Midterm 2, sample 1.

This sample exam is a slightly modified version of the Fall 2015 Midterm 2.

1. Compute the following integrals. or else show that it diverges.

(a) $\displaystyle\int \frac{x+3}{x^3+3x}\,dx$

(b) $\displaystyle\int_{-\infty}^{\infty} \frac{1}{36+x^2}\,dx$

(c) $\displaystyle\int_{1}^{\infty} \frac{e^{\frac{1}{x}}}{x^2}\,dx$

2. [10 Points] Determine **and state** whether the following sequence **converges** or **diverges**. If it converges, compute its limit. Justify your answer. Do **not** just put down a number.

$$\left\{\left(\frac{n}{n+5}\right)^{2n+1}\right\}_{n=1}^{\infty}$$

3. Find the **sum** of the following series (which does converge).

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

4. Use the **Integral Test** to **determine** and **state** whether the series $\displaystyle\sum_{n=1}^{\infty}\frac{\ln n}{n^3}$ converges or diverges. Justify all of your work.

5. Determine whether each of the following series **converges** or **diverges**. Name any convergence test(s) you use, and justify all of your work.

(a) $\displaystyle\sum_{n=1}^{\infty} \arctan\left(\frac{\sqrt{3}\,n^3+1}{n^3+n}\right)$

(b) $\displaystyle\sum_{n=1}^{\infty} (-1)^n\,\frac{\arctan(\sqrt{3}\,n^3+1)}{n^3+n}$

6. In each case determine whether the given series is **absolutely convergent**, **conditionally convergent**, or **diverges**. Name any convergence test(s) you use, and justify all of your work.

(a) $\displaystyle\sum_{n=1}^{\infty} (-1)^n\,\frac{n^3+7n}{n^9+\sqrt{n}}$

(b) $\displaystyle\sum_{n=1}^{\infty} \frac{(-1)^n\cdot 15^n}{(n!)^2}$

(c) $\displaystyle\sum_{n=1}^{\infty} (-1)^{n+1}\,\frac{1}{\sqrt{n}+7}$