MAC 2313 Quiz 5 Name Deuce
Calc III

1. For the differentiable function $h(x,y)$, we are told that $h(100,600)=200$ and $h_x(100,600)=+8$ and $h_y(100,600)=12$. Estimate $h(97,598)$.

$\Delta h \approx (+8)(-3) + (12)(-2)$
$= -24 - 24 = -48$

So $h(97,598) \approx 200 - 48 = 152$

2. Suppose that the temperature (in degrees Fahrenheit) at a point (x,y) on a flat plate is $T(x,y)=150-x^2-y^2$, where x and y are in inches.

A) If an ant is at the point (3,4) and starts to move in a straight line toward the origin (5,0) what will be the instantaneous rate of change in temperature leaving the point (3,4)? **Include Units**

$\vec{u} = \frac{2}{\sqrt{20}}\hat{i} - \frac{4}{\sqrt{20}}\hat{j}$ $\quad \vec{\nabla T} = -2x\hat{i} - 2y\hat{j}$

$\vec{\nabla T}(3,4) = -6\hat{i} - 8\hat{j}$

$\vec{\nabla T}\cdot\vec{u} = -\frac{12}{\sqrt{20}} + \frac{32}{\sqrt{20}} = \frac{20}{\sqrt{20}}$ or $\sqrt{20}\ \frac{F^\circ}{in}$

B) An ant is located at the point (3,4) on the plate. If the ant moves in the direction in which the temperature is decreasing most rapidly, how fast is the temperature decreasing in that direction? **Include Units.**

$\|\vec{\nabla T}(3,4)\| = \sqrt{36+64} = \sqrt{100} = 10\ \frac{F^\circ}{in}$

C) If the ant is traveling at the rate of 3 in per sec as he goes in the direction specified in part B), how fast, measured in F°/sec, is the temperature decreasing?

$\left(10\ \frac{F^\circ}{in}\right)\left(3\ \frac{in}{sec}\right) = 30\ \frac{F^\circ}{sec}$

Problem 3 and 4 are Multiple Choice questions. They are on the next page. So that you don't have to send a second page, just put your answer to the multiple choice questions below.

3. Answer: A

4. Answer: B