NAME____

I___II___III___IV___V___VI___VII___VIII___IX___X___XI___XII___TOTAL___________
(15) (5) (10) (10) (5) (5) (5) (5) (10) (15) (10) (5) (100)

February 5 2010 | Mathematics 206 Multivariable Calculus Examination #1 | Mr. Haines

(15) I. If **a** = **i** + **j** and **b** = **i** - 2**j** , compute these:

A. **a** $\bullet$ **b** =

B. $\|\mathbf{b}\|$ =

C. $\text{comp}_{\mathbf{b}}\mathbf{a}$ =

D. $\mathbf{proj}_{\mathbf{b}}\mathbf{a}$ =

(5) II. Give an equation of the plane containing the points (1, 2, 3) and (3, 6, 7) and with normal 2**i** - **j**.

(10) III. Give examples of the following sets in $\mathbb{R}^2$

A. A set that is open and bounded.

B. A set that is open and not bounded.

(10) IV. $\boldsymbol{A}(t) = \left(1+t, t^2, \frac{1}{t}\right)$ with $t \geq 1$ is a path in $\Re^3$.

A. Calculate $\boldsymbol{A}'(t)$, the derivative of $\boldsymbol{A}(t)$.

B. Give an equation of the tangent line to this path at the point where $t = 1$.

(5) V. Identify in words the surface whose equation is $x^2 - y^2 - z^2 - 1 = 0$

(5) VI. Suppose **a** is a vector with tail at the point (1,2,3) and head at the point (3,5,5) . Give a unit vector that is perpendicular to **a** .

(5) VII. Compute the area of the parallelogram in $\mathbb{R}^2$ with vertices (1,1), (5,7), (4,5), and (2,3).

(5) VIII. The plane P has coordinate equation $2x + 3y + z = 5$.

Give an equation for any line lying in P:

(10) IX. Give examples of:

A. Two unit vectors in $\Re^3$ that are perpendicular.

B. Equations of two distinct parallel planes.

(15) X. If $f(x, y) = x \sin y$

A. $\frac{\partial f}{\partial x}(x, y) =$

B. $\frac{\partial f}{\partial y}(x, y) =$

C. $\frac{\partial^2 f}{\partial y \partial x}(x, y) =$

D. $\frac{\partial^2 f}{\partial x \partial y}(x, y) =$

(10) XI. For the quadratic form

$$p(x, y, z) = -x^2 - 2y^2 - 5z^2 - 2xz \,,$$

A. Give a symmetric matrix S that is the matrix of this quadratic form.

B. By taking determinants and using Sylvester's Theorem, determine if p is positive definite, negative definite, indefinite, or none of these.

(5) XII. A student says that any three points in $\mathbb{R}^3$ determine a plane. She wants to find the equation of the plane that contains the points (1, 1, 3), (1, 0, 4), and (1, -1, 5). She knows she needs to find a normal to the plane, but has trouble computing it. Why?