

DEPARTMENT OF MATHEMATICS

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COMPLEX ANALYSIS (MCQ) FOR M.SC. STUDENTS

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(1) If $f(z)$ is an analytic function and $z = re^{i\theta}$, The Cauchy Riemann

equations are

- (a) $\frac{\partial u}{\partial r} = \frac{1}{r} \frac{\partial v}{\partial \theta}, \frac{\partial v}{\partial r} = \frac{1}{r} \frac{\partial u}{\partial \theta}$
 (b) $\frac{\partial u}{\partial r} = \frac{1}{r} \frac{\partial v}{\partial \theta}, \frac{\partial v}{\partial r} = -\frac{1}{r} \frac{\partial u}{\partial \theta}$ ★
 (c) $\frac{\partial u}{\partial r} = -\frac{1}{r} \frac{\partial v}{\partial \theta}, \frac{\partial v}{\partial r} = \frac{1}{r} \frac{\partial u}{\partial \theta}$
 (d) $\frac{\partial u}{\partial r} = -\frac{1}{r} \frac{\partial v}{\partial \theta}, \frac{\partial v}{\partial r} = -\frac{1}{r} \frac{\partial u}{\partial \theta}$

(2) Cartesian form of the Cauchy- Riemann equation is:

- (a) $u_x = v_y, u_y = -v_x$ ★
 (b) $v_x = u_y, u_y = -v_x$
 (c) $u_x = v_y, u_x = -v_y$
 (d) $u_y = v_x, u_y = -v_x$

(3) Which of the following is true?

- (a) Differentiability does not implies continuity
 (b) Differentiability implies continuity ★
 (c) Continuity implies differentiability
 (d) There is no relation between continuity and differentiability

(4) The function $f(z) = |z|^2$ has

- (a) One singular point
 (b) Two singular points
 (c) Three singular points
 (d) No singular point ★

(5) What is the value of m for which $f(x, y) = 2x - x^2 + my^2$ is harmonic

?

- (a) 1
 - (b) -1
 - (c) 2 ★
 - (d) -2
- (6) Which of the following function $f(z)$, of the complex variable z , is not analytic at all the points of the complex plane?
- (a) $f(z) = z^2$
 - (b) $f(z) = e^z$
 - (c) $f(z) = \log(z)$ ★
 - (d) $f(z) = \sin z$
- (7) If $f(z)$ is an analytic function whose real part is constant then $f(z)$ is:
- (a) function of z
 - (b) function of x only
 - (c) function of y only
 - (d) constant ★
- (8) A function which is analytic everywhere in a complex plane is known as
- (a) Harmonic function
 - (b) differentiable function
 - (c) entire function ★
 - (d) regular function
- (9) The function $f(z) = xy + iy$ is
- (a) Nowhere analytic

- (b) Analytic every where
- (c) Analytic only at origin ★
- (d) Analytic except at the origin
- (10) The harmonic conjugate of $u = \frac{y}{x^2+y^2}$
- (a) $2xy + y + c$
- (b) $2xy + 2y + c$
- (c) $xy + y + c$
- (d) $2xy - y + c$
- (11) Period of e^z is
- (a) -2π
- (b) 2π ★
- (c) $2\pi i$
- (d) $-2\pi i$
- (12) The value of the integral $\int_c \frac{dz}{z^2}$ where c is the positively oriented circle $z = 2e^{i\theta}$, $(-\pi \leq \theta \leq \pi)$ about the origin is
- (a) 1
- (b) -1
- (c) 0 ★
- (d) 2
- (13) The integral of $\int_c \frac{dz}{z^2+9}$, where c is the unit circle is
- (a) 0 ★
- (b) 1

- (c) 3
- (d) -3
- (14) The integral of $\int_c \frac{z^2}{z-2} dz$, where c is the circle $|z| = 3$ is
- (a) $2\pi i$
- (b) $4\pi i$ ★
- (c) $8\pi i$
- (d) $-\pi i$
- (15) The integral of $\int_c \frac{z^2}{z-i} dz$, where c is the circle $|z| = 2$ is
- (a) $2\pi i$ ★
- (b) $4\pi i$
- (c) $8\pi i$
- (d) $-\pi i$
- (16) The integral of $\int_c \frac{1}{3z^2+1} dz$, where c is the circle $|z| = 1$ is
- (a) πi ★
- (b) $-\pi i$
- (c) 0
- (d) 1
- (17) If $p(z)$ is a polynomial of degree $n \geq 1$ then it has
- (a) n zeros ★.
- (b) $n + 1$ zeros
- (c) $n - 1$ zeros
- (d) $n + 2$ zeros

(18) If a function $f(z)$ is analytic throughout a simple connected domain

D , then $\int_c f(z)dz =$

- (a) 0 ★
- (b) $2\pi i$
- (c) $2\pi i f(z)$
- (d) 1

(19) The integral of the function $\int_c \frac{\cos z}{z} dz$ where c is the unit circle is

- (a) π
- (b) πi
- (c) $-\pi i$
- (d) $2\pi i$ ★

(20) The integral of the function $\int_c \frac{\sin z}{z} dz$ where c is the unit circle is

- (a) π
- (b) πi
- (c) $-\pi i$
- (d) 0 ★

(21) The integral of the function $\int_c \frac{e^z}{z} dz$ where c is the unit circle is

- (a) π
- (b) πi
- (c) $-\pi i$
- (d) $2\pi i$ ★

(22) The integral of the function $\int_c \frac{z+2}{z-2} dz$ where c is the unit circle is

- (a) π

(b) πi

(c) $-\pi i$

(d) 0 ★

(23) The integral of the function $\int_c \frac{\cos z}{z^2} dz$ where c is the unit circle is

(a) π

(b) πi

(c) $-\pi i$

(d) 0 ★

(24) The integral of the function $\int_c \frac{\cos z}{2z} dz$ where c is the unit circle is

(a) π

(b) $4\pi i$ ★

(c) $-\pi i$

(d) 0

(25) The integral of the function $\int_c e^z \cos z dz$ where c is the unit circle is

(a) $\pi(3 + 2i)$

(b) $\frac{\pi}{2}(3 + 2i)$

(c) $\frac{\pi}{3}(3 + 2i)$

(d) $\frac{\pi}{2}(2 + 3i)$

(26) If $f(z)$ is analytic within and on a simple closed positively oriented

contour c and if z_0 is a point interior to c , then $\int_c \frac{f(z)}{(z-z_0)^{n+1}}$ equals

(a) $\frac{2\pi i}{n!} f(z_0)$

(b) $\frac{2\pi i}{n!} f'(z_0)$

(c) $\frac{2\pi i}{n!} f''(z_0)$

(d) $\frac{2\pi i}{n!} f^{(n)}(z_0)$ ★

(27) If $f(z)$ is continuous in a domain D and if $\int_c f(z)dz = 0$ for every simple closed positively oriented contour c in D , then

(a) $f(z)$ is analytic in D ★

(b) $f(z)$ is single valued in D

(c) $f(z)$ is constant in D

(d) None of these

(28) The converse of Cauchy- integral theorem is if $f(z)$ is continuous in D

(a) Euler's theorem

(b) Morera's theorem ★

(c) Liouville's theorem

(d) Goursat's theorem

(29) Piecewise smooth curve is also known as

(a) contour ★

(b) smooth curve

(c) circle

(d) regular curve

(30) Taylor series representation for $\frac{1}{z}$ about $z = 1$ is

(a) $1 - (1 - z) + (1 - z)^2 - \dots$ ★

(b) $1 + (1 - z) + (1 - z)^2 + \dots$

(c) $1 - (1 - z) - (1 - z)^2 - \dots$

(d) $1 - (1 - z) - (1 - z)^2 - \dots$

(31) A Maclaurin series is a Taylor series with center

- (a) 0 ★
- (b) 1
- (c) -1
- (d) 2

(32) Maclaurin series of $\sin z$ is

- (a) $\sum_{n=0}^{\infty} (-1)^{n+1} \frac{z^{2n+1}}{(2n+1)!}$
- (b) $\sum_{n=0}^{\infty} (-1)^n \frac{z^{2n+1}}{(2n+1)!}$ ★
- (c) $\sum_{n=0}^{\infty} (-1)^{n+1} \frac{z^{2n}}{(2n)!}$
- (d) $\sum_{n=0}^{\infty} (-1)^n \frac{z^{2n}}{(2n)!}$

(33) The radius of convergence of the series $\sum_{n=0}^{\infty} \frac{n!}{n^n} z^n$ is

- (a) $\frac{1}{e}$ ★
- (b) 0
- (c) e
- (d) 1

(34) The center of the power series $\sum_{n=0}^{\infty} (z - 4i)^n$ is

- (a) $4i$
- (b) $-4i$ ★
- (c) $2i$
- (d) None of these

(35) A power series always $\sum_{n=0}^{\infty} a_n (z - z_0)^n$ converges for

- (a) at all z which are either real or purely imaginary
- (b) at all z with $|z - z_0| < R$ for some $R > 0$ ★

- (c) at least one point z
 - (d) all complex numbers z
- (36) If the principal part of $f(z)$ at z_0 is zero, then the point z_0 is known as
- (a) removable singular point ★
 - (b) Pole
 - (c) Simple pole
 - (d) None of these
- (37) If the principal part of $f(z)$ at z_0 has finite terms, then the point z_0 is known as
- (a) removable singular point
 - (b) Pole
 - (c) Simple pole
 - (d) essential singular point ★
- (38) The zero of the function $\frac{z}{\cos z}$ is
- (a) 1
 - (b) 0 ★
 - (c) -1
 - (d) π
- (39) The singularity of the function $\frac{e^z-1}{z}$ is
- (a) π
 - (b) $-\pi$
 - (c) 0 ★
 - (d) 1

- (40) if $f(z)$ has a pole of order m at z_0 then $g(z) = \frac{f(z)}{f'(z)}$ at z_0 has
- (a) a simple pole ★
 - (b) a pole of order m
 - (c) a pole of order $m + 1$
 - (d) None of these
- (41) The singular point of the function $\frac{1}{4z-z^2}$ are
- (a) 0,4 ★
 - (b) 0,-4
 - (c) 0,0
 - (d) 0,2
- (42) The nature of the singularity of function $\frac{1}{\cos z - \sin z}$ at $z = \frac{\pi}{4}$ is
- (a) removable singularity
 - (b) isolated singularity ★
 - (c) simple pole
 - (d) essential singularity
- (43) Which of the following is related to Cauchy residue theorem?
- (a) $\int_c f(z) dz = 0$
 - (b) $\int_c \frac{f(z)}{z-z_0} dz = 2\pi i f(z_0)$
 - (c) $\int_c f(z) dz = 2\pi i$ (sum of residues) ★
 - (d) None of these
- (44) Analytic function $f(z) = u + iv$ of which the real part $u = e^x(x \cos y - y \sin y)$ is
- (a) $z + e^z$

(b) $ze^z + \sin z$

(c) $ze^z + c$ ★

(d) None of above

(45) If $f(z)$ is an analytic within and on a closed contour C a is any point lying in it, then :

(a) $2\pi i f(a) = \int \frac{f(z)}{(z-a)^2}$

(b) $2\pi i f'(a) = \int \frac{f(z)}{(z-a)^2}$ ★

(c) $f'(a) = \int \frac{f(z)}{(z-a)^2}$

(d) None of these

(46) $f(z) = \frac{z+2}{(z-1)(z-2)(z-3)}$ has singularities at :

(a) $z = 1$

(b) $z = 1, 2$

(c) $z = 1, 2, 3$

(d) All true ★

(47) The value of $\int_C \frac{dz}{(z-1)(z+1)}$ Where C is $|z| = 3$:

(a) 1

(b) 0 ★

(c) -1

(d) None

(48) $\int_0^{2\pi} \frac{\cos 2\theta}{5 + 4\cos\theta}$ is :

(a) $\frac{\pi}{2}$

(b) π

- (c) $\frac{\pi}{6}$ ★
- (d) $\frac{\pi}{3}$
- (49) $\int_0^\infty \frac{\sin mx}{x}$ is :
- (a) $\frac{\pi}{2}$ ★
- (b) π
- (c) $\frac{\pi}{6}$
- (d) $\frac{\pi}{3}$
- (50) Residue of $\frac{z^2}{z^2+1}$ at $z = i$ is:
- (a) $\frac{i}{4}$
- (b) $-\frac{i}{4}$
- (c) $\frac{i}{2}$ ★
- (d) $\frac{1}{4}$
- (51) Number of isolated singularities of the function $f(z) = \frac{1}{\sin \frac{\pi}{z}}$:
- (a) 1
- (b) 2
- (c) 5
- (d) ∞ ★
- (52) Number of poles of the function $f(z) = \tan \frac{1}{z}$ is:
- (a) 1
- (b) 2
- (c) 4
- (d) ∞ ★

- (53) Under the transformation $w = z + 1 - i$, the image of line $x = 0$ in w -plane is
- (a) $u = 1$ ★
 - (b) $u = 0$
 - (c) $v = 1$
 - (d) $v = 0$
- (54) A transformation of type $w = \alpha z + \beta$ where α and β are complex constant:
- (a) Translation
 - (b) Magnification
 - (c) Translation and Magnification ★
 - (d) None
- (55) For two complex numbers z_1, z_2 then $|z_1 - z_2|$ is:
- (a) $\geq |z_1| - |z_2|$ ★
 - (b) $\geq |z_1| + |z_2|$
 - (c) $= |z_1| - |z_2|$
 - (d) None of these
- (56) A harmonic conjugate of $u = e^x \sin y$ is:
- (a) $e^y \cos x$
 - (b) $-e^x \cos y$ ★
 - (c) $-e^{x \cos y + 1}$
 - (d) $\frac{e^y}{\sin x}$

(57) If $|f(z)| \leq M$ on curve C $|z - z_0| < \rho$ then :

(a) $|f^{(n)}(z_0)| \leq n! \frac{M}{\rho^n}$ ★

(b) $|f^{(n)}(z_0)| < n! \frac{M}{\rho^n}$

(c) $|f^{(n)}(z_0)| \geq n! \frac{M}{\rho^n}$

(d) All of these

(58) $z = 0$ for the function $f(z) = \log z$ is :

(a) Isolated singularity ★

(b) Pole

(c) Non-isolated singularity

(d) All of these

(59) If $f(z)$ has zero of order m , then :

(a) $f^{(m)} = 0$

(b) $f^{(m-2)} = 0$

(c) $f^{(m-1)} = 0$ ★

(d) All of these

(60) The integral of $\int_c \frac{z^2}{z-i} dz$, where c is the circle $|z| = 2$ is

(a) $-2\pi i$ ★

(b) $4\pi i$

(c) $8\pi i$

(d) $-\pi i$

(61) The integral of $\int_c \frac{1}{3z^2+1} dz$, where c is the circle $|z| = 1$ is

(a) πi

(b) $-\pi i$

- (c) 0 ★
- (d) 1
- (62) If $p(z)$ is a polynomial of degree $n \geq 1$ then it has
- (a) n zeros ★
- (b) $n + 1$ zeros
- (c) $n - 1$ zero
- (d) $n + 2$ zeros
- (63) If a function $f(z)$ is analytic throughout a simple connected domain D , then $\int_c f(z)dz =$
- (a) 0 ★
- (b) $2\pi i$
- (c) $2\pi i f(z)$
- (d) 1
- (64) The integral of the function $\int_c \frac{\cos z}{z} dz$ where c is the unit circle is
- (a) π
- (b) πi
- (c) $-\pi i$
- (d) $2\pi i$ ★
- (65) The integral of the function $\int_c \frac{\sin z}{z} dz$ where c is the unit circle is
- (a) π
- (b) πi
- (c) $-\pi i$
- (d) 0 ★

(66) If $T_1(z) = \frac{z+2}{z+3}$, $T_2(z) = \frac{z}{z+1}$, then the value of $T_2^{-1}T_1(z)$ is

(a) $z - 2$

(b) $z + 2$ ★

(c) $2z$

(d) $\frac{z+2}{z-3}$

(67) Which is not Magnification

(a) $w = 10z$

(b) $w = \frac{1}{8z}$

(c) $w = 3z$

(d) $w = z + 3$ ★

(68) Under the translation transformation, if $w = z + (1 - 2i)$, then u and

v are

(a) $u = x; v = y$

(b) $u = x - 1; v = y - 2$

(c) $u = x + 1; v = y - 2$ ★

(d) $u = x + y; v = 0$

(69) The function $f(z) = \frac{1}{z(z-3)}$ is not analytic at $z = \dots$

(a) $0, 0$

(b) $3, 3$

(c) $0, 3$ ★

(d) $3, \infty$

(70) The real component of the function $\sin h(e^z)$ is :

(a) $\cosh(e^x) + \sinh(e^x)$

- (b) $\cosh(e^x) - \sinh(e^x)$
 (c) $\cos(e^x) + \sin(e^x)$
 (d) $\sinh(e^x \cos y) \cos(e^x \sin y)$ ★

(71) If $w = f(z) = u + iv$ and $u - v = e^x(\cos y - \sin y)$, find w in terms of z :

- (a) $f(z) = w = e^z + c$ ★
 (b) $f(z) = w = e^{iz} + c$
 (c) $f(z) = w = e^x$
 (d) $f(z) = w = e^y$

(72) Evaluate $\frac{1}{4z - z^2}$, when $0 < |z| < 4$:

- (a) $\sum_{n=0}^{\infty} z^{n-1}$
 (b) $\sum_{n=0}^{\infty} z^{n-1} 4^{n+1}$
 (c) $\sum_{n=0}^{\infty} z^{n+1} 4^{n+1}$
 (d) $\sum_{n=0}^{\infty} \frac{z^{n-1}}{4^{n+1}}$ ★

(73) Expand e^z in a Taylor's series with region of convergence:

- (a) $\sum_{n=0}^{\infty} \frac{z^n}{n!}$ when $|z| < \infty$ ★
 (b) $\sum_{n=0}^{\infty} z^n n!$ when $|z| < \infty$
 (c) $\sum_{n=0}^{\infty} z^{-n} n!$ when $|z| > \infty$
 (d) $\sum_{n=0}^{\infty} z^{-n}$ when $|z| = 0$

(74) If c is a closed curve with $z = a$ inside c , then $\int_c \frac{dz}{z - a} = \dots$:

- (a) πi
 (b) $2\pi i$ ★
 (c) $3\pi i$
 (d) $4\pi i$

- (75) Evaluate $\int_0^{1+i} z^2 dz = \dots$:
- (a) $(1+i)^3$
 - (b) $(1-i)^3$
 - (c) $\frac{1}{3}(1+i)^3$ ★
 - (d) $\frac{1}{3}(1-i)^3$
- (76) Evaluate $|z_1 + z_2|^2 + |z_1 - z_2|^2 = \dots$:
- (a) $2|z_1|^2 - 2|z_2|^2$
 - (b) $2|z_1|^2 + 2|z_2|^2$ ★
 - (c) $|z_1|^2 - |z_2|^2$
 - (d) $|z_1|^2 + |z_2|^2$
- (77) Evaluate $|z_1 + z_2|^2 + |z_1 - z_2|^2 = \dots$:
- (a) $2|z_1|^2 - 2|z_2|^2$
 - (b) $2|z_1|^2 + 2|z_2|^2$ ★
 - (c) $|z_1|^2 - |z_2|^2$
 - (d) $|z_1|^2 + |z_2|^2$
- (78) Modulus and Argument of $\left(\frac{2+i}{3-i}\right)^2$:
- (a) $1/2$ and $\pi/2$ ★
 - (b) $1/4$ and $\pi/4$
 - (c) 1 and π
 - (d) $1/4$ and $\pi/2$
- (79) If $f(z) = e^x(\cos y + i \sin y)$, then $f(z) = \dots$:
- (a) e^{-z}
 - (b) e^z ★

(c) ze^z

(d) $-ze^{-z}$

(80) Let $f(z) = e^{-z^{-4}}$ ($z \neq 0$) and $f(0) = 0$ is not analytic at $z = \dots$:

(a) 0 ★

(b) 1

(c) -1

(d) ∞

(81) Cauchy-Reimann equations are:

(a) $u_x = v_y, u_y = -v_x$ ★

(b) $u_x = v_x, u_y = -v_y$

(c) $u_x = v_y, u_y = v_x$

(d) $u_x = -v_y, u_y = v_x$

(82) Cauchy-Reimann equations are:

(a) $v_\theta = ru_r, u_\theta = -rv_r$ ★

(b) $v_\theta = -ru_r, u_\theta = -rv_r$

(c) $v_\theta = ru_r, u_\theta = rv_r$

(d) $v_\theta = u_r, u_\theta = -v_r$

(83) Cauchy-Reimann equations are:

(a) $v_\theta = ru_r, u_\theta = -rv_r$ ★

(b) $v_\theta = -ru_r, u_\theta = -rv_r$

(c) $v_\theta = ru_r, u_\theta = rv_r$

(d) $v_\theta = u_r, u_\theta = -v_r$

(84) Orthogonal system of two family of curves:

(a) $u_x v_x + u_y v_y = 0$ ★

(b) $u_x v_x - u_y v_y = 0$

(c) $u_x v_y + u_y v_x = 0$

(d) $u_x v_y - u_y v_x = 0$

(85) Any function of x and y possessing continuous partial derivatives of the first and second order is called a harmonic function if it satisfies:

(a) Laplace equation ★

(b) Eulers equation

(c) Lagrangian equation

(d) None of above

(86) Find the analytic function of which the real part $u = e^{-x} [(x^2 - y^2) \cos y + 2xy \sin y]$:

(a) $(x + iy)^2 e^x (\cos y + i \sin y) + c$

(b) $(x + iy)^2 e^x (\cos x + i \sin x) + c$

(c) $e^{-x} (\cos x + i \sin x) + c$

(d) $(x + iy)^2 e^{-x} (\cos y - i \sin y) + c$ ★

(87) If the function $u = x^3 - 3xy^2$ is harmonic, then its corresponding analytic function is:

(a) $f(z) = z + c$

(b) $f(z) = z^3 + c$ ★

(c) $f(z) = z^2 + z + c$

(d) $f(z) = z^2 - z + c$

(88) Which of the following is not correct for analytic function $f(z)$ and

$g(z)$ in a region R :

- (a) $f(z) + g(z)$ is analytic in R
- (b) $f(z).g(z)$ is analytic in R
- (c) $f(z) - g(z)$ is analytic in R
- (d) $f(z)/g(z)$ is analytic in R ★

(89) Radius of convergence of the power series $\sum(\log n)^n z^n$ is:

- (a) 0 ★
- (b) 1
- (c) -1
- (d) ∞

(90) Cauchy's integral formula is:

- (a) $f(z_0) = \frac{1}{2\pi i} \int_c \frac{f(z)}{z - z_0} dz$ ★
- (b) $f(z_0) = \frac{1}{2\pi i} \int_c \frac{f(z)}{z + z_0} dz$
- (c) $f(z_0) = \frac{1}{2\pi} \int_c \frac{f(z)}{z - z_0} dz$
- (d) $f(z_0) = \frac{1}{2\pi} \int_c \frac{f(z)}{z + z_0} dz$

(91) Cauchy's Residue Theorem is:

- (a) $\int_c f(z) dz = 2\pi i R$
- (b) $\int_c f(z) dz = \sum R$
- (c) $\int_c f(z) dz = 2\pi i \sum R$ ★
- (d) $\int_c f(z) dz = -2\pi i R$

(92) Maclaurin's series is:

- (a) $f(z) = \sum_{n=1}^{\infty} \frac{z^n}{n!} f^{(n)}(0)$

$$(b) f(z) = \sum_{n=1}^{\infty} z^n f^{(n)}(0)$$

$$(c) f(z) = f(0) + \sum_{n=1}^{\infty} \frac{z^n}{n!} f^{(n)}(0) \star$$

$$(d) f(z) = \sum_{n=1}^{\infty} \frac{z^n}{(n-1)!} f^{(n)}(0)$$

$$(93) \int_0^{2\pi} \frac{d\theta}{a + b \cos \theta} =:$$

$$(a) 2\pi\sqrt{a^2 - b^2}, a > b > 0$$

$$(b) 2\pi\sqrt{a^2 + b^2}, a > b > 0$$

$$(c) 2\pi i\sqrt{a^2 - b^2}, a > b > 0$$

$$(d) \frac{2\pi}{\sqrt{a^2 - b^2}} a > b > 0 \star$$

$$(94) \int_0^{2\pi} \frac{d\theta}{5 + 3 \cos \theta} =:$$

$$(a) 2\pi$$

$$(b) \frac{\pi}{2} \star$$

$$(c) \pi\sqrt{3}$$

$$(d) \frac{\pi}{(5 + 3i)}$$

$$(95) \int_0^{2\pi} \frac{d\theta}{a + b \sin \theta} =:$$

$$(a) 2\pi\sqrt{a^2 - b^2}, a > b > 0$$

$$(b) 2\pi\sqrt{a^2 + b^2}, a > b > 0$$

$$(c) 2\pi i\sqrt{a^2 - b^2}, a > b > 0$$

$$(d) \frac{2\pi}{\sqrt{a^2 - b^2}} a > b > 0 \star$$

$$(96) \int_0^{2\pi} \frac{d\theta}{5 + 3 \sin \theta} =:$$

$$(a) 2\pi$$

$$(b) \frac{\pi}{2} \star$$

- (c) $\pi\sqrt{3}$
- (d) $\frac{\pi}{(5+3i)}$
- (97) If $w = T_z = \frac{z+2}{z+3}$, then $T^{-1}(w)$ is:
- (a) $\frac{2+3w}{w+1}$
- (b) $w(2-3w)$
- (c) $\frac{2-3w}{w-1}$ ★
- (d) $\frac{w}{w-1}$
- (98) Polar form of complex number $-5+5i$ is:
- (a) $5\sqrt{2}e^{\frac{\pi i}{4}}$
- (b) $5\sqrt{2}e^{\frac{-3\pi i}{4}}$
- (c) $5\sqrt{2}e^{\frac{3\pi i}{4}}$ ★
- (d) None of above
- (99) z_1 and z_2 are two complex numbers then:
- (a) $|z_1 - z_2| = |z_1| - |z_2|$
- (b) $|z_1 - z_2| \leq |z_1| - |z_2|$
- (c) $|z_1 - z_2| \leq |z_1| + |z_2|$ ★
- (d) $|z_1 - z_2| \geq |z_1| + |z_2|$
- (100) Derivative of function in polar form of $w = f(z)$:
- (a) $\frac{dw}{dz} = \frac{\partial w}{\partial r} e^{i\theta}$ ★
- (b) $\frac{dw}{dz} = -\frac{\partial w}{\partial r} e^{-i\theta}$
- (c) $\frac{dw}{dz} = \frac{\partial w}{\partial \theta} e^{i\theta}$
- (d) $\frac{dw}{dz} = -\frac{\partial w}{\partial \theta} e^{-i\theta}$

(101) Which of the following is correct for the $w = f(z)$:

(a) $\frac{dw}{dz} = \frac{\partial w}{\partial x}$ ★

(b) $\frac{dw}{dz} = -\frac{\partial w}{\partial x}$

(c) $\frac{dw}{dz} = \frac{\partial w}{\partial y}$

(d) $\frac{dw}{dz} = -\frac{\partial w}{\partial y}$

(102) If the power series $\sum a_n z_n$ is convergent and $\sum |a_n z_n|$ is not convergent,

the series $\sum a_n z_n$ is said to be:

(a) divergent

(b) oscillatory

(c) conditionally convergent ★

(d) None of above

(103) Radius of convergent, the series $\sum n^n z_n$ is:

(a) 0

(b) 1

(c) ∞ ★

(d) None of above

(104) Radius of convergent, the series $\sum \frac{n}{2^n} z^n$ is:

(a) 2

(b) 1

(c) ∞ ★

(d) None of above

(105) The value of $\int_C \frac{1}{z} dz$, where C is circle $z = e^{i\theta}$ with $0 \leq \theta \leq \pi$:

(a) πi ★

(b) $-\pi i$

(c) $2\pi i$

(d) 0

(106) Which of the following functions does represent the series $\sum_{n=0}^{\infty} \frac{z^n}{n!}$ for

$|z| < \infty$:

(a) $\sin z$

(b) $\cos z$

(c) e^z ★

(d) $\log(1+z)$

(107) Number of poles of the function $f(z) = \tan\left(\frac{1}{z}\right)$:

(a) 2

(b) 4

(c) ∞ ★

(d) *None of above*

(108) Residue of the function $f(z) = \frac{z+1}{(z-1)(z-2)}$ at $z=1$ is:

(a) 2

(b) -2 ★

(c) 1

(d) -1

(109) Residue of the function $f(z) = \frac{e^z}{z^2(z^2+9)}$ at $z=1$ is:

(a) 1

(b) $1/9$ ★

(c) $1/2$

(d) $2/3$

(110) The value of $\int_0^{\infty} \frac{\log x}{1+x^2}$ is:

(a) 1

(b) 0

(c) π

(d) $\frac{\pi}{2}$ ★

(111) The number of isolated singular points of the function $f(z) = \frac{z+3}{z^2(z^2+2)}$

is:

(a) 1

(b) 2

(c) 3 ★

(d) 4