Math 322 Written Homework 3 due **Thursday February 9**

Please write up complete, clear solutions on your own paper. We will be looking for your reasoning and explanations, not just a correct answer. Please copy each question and write neatly.

This assignment covers material in sections 1.8, and 1.9. The textbook is a helpful reference for these. You can also get help via email (ewhitaker@uky.edu), via office hours (stop by or make an appointment) or possibly in the Mathskeller (depending on who is tutoring at the time).

1. For each transformation T find the standard matrix A, and find m and n so that $T:\mathbb{R}^n \to \mathbb{R}^m$.

   a. $T\left(\begin{bmatrix} x \\ y \end{bmatrix}\right) = \begin{bmatrix} x+y \\ x \\ -y \end{bmatrix}$

   b. $T(x_1, x_2, x_3, x_4) = (x_1 + 5x_2,\ x_1 + 2x_3,\ x_2 - x_3)$

2. An affine transformation $T:\mathbb{R}^n \to \mathbb{R}^m$ has the form $T(\mathbf{x}) = A\mathbf{x} + \mathbf{b}$ with A an $m \times n$ matrix, and $\mathbf{b}$ in $\mathbb{R}^m$. Show T is not a linear transformation if $\mathbf{b} \neq 0$.

3. Suppose T is a linear transformation $T:\mathbb{R}^n \to \mathbb{R}^m$. Can you give a relationship between m and n
   a. if T is onto,?
   b. if T is one-to-one?

4. Let T is a linear transformation from $\mathbb{R}^2 \to \mathbb{R}^2$ which first reflects points through the horizontal x axis and then reflects points through the line $y = x$. Find the standard matrix associated to this linear transformation.