Objectives for Math 166

1 Applications of the Integral

Set up and evaluate integrals to calculate

1. Area of a plane region
2. Volume of a solid of revolution
3. Length of a plane curve
4. Area of a surface of revolution
5. Work done by a variable force
6. Force due to fluid pressure
7. Moments and center of mass of a plane lamina, centroid of a plane region.

2 Techniques of Integration

1. Evaluate integrals of trigonometric functions.
2. Use trigonometric and rationalizing substitutions to evaluate integrals.
3. Carry out integration by parts and apply it to evaluate integrals.
4. Use partial fractions to evaluate integrals of rational functions.

3 Indeterminate Forms and Improper Integrals

1. Apply l'Hospital's Rule to evaluate limits having the indeterminate forms $0/0$, ∞/∞, $0 \cdot \infty$ and $\infty - \infty$.
2. Determine convergence or divergence of improper integrals; evaluate improper integrals that converge.

4 Infinite Series

1. Apply limit rules to calculate limits of sequences. Apply the concept of boundedness to identify convergent monotonic sequences.

2. Use the concept of partial sum to distinguish between convergent and divergent series and to define the sum of a convergent series.

3. Recognize geometric series and collapsing series and calculate their sums when convergent.

4. Use the integral test, the comparison test, the limit comparison test and the ratio test to determine the convergence or divergence of series. Use the error estimate derived from the integral test to estimate sums or tails of series.

5. Recognize alternating series, and apply the alternating series test and associated error estimate. Identify absolutely convergent series.

6. Determine radius of convergence and convergence set of a power series.

7. Apply term-by-term integration and differentiation to power series. Perform algebraic operations on power series.

8. Expand a function in a Taylor series. Recall and use the Taylor series of elementary functions.

9. Use the remainder in Taylor's formula to estimate the approximation error in a Taylor polynomial.

5 Plane Parametric Curves, Polar Coordinates

1. Derive parametric representations for plane curves described "mechanically."

2. Find tangents and compute length for parametric curves.

3. Use polar coordinates, and convert between polar and rectangular coordinates. Identify the polar equations for lines, circles and conics.

4. Compute the area of regions whose boundaries are defined by equations in polar coordinates.