

NAME: (print!) \_\_\_\_\_

Section: \_\_\_\_ E-Mail address: \_\_\_\_\_

MATH 251 (1-3,10 ), Dr. Z. , Exam 1, Thurs., Oct. 8, 2009, SEC 118 [Blue Version]

**FRAME YOUR FINAL ANSWER(S) TO EACH PROBLEM**

Do not write below this line

\_\_\_\_\_

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 pts.) Find the curvature of the curve

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

at the point  $(1, 0, 1)$ .

The **type** of the answer is:

**2.** (10 points) Find  $\frac{\partial h}{\partial q}$  at  $(q, r) = (3, 2)$  where  $h(u, v) = ue^v$ ,  $u = q^3$ ,  $v = qr^2$

The **type** of the answer is:

**3.** (10 points) Find the directional derivative of  $f(x, y, z) = xy + z^3$  at  $P = (3, -2, -1)$  in the direction pointing to the point  $Q = (2, -3, -3)$ .

The **type** of the answer is:

4. (10 points) Find an equation of the tangent plane at the given point

$$H(s, t) = te^{s^2t}, (0, 0) \quad .$$

The **type** of the answer is:

5. (10 points) Compute  $f_{yy}(2, 3)$  if  $f(x, y) = x \ln(y^2)$ .

The **type** of the answer is:

6. (10 points) Use the linearization of  $f(x, y) = \sqrt{x + 2y}$  to approximate  $f(3.01, 2.96)$ .

The **type** of the answer is:

7. (10 points, altogether) Do the following limits exist? If they do, find them. Explain!

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

a. (4 points)

$$\lim_{(x,y,z) \rightarrow (0,0,0)} \frac{x^3 + y^3 + z^3}{1 + x + y + z}$$

b. (6 points)

$$\lim_{(x,y) \rightarrow (0,0)} \frac{x^2 + 2y^2}{x^2 + 3y^2} \quad .$$



8. (10 points) Find the length of the curve

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

The **type** of the answer is:

9. (10 points) A certain particle has acceleration

$$\mathbf{a}(t) = \langle 12t^2, 20t^3, 30t^4 \rangle \quad ,$$

and at  $t = 1$  its velocity is  $\langle 4, 5, 6 \rangle$  and its position vector is  $\langle 1, 1, 1 \rangle$ , find its velocity and position vector at time  $t = 2$ .

The **type** of the answer is:

**10.** (10 points) Find an equation to the plane that passes through the points  $(1, 1, 1)$ ,  $(2, 2, 0)$ ,  $(0, 3, 0)$ .

The **type** of the answer is: