Homework, MA 213 **Due: 2014-Nov-17**

You may work with others to figure out how to do questions, and you are welcome to look for answers in the book, online, by talking to someone who had the course before, etc. However, you must write the answers on your own. You must also show your work (you may, of course, quote any result from the book).

1. Find the determinant.

   (a) $\begin{vmatrix} 1 & 4 \\ 2 & 8 \end{vmatrix}$

   (b) $\begin{vmatrix} 2 & 1 & 1 \\ 1 & 1 & 0 \\ 6 & 4 & 1 \end{vmatrix}$

2. Consider the linear transformation $t\colon \mathbb{R}^3 \to \mathbb{R}^3$ represented with respect to the standard bases by this matrix.

$$\begin{pmatrix} 1 & 0 & -1 \\ 3 & 1 & 1 \\ -1 & 0 & 3 \end{pmatrix}$$

   (a) Compute the determinant of the matrix.

   (b) Find the size of the box defined by these vectors.

$$\begin{pmatrix} 1 \\ -1 \\ 2 \end{pmatrix} \quad \begin{pmatrix} 2 \\ 0 \\ -1 \end{pmatrix} \quad \begin{pmatrix} 1 \\ 1 \\ 0 \end{pmatrix}$$

   Wht is its orientation?

   (c) Find the image under t of the vectors in the prior item and find the size of the box that they define.

3. Consider this transformation of $\mathbb{R}^3$.

$$t(\begin{pmatrix} x \\ y \\ z \end{pmatrix}) = \begin{pmatrix} x - z \\ z \\ 2y \end{pmatrix}$$

   Consider also these two bases.

$$B = \langle \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}, \begin{pmatrix} 0 \\ 1 \\ 0 \end{pmatrix}, \begin{pmatrix} 0 \\ 0 \\ 1 \end{pmatrix} \rangle \qquad D = \langle \begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix}, \begin{pmatrix} 1 \\ 1 \\ 0 \end{pmatrix}, \begin{pmatrix} 1 \\ 0 \\ 1 \end{pmatrix} \rangle$$

   We will represent the transformation using two similar matrices.

   (a) Draw the arrow diagram.

   (b) Compute $T = \mathrm{Rep}_{B,B}(t)$.

   (c) Compute $\hat{T} = \mathrm{Rep}_{D,D}(t)$.

   (d) Compute the matrices for other two sides of the arrow square.