Due Date: March 28, 2011 Monday NAME:.....

Ali Sinan Sertöz STUDENT NO:.....

Math 114 Calculus – Homework 2

1	2	3	4	TOTAL
25	25	25	25	100

Please do not write anything inside the above boxes!

Check that there are 4 questions on your booklet. Write your name on top of every page. Show your work in reasonable detail. A correct answer without proper or too much reasoning may not get any credit.

Q-1) Consider the functions

$$f(x,y) = \begin{cases} \frac{x^3+y^4}{x^2+y^2} & (x,y) \neq (0,0), \\ 0 & (x,y) = (0,0). \end{cases} \text{ and } g(x,y) = \begin{cases} \frac{xy^2}{x^2+y^2} & (x,y) \neq (0,0), \\ 0 & (x,y) = (0,0). \end{cases}.$$

(i): Is f differentiable at the origin?
(ii): Is g differentiable at the origin?
(iii): Is $f+g$ differentiable at the origin?

Solution:

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Q-2) By approximately what percentage will the value of $\dfrac{xy^2}{x^2+y^2}$ increase or decrease at the point $(1,2)$ if x increases by 4% and y increases by 7%?

Solution:

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Q-3) Show that the equations

$$\begin{cases} xy^2 + zu + v^2 = 3 \\ x^3z + 2y - uv = 2 \\ xu + yv - xyz = 1 \end{cases}$$

can be solved for x, y, z as functions of u, v near the point $p_0 = (x, y, z, u, v) = (1, 1, 1, 1, 1)$ and find $\left(\dfrac{\partial z}{\partial u}\right)_v$ at $(u, v) = (1, 1)$.

Solution:

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The first edition of our textbook was printed in 1983. At that time it was "Single-Variable Calculus" and was authored by Robert Alexander Adams alone. On page 225 there was a starred problem, problem 33, which was notoriously involved and was the talk of the town. Here it is for your enjoyment. Refresh your calculus tools from last semester.

Q-4) You are in a tank (the military variety) moving down the y-axis toward the origin. At time $t = 0$ you are 4 km from the origin, and 10 min later you are 2 km from the origin. Your speed is decreasing; it is proportional to your distance from the origin. You know that an enemy tank is waiting somewhere on the positive x-axis, but there is a high wall along the curve $xy = 1$ (all distances in km) preventing you from seeing just where it is. How fast must your gun turret be capable of turning to maximize your chances of surviving the enemy?

Solution: