Math 126, Sections A and B, Winter 2011, Midterm II

February 24, 2011

Name________________________________

TA/Section________________________________

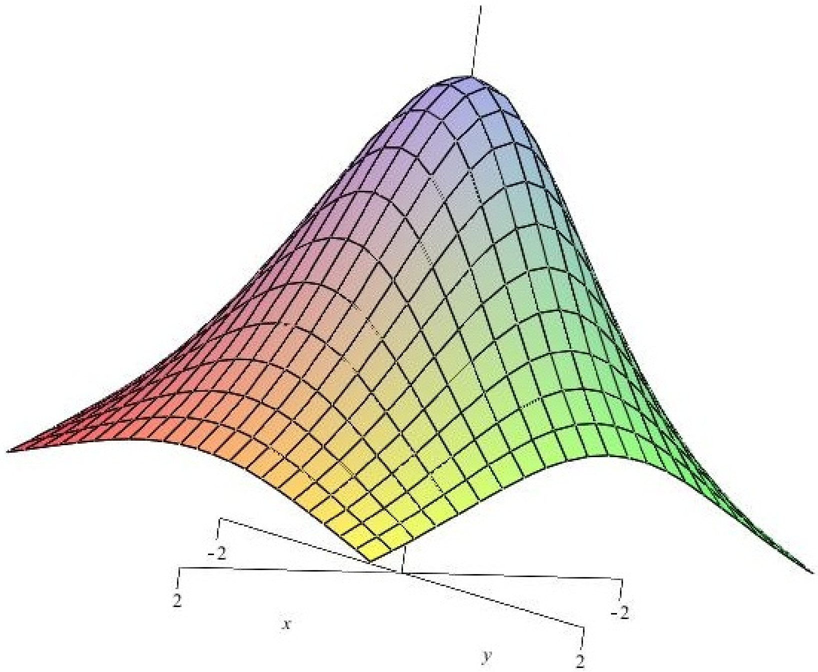
Instructions.

- There are 4 questions. The exam is out of 40 points.
- You are allowed to use one page of notes written only on one side of the sheet in your own handwriting. **Hand in your notes with your exam paper.**
- You may use a calculator which does not graph and which is not programmable. Even if you have a calculator, give me exact answers. ($\frac{2\ln 3}{\pi}$ is exact, 0.7 is an approximation for the same number.)
- **Show your work**. If I cannot read or follow your work, I cannot grade it. You may not get full credit for a right answer if your answer is not justified by your work. If you continue at the back of a page, make a note for me. Please $\boxed{\text{BOX}}$ your final answer.

Question	points
1	
2	
3	
4	
Total	

1. Answer the following.

   (a) (4 points) Below is a graph of the surface $z = f(x, y)$.

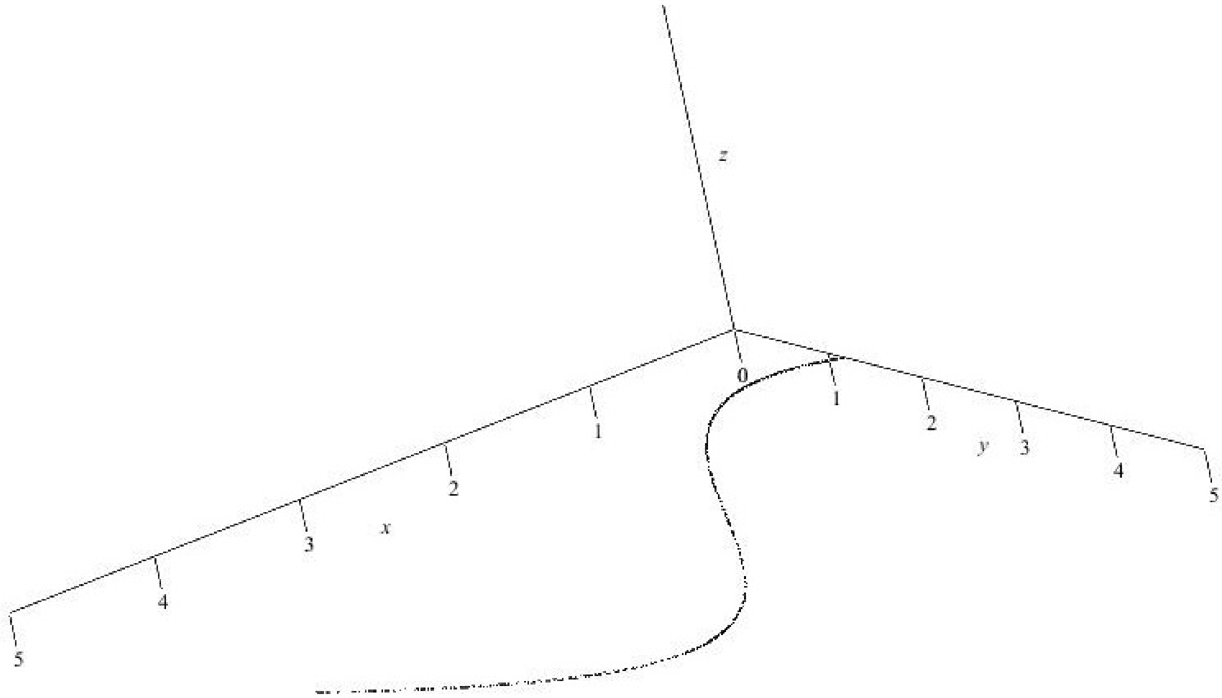


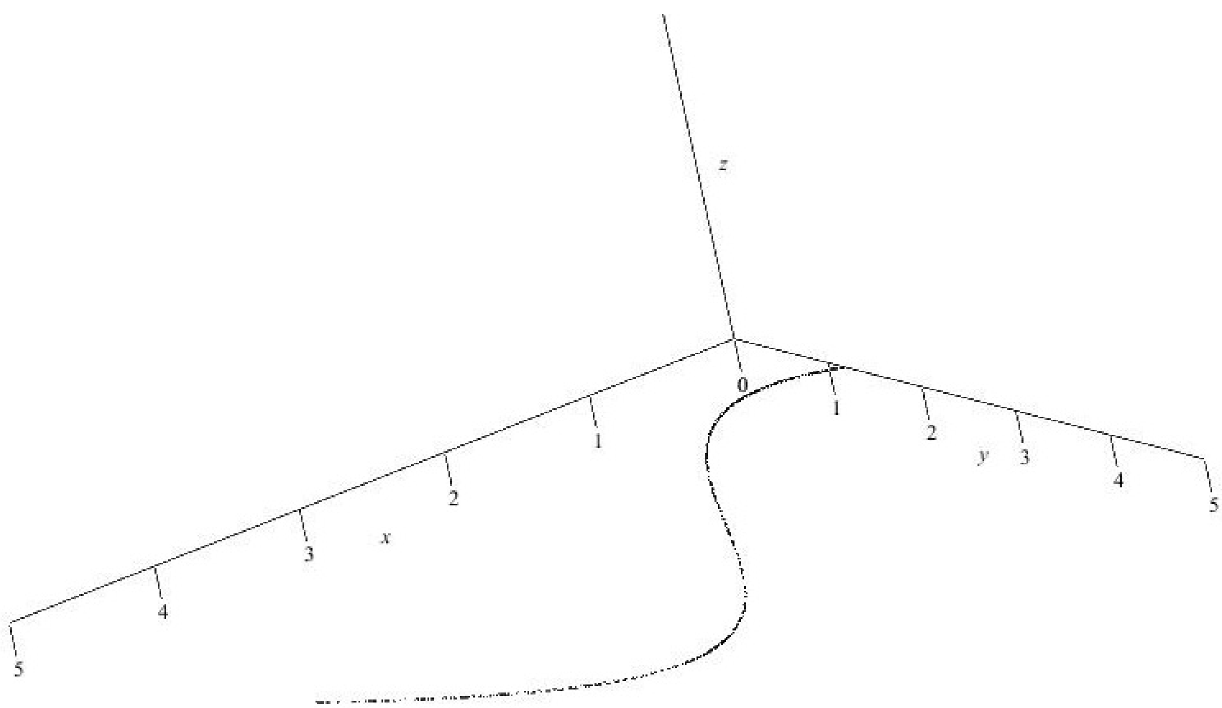
   Decide if the following partial derivatives are positive or negative.

   $f_x(0.2, 0.1)$ $f_y(1, 2)$ $f_{xy}(0.1, 0.1)$ $f_{xx}(0.1, 0.1)$

   (b) (3 points) Compute the curvature of $\mathbf{r} = < \sin t, \sin(2t), t >$ at the point when $t = \pi/3$.

(c) (3 points) The vector function $\mathbf{r}(t)$ has the graph below. The curve is on the xy-plane. As t increase, it is traced in the direction of increasing x. The speed of the particle decreases as it gets further away from the origin. The point $(3.5, 5, 0)$ is on the curve and corresponds to the value $t = t_0$. Sketch the vectors $\mathbf{r}(t_0)$, $\mathbf{r}'(t_0)$, $\mathbf{r}''(t_0)$ on the first picture and the vectors $\mathbf{T}(t_0)$, $\mathbf{N}(t_0)$, $\mathbf{B}(t_0)$ on the second picture. Approximate the curvature from the graph explaining your reasoning.





2. Given the implicit function

$$2x^2 + 4yz + 3z^3 - 5xz + x - 13 = 0$$

(a) (4 points)Use implicit differentiation to find $\frac{\partial z}{\partial x}$ and $\frac{\partial z}{\partial y}$.

(b) (4 points)Check that the point $(1, -2, -1)$ is on the surface $2x^2 + 4yz + 3z^3 - 5xz + x - 13 = 0$ and find the equation of its tangent plane at that point.

(c) (2 point) Use linearization to approximate the value of z near $z = -1$ when $x = 1.1$ and $y = -1.95$.

3. (10 points) Find and classify the critical points of

$$f(x, y) = 2x^3 + y^3 - 3x^2 - 12x - 3y.$$

4. (10 points) Find the volume of the solid under the hyperboloid $z = xy$ and above the triangle in the xy-plane with vertices $(0, 0)$, $(1, 3)$ and $(3, 1)$.