DEPARTMENT OF MATHEMATICS

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COMPLEX ANALYSIS (MCQ) FOR B.A. AND B.SC. STUDENTS

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(1) Let (X, d) be a metric space. If there exist a number K such that $d(x, y) \leq K$, $\forall x, y \in X$, then metric space is called:

(a) Bounded Metric space ★

(b) Discrete metric space

(c) Usual metric space

(d) None of above

(2) Let (X, d) be a metric space such that $d(x, y) = 1$ if $x \neq y$ and $d(x, y) = 0$ if $x = y$ then:

(a) $d(x, y) \leq d(x, z) + d(z, y)$ ★

(b) $d(x, y) \geq d(x, z) + d(z, y)$

(c) $d(x.y) > 0$

(d) None of above

(3) If $d(x, y) = \sqrt{(x_1 - y_1)^2 + (x_2 - y_2)^2}$ where $x = (x_1, x_2), y = (y_1, y_2) \in R^2$ then:

(a) $d(x, y) \neq d(y, x)$

(b) (R^2, d) is metric space ★

(c) (R^2, d) is not metric space

(d) None of above

(4) For usual metric (R, d) on R every singleton set in R is:

(a) Open

(b) Closed ★

(c) Open and Closed

(d) None of above

(5) The unit open ball (R^2, d) at the origin is:

(a) $\{(x, y) \in R^2 : |x| + |y| < 1\}$

(b) $\{(x, y) \in R^2 : x^2 + y^2 > 1\}$

(c) $\{(x, y) \in R^2 : x^2 + y^2 < 1\}$ ★

(d) $\{(x, y) \in R^2 : |x| + |y| >\}$

(6) If A and B are subsets of metric space (X, d) and $\bar{A}$ denotes the closure of A, which of the following is false:

(a) $A \subset \bar{A}$

(b) $A \subset B \Rightarrow \bar{A} \subset \bar{B}$

(c) $\overline{A \cup B} \subseteq \bar{A} \cup \bar{B}$ ★

(d) $\overline{A \cap B} \subseteq \bar{A} \cap \bar{B}$

(7) If A and B are subsets of metric space (X, d) and A^0 denotes the interior of A, which of the following is true:

(a) $A^0 \cup B^0 = (A \cup B)^0$

(b) $(A \cup B)^0 \subset A^0 \cup B^0$

(c) $(A \cup B)^0 \supset A^0 \cup B^0$ ★

(d) None of these

(8) Every subset of a discrete metric space (X, d) is:

(a) Open

(b) Closed

(c) Open as well as closed ★

(d) None of above

(9) Union of two compact sets in a metric space (X, d) is:

(a) Open set

(b) Closed set

(c) Compect set ★

(d) None of above

(10) A compact subset of a metric space (X, d) is:

(a) Open set

(b) Closed set ★

(c) Unbounded set

(d) None of above

(11) A set R of real numbers with usual metric space is:

(a) Disconnected space

(b) Connected space ★

(c) Totally disconnected space

(d) None of above

(12) Let A and B be any two connected sets in a metric space X, then:

(a) $A \cup B$ is always connected

(b) $A \cup B$ is not connected

(c) $A \cup B$ is connected, if $A \cap B \neq \phi$ ★

(d) $A \cup B$ is connected if $A \cap B = \phi$

(13) A real numbers set E is compact if:

(a) E is bounded and open

(b) E is unbounded and closed

(c) E is bounded and closed ★

(d) E is unbounded and open

(14) For a subset A of a metric space (X, d), we have $\bar{\bar{A}} =$:

(a) A ★

(b) $\bar{A}$

(c) A^c

(d) A^0

(15) Subset A of a metric space (X, d), we have is open if and only if:

(a) $A = \bar{A}$ ★

(b) $A = A^0$

(c) $A \neq A^0$

(d) None of above

(16) If $f(z)$ is a 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) $\frac{\partial u}{\partial r} = -\frac{1}{r}\frac{\partial v}{\partial \theta}, \frac{\partial v}{\partial r} = -\frac{1}{r}\frac{\partial u}{\partial \theta}$

(17) 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) $u_y = v_x, u_y = -v_x$

(18) 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

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

(a) One singular point

(b) Two singular points

(c) Three singular points

(d) No singular point ★

(20) 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

(21) 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) $f(z) = \sin z$

(22) 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 ★

(23) 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

(24) 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

(25) The harmonic conjugate of $u = \frac{y}{x^2+y^2}$

(a) $2xy + y + c$

(b) $2xy + 2y + c$

(c) $xy + y + c$

(d) $2xy - y + c$

(26) Period of e^z is

(a) -2π

(b) 2π ★

(c) $2\pi i$

(d) $-2\pi i$

(27) 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

(28) 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

(29) The integral of $\int_c \frac{z^2}{z-2} dz$, where c is the circle $\mid z \mid= 3$ is

(a) $2\pi i$

(b) $4\pi i$ ★

(c) $8\pi i$

(d) $-\pi i$

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

(a) $2\pi i$ ★

(b) $4\pi i$

(c) $8\pi i$

(d) $-\pi i$

(31) 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

(32) 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

(33) 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

(34) 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) $2\pi i$ ★

(35) 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 ★

(36) 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) $2\pi i$ ★

(37) 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 ★

(38) 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 ★

(39) 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

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

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

(42) 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

(43) 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

(44) Piecewise smooth curve is also known as

(a) contour ★

(b) smooth curve

(c) circle

(d) regular curve

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

(a) $1 - (1-z) + (1-z)^2 - \cdots$ ★

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

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

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

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

(a) 0 ★

(b) 1

(c) -1

(d) 2

(47) 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) $\sum_{n=0}^{\infty} (-1)^{n} \frac{z^{2n}}{(2n)!}$

(48) 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

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

(a) $4i$

(b) $-4i$ ★

(c) $2i$

(d) None of these

(50) 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

(51) 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

(52) If the principal part of $f(z)$ at z_0 has finit terms, then the point z_0 is known as (a) removable singular point

(b) Pole

(c) Simple pole

(d) essential singular point ★

(53) The zero of the function $\frac{z}{\cos z}$ is

(a) 1

(b) 0 ★

(c) -1

(d) π

(54) The singularity of the function $\frac{e^z-1}{z}$ is

(a) π

(b) $-\pi$

(c) 0 ★

(d) 1

(55) 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

(56) The singular point of the function $\frac{1}{4z-z^2}$ are

(a) 0,4 ★

(b) 0,-4

(c) 0,0

(d) 0,2

(57) 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

(58) 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

(59) Analytic function $f(z) = u + iv$ of which the real part $u = e^x(xcosy - ysiny)$ is

(a) $z + e^z$

(b) $ze^z + sinz$

(c) $ze^z + c$ ★

(d) None of above

(60) 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

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

(a) $z = 1$

(b) $z = 1, 2$

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

(d) All true ★

(62) The value of $\int_c \dfrac{dz}{(z-1)(z+1)}$ Where C is $|z| = 3$:

(a) 1

(b) 0 ★

(c) -1

(d) None

(63) $\int_0^{2\pi} \dfrac{cos2\theta}{5+4cos\theta}$ is :

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

(b) π

(c) $\dfrac{\pi}{6}$ ★

(d) $\dfrac{\pi}{3}$

(64) $\int_0^{\infty} \dfrac{sinmx}{x}$ is :

(a) $\dfrac{\pi}{2}$ ★

(b) π

(c) $\dfrac{\pi}{6}$

(d) $\dfrac{\pi}{3}$

(65) Residue of $\dfrac{z^2}{z^2+1}$ at $z = i$ is:

(a) $\dfrac{i}{4}$

(b) $-\dfrac{i}{4}$

(c) $\frac{i}{2}$ ★

(d) $\frac{1}{4}$

(66) Number of isolated singularities of the function $f(z) = \dfrac{1}{sin\frac{\pi}{z}}$:

(a) 1

(b) 2

(c) 5

(d) ∞ ★

(67) Number of poles of the function $f(z) = tan\frac{1}{z}$ is:

(a) 1

(b) 2

(c) 4

(d) ∞ ★

(68) 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) $v = 0$

(69) 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

(70) 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

(71) A harmonic congate of $u = e^x siny$ is:

(a) $e^y cosx$

(b) $-e^x cosy$ ★

(c) $-e^{xcosy+1}$

(d) $\dfrac{e^y}{sinx}$

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

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

(b) $| f^{(n)}(z_0) | < n! \dfrac{M}{\varrho^n}$

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

(d) All of these

(73) $z = 0$ for the fuction $f(z) = \log z$ is :

(a) Isolated singularity ★

(b) Pole

(c) Non-isolated singularity

(d) All of these

(74) 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

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

(a) $-2\pi i$ ★

(b) $4\pi i$

(c) $8\pi i$

(d) $-\pi i$

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

(a) πi

(b) $-\pi i$

(c) 0 ★

(d) 1

(77) 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

(78) 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

(79) 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) $2\pi i$ ★

(80) 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 ★

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

(a) $z - 2$

(b) $z + 2$ ★

(c) $2z$

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

(82) Which is not Magnification

(a) $w = 10z$

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

(c) $w = 3z$

(d) $w = z + 3$ ★

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

(84) The function $f(z) = \dfrac{1}{z(z-3)}$ is not analytic at $z = ...$

(a) $0, 0$

(b) $3, 3$

(c) $0, 3$ ★

(d) $3, \infty$

(85) 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) $\sinh(e^x \cos y)\cos(e^x \sin y)$ ★

(86) 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) $f(z) = w = e^y$

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

(a) $\sum\limits_{n=0}^{\infty} z^{n-1}$

(b) $\sum_{n=0}^{\infty} z^{n-1}4^{n+1}$

(c) $\sum_{n=0}^{\infty} z^{n+1}4^{n+1}$

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

(88) 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 $|z| = 0$

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

(a) πi

(b) $2\pi i$ ★

(c) $3\pi i$

(d) $4\pi i$

(90) Evaluate $\int_0^{1+i} z^2 dz = ...$:

(a) $(1+i)^3$

(b) $(1-i)^3$

(c) $\frac{1}{3}(1+i)^3$ ★

(d) $\frac{1}{3}(1-i)^3$

(91) Evaluate $|z_1 + z_2|^2 + |z_1 - z_2|^2 = ...$:

(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) $|z_1|^2 + |z_2|^2$

(92) Evaluate $|z_1 + z_2|^2 + |z_1 - z_2|^2 = ...$:

(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) $|z_1|^2 + |z_2|^2$

(93) 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 $\pi/2$

(94) If $f(z) = e^x(\cos y + i \sin y)$, then $f(z) = ...$:

(a) e^{-z}

(b) e^z ★

(c) ze^z

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

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

(a) 0 ★

(b) 1

(c) -1

(d) ∞

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

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

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

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

(100) 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

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

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

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

(103) 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 ★

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

(a) 0 ★

(b) 1

(c) -1

(d) ∞

(105) 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) $f(z_0) = \frac{1}{2\pi} \int_c \frac{f(z)}{z + z_0} dz$

(106) 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) $\int_c f(z)dz = -2\pi i R$

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

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

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

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

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

(a) 2π

(b) $\frac{\pi}{2}$ ★

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

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

(110) $\int\limits_0^{2\pi} \dfrac{d\theta}{a+b\sin\theta} =$:

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

(111) $\int\limits_0^{2\pi} \dfrac{d\theta}{5+3\sin\theta} =$:

(a) 2π

(b) $\dfrac{\pi}{2}$ ★

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

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

(112) If $w = T_z = \dfrac{z+2}{z+3}$, then $T^{-1}(w)$ is:

(a) $\dfrac{2+3w}{w+1}$

(b) $w(2-3w)$

(c) $\dfrac{2-3w}{w-1}$ ★

(d) $\dfrac{w}{w-1}$

(113) 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

(114) 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) $|z_1 - z_2| \geq |z_1| + |z_2|$

(115) Derivative of function in polar form of $w = f(z)$:

(a) $\dfrac{dw}{dz} = \dfrac{\partial w}{\partial r} e^{i\theta}$ ★
(b) $\dfrac{dw}{dz} = -\dfrac{\partial w}{\partial r} e^{-i\theta}$
(c) $\dfrac{dw}{dz} = \dfrac{\partial w}{\partial \theta} e^{i\theta}$
(d) $\dfrac{dw}{dz} = -\dfrac{\partial w}{\partial \theta} e^{-i\theta}$

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

(a) $\dfrac{dw}{dz} = \dfrac{\partial w}{\partial x}$ ★
(b) $\dfrac{dw}{dz} = -\dfrac{\partial w}{\partial x}$
(c) $\dfrac{dw}{dz} = \dfrac{\partial w}{\partial y}$
(d) $\dfrac{dw}{dz} = -\dfrac{\partial w}{\partial y}$

(117) 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) conditionaly convergent ★

(d) None of above

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

(a) 0

(b) 1

(c) ∞ ★

(d) None of above

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

(a) 2

(b) 1

(c) ∞ ★

(d) None of above

(120) 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

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

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

(a) 2

(b) 4

(c) ∞ ★

(d) $None of above$

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

(a) 2

(b) -2 ★

(c) 1

(d) -1

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

(a) 1

(b) 1/9 ★

(c) 1/2

(d) 2/3

(125) The value of $\int\limits_0^\infty \dfrac{\log x}{1+x^2}$ is:

(a) 1

(b) 0

(c) π

(d) $\dfrac{\pi}{2}$ ★

(126) The number of isolated singular points of the function $f(z) = \dfrac{z+3}{z^2(z^2+2)}$ is:

(a) 1

(b) 2

(c) 3 ★

(d) 4