

Homework 8 MATH 304 Section 3 *Solution*

Assigned: Wednesday, October 8.
 Potentially Collected: Wednesday, October 15.

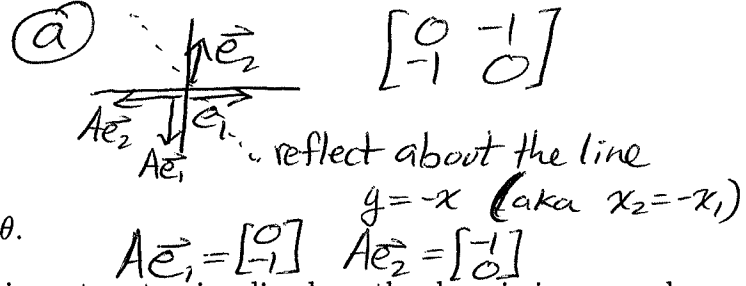
1. Find the standard basis matrix for the linear transformation $T: \mathbb{R}^2 \rightarrow \mathbb{R}^2$ that maps a point (x_1, x_2) into

(a) its reflection about the line $x_2 = -x_1$.

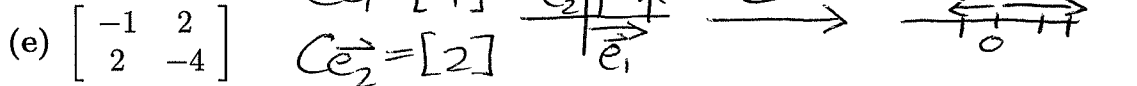
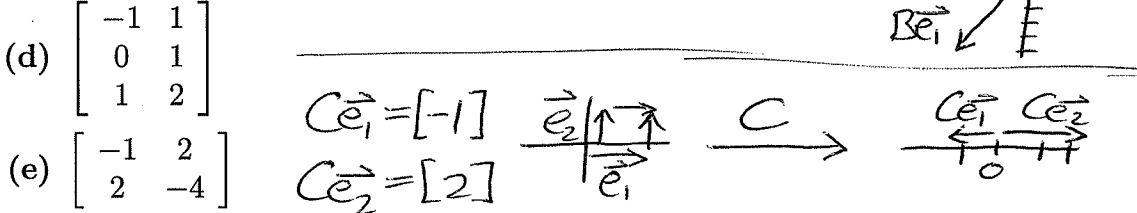
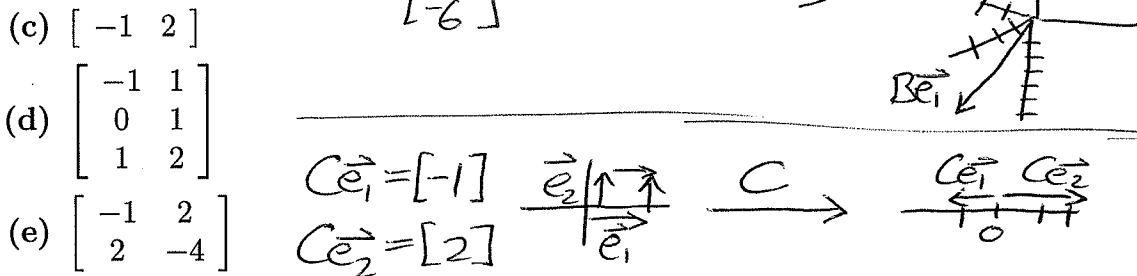
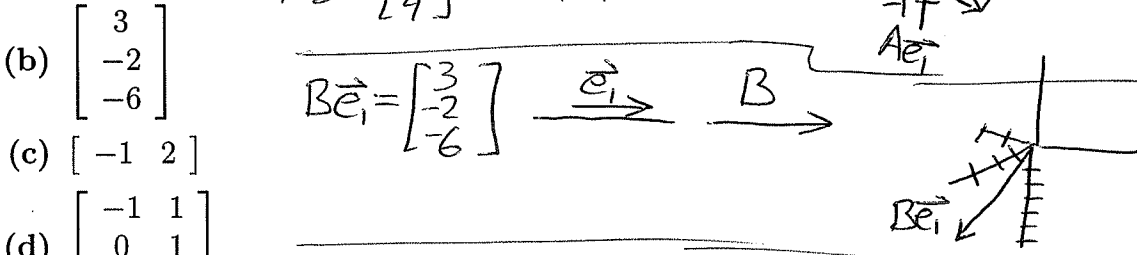
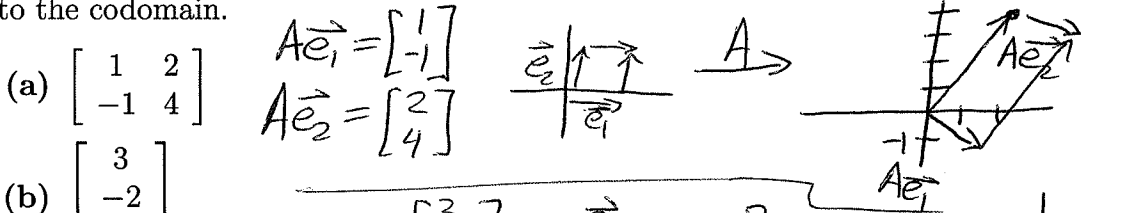
(b) its projection on the x_1 -axis.

(c) its projection on the x_2 -axis.

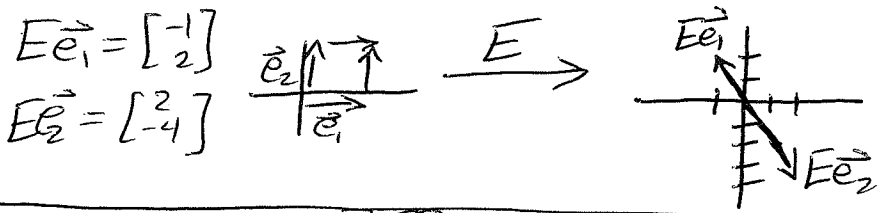
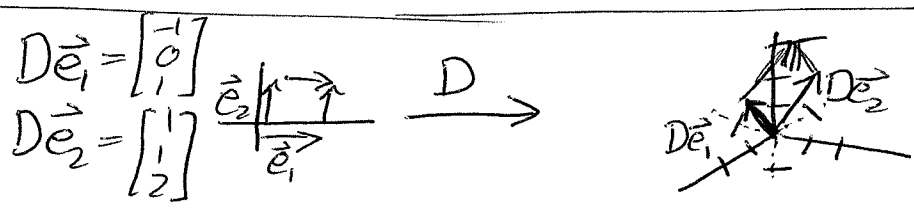
(d) its rotation clockwise through an angle of θ .



2. For each of the matrices below, use standard basis vectors to visualize how the domain is mapped to the codomain.



(b) projection sends (x_1, x_2) to $(x_1, 0)$
 B
 $Be_1 = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$, $Be_2 = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$
 $\begin{bmatrix} 1 & 0 \\ 0 & 0 \end{bmatrix}$



(c) Projection sends (x_1, x_2) to $(0, x_2)$
 C
 $Ce_1 = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$ $Ce_2 = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$
 $\begin{bmatrix} 0 & 0 \\ 0 & 1 \end{bmatrix}$

(d) θ counter-clockwise rotation (see class notes)
 $\begin{bmatrix} \cos \theta & -\sin \theta \\ \sin \theta & \cos \theta \end{bmatrix}$
 a clockwise rotation is $-\theta$ of counter-clockwise
 $\begin{bmatrix} \cos(-\theta) & -\sin(-\theta) \\ \sin(-\theta) & \cos(-\theta) \end{bmatrix}$