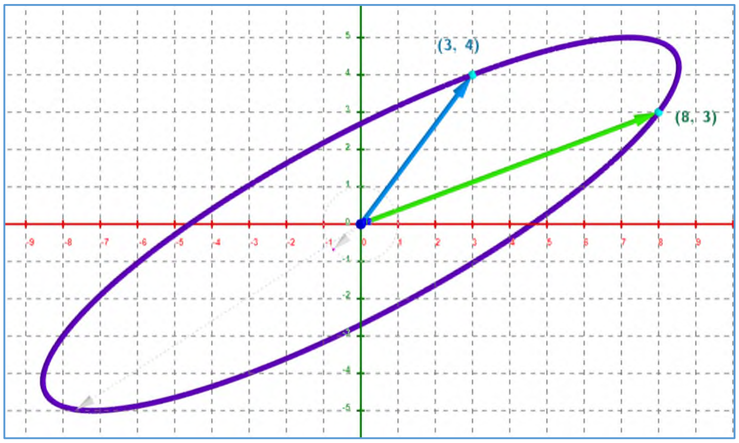
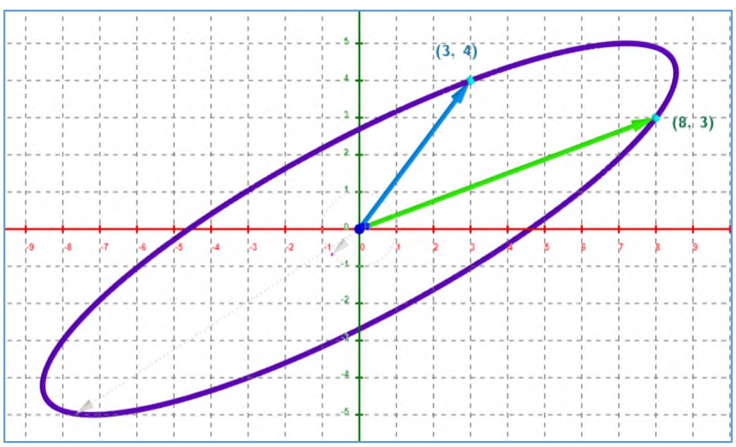
MT 255 Linear Algebra - Review Assessment

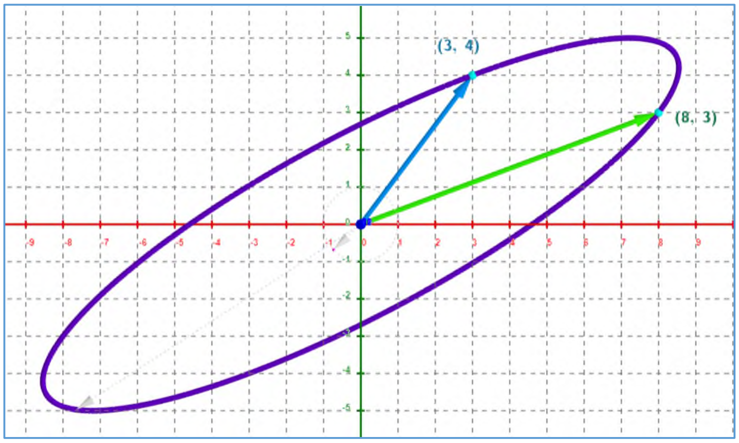
Using the Gram-Schmidt Process

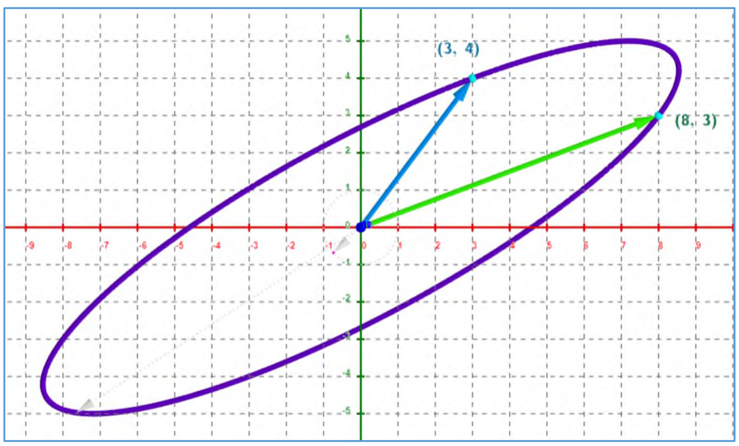
Given the following ellipse defined by $\begin{bmatrix}3\\4\end{bmatrix}$ and $\begin{bmatrix}8\\3\end{bmatrix}$, use the Gram-Schmidt Process to create a unit circle defined in a new coordinate system centered at the same origin (0, 0) as the one below.

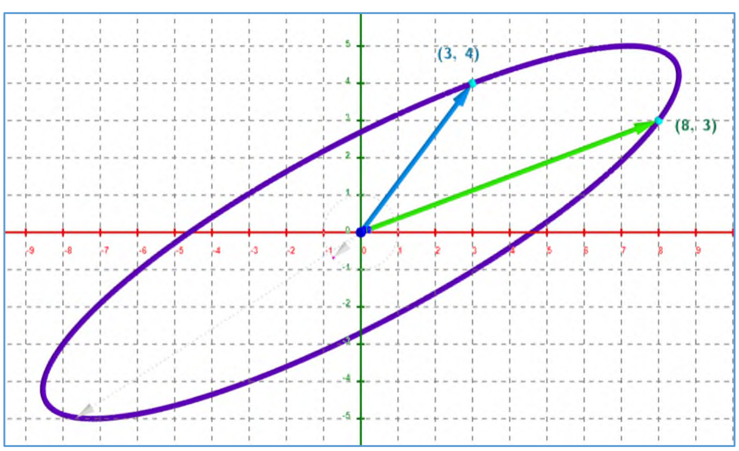
<u>**State, draw,** and **explain** every step of the process</u>. (Make use of the Gram-Schmidt Applet). Some successive pictures of the ellipse and defining vectors are given for you. Draw and label each step of the process on the picture, stating the mathematics deriving that step and explaining its meaning on the right of each picture. Add more pictures, as needed, to cover all necessary steps.











etc.

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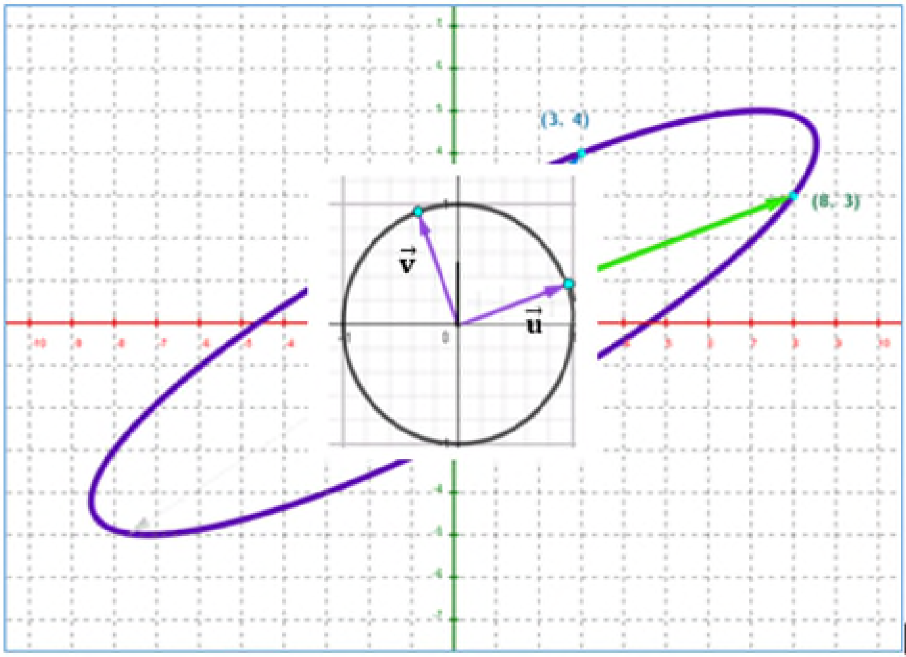
The result of applying the Gram-Schmidt process will lead to the following unit circle.



When you arrive at this step state the vectors $\vec{\mathbf{u}}$ and $\vec{\mathbf{v}}$ in **the standard coordinate system**. Write each vector as linear combination of the standard basis vectors $\left\{\begin{bmatrix}1\\0\end{bmatrix}, \begin{bmatrix}0\\1\end{bmatrix}\right\}$. State, draw, and label on this picture the corresponding point for each vector $\vec{\mathbf{u}}$ and $\vec{\mathbf{v}}$. (Recall, the corresponding point is the terminal point of the vector.) Show all work in arriving at your answer.

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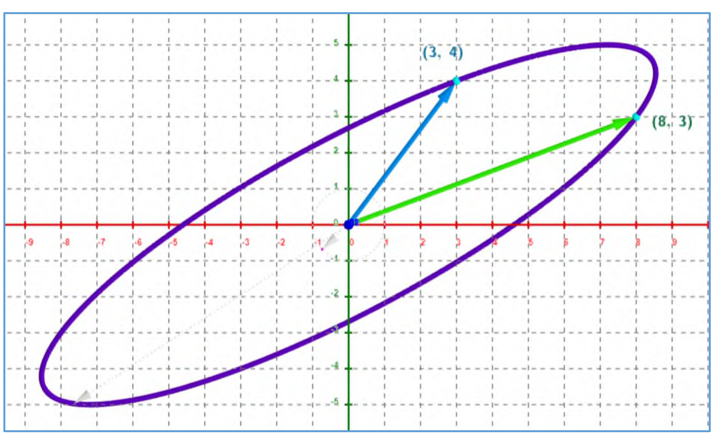
Use $\{\vec{\mathbf{u}}, \vec{\mathbf{v}}\}$ as a basis to **define a new coordinate system**. From the **Gram-Schmidt Applet** copy and then paste the new coordinate system to this assessment.

Then write each vector $\vec{\mathbf{u}}, \vec{\mathbf{v}}$ as a linear combination of the basis vectors $\vec{\mathbf{u}}$ and $\vec{\mathbf{v}}$**.** State, draw, and label the point at the end of each basis vector **in the new coordinate system**.

State what these points at the end of $\vec{\mathbf{u}}$ and $\vec{\mathbf{v}}$ correspond to in the standard coordinate system.

Given the point **(3, 4),** defined by $\begin{bmatrix} 3 \\ 4 \end{bmatrix}$, in **the standard coordinate system,** state the vector $\begin{bmatrix} 3 \\ 4 \end{bmatrix}$ as a linear combination in the **standard system**.



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Determine, **in the new coordinate system**, the point and vector corresponding to the point **(3, 4)** and vector $\begin{bmatrix} 3 \\ 4 \end{bmatrix}$ from the **standard system**. State the vector and point. Then draw and label the vector and the point **on a copy of the new coordinate system** placed here. (Use the Change of Basis Applet to determine this information and the copy of the coordinate system should be placed and labeled here) (Show all work)

Given the point **(2, 3),** defined by $\begin{bmatrix} \mathbf{2} \\ \mathbf{3} \end{bmatrix}$, in **the new coordinate system,** state the vector $\begin{bmatrix} 2 \\ 3 \end{bmatrix}$ as a linear combination in the **new system**.

Determine, **in the standard coordinate system**, the point and vector corresponding to the point **(2, 3)** and vector $\begin{bmatrix} 2 \\ 3 \end{bmatrix}$ from **the new system**. State the vector and point. Then draw and label the vector and the point **on a copy of the standard system**.

(Use the Change of Basis Applet to determine this information and the copy of the coordinate system should be placed and labeled here) (Show all work)