
Study Guide for Math 120B Midterm 1 (Friday, April 27 2018)

Here is a list of topics which you should know for the first midterm.

1. The order of zeros of an analytic functions.
2. The classification of isolated singularities including:
 - a) finding the principal part of the Laurent series at an isolated singularity,
 - b) determining if the singularity is removable, a pole, or an essential singularity,
 - c) if it is a pole know how to find its order.
3. Basic knowledge of how to compute the residue of an isolated singularity.
4. Know the residue theorem and how to use it to compute integrals of a real variable including integrals of the form;
 - a) $\int_{\mathbb{R}} \frac{p(x)}{q(x)} dx$ where $p(z)$ and $q(z)$ are polynomials with $\deg q \geq \deg p + 2$.
 - b) $\int_{\mathbb{R}} \frac{p(x)}{q(x)} e^{i\lambda x} dx$ where $\lambda \in \mathbb{R}$ with $\lambda \neq 0$ and $p(z)$ and $q(z)$ are polynomials with $\deg q \geq \deg p + 1$. [You should understand how Jordan's lemma is needed here.
 - c) Integral techniques associated to branch cuts.
 - d) Integrals of the form,

$$\int_0^{2\pi} F(\{\cos k\theta, \sin k\theta\}_{k=1}^n) d\theta,$$

for "nice" F .

5. Know how to compute winding numbers ($N_{\sigma}(w)$) of a loop, σ , in \mathbb{C} about points, w , not in the image of σ .
6. Understand the argument principle and use it to get information about the number of poles and zeros of meromorphic functions.