

Name: _____

Student ID#: _____

Take Home Final Exam

Due: 5:00pm Friday, March 22

Temple-Math 185A–Winter 2024

PLEASE make this the cover page for your Final Exam, and upload your exam in PDF to Canvas, (*not* to TA *or* Professor!), by 5 pm, Friday, March 22, 2024. Please enjoy the understanding you get from writing this up in your own words, as this material, resulting in the Residue Theorem of Complex Variables is one of the greatest creations in the history of mathematics.

NOTE: This is **NOT** a group project, and to get credit the writeup must be in your own words. Collaborating on a Final Exam is considered cheating in the University of California. You are however free to consult references, and to email specific questions to TA or Professor.

(Part I:) Write up complete solutions to problems circled 1-10 in Green in Chapters VIII, IX, X of Professors posted lecture notes.

(Part II-A:) Present a self contained discussion of the Taylor’s Theorem, the Laurent Expansion Theorem, and a discussion of zeros of an analytic functions $f(z)$, explaining why $1/f(z)$ admits “isolated singularities” of finite order at the zeros of f . Include the proofs, the main results.

(Part II-B:) Present a self contained discussion of the Residue Theorem as follows:

(1) Start with a correct statement (without proof) of the Laurent Expansion Theorem for analytic functions in an annulus $r < z < R$, stating conditions under which the series converges uniformly, and describing when one can pass integrals through summation signs.

(2) Assuming Part (II-A), derive the Residue Theorem for meromorphic functions from the Cauchy Integral Formula.

(3) Present in your own words, the four applications of the Residue Theorem to evaluating real integrals as discussed in Lecture Notes VIII, IX, X posted on Professor’s webpage.