

Matrices & Linear Algebra II  
C Term, Section C01  
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### Linear Algebra Assignment 4

**DUE DATE:** Wednesday, February 11, by 4pm in my mailbox, SH108. Alternatively, you may hand your completed assignment to me personally.

Please keep in mind the presentation rules for assignments in this course.

The following problems are worth 10 points each.

- 1.) Problem # 4 on page 84 in the text.
- 2.) Let  $T : \mathbb{R}^2 \rightarrow \mathbb{R}^2$  be a rotation about the origin by 150 degrees counterclockwise. Find the matrix representing  $T$ 
  - (a) with respect to the standard ordered basis
  - (b) with respect to the ordered basis  $\gamma = \{(2, 1), (1, -2)\}$ .
- 3.) In  $\mathbb{R}^3$ , let  $T$  be the linear transformation representing rotation about the axis joining the origin to  $(1, 1, 0)$  by an angle of 30 degrees counterclockwise. (We have to define counterclockwise: say the viewer is at  $(10, 10, 0)$  looking toward the origin.) Find the matrix representing  $T$ 
  - (a) with respect to the ordered basis  $\gamma = \{(\sqrt{2}, \sqrt{2}, 0), (\sqrt{2}, -\sqrt{2}, 0), (0, 0, 1)\}$ .
  - (b) with respect to the standard ordered basis
- 4.) An engineer tracking stress in a steel beam observes that markers placed at time zero at positions  $(4, 4)$  and  $(4, 3)$  have moved to positions  $(3.9, 4.2)$  and  $(3.95, 3.1)$  respectively at time one (six months later). Assuming that this motion is a shear along some axis (and with respect to some origin), find an expression for the corresponding linear transformation  $T$  by giving
  - the origin of your coordinate system
  - a basis  $\beta$  for your coordinate system
  - the matrix  $[T]_\beta$  representing  $T$  with respect to this coordinate system.
- 5.) Continuing with the scenario in Problem 4, Suppose now that the steel beam will fail when the point  $(1, 1)$  collides with the line  $3x - y = 9$ . At what time will this happen? Assume that every six months, the system evolution is described by the linear operator  $T$ . [HINT: The answer will be an integer number of years.]