Matrix Basics Worksheet Name _____

Show all work for full credit. Period _____ Date _____

State the dimensions of the following matrices.

1) $\begin{bmatrix} 3 & -2 & 7 & 9 \\ 1 & 0 & -3 & 5 \\ -8 & 2 & 10 & -6 \end{bmatrix}$

3×4

2) $\begin{bmatrix} 5 & -7 & -2 & 1 \end{bmatrix}$

1×4

3) $\begin{bmatrix} 9 \\ 6 \\ 5 \end{bmatrix}$ 3×1

4) $\begin{bmatrix} 6 & 8 & -17 \\ -7 & -5 & 15 \\ 1 & 14 & 2 \\ 11 & 13 & -3 \end{bmatrix}$ 4×3

Perform the indicated operations:

5) $3\begin{bmatrix} 5 & -6 & 3 \\ 0 & -4 & 8 \\ 10 & -11 & 12 \end{bmatrix} - 2\begin{bmatrix} 2 & -4 & 0 \\ 5 & 11 & -2 \\ 5 & 0 & -10 \end{bmatrix}$

$\begin{bmatrix} 15 & -18 & 9 \\ 0 & -12 & 24 \\ 30 & -33 & 36 \end{bmatrix} + \begin{bmatrix} -4 & +8 & 0 \\ -10 & -22 & 4 \\ -10 & 0 & 20 \end{bmatrix}$

$\begin{bmatrix} 11 & -10 & 9 \\ -10 & -34 & 28 \\ 20 & -33 & 56 \end{bmatrix}$

6) $\begin{bmatrix} -2 & 8 \\ -11 & 5 \end{bmatrix} + 3\begin{bmatrix} 5 & 3 & -11 \\ 44 & 0 & 5 \\ -3 & 2 & 8 \end{bmatrix}$

not possible

Solve for x and/or y:

7) $\begin{bmatrix} -3 & 5 \\ 25 & -2 \end{bmatrix} - 3\begin{bmatrix} 0 & -2 \\ x & 4 \end{bmatrix} = \begin{bmatrix} -3 & 11 \\ 15 & -14 \end{bmatrix}$

$\begin{bmatrix} -3 & 5 \\ 25 & -2 \end{bmatrix} + \begin{bmatrix} 0 & 6 \\ -3x & -12 \end{bmatrix} = \begin{bmatrix} -3 & 11 \\ 15 & -14 \end{bmatrix}$

$\begin{bmatrix} -3 & 11 \\ 25-3x & -14 \end{bmatrix} = \begin{bmatrix} -3 & 11 \\ 15 & -14 \end{bmatrix}$

$25 - 3x = 15$

$-3x = -10$

$x = 10/3$

8) $-5\begin{bmatrix} 5 & 6 \\ 10 & -7 \\ 8 & x \\ 1 & -6 \\ 7 & 8 \end{bmatrix} + 4\begin{bmatrix} 0 & 1 \\ 1 & -2 \\ 2 & 3 \\ 4 & 11 \\ -5 & 3 \end{bmatrix} = 2\begin{bmatrix} 12.5 & -13 \\ -23 & 13.5 \\ -16 & 100 \\ y & 37 \\ -27.5 & -14 \end{bmatrix}$

$-5x + 4(3) = 2(100)$

$-5x + 12 = 200$

$-5x = 188$

$x = -37.6$

$30 + 44 = 2y$

$74 = 2y$

$37 = y$

Matrix A represents the number of points scored in each quarter for the first 4 games of football played by Frederick High School. Matrix B represents the number of points scored in each quarter for the first 4 games of football played by Thomas Johnson High School.

Matrix A

	Q1	Q2	Q3	Q4
Game 1	6	0	13	3
Game 2	21	18	0	7
Game 3	14	28	6	0
Game 4	0	0	35	17

Matrix B

	Q1	Q2	Q3	Q4
Game 1	0	3	9	0
Game 2	7	14	7	6
Game 3	3	9	12	17
Game 4	23	0	9	7

9) Write a matrix that represents the combined points scored per quarter for the first 4 games.

$$\begin{bmatrix} 6 & 3 & 22 & 3 \\ 28 & 32 & 7 & 13 \\ 17 & 37 & 18 & 17 \\ 23 & 0 & 44 & 24 \end{bmatrix}$$

10) A toymaker makes handcrafted toys for children. His output last year is represented by the matrix M below.

$$\begin{array}{r} \\ \text{dolls} \\ \text{stuffed animals} \end{array} \begin{array}{c} \begin{array}{ccc} \text{sm} & \text{med} & \text{lg} \end{array} \\ \begin{bmatrix} 5 & 10 & 18 \\ 12 & 22 & 9 \end{bmatrix} \end{array} = M$$

a) Suppose he wants to increase his output by 30%. Write a matrix that represents the needed output.

$$\begin{bmatrix} 5 & 10 & 18 \\ 12 & 22 & 9 \end{bmatrix} + .30\begin{bmatrix} 5 & 10 & 18 \\ 12 & 22 & 9 \end{bmatrix} = \begin{bmatrix} 5 & 10 & 18 \\ 12 & 22 & 9 \end{bmatrix} + \begin{bmatrix} 1.5 & 3 & 5.4 \\ 3.6 & 6.6 & 2.7 \end{bmatrix}$$

$$= \begin{bmatrix} 6.5 & 13 & 23.4 \\ 15.6 & 28.6 & 11.7 \end{bmatrix}$$

b) Find $2M$ and explain what the matrix represents.

$$2M = \begin{bmatrix} 10 & 20 & 36 \\ 24 & 44 & 18 \end{bmatrix}$$

Increased output by 100%

Matrix Multiplication Worksheet **Name** _____

Show all work for full credit. **Period** _____ **Date** _____

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

1) $\begin{bmatrix}3 & -1\end{bmatrix}\begin{bmatrix}5\\7\end{bmatrix} = \begin{bmatrix}3(5)+-1(7)\end{bmatrix}$

$1\times\underline{2\ \ 2}\times 1 = [8]$

1×1

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

$2\times\underline{2\ \ 1}\times 2$

not possible

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

$2\times\underline{2\ \ 2}\times 2$

2×2

$= \begin{bmatrix}-12 & 15\\8 & -4\end{bmatrix}$

4) $\begin{bmatrix}5 & 2\\0 & -4\\1 & 6\end{bmatrix}\begin{bmatrix}3 & 7\\-2 & 0\end{bmatrix} = \begin{bmatrix}5(3)+2(-2) & 5(7)+2(0)\\0(3)+-4(-2) & 0(7)+-4(0)\\1(3)+6(-2) & 1(7)+6(0)\end{bmatrix}$

$3\times\underline{2\ \ 2}\times 2$

3×2

$= \begin{bmatrix}11 & 35\\8 & -4\\-9 & 7\end{bmatrix}$

5) $\begin{bmatrix}1 & 3 & 0\\2 & 12 & -4\end{bmatrix}\begin{bmatrix}9 & 1\\4 & -3\\-2 & 4\end{bmatrix} = \begin{bmatrix}1(9)+3(4)+0(-2) & 1(1)+3(-3)+0(4)\\2(9)+12(4)+-4(-2) & 2(1)+12(-3)+-4(4)\end{bmatrix}$

$2\times\underline{3\ \ 3}\times 2$

2×2

$= \begin{bmatrix}21 & -8\\74 & -50\end{bmatrix}$

Solve for the variables.

6) $\begin{bmatrix}-2 & 1 & 2\\3 & 2 & 4\\0 & -2 & 4\end{bmatrix}\begin{bmatrix}1\\x\\3\end{bmatrix} = \begin{bmatrix}6\\19\\y\end{bmatrix}$

$\begin{bmatrix}-2+x+3\\3+2x+12\\-2x+12\end{bmatrix} = \begin{bmatrix}6\\19\\y\end{bmatrix}$

$-2+x+3=6$ $\quad -2x+12=y$

$x+1=6$ $\quad -2(5)+12=y$

$\boxed{x=5}$ $\quad \boxed{2=y}$

7) $\begin{bmatrix}4 & 1 & 3\\-2 & x & 1\end{bmatrix}\begin{bmatrix}9 & -2\\2 & 1\\-1 & 1\end{bmatrix} = \begin{bmatrix}y & -4\\-13 & 8\end{bmatrix}$

$\begin{bmatrix}35 & -4\\-19+2x & x+5\end{bmatrix} = \begin{bmatrix}y & -4\\-13 & 8\end{bmatrix}$

$\boxed{35=y}$ $\quad x+5=8$

$\boxed{x=3}$

Write an inventory matrix and a cost per item matrix. The use matrix multiplication to write a total cost matrix.

8) A softball team needs to buy 12 bats at $21 each, 45 balls at $4 each, and 15 uniforms at $30 each.

$$\#\ \begin{matrix}\text{bats} & \text{balls} & \text{uniforms}\end{matrix}\begin{bmatrix}12 & 45 & 15\end{bmatrix} \qquad \$\begin{matrix}\text{bats}\\ \text{balls}\\ \text{uniforms}\end{matrix}\begin{bmatrix}21\\4\\15\end{bmatrix}$$

$$\text{total cost} = \begin{bmatrix}12 & 45 & 15\end{bmatrix}\begin{bmatrix}21\\4\\15\end{bmatrix} = \begin{bmatrix}657\end{bmatrix}$$

9) A teacher is buying supplies for two art classes. For class 1, the teacher buys 24 tubes of paint, 12 brushes, and 17 canvasses. For class 2, the teacher buys 20 tubes of paint, 14 brushes, and 15 canvasses. Each tube of paint costs $3.35, each brush costs $1.75, and each canvas costs $4.50.

$$\begin{matrix}\\ \text{class 1}\\ \text{class 2}\end{matrix}\begin{bmatrix}24 & 12 & 17\\ 20 & 14 & 15\end{bmatrix}\begin{matrix}\text{paint}\\ \text{brushes}\\ \text{canvases}\end{matrix}\qquad \$\begin{bmatrix}3.35\\1.75\\4.50\end{bmatrix}$$

$$\text{total cost} = \begin{bmatrix}24 & 12 & 17\\ 20 & 14 & 15\end{bmatrix}\begin{bmatrix}3.35\\1.75\\4.50\end{bmatrix} = \begin{bmatrix}177.90\\159\end{bmatrix}$$