MAT 205 SPRING 2000
MIDTERM I

NAME (first and last; readable): SSN:

THERE ARE FOUR PROBLEMS PLUS ONE EXTRA CREDIT PROBLEM
SHOW YOUR WORK!!!

1) Let

$$\mathbf{a} = < 2, 1, -1 >, \quad \mathbf{b} = < 1, -2, 3 >, \quad \mathbf{c} = < 1, 0, -2 > .$$

A) Compute $\mathbf{b} \cdot (\mathbf{a} + \mathbf{c})$.

B) Let $\mathbf{d} = < 2, m, 1 >$ be a vector varying with the parameter m. Find the values of m, if any, that make $\mathbf{d}$ and $\mathbf{a}$ perpendicular.

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2) Let

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

be three points in space.
Find the plane passing through P, Q and R.

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3) Sketch the surface

$$y = \sqrt{x^2 + z^2}.$$

Give also a brief explanation *in words* as to why it looks like you have drawn it.

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4) A particle is moving in space with position vector $\mathbf{r}(t)$.
The acceleration is

$$\mathbf{a}(t) = \mathbf{i} - 2\mathbf{k}.$$

The velocity at time $t = 0$ is

$$\mathbf{v}(0) = \mathbf{i} - \mathbf{j} + \mathbf{k}.$$

The position at time $t = 0$ is

$$\mathbf{r}(0) = 2\mathbf{i} - 2\mathbf{k}.$$

Find the position vector $\mathbf{r}(2)$ at time $t = 2$.

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THIS IS FOR EXTRA CREDIT. ATTEMPT THE FIRST FOUR PROBLEMS FIRST.

5) Let $\mathbf{a}$ and $\mathbf{b}$ be non zero vectors.
Show that the vector

$$\mathbf{b} - proj_{\mathbf{a}}\mathbf{b}$$

is orthogonal to the vector $\mathbf{a}$.