Math-I 110 3.6 Notes

→ # rows X # columns

Determine the dimensions of the matrix

$\begin{bmatrix}1 & 2\\ 3 & 4\end{bmatrix}$ 2 x 2 or 2, 2	$\begin{bmatrix}1 & 2 & 5\\ 3 & 4 & 6\end{bmatrix}$ 2 x 3
$\begin{bmatrix}1 & 2\\ 5 & 6\\ 3 & 4\end{bmatrix}$ 3 x 2	$\begin{bmatrix}1 & 2 & 7\\ 5 & 6 & 8\\ 3 & 4 & 9\end{bmatrix}$ 3 x 3

Given the following matrices

same # of rows AND same # of columns

You can only add and subtract matrices with like dimensions

$\boldsymbol{A} = \begin{bmatrix}1 & 2\\ 3 & 4\end{bmatrix}$ 2x2	$\boldsymbol{B} = \begin{bmatrix}-1 & -3\\ -2 & -4\end{bmatrix}$ 2x2	$\boldsymbol{C} = \begin{bmatrix}2\\ -2\end{bmatrix}$ 2x1	$\boldsymbol{D} = [3 \quad 6]$ 1x2

Find the following if possible

1. **A + B** ✓

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

2. **B+D** X

Not Possible

3. **A-B** ✓

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

4. **B-A**

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

$$=\begin{bmatrix}-2 & -5\\ -5 & -8\end{bmatrix}$$

5. **C+D**

Not Possible.

Scalar Multiplication

Given the following matrices

$\boldsymbol{A}=\begin{bmatrix}1 & 2\\ 3 & 4\end{bmatrix}$	$\boldsymbol{B}=\begin{bmatrix}-1 & -3\\ -2 & -4\end{bmatrix}$	$\boldsymbol{C}=\begin{bmatrix}2\\ -2\end{bmatrix}$	$\boldsymbol{D}=\begin{bmatrix}3 & 6\end{bmatrix}$

Find each of the following if possible

1. **3B**

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

$$=\begin{bmatrix}-3 & -9\\ -6 & -12\end{bmatrix}$$

2. (-1)**B**

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

3. (-1)**C**

$$(-1)C=\begin{bmatrix}-2\\ 2\end{bmatrix}$$

$A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$	$B = \begin{bmatrix} -1 & -3 \\ -2 & -4 \end{bmatrix}$	$C = \begin{bmatrix} 2 \\ -2 \end{bmatrix}$	$D = [3 \quad 6]$

4. **5D**

$5D = [15 \quad 30]$

5. **2A+B**

$2A = \begin{bmatrix} 2 & 4 \\ 6 & 8 \end{bmatrix}$

$2A+B = \begin{bmatrix} 2+(-1) & 4+(-3) \\ 6+(-2) & 8+(-4) \end{bmatrix} = \begin{bmatrix} 1 & 1 \\ 4 & 4 \end{bmatrix}$

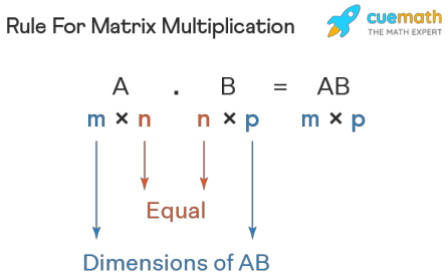
6. **A+2B**

$2B = \begin{bmatrix} -2 & -6 \\ -4 & -8 \end{bmatrix}$

$A+2B = \begin{bmatrix} 1-2 & 2-6 \\ 3-4 & 4-8 \end{bmatrix} = \begin{bmatrix} -1 & -4 \\ -1 & -4 \end{bmatrix}$

Matrix Multiplication

You can only multiple two matrices where the number of columns in the first matrix equals the number of rows in the second.



$AB \neq BA$

Given the following Matrices

$A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$	$B = \begin{bmatrix} -1 & -3 \\ -2 & -4 \end{bmatrix}$	$C = \begin{bmatrix} 2 \\ -2 \end{bmatrix}$	$D = [3 \quad 6]$
2×2	2×2	2×1	1×2

Find the following if possible

1. **AC** → yes

$2 \times 2 \cdot 2 \times 1 \Rightarrow 2 \times 1$

$\begin{bmatrix} * \\ * \end{bmatrix} = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} \begin{bmatrix} 2 \\ -2 \end{bmatrix}$

$\begin{matrix} \cdot & \cdot \\ \cdot & \cdot \end{matrix} \begin{matrix} 2 \\ -2 \end{matrix} = \begin{matrix} 1 \cdot 2 \\ + \\ 2(-2) \end{matrix}$

$= \begin{bmatrix} 1\cdot 2+2(-2) \\ 3\cdot 2+4(-2) \end{bmatrix} = \begin{bmatrix} -2 \\ -2 \end{bmatrix}$ 2×1

$= 2+(-4)$
$= -2$

2. **BD**

$2\times 2 \quad \cdot \quad 1\times 2$

Not Possible

3. **CA**

$2\times 1 \quad 2\times 2$

Not Possible

$A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ 2×2 | $B = \begin{bmatrix} -1 & -3 \\ -2 & -4 \end{bmatrix}$ 2×2 | $C = \begin{bmatrix} 2 \\ -2 \end{bmatrix}$ 2×1 | $D = [3 \quad 6]$ 1×2

4. **DB** $(1\times 2)\cdot(2\times 2) = 1\times 2$

$DB = [3 \quad 6]\begin{bmatrix} -1 & -3 \\ -2 & -4 \end{bmatrix} = [3(-1)+6(-2) \quad 3(-3)+6(-4)]$

$= [-3-12 \quad -9-24]$

$= [-15 \quad -33]$

5. **CD** $(2\times 1)\cdot(1\times 2) = 2\times 2$

$CD = \begin{bmatrix} 2 \\ -2 \end{bmatrix}[3 \quad 6] = \begin{bmatrix} 2(3) & 2(6) \\ -2(3) & -2(6) \end{bmatrix}$

$= \begin{bmatrix} 6 & 12 \\ -6 & -12 \end{bmatrix}$

6. **DC** $(1\times 2)\cdot(2\times 1) = (1\times 1)$

$DC = [3 \quad 6]\begin{bmatrix} 2 \\ -2 \end{bmatrix} = [3(2)+6(-2)]$

$= [-6]$

i^{th} row j^{th} column element in the Product is obtained by multiplying i^{th} row of first factor with j^{th} column of second factor.

In-class Quiz 4

Sep 23

(1) 7 Pts

$$\left.\begin{aligned} 2x + y &= 3 \\ y &= 2x - 1 \end{aligned}\right\}$$ Solve the system for x and y

(2) 8 Pts

$$\left.\begin{aligned} 3x + 4y &= 7 \\ 4x - 3y &= 1 \end{aligned}\right\}$$ Solve the system for x and y.

(3) 5 Pts

There are two complementary angles (Sum is 90°) which differ by 2 degrees. Find the angles.

x, y

$$x + y = 90$$
$$x - y = 2$$
$$2x = 92 \Rightarrow x = 46$$
$$y = 44$$