Math 252: Quiz 8 **24 March, 2022**

Name: ______________________________ | ________ / 25

30 minutes maximum. No aids (book, calculator, etc.) are permitted. Show all work and use proper notation for full credit. Answers should be in reasonably-simplified form. 25 points possible.

1. [6 points] Consider the series $\displaystyle\sum_{n=1}^{\infty} \frac{1}{n^2+1}$.

a. Use the integral test to show this series converges.

b. Use a comparison test to show this series converges. (*Make sure to say which series you are comparing to, and why it converges.*)

2. [3 points] Consider the p-series $\displaystyle\sum_{n=1}^{\infty} \frac{1}{n^p}$ for $p < 0$. Show that such p-series diverge by the divergence test.

3. [9 points] Use the comparison test or the limit comparison test to determine whether the following series converge or diverge. (*Say which comparison test you are using, and what series you are comparing to!*)

a. $\displaystyle\sum_{n=1}^{\infty} \frac{2^n}{4^n - 3^n}$

b. $\displaystyle\sum_{n=2}^{\infty} \frac{\ln n}{n}$

c. $\displaystyle\sum_{n=1}^{\infty} \frac{\cos^2 n}{n^2}$

4. **[4 points]** Simplify the following series, and then determine if the series converges or diverges by applying a test. (*Justify your conclusion about converge or diverge.*)

a. $\displaystyle\sum_{n=2}^{\infty} \frac{(n-1)!}{n!}$

b. $\displaystyle\sum_{n=2}^{\infty} \frac{n!}{(n-1)!}$

5. **[3 points]** Sketch a partial sum S_N of the harmonic series as the total area of rectangles of width one. (*Please label axes appropriately.*)

Extra Credit. [2 points] Which of the following two series do we **know** converges or diverges? (Which is it, and why?) Explain in words why the answer is unknown for the other series.

$$\sum_{n=1}^{\infty} \frac{(\cos n)^2}{n}, \qquad \sum_{n=1}^{\infty} \frac{1}{n(\cos n)^2}$$

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