – World Data with Matrices I CAN model data using matrices. I CAN use a matrix to solve a system of linear equation. I CAN add, subtract, and multiply matrices.

EQ: How is adding and subtracting matrices different than multiplying matrices?

Lesson 2-3: Modeling Real – World Data with Matrices I CAN model data using matrices. I CAN use a matrix to solve a system of linear equation. I CAN add, subtract, and multiply matrices.

EQ: How is adding and subtracting matrices different than multiplying matrices?