VCU

MATH 307

MULTIVARIATE CALCULUS

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TEST 1

September 13, 2013

Name: _____

Score: _____

Directions. Solve the following questions in the space provided. Unless noted otherwise, you must show your work to receive full credit. This is a closed-book, closed-notes test. Calculators, computers, etc., are not used. Put a your final answer in a box, where appropriate.

6. (10 pts.) Consider the following vectors:

$\mathbf{u} = \langle 1, 3, -2 \rangle$, $\mathbf{v} = \langle 2, 2, 4 \rangle$, and $\mathbf{w} = \left\langle -1, -2, \frac{3}{2} \right\rangle$.

State all pairs that are orthogonal to each other.

GOOD LUCK!

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1. (25 points) Let $\mathbf{u} = \langle\, 1, 1, 0 \,\rangle$ and $\mathbf{v} = \langle 0, -1, \, 1 \,\rangle$.

(a) $|\mathbf{u}| =$

(b) Find a unit vector with the same direction as $\mathbf{u}$.

(c) $\mathbf{u} \cdot \mathbf{v} =$

(d) Find the angle θ between $\mathbf{u}$ and $\mathbf{v}$.

(e) Find a vector orthogonal to both $\mathbf{u}$ and $\mathbf{v}$.

2. (20 pts.) Consider the vectors $\mathbf{u} = \langle 1, 1, 3 \rangle$ and $\mathbf{v} = \langle -1, 2, 1 \rangle$ (in standard position).

(a) Find the area of the parallelogram formed by $\mathbf{u}$ and $\mathbf{v}$.

(b) Find the equation of the plane that $\mathbf{u}$ and $\mathbf{v}$ lie in.

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3. (15 pts.) Find the distance between the point $P(5, 1, 4)$ and the plane whose equation is $3x - 2y + z = 6$.

4. (15 pts.) Find the length of the curve $\mathbf{r}(t) = \left\langle\ t,\ \ 1,\ \ \frac{2}{3}\,t^{3/2}\ \right\rangle$ for $0 \leqslant t \leqslant 8$.

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5. (15 pts.) At time $t = 0$ (seconds) a particle is at the point $(1, 2, 3)$. It travels in a straight line to the point $(4, 1, 4)$. It has a speed of 2 units per second at $(1, 2, 3)$ and a constant acceleration of $\langle 3, -1, 1\rangle$. Find the position vector $\mathbf{r}(t)$ of the particle.