

**MATH 116. COMPLEX ANALYSIS  
FINAL EXAM - LIST OF TOPICS**

**Note:** This list is only intended to help you study. Questions based on any material covered in class may appear on the actual test.

1. COMPLEX NUMBERS

- Definition
- Arithmetic operations
- Geometrical interpretation
- Absolute value. Argument. Trigonometric form of a complex number
- Roots of unity
- Riemann sphere

2. COMPLEX FUNCTIONS

- Analytic Functions. Definition. Examples.
- Cauchy-Riemann conditions
- Polynomials
- Rational Functions. Partial Fractions decomposition
- Power Series. Radius of Convergence. Abel's Theorem.
- Exponential and Trigonometric functions
- Branches of Complex Logarithms

3. COMPLEX INTEGRATION

- Differentiable arcs. Piece-wise differentiable arcs. Parametrization.
- Definition of an integral over an arc. Independence of Parametrization.
- Criterion for when the integral depends only on the end points of the arc
  
- Analytic functions defined over a disc admit anti-derivatives. Removable singularity case.
- Winding Number
- Cauchy's Integral Formula
- Higher order derivatives derived from Cauchy's Formula
- Maximum Principle
- Liouville's Theorem. Fundamental Theorem of Algebra.
- Taylor Series associated to an analytic function
- Isolated Singularities. Classification (Removable, Pole, Essential).
- Poles. Order of a pole. Laurent series. Residue.
- Residue Formula.
- Applications. Improper real integrals.
- Argument Principle. Rouché's Theorem. Counting zeros and poles in a given domain.