

Score:

Name: _____

Period (circle one): 1 2 3 4 5 6

Team (circle one): a b c d e f

SM 261 – Matrix Algebra – Quiz 22 – Open Notes Section 5.4 – Transformations

1. Find the projection and reflection of the vector $\vec{u} = \begin{bmatrix} 2 \\ 2 \end{bmatrix}$ on the line $2x - y = 0$.

$$\vec{V}_{\parallel} = \begin{bmatrix} 1 \\ 2 \end{bmatrix} \quad \vec{V}_{\perp} = \begin{bmatrix} -2 \\ -1 \end{bmatrix}$$

$$\Rightarrow c_1 \begin{bmatrix} 1 \\ 2 \end{bmatrix} + c_2 \begin{bmatrix} -2 \\ -1 \end{bmatrix} = \begin{bmatrix} 2 \\ 2 \end{bmatrix}$$

"Finding coordinates"

$$\Rightarrow \text{res} \begin{bmatrix} 1 & -2 & 2 \\ 2 & 1 & 2 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 1.2 \\ 0 & 1 & -1.4 \end{bmatrix} \Rightarrow \begin{bmatrix} \vec{x} \\ \vec{y} \end{bmatrix}_B = \begin{bmatrix} 1.2 \\ -1.4 \end{bmatrix}$$

Projection (perpendicular component goes away)

$$\Rightarrow \begin{bmatrix} \vec{x} \\ \vec{y} \end{bmatrix}_{B(\text{proj})} = \begin{bmatrix} 1.2 \\ 0 \end{bmatrix} \Rightarrow \vec{u}_{\text{proj}} = 1.2 \begin{bmatrix} 1 \\ 2 \end{bmatrix} + 0 \begin{bmatrix} -2 \\ -1 \end{bmatrix} = \begin{bmatrix} 1.2 \\ 2.4 \end{bmatrix}$$

Reflection (perpendicular component goes negative)

$$\Rightarrow \begin{bmatrix} \vec{x} \\ \vec{y} \end{bmatrix}_{B(\text{res})} = \begin{bmatrix} 1.2 \\ -1.4 \end{bmatrix} \Rightarrow \vec{u}_{\text{res}} = 1.2 \begin{bmatrix} 1 \\ 2 \end{bmatrix} + (-1.4) \begin{bmatrix} -2 \\ -1 \end{bmatrix}$$

$$= \begin{bmatrix} 1.2 \\ 2.4 \end{bmatrix} + \begin{bmatrix} -2.8 \\ 1.4 \end{bmatrix} = \begin{bmatrix} -1.6 \\ 3.8 \end{bmatrix}$$