MATH 261 Test I Fall 2007 Name:

Show all work. **1** 10 pts **2-7** 15 points each.

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1. Define the magnitude of a vector.

Compute and draw the vectors $\mathbf{a}$, $\mathbf{b}$ and $\mathbf{a} - \mathbf{2b}$ if $\mathbf{a} = \langle -1, 2 \rangle$, $\mathbf{b} = \langle 2, 1 \rangle$

2. Define the dot product of two vectors.

Compute the volume of the parallelepiped determined by the vectors $\mathbf{a} = \langle 2, 3, 1 \rangle$, $\mathbf{b} = \langle 1, -1, 0 \rangle$,$\mathbf{c} = \langle 7, 3, 2 \rangle$.

3. Define the equation of a plane (vector or other form).

Find the equation of a plane (any form) through the points $(0, 1, 1)$, $(2, 0, 2)$, and $(2, 2, 0)$.

4. Find the tangent vector of $\mathbf{r}(t) = \langle 2t, \ln(t), 2t + 1 \rangle$

Find the equation of the tangent line to the curve $\mathbf{r}(t)$ at the point corresponding to $t = 1$.

5. Define the arc length function $s(t)$ of a vector $\mathbf{r}(\mathbf{t})$.

Find the unit tangent vector and the unit normal vector for $\mathbf{r}(t) = \langle \cos(t), \sin(t), t \rangle$

Verify that the two vectors above are orthogonal.

6. Define the speed of a particle at time t.

Find the velocity and position vectors of a particle that has the given acceleration and the given initial velocity and position vectors.

$$\mathbf{a}(t) = -10\mathbf{k},\ \mathbf{v}(0) = \mathbf{i} + \mathbf{j} + \mathbf{k},\ \mathbf{r}(0) = 2\mathbf{i} + 3\mathbf{j}$$

7. Define the cross product of two vectors.

Let P be a point not on the line L that passes through the points Q and R. Draw the parallelogram associated to the vectors $\mathbf{a} = \overline{QR}$ and $\mathbf{b} = \overline{QP}$, then show that the distance d between the point P and the line L is given by

$$d = \frac{|\mathbf{a} \times \mathbf{b}|}{|\mathbf{a}|}$$