HAT

9/11/17

3.5 & 3.6 Matrix Operations

Warm Up:
Solve for a, b, c, d, e and f.

$$\begin{bmatrix} 2a+1 & 8b \\ \frac{c}{7} & \sqrt{d} \\ -e & 4-f \end{bmatrix} = \begin{bmatrix} -7 & 16 \\ -3 & 5 \\ 2 & -6 \end{bmatrix}$$

corresponding entries are equivalent

What is the dimension of each of the matrices?

rows x # of columns

RC col

3 x 2

Example #1:

Two branches of Macy's department store reported last month's jean sales.

Chicago

	M	W
Levi	150	100
Lee	105	90
Wrangler	35	70

Atlanta

	M	W
Levi	95	80
Lee	90	85
Wrangler	40	50

Create a matrix the represents the total sales.

TOTAL SALES

$$\begin{matrix} & M & W \\ \text{Levi} \\ \text{Lee} \\ \text{Wrangler} \end{matrix} \begin{bmatrix} 245 & 180 \\ 195 & 175 \\ 75 & 120 \end{bmatrix}$$

To add, matrices must have the same dimensions. Add corresponding entries.

What would Chicago's matrix look like if Chicago doubled its sales?

$$2 \cdot \begin{bmatrix} 150 & 100 \\ 105 & 90 \\ 35 & 70 \end{bmatrix} = \begin{bmatrix} 300 & 200 \\ 210 & 180 \\ 70 & 140 \end{bmatrix}$$

Scalar multiplication

Create a matrix that represents the difference in jean sales.

Chicago - Atlanta

$$\begin{bmatrix} 150 & 100 \\ 105 & 90 \\ 35 & 70 \end{bmatrix} - \begin{bmatrix} 95 & 80 \\ 90 & 85 \\ 40 & 50 \end{bmatrix} = \begin{bmatrix} 55 & 20 \\ 15 & 5 \\ -5 & 20 \end{bmatrix}$$

How many more Chicago sold than Atlanta

Example #2: Simplify

$$2\begin{bmatrix} 4 & 8 & 3 \\ -3 & -2 & 2 \\ 0 & 5 & 1 \end{bmatrix} - \begin{bmatrix} 4 & -2 & 8 \\ 10 & 0 & 12 \\ 5 & -1 & -6 \end{bmatrix}$$

$$\begin{bmatrix} 4 & 18 & -2 \\ -16 & -4 & -8 \\ -5 & 11 & 8 \end{bmatrix}$$

Example #3:

$$\begin{bmatrix} 3 & -1 & 4 \end{bmatrix} + \begin{bmatrix} -2 \\ 0 \\ 8 \end{bmatrix}$$

No solution

In order to add matrices the dimensions must be the same.

Example #4:

Mr. Kohmetcher is planning his birthday party for 100 of his closest friends. He will need to rent 100 chairs, 12 tables, and 2 tents. There are two rental shops nearby that rent all these items but they have different prices as shown in the matrix.

	Weinhardt	*Sun Rental*
Chairs	\$2.25	\$3
Tables	\$6.50	\$10
Tents	\$385	\$325

Put the information about how many chairs, tables, and tents into a row matrix.

chairs tables tents

$$\begin{bmatrix} 100 & 12 & 2 \end{bmatrix}$$

Use matrix multiplication to find a matrix that shows the total cost of renting all the equipment from each of the two shops.

$$\begin{bmatrix} C & TA & TE \\ 100 & 12 & 2 \\ 1\times 3 & & \end{bmatrix} \cdot \begin{matrix} \\ C \\ TA \\ TE \end{matrix}\begin{bmatrix} W & S \\ 2.25 & 3 \\ 6.50 & 10 \\ 385 & 325 \\ 3\times 2 & \end{bmatrix} = \begin{bmatrix} W & S \\ 1073 & 1070 \end{bmatrix}$$

$100(2.25) + 12(6.50) + 2(385) = 1073$

$100(3) + 12(10) + 2(325) = 1070$

Matrix Multiplication

Example #5

$$\begin{bmatrix} -1 & 2 \\ 4 & 0 \end{bmatrix} \cdot \begin{bmatrix} -2 & 3 \\ 1 & 5 \end{bmatrix} = \begin{bmatrix} 4 & 7 \\ -8 & 12 \end{bmatrix}$$

2x2 2x2

Mult will work

Dimensions of solution

$-1(-2)+2(1)=4$ $-1(3)+2(5)=7$

$4(-2)+0(1)=-8$ $4(3)+0(5)=12$

Example #6

$$\begin{bmatrix} 4 & -1 \end{bmatrix} \begin{bmatrix} -3 & 6 & 1 \\ 0 & 7 & -4 \end{bmatrix} = \begin{bmatrix} -12 & 17 & 8 \end{bmatrix}$$

1x2 2x3

Example #7

2x3 1x2 ← Mult is not commutative in matrices.

$$\begin{bmatrix} 4 & -1 & 2 \end{bmatrix} \cdot \begin{bmatrix} -3 & 6 & 1 \\ 0 & 7 & -4 \end{bmatrix}$$

1x3 2x3

No solution.

The number of columns in the 1st matrix does not match the number of rows in the 2nd matrix.