

MT220: Complex Variables and Transforms

Section: A,B (Fall 2021)

A 02

[Total maks 70]

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Chapters:
02

Launch:
Sat, Oct 16 '21

Submit Date:
Fri, Oct 22 '21

CLO-02: Linear Mapping, Limit and Continuity of Functions.

Submit on GCR by Submit Date – Late Assignments not accepted

Submitted by:	Roll #:	Section:
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Assignment Submission: Terms & Conditions

1. This is a graded assignment; students are advised to revise all concepts before attempting.
2. Submit a **single PDF** in **GCR** by the submit date mentioned in GCR; SLATE/email not accepted.
3. Any pics or images used in the PDF must be scanned with **ClearScanner** app.
4. **Do not use** CamScanner or MS Lens as it deteriorates the image quality and the writing at the back of the page is also visible.
5. Submitting individual pictures or attaching multiple files **not accepted**.
6. **Late submission not accepted**.
7. Be sure to fill and checkmark the agreement in the submission box. **If not filled or checked, submission not accepted**.

Assignment Collaboration: Terms & Conditions

1. Collaboration is permitted with limitations as defined below.
2. All collaboration to be strictly done on GCR -> Assignment Collaboration Channel. May not post/discuss on any other forum.
3. Permitted forms of collaboration include (but not limited to) asking questions, answering questions, explaining intent of the question, explaining concepts, highlighting methods, discussion of all types, etc.
4. Forbidden forms of collaboration include (but not limited to) uploading solutions or partial solutions, letting know the partial or final answers, etc.

This Channel will be monitored continuously. Anyone indulging in forbidden activities will be removed from the channel, their posts deleted, and zero marks assigned in the assignment.

Assignment Problem:

For the first few assignments and quizzes, to develop students' complex number solving skills on their calculators, correct answers will be very important and weighted highly. Later in the course, the focus will mainly be on selection of appropriate tool to solve the problem, writing correct equations, etc.

1. Show that the lines $ay = x$ ($a \neq 0$) are mapped onto the spirals $p = \exp(a\varphi)$ under the transformation $w = p \exp(i\varphi)$. (10)
2. By considering the images of horizontal line segments, verify that the image of the rectangular region $c \leq x \leq b, c \leq y \leq d$ under the transformation $w = e^z$ is the region $e^c \leq p \leq e^b, c \leq \varphi \leq d$. (10)
3. One interpretation of a function $w = f(z) = u(x, y) + iv(x, y)$ is that of a vector field in the domain of definition of f . The function assigns a vector w , with components $u(x, y)$ and $v(x, y)$, to each point z at which it is defined. Indicate graphically the vector fields represented by (10)
 - (a) $w = iz$
 - (b) $w = z/|z|$
4. Consider a multiple valued function (10)
 - a) What is the branch point of F ? Explain.
 - b) Explicitly define two distinct branches of f_1 and f_2 of F . In each case state the branch cut.
5. Express the given composition of mappings as a linear mapping $f(z) = az + b$. (10)
 - (a) Rotation through $\pi/4$, magnification by 2, and translation by $1 + i$.
 - (b) Magnification by 2, translation by $\sqrt{2}$, and rotation through $\pi/4$.
 - (c) Translation by $\sqrt{2}/2$ rotation through $\pi/4$, then magnification by 2.
 - (d) What do you notice about the linear mappings in (a)–(c)?

6. Show that the image of the open disk $|z + 1 + i| < 1$ under the transformation

$$w = (3 - 4i)z + 6 + 2i \text{ is the open disc } |w + 1 - 3i| < 5. \quad (10)$$

7. Find the images of the vertical lines $x = a$ and the horizontal lines $y = b$ under the

$$\text{mapping } w = 1/z. \quad (10)$$