MAT 296, Fall 2015, Quiz 9 Solutions **Score**

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No calculators will be allowed on any quiz, midterm exam or on the final exam. Using or having available any calculator or other electronic device during a quiz, midterm exam or the final exam is a violation of the Academic Integrity Policy.

To receive credit you must justify your answer in full detail!

1. Determine whether the series $\sum_{n=1}^{\infty} \frac{(-1)^n}{\sqrt{n}}$ converges absolutely, converges conditionally, or diverges.

$a_n = \frac{(-1)^n}{\sqrt{n}}$

1) $\lim_{n\to\infty} a_n = \lim_{n\to\infty} \frac{(-1)^n}{\sqrt{n}} = 0$

2) a_n is decreasing

$n+1 > n$

$\sqrt{n+1} > \sqrt{n}$, $\sqrt{\ }$ is increasing function

$\frac{1}{\sqrt{n+1}} < \frac{1}{\sqrt{n}}$ so a_n decreasing

By the alternating series test, $\sum_{n=1}^{\infty} \frac{(-1)^n}{\sqrt{n}}$ converges

$\sum_{n=1}^{\infty} \frac{1}{\sqrt{n}}$

$a_n = \frac{1}{\sqrt{n}}$

1) $a_n > 0$ for all n

2) a_n decreasing (see other (2))

By Integral Test,

$\sum_{n=1}^{\infty} \frac{1}{\sqrt{n}}$ converges $\rightleftarrows \int_1^{\infty} \frac{1}{\sqrt{x}}\,dx$ converges

$$\lim_{b\to\infty} \int_1^b \frac{dx}{\sqrt{x}} = \lim_{b\to\infty} 2\sqrt{x}\Big|_1^b = -2 + \lim_{b\to\infty} 2\sqrt{b}$$

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So $\int_1^{\infty} \frac{dx}{\sqrt{x}}$ diverges so $\sum_{n=1}^{\infty} \frac{1}{\sqrt{n}}$ diverges

Since $\sum_{n=1}^{\infty} \frac{(-1)^n}{\sqrt{n}}$ converges but $\sum_{n=1}^{\infty} \frac{1}{\sqrt{n}}$ diverges, the series $\sum_{n=1}^{\infty} \frac{(-1)^n}{\sqrt{n}}$ converges conditionally.