CAMOSUN

Name: _____

Mark: ____/25

MATH 251
Assignment 1

1. (4 marks) Consider two points A and B in $\mathbb{R}^3$. Suppose $A = (3, 0, 2)$ and $\overrightarrow{AB} = \begin{bmatrix} 2 \\ -3 \\ 6 \end{bmatrix}$.

   (a) Find the coordinates of point B.

   (b) Find two distinct unit vectors that are parallel to $\overrightarrow{AB}$.

   (c) Find parametric equations for the line passing through points A and B.

   (d) At what point does the line from part (c) intersect the xy-plane?

2. (7 marks) Consider the three points

$$A = (2, 0, -5), \qquad B = (8, 2, -9), \qquad C = (7, 9, -7).$$

(a) Find the area of triangle $\triangle ABC$. Give an exact, simplified answer.

(b) Find the angle $0° \leq \theta \leq 180°$ between $\overrightarrow{AB}$ and $\overrightarrow{AC}$. Round your answer to two decimal places.

(c) Determine whether or not $\triangle ABC$ is a right triangle.

(d) Find the equation, in general form, of the plane passing through the points A, B, and C.

3. (3 marks) Using projections, find the distance between the parallel planes $x + y - 2z = 2$ and $x + y - 2z = 4$. Given an exact, simplified answer.

4. (3 marks) Let $\mathbf{u} = [-4, 0, 3]$ and $\mathbf{v} = [2, 5, 1]$. Find vectors $\mathbf{p}$ and $\mathbf{q}$ so that $\mathbf{v} = \mathbf{p} + \mathbf{q}$, $\mathbf{p}$ is parallel to $\mathbf{u}$, and $\mathbf{q}$ is orthogonal to $\mathbf{u}$. *[Hint: Use projections to find one of the vectors.]*

5. (3 marks) Find an equation, in parametric form, of the line passing through the point $P = (1, 2, -1)$ and orthogonal to the plane defined by

$$\begin{cases} x = 6 + 2s - t \\ y = 1 - 3s + 5t \\ z = -7 + s - t. \end{cases}$$

6. (3 marks) Find the vector form of the equation of the plane $3x - 4y + 2z = 12$.

7. (2 marks) Find the value(s) of k such that the vector

$$\mathbf{v} = \begin{bmatrix} -1 \\ k \\ 2 \end{bmatrix}$$

is orthogonal to the plane $2x + 3y - 4z = 0$.