Homework, MA 213 **Due: 2014-Oct-24**

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. Verify that each map is a homomorphism.

   (a) $h\colon \mathcal{P}_3 \to \mathbb{R}^2$ given by

   $$ax^2 + bx + c \mapsto \begin{pmatrix} a+b \\ a+c \end{pmatrix}$$

   (b) $f\colon \mathbb{R}^2 \to \mathbb{R}^3$ given by

   $$\begin{pmatrix} x \\ y \end{pmatrix} \mapsto \begin{pmatrix} 0 \\ x-y \\ 3y \end{pmatrix}$$

2. For each map in the prior question, describe the rangespace and find the rank of the map.

3. Verify that this map is an isomorphism: $h\colon \mathbb{R}^4 \to \mathcal{M}_{2\times 2}$ given by

   $$\begin{pmatrix} a \\ b \\ c \\ d \end{pmatrix} \mapsto \begin{pmatrix} c & a+d \\ b & d \end{pmatrix}$$