Booklet Serial No. : 074

DO NOT OPEN THIS TEST BOOKLET UNTIL YOU ARE ASKED TO DO SO

TEST BOOKLET

AP (CC) MATHS—2018

Time Allowed : 2 Hours] [Maximum Marks : 100

All questions carry equal marks.

INSTRUCTIONS

1. Immediately after the commencement of the examination, you should check that test booklet does not have any unprinted or torn or missing pages or items, etc. If so, get it replaced by a complete test booklet.
2. Write your Roll Number only in the box provided alongside. Do not write anything else on the Test Booklet.
3. This Test Booklet contains **100** items (questions). Each item comprises four responses (answers). Choose only one response for each item which you consider the best.
4. After the candidate has read each item in the Test Booklet and decided which of the given responses is correct or the best, he has to mark the circle containing the letter of the selected response by blackening it completely with Black or Blue ball pen. In the following example, response "C" is so marked :

5. Do the encoding carefully as given in the illustrations. While encoding your particulars or marking the answers on answer sheet, you should blacken the circle corresponding to the choice in full and no part of the circle should be left unfilled. After the response has been marked in the ANSWER SHEET, no erasing/fluid is allowed.
6. You have to mark all your responses ONLY on the ANSWER SHEET separately given according to 'INSTRUCTIONS FOR CANDIDATES' already supplied to you. *Responses marked on the Test Booklet or in any paper other than the answer sheet shall not be examined.*
7. All items carry equal marks. Attempt all items. Your total marks will depend only on the number of correct responses marked by you in the Answer Sheet. There will be negative marking and 1/4 (0.25) of the marks will be deducted as penalty for wrong answer.
8. Before you proceed to mark responses in the Answer Sheet fill in the particulars in the front portion of the Answer Sheet as per the instructions sent to you.
9. If a candidate gives more than one answer, it will be treated as a wrong answer even if one of the given answers happens to be correct.
10. After you have completed the test, hand over the Answer Sheet only, to the Invigilator.

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P.T.O.

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1. Which one of the set is *not* countable ?

   (A) The set of all polynomial functions with integer coefficients

   (B) The set of real numbers in [0, 1]

   (C) The set of all ordered pairs of integers

   (D) The set of rational numbers in [0, 1]

2. Which one of the set is not open in **R** ?

   (A) **R** (B) **Q**

   (C) (a, b) (D) Empty set

3. Which one of the following set has no limit point ?

   (A) $\left\{(-1)^n \frac{n}{n^2+1}; n \in \mathbf{N}\right\}$ (B) $\left\{\frac{1}{n}; n \in \mathbf{N}\right\}$

   (C) $\left\{\frac{1}{n^2}; n \in \mathbf{N}\right\}$ (D) $\left\{3^n + \frac{1}{3^n}; n \in \mathbf{N}\right\}$

4. Let $f : \mathrm{I} \to \mathbf{R}$ be an increasing function. Then which one of the following statements is *not correct* ?

   (A) f^2 is always increasing

   (B) f^2 may be decreasing

   (C) f^2 may be increasing

   (D) f^2 may be neither decreasing nor increasing

5. Let f and g be differentiable functions on $[a, b]$ such that $f' = g'$ on (a, b). Then, for all $x \in (a, b)$, there is a constant C such that :

(A) $f(x) - g(x) = C$

(B) $f(x)\, g(x) = C$

(C) $f(g(x)) = C$

(D) $g(f(x)) = C$

6. Which one of the following statements about sequence in **R** is *not* true ?

(A) Convergent sequences are Cauchy sequences

(B) Cauchy sequences are bounded

(C) Every sequence has a monotone subsequence

(D) Bounded monotone sequences need not converge

7. The sequence $\left\langle (-1)^n \left(1 + \frac{1}{n}\right)\right\rangle$ is :

(A) convergent

(B) divergent

(C) oscillates finitely

(D) Oscillate infinitely

8. If a sequence $<S_n>$ is defined by $S_n = \frac{S}{1 + S_{n-1}}$, where $S > 0$, $S_1 > 0$, $n \geq 2$, then the sequence $<S_n>$ converges to the positive root of the equation :

(A) $2x^2 + x + S = 0$

(B) $3x^2 + 2x - S = 0$

(C) $x^2 + 2x + S = 0$

(D) $x^2 + x - S = 0$

9. The series $\Sigma_{n=3}^{\infty} \frac{1}{n \log n (\log \log n)^p}$:

(A) converges if $p < 1$

(B) converges if $p = 1$

(C) converges if $p > 1$

(D) diverges if $p > 1$

10. Which one of the following functions is *not* uniformly continuous ?

(A) x^3 on $[0, 1]$

(B) $x/(1 + x^2)$ on $\mathbf{R}$

(C) $1/x$ on $(0, 1)$

(D) $\sin x$ on $(-\infty, \infty)$

11. Which one of the following sequences is *not* uniformly convergent ?

(A) $1/(1 + nx)$ for all $x \in [0, 1]$

(B) $x^n/(1 + x^{2n})$ for all $x \in \mathbf{R}$

(C) $1/(1 + x^{2n})$ for all $x \in \mathbf{R} \setminus \{1\}$

(D) $1/(n + x)$ for all $x \in \mathbf{R} \setminus \{1\}$

12. The exact interval of convergence for the series $\Sigma_{n=1}^{\infty} \frac{(-1)^{n+1}}{n} (x - 1)^n$ is :

(A) $(0, 3]$

(B) $(0, 1]$

(C) $(0, 2]$

(D) $(0, 4]$

13. Which one of the following series is *not* uniformly convergent ?

(A) $\Sigma_{n=0}^{\infty}(1-x)x^n$ for all $x \in [0, 1]$

(B) $\Sigma_{n=0}^{\infty}\frac{(-1)^n x^{2n}}{n^p(1+x^{2n})}$ for all $x \in \mathbf{R}$ and $p > 1$

(C) $\Sigma_{n=0}^{\infty}\frac{x}{n^p + x^2 n^q}$ for all $x \in \mathbf{R}$ and $p + q > 1$

(D) $\Sigma_{n=0}^{\infty}\frac{\cos nx}{n^p}$ for all $x \in \mathbf{R}$ and $p > 1$

14. The function :

$$f(x) = \begin{cases} x, & \text{if } x \text{ is rational} \\ 1-x, & \text{if } x \text{ is irrational} \end{cases}$$

is continuous at :

(A) $x = 0$ (B) $x = 1/2$

(C) $x = 1$ (D) $x = 2$

15. If f is uniformly continuous on a set S and $<S_n>$ is a Cauchy sequence in S, then :

(A) $<f(S_n)>$ is unbounded sequence

(B) $<f(S_n)>$ is not a uniformly convergent sequence

(C) $<f(S_n)>$ is not a convergent sequence

(D) $<f(S_n)>$ is a Cauchy sequence

16. If f is continuous in $\mathbf{R}$, then the set $A = \{x : |f(x)| = 1\}$ is :

(A) open

(B) closed

(C) union of open sets

(D) neither open nor closed

17. Which one of the following functions *does not* satisfies the Rolle's theorem ?

(A) $\sqrt{1-x^2}$ on $[-1, 1]$

(B) $1 - (x-1)^{2/3}$ on $[0, 2]$

(C) e^x on $[0, \pi]$

(D) $x^3 - 6x^2 + 11x - 6$ on $[1, 3]$

18. The value of an improper integral $\int_0^\infty 2^{-9x^2}\, dx$ is :

(A) $\frac{1}{6}\sqrt{\frac{\pi}{\log 2}}$

(B) $\frac{1}{3}\sqrt{\frac{\pi}{\log 2}}$

(C) $\frac{1}{2}\sqrt{\frac{\pi}{\log 2}}$

(D) $\sqrt{\frac{\pi}{\log 2}}$

19. Which one of the following statements about function on $[0, 1]$ is *not correct* ?

(A) Every continuous function is integrable

(B) Every monotone function is integrable

(C) Every bounded function is integrable

(D) Every bounded function having a finite number of discontinuity is integrable

20. In interval [0, 2], the greatest integer function $f(x) = [x]$ is :

(A) continuous

(B) not integrable

(C) function of bounded variation

(D) differentiable

21. A basis of the space of the solutions of the differential equation

$$\frac{d^2y}{dt^2} = -y$$

is :

(A) $(e^t, \sin t)$ (B) (e^t, e^{-t})

(C) $(\cos t, \sin t)$ (D) $(\cos t, e^t)$

22. Which one of the following statements is *not correct* ?

(A) Similar matrices have same characteristic equation

(B) Similar matrices have same eigenvalues

(C) Similar matrices represent same linear transformation

(D) Similar matrices have same algebraic multiplicity

23. The system of equations

$$x + 2y + 3z = 6$$

$$x + 3y + 5z = 9$$

$$2x + 5y + az = b$$

has infinite number of solutions if :

(A) $a = 8, b = 10$ (B) $a = 8, b = 15$

(C) $a = 7, b = 15$ (D) $a = 8, b = 7$

24. If $f'(x) = \frac{1}{3 - x^2}$ and $f(0) = 1$, then $f(1)$ lies in an interval :

(A) [0, 1] (B) [4/3, 5/3]

(C) [1/3, 3/2] (D) [4/3, 3/2]

25. The algebraic and geometric multiplicity of the matrix

$$A = \begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 1 & -3 & 3 \end{pmatrix}$$

are :

(A) 3, 1 (B) 1, 3

(C) 1, 1 (D) 3, 3

26. Let $U = \{(a, b, c, d) : a + c + d = 0, b + c + d = 0)\}$ be a subspace of $\mathbf{R}^4$. Then dimension of the subspace U is :

(A) 1 (B) 2

(C) 3 (D) 4

27. The rank of the matrix :

$$A = \begin{pmatrix} 1 & 1 & -1 & 0 \\ 4 & 4 & -3 & 1 \\ b & 2 & 2 & 2 \\ 9 & 9 & b & 3 \end{pmatrix}$$

is 3 if :

(A) $b = 1$ (B) $b = 2$

(C) $b = 3$ (D) $b = 4$

28. The determinant of the permutation matrix P is :

(A) ± 1 (B) ± 2

(C) ± 3 (D) ± 4

29. Which one of the following matrix is diagonalizable ?

(A) $\begin{pmatrix} 1 & 1 & 0 \\ 0 & 1 & 1 \\ 0 & 0 & 1 \end{pmatrix}$ (B) $\begin{pmatrix} 1 & 1 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$

(C) $\begin{pmatrix} 3 & 1 & -1 \\ -2 & 1 & 2 \\ 0 & 1 & 2 \end{pmatrix}$ (D) $\begin{pmatrix} 1 & 2 & 2 \\ 0 & 2 & 1 \\ -1 & 2 & 2 \end{pmatrix}$

30. Which one of the following matrix is *not* positive definite ?

(A) $\begin{pmatrix} 2 & 1 & 3 \\ -4 & 4 & -1 \\ -1 & 1 & 2 \end{pmatrix}$ (B) $\begin{pmatrix} 1 & 0 & i \\ 0 & 1 & 0 \\ -i & 0 & 3 \end{pmatrix}$

(C) $\begin{pmatrix} -3 & -2 & 1 \\ -2 & 0 & 4 \\ -6 & -3 & 5 \end{pmatrix}$ (D) $\begin{pmatrix} 2 & 1 \\ 2 & 4 \end{pmatrix}$

31. A real symmetric matrix of the quadratic form $Q = x^2 + 3y^2 + 2z^2 + 2xy + 6yz$ is :

(A) $\begin{pmatrix} 1 & 1 & 0 \\ 1 & 3 & 3 \\ 0 & 3 & 2 \end{pmatrix}$ (B) $\begin{pmatrix} 1 & 2 & 1 \\ 2 & 3 & 3 \\ 0 & 3 & 2 \end{pmatrix}$

(C) $\begin{pmatrix} 3 & 1 & 0 \\ 1 & 5 & 0 \\ 0 & 0 & 3 \end{pmatrix}$ (D) $\begin{pmatrix} 2 & 1 & 3 \\ 1 & 0 & 2 \\ 0 & 2 & 7 \end{pmatrix}$

32. If a function $f(z)$ and its conjugate $\overline{f(z)}$ are both analytic in a given domain **D**, then $f(z)$ is :

(A) identity function

(B) sine function

(C) exponential function

(D) constant function

33. The value of the integral $\int_C f(z)dz$ where $f(z) = 1$ if $y < 0$ and $f(z) = 4y$ if $y > 0$ and C is the arc from $z = -1 - i$ to $z = 1 + i$ along the curve $y = x^3$, is :

(A) $2 + 3i$

(B) $3 + 2i$

(C) $1 + 2i$

(D) $1 + 3i$

34. The mapping $f(z) = \frac{e^z - 1}{e^z + 1}$ maps the infinite strip $\{z : |Imz| < \pi/2\}$ on to :

(A) the line segment

(B) the triangle

(C) the square

(D) the open unit disk

35. Let G be a region and suppose that f is a non-constant analytic function on G. Then for any open set U in G, $f(U)$ is :

(A) closed

(B) open

(C) either open or closed

(D) neither open nor closed

36. The function $\frac{1-\cos z}{z^4}$ has :

(A) a simple pole at $z = 0$

(B) the removable singularity at $z = 0$

(C) an essential singularity at $z = 0$

(D) a pole of order 2 at $z = 0$

37. The value of an improper integral $\int_{-\infty}^{\infty} \frac{e^{x/2}}{1+e^x} dx$ is :

(A) π (B) 2π

(C) 3π (D) 4π

38. Let f be meromorphic on a set G. Then :

(A) the poles of function f have a limit point in G

(B) the zeros of function f have a limit point in G

(C) either zeros or the poles of function f have a limit point in G

(D) neither zeros nor the poles of function f have a limit point in G

39. The value of the contour integral $\oint_{C:|z|=1} \sin(1/z)\cos(1/2\, z)dz$ is :

(A) 0 (B) πi

(C) $-\pi$ (D) $2\pi i$

40. The series $\Sigma_{n=1}^{\infty} \frac{z^n - 1}{n^2 + |z|^2}$ converges uniformly in the open disk :

(A) $|z| < 1$ (B) $|z| < 2$

(C) $|z| < 3$ (D) $|z| < 4$

41. At $z = 0$, the function $fz = \frac{\sin z}{z^r}; r \geq 2$ is a positive integer, has :

(A) a pole of order $r - 1$ (B) a pole of order r

(C) a pole of order $r + 1$ (D) removable singularity

42. If $f(z) = z^3 \cos(1/z)$ and $g(z) = z/(e^{-z^2} + 1)$, then the residue of $f(z) + g(z)$ at $z = \infty$ is :

(A) $-\frac{1}{12}$ (B) 0

(C) $-\frac{1}{24}$ (D) $-\frac{1}{6}$

43. The image of $y < 0$ under the mapping $w = i/(z - i)$ is :

(A) $\left|w - \frac{1}{2}\right| < \frac{1}{2}$ (B) $\left|w - \frac{1}{4}\right| < \frac{1}{2}$

(C) $\left|w + \frac{1}{2}\right| < \frac{1}{2}$ (D) $|w + 1| < \frac{1}{2}$

44. The solution of the initial value problem

$$\frac{dy}{dx} + 3y + 2\int_0^t y(p)\,dp = t; \quad y(0) = 0$$

is :

(A) $\frac{1}{2}e^{-2t} - e^{-t} + \frac{1}{2}$

(B) $2e^{-2t} + e^{-t} - 3$

(C) $e^{-2t} + 2e^{-t} - 3$

(D) $e^{-2t} + e^{-t} - 2$

45. The Laplace transform of the periodic function

$$f(t) = \begin{cases} t/a & 0 \le t \le a \\ (2a - t)/a, & a \le t \le 2a \end{cases}$$

is :

(A) $\frac{1}{as^2}\operatorname{sech}\left(\frac{as}{2}\right), s > 0$

(B) $\frac{1}{as^2}\tanh\left(\frac{as}{2}\right), s > 0$

(C) $\frac{1}{as^2}\coth\left(\frac{as}{2}\right), s > 0$

(D) $\frac{1}{as^2}\cosh\left(\frac{as}{2}\right), s > 0$

46. The Laplace transform does not exit for the function :

(A) e^t

(B) e^{-t}

(C) e^{t^2}

(D) $t^{-1/2}$

47. The directional derivative of $f(x, y, z) = xy^2 + 4xyz + z^2$ at the point (1, 2, 3) in the direction of $3i + 4j - 5k$ is :

(A) $\frac{78}{5\sqrt{3}}$ (B) $\frac{78}{5\sqrt{5}}$

(C) $\frac{78}{5\sqrt{2}}$ (D) $\frac{78}{5\sqrt{7}}$

48. The value of the integral $\oint_C (x^2 + y^2)dx + (y + 2x)dy$, where C is the boundary of the region in the first quadrant that is bounded by the curves $y^2 = x$ and $x^2 = y$, is :

(A) 11/30 (B) 11/15

(C) 11/45 (D) 11/60

49. The vector valued function

$$A = (bx^2y + yz)i + (xy^2 - xz^2)j + (2xyz - 2x^2y^2)k$$

has zero divergence if :

(A) $b = 0$ (B) $b = 3$

(C) $b = -2$ (D) $b = -1$

50. The total work done in moving a particle in a force field $A = 3xyi - 5zj + 10xk$ along the curve $x = t^2 + 1$, $y = 2t^2$, $z = t^3$ from $t = 1$ to $t = 2$, is :

(A) 301 unit

(B) 302 unit

(C) 303 unit

(D) 304 unit

51. Let L denotes the Laplace transform. If $L(\sin\sqrt{t}) = \frac{\sqrt{\pi}}{2s^{3/2}} e^{-(1/4s)}$, then $L\left(\frac{\cos\sqrt{t}}{\sqrt{t}}\right)$ is :

(A) $\sqrt{\frac{\pi}{s}} e^{-1/4s}$

(B) $\sqrt{\frac{\pi}{2s}} e^{-1/4s}$

(C) $\sqrt{\frac{\pi}{3s}} e^{-1/4s}$

(D) $\sqrt{\frac{\pi}{4s}} e^{-1/4s}$

52. An approximate root of the equation $x \sin x + \cos x = 0$ is :

(A) 2.4980

(B) 2.7984

(C) 2.1237

(D) 2.9990

53. Chebyshev polynomial is orthogonal in the interval :

(A) $[-1, \infty)$

(B) $[-1, 1]$

(C) $(-\infty, 1]$

(D) $(-\infty, \infty)$

54. Let $p(x)$ be the cubic polynomial which takes the values $y(0) = 0$, $y(1) = 0$, $y(2) = 1$ and $y(3) = 10$. Then by using Newton forward difference formula, the value of $y(4)$ is :

(A) 30 (B) 31

(C) 32 (D) 33

55. By using modified Euler's method, the value of y, when $x = 0.1$ given that $y(0) = 1$ and $y' = x^2 + y$, is :

(A) 1.0055 (B) 1.1055

(C) 1.0005 (D) 1.9555

56. The solution of the initial value problem $\cos y dx - \sin y dy = 0$, $y(0) = 0$ is :

(A) $e^x \cos y = 1$ (B) $e^x \sin y = 1$

(C) $\sin y + \cos y = 1$ (D) $e^x(\sin y + \cos y) = 1$

57. The singular solution of the differential equation $y = xy' - (1/y')$ is :

(A) $y^2 + x = 0$ (B) $y^2 + 2x = 0$

(C) $y^2 + 3x = 0$ (D) $y^2 + 4x = 0$

58. The particular integral of the differential equation $(D^4 + 2D^2 + 1)y = x^2 \cos x$ is :

(A) $\frac{1}{12}x^3 \sin x + \frac{1}{48}(x^4 - 9x^3)\cos x$ (B) $\frac{1}{12}x^3 \sin x - \frac{1}{48}(x^4 - 9x^2)\cos x$

(C) $\frac{1}{12}x^3 \sin x + \frac{1}{48}(x^3 - 9x^2)\cos x$ (D) $\frac{1}{12}x^3 \sin x + \frac{1}{48}(x^4 - x^3)\cos x$

59. The general solution of the partial differential equation $p + q = 1$ is :

(A) $f(x - y, y - z) = 0$ (B) $f(xy, yz) = 0$

(C) $f(x/y, y/z) = 0$ (D) $f(xy/z, yz/x) = 0$

60. The complete integral of the partial differential equation $9(p^2z + q^2) = 4$ is :

(A) $(z + a) = (x + ay + b)$ (B) $(z + a)^3 = (x + ay + b)$

(C) $(z + a)^3 = (x + ay + b)^2$ (D) $(z + a) = (x + ay + b)^2$

61. The solution of the partial differential equation $r - s - 2t = (y - 1)e^x$ is :

(A) $f(y + 2x) + g(y - 3x) + \frac{1}{4}ye^x$

(B) $f(y + 3x) + g(y + x) + \frac{1}{2}ye^x$

(C) $f(y + 3x) + g(y - x) + \frac{1}{3}ye^x$

(D) $f(y + 2x) + g(y - x) + ye^x$

62. The coin is tossed until a tail appears. The expected number of tosses required is :

(A) 2 (B) 3

(C) 1 (D) 0

63. Which one of the following is *false* ?

(A) Any two norms are equivalent on a finite-dimensional vector space

(B) Any two finite dimensional normed spaces of the same dimension are isomorphic

(C) Closed unit ball is a finite dimensional normed linear space is compact always

(D) All linear operators from $\mathbf{R}^n$ to $\mathbf{R}^n$ are not continuous

64. Which one of the following is *true* ?

(A) product of two regular space is regular

(B) product of two Hausdorff space need not to be Hausdorff

(C) product of two normal space is normal

(D) product of two Lindelof space is Lindelof

65. If $\mathbf{R}_l$ is the set $\mathbf{R}$ with lower limit topology, then which one of the following is *false* ?

(A) $\mathbf{R}_l$ is separable

(B) $\mathbf{R}_l$ is a Lindelof space

(C) $\mathbf{R}_l$ is second countable

(D) $\mathbf{R}_l$ is countable

66. Whihc one of the following set in $\mathbf{R}^2$ is not connected ?

(A) $\{(x, y) : x^2 + y^2 = 1\}$

(B) $\{(x, y) : 1 < x^2 + y^2 < 2\}$

(C) $\{(x, y) : x^2 + y^2 \leq 1\}$

(D) $\{(x, y) : xy = 1\}$

67. Let X, Y be compact Hausdorff space. Then :

(A) If $Z \subseteq X$, then Z is compact

(B) $f(X)$ is compact if f is continuous

(C) $X \times Y$ is not compact

(D) $X \cup Y$ is not compact

68. If G is a group such that $(a \cdot b)^n = a^n b^n$ for three consecutive integers n and for all $a, b \in G$, then G :

(A) is abelian group

(B) is quaternion group

(C) must be cyclic group

(D) must be simple

69. In a group G, $a^5 = e$, $aba^{-1} = b^2$ for all $a, b \in G$, then order of b is :

(A) 5 (B) 15

(C) 30 (D) 31

70. Which one of the following is *not* cyclic group ?

(A) $(\mathbf{Q}, +)$

(B) $\mathbf{Z}, +$

(C) G = {–1, 1} under multiplication

(D) G = {–1, 1, i, $-i$} under multiplication

71. The number of generators of an infinite cyclic group is :

(A) 1 (B) 2

(C) 3 (D) infinite

72. A group G of order 22 has :

(A) at least one subgroup of order 11

(B) at most one subgroup of order 11

(C) exactly one subgroup of order 11

(D) two subgroups of order 11

73. Which one of the following is *not* true ?

(A) Any infinite cyclic group is isomorphic to $(\mathbf{Z}, +)$

(B) Any two cyclic groups of same order are isomorphic

(C) A finite cyclic group of order n is isomorphic to the multiplicative group of nth roots of unity

(D) A finite cyclic group of order n is isomorphic to Quaternion group

74. The number of conjugate classes of a non-abelian group of order p^3 are :

(A) p^3

(B) $p^2 + p - 1$

(C) $p^2 - p + 1$

(D) $p^2 + p + 1$

75. Which one of the following is *not* a complete metric space ?

(A) l^∞

(B) l^1

(C) l^2

(D) M, where M is the subspace of l^∞ consisting of all sequences with at most finitely many non-zero terms

76. Let X be a metric space. Which one of the following is *not* equivalent to the other three statements ?

(A) X is compact

(B) X is sequently compact

(C) X is complete

(D) Every infinite set in X has a limit point

77. Let A be a subset of a metric space (X, d). Then $d(x, A) = 0$ if and only if :

(A) $x \in A$ (B) $x \in \bar{A}$

(C) $x \in \partial A$ (D) $x \in X - A$

78. In a finite dimensional normed space X, any subset $M \subset X$ is compact if and only if M is :

(A) open (B) only bounded

(C) only closed (D) bounded and closed

79. Let X be a Banach space, Y a normed space, and let $T \in \mathbf{B}(X, Y)$. Which one of the following is not equivalent to the other three statements ?

(A) T is invertible (B) T^* is invertible

(C) T and T^* are bounded below (D) Im T is dense in Y

80. Which one of the following functions is *not* Lebesgue measurable ?

(A) Monotone function

(B) Continuous function

(C) Characteristic function

(D) Constant function

81. Who is the Lt. Governor of Delhi ?

(A) Naseeb Jung

(B) Tajendra Khanna

(C) Anil Baijal

(D) P.K. Dave

82. Who was the first Viceroy of India ?

(A) Lord Elgin

(B) Lord Canning

(C) Robert Napier

(D) Lord Mayo

83. Who has the sole authority to decide whether a bill is a money bill ?

(A) Chairman, Rajya Sabha

(B) Chief Justice, Supreme Court

(C) President of India

(D) Speaker, Lok Sabha

84. When was Rabindra Nath Tagore (year) born ?

(A) 1851 (B) 1861

(C) 1871 (D) 1875

85. Gandhi was born at :

(A) Vankaner (B) Rajkot

(C) Porbandar (D) Thane

86. When was the Rowlatt Act passed ?

(A) 1905 (B) 1919

(C) 1907 (D) 1913

87. The book Asian Drama was written by :

(A) Agatha Christie (B) Anne Frank

(C) Gunnar Myrdal (D) Arthur Miller

88. Where did Mahatma Gandhi complete his high school study ?

(A) Ahmedabad (B) Bhavanagar

(C) Rajkot (D) Junagarh

89. When did States' Reorganisation Act, received the Assent of the President of India ?

(A) 1952 (B) 1956

(C) 1958 (D) 1954

90. Ghulam Qadir Rohilla launched an attack against :

(A) Kahlur State (B) Koti State

(C) Jubbal State (D) Kumharsain State

91. When did Jagat Prakash succeed to the throne of Sirmour State ?

(A) 1751 (B) 1714

(C) 1803 (D) 1773

92. Which two constituencies in Himachal Pradesh are being represented by the independent candidates in 2017 assembly ?

(A) Jogindernagar and Shimla

(B) Dharmashala and Jogindernagar

(C) Dehra and Jogindernagar

(D) Dehra and Palampur

93. When did the territorial council come into existence in Himachal Pradesh ?

(A) 15 August, 1957 (B) 16 June, 1956

(C) 21 December, 1955 (D) 1 January, 1958

94. Which ruler did Raja Mahan Chand (Kahlur) invite for help against invasion of Raja Sansar Chand ?

(A) Ruler of Sirmour (B) Ruler of Bushahr

(C) Ruler of Jubbal (D) Ruler of Bhajji

95. Which constituency had the highest winning margin in 2017 H.P. Assembly elections ?

(A) Kasumpati (B) Nachan

(C) Jaisinghpur (D) Mandi

96. When was "Beti Hai Anmol Yojana" launched in Himachal Pradesh ?

(A) 2010 (B) 2012

(C) 2013 (D) 2015

97. Who was the First Deputy Speaker of H.P. Vidhan Sabha ?

(A) Krishan Chander (B) Vidya Dhar

(C) Lekh Ram Thakur (D) Tapinder Singh

98. In which district of H.P. is Giri Bata project ?

(A) Shimla (B) Solan

(C) Sirmour (D) Kangra

99. In which district is Khokhan wildlife sanctuary ?

(A) Shimla (B) Sirmour

(C) Lahaul-Spiti (D) Kullu

100. The First Round Table Conference was held in London in :

(A) 1930 (B) 1931

(C) 1929 (D) 1932