



Due Date: 19 November 2015, Thursday
Time: Class time
Instructor: Ali Sinan Sertöz

NAME:.....

STUDENT NO:.....

Math 202 Complex Analysis – Homework 3

| 1 | 2 | 3 | 4 | 5 | TOTAL |
|----|----|----|----|----|-------|
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| 20 | 20 | 20 | 20 | 20 | 100 |

Please do not write anything inside the above boxes!

Check that there are **3** questions on your exam booklet. Write your name on top of every page. Show your work in reasonable detail. A correct answer without proper or too much reasoning may not get any credit.

Submit your solutions on this booklet only. Use extra pages if necessary.

Rules for Homework and Take-Home Exams

- (1) You may discuss the problems only with your classmates or with me. In particular you may not ask your assigned questions or any related question to online forums.
- (2) You may use any written source be it printed or online. Google search is perfectly acceptable.
- (3) It is absolutely mandatory that you write your answers alone. Any similarity with your written words and any other solution or any other source that I happen to know is a direct violation of honesty.
- (4) You must obey the usual rules of attribution: all sources you use must be explicitly cited in such a manner that the source is easily retrieved with your citation. This includes any ideas you borrowed from your friends.
- (5) Even if you find a solution online, you must rewrite it in your own narration, fill in the blanks if any, making sure that you exhibit your total understanding of the ideas involved.

Affidavit of compliance with the above rules: I affirm that I have complied with the above rules in preparing this submitted work.

Please sign here:

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Q-1) Define a function $F(m, n) = \int_{|z|=2} z^n (1 - z)^m dz$, where $m, n \in \mathbb{Z}$. Find explicitly the value of $F(m, n)$.

Solution:

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Q-2) Let f be an entire function. Fix two arbitrary points $z_1 \neq z_2$ in \mathbb{C} . Show that the integral of f along any contour from z_1 to z_2 is the same regardless of which contour used. Thus define a function $G(z) = \int_0^z f(z) dz$. Show that $G'(z) = f(z)$. Let F be any antiderivative of f . Show that $\int_{z_1}^{z_2} f(z) dz = F(z_2) - F(z_1)$.

Solution:

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Q-3) Evaluate the integral $\int_{|z|=1} z^n dz$ in two ways: (a) Use Cauchy theorems, (b) Use the definition of path integral.

Solution:

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Q-4) Let f be an entire function whose n -th derivative is bounded in the plane. Show that f is a polynomial of degree n .

Solution:

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Q-5) Let a, b, c be distinct complex numbers and let C be a simple closed contour containing all of them in its interior. Show that

$$\frac{1}{2\pi i} \int_C \frac{z^2}{(z-a)(z-b)(z-c)} dz = 1.$$

Solution: