$$A = \begin{bmatrix} 3 & 6 & 7 \\ 12 & 9 & 11 \end{bmatrix} \qquad B = \begin{bmatrix} 6 & 12 \\ 5 & 10 \\ 13 & 2 \end{bmatrix} \qquad C = \begin{bmatrix} 1 & 7 & 8 \\ 2 & 4 & 3 \end{bmatrix}$$

$2 \times 3 \qquad 3 \times 2 \qquad 2 \times 3$

$$AB = \begin{bmatrix} 139 & 110 \\ 260 & 256 \end{bmatrix}_{2 \times 2}$$

$$BC = \begin{bmatrix} 30 & 90 & 84 \\ 25 & 75 & 70 \\ 17 & 99 & 110 \end{bmatrix}_{3 \times 3}$$

$6 + 24 = 30$

$$BC = \begin{bmatrix} b_1c_1 & b_1c_2 & b_1c_3 \\ b_2c_1 & b_2c_2 & b_2c_3 \\ b_3c_1 & b_3c_2 & b_3c_3 \end{bmatrix}$$

Commutative

A & B

$A+B=B+A$

$A-B \longrightarrow A+(-B)$ *

$$A=\begin{bmatrix}4 & 11\\ 17 & 6\end{bmatrix} \quad B=\begin{bmatrix}3 & 7\\ 6 & 2\end{bmatrix}$$

$$A-B=\begin{bmatrix}4-3 & 11-7\\ 17-6 & 6-2\end{bmatrix}$$

$$=\begin{bmatrix}1 & 4\\ 11 & 4\end{bmatrix} \quad \text{L.H.S.}$$

$$-B+A=\begin{bmatrix}-3+4 & -7+11\\ -6+17 & -2+6\end{bmatrix}$$

$$-B+A=\begin{bmatrix}1 & 4\\ 11 & 4\end{bmatrix} \quad \text{R.H.S}$$

Associative

$(A+B)+C = A+(B+C)$

Matrix Multiplication.

Commutative $AB \neq BA$

$kA = Ak$

scalar multiplication

$$X_{a \times b} \quad Y_{c \times d} \quad Z_{e \times f}$$

If $b = c$ & $d = e$, the associate law will apply as long as the matrices are multiplied in the order of conformability.

$$(XY)Z = X(YZ)$$

matrix multiplication

Distributive law

$$A(B+C) = AB + AC$$

H.W.

$$A = \begin{bmatrix} 7 & 5 \\ 1 & 3 \\ 8 & 6 \end{bmatrix}_{3\times 2} \quad B = \begin{bmatrix} 4 & 9 & 10 \\ 2 & 6 & 5 \end{bmatrix}_{2\times 3} \quad C = \begin{bmatrix} 2 \\ 6 \\ 7 \end{bmatrix}_{3\times 1}$$

$$(AB)C = A(BC)$$

Identity matrix

$$I = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \Longrightarrow 1$$

$$1^3 = 1$$

$$I\,I = I^2 = I$$

$$3 \times 1 = 3$$

$$A \cdot I = I\,A = A$$

Null Matrix

$$N = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}_{2\times 2} \Rightarrow 0$$

$$N = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix} \qquad N = \begin{bmatrix} 0 & 0 \\ 0 & 0 \\ 0 & 0 \end{bmatrix}$$

$$B = \begin{bmatrix} 5 & 12 \\ 20 & 4 \end{bmatrix}_{2\times 2}$$

$$BN = \begin{bmatrix} 5(0)+12(0) & 5(0)+12(0) \\ 20(0)+4(0) & 20(0)+4(0) \end{bmatrix}$$

$$= \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} = N$$