

Name: _____
Student ID: _____

Test 3

This test is graded out of 31 marks. No books, notes, graphing calculators or cell phones are allowed. You must show all your work, the correct answer is worth 1 mark the remaining marks are given for the work. If you need more space for your answer use the back of the page.

Question 1. (3 marks) Find the area of the parallelogram determined by $\mathbf{u} = (2, 0, -3)$ and $\mathbf{v} = (-1, 1, -1)$.

Question 2. (3 marks) Compute the scalar triple product of $\mathbf{u} = (2, 1, -3)$, $\mathbf{v} = (0, 1, 0)$ and $\mathbf{w} = (2, 1, -2)$.

Question 3. (3 marks) Determine if the line $(x, y, z) = (1, 0, 2) + t(1, 2, 2)$ and the plane $2x - 3y + 5z = 0$ intersect, if so find the intersection.

Question 4. (5 marks) Find the distance between the two planes $-2x + y - z = 10$ and $4x - 2y + 2z = -4$. (using projections)

Question 5. (5 marks) Find the distance between the two parallel lines $(x, y, z) = (2, 2, 0) + t(0, 2, 4)$ and $(x, y, z) = (0, 1, 2) + s(0, 1, 2)$ (using projections)

Question 6. Given the following two planes $x - y + 3z = 4$ and $-2x + y + 3z = 5$.

- a. (4 marks) Find the parametric equation of the line of intersection of the two planes.
- b. (2 marks) Find the equation of the line passing through the point $(2, 0, 1)$ and parallel to the intersection of the two planes.

Question 7. (6 marks) Minimize $C = x + y + 2z$ subject to

$$x + y + z \geq 10$$

$$2x + 4y + 2z \geq 30$$

Bonus Question. (3 marks) Find all unit vectors lying on the plane $2x - 3y + z = 4$ and orthogonal to the vector $\mathbf{w} = (2, 1, 3)$.