Quiz 7; Tuesday, October 18
MATH 54 with Ming Gu
GSI: Eric Hallman

Student name:

You have 15 minutes to complete the quiz. Calculators are not permitted.

1. (4 points) Find the QR factorization of the matrix $\begin{bmatrix} 0 & 3 \\ 1 & -2 \end{bmatrix}$. In other words, write the matrix as a product QR, where Q is orthogonal and R is upper triangular.

2. (4 points) Let $\mathbf{u}$ be a unit vector in $\mathbb{R}^2$ and let $\mathbf{x}$ be a vector such that $\mathbf{u}^T\mathbf{x} = -2$ and that $\mathbf{x}$ and $\mathbf{u}$ are linearly independent. Sketch and label $\mathbf{u}$, $\mathbf{x}$, $\text{proj}_{\mathbf{u}}(\mathbf{x})$, and $\mathbf{x} - \text{proj}_{\mathbf{u}}(\mathbf{x})$. There may be multiple correct sketches.

3. (4 points) Mark each statement as True or False. You do not have to explain your reasoning.

    (a) If L is a line through $\mathbf{0}$ and $\hat{\mathbf{y}}$ is the orthogonal projection of $\mathbf{y}$ onto L, then $\|\hat{\mathbf{y}}\|$ gives the distance from $\mathbf{y}$ to L.

    (b) For any subspace W and vector $\mathbf{x}$, $\mathbf{x} - \mathrm{proj}_W \mathbf{x}$ *must* be an element of $W^\perp$.

    (c) For any matrix U, $UU^T\mathbf{y}$ is the projection of $\mathbf{y}$ onto the span of U.

    (d) If Q is an orthogonal matrix then Q^{-1} is also an orthogonal matrix.