MA 2733
Examination 2 – October 24, 2012

Name _____

5 T/F, 2 long answer. 50 points.

General Instructions: Please answer the following, without use of calculators. You may refer to a 3x5 card, but no other notes. Correct answers without correct supporting work may not receive full credit (excluding the True/False section). You may use the back of each page for additional answer space (please clearly indicate if you have done so), or scratch work.

Mississippi State University Honor Code: "As a Mississippi State University student I will conduct myself with honor and integrity at all times. I will not lie, cheat, or steal, nor will I accept the actions of those who do."

Signature _____

1. True/False. Enter T or F in each blank. A correct answer is worth 2 points, a blank space is worth 0 points, and a wrong answer is worth -2 points. (Your total on this problem will be rounded up to zero if necessary.)

   (a) ____ The sequence $a_n = 4 \cdot 3^n$ can be expressed recursively as $a_1 = 12$, $a_n = 3a_{n-1}$ for $n > 1$.

   (b) ____ $\sum_{n=1}^{\infty} a_n = L$ means that $\lim_{n\to\infty} \sum_{n=1}^{m} a_m = L$.

   (c) ____ For the sequence $a_n = \sin(\frac{\pi}{2}n)$, we have $\lim_{n\to\infty} a_n = 0$.

   (d) ____ For the sequence $a_n = \frac{1}{n}\sin(n^2)$, we have $\lim_{n\to\infty} a_n = 0$.

   (e) ____ The acceleration vector of any particle is orthogonal to its velocity vector.

2. Planes and surfaces

   (a) (4 points) Find a vector that is orthogonal to the plane $x - y + z = 3$.

   (b) (6 points) On the same axis, graph the traces of the surface $\sin x + \cos y = z$ in the planes $x = -\pi/2$, $x = 0$, and $x = \pi/2$.
   For full credit: label each axis and indicate which trace is which!

3. (7 points) The "explain" problem.
   Let $\mathbf{r}(t)$ be a vector function with $\|\mathbf{r}(t)\| = 3$. Show $\mathbf{r}(t)$ to be orthogonal to $\mathbf{r}'(t)$.

   (At least 4 points will be given if you instead show $\mathbf{T}$ to be orthogonal to $\mathbf{T}'$.)

4. Calculus on vector functions.

   (a) (15 points) Calculate the unit tangent vector $\mathbf{T}(t)$ and curvature $\kappa(t)$ for the curve $\mathbf{r}(t) = \langle \cos t, \sin t, t^3/3 \rangle$.

   (b) (8 points) Find the arc length function $s(t)$ of the curve $\mathbf{r}(t) = \langle \cos t^2, \sin t^2, t^3/3 \rangle$.

   Recall that $s(t)$ is the arc length of the curve between 0 and t.
   (At least half credit is given if you just calculate $s(2\sqrt{3})$.)