29.07.2021 18MAB102T-CLAT3 - B SLOT - Advanced Calculus and Complex Analysis- Dr. G. Arul Joseph

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18MAB102T-CLAT3 - B SLOT -Advanced Calculus and Complex Analysis

MCQ Questions
Each question carry one mark

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The value of $\oint_C \frac{1}{2z-3}dz$ where C is the circle $|z| = 1$ is

a. 0

b. $2\pi i$

c. $\frac{\pi}{2}i$

d. πi

- ( ) a
- ( ) b
- ( ) c
- (x) d

*

The bilinear transformation which maps the points $\infty, i, 0$ into $0, i, \infty$ respectively is

a. $w = z$

b. $w = -z$

c. $w = -\frac{1}{z}$

d. $w = \frac{1}{z}$

- ○ a
- ○ b
- ◉ c
- ○ d

*

If $f(z) = \frac{-1}{(z-1)} - 2[1 + (z-1) + (z-1)^2 + \ldots]$ then the residue of $f(z)$ at $\mathrm{z} = 1$is

a. 1

b. -1

c. 0

d. -2

- ○ a
- ○ b
- ◉ c
- ○ d

*

If $u(x, y)$ is a real part of analytic function and satisfies $u_{xx} + u_{yy} = 0$, then u is

a. Harmonic

b. Analytic

c. Differentiable

d. continuous

- ◉ a
- ○ b
- ○ c
- ○ d

*

If $u + iv$ is analytic then $v - iu$ is

a. analytic

b. not analytic

c. analytic only at the origin

d. analytic expect at the origin

- a
- b
- c
- d

*

The residue of $f(z) = \frac{z}{z^2+1}$ at $z = i$ is

a. 1

b. -1

c. 0

d. 1/2

- ○ a
- ○ b
- ○ c
- ◉ d

*

$w = log\, z$ is

a. analytic at all points

b. not analytic at the origin

c. nowhere analytic

d. analytic at infinity

- ◉ a
- ○ b
- ○ c
- ○ d

*

Find the analytic function $f(z)$ where $v = x^4 - 6x^2y^2 + y^4$

a. $iz^4 + c$

b. $iz^3 + c$

c. $-iz^4 + c$

d. $-iz^3 + c$

- [x] a
- [ ] b
- [ ] c
- [ ] d

*

Construction of an analytic functions $f(z)$ when real part is given using Milne's Thomson method $u_x = \phi_1(x, y), u_y = \phi_2(x, y)$, $v_x = \Psi_2(x, y), v_y = \Psi_1(x, y)$

a. $f(z) = \int [\phi_1(z, 0) - i\phi_2(z, 0)]dz + c$

b. $f(z) = \int [\phi_1(z, 0) + i\phi_2(z, 0)]dz + c$

c. $f(z) = \int [\Psi_1(z, 0) + i\Psi_2(z, 0)]dz + c$

d. $f(z) = \int [\Psi_1(z, 0) - i\Psi_2(z, 0)]dz + c$

- (●) a
- ( ) b
- ( ) c
- ( ) d

*

If $f(z)$ is not analytic at $z = z_0$ and there exists $\lim_{z \to z_0} f(z)$ and is finite then

a. The point $z = z_0$ is isolated singularity of $f(z)$

b. The point $z = z_0$ is a removable singularity of $f(z)$

c. The point $z = z_0$ is essential singularity of $f(z)$

d. The point $z = z_0$ is non isolated singularity of $f(z)$

- ( ) a
- (●) b
- ( ) c
- ( ) d

*

If $f(z) = u + iv$ is an analytic function of z then the Cauchy Riemann equations is

a. $u_x = v_{y,} u_y = v_x$

b. $u_x = v_{y,} u_y = -v_x$

c. $u_x = -v_{y,} u_y = -v_x$

d. $u_x = -v_{y,} u_y = v_x$

- ( ) a
- (•) b
- ( ) c
- ( ) d

*

The mapping $w = z + c$ gives

a. Translation

b. Rotation

c. inversion

d. reflection

- (selected) a
- b
- c
- d

*

If $f(z) = r^2(cos2\theta + isinp\theta)$ is analytic, then the value of p is

a. $\frac{1}{2}$

b. 0

c. 2

d. 1

- a
- b
- c
- d

*

The value of $\oint_C \frac{z^2}{(z-2)^2} dz$ where C is the circle $|z| = 3$ is

a. 0

b. $2\pi i$

c. $4\pi i$

d. $8\pi i$

- ○ a
- ○ b
- ○ c
- ◉ d

*

The value of the integral $\oint_C e^z dz$ where $|z| = 1$ is

a. $2\pi i$

b. $\frac{\pi}{2} i$

c. πi

d. 0

- (selected) a
- b
- c
- d

*

Let $C: |z-a| = r$ be a circle, the $f(z)$ can be expanded as a Taylor's series if

a. $f(z)$ is a function on C

b. $f(z)$ is an analytic function within C

c. $f(z)$ is not an analytic function within C

d. $f(z)$ is an analytic function outside C

- a
- (selected) b
- c
- d

*

If $\oint_C \frac{e^z}{z^2} dz = 0$, then C is

a. $|z| = 1$

b. $|z - 1| = 2$

c. $|z - 2| = 1$

d. $|z| = 2$

- (•) a
- ( ) b
- ( ) c
- ( ) d

*

A continuous curve which does not have a point of self-intersection is called a

a. Curve

b. Closed curve

c. Simple closed curve

d. Multiple curve

- ( ) a
- ( ) b
- (•) c
- ( ) d

*

The Laurent's series expansion $-\frac{1}{2}\sum\frac{(z+2)^n}{4^n} - \sum\frac{3^n}{(z+2)^n}$ for the function $f(z) = \frac{z}{(z-1)(z-2)}$ is valid in the region

a. $|z+2| < 3$

b. $1 < |z+2| < 2$

c. $3 < |z+2| < 4$

d. $|z+2| > 4$

- ○ a
- ○ b
- ○ c
- ○ d

*

Let $z = a$ is a pole of order m for $f(z)$, then the residue is

a. $\lim_{z \to a}[(z - a)f(z)]$

b. $\lim_{z \to a}[(z - a)f''(z)]$

c. $\lim_{z \to a} \frac{1}{(m-1)!} \frac{d^{m-1}}{dz^{m-1}} [(z - a)^m f(z)]$

d. $\lim_{z \to a} \frac{1}{m!} \frac{d^m}{dz^m} [(z - a)^m f(z)]$

- ○ a
- ○ b
- ◉ c
- ○ d

*

Expansion of $\frac{\sin z}{(z-\pi)}$ in Taylor's series about $z = \pi$ is

a. $\frac{(z-\pi)}{1!} - \frac{(z-\pi)^3}{3!} + \frac{(z-\pi)^5}{5!} - \ldots$

b. $\frac{(z-\pi)^2}{2!} - \frac{(z-\pi)^4}{4!} + \frac{(z-\pi)^6}{6!} - \ldots$

c. $-1 + \frac{(z-\pi)^2}{3!} - \frac{(z-\pi)^4}{5!} + \ldots$

d. $\frac{(z-\pi)}{2!} + \frac{(z-\pi)^3}{4!} - \frac{(z-\pi)^5}{6!} + \ldots$

- a
- b
- c
- d

*

The residue of $f(z) = \frac{z}{(z-1)^2}$ at $z = 1$ is

a. π

b. 1

c. -1

d. 0

- ( ) a
- ( ) b
- ( ) c
- (•) d

*

The critical points of the transformation $w = \frac{1}{2}\left(z + \frac{1}{z}\right)$

a. $z = \pm 1$

b. $z = \pm i$

c. $z = \pm 2$

d. $z = 1$

- (•) a
- ( ) b
- ( ) c
- ( ) d

*

$f(z) = |z|^2$ is analytic at

a. at the origin

b. at infinity

c. at all points of z-plane

d. nowhere

- [ ] a
- [ ] b
- [x] c
- [ ] d

*

If $f(z)$ is analytic inside and on C, then the value of $\oint_C \frac{f(z)}{(z-a)^5}dz$, where C is the simple closed curve and a is any point within C is

a. $2\pi i \frac{f^{v}(a)}{5!}$

b. $2\pi i\, f(a)$

c. $2\pi i \frac{f^{iv}(a)}{4!}$

d. 0

- ( ) a
- ( ) b
- (•) c
- ( ) d

*

The annular region for the function $f(z) = \frac{1}{z^2-z-6}$ is

a. $0 < |z| < 1$

b. $1 < |z| < 2$

c. $2 < |z| < 3$

d. $|z| < 3$

- ( ) a
- ( ) b
- ( ) c
- (•) d

*

The invariant point of the transformation $w = \frac{1}{z+2i}$ is

a. $z = i$

b. $z = -i$

c. $z = 1$

d. $z = -1$

- ( ) a
- (•) b
- ( ) c
- ( ) d

*

If $f(z) = u + iv$ is analytic at a point then which of the following is not true?

a. $u_x = v_y$ at the point

b. $u_y = -v_x$ at the point

c. $u_{xx} + u_{yy} \neq 0$ at the point

d. u_x, u_y, v_x, v_y are continuous at the point

- ( ) a
- ( ) b
- (•) c
- ( ) d

*

The value of $\oint_C \frac{e^{-z}}{z+1} dz$ where C is the circle $|z| = \frac{1}{3}$ is

a. 0

b. $2\pi ie$

c. $\frac{\pi}{2} ie$

d. πie

- (selected) a
- b
- c
- d

*

A single valued continuous function $f(z) = u + iv$ is analytic in a region R if it satisfy the C-R equations at each point and also possess one of the following

a. $u_x = v_y$

b. $v_x = u_y$

c. continuous u_x, u_y in a region R

d. continuous u_x, u_y, v_x, v_y at each point of the region R

- (x) a
- ( ) b
- ( ) c
- ( ) d

*

The region in which $f(z) = (x - y)^2 + 2i\,(x + y)$ is analytic

a. $x + y = 1$

b. $x = 1$

c. $x - y = 1$

d. $y = 1$

- ( ) a
- ( ) b
- ( ) c
- ( ) d

*

Find an analytic function $f(z)$ whose real part is $u = e^x \, siny$

a. $e^z + c$

b. $- e^z + c$

c. $-(1 + i)e^z + c$

d. $-ie^z + c$

- a
- b
- c
- d

*

If $f(z) = \frac{sinz}{z}$, then

a. $z = 0$ is a simple pole

b. $z = 0$ is a pole of order 2

c. $z = 0$ is a removable singularity

d. $z = 0$ is a zero of $f(z)$

- ○ a
- ○ b
- ◉ c
- ○ d

*

Let $C_1: |z-a| = R_1$ and $C_2: |z-a| = R_2$ be two concentric circles $(R_2 < R_1)$, the annular region is defined as

a. Within C_1

b. Within C_2

c. Within C_2 and outside C_1

d. Within C_1 and outside C_2

- ○ a
- ○ b
- ○ c
- ◉ d

*

The part $\sum_{n=1}^{\infty} b_n(z-a)^{-n}$ consisting of negative integral powers of $(z-a)$ is called as

a. The analytic part of the Laurent's series
b. The principal part of the Laurent's series
c. The real part of the Laurent's series
d. The imaginary part of the Laurent's series

- ○ a
- ◉ b
- ○ c
- ○ d

*

An analytic function with constant modulus is

a. Zero

b.constant

c. Analytic

d.harmonic

- a
- b
- c
- d

*

The zero's of $f(z) = \frac{z^2+1}{1-z^2}$ are

a. 0

b. $\pm i$

c. ± 1

d. 1

- [ ] a
- [x] b
- [ ] c
- [ ] d

*

The value of $\oint_C \frac{e^{2z}}{(z+1)^3}dz$ where C is the circle $|z| = 2$ is

a. 0

b. $2\pi ie^{-2}$

c. $8\pi ie^{-2}$

d. $4\pi ie^{-2}$

- ( ) a
- ( ) b
- ( ) c
- (x) d

*

Critical point of the map $w^2 = (z-\alpha)(z-\beta)$ are

a. $z = \frac{1}{2}(\alpha+\beta)$

b. $z = \frac{\alpha\beta}{2}$

c. $z = (\alpha+\beta)$

d. $z = \frac{1}{2}(\alpha-\beta)$

- [ ] a
- [ ] b
- [ ] c
- [ ] d

*

Let $z = a$ is a simple pole for $f(z)$ and $b = \lim_{z\to a}(z-a)f(z)$, then

a. b is a simple pole

b. b is removable singularity

c. b is a residue at a of order n

d. b is a residue at $z = a$

- [ ] a
- [x] b
- [ ] c
- [ ] d

*

Under the mapping $w = \frac{1}{z}$, the image of $|z| \leq 1$ is

a. $|w| \geq 1$

b. $|w| = 1$

c. $|w| > 1$

d. $|w - 1| = 1$

- a
- b
- c
- d

*

The bilinear transformation that maps the points $z = 0, 1, \infty$ into the points $w = -5, -1, 3$ respectively is

a. $w = \frac{3z-5}{z-1}$

b. $w = \frac{3z-5}{z+1}$

c. $w = \frac{2z+5}{z+1}$

d. $w = \frac{z-5}{z+1}$

- a
- b
- c
- d

*

$\nabla^2\{\log|f(z)|\} =$

a. 2

b.0

c. 1

d. 3

- [ ] a
- [ ] b
- [ ] c
- [ ] d

*

The points at which the function $f(z) = \frac{1}{1+z^2}$ fails to be analytic are

a. $z = \pm 1$

b. $z = \pm i$

c. $z = \pm 2$

d. $z = 1$

- [ ] a
- [x] b
- [ ] c
- [ ] d

*

If the integral $\oint_0^{2\pi} \frac{d\theta}{5+3\cos\theta} = \oint_C f(z)dz$, C is $|z| = 1$, then
(A) $z = -\frac{1}{3}$ lies inside C and
(B) $z = 3$ lies outside C. Which of the following is true.

a. Both A and B
b. Only A
c. Only B
d. Neither A nor B

- (selected) a
- b
- c
- d

*

If $w = z + \frac{1}{z}$ then $\frac{dw}{dz}$ is

a. $1 + \frac{1}{z^2}$

b. $1 - \frac{1}{z^2}$

c. $1 + \frac{1}{z}$

d. $1 - \frac{1}{z}$

- a
- b
- c
- d

*

The invariant points of the transformation $w = \frac{2z-5}{z+4}$ are

a. $z = \pm i$

b. $-1 \pm 2i$

c. $1 \pm 2i$

d. $-1 \pm i$

- ○ a
- ◉ b
- ○ c
- ○ d

*

If $f(z)$ is analytic inside and on C, then the value of $\oint_C \frac{f(z)}{z-a} dz$, where C is the simple closed curve and a is any point within C is

a. $f(a)$

b. $2\pi i f(a)$

c. $\pi i f(a)$

d. 0

- ○ a
- ◉ b
- ○ c
- ○ d

*

In Cauchy's Lemma for contour integration, if $f(z)$ be continuous function such that $|zf(z)| \to 0$ as $|z| \to \infty$, for C is the circle $|z| = R$, then

a. $\oint_C f(z)dz \to \infty \ as \ R \to \infty.$

b. $\oint_C f(z)dz \to 0 \ as \ R \to \infty.$

c. $\oint_C f(z)dz \to 0 \ as \ R \to 0.$

d. $\oint_C f(z)dz \to \infty \ as \ R \to 0.$

- ( ) a
- ( ) b
- ( ) c
- ( ) d

*

If $f(z)$ is analytic with the real part $e^x \, cosy$ then $f'(z)$ is equal to

a. $cosz$

b. $-e^z$

c. e^z

d. $sinz$

- ( ) a
- ( ) b
- (•) c
- ( ) d

Page 2 of 2

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