Sec 5.7 – VECTORS
Vector Matrices and Transforms

Name:

1. Let the following vectors be defined: $\vec{a}: \langle -3, 5\rangle$ $\vec{b}: \langle 7, 2\rangle$ $\vec{c}: \langle 4, -9\rangle$ $\vec{d}: \langle -2, -1\rangle$

A. Rewrite each vector as a column & row matrix. Then, store each as a column matrix in your Graphing Calculator.

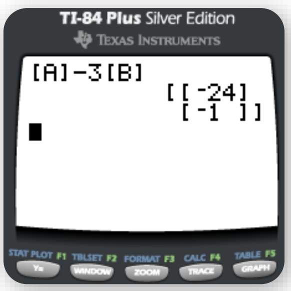
MATRIX EDIT

(Press  and change the dimensions to 2 x 1 and enter the vector components)

B. Using your Graphing Calculator evaluate the following:

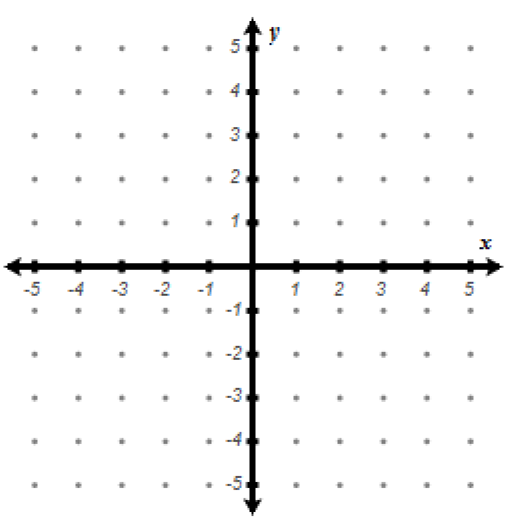
(i) $\vec{a} - 3\vec{b}$ (ii) $-4\vec{d}$ (iii) $2\vec{b} + 3\vec{a} - 4\vec{c}$

e.g.

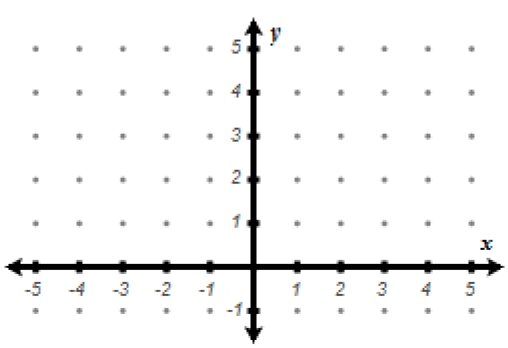


2. Using matrices to define vectors can be helpful to create transformations of vectors. Graph each matrix expression as a vector in standard position and describe how each vector compares to vector $\vec{v}$.

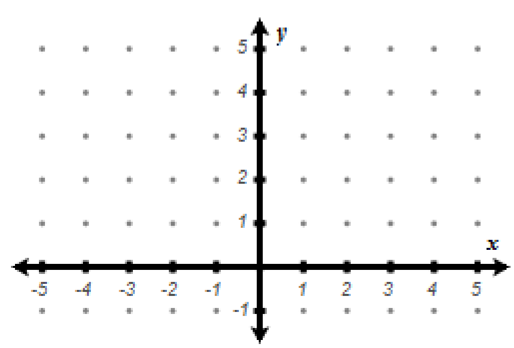
A. The vector $\vec{v}$: $\begin{bmatrix} 3 \\ 1 \end{bmatrix}$



B. The vector $\vec{u}$: $\begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix} \cdot \begin{bmatrix} 3 \\ 1 \end{bmatrix}$



C. The vector $\vec{w}$: $\begin{bmatrix} -2 & 0 \\ 0 & 2 \end{bmatrix} \cdot \begin{bmatrix} 3 \\ 1 \end{bmatrix}$



Here are the 2-dimensional vector transformation matrices.

Reflection Matrices

Reflect over <u>y-axis</u>	Reflect over <u>x-axis</u>	Reflect over *y = x*	Reflect over *y = – x*
$\begin{bmatrix} -1 & 0 \\ 0 & 1 \end{bmatrix}$	$\begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}$	$\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$	$\begin{bmatrix} 0 & -1 \\ -1 & 0 \end{bmatrix}$

Rotation Matrices about the Origin

Rotate by <u>90°</u>	Rotate by <u>180°</u>	Rotate by <u>270°</u>	Rotate by <u>θ°</u>
$\begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}$	$\begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix}$	$\begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix}$	$\begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix}$

3. **Given that vector $\vec{v}$ can be defined as $\vec{v}$: $\begin{bmatrix} a \\ b \end{bmatrix}$ describe what transformations take place with each of the following (compared to $\vec{v}$)**

   A. The vector $\vec{p}$: $3 \cdot \begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix} \cdot \begin{bmatrix} a \\ b \end{bmatrix}$

   B. The vector $\vec{q}$: $\begin{bmatrix} 4 & 0 \\ 0 & -4 \end{bmatrix} \cdot \begin{bmatrix} a \\ b \end{bmatrix}$

4. **Given that vector $\vec{u}$ can be defined as $\vec{u}$: $\begin{bmatrix} 2 \\ 6 \end{bmatrix}$, perform the following transformations on the vector.**

   A. Rotate vector $\vec{u}$ 180° about the origin and decrease the magnitude by ½ .

   B. Reflect vector $\vec{u}$ over the y – axis. Then, rotate 50° about the origin and finally, dilate it by a factor of 2.