Your Name

Your Signature

Student ID #

Your TA's name

Your Quiz Section Label and Time

Problem	Points	Possible
1		10
2		8
3		6
4		10
5		16
Total		50

- No books allowed. You may use a scientific calculator and one $8\frac{1}{2} \times 11$ sheet of notes.
- Do not share notes.
- In order to receive credit, you must show your work and explain your reasoning (except on the "short answer" questions).
- **Place a box around $\boxed{\text{YOUR FINAL ANSWER}}$ to each question.**
- If you need more room, use the backs of the pages and indicate to the grader where to find your work.
- Raise your hand if you have a question or need more paper.

Don't open the test until everyone has a copy and the start of the test is announced.

GOOD LUCK!

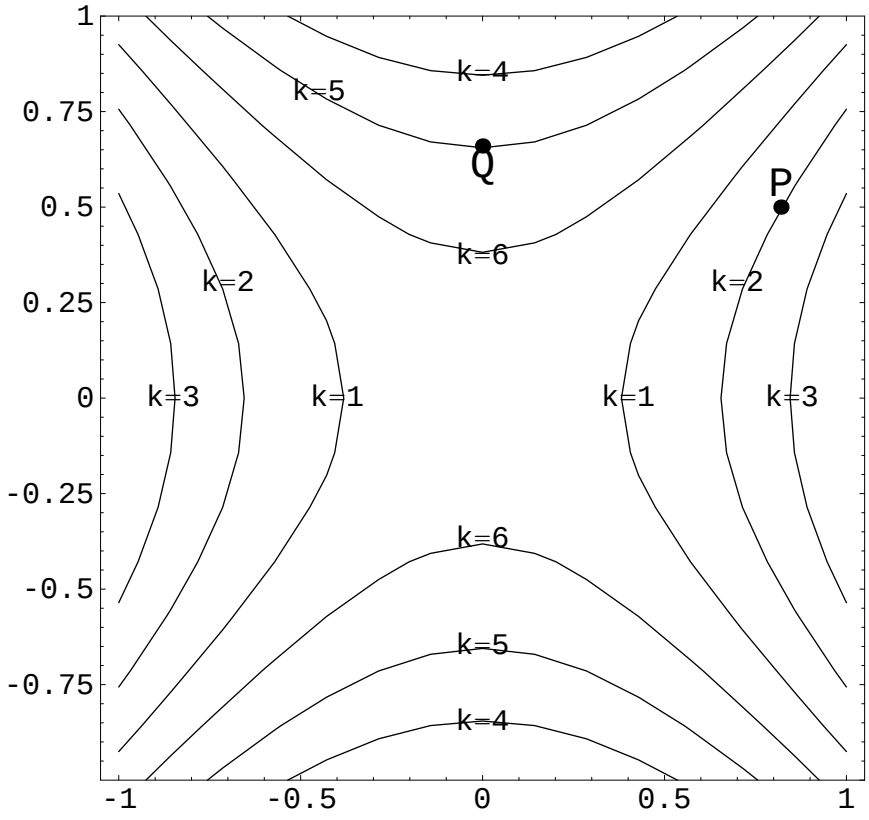
1. (**10=3+3+4 points**) All the parts of this problem concern the vector function $\mathbf{r}(t)$ that satisfies the following conditions: the acceleration is $\mathbf{a}(t) = 6t\mathbf{i} + \mathbf{j} - 12t^2\mathbf{k}$ and the initial position and velocity are given by $\mathbf{r}(0) = 2\mathbf{k}$ and $\mathbf{v}(0) = \mathbf{i} + \mathbf{j}$.

   (a) Write an equation of the normal plane to the curve described by $\mathbf{r}(t)$ at the point where $t = 0$.

   (b) Compute the normal component of acceleration at $t = 0$.

   (c) Find this vector function $\mathbf{r}(t)$.

2. (**8 points**) The level curves of a function $f(x, y)$ are shown below.



Determine whether the following partial derivatives are positive (> 0), negative (< 0) or zero ($= 0$). *No explanation of answers needed for this problem. Be sure to explain your answers on other problems!*

	Circle one:		
(a) $\frac{\partial f}{\partial x}$ at the point P is	$> \mathbf{0}$	$< \mathbf{0}$	$= \mathbf{0}$
(b) $\frac{\partial f}{\partial y}$ at the point P is	$> \mathbf{0}$	$< \mathbf{0}$	$= \mathbf{0}$
(c) $\frac{\partial f}{\partial x}$ at the point Q is	$> \mathbf{0}$	$< \mathbf{0}$	$= \mathbf{0}$
(d) $\frac{\partial f}{\partial y}$ at the point Q is	$> \mathbf{0}$	$< \mathbf{0}$	$= \mathbf{0}$

3. ($6 = 2 + 2 + 2$ **points**) Consider the function $f(x, y) = e^{3x+5y-1}$.

   (a) Calculate the partial derivatives f_x and f_y.

   (b) Write an equation for the tangent plane to the graph of $f(x, y)$ at the point $(2, -1, 1)$.

   (c) Use the linear approximation for f at $(2, -1)$ to estimate the value $f(1.8, -0.9)$.

4. (**10 points**) Find the local maximum and minimum values and saddle points of the function $f(x, y) = (x^2 + y)e^{y/2}$.

5. (**8 points**)

   (a) Evaluate the integral

$$\int_0^1 \int_{\sqrt{y}}^1 \sqrt{x^3+1}\, dx\, dy.$$

   (b) Compute the volume of the solid bounded by the paraboloids $z = x^2 + y^2$ from below and $z = \frac{x^2}{2} + \frac{y^2}{2} + 1$ from above. (**Hint:** draw a picture.)