Two and Four dimensional Matricies

1a. $\begin{pmatrix} x & -y \\ y & x \end{pmatrix} + \begin{pmatrix} u & -v \\ v & u \end{pmatrix} = \begin{pmatrix} (x+u) & (-y-v) \\ (y+x) & (v+u) \end{pmatrix}$

$\begin{pmatrix} x & -y \\ y & x \end{pmatrix} \begin{pmatrix} u & -v \\ v & u \end{pmatrix} = \begin{pmatrix} (xu - yv) & (-vx - yu) \\ (uy + xv) & (-vy + xu) \end{pmatrix}$

b. Y would be 0 so in the addition it would be

$\begin{pmatrix} (x+u) & (-v) \\ (x) & (v+u) \end{pmatrix}$

and the multiplication would be

$\begin{pmatrix} xu & -vx \\ xv & xu \end{pmatrix}$

c. Using complex numbers would result in a matrix with complex numbers.

d. $\begin{pmatrix} \sqrt{-1} & \sqrt{0} \\ 0 & -1 \end{pmatrix}$

2a. $\begin{pmatrix} i & 0 \\ 0 & -i \end{pmatrix}^2$

$\begin{pmatrix} i & 0 \\ 0 & -i \end{pmatrix} \begin{pmatrix} i & 0 \\ 0 & -i \end{pmatrix} = \begin{pmatrix} i^2 & 0 \\ 0 & i^2 \end{pmatrix}$

$j^2 =$

$\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix} \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$

$\begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$

$k^2 =$

$\begin{pmatrix} 0 & i \\ i & 0 \end{pmatrix} \begin{pmatrix} 0 & i \\ i & 0 \end{pmatrix}$

$\begin{pmatrix} i^2 & 0 \\ 0 & i^2 \end{pmatrix}$

b. ij

$\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix} = \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$

ji

$\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix} \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} = \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$

jk

$$\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}\begin{pmatrix} 0 & i \\ i & 0 \end{pmatrix} = \begin{pmatrix} i & 0 \\ 0 & -i \end{pmatrix}$$

kj

$$\begin{pmatrix} 0 & i \\ i & 0 \end{pmatrix}\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix} = \begin{pmatrix} -i & 0 \\ 0 & i \end{pmatrix}$$

ki

$$\begin{pmatrix} 0 & i \\ i & 0 \end{pmatrix}\begin{pmatrix} i & 0 \\ 0 & -i \end{pmatrix} = \begin{pmatrix} 0 & -i^2 \\ i^2 & 0 \end{pmatrix}$$

ik

$$\begin{pmatrix} i & 0 \\ 0 & -i \end{pmatrix}\begin{pmatrix} 0 & i \\ i & 0 \end{pmatrix} = \begin{pmatrix} 0 & i^2 \\ -i^2 & 0 \end{pmatrix}$$

c. $\begin{pmatrix} i & 0 \\ 0 & -i \end{pmatrix}$

$\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$

$$\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}\begin{pmatrix} 0 & i \\ i & 0 \end{pmatrix} = \begin{pmatrix} 0 & i \\ -i & 0 \end{pmatrix}$$

$$\begin{pmatrix} 0 & i \\ -i & 0 \end{pmatrix}\begin{pmatrix} i & 0 \\ 0 & -i \end{pmatrix} = \begin{pmatrix} 0 & -i^2 \\ -i^2 & 0 \end{pmatrix}$$

$$\begin{pmatrix} 0 & -i^2 \\ -i^2 & 0 \end{pmatrix}\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix} = \begin{pmatrix} -i^2 & 0 \\ 0 & -i^2 \end{pmatrix}$$

each time until the last the 0 stayed in the same position.