NAME: (print!) ____

Section: ____ **E-Mail address:** ____________________

MATH 251 (4,6,7), Dr. Z. , Exam 1, Thurs., Oct. 16, 2017, SEC 118

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 pts.) Find $\frac{\partial z}{\partial x}$ and $\frac{\partial z}{\partial y}$ **at the point** $(1, 1, 1)$ if $z(x, y)$ is given implictly by the equation

$$x^3 + y^3 + z^3 - 2xyz = 1 \quad .$$

The **type** of the answers is:

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ans. $\frac{\partial z}{\partial x}(1, 1) =$ $\qquad\qquad$ $\frac{\partial z}{\partial y}(1, 1) =$

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2. (10 points) Find $\frac{\partial h}{\partial r}$ at $(q, r) = (2, 1)$ where $h(u, v) = ue^{v^2}$, $u = q^3 + q$, $v = q^2 r^3$

The **type** of the answer is:

ans.

3. (10 points) Find the directional derivative of $f(x, y, z) = x^3y^4z^5$ at $P = (1, -1, 1)$ in the direction pointing from the point P to the point $Q = (1, 2, 2)$. (Hint: first find the vector $\mathbf{PQ}$.)

The **type** of the answer is:

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ans.

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

$$xy + 2yz + 3xz \; = \; 6 \quad , (1, 1, 1) \quad .$$

The **type** of the answer is:

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ans.

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5. (10 points) Compute $f_{xy}(1,1)$ if $f(x,y) = x^5 \ln(x+y)$.

The **type** of the answer is:

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ans.

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6. (10 points) Use the linearization of $f(x, y, z) = \sqrt{2x + 3y + 4xz}$ to approximate $f(1.01, 0.99, 1.02)$.

The **type** of the answer is:

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ans.

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

a. (3 points)

$$\lim_{(x,y,z)\to(1,1,1)} \frac{\ln(x^2+y^2+z^2)}{x+y+z}$$

b. (3 points)

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

c. (4 points)

$$\lim_{(x,y,z)\to(0,0,0)} (x+y+z)\,\sin\left(\frac{1}{x+y+z}\right) \quad .$$

8. (10 points) Find the local maximum and minimum point(s), and saddle points (if they exist) of the functions

$$f(x,y) = 6x^2 - 2x^3 + 3y^2 + 6xy \quad .$$

The **type** of the answer(s) is:

ans.

local maximum point(s):

local minimum point(s):

saddle point(s):

9. (10 points) A certain particle has acceleration

$$\mathbf{a}(t) = \langle\, e^t, -\sin t, -4\cos 2t \,\rangle \quad ,$$

and at $t = 0$ its velocity is $\langle 1, 1, 0\rangle$ and its position vector is $\langle 1, 0, 1\rangle$, find its velocity and position vector at time $t = \frac{\pi}{2}$.

The **type** of the answer(s) is:

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ans.

velocity vector at $t = \pi/2$:

position vector at $t = \pi/2$:

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10. (10 points) Find an equation to the plane that passes through the points $(6, 0, 0)$, $(0, 4, 0)$, $(0, 0, 3)$.

The **type** of the answer is:

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ans.
