Math 20C
Midterm Exam 2
March 1, 2013
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Version A

Instructions

1. **No calculators or other electronic devices are allowed during this exam.**
2. **You may use one page of notes, but no books or other assistance during this exam.**
3. **Write your *Name*, *PID*, and *Section* on the front of your Blue Book.**
4. **Write the *Version* of your exam at the top of the page on the front of your Blue Book.**
5. **Write your solutions clearly in your Blue Book**
   (a) **Carefully indicate the number and letter of each question and question part.**
   (b) **Present your answers in the same order they appear in the exam.**
   (c) **Start each question on a new side of a page.**
6. **Read each question carefully, and answer each question completely.**
7. **Show all of your work; no credit will be given for unsupported answers.**

0. (1 point) Carefully read and complete the instructions at the top of this exam sheet and any additional instructions written on the chalkboard during the exam.

1. (6 points) Let $f(x,y) = x^3+y^3+3x^2-12y+6$. Find all critical points of f. Classify each critical point as a local maximum, local minimum, or saddle point. Compute the value of f at each critical point.

2. Let $f(x,y) = x^2 + y^3 + xy + 21$.
   (a) (4 points) Find an equation for the tangent plane to the surface $z = f(x,y)$ at the point where $x = 3$ and $y = -1$.
   (b) (2 points) Use the linear approximation to $f(x,y)$ at $(3,-1)$ to estimate the value of $f(3.1,-1.2)$. *Hint: This makes use of your answer to (b) and is not the exact value of* $f(3.1,-1.2)$.

3. (6 points) Find the global maximum and minimum values of $f(x,y) = 10+2x-x^2-y^2$ on the domain $\mathcal{D} = \{(x,y) \mid x^2+y^2 \le 4\}$.

4. (6 points) A light is turned on near the lair of a wolf spider. The brightness of the light is $B(x,y) = \dfrac{18}{1+x^2+y^2}$ lumens, with x and y in centimeters. To get away from the light, the spider crawls along a path $\mathbf{r}(t)$ so that 2 seconds later, its position is $\mathbf{r}(2) = \langle 2,2\rangle$ centimeters and its velocity is $\mathbf{r}'(2) = \langle 7,5\rangle$ centimeters/second. Find the rate of change of brightness in lumens/second along the spider's path at time $t = 2$ seconds.