Math 233 Calculus 3 Spring 12 Midterm 2b

Name: Solutions

- Do any 8 of the following 10 questions.
- You may use a calculator, but no notes.

1	10
2	10
3	10
4	10
5	10
6	10
7	10
8	10
9	10
10	10
	80

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(1) (10 points)

- (a) Sketch some level sets for the surface z = xy, and label them.
- (b) Draw the gradient vector at the point (-1,1).
- (c) Describe the surface.

c) saddle surface

(2) (10 points) Show that the following limit does not exist

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

$$\lim_{(240)\rightarrow(040)}\frac{-x^2}{x^2}=-1$$

$$\lim_{(04)\rightarrow(040)}\frac{y^2}{y^2}=+1$$

$$\lim_{(04)\rightarrow(040)}\frac{y^2}{y^2}=+1$$

(3) (10 points) Find all first order partial derivatives of

$$f(x, y, z) = \frac{e^{-2xz}}{\cos(y+z)}.$$

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$$f_{\chi} = \frac{e^{-2\chi t}}{e^{-1/2t}}$$

$$G_{\chi} = \frac{e^{-1/2t}}{(y+2)}$$

$$f_{y} = e^{-2\alpha \epsilon} - (\omega_{s}(y+\epsilon)) \cdot (-s_{1}n(y+\epsilon))$$

(4) Find
$$f_{yz}$$
 and f_{zz} if
$$f(x,y,z) = xe^{3yz} + \ln(y+xz).$$

$$f_y = \chi e^{3y^2} \cdot 3z + \frac{1}{y+\chi^2}$$

$$f_{yz} = \chi e^{3y^2} \cdot 3 + \chi e^{3y^2} \cdot 3y \cdot 3z + -(y+\chi^2)^2 \cdot \chi$$

$$f_z = \chi e^{3y^2} \cdot 3y + \frac{1}{y+\chi^2} \cdot \chi$$

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$$f_{zz} = ne^{2\eta z} + -(v_{z} + xz)^{-2}$$

(5) (10 points) Find the equation of the tangent plane to the surface $z = xy + y^2$ at the point $(2, -1, \beta)$.

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$$f_{x} = y$$
 $f_{x}(2_{1}-1) = -1$
 $f_{y} = x+2y$ $f_{y}(2_{1}-1) = 0$

$$7 = 9 - 1 - (x - 2) + 0.(y + 1) = -1 - x + 2 = -x + 1$$

(6) (10 points) Find the normal vector to the surface $z = x^3 + xy - y^3$ at the point (1, 1, -1).

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$$f(x_1y_1z) = x^3 + xy - y^3 - z$$

 $\nabla f = \langle 3x^2 + y \rangle, x - 3y^2, -1 \rangle$
 $\nabla f(y_1y_1-y_1) = \langle 4, -2, -1 \rangle = y_1$

(7) (10 points) You are standing on the surface given by $z = y^2 - x$ at the point (2, 2, 2). Which direction is the fastest way down?

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$$f(244) = 4^{1} - x$$
 $\nabla f = \langle -1, 24 \rangle$
 $\nabla f(212) = \langle -1, 4 \rangle$

fastest way down $-\nabla f(212) = \langle 1, -4 \rangle$

(8) (10 points) Suppose you move on the path $r(t) = (t^2, t)$. Use the chain rule to find the rate of change along the path of $f(x, y) = x^2 + y^2$ at t = 2.

$$\Gamma'(t) = \langle 2t, 1 \rangle$$
 $\forall f = \langle 2x, 2y \rangle$
 $(f(r(t)))' = \forall f(r(t)) \cdot f(t)$
 $= \langle 2t^2, 2t \rangle \cdot \langle 2t, 1 \rangle = \langle 4t^3 + 2t \rangle$
 $dt \ t = 2 \ f(r(u))' = \langle 4 \cdot 8 + 4 \rangle = 36$

(9) (10 points) Find the critical points of the function $f(x,y) = xy + y^2 - x$, i.e. the points where both f_x and f_y are zero.

国民政策制度是一种国家工作的政制的国际工作,但是自己的政策工作,但是自己的对象的对象,但是不是一种国家工作,但是一个企业,但是一个企业工作,但是一个企业工作的 第一章

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$$f_x = y-1 = 0 \Rightarrow y=1$$

 $f_y = x + 2y = 0 \Rightarrow x = -2$
which paint $(-2,1)$

(10) (10 points) Find the linear linear approximation to f(x, y, z) = xz - y at the point (2, 1, -1).

$$L(x_{1}y_{1}z) = f(a_{1}b_{1}c) + f_{x}(a_{1}b_{1}c)(x-a) + f_{y}(a_{1}b_{1}c)(y-b) + f_{z}(a_{1}b_{1}c)(z-c)$$

$$f_{x} = z$$

$$f_{y} = -1$$

$$f_{z} = x$$

$$f_{z} = x$$