NAME: (print!) _____

Section: ___ **E-Mail address:** _____

MATH 251 (4-6,11), Dr. Z. , Exam 1, Thurs., Oct. 8, 2009, SEC 117, 12:00-1:20pm [Blue Version]

FRAME YOUR FINAL ANSWER(S) TO EACH PROBLEM
Do not write below this line

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1. (out of 10)

2. (out of 10)

3. (out of 10)

4. (out of 10)

5. (out of 10)

6. (out of 10)

7. (out of 10)

8. (out of 10)

9. (out of 10)

10. (out of 10)

Types: Number, Function of *variable*(s), 2D vector of numbers, 3D vector of numbers, 2D vector of functions, 3D vector of functions, equation of a plane, parametric equation of a line, equation of a line, equation of a surface, equation of a line, DNE (does not exist).

1. (10 points) Use the chain rule to find f_u and f_v if

$$f(x,y) = x^3 + y^3 \quad , \quad x = e^{u+v} \quad , \quad y = 2u + 3v \quad .$$

Express your answer in terms of u and v.

The **types** of the answer are:

2. (10 points) Find an equation of the tangent plane to the surface

$$xz + 2x^2y + y^2z^3 = 11$$

at the point $(2, 1, 1)$.

The **type** of the answer is:

3. (10 points) Find the maximal rate of change of $f(x, y, z) = x^2y^3z^4$ at $(1, 1, 1)$, and the **unit** direction where it occurs.

The **types** of the answers are:

4. (10 points) Compute f_{xx}, f_{xy}, and f_{yy} if

$$f(x, y) = e^{x^2+y^2} \quad .$$

The **types** of the answers are:

5. (10 points) Use implicit differentiation to find $\frac{\partial z}{\partial x}$ and $\frac{\partial z}{\partial y}$ if

$$z^3 + x^3 + y^3 + 3xyz = 6 \quad .$$

The **types** of the answer are:

6. (10 points) Find a parametric equation of the line of intersection of the planes $x + 2y + 3z = 6$ and $3x + 2y + z = 6$.

The **type** of the answer is:

7. (10 points) A certain particle has law of motion

$$\mathbf{r}(t) = \langle \sin t\,,\, \cos 2t\,,\, e^t \rangle \quad ,$$

Find its velocity, acceletartin, and speed at $t = \pi/6$.

The **types** of the answers are:

8. (10 points) Write a definite integral that describes the length of the curve

$$\mathbf{r}(t) = \langle \sin 5t \, , \, e^{2t} \, , \, e^{3t} \rangle \quad , \quad 0 \leq t \leq \pi \quad .$$

Do not try to evaluate the integral!

The **type** of the answer is:

9. (10 points, altogether) Do the following limits exist? If they do, find them. Explain!

The **types** of the answers are: and .

a. (5 points) If

$$\lim_{(x,y,z)\to(1,2,3)} f(x,y,z) = 1 \quad , \quad \lim_{(x,y,z)\to(1,2,3)} g(x,y,z) = 2$$

compute

$$\lim_{(x,y,z)\to(1,2,3)} (f(x,y,z) + g(x,y,z))^3 e^{g(x,y,z)}$$

b. (5 points)

$$\lim_{(x,y)\to(0,0)} \frac{x^4 + y^4}{2x^4 + y^4} \quad .$$

10. (10 pts.) A force with magnitude $500N$ is moving a body of mass $5kg$ in the direction $\langle 3, 4, 0\rangle$. If at $t = 0$ the body is at location $(1, 2, 3)$ and it is moving with velocity $\langle 2, 1, 4\rangle$,
(i)find its position vector $\mathbf{r}(t)$ at time t ;
(ii) find its speed at time t.

The **types** of the answers are: