

Problems for lecture 22

March 16, 2015

1. Consider the function

$$f(x) = \begin{cases} x^2 \sin \frac{1}{x^2} & \text{when } x \neq 0 \\ 0 & \text{when } x = 0 \end{cases}.$$

- (a) Show that $f(x)$ is differentiable on \mathbb{R} and find a formula for $f'(x)$. Hint: follow the example in the lecture.
- (b) Show that $f'(x)$ is not continuous at 0.

2. Consider the function

$$f(x) = f(x) = \begin{cases} x^r \sin \frac{1}{x} & \text{when } x \neq 0 \\ 0 & \text{when } x = 0 \end{cases}.$$

Determine ALL values r where $f'(0)$ exists.