# MATH 2270: QUIZ 3

**1. (2 points)** Write down the matrix for the transformation $T: \mathbb{R}^2 \to \mathbb{R}^2$ that first rotates a vector by 90 degrees (counterclockwise) and then flips across the horizontal $x_1$-axis.

**2. (4 points)** Write down a $2 \times 4$ matrix $A$ in echelon form that corresponds to an **onto** map from $\mathbb{R}^4 \to \mathbb{R}^2$.

Write down a $3 \times 3$ matrix $B$ that is 1 to 1. Is your $B$ onto as well? Explain why or why not.

**THERE ARE PROBLEMS ON THE BACK SIDE OF THIS QUIZ**

**3. (1 point each)** Short answer (no justification needed).

A) If $A$ is an $n \times m$ matrix that defines an onto linear transformation, then what is the span of the columns?

B) Explain why you can quickly see that the matrix

$$\begin{pmatrix} 1 & 2 & 7 \\ 2 & 4 & -1 \\ 6 & 12 & 0 \end{pmatrix}$$

does not define a 1-1 transformation.

C) If $T : \mathbb{R}^2 \to \mathbb{R}^2$ with $T(\mathbf{e_1}) = 2\mathbf{e_2}$ and $T(\mathbf{e_2}) = 3\mathbf{e_1}$, write down the matrix for $T$.

D) With $T$ as in part $C$ can you find the matrix for $T^5$? i.e, the map that applies $T$ five times? (Hint: You can do it without multiplying matrices... )