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

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

MCQ Questions
Each question carry one mark

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$w = log\, z$ is

a. analytic at all points

b. not analytic at the origin

c. nowhere analytic

d. analytic at infinity

- [ ] a
- [x] 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

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

*

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

a. 1

b. -1

c. 0

d. -2

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

*

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
- [x] b
- [ ] 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
- [x] 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

*

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 mapping $w = z + c$ gives

a. Translation

b. Rotation

c. inversion

d. reflection

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

*

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

a. 2

b.0

c. 1

d. 3

- ( ) 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

*

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

- (•) 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
- ◉ 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. $-iz^3 + c$

- ○ 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

*

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

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

*

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. $|w - 1| = 1$

- (selected) 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
- (selected) 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. continuousu_x, u_y in a region R

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

- ○ a
- ○ 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

- ( ) 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

*

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

*

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

- [x] 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

- ○ 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
- [x] 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
- ◉ 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
- [x] 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
- [x] 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

*

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
- [ ] b
- [ ] c
- [x] 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. $\frac{(z-\pi)}{2!} + \frac{(z-\pi)^3}{4!} - \frac{(z-\pi)^5}{6!} + \ldots$

- (x) 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 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
- ( ) 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

*

An analytic function with constant modulus is

a. Zero

b.constant

c. Analytic

d.harmonic

- [ ] a
- [x] 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
- [x] 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

*

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 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
- [x] 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
- [x] 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. $z = 1$

- (selected) a
- b
- c
- 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

*

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

*

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

a. 0

b. $2\pi i e^{-2}$

c. $8\pi i e^{-2}$

d. $4\pi i e^{-2}$

- (selected) 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

*

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

a. at the origin

b. at infinity

c. at all points of z-plane

d. nowhere

- ( ) a
- ( ) b
- (•) 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

*

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

- (selected) a
- b
- c
- d

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