DAY 1 Name: Key

MATRICES

A Matrix is simplified version of working with equations with multiple variables.

If a car company is building cars and trucks they can use matrices to determine the number of parts they will need over a given span of time, producing a particular number of vehicles. If each car needs 4 wheels, 2 bench seats, and 1 gas tank. Each truck needs 6 wheels, 1 bench seat and 3 gas tanks. Then we can set-up a matrix where each row and column are for a given part of the equation.

$$\begin{array}{c c} & \begin{array}{ccc} w & s & g \end{array} \\ \begin{array}{c} c \\ t \end{array} & \begin{bmatrix} 4 & 2 & 1 \\ 6 & 1 & 3 \end{bmatrix} \end{array}$$

, where the c=cars, t=trucks, w=wheels, s=seats, and g=gas tanks

Using matrices we can solve for all kinds of situations. Matrices have their own specific rules for adding, subtracting, multiplying, and dividing. RC cola

The size (dimension) of a Matrix is *# Rows by # Columns*. (Rows go across, columns up and down)

EXAMPLE: $B = \begin{bmatrix} 3 & 2 \\ 1 & 0 \\ -1 & -2 \end{bmatrix} \leftarrow row$ Matrix B is a 3 x 2 matrix.

ROW X COLUMNS

$\uparrow$ *Column*

$\begin{bmatrix} 3 & 2 \\ 1 & 0 \\ -1 & -2 \end{bmatrix}$ 3 ROWS $\begin{bmatrix} 3 & 2 \\ 1 & 0 \\ -1 & -2 \end{bmatrix}$ 2 COLUMNS

An element of a Matrix is the value in a particular position.

EXAMPLE: $B = \begin{bmatrix} 3 & 2 \\ 1 & 0 \\ -4 & -5 \end{bmatrix}$ $b_{row,column}$ $b_{1,2} = 2$

2 is the element in the 1st row and 2nd column

<u>Use the matrices below to answer all questions.</u>

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

$$E = \begin{bmatrix} 2 & -8 & 13 & 5 \end{bmatrix} \quad F = \begin{bmatrix} 4 \\ 7 \end{bmatrix} \quad G = \begin{bmatrix} 0 & 2 & -4 \\ 3 & 5 & -5 \\ 1 & 1 & 6 \end{bmatrix} \quad H = \begin{bmatrix} -4 & 2 & 1 & 0 \\ -2 & -1 & 4 & 1 \end{bmatrix}$$

<u>List the dimensions for the specified matrix</u>

1. E 1 x 4
2. F 2 x 1
3. D 3 x 2
4. H 2 x 4
5. A 3 x 3
6. B 3 x 2

Identify the element in the specified locations, If possible.

5. Matrix D, $d_{2,1}$ 5. 7

ROW, COLUMN

6. Matrix A, $a_{2,3}$ 6. 5

7. Matrix H, $h_{4,4}$ 7. 0

8. Matrix E, $e_{1,3}$ 8. 13

If the Matrices are set equal to each other, ***each element must be the same.***

Solve for all variables

9. $\begin{bmatrix} 4 & x \\ y+3 & -8 \end{bmatrix} = \begin{bmatrix} 4 & 0 \\ 12 & z-8 \end{bmatrix}$

$\boxed{x=0}$ $y+3=12$ $\boxed{y=9}$ $-8=z-8$ $\boxed{0=z}$

10. $\begin{bmatrix} 2a+1 & 16 \\ 7-b & 1 \end{bmatrix} = \begin{bmatrix} 17 & 16 \\ -15 & c+4 \end{bmatrix}$

$2a+1=17$ $2a=16$ $\boxed{a=8}$ $7-b=-15$ $-b=-22$ $\boxed{b=22}$ $1=c+4$ $\boxed{-3=c}$

ADDING, SUBTRACTING, AND SCALAR MULTIPLICATION

When Adding and Subtracting Matrices, the matrices ***must be the same exact size!***

Adding- make sure you add <u>ALL</u> elements in the 2nd matrix.

Subtracting – make sure you subtract <u>ALL</u> elements in the 2nd matrix.

Scalar Multiplication – make sure you distribute the multiplier to <u>ALL</u> elements in the matrix.

EXAMPLES: $A = \begin{bmatrix} 1 & 0 & -2 \\ 2 & 3 & 5 \\ 2 & -3 & 0 \end{bmatrix}$ $C = \begin{bmatrix} -3 & 0 & 2 \\ 1 & -1 & 0 \\ 0 & -4 & 3 \end{bmatrix}$ Use the following matrices for these examples:

<u>Work:</u>

1. $A+C = \begin{bmatrix} 1+-3 & 0+0 & -2+2 \\ 2+1 & 3+-1 & 5+0 \\ 2+0 & -3+-4 & 0+3 \end{bmatrix}$ 2. $A-C = \begin{bmatrix} 1-(-3) & 0-0 & -2-2 \\ 2-1 & 3-(-1) & 5-0 \\ 2-0 & -3-(-4) & 0-3 \end{bmatrix}$ 3. $4A = \begin{bmatrix} 4(1) & 4(0) & 4(-2) \\ 4(2) & 4(3) & 4(5) \\ 4(2) & 4(-3) & 4(0) \end{bmatrix}$

<u>Answer:</u>

1. $A + C = \begin{bmatrix} -2 & 0 & 0 \\ 3 & 2 & 5 \\ 2 & -7 & 3 \end{bmatrix}$ 2. $A - C = \begin{bmatrix} 4 & 0 & -4 \\ 1 & 4 & 5 \\ 2 & 1 & -3 \end{bmatrix}$ 3. $4A = \begin{bmatrix} 4 & 0 & -8 \\ 8 & 12 & 20 \\ 8 & -12 & 0 \end{bmatrix}$

Perform the appropriate operation on the given matrices. SHOW ALL YOUR WORK!!

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

11. D + B

$$\begin{bmatrix}-2 & -2\\ 7 & 9\\ 3 & 6\end{bmatrix}+\begin{bmatrix}3 & 2\\ 1 & 0\\ -1 & -2\end{bmatrix}=\begin{bmatrix}-2+3 & -2+2\\ 7+1 & 9+0\\ 3+(-1) & 6+(-2)\end{bmatrix}=\begin{bmatrix}1 & 0\\ 8 & 9\\ 2 & 4\end{bmatrix}$$

12. G – C

$$\begin{bmatrix}0 & 2 & -4\\ 3 & 5 & -5\\ 1 & 1 & 6\end{bmatrix}-\begin{bmatrix}-3 & 0 & 2\\ 1 & -1 & 0\\ 0 & -4 & 3\end{bmatrix}=\begin{bmatrix}0-(-3) & 2-0 & -4-2\\ 3-1 & 5-(-1) & -5-0\\ 1-0 & 1-(-4) & 6-3\end{bmatrix}=\begin{bmatrix}3 & 2 & -6\\ 2 & 6 & -5\\ 1 & 5 & 3\end{bmatrix}$$

13. 3B

$$3\begin{bmatrix}3 & 2\\ 1 & 0\\ -1 & -2\end{bmatrix}=\begin{bmatrix}3(3) & 3(2)\\ 3(1) & 3(0)\\ 3(-1) & 3(-2)\end{bmatrix}=\begin{bmatrix}9 & 6\\ 3 & 0\\ -3 & -6\end{bmatrix}$$

14. G + A – C

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

15. 4D + -3B

$$4\begin{bmatrix}-2 & -2\\ 7 & 9\\ 3 & 6\end{bmatrix}+-3\begin{bmatrix}3 & 2\\ 1 & 0\\ -1 & -2\end{bmatrix}=\begin{bmatrix}4(-2) & 4(-2)\\ 4(7) & 7(9)\\ 4(3) & 4(6)\end{bmatrix}+\begin{bmatrix}-3(3) & -3(2)\\ -3(1) & -3(0)\\ -3(-1) & -3(-2)\end{bmatrix}$$

$$\begin{bmatrix}-8 & -8\\ 28 & 63\\ 12 & 24\end{bmatrix}+\begin{bmatrix}-9 & -6\\ -3 & 0\\ 3 & 6\end{bmatrix}=\begin{bmatrix}-8+(-9) & -8+(-6)\\ 28+(-3) & 63+0\\ 12+3 & 24+6\end{bmatrix}=\begin{bmatrix}-17 & -14\\ 25 & 63\\ 15 & 30\end{bmatrix}$$