List of Topics for Final

Chapter 7: Integrals

- (7.1) Evaluate integrals using integration by parts.
- (7.1) Evaluate integrals using a combination of substitution and integration by parts.
- (7.2) Evaluate integrals of the form $\int \sin^m(x)\cos^n(x)$.
- (7.2) Evaluate integrals of the form $\int \tan^m(x)\sec^n(x)$.
- (7.2) Evaluate integrals of the form $\int \sin(Ax)\cos(Bx)$.
- (7.3) Evaluate integrals using substitutions of the form $x = \sin\theta$, $x = \tan\theta$, and $x = \sec\theta$.
- (7.4) Carry out long division between two polynomials $P(x)$ and $Q(x)$.
- (7.4) Decompose a function of the form $P(x)/Q(x)$ into partial fractions.
- (7.4) Integrate functions of the form $(ax + b)(cx^2 + dx + e)$ where the denominator is irreducible.
- (7.3-7.4) Re-write a function of the form $ax^2 + bx + c$ in the form $a(x + h)^2 + k$.
- (7.7) Estimate definite integrals using the Midpoint Rule, Trapezoidal Rule, and Simpson's Rule.
- (7.7) Put upper bounds on the errors of any of the above estimates.
- (7.8) Use L'Hospital's Rule to find the limit of a function.
- (7.8) Evaluate improper integrals using the limit definition.
- (7.8) Demonstrate whether a given improper integral converges by using the p-test, comparison test, or limit comparison test.

Chapter 11: Sequences and Series

- (11.1) State the Monotone Convergence Theorem. Find a function where the MTC applies and one where it doesn't.
- (11.1) Decide whether a given sequence converges or diverges. If it converges, find its limit.
- (11.2) Find the sum of a given geometric series.
- (11.2) Use the Test for Divergence to show that a given series diverges.
- (11.3) Use the Integral Test to show whether a series converges or diverges.
- (11.3) Given a partial sum s_n of a series s, use the Integral test to estimate the remainder $R = s - s_n$.
- (11.4) Use the Comparison Test and Limit Comparison Test to show whether a given series converges or diverges.
- (11.5) Use the Alternating Series Test to show that a given series converges.
- (11.5) Find divergent series that satisfy two of the three conditions for the AST.
- (11.6) Use the Ratio and Root Tests to decide whether a given series is absolutely convergent.

- (11.6) Find examples of series that are convergent but not absolutely convergent.
- (11.8) Find the interval of convergence for a given power series.
- (11.10) Find the Taylor series of a given function by computing its derivatives at a specified point.
- (11.10) Find the Taylor series of a given function by building it up from simpler Taylor series.
- (11.10) Given two Taylor series, find their sum, product, and quotient up to a specified order.
- (11.10) Use Taylor series to evaluate the limit of a given function.

Chapters 9/17: Differential Equations

- (9.1) Given a function f, check that it verifies a given differential equation.
- (9.2) Given a list of differential equations and pictures of direction fields, match each equation with the appropriate picture.
- (9.2) Make a rough sketch of the direction field for a given differential equation, including the curves where $y' = 0$.
- (9.2) Given a differential equation, initial value y_0, and step size h, approximate values for the solution using Euler's method.
- (9.3) Given a differential equation that can be expressed in the form $y' = f(y)g(x)$, find the general solution for y.
- (9.5) Find the general solution to differential equations of the form $y' + P(x)y = Q(x)$.
- (17.1) Find the general solution to differential equations of the form $ay'' + by' + cy = 0$.
- (17.2) Find the general solution to differential equations of the form $ay'' + by' + cy = G(x)$ (1) by using the method of undetermined coefficients and (2) by using variation of parameters.
- (General) Given any general solution to a first-order differential equation, find the specific solution when given an initial value (e.g. $y(0)$).
- (General) Given any general solution to a second-order differential equation, find the specific solution when given initial values (e.g. $y(0), y'(0)$) or boundary values (e.g. $y(0), y(2)$).