Math 117 Fall 2014 Homework 8

Due Thursday Nov. 13 3pm in Assignment Box

Question 1. (5 pts) *Calculate $f'(x)$ for the following functions.*

a) (1 pt) $f_1(x) := \sqrt{\frac{x^2+1}{x^4+1}}$;

b) (1 pt) $f_2(x) := \arctan(\cos x)$.

c) (3 pts) $f_3(x) := \begin{cases} e^{-1/x} & x > 0 \\ 0 & x \leqslant 0 \end{cases}$.

Question 2. (5 pts) *Find all $k \in \mathbb{Z}$ such that $|x|^k$ is differentiable everywhere on $\mathbb{R}$. Justify your claim.*

Question 3. (5 pts) *Let $f(x) = 3x - \sin x$.*

a) (1 pt) *Prove that $f\colon \mathbb{R} \mapsto \mathbb{R}$ is one-to-one;*

b) (2 pts) *Prove that $f\colon \mathbb{R} \mapsto \mathbb{R}$ is onto.*

c) (2 pts) *Let $g\colon \mathbb{R} \mapsto \mathbb{R}$ be the inverse function of f, calculate $g'(0)$.*

Question 4. (5 pts) *Find a bounded function $f(x)$ which is differentiable everywhere on $\mathbb{R}$ yet $f'(x)$ is unbounded on $\mathbb{R}$. Justify your claim.*