MEMORIAL UNIVERSITY OF NEWFOUNDLAND
DEPARTMENT OF MATHEMATICS AND STATISTICS

ASSIGNMENT 3   **MATH 2050**   WINTER 2018

Due: Monday, February 5th, 2018. SHOW ALL WORK.

> **Note:** You should complete the worksheets for Sections 1.4 and 1.5 before you work on this assignment.

1. Consider the vectors $\mathbf{u} = \begin{bmatrix} 2 \\ -3 \\ 0 \end{bmatrix}$ and $\mathbf{v} = \begin{bmatrix} 4 \\ 1 \\ -1 \end{bmatrix}$.

   (a) Find the projection of $\mathbf{u}$ onto $\mathbf{v}$.

   (b) Find the projection of $\mathbf{v}$ onto $\mathbf{u}$.

2. Consider the plane π with equation $x - 2y + 3z = 0$.

   (a) Find two orthogonal vectors which span π.

   (b) Find the projection of the vector $\mathbf{t} = \begin{bmatrix} 1 \\ -1 \\ 1 \end{bmatrix}$ onto π.

3. Consider the plane π with equation $y - 3z = 7$. Find the point in π which is closest to the point $P(-2, 1, -4)$.

4. Consider the line ℓ with vector equation

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} -1 \\ 3 \\ -4 \end{bmatrix} + t \begin{bmatrix} 2 \\ -1 \\ 1 \end{bmatrix}.$$

   Find the distance from the origin to ℓ.

PLEASE TURN OVER

5. Given

$$\mathbf{u} = \begin{bmatrix} 2 \\ 7 \\ -3 \\ 4 \end{bmatrix} \quad \text{and} \quad \mathbf{v} = \begin{bmatrix} 5 \\ -1 \\ 5 \\ 4 \end{bmatrix}$$

find all values of k, if any, such that $\mathbf{u}$ is orthogonal to $\mathbf{u} + k\mathbf{v}$.

6. Determine whether each of the following sets of vectors is linearly independent or linearly dependent.

(a) $\mathbf{u}_1 = \begin{bmatrix} 5 \\ -3 \\ 9 \end{bmatrix}$, $\mathbf{u}_2 = \begin{bmatrix} -6 \\ -2 \\ -1 \end{bmatrix}$, $\mathbf{u}_3 = \begin{bmatrix} -3 \\ 1 \\ -4 \end{bmatrix}$

(b) $\mathbf{u}_1 = \begin{bmatrix} 5 \\ 0 \\ -2 \\ 8 \end{bmatrix}$, $\mathbf{u}_2 = \begin{bmatrix} 0 \\ 3 \\ 2 \\ 0 \end{bmatrix}$, $\mathbf{u}_3 = \begin{bmatrix} -1 \\ -4 \\ 2 \\ 0 \end{bmatrix}$, $\mathbf{u}_4 = \begin{bmatrix} 2 \\ -4 \\ 1 \\ 3 \end{bmatrix}$