Key

Quiz 6

This is a two-stage quiz. During the first stage, use a one-sided 8.5 by 11 & calculator. You have 15 min. In the second stage, you are now welcome to use your books, notes, and students in the class to retake the same quiz. You have the remainder of the quiz time to write one solution (with everyones name on it!!!) to be turned in for the group.

1. [4] Use the table below to find a linear approximation of the Heat Index (I) when the temperature is close to 96°F with 70% relative humidity.

Table 1 Heat Index I As a Function of Temperature and Humidity

Relative humidity (%) = H; Actual temperature (°F) = T

T \ H	50	55	60	65	70	75	80	85	90
90	96	98	100	103	106	109	112	115	119
92	100	103	105	108	112	115	119	123	128
94	104	107	111	114	118	122	127	132	137
96	109	113	116	121	125	130	135	141	146
98	114	118	123	127	133	138	144	150	157
100	119	124	129	135	141	147	154	161	168

Looking for a tangent plane

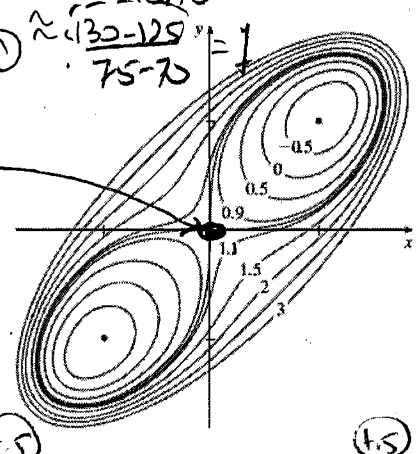
(+.5) $z - z_0 = m_x(x-x_0) + m_y(y-y_0)$ or $I - I_0 = m_T(T-T_0) + m_H(H-H_0)$

(+.5) $m_T = \frac{\partial I}{\partial T}\Big|_{(96,70)}$ (+1) $\approx \frac{133-125}{98-96} = 4$

(+.5) thru the pt $(96, 70, 125)$ so $I - 125 = 4(T-96) + 1(V-70)$

(+.5) $m_V = \partial I/\partial V\Big|_{96,70}$ (+1) $\approx \frac{130-125}{75-70} = 1$

2. Let $f(x,y) = x^4 + y^4 - xy + 1$.



(a) [1] Identify a critical point that is not a local minimum or maximum.

saddle @ $(0,0,1)$

(b) [3] Find $\nabla f(x,y)$ $= \langle f_x, f_y \rangle$ (+.5)

$\langle \underbrace{4x^3 - y}_{(+1)}, \underbrace{4y^3 - x}_{(+1)} \rangle$ notation (+.5)

(c) [2] Let $\vec{u} = \langle \frac{1}{\sqrt{2}}, -\frac{1}{\sqrt{2}} \rangle$. Find $D_{\vec{u}} f(0,1)$.

note $\|\vec{u}\| = \sqrt{(\frac{1}{\sqrt{2}})^2 + (\frac{1}{\sqrt{2}})^2} = 1$
so we already have a unit vector :)

So $D_{\vec{u}} f(0,1) = \nabla f(0,1) \cdot \vec{u}$ (+.5)

$= \langle 4x^3 - y, 4y^3 - x \rangle\Big|_{(0,1)} \cdot \langle \frac{1}{\sqrt{2}}, \frac{-1}{\sqrt{2}} \rangle$

(+.5) $\langle 0-1, 4-0 \rangle \cdot \langle \frac{1}{\sqrt{2}}, \frac{-1}{\sqrt{2}} \rangle$

$= -\frac{1}{\sqrt{2}} + 4\left(\frac{-1}{\sqrt{2}}\right)$ (+1)

$= \frac{-5}{\sqrt{2}}$