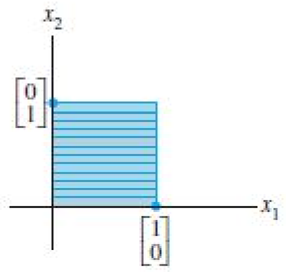
Assignment - 9



1. Linear transformations from R^2 to R^2 are determined completely by looking at what they do to $\begin{bmatrix}1\\0\end{bmatrix}$ and $\begin{bmatrix}0\\1\end{bmatrix}$. Using this fact and looking at image of unit square, write matrix of following linear transformations described geometrically.
   (a) Reflection through the x-axis.
   (b) Reflection through the y-axis.
   (c) Reflection through the line $x_2 = x_1$.
   (d) Reflection through the line $x_2 = -x_1$.
   (e) Reflection through the origin.

For each of the following linear transformation T, write matrix of T w.r.t. standard basis on both sides.

1. $T : R^2 \to R^2$ is a vertical shear transformation that maps e_1 into $e_1 - 3e_2$, but leaves e_2 unchanged. (draw and try to understand shear transforation)
2. $T : R^2 \to R^2$ is a horizontal shear transformation that maps e_2 into e_2+2e_1 , but leaves e_1 unchanged. (draw and try to understand shear transforation)
3. $T : R^2 \to R^2$ linear transformation which rotates points **counterclockwise** about the origin through the angle $\frac{\pi}{2}$.
4. $T : R^2 \to R^2$ linear transformation which rotates points **clockwise** about the origin through the angle $(-\frac{3\pi}{2})$.
5. $T : R^2 \to R^2$ linear transformation which rotates points **clockwise** about the origin through the angle $(-\frac{3\pi}{4})$ and then reflects points through the x-axis.
6. $T : R^4 \to R^4$ linear transformation $T(x_1, x_2, x_3, x_4) = (x_1 + 2x_2, 0, 2x_2 + x_4, x_2 - x_4)$
7. $T : R^4 \to R^2$ linear transformation $T(x_1, x_2, x_3, x_4) = (x_1 - 5x_2 + 4x_3, x_2 - 6x_3)$
8. $T : R^4 \to R$ linear transformation $T(x_1, x_2, x_3, x_4) = 3x_1 + 4x_3 - 2x_4$