MATH 2050 **Assignment 4** **Fall 2018**

Due: Thursday, Oct. 11

[5] 1. Let $\vec{u} = \begin{bmatrix} 2 \\ 2 \\ 3 \end{bmatrix}$ and $\vec{v} = \begin{bmatrix} 1 \\ 1 \\ -1 \end{bmatrix}$. Find the projection of $\vec{u}$ onto $\vec{v}$; and the projection of $\vec{v}$ onto $\vec{u}$ respectively.

[10] 2. (a) Find two orthogonal vectors in the plane $x + y - 2z = 0$.

(b) Find the projection of $\vec{u} = \begin{bmatrix} 2 \\ 1 \\ 3 \end{bmatrix}$ onto the plane $x + y - 2z = 0$.

[5] 3. Calculate the distance from point $P(1, 2, 1)$ to the line $\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 1+t \\ 2-2t \\ 2t-1 \end{bmatrix}$.

[5] 4. Calculate the distance from point $P(1, 2, 1)$ to the plane $2x - y + 2z = 1$.

[5] 5. Are vectors $\vec{u} = \begin{bmatrix} 1 \\ -1 \\ 1 \end{bmatrix}$, $\vec{v} = \begin{bmatrix} -1 \\ 1 \\ 2 \end{bmatrix}$, $\vec{w} = \begin{bmatrix} 0 \\ 1 \\ 1 \end{bmatrix}$, and $\vec{x} = \begin{bmatrix} -1 \\ 0 \\ 1 \end{bmatrix}$ linearly independent?

[10] 6. Let $\vec{u} = \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix}$, $\vec{v} = \begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix}$ and $\vec{w} = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$.

(a) Show that $\vec{u}$, $\vec{v}$ and $\vec{w}$ are linearly independent.

(b) Show that any 3-dimensional vector $\vec{x} = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$ can be written as a linear combination of $\vec{u}$, $\vec{v}$ and $\vec{w}$.

[10] 7. Let $\vec{u} = \begin{bmatrix} 1 \\ -2 \\ 2 \end{bmatrix}$, $\vec{v} = \begin{bmatrix} -2 \\ 1 \\ -1 \end{bmatrix}$, and $\vec{w} = \begin{bmatrix} -1 \\ -1 \\ 1 \end{bmatrix}$.

(a) Are $\vec{u}$, $\vec{v}$ and $\vec{w}$ linearly independent?

(b) Can any 3-dimensional vector be written as a linear combination of $\vec{u}$, $\vec{v}$ and $\vec{w}$? If yes, please show your reason; if no, please provide one example.

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