Due Date: October 22, 2010 Friday NAME:..

Ali Sinan Sertöz STUDENT NO:..

Math 113 Calculus – Homework 1

1	2	3	4	5	TOTAL
20	20	20	20	20	100

Please do not write anything inside the above boxes!

Check that there are 5 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) Let $f : (a, b) \longrightarrow \mathbb{R}$ be a differentiable function. Assume that for some $x_0 \in (a, b)$, $\lim\limits_{x \to x_0} f'(x)$ exists and is L. Show that $f'(x_0) = L$.

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Q-2) Let $f : \mathbb{R} \longrightarrow \mathbb{R}$ be a differentiable function. Assume that f' is not continuous at some $x_0 \in \mathbb{R}$.
Prove or disprove each of the following statements:
(i) It is possible that $\lim\limits_{x \to x_0^+} f'(x) = f'(x_0)$.
(ii) It is possible that $\lim\limits_{x \to x_0^+} f'(x) = L \neq f'(x_0)$.
(iii) It is possible that $\lim\limits_{x \to x_0^+} f'(x) = \infty$.

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Q-3) Let $f : \mathbb{R} \longrightarrow \mathbb{R}$ be a differentiable function. Assume that $f'(x_0) > 0$ for some $x_0 \in \mathbb{R}$.
Prove or disprove the following statement:

There exists a $\delta > 0$ such that f is increasing (strictly or not) on the interval $(x_0 - \delta, x_0 + \delta)$.

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Q-4) Find all the points, if any exist, on this ellipse

$$\frac{(x-2)^2}{9} + \frac{(y-3)^2}{4} = 1$$

satisfying the property that the line joining the point to the origin is tangent to the ellipse at that point.

(You may use a computer algebra program if need arises.)

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Q-5) Find the equation of the tangent line to the curve $x^2y^3 - x^3y^2 = 4$ at the point $(1, 2)$. Show that there is no point $p = (x_0, y_0)$ on the curve where the tangent line to the curve at p passes also from the origin.