

Math 242 Review

- Applications of Integration to Geometry
 - Area, Volume by Cross-Sections, Volume by Shells, Length, & Surface Area
 - Example: Find the surface area generated in revolving the curve $y = \sqrt{x+1}$, $1 \leq x \leq 5$ about the x-axis
- Applications of Integration to Physics
 - Work, Fluid Force, and Center of Mass
 - Example: Find the total fluid force on one side of the semicircular plate of radius 5 that rests vertically on its diameter at the bottom of a pool filled with water of weight density $\varpi = 62.4 \text{ lb/ft}^3$ to a depth of 6 ft.
- Techniques of Integration
 - Integration by Parts, Trigonometric Integrals, Partial Fractions, and Trigonometric Substitution
 - Examples:
 - $\int (\sin^2 x \cos^3 x) dx$
 - $\int_0^1 x^3 e^{2x} dx$
 - $\int \frac{\sqrt{y^2 - 25}}{y^3} dy, y > 5$
 - $\int_0^{\frac{\pi}{4}} (\tan^3 x) dx$
 - $\int \frac{z}{z^3 - z^2 - 6z} dz$
- Improper Integrals
 - Evaluating and Testing Convergence
 - Example: $\int_{-1}^2 \frac{1}{x^2} dx$
- Sequences
 - Formulas for Sequences and Testing for Convergence
 - Example: Determine whether $a_n = \left(-\frac{1}{2}\right)^n$ converges or diverges

- Series Convergence

- By Definition, Geometric Series, nth Term Test, Integral Test, P-Series, LCT, DCT, Ratio Test, Root Test, AST, and ACT
- Examples: Determine whether the following series converge or diverge

- $\sum_{n=0}^{\infty} \tan^{-1} n$

- $\sum_{n=5}^{\infty} \frac{n^2}{\sqrt{n^5 + n^3 - n^2 - 6}}$

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

- $\sum_{n=0}^{\infty} \frac{3^n}{n!}$

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

- $\sum_{n=1}^{\infty} \left(\cos^{-1} \left(\frac{1}{n+1} \right) - \cos^{-1} \left(\frac{1}{n+2} \right) \right)$

- $\sum_{n=0}^{\infty} \frac{2^n}{3^{n+1}}$

- Power Series

- Determine interval and radius of convergence

- Example: $\sum_{n=1}^{\infty} \frac{(x-1)^n}{\sqrt{n}}$

- Taylor Series

- Taylor Series, Taylor Polynomials, Remainder Theorem, and Applications

- Example:

- Use a Taylor polynomial to approximate $\int_0^{0.1} e^{-x^2} dx$ with an error magnitude less than 10^{-8}

- Parametric Equations

- Write parametric equations, convert between Cartesian and parametric, slope, area, length, and surface area.

- Example: Find the area underneath one arch of
$$\begin{aligned} x &= \sin t - t \\ y &= 1 + \cos t \end{aligned}$$

- Polar Equations

- Convert between polar and Cartesian equations, find slope, area, and length

- Example: Find the area shared by $r = \sin \theta$ and $r = \cos \theta$