Unit 5H Matrix Operations Study Guide

Name:________________________ Per:_____

Targets	Sample	Struggle	Help	Master	Assn
Create Matrix from data	Organize the data for the drama and X-Country parties into a matrix.				5.1, 5.2, 5.3, 5R
Add and Subtract Matrices	How many total food items were purchased by group by type.				5.1, 5.2, 5.3, 5R
Multiply Matrix by a Scalar	Given Matrices A and B, find 2A				5.2, 5.3, 5R
Multiply Matrices	Given Matrices A and B, find AB				5.3, 5R

Section	Title	Done?	A Day	B Day
5.1	Matrices Intro		10-25	10-26
5.2	Matrix Operations		10-29	10-30
5.3	Multiplying Matrices		10-31	11-1
5R	Matrices Review		11-2	11-3
SG	Matrix Operations Study Guide		11-2	11-3

Vocabulary

Matrix:____

Rows:_______________________________ Columns:____

Dimensions:___________________________________ Elements:______________________________

Adding/Subtracting Matrices: ____

Multiply Matrices:____

Matrix

A **matrix** is a rectangular arrangement of numbers or **elements** in _______ and columns. Matrix A to the right has two rows (r) and three _____________ (c) written as "2 × 3" or "r × c" (read as "2 by 3" or "r by c"). Matrix B would be a ____× ____ matrix.

$$A = \begin{bmatrix} 1 & 2 & -1 \\ 3 & 4 & -4 \end{bmatrix} \quad B = \begin{bmatrix} \sqrt{1} & \sqrt[3]{27} \\ \frac{4}{2} & 2^2 \\ -1^3 & -2(2) \end{bmatrix}$$

Two matrices are equal if their **dimensions** are the same and their corresponding **elements** are equal. Matrices A and B are NOT equal although they have equal elements. (The element *A_{23} = –4. It is NOT equal to element B_{23} in matrix B because B is NOT a 2 × 3 matrix and B_{23} does not exist.) **A_{23} is saying Matrix A in row 2 and column 3*

Organizing and Reading Data

Organize the data from a problem so that all ________ represent one classification and columns have another classification. (It does not matter what data goes into rows or columns until performing math operations on those matrices.) If an element in a row represents the price of leashes from a store, all of the elements in that row should represent the prices of ___________ at the store. The matrix to the right shows the orders at the Turf 'N Turf restaurant.

	Fri	Sat	Sun
Burgers	127	138	106
Hotdogs	85	104	98
Fries	207	235	214
Drinks	245	306	294

- Explain what each column probably represents. ______________________________________
- Explain what each row probably represents. ____
- Write the dimensions of the matrix (rows x columns). __________________________________

- How many elements are in the matrix? ______________________________
- Which day did they sell the most burgers?______________________________
- How many total drinks did they sell on the weekend?______________________________

Adding/Subtracting Matrices

1. When adding/subtracting matrices, they must be the ________ dimension.
2. Add/subtract each element that is in the same ____________ in the matrices.
3. The sum/difference is a new ___________.

Example:

$$\begin{bmatrix} 2 & 8 & -2 \\ 6 & -4 & 3 \\ 1 & 5 & 9 \end{bmatrix} + \begin{bmatrix} 4 & -3 & 5 \\ -1 & 3 & 2 \\ 8 & 7 & -5 \end{bmatrix} = \begin{bmatrix} 6 & 5 & 3 \\ 5 & -1 & 5 \\ 9 & 12 & 4 \end{bmatrix}$$

➢ **Fill in the blanks for the following matrices.**

$$\begin{bmatrix} 2 & 8 \\ 4 & -3 \end{bmatrix} + \begin{bmatrix} \_\_ & 1 \\ -5 & \_\_ \end{bmatrix} = \begin{bmatrix} 7 & \_\_ \\ \_\_ & -9 \end{bmatrix}$$

Multiplying Matrices ("Scalar multiplication")

Multiply each element of the matrix by the constant. For example, "After taking data over an average weekend, Turf 'N Turf wants to estimate how many items they will sell on each night (Fri, Sat, Sun) for **4** weekends."

$$4\begin{bmatrix} 127 & 138 & 106 \\ 85 & 104 & 98 \\ 207 & 235 & 214 \\ 245 & 306 & 294 \end{bmatrix} = \begin{bmatrix} 508 & 552 & 424 \\ 340 & 416 & 392 \\ 820 & 940 & 856 \\ 980 & 1224 & 1176 \end{bmatrix}$$

$$4\begin{bmatrix} \_\_\_ & 8 \\ 5 & \_\_\_ \end{bmatrix} = \begin{bmatrix} 8 & \_\_\_ \\ \_\_\_ & -16 \end{bmatrix}$$

➢ **Fill in the blanks for the above matrices.**

The multiplier could also be a fraction. (Dividing by a constant is the same as multiplying by a fraction.) Constants sometimes affect a single row or column, but it must multiply everything in that _____ or column.

➢ If $A = \begin{bmatrix} -9 & 3 \\ 0 & -1 \end{bmatrix}$ find $\frac{1}{3}A$

Find $\frac{1}{3}R_1$ of matrix A

Multiplying a Matrix by a Matrix

1. Each row of the first matrix is multiplied by each column of the second matrix.
2. All of the row and column elements are added together to make a new matrix.

a. $$\begin{bmatrix} a & b & c \\ d & e & f \end{bmatrix} \text{X} \begin{bmatrix} g & j \\ h & k \\ i & l \end{bmatrix} = \begin{bmatrix} ag+bh+ci & aj+bk+cl \\ dg+eh+fi & dl+ek+fl \end{bmatrix}$$ (Yikes! That's a bit overwhelming.)

Consider this example. $$\begin{bmatrix} 2 & 5 & -2 \\ -1 & 3 & 8 \end{bmatrix} X \begin{bmatrix} 2 & 7 \\ -4 & 1 \\ 9 & -3 \end{bmatrix} = \begin{bmatrix} (2)(2)+(5)(-4)+(-2)(9) & (2)(7)+(5)(1)+(-2)(-3) \\ (-1)(2)+(3)(-4)+(8)(9) & (-1)(7)+(3)(1)+(8)(-3) \end{bmatrix}$$

$$= \begin{bmatrix} 4+-20+-18 & 14+5+6 \\ -2+-12+72 & -7+3+-24 \end{bmatrix} = \begin{bmatrix} -34 & 25 \\ 58 & -28 \end{bmatrix}$$

$$\begin{bmatrix} 2 & 7 \\ -4 & 1 \\ 9 & -3 \end{bmatrix}$$

You can see it more easily if you move your matrices. $$\begin{bmatrix} 2 & 5 & -2 \\ -1 & 3 & 8 \end{bmatrix} \begin{bmatrix} -34 & 25 \\ 58 & -28 \end{bmatrix}$$

Because each element of each ________ must multiply each element of the columns, the number of elements in the rows must match the number of elements in the ________________. In the example above, the 2×3 matrix was multiplied by the 3×2. The result is a 2×2. NOTE: The middle numbers must be the same and the resultant matrix is the outside numbers. $2 \times (3 * 3) \times 2$. **The order in which you multiply matrices is very __________________. (Matrix multiplication is NOT commutative.)**

Given: $A = \begin{bmatrix} 2 & 3 \\ 4 & 5 \end{bmatrix}$ and $B = \begin{bmatrix} 6 & 7 \\ 8 & 9 \end{bmatrix}$ **Find *AB*** *(Show your steps)* **Find *BA*** *(Show your steps)*

The answers to your multiplication are shown below. I want to see the steps above for credit.

$AB = \begin{bmatrix} 36 & 41 \\ 64 & 73 \end{bmatrix}$ and $BA = \begin{bmatrix} 40 & 53 \\ 52 & 69 \end{bmatrix}$

Division of Matrices

You cannot divide matrices. You can either multiply by a fraction constant (see above), or multiply by the inverse of a matrix. We will not be dealing with that at this time.

Organizing Matrices from Story Problems

Define the variables in the problem and assign rows and ______________ to those variables.

➢ **Show all your steps to solve the following using matrices.**

Mr. Lemen wants to compare shopping for band uniforms consisting of pants and shirts. Each student needs 2 pairs of pants and 3 shirts. He finds the same clothes at both Shopko and Target. At Shopko, the pants cost $9 and the shirts cost $8. At Target, the shirts are on sale for $5 but the pants are $12. Set up three different matrices (label). **SHOW YOUR WORK** to answer the following using those matrices.

a. Define your variables.

b. Create the matrices.

c. How many items will be bought for 45 students?

d. Using the matrix from *a*, show how to calculate the total cost of the 45 sets of uniforms at each store?
Shopko Target

e. Where should he buy his uniforms? ____________ Justify your decision by the work you did above.