

Math 320 Linear Algebra Assignment # 7

1. Let $T : \mathbb{R}^2 \rightarrow \mathbb{R}^2$ 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 $T : \mathbb{R}^n \rightarrow \mathbb{R}^m$ defined by $T(\vec{v}) = A\vec{v}$.

(a) What are m and n ?

(b) Use the Gauss-Jordan 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) By working the steps of part (b) backwards to find \vec{b} so that $[A \mid \vec{b}]$ reduces to:

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