Signature PRINTED NAME

Math 202
November 5, 2013

Exam 2

Jerry L. Kazdan
12:00 — 1:20

DIRECTIONS: Part A has 5 shorter problems (8 points each) while Part B has 4 traditional problems (15 points each). [100 points total].
To receive full credit your solution should be clear and correct. Neatness counts. You have 1 hour 20 minutes. Closed book, no calculators, but you may use one 3 ×5 with notes on both sides.

PART A: Five shorter problems, 8 points each [total: 40 points]

Score	
A-1	
A-2	
A-3	
A-4	
A-5	
B-1	
B-2	
B-3	
B-4	
Total	

A-1. Give an example of an infinite series $\sum a_n$ that converges but does not converge absolutely. [You do not need to justify your assertion.]

A-2. Give an example of a bounded function defined on $-2 \le x \le 2$ that is continuous everywhere *except* at $x = 0$. [You do not need to justify your assertion].

A-3. Show that the polynomial $p(x) := x^6 + x^5 - 5$ has at least two *real* zeroes.

A-4. Let $g(x)$ be any smooth function and let $f(x) = (x-1)(x-2)(x-3)g(x)$. Show there is a point $c \in (1, 3)$ where $f''(c) = 0$.

A-5. Say a function $f(x)$ has the properties $f'(x) = 2$ for all $x \in \mathbb{R}$ and $f(1) = 2$. Show that $f(x) = 2x$. [HINT: To show that "$A = B$", it is often easiest to show that "$A - B = 0$".]

Part B: Four traditional problems, 15 points each [60 points[

B-1. Determine if the series $1 + \frac{1}{3} + \frac{1}{5} + \frac{1}{7} + \cdots$ converges or diverges. Please explain your reasoning.

B-2. Use the definition of the derivative as the limit of a difference quotient to show that if $f(x) = \cos 2x$, then f is differentiable everywhere and compute its derivative. [You may use that $\lim_{\theta \to 0} \frac{\sin \theta}{\theta} = 1$ and $\lim_{\theta \to 0} \frac{1 - \cos \theta}{\theta} = 0$.]