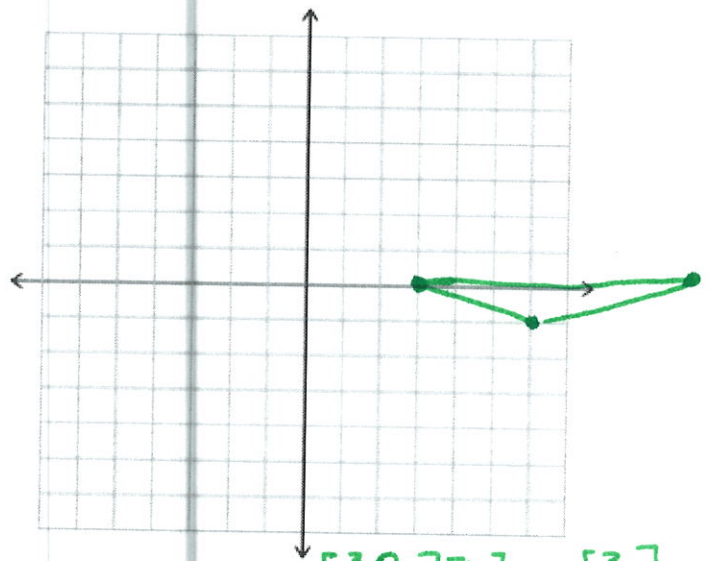
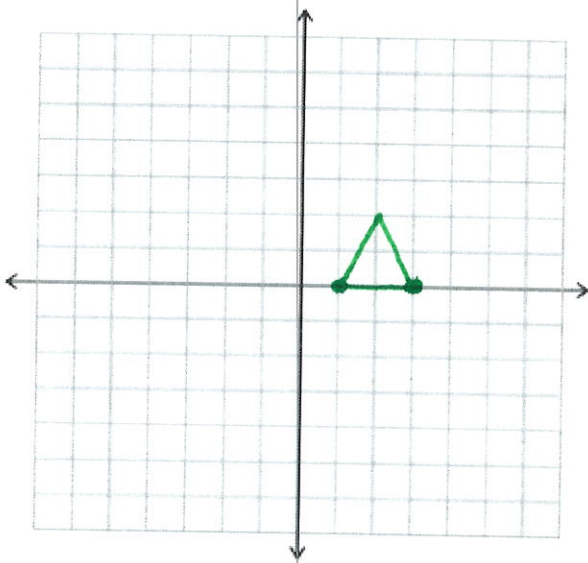


**Instructions:** Show all work. Some problems will instruct you to complete operations by hand, some can be done in the calculator. To show work on calculator problems, show the commands you used, and the resulting matrices. **Give exact answers** (yes, that means fractions, square roots and exponentials, and not decimals) unless specifically directed to give a decimal answer. This will require some operations to be done by hand even if not specifically directed to. Be sure to complete all parts of each question.

- Let  $T: R^2 \rightarrow R^2$  be the transformation that performs a horizontal stretch by 3, a vertical contraction by 2, followed by a reflection over the  $x$ -axis. Write the matrix of the transformation, then use it to transform a triangle with vertices  $(1,0)$ ,  $(3,0)$ ,  $(2,2)$ . Sketch the triangle before and after the transformation on the graphs below.



$$\begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix} \begin{bmatrix} 1 & 0 \\ 0 & \frac{1}{2} \end{bmatrix} \begin{bmatrix} 3 & 0 \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} 3 & 0 \\ 0 & -\frac{1}{2} \end{bmatrix}$$

$$\begin{bmatrix} 3 & 0 \\ 0 & -\frac{1}{2} \end{bmatrix} \begin{bmatrix} 1 \\ 0 \end{bmatrix} = \begin{bmatrix} 3 \\ 0 \end{bmatrix}$$

$$\begin{bmatrix} 3 & 0 \\ 0 & -\frac{1}{2} \end{bmatrix} \begin{bmatrix} 3 \\ 0 \end{bmatrix} = \begin{bmatrix} 9 \\ 0 \end{bmatrix}$$

$$\begin{bmatrix} 3 & 0 \\ 0 & -\frac{1}{2} \end{bmatrix} \begin{bmatrix} 2 \\ 2 \end{bmatrix} = \begin{bmatrix} 6 \\ -1 \end{bmatrix}$$

- Define  $S = \{e^x, e^{-x}, xe^x, xe^{-x}\}$ . If  $T = \frac{d}{dx}[f(x)]$  for  $f(x)$  in  $S$ . Find the matrix of the transformation.

$$\begin{bmatrix} 1 \\ 0 \\ 0 \\ 0 \end{bmatrix} \Rightarrow \begin{bmatrix} 1 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

$$\begin{bmatrix} 0 \\ 1 \\ 0 \\ 0 \end{bmatrix} \Rightarrow \begin{bmatrix} 0 \\ -1 \\ 0 \\ 0 \end{bmatrix}$$

$$\begin{bmatrix} 0 \\ 0 \\ 1 \\ 0 \end{bmatrix} \Rightarrow \begin{bmatrix} 0 \\ 0 \\ 1 \\ 0 \end{bmatrix}$$

$$\begin{bmatrix} 0 \\ 0 \\ 0 \\ 1 \end{bmatrix} \Rightarrow \begin{bmatrix} 0 \\ 0 \\ -1 \\ 1 \end{bmatrix}$$

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

$$e^x \rightarrow e^x$$

$$e^{-x} \rightarrow -e^{-x}$$

$$xe^x \rightarrow e^x + xe^x$$

$$xe^{-x} \rightarrow e^{-x} - xe^{-x}$$