

PUNJAB PUBLIC SERVICE COMMISSION
WRITTEN TEST FOR RECRUITMENT TO THE POSTS OF
LECTURER MATHEMATICS (BS-17)
(MALE/ FEMALE)

ROLL NO.

IN THE PUNJAB HIGHER EDUCATION DEPARTMENT-2015

TIME ALLOWED: TWO HOURS**MAXIMUM MARKS: 100****INSTRUCTIONS**

- Write your allotted Roll No. in the top right corner of QUESTION PAPER and in the specified place of ANSWER SHEET.
- Read QUESTION PAPER carefully and mark your answer on the ANSWER SHEET.
- Each question has four options. Fill only one box that you think is the correct answer. Each question carries 1 mark. 0.25 mark will be deducted for each incorrect answer.
- Instructions for filling box have been given on the Answer Sheet. Read them carefully before you attempt.
- Read the Instructions for filling your ROLL NO. and marking your answer on the ANSWER SHEET carefully before you start answering.
- Sign the Answer Sheet in the box provided at the bottom corner.
- Return both Question Paper and Answer Sheet, to the Staff, at the end of the test.
- Use of Calculator is not allowed.

- Q.1. $\int_{-4}^0 \frac{t dt}{\sqrt{16-t^2}} = \text{_____}$. (A) 0 (B) Divergent (C) -4 (D) 4
- Q.2. The period of the function $A \cos \omega t + B \sin \omega t$ is _____ . (A) $\frac{\omega}{2\pi}$ (B) $2\pi\omega$ (C) $\frac{\omega}{2\pi}$ (D) $\frac{2\pi}{\omega}$
- Q.3. $\mathbf{A} = (-4x - 3y + az)\mathbf{i} + (bx + 3y + 5z)\mathbf{j} + (4x + cy + 3z)\mathbf{k}$ is irrotational when a, b, c are _____ . (A) 4, -3, 5 (B) 4, 5, -3 (C) -3, 4, 5 (D) 2, 3, 5
- Q.4. $\mathbf{V} = (-4x - 6y + 3z)\mathbf{i} + (-2x + y - 5z)\mathbf{j} + (5x + 6y + az)\mathbf{k}$ is solenoidal for $a = \text{_____}$. (A) 1 (B) 2 (C) 3 (D) 4
- Q.5. $\int_{(0,0)}^{(2,1)} (10x^4 - 2xy^3) dx - 3x^2y^2 dy$ along the path $x^4 - 6xy^3 = 4y^2$ is _____ . (A) 56 (B) 60 (C) 62 (D) 64
- Q.6. If S is the closed surface and v is the volume enclosed by S then $\iint_S \mathbf{r} \cdot \underline{n} ds = \text{_____}$. (A) v (B) $2v$ (C) $3v$ (D) $4v$
- Q.7. Centrifugal acceleration is _____ . (A) $-\omega \times (\omega \times r)$ (B) $\omega \times (\omega \times r)$ (C) $\omega \cdot (\omega \times r)$ (D) $r \times (\omega \times r)$
- Q.8. Number of degrees of freedom of two particles connected by a rigid rod moving freely in a plane is _____ . (A) 2 (B) 3 (C) 4 (D) 5
- Q.9. The centroid of a uniform semicircular wire of radius a is _____ . (A) $2a/\pi$ (B) $4a/\pi$ (C) a/π (D) $a/2\pi$
- Q.10. Moment of inertia of a rectangular plate with sides a, b about an axis \perp to plate and passing through vertex is _____ . (A) $\frac{1}{3}Ma^2$ (B) $\frac{1}{3}Mb^2$ (C) $\frac{1}{3}M(a^2+b^2)$ (D) $\frac{1}{3}M(a^2+b^2)$
- Q.11. Every bounded infinite set has at least one limit point, is the statement of _____ . (A) Heine-Borel Theorem (B) Weierstrass-Bolzano Theorem (C) Cantor's Intersection Theorem (D) None of these
- Q.12. $\lim_{x \rightarrow 0} \frac{\bar{z}}{x} = \text{_____}$. (A) $\frac{1+i}{1-i}$ (B) 1 (C) Does not exist (D) -1
- Q.13. Cauchy-Riemann equations in polar form 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) $\frac{\partial u}{\partial r} = \frac{1}{r} \frac{\partial v}{\partial \theta}, \frac{\partial v}{\partial r} = \frac{1}{r} \frac{\partial u}{\partial \theta}$
- Q.14. Evaluate $\int_C \frac{z^2 - z + 1}{z-1} dz$, where C is the circle $|z| = \frac{1}{2}$: (A) 1 (B) 2 (C) $\frac{1}{2}$ (D) 0
- Q.15. The principal value of $(-i)^i$ is: (A) $e^{-\frac{\pi}{2}}$ (B) 1 (C) $e^{\frac{\pi}{2}}$ (D) e^{π}
- Q.16. The Residue of $f(z) = \frac{z^2 - 2z}{(z+1)^2(z^2+4)}$ at $z=2i$ is _____ . (A) $\frac{14}{25}$ (B) $\frac{7+i}{25}$ (C) $\frac{7-i}{25}$ (D) $\frac{-7-i}{25}$
- Q.17. Radius of convergence of $\sum (3+4i)^n z^n$ is _____ . (A) $\frac{1}{5}$ (B) 5 (C) 7 (D) ∞
- Q.18. $\lim_{n \rightarrow \infty} (1 + \frac{z}{n})^n$ is _____ . (A) 1 (B) 0 (C) e^z (D) e^n
- Q.19. $U(x, y) = e^x \cos y$ is _____ . (A) Harmonic (B) Analytic (C) Not Harmonic (D) None of these
- Q.20. $\int_0^\infty \frac{\sin x}{x} dx = \text{_____}$. (A) 0 (B) $-\frac{\pi}{2}$ (C) $\frac{\pi}{2}$ (D) π
- Q.21. $\log(1+i) = \text{_____}$. (A) $\frac{1}{2} \ln 2 + \frac{\pi i}{4}$ (B) $\frac{1}{2} \ln 2 - \frac{\pi i}{4}$ (C) $\frac{1}{2} \ln 2 - \frac{3\pi i}{4}$ (D) $\frac{1}{2} \ln 2 + \frac{3\pi i}{4}$

- Q.22.** Which of the following space is complete.
 (A) \mathbb{Q} (B) $[0,1]$ (C) \mathbb{Z} (D) \mathbb{R}
- Q.23.** Least upper bound of $\{\frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \dots\}$ is:
 (A) 1 (B) 0 (C) ∞ (D) $\frac{n}{n+1}$
- Q.24.** Error! Bookmark not defined. $\lim_{x \rightarrow 1} \frac{x^x - x}{1 - x + \ln x}$ is:
 (A) 2 (B) -2
 (C) 1 (D) -1
- Q.25.** $\lim_{x \rightarrow 0} x^{sin x}$ is _____.
 (A) 0 (B) $\frac{1}{2}$ (C) e (D) ∞
- Q.26.** Minimum and maximum values of $f(x) = x^{\frac{2}{3}}(x^2 - 8)\ln x$ in interval $[-1, \frac{1}{2}]$ are
 (A) -7, 0 (B) 0, 6 (C) 1, 2 (D) -2, 3
- Q.27.** $\int_0^1 \frac{4}{1+x^2} dx =$ _____.
 (A) 0 (B) π (C) $\frac{4\pi}{3}$ (D) $-\pi$
- Q.28.** $\int_0^{\pi} \operatorname{cosec}^2 x dx =$ _____.
 (A) 0 (B) 1 (C) -1 (D) ∞
- Q.29.** $\lim_{x \rightarrow 0} \sin \frac{1}{x} =$ _____.
 (A) does not exist (B) 1 (C) 0 (D) -1
- Q.30.** $\int_0^{\frac{3\pi}{4}} |\cos x| dx =$ _____.
 (A) $\frac{1}{\sqrt{2}}$ (B) $\frac{-1}{\sqrt{2}}$ (C) ∞ (D) $2 - \frac{1}{\sqrt{2}}$
- Q.31.** $\sec(\tan^{-1} \frac{2}{3}) =$ _____.
 (A) $\frac{2}{\sqrt{13}}$ (B) $\frac{3}{\sqrt{13}}$ (C) $\frac{\sqrt{13}}{3}$ (D) $\frac{\sqrt{13}}{2}$
- Q.32.** Which of the following is convergent series?
 (A) $\sum \frac{1}{n^2}$ (B) $\sum \frac{1}{\sqrt{n}}$ (C) $\sum \frac{1}{n}$ (D) $\sum \frac{1}{n^3}$
- Q.33.** $x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \dots$ is the Maclaurin's series of _____.
 (A) $\cos x$ (B) $\sin x$ (C) $\sinh x$ (D) $\cosh x$
- Q.34.** $\int_1^2 \int_0^{y^2} \frac{x}{y^2} dy dx =$ _____.
 (A) $\frac{3}{4}$ (B) $\frac{7}{8}$ (C) $\frac{3}{2}$ (D) $\frac{1}{2}$
- Q.35.** Domain of $f(x) = \sqrt{1 - x^2}$ is _____.
 (A) $x < 1$ (B) $x > 1$ (C) $|x| \leq 1$ (D) $|x| \geq 1$
- Q.36.** Domain of $f(x) = \frac{1}{\sqrt{(1-x)(2-x)}}$ is _____.
 (A) $\mathbb{R} \setminus [1,2]$ (B) $\mathbb{R} \setminus \{1,2\}$ (C) $[1,2]$ (D) $[1,2[$
- Q.37.** $f: \mathbb{R} \rightarrow (-1, 1)$ defined by $f(x) =$ _____ is bijective.
 (A) $\frac{x}{1-|x|}$ (B) $\frac{x}{1+|x|}$ (C) $\frac{1}{1+|x|}$ (D) $\frac{x}{-1+|x|}$
- Q.38.** Interval of convergence of $\sum_{k=1}^{\infty} x^k$ is _____.
 (A) $] -1, 1[$ (B) $[-1, 1]$ (C) $(-\infty, +\infty)$ (D) $x = 0$
- Q.39.** Which of the following are open in the usual metric space (\mathbb{R}, d) ?
 (A) Subsets of \mathbb{R} (B) Union of open intervals (C) Intervals (D) Singleton subsets
- Q.40.** Let $A = (0,1] \cup (1,3]$ and \mathbb{R} with usual metric space. Then $A^0 =$ _____.
 (A) $A \setminus \{0\}$ (B) $A \setminus \{1\}$ (C) $A \setminus \{3\}$ (D) $(0,1) \cup (1,3)$
- Q.41.** Let A be a finite subset of a metric space X . Then $A^d =$ _____.
 (A) singleton set (B) \emptyset (C) A (D) $X \setminus A$
- Q.42.** Let A be a finite subset of (X, d) . Then A is _____.
 (A) Open set (B) Open as well as closed (C) Closed set (D) neither open nor closed
- Q.43.** If Y is a subset of (X, d) then _____.
 (A) Every open set in Y is open in X . (B) Every open set in X is open in Y .
 (C) O is open in $Y \Leftrightarrow O$ is open in X . (D) O is open $\Leftrightarrow O = Y \cap G$ where G is open in X .
- Q.44.** Let $f(x) = 1 + x^3$. Then $(0,0)$ is the point of _____.
 (A) maximum value (B) minimum value (C) point of inflection (D) none of these
- Q.45.** Number of elements in a co-finite topological space (X, τ) where $X = \{s, t, u\}$ is _____.
 (A) 2 (B) 3 (C) 4 (D) 8
- Q.46.** The boundary of a subset $B = \{\frac{1}{n} : n \in \mathbb{N}\}$ of (\mathbb{R}, d) is _____.
 (A) B (B) $\{0\}$ (C) $B \cup \{0\}$ (D) \emptyset
- Q.47.** The real line \mathbb{R} is homeomorphic to _____.
 (A) $(0, 4)$ (B) $[-1, 1]$ (C) \mathbb{Q} (D) \mathbb{Z}
- Q.48.** \mathbb{R} with co-finite topology is _____.
 (A) T_0 -space (B) T_1 -space (C) T_1 -space but not T_2 -space (D) T_2 -space
- Q.49.** Let $X = \{a, b, c\}$, $\tau = \{\emptyset, \{a\}, \{b\}, \{a,b\}, X\}$. Then X is _____.
 (A) T_1 -space (B) Regular space (C) T_2 -space (D) Normal space
- Q.50.** Which of the following is connected in \mathbb{R} with usual topology ?
 (A) \mathbb{N} (B) \mathbb{Q} (C) $(0,1]$ (D) \mathbb{Z}
- Q.51.** Which of the following topology is not totally disconnected ?
 (A) $\{1\}$ (B) Discrete space (C) \mathbb{R} with usual topology (D) \mathbb{Q}
- Q.52.** Which of the following is nowhere dense in \mathbb{R} _____.
 (A) $\mathbb{R} \setminus \mathbb{Z}$ (B) \mathbb{Z} (C) $\bigcup (n, n+1), n \in \mathbb{Z}$ (D) \mathbb{Q}
- Q.53.** Which of the following is dense in \mathbb{R} _____.
 (A) \mathbb{N} (B) \mathbb{Z} (C) $\mathbb{R} \setminus \mathbb{Z}$ (D) \mathbb{Q}
- Q.54.** $xy'' + y' = 0$ has a solution $y = \ln x$ on interval _____.
 (A) $(0, \infty)$ (B) $(-\infty, 0)$ (C) $(-\infty, \infty)$ (D) $[0, \infty[$

- Q.55.** Which of the following is not linear?
 (A) $y' = (\sin x)y$ (B) $y' = (\sin y)x + e^x$ (C) $y' + xy = e^x y$ (D) $y' = 5$
- Q.56.** Solution of $y' = \frac{x+y}{x}$ is _____.
 (A) $y = \ln|xk|$ (B) $y = \ln|x|$ (C) $y = x \ln|xk|$ (D) $y = \ln|x| + k$
- Q.57.** Which of the following differential equation is not exact?
 (A) $2xydx + (1+x^2)dy = 0$ (B) $ydx - xdy = 0$ (C) $y' = \frac{2+ye^{x^2}}{2y-xe^{x^2}}$ (D) $(x + \sin y)dx + (x \cos y - 2y)dy = 0$
- Q.58.** Integrating factor for $y' + \left(\frac{1}{x}\right)y = x^4$ is _____.
 (A) x^4 (B) $\ln x^4$ (C) $4 \ln|x|$ (D) $\ln|x|$
- Q.59.** The area bounded by $y = 4 - x^2$ and $X\text{-axis}$ is _____.
 (A) $\frac{4}{3}$ (B) $\frac{8}{3}$ (C) $\frac{16}{3}$ (D) $\frac{32}{3}$
- Q.60.** Which of the following is scalar?
 (A) $(\underline{a} \cdot \underline{b})\underline{c}$ (B) $\underline{a} \cdot (\underline{b} \times \underline{c})$ (C) $\underline{a} \times (\underline{b} \times \underline{c})$ (D) $(\underline{a} \cdot \underline{b})(\underline{a} - \underline{b})$
- Q.61.** Projection of \underline{a} on \underline{b} is _____.
 (A) $\underline{a} \cdot \underline{b}$ (B) $\frac{\underline{a}}{|\underline{a}|} \cdot \underline{b}$ (C) $\underline{a} \cdot \frac{\underline{b}}{|\underline{b}|}$ (D) $\underline{a} \times \underline{b}$
- Q.62.** Which of the following is scalar quantity?
 (A) Momentum (B) Magnetic field intensity (C) Specific heat (D) Moment of force
- Q.63.** A vector lying in the plane of \underline{a} and \underline{b} is _____.
 (A) $(\underline{a} \times \underline{b}) \times \underline{c}$ (B) $\underline{a} \times (\underline{b} \times \underline{c})$ (C) $(\underline{c} \times \underline{a}) \times \underline{b}$ (D) $(\underline{c} \times \underline{b}) \times \underline{a}$
- Q.64.** Let \underline{t} , \underline{n} and \underline{b} denote respectively the tangent, principal normal and binormal vectors to the curve. The osculating plane to the curve at P contains _____.
 (A) $\underline{t}, \underline{b}$ (B) $\underline{n}, \underline{b}$ (C) $\underline{t}, \underline{n}$ (D) $\underline{t}, \underline{n}, \underline{b}$
- Q.65.** Let \underline{t} , \underline{n} , and \underline{b} be as in the above question. Then $\tau \underline{b} - k \underline{t} =$ _____.
 (A) $\frac{d\underline{t}}{ds}$ (B) $\frac{d\underline{n}}{ds}$ (C) $\frac{d\underline{b}}{ds}$ (D) $\frac{d}{ds} \left(\frac{(\underline{t} \times \underline{n})}{ds} \right)$
- Q.66.** Normal plane is perpendicular to _____.
 (A) \underline{t} (B) \underline{n} (C) \underline{b} (D) $\underline{t} \times \underline{n}$
- Q.67.** $\underline{t} \times \underline{b} =$ _____.
 (A) \underline{n} (B) $-\underline{n}$ (C) $\underline{n} \times \underline{b}$ (D) none of these
- Q.68.** $\{x/x \in C : x^4 = 1\}$ is a _____.
 (A) Subgroup of $(C \setminus \{0\}, \cdot)$ (B) Subgroup of $(C, +)$ (C) Non cyclic group (D) Subgroup of $(Q \setminus \{0\}, \cdot)$
- Q.69.** R^3 under vector product forms a _____.
 (A) group (B) monoid (C) semi-group (D) groupoid
- Q.70.** An element x of group G satisfying $x^2 = x$ is called _____.
 (A) Involution (B) Idempotent (C) Transposition (D) Cycle
- Q.71.** $\frac{Z}{(n)}$ is isomorphic to _____.
 (A) nZ (B) $\langle n \rangle$ (C) Z_n (D) $\{0, \pm 2n, \pm 4n, \dots\}$
- Q.72.** Let $G = \langle a : a^{12} = e \rangle$. Then $G =$ _____.
 (A) $\{a^5\}$ (B) $\langle a^6 \rangle$ (C) $\langle a^2 \rangle$ (D) $\langle a^8 \rangle$
- Q.73.** Let $G = \langle b : b^{17} = e \rangle$. Then G can be generated by _____.
 (A) Any element of G (B) Any non identity element of G (C) b, b^{-1} are the only generators of G
 (D) Identity
- Q.74.** If $G = \langle \alpha, \beta : \alpha^3 = \beta^2 = (\alpha\beta)^2 = e \rangle$ then $N_G(\{e, \beta\}) =$ _____.
 (A) $\{e\}$ (B) $\{e, \beta, \alpha\beta\}$ (C) G (D) $\{e, \beta\}$
- Q.75.** Let $G = \langle \alpha, \beta : \alpha^4 = \beta^2 = (\alpha\beta)^2 = e \rangle$. Then $Z(G) =$ _____.
 (A) $\{e\}$ (B) $\{e, \alpha^2\}$ (C) $\{e, \alpha, \alpha^2, \alpha^3\}$ (D) G
- Q.76.** Which of the following is not true for an Abelian group G?
 (A) $[a, b] = e \forall a, b \in G$ (B) G is simple group of order 60. (C) $G' = \{e\}$ (D) $Z(G) = G$
- Q.77.** Inner automorphisms of $Q = \{\pm 1, \pm i, \pm j, \pm k\}$ is _____.
 (A) $\{e\}$ (B) $C_2 \times C_2$ (C) Q (D) C_4
- Q.78.** Number of conjugacy classes of a cyclic group of order 6 is _____.
 (A) 1 (B) 2 (C) 3 (D) 6
- Q.79.** Number of non-isomorphic abelian groups of order 12 is _____.
 (A) 1 (B) 2 (C) 3 (D) 4
- Q.80.** Order of sylow-2 subgroup of Q_8 is _____.
 (A) 1 (B) 2 (C) 4 (D) 8
- Q.81.** Which of the following is an ideal of R?
 (A) Z (B) $\{0\}$ (C) C (D) Q
- Q.82.** Which of the following is not an integral domain?
 (A) Z (B) Z_7 (C) Q (D) Set M_2 of 2×2 matrices with integer entries
- Q.83.** Which of the following is a field?
 (A) $\{a + b\sqrt{2} : a, b \in Q\}$ (B) $Q \setminus \{0\}$ (C) Z (D) Z_6
- Q.84.** Which of the following is not a vector space?
 (A) $R(R)$ (B) $R(Q)$ (C) $R(C)$ (D) $C(Q)$
- Q.85.** Let $\varphi : Z \rightarrow Z_5$ be $\varphi(a) = a \pmod{5}$. Then $\text{Ker}(\varphi) =$ _____.
 (A) $\{0\}$ (B) $\{0, \pm 5, \pm 10, \dots\}$ (C) Z_5 (D) Z

- Q.86.** The number of proper ideals of Z_{17} is _____. (A) 0 (B) 1 (C) 2 (D) 3
- Q.87.** Which of the following is a division Ring? (A) $(Z, +, \cdot)$ (B) $(E, +, \cdot)$ (C) $(Q, +, \cdot)$ (D) (z_6, \oplus_6, \odot_6)
- Q.88.** $\int_{-1}^2 (x + |x|) dx =$ (A) 0 (B) 4 (C) 2 (D) 6
- Q.89.** $x = 6$ in R^3 represents a (A) point (B) Line (C) Plane (D) Space
- Q.90.** Kernel of $T: R^3 \rightarrow R^3$, where $T(x, y, z) = (x, y, 0)$, is (A) Point (B) Line (C) Plane (D) Space
- Q.91.** Dimension of $\text{Hom}(R^3, R^4) =$ (A) 3 (B) 4 (C) 7 (D) 12
- Q.92.** Dimension of $\text{Hom}(M_{2,4}, P_2(t)) =$ _____. (A) 4 (B) 8 (C) 16 (D) 24
- Q.93.** A dice is thrown. The probability that the dots on the top are prime numbers or odd numbers is _____. (A) $\frac{1}{3}$ (B) $\frac{2}{3}$ (C) 1 (D) $\frac{5}{6}$
- Q.94.** A coin is tossed 4 times in succession. The probability that at-least one head occurs is _____. (A) $\frac{1}{16}$ (B) $\frac{4}{16}$ (C) $\frac{12}{16}$ (D) $\frac{15}{16}$
- Q.95.** Number of necklaces made from 9 beads of different colors is _____. (A) $\frac{8!}{2}$ (B) 8! (C) 7! (D) 9!
- Q.96.** Period of $3 \cos \frac{x}{5}$ is _____. (A) 2π (B) $\frac{2\pi}{5}$ (C) 6π (D) 10π
- Q.97.** Range of $\sec^{-1} x$ is _____. (A) $[0, \pi]$ (B) $[0, \pi] \setminus \frac{\pi}{2}$ (C) $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$ (D) $\left[\frac{-\pi}{2}, \frac{\pi}{2}\right] \setminus \{0\}$
- Q.98.** Solution set of $\sin x \cos x = \frac{\sqrt{3}}{4}$ is _____. (A) $\left\{\frac{\pi}{6} + n\pi\right\} \cup \left\{\frac{\pi}{3} + n\pi\right\}$ (B) $\left\{\frac{\pi}{3} + 2n\pi\right\} \cup \left\{\frac{2\pi}{3} + 2n\pi\right\}$ (C) $\left\{\frac{\pi}{6} + 2n\pi\right\} \cup \left\{\frac{5\pi}{6} + 2n\pi\right\}$ (D) $\left\{\frac{\pi}{12} + n\pi\right\} \cup \left\{\frac{5\pi}{12} + n\pi\right\}$
- Q.99.** Which of the following is tautology? (A) $p \rightarrow \sim q$ (B) $(p \rightarrow q) \cap (p \sim q)$ (C) $p \rightarrow q \leftrightarrow \sim q \rightarrow \sim p$ (D) $p \cap \sim p$
- Q.100.** $f(z) = \frac{1}{z}$ is not uniformly continuous in the region _____. (A) $0 \leq |z| \leq 1$ (B) $0 \leq |z| < 1$ (C) $0 < |z| \leq 1$ (D) $0 < |z| < 1$

FOR USE OF ROUGH WORK