

Math 108, Final Exam Checklist

This is a rough list of topics that we've covered in class or homeworks. Please simply view this list as a good jumping-off point in your review: don't forget to carefully review your notes, homeworks, and the textbook for details and subtle points not mentioned here.

Chapter 1: Basic properties of functions

- Ways to represent functions
- Domain and range of a function
- Building new functions out of old ones. Composition.
- Inverse of a function
- Piecewise functions
- Vertical and horizontal translation and stretch/squeeze
- Elementary functions: Polynomials, rational functions, exponential functions, logarithms, trigonometric functions, inverse trigonometric functions

Chapter 2: Limits, Continuity and Derivatives

- Intuitive definition of limit
- One-sided limits
- Infinite limits and vertical asymptotes
- Limits at infinity and horizontal asymptotes
- Limit laws: sum, product, quotient, power, root
- Squeeze theorem
- Precise definition of limit
- Continuity
- Direct substitution property
- Examples of discontinuities: jump, removable, infinity, etc.
- Building new continuous functions from old ones
- Intermediate value theorem (IVT)
- Using IVT to find where a function is positive and where it is negative.
- Definition of derivative
- Tangent line

Chapter 3: Differentiation rules

- Differentiation rules: sum, product, quotient and chain rule.
- Derivatives of elementary functions: E.g. derivative of x^a vs a^x
- Implicit differentiation
- Logarithmic differentiation
- Related rates
- Linear approximation

Chapter 4: Application of Differentiation

- Definition of absolute extrema vs. local extrema.
- Extreme value theorem
- Fermat's Theorem
- Critical number
- Closed Interval Method
- Rolle's Theorem and the Mean Value Theorem (MVT)
- Constancy of functions with $f' = 0$.
- Definition of increasing and decreasing on an interval.
- Increasing/decreasing test
- First derivative test for local extrema
- Geometric meaning of concave up and concave down
- Concavity test
- Definition of inflection point
- Second derivative test
- Indeterminate forms and L'Hospital's rule
- Curve Sketching
- Optimization
- Antiderivatives

Chapters 5 and 6: Integrals and some applications

- Riemann sums and area under a curve
- Definite integral as limit of Riemann sums
- Properties of definite integral: e.g. sum, constant multiple, breaking up limits, comparison properties...
- Fundamental Theorem of Calculus (FTC)
- Net Change Theorem
- Indefinite integrals
- Substitution rule for indefinite and definite integrals
- Area between curves.
- Average value of a function
- Integral Mean Value Theorem