



Name: \_\_\_\_\_

**MATH 251 (Winter, 2019)**

**Term Test 1**

**by George Ballinger**

Answer the questions in the space provided.  
This test has 5 questions for a total of 25 marks.

1. (6 marks) Consider the three points

$$A = (1, 2, 2), \quad B = (1, 0, 3), \quad C = (0, 2, 1).$$

- (a) Find parametric equations for the line passing through points  $A$  and  $B$ .
- (b) At what point does the line from part (a) intersect the  $xy$ -plane?
- (c) Find an equation in the general form  $ax + by + cz = d$  for the plane containing the three points  $A$ ,  $B$  and  $C$ .

2. (5 marks) Consider the line through the point  $P = (3, -1, 2)$  with direction vector

$$\mathbf{d} = \begin{bmatrix} -1 \\ 0 \\ 2 \end{bmatrix}.$$

Find the distance from the point  $A = (-5, 4, 3)$  to the line. Give an exact answer.

3. (5 marks) Consider the vectors

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

- (a) Determine whether or not  $\mathbf{u}$  or  $\mathbf{v}$  are unit vectors.
- (b) Find the angle  $0^\circ \leq \theta \leq 180^\circ$  between  $\mathbf{u}$  and  $\mathbf{v}$ . Round your answer to the nearest degree.
- (c) Find the area of the triangle formed by  $\mathbf{u}$ ,  $\mathbf{v}$  and  $\mathbf{u} - \mathbf{v}$ . Round your answer to two decimal places.

4. (5 marks) Use the Gauss-Jordan Elimination method to find all the solutions of the system of linear equations. Write your answer in column vector form.

$$\begin{cases} x_1 - x_2 - x_3 + 2x_4 = 1 \\ 2x_1 - 2x_2 - x_3 + 3x_4 = 3 \\ -x_1 + x_2 - x_3 = -3 \end{cases}$$

5. (4 marks) Consider the vectors

$$\mathbf{v}_1 = \begin{bmatrix} 1 \\ 2 \\ 2 \end{bmatrix}, \quad \mathbf{v}_2 = \begin{bmatrix} 0 \\ 1 \\ k \end{bmatrix}, \quad \text{and} \quad \mathbf{u} = \begin{bmatrix} 2 \\ 3 \\ 5 \end{bmatrix}.$$

For what value(s) of  $k$  (if any) is  $\mathbf{u}$  in  $\text{span}(\mathbf{v}_1, \mathbf{v}_2)$ ?