Linear Algebra (MATH 3333 - 04) Spring 2011
Homework 8

Due: Fri. Apr. 8, start of class

Instructions: Please read the homework policies and guidelines posted on the course webpage. You may **not** use a calculator (or computer). Make sure to write your name, course and section numbers in the top right corner of your solution set, as well as the assignment number on top. Please staple your homework. Sections and exercises refer to the exercises in the required course text.

Reading

Sections 4.6, 4.8, 4.9

Conceptual Questions (not to be turned in)

1. How can you determine the image of a linear transformation?

Written Assignment

Total: 100 points

Each problem is worth 10 points.

Section 4.6: 20, 41, 44

Section 4.8: 2, 4, 8

Section 4.9: 1, 10 (just column rank)

Problem A. Consider the linear transformation $A : \mathbb{R}^3 \to \mathbb{R}^3$ given by the matrix

$$A = \begin{pmatrix} 1 & 2 & 3 \\ 1 & 1 & 2 \\ 1 & 4 & 5 \end{pmatrix}.$$

Find the rank and image of A.

Problem B. Consider an arbitrary linear transformation $A : \mathbb{R}^2 \to \mathbb{R}^2$ given by $A = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$.

(i) Show that if A is a projection (the image of A is either a line or a point), then $\det(A) := ad - bc = 0$.
(ii) Show the converse is also true, i.e., if $ad - bc = 0$, then A is a projection.