Math 320 Linear Algebra
Assignment # 5

1. Let $T : \mathbb{R}^2 \to \mathbb{R}^2$ be defined by rotating every vector by $2\pi/3$ ($120°$) counter-clockwise. Find the standard matrix of this transformation.

2. Let:

$$A = \begin{bmatrix} -4 & -8 & -2 & -8 & -7 \\ 1 & 2 & 0 & 0 & -1 \\ 2 & 4 & 1 & 4 & 7/2 \\ 2 & 4 & 1 & 0 & -5/2 \end{bmatrix}$$

   and define $T : \mathbb{R}^n \to \mathbb{R}^m$ defined by $T(\vec{v}) = A\vec{v}$.

   (a) What are m and n?

   (b) Use the Gauss-Jordon algorithm to show that A reduces to:

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

   (c) Is T one-to-one?

   (d) Is T onto?

   (e) Find $\vec{b} \in \mathbb{R}^4$ such that $\vec{b} \notin \mathrm{Im}(T)$.