Problem Set 2

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1. Determine whether the following sequences $\{a_n\}$ are convergent or divergent. Find the limit of any convergent sequences.

$$\textbf{a. } a_n = \left(\frac{n^3+5n^4}{2n^4+2n-1}\right)^{\frac{1}{3}} \qquad \textbf{b. } a_n = n\sin\left(\frac{1}{n}\right)$$

2. Evaluate

$$\int \frac{1}{(1+x^2)^{\frac{5}{2}}}\,\mathrm{d}x$$

3. Check the convergence or divergence of the following sequences:

$$\textbf{a. } a_n = \log(2n^2+1) - 2\log(n) \qquad \textbf{b. } a_n = ne^{-n}$$

4. Check the convergence or divergence of the following integral:

$$\int_1^\infty \frac{1}{(x^2+3x+2)}\,\mathrm{d}x$$

5. Evaluate

$$\int \ln(x^2+1)\,\mathrm{d}x$$

6. Check the convergence or divergence of the following sequences:

$$\textbf{a. } a_n = \log(n^2+1) - 3\log(n) \qquad \textbf{b. } a_n = \sqrt{n}\left(1-\cos\left(\frac{1}{n}\right)\right)$$

7. Consider the integral

$$\int_2^4 \frac{1}{2x-3}\,\mathrm{d}x.$$

Estimate the integral using the **trapezoidal** rule with $n = 4$ steps.

8. Evaluate the following integrals if they are convergent or show they are divergent:

$$\textbf{a. } \int_0^\pi \tan^2(x)\sec^2(x)\,\mathrm{d}x \qquad \textbf{b. } \int_1^\infty \frac{x}{x^2+1}\,\mathrm{d}x$$