

# Final Exam Review

The final exam will take place on December 8, 2025 from 7pm to 9pm in Wilson Hall. You should go over the past three midterms and determine which areas you need to review in the coming weeks. Here is a list of the topics and which aspects you should prepare:

## 1. Midterm 1 Content

### (a) Exponential and logarithmic functions

- i. Algebraic properties
- ii. Derivatives and Integrals

### (b) Inverse trigonometric functions

- i. Domains and ranges
- ii. Derivatives
- iii. Exact values

### (c) U-Substitution

- i. Logarithm integrals (integrals of the form  $\int \frac{f'(x)}{f(x)} dx$ )
- ii. Arctan integrals (integrals of the form  $\int \frac{f'(x)}{1 + (f'(x))^2} dx$ )

### (d) Limits

- i. Calculating limits that go to  $\infty$
- ii. Calculating limits using L'Hopitals rule

### (e) Logarithmic differentiation

### (f) Inverse functions

- i. Determining if a function is one-to-one

## 2. Midterm 2 Content

### (a) Integration by parts

### (b) Improper integrals

- i. Evaluating improper integrals of the form  $\int_a^\infty f(x) dx$
- ii. Determining if an improper integral converges by using the comparison test

### (c) Partial fraction decomposition

- i. Setting up a partial fraction decomposition
- ii. Determining the constants of a basic decomposition by solving a system of equations

### (d) Differential Equations

- i. Determining if a differential equation is separable

- ii. Solving separable differential equations
  - iii. Solving initial value problems
- (e) Sequences
  - i. Determining if a sequence will converge or diverge
- 3. Midterm 3 Content
  - (a) Series of constants
    - i. Partial sums
    - ii. Geometric series
    - iii. Telescoping series
    - iv. Given a series, determine if the series converges or diverges.
    - v. Given an alternating series, determine if the series converges absolutely, converges conditionally, or diverges
  - (b) Power series
    - i. Calculate the radius and interval of convergence of a power series
    - ii. Calculate terms of a Taylor series using Taylor's formula
    - iii. Manipulate the main series expansions
      - A.  $e^x$
      - B.  $\sin(x)$
      - C.  $\cos(x)$
      - D.  $\arctan(x)$
      - E.  $\frac{1}{1-x}$
      - F.  $\ln(1-x)$
    - iv. Estimating alternating series
- 4. Content after Midterm 3
  - (a) Parametric Equations
    - i. Transforming equations into parametric equations and vice versa
    - ii. Calculating derivatives of parametric equations
    - iii. Calculating the points of horizontal and vertical lines of a parametric equation
    - iv. Calculating arc length of parametric equations
  - (b) Polar Coordinates
    - i. Transforming an equation in  $(x, y)$  to an equation in  $(r, \theta)$  and vice versa.
    - ii. Understanding the basic graphs in polar form
    - iii. Calculating the slope of the tangent line for a polar function
    - iv. Calculating the points of horizontal and vertical lines of a polar function
    - v. Calculating the arc length of a polar function