**MATH 202B, Quiz 1**
**Time: 60 minutes**

**Your name** (print): . . . . . . . . . . . . . . . . . . . . . . . . . . . . .

*Please show all work. Books, notes and calculators are not permitted on this exam. Do not discuss the quiz with anyone until after the 3PM Friday deadline.*

**Write** below and **sign** the Pledge: *I pledge my honor that I have not violated the Honor Code during this examination.*

**1.(8pts)** Set up and solve a linear system to find all vectors $\vec{x}$ in 3-space that are simultaneously perpendicular to the vectors $(1,1,1)$ and $(2,1,3)$. Interpret your results geometrically.

**2. (a)(8pts)** Find a matrix for projection in $\mathbf{R}^2$ onto the line through the origin of slope 3.

**(b)(8pts)** Find a matrix for all linear transformations $T$ from $\mathbf{R}^2$ to $\mathbf{R}^2$ such that

$$T\begin{bmatrix} 1 \\ 2 \end{bmatrix} = \begin{bmatrix} 3 \\ 4 \end{bmatrix} \text{ and } T\begin{bmatrix} 1 \\ 3 \end{bmatrix} = \begin{bmatrix} 4 \\ 5 \end{bmatrix}$$

**(c)(8pts)** Show that the transformation given below is a shear along the line of slope 1 through the origin.

$$T\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} x_1/2 + x_2/2 \\ -x_1/2 + 3x_2/2 \end{bmatrix}$$

**3. (a)(8pts)** Find a $2 \times 2$ matrix A with no zero entries such that $A^2 = 0$.

**(b)(8pts)** Find all $2 \times 2$ matrices A that commute with counterclockwise rotation by 90 degrees.