Name: _____

20C, Ferrara, Oct 19, Version 1 SID: _____

# Midterm 1

This exam has 6 pages and 5 problems. Make sure that your exam has all 6 pages and that your name is on every page.
Put your name and student ID on every page.
You must show your work and justify your answers to receive full credit unless otherwise stated.
If you need more space, use the pack of the pages; clearly indicate when you have done this.
You may not use books or calculators on this exam; one hand written 8.5in x 11in page (front and back) of notes is allowed.

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1. (10 points) Let $\mathbf{v} = (-1, 1, 4), \mathbf{w} = (2, 4, 4), \alpha = 7$. Calculate the following (use the space at the bottom of the page for your work):

   (a) $\mathbf{v} + \mathbf{w} =$ _____

   (b) $\alpha\mathbf{v} =$ _____

   (c) $\mathbf{v} \cdot \mathbf{w} =$ _____

   (d) $\|\mathbf{v}\| =$ _____

   (e) $\|\mathbf{w}\| =$ _____

   (f) $\mathbf{v} \times \mathbf{w} =$ _____

   (g) $\mathbf{w} \times \mathbf{v} =$ _____

   (h) $\mathbf{v} \cdot (\mathbf{v} \times \mathbf{w}) =$ _____

   (i) $\mathbf{w} \cdot (\mathbf{v} \times \mathbf{w}) =$ _____

   (j) Angle between $\mathbf{v}$ and $\mathbf{w}$ is _____.

2. (10 points) Find the equation of the line that contains the point $(2, -1, 1)$, and is perpendicular and intersecting the line with equation $q(t) = (4, 3, 3) + t(3, 1, 0)$.

3. (10 points) Find the equation of the plane contianing the line $\ell(t) = (3+t, -1, 2-5t)$ and the point $(3, 1, 3)$.

4. Let $S$ be the surface defined by the equation $\cos(xy) + x^2y - 2z = 0$.

   (a) (4 points) Write down a function $f(x, y, z)$ of three variables and a constant $c$ such that $S$ is the level set of $f$ of value $c$.

   (b) (6 points) Find a real valued function $g(x, y)$ of two variables such that $S$ is the graph of $g$.

5. (Extra Credit) (5 points) Let $f(x, y, z) = x^2 - z^2 + 1$. Is there a $c$ such that the level set of $f$ of value $c$ is a collection of planes? If so, what's the $c$ and what are the planes?