

Date: Fall 2022

Name: _____

Instructor: Patricia Wrean

Math 251
Test 1

Total = $\overline{20}$

Show your work. All of the work on this test must be your own.

GOOD LUCK!

1. (6 points) Consider the following vectors.

$$\mathbf{u} = \begin{bmatrix} -1 \\ 4 \\ 2 \end{bmatrix} \quad \mathbf{v} = \begin{bmatrix} 2 \\ 0 \\ 3 \end{bmatrix} \quad \mathbf{w} = \begin{bmatrix} 1 \\ -1 \\ 1 \end{bmatrix}$$

- (a) Calculate the angle $0 \leq \theta < 180^\circ$ between \mathbf{u} and \mathbf{v} .

- (b) Find all unit vectors that are parallel to \mathbf{u} .

- (c) Compute $\|2\mathbf{v} - \mathbf{w}\|$.

2. (4 points) Consider the plane $3x + 2y - z = 5$.

(a) Is point $P = (2, -7, -13)$ in this plane? Explain your reasoning.

(b) Give parametric equations for the line perpendicular to this plane that goes through the point $Q = (-1, 1, 4)$.

3. (5 points) Consider three points

$$P = (2, 0, -1), \quad Q = (-1, 3, -2), \quad R = (0, 4, -1).$$

(a) Calculate the area of the triangle PQR .

(b) Give the general equation for the plane that contains points P , Q , and R .

(c) Is the vector $\mathbf{u} = \begin{bmatrix} 1 \\ 4 \\ 2 \end{bmatrix}$ parallel to the plane you found in part (b)? Explain briefly.

4. (5 points) Consider the line that goes through the point P and has direction vector \mathbf{v} where

$$P = (1, -1, 1) \quad \mathbf{v} = \begin{bmatrix} 1 \\ -3 \\ 2 \end{bmatrix}$$

Find the point on this line that is closest to point $Q = (4, -2, 1)$