

Date: Fall 2021

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. (5 points) Consider the triangle  $ABC$  where

$$A = (2, 2, 1), \quad B = (-1, 3, -1), \quad C = (0, 4, 1).$$

- (a) Calculate the area of this triangle.
- (b) Is this triangle a right triangle? Explain your reasoning.

- 
2. (5 points) Consider the point  $P = (4, -2, 1)$  and the plane  $3x + 2y - z = 5$ . Find the point  $Q$  in the plane that is closest to  $P$ .

3. (5 points) Consider the line that goes through the point  $P$  and has direction vector  $\mathbf{v}$  where

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

- (a) At what point does this line intersect the  $xy$ -plane?  
(b) What angle does this line make with the  $xy$ -plane?

4. (5 points) Consider the following systems.

- (a) Use Gauss-Jordan elimination to find all solutions of the following linear system. Write your answer in parametric form. Clearly show your steps, including your row operations.

$$\begin{cases} w - 2x + 3y & = & 4 \\ 3w - 6x + 2y + 7z & = & -2 \end{cases}$$

- (b) For what values of  $h$  and  $k$  does the following system have one unique solution?

$$\begin{cases} x + 3y & = & 5 \\ 2x + hy & = & k \end{cases}$$