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MATH:1860 Activity 9 – (Sections 11.4-11.6)

Apr. 03

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Instructions: Work with others or independently to complete the activity.

1. The meaning of the decimal representation $0.d_1d_2d_3\dots$ of a number in base 10, where $0 \le d_i \le 9$, is that $0.d_1d_2d_3d_4\dots = \frac{d_1}{10} + \frac{d_2}{10^2} + \frac{d_3}{10^3} + \cdots$. Show that this series converges for all choices of the d_i. (Hint: We know $0.9999\ldots = 1$.)

$$\sum_{n=1}^{\infty} \frac{9}{10^n} = 1$$

$$0 \le \frac{d_n}{10^n} \le \frac{9}{10^n}$$ DCT implies convergence

2. Determine whether each of the following series converge or diverge.

(a) $\sum_{n=1}^{\infty} (-1)^n \cos \frac{\pi}{n}$

$$\lim_{n\to\infty} \cos\frac{\pi}{n} = \cos\left(\lim_{n\to\infty} \frac{\pi}{n}\right) = \cos 0 = 1$$

AST doesn't apply

Diverges

(b) $\sum_{n=1}^{\infty} \frac{\sin(e^n)}{n^e}$

(c) $\sum_{n=1}^{\infty} \frac{e^{1/n}}{n^2}$

$$\lim_{n\to\infty} \frac{\frac{e^{1/n}}{n^2}}{\frac{1}{n^2}} = \lim_{n\to\infty} e^{1/n} = e^{\lim_{n\to\infty} \frac{1}{n}} = e^0 = 1 > 0$$

$\sum \frac{1}{n^2}$ converges so LCT implies convergence

(d) $\displaystyle\sum_{n=2}^{\infty} \frac{(-1)^{n-1}}{(\ln n)^n}$

(e) $\displaystyle\sum_{n=1}^{\infty} (-1)^n \frac{n^2}{5^n}$

3. Determine whether $\displaystyle\sum_{n=1}^{\infty} \frac{\cos n\pi}{3n+2}$ is absolutely convergent, conditionally convergent, or divergent.