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A

SET-Z

UG-EE-June, 2024

SUBJECT : Mathematics (4 Year)

10013

Sr. No. .....

Time : **1¼ Hours** Max. Marks : **100** Total Questions : **100**

Roll No. (in figures)_____ (in words) _____

Name _____ Date of Birth_____

Father's Name _____ Mother's Name _____

Date of Examination _____

(Signature of the Candidate) (Signature of the Invigilator)

CANDIDATES MUST READ THE FOLLOWING INFORMATION/INSTRUCTIONS BEFORE STARTING THE QUESTION PAPER.

1. ***All questions are compulsory.***
2. The candidates ***must return*** the question booklet as well as OMR Answer-Sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfair-means / mis-behaviour will be registered against him / her, in addition to lodging of an FIR with the police. Further the answer-sheet of such a candidate will not be evaluated.
3. Keeping in view the transparency of the examination system, carbonless OMR Sheet is provided to the candidate so that a copy of OMR Sheet may be kept by the candidate.
4. Question Booklet along with answer key of all the A, B, C & D code shall be got uploaded on the University Website immediately after the conduct of Entrance Examination. Candidates may raise valid objection/complaint if any, with regard to discrepancy in the question booklet/answer key within 24 hours of uploading the same on the University Website. The complaint be sent by the students to the Controller of Examinations by hand or through email. Thereafter, no complaint in any case, will be considered.
5. The candidate ***must not*** do any rough work or writing in the OMR Answer-Sheet. Rough work, if any, may be done in the question booklet itself. Answers ***must not*** be ticked in the question booklet.
6. ***There will be no negative marking. Each correct answer will be awarded one full mark. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.***
7. Use only **Black** or **Blue Ball Point Pen** of good quality in the OMR Answer-Sheet.
8. *Before answering the questions, the candidates should ensure that they have been supplied correct and complete booklet. Complaints, if any, regarding misprinting etc. will not be entertained* **30** *minutes after starting of the examination.*

1. Which of the following sets is an empty set ?

   (1) The set having zero as its only element

   (2) $\{x : x + 3 = 3\}$

   (3) $\{y : y^3 = 27, y = 2\}$

   (4) None of these

2. If A and B are two disjoint sets, then $n(A \cup B)$ is equal to :

   (1) $n(A) + n(B)$

   (2) $n(A) + n(B) - n(A \cap B)$

   (3) $n(A) + n(B) + n(A \cap B)$

   (4) $n(A) \, . \, n(B)$

3. If n elements are common to A and B, then number of elements common in $A \times B$ and $B \times A$ is :

   (1) n (2) $2n$

   (3) n^3 (4) n^2

4. The function $f : R \to R$ is defined by $f(x) = \cos^2 x + \sin^4 x$ then $f(R)$ equals :

   (1) $\left[\frac{3}{4}, 1\right)$ (2) $\left(\frac{3}{4}, 1\right]$

   (3) $\left[\frac{3}{4}, 1\right]$ (4) $\left(\frac{3}{4}, 1\right)$

5. If $\tan x = a/b$, then $b \cos 2x + a \sin 2x$ is equal to :

   (1) a (2) b

   (3) a/b (4) b/a

6. If x is an acute angle and $\tan x = 1/\sqrt{7}$, then the value of $\frac{\operatorname{cosec}^2 x - \sec^2 x}{\operatorname{cosec}^2 x + \sec^2 x}$ is :

(1) $3/4$ (2) $1/2$

(3) 2 (4) $5/4$

7. The trigonometric function $\cos x$ is increasing in quadrant :

(1) I and II

(2) II and III

(3) III and IV

(4) I and IV

8. The complex number, which when multiplied by $2 + 5i$ gives $3 - 7i$, is :

(1) $-1 + i$ (2) $-1 - i$

(3) $1 - i$ (4) $1 + i$

9. The value of $\sin 30° + \cos 30°$ in polar form :

(1) $\cos \pi/6 + i \sin \pi/6$

(2) $\cos \pi/6 - i \sin \pi/6$

(3) $\cos \pi/3 - i \sin \pi/3$

(4) None of these

10. Solution of the quadratic equation $x^2 - 7ix - 12 = 0$ are :

(1) $3i, 4i$ (2) $-3i, 4i$

(3) $-3i, -4i$ (4) None of these

11. If x and b are real number, $b > 0$ and $|x| > b$, then :

(1) $x \in (-b, \infty)$

(2) $x \in (-\infty, b)$

(3) $x \in (-b, b)$

(4) $x \in (-\infty, -b) \cup (b, \infty)$

12. Which of the points lies in the half-plane $\frac{x}{2}+\frac{y}{3}-1 \geq 0$?

(1) (0, 1)

(2) (1, 5)

(3) (–3, –4)

(4) None of these

13. The number of words which can be formed out of the letters of the word ARTICLE, so that vowels occupy the even place is :

(1) 1440

(2) 144

(3) 7!

(4) None of these

14. If ${}^{n}P_{r} = 840$, ${}^{n}C_{r} = 35$, find the value of r :

(1) 8

(2) 6

(3) 4

(4) None of these

15. In how many ways can 5 boys and 5 girls be seated at a round table, so that no two girls are seated together ?

(1) 2880

(2) 2680

(3) 1860

(4) None of these

16. Find the middle term in the expansion of $\left(\frac{2x^2}{3}+\frac{3}{2x^2}\right)^{10}$:

(1) 252

(2) $250\,x^2$

(3) $248\,x^{-2}$

(4) None of these

17. Find the co-efficient of x^4 in the expansion of $(1+x+x^2+x^3)^{11}$:

(1) 890

(2) 990

(3) 690

(4) None of these

18. The first and last term of an A.P. are 1 and 11. If the sum of its terms is 36, then the number of terms will be :

(1) 8

(2) 7

(3) 6

(4) None of these

19. Which term of the sequence $8-6i, 7-4i, 6-2i, \ldots\ldots$ is purely imaginary ?

(1) 4

(2) 7

(3) 9

(4) None of these

20. The third term of G.P. is 4. The product of its first five term is :

(1) 4^2

(2) 4^3

(3) 4^4

(4) 4^5

21. The minimum value of the expression $3^x + 3^{1-x}$, $x \in R$ is given by :

(1) $\geq 2\sqrt{3}$ (2) $\leq 2\sqrt{3}$

(3) $4\sqrt{3}$ (4) None of these

22. If the vertices of a triangle are $(-4, 6)$, $(2, -2)$ and $(2, 5)$, then its centroid is :

(1) $(3, 0)$ (2) $(-3, 0)$

(3) $(0, -3)$ (4) $(0, 3)$

23. The distance between the lines $5x + 3y - 7 = 0$ and $15x + 9y + 14 = 0$ is :

(1) $\frac{35}{\sqrt{34}}$ (2) $\frac{1}{3\sqrt{34}}$

(3) $\frac{35}{3\sqrt{34}}$ (4) None of these

24. If the lines $ax + 2y + 1 = 0$, $bx + 3y + 1 = 0$ and $cx + 4y + 1 = 0$ are concurrent, then relation between a, b, c is given by :

(1) $a + b = c$

(2) $a + c = 2b$

(3) $a + c = b$

(4) None of these

25. The line which cuts off equal intercept from the axes and pass through the point $(1, -2)$ is :

(1) $x + y + 1 = 0$

(2) $x - y + 5 = 0$

(3) $x + 3y = 0$

(4) None of these

4

26. The equation of circle which touches the y-axis at origin and whose radius is 3 units.

(1) $x^2 + y^2 = 9$

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

(3) $x^2 + y^2 \pm 6x = 0$

(4) None of these

27. If the focus of a parabola is (–2, 1) and the directrix has the equation $x + y = 3$, then its vertex :

(1) (0, 3)

(2) $\left(-1, \frac{1}{2}\right)$

(3) (2, –1)

(4) (–1, 2)

28. Equation of the hyperbola whose vertices are (±3, 0) and foci at (±5, 0) is :

(1) $9x^2 - 16y^2 = 144$

(2) $16x^2 - 9y^2 = 144$

(3) $25x^2 - 9y^2 = 225$

(4) None of these

29. The length of the perpendicular drawn from the point $P(a, b, c)$ on z-axis is :

(1) $\sqrt{a^2 + b^2}$

(2) $\sqrt{b + c^2}$

(3) $\sqrt{a^2 + c^2}$

(4) $\sqrt{a^2 + b^2 + c^2}$

30. A is the foot of the perpendicular drawn from a point $P(3, 4, 5)$ on the xz-plane. The co-ordinates of point A are :

(1) (3, 0, 0)

(2) (0, 4, 5)

(3) (3, 0, 5)

(4) None of these

31. $\lim_{x \to 1}[x-1]$, where [.] is a greatest integer function, is equal to :

(1) 1

(2) 2

(3) 0

(4) Does not exist

32. The value of $\lim_{x \to 5} \frac{e^x - e^5}{x-5}$ is equal to :

(1) 5

(2) e

(3) e^5

(4) None of these

33. If $f(x) = 1 - x + x^2 - x^3 + \ldots\ldots\ldots - x^{99} + x^{100}$, then the value of $f'(1)$ is :

(1) 50

(2) 25

(3) 0

(4) None of these

34. The mean deviation of the data 3, 10, 10, 4, 7, 10, 5 from the mean is :

(1) 2

(2) 2.57

(3) 3

(4) None of these

35. The standard deviation for first 10 natural numbers is :

(1) 2.87

(2) 2.97

(3) 3.87

(4) None of these

36. The mean of first n terms of an A.P. whose first term is a and common difference is d.

(1) $a + (n-1)d$

(2) $a + nd$

(3) $a + (n-1)\frac{d}{2}$

(4) None of these

37. In a leap year the probability of having 53 Sunday or 53 Monday is :

(1) $2/7$ (2) $3/7$

(3) $4/7$ (4) None of these

38. Seven persons are to be seated in a row. The probability that two particular persons sit next to each other is :

(1) $\frac{1}{3}$ (2) $\frac{1}{6}$

(3) $\frac{2}{7}$ (4) None of these

39. A card is drawn at random from a well shuffled pack of 52 cards. The probability of getting a two of heart or a two of diamond is :

(1) $1/52$ (2) $3/52$

(3) $4/52$ (4) $1/26$

40. If R is a relation from a set A to a set B and S is a relation from B to a set C, then the relation SoR :

(1) is from A to C (2) is from C to A

(3) does not exist (4) None of these

41. Set A has 3 elements and set B has 4 elements. The number of injections that can be defined from A to B is :

(1) 144 (2) 12

(3) 24 (4) None of these

42. Let S be a finite set containing n elements, then the total number of binary operation of S is :

(1) n^n (2) 2^n

(3) n^2 (4) None of these

43. The least values of $(\sin^{-1} x)^2 + \cos^{-1} x^2$ is :

(1) $\pi^2/16$ (2) $\pi^2/8$

(3) $\pi^2/4$ (4) None of these

44. If $\tan^{-1} x - \cot^{-1} x = \tan^{-1}\left(\frac{1}{\sqrt{3}}\right)$, the value of x is :

(1) $\frac{1}{\sqrt{3}}$ (2) $\sqrt{3}$

(3) $2\sqrt{3}$ (4) None of these

45. For any 2×2 matrix A, if $A(adj\ A) = \begin{bmatrix} 10 & 0 \\ 0 & 10 \end{bmatrix}$, then $|A|$ is equal to :

(1) 0

(2) 10

(3) 20

(4) None of these

46. The diagonal elements of a skew-hermitian matrix are :

(1) Equal to one

(2) Real

(3) Purely imaginary or zero

(4) None of these

47. Every real symmetric metric is :

(1) Hermitian

(2) Skew-hermitian

(3) Skew-symmetric

(4) None of these

48. A and B be two square matrices and if their inverse exists than $(AB)^{-1}$ is equal to :

(1) $A^{-1}B^{-1}$ (2) AB^{-1}

(3) $A^{-1}B$ (4) $B^{-1}A^{-1}$

49. If the system of equation $x + ay = 0$, $az + y = 0$, $ax + z = 0$ has infinite solutions, than the value of a is :

(1) -1 (2) 1

(3) 0 (4) None of these

50. A and B are square matrices of order 3 each, $|A| = 2$ and $|B| = 3$, the value of $|3AB|$ is :

(1) 18 (2) 54

(3) 108 (4) None of these

51. If $\begin{vmatrix} 2 & 3 & 2 \\ x & x & x \\ 4 & 9 & 1 \end{vmatrix} + 3 = 0$, then the value of x is :

(1) 9

(2) 4

(3) 1

(4) -1

52. If $f(x) = x^2 - 3x + 1$ and $f(2\alpha) = 2f(\alpha)$, then α is equal to :

(1) $\frac{1}{\sqrt{2}}$ (2) $\frac{1}{\sqrt{3}}$

(3) $\frac{1}{\sqrt{5}}$ (4) None of these

53. The range of the function $\sin(\sin^{-1} x + \cos^{-1} x)$, $|x| \leq 1$ is :

(1) $[-1, 1]$

(2) $(-1, 1)$

(3) $\{0\}$

(4) $\{1\}$

54. The domain of the function $f(x) = \cos^{-1}[x]$ is :

(1) $(-1, 2)$ (2) $(-2, 1)$

(3) $[-1, 2)$ (4) $[1, 2]$

55. If $y = \sin^{-1} x$ and $z = \cos^{-1}\sqrt{1-x^2}$, then $\frac{dy}{dz}$ is equal to :

(1) $\frac{1}{\sqrt{1-x^2}}$ (2) $\cos^{-1} x$

(3) 1 (4) None of these

56. Derivative of x^{2x} w.r.t. x is :

(1) x^{2x-1}

(2) $2x^{2x}\log x$

(3) $2x^{2x}(1-\log x)$

(4) $2x^{2x}(1+\log x)$

57. $f(x) = 3x^3 - x^2$, then $f(x)$ is increasing in the interval :

(1) $\left(\frac{1}{3}, \infty\right)$

(2) $\left(-\infty, \frac{1}{3}\right)$

(3) $\left(0, \frac{1}{3}\right)$

(4) None of these

58. If $x + y = 8$, then the maximum value of xy is :

(1) 12

(2) 16

(3) 20

(4) None of these

59. The minimum value of $x + \cos x$ in $[0, \pi)$ is :

(1) π

(2) 1

(3) $\pi/2$

(4) None of these

60. $\int_0^{\pi/2} \cos^6 x\, dx$ is equal to :

(1) $3\pi/32$

(2) $4\pi/32$

(3) $5\pi/32$

(4) None of these

61. $\int_0^1 \frac{\tan^{-1} x}{1+x^2} dx$ is equal to :

(1) $\pi^2/4$

(2) $\pi^2/32$

(3) 1

(4) None of these

62. $\int_0^{\pi} \cos^{101} x \, dx$ is equal to :

(1) $\pi/4$

(2) $1/102$

(3) $(\pi/3)^{101}$

(4) 0

63. $\int_0^{1/2} |\sin \pi x| dx$ is equal to :

(1) 0

(2) π

(3) $-\pi$

(4) $1/\pi$

64. The value of $\int e^x (f(x) + f'(x)) dx$ is :

(1) $e^x f(x) + c$

(2) $e^x + f(x) + c$

(3) $2e^x f(x) + c$

(4) None of these

65. The area of region bounded by curve $x + 2y + 3$, lines $y = 1$, $y = -1$ and y-axis is :

(1) 4 square units

(2) $3/2$ square units

(3) 6 square units

(4) None of these

66. If $\int_0^a \frac{dx}{1+4x^2} = \pi/8$, then value of a is :

(1) $1/2$

(2) $1/4$

(3) $1/8$

(4) None of these

67. The value of $\int_{-\pi}^{\pi} \sin^3 x \cos^2 x \, dx$ is :

(1) $\pi/4$

(2) $\pi/2$

(3) 0

(4) None of these

68. The integrating factor of the differential equation $\frac{dy}{dx} + y = \frac{1+y}{x}$ is :

(1) x/e^x

(2) e^x/x

(3) xe^x

(4) None of these

69. The sum of the order and degree of the differential equation $1+\left(\frac{dy}{dx}\right)^4 = 7\left(\frac{d^2y}{dx^2}\right)^3$ is :

(1) 7

(2) 5

(3) 3

(4) None of these

70. The general solution of the differential equation $\frac{dy}{dx} = e^{x+y}$ is :

(1) $e^{x+y} + c = 0$

(2) $e^x + e^y = c$

(3) $e^x + e^{-y} = c$

(4) None of these

71. The slope at any point of a curve $y = f(x)$ is given by $\frac{dy}{dx} = 3x^2$ and it passes through $(-1, 1)$. The equation of the curve is :

(1) $x^3 + 2$

(2) $-x^3 - 2$

(3) $3x^3 + 4$

(4) None of these

72. The order of differential equation whose solution is $y = A\cos x + B\sin x + Ce^{-x}$ is :

(1) 1

(2) 2

(3) 3

(4) None of these

73. The probability of having at least one tail in 4 throws with a coin is :

(1) $\frac{1}{16}$

(2) $\frac{15}{16}$

(3) 1

(4) None of these

74. If for any two events A and B, $P(A) = \frac{4}{5}$ and $P(A \cap B) = \frac{7}{10}$, then $P(B/A)$ is equal to :

(1) $\frac{1}{10}$

(2) $\frac{1}{8}$

(3) $\frac{7}{8}$

(4) None of these

75. If three dice are thrown simultaneously, then the probability of getting a score of 5 is :

(1) $1/6$

(2) $1/72$

(3) $5/216$

(4) $1/36$

76. Three vertices out of six of a hexagon are chosen at random. The probability that the triangle is equilateral triangle is :

(1) $1/10$ (2) $2/5$

(3) $3/2$ (4) $4/5$

77. The probability that a man will live 10 more years is $1/4$ and the probability that his wife will live 10 more years is $1/3$. Then the probability that neither will be alive in 10 years is :

(1) $5/12$ (2) $1/2$

(3) $7/12$ (4) $11/12$

78. If $|\vec{a}\times\vec{b}| = |\vec{a}.\vec{b}|$, then the angle between $\vec{a}$ and $\vec{b}$ is :

(1) $\pi/2$ (2) $\pi/4$

(3) $2\pi/3$ (4) None of these

79. Let $\vec{a}$ and $\vec{b}$ be the two unit vectors such that angle between them is 60°, then $|\vec{a}-\vec{b}|$ is equal to :

(1) $\sqrt{5}$ (2) $\sqrt{3}$

(3) 0 (4) 1

80. Which of the following is a true statement ?

(1) $(\vec{a}\times\vec{b})\times\vec{c}$ is coplanar with $\vec{c}$

(2) $(\vec{a}\times\vec{b})\times\vec{c}$ is perpendicular to $\vec{a}$

(3) $(\vec{a}\times\vec{b})\times\vec{c}$ is perpendicular to $\vec{b}$

(4) $(\vec{a}\times\vec{b})\times\vec{c}$ is perpendicular to $\vec{c}$

81. The volume of the parallelopiped whose edges are represented by the vectors $\hat{i}+\hat{j}$, $\hat{j}+\hat{k}$ and $\hat{i}+\hat{k}$ is :

(1) 2

(2) 0

(3) $\sqrt{2}$

(4) None of these

82. The value of $[\vec{a}-\vec{b}, \vec{b}-\vec{c}, \vec{c}-\vec{a}]$ where $|\vec{a}|=1$, $|\vec{b}|=2$ and $|\vec{c}|=3$ is :

(1) 6

(2) 3

(3) 1

(4) 0

83. The minimum value of $P = 6x + 16y$ subject to constraints $x \leq 40$, $y \geq 20$ and $x, y \geq 0$:

(1) 240

(2) 320

(3) 560

(4) None of these

84. Let $z = px + qy$, where $p, q > 0$ be the objective function. Find the condition on p and q so that the maximum value of z occurs at $B(10, 14)$ and $C(12, 12)$:

(1) $p > q$

(2) $p = q$

(3) $p < q$

(4) None of these

85. Which of the terms is not used in a linear programming problem ?

(1) Slack variables

(2) Objective function

(3) Concave region

(4) Feasible region

86. The maximum value of $P = 8x + 3y$ subject to the constraints $x + y \leq 3$, $4x + y \leq 6$, $x \geq 0, y \geq 0$ is :

(1) 6

(2) 12

(3) 14

(4) None of these

87. The co-ordinates of foot of perpendicular drawn from point (1, 3, 9) on x-axis are :

(1) (1, 0, 0)

(2) (0, 3, 0)

(3) (0, 3, 9)

(4) (0, 0, 9)

88. The points (1, 1, 0), (0, 1, 1), (1, 0, 1) and $\left(\frac{2}{3}, \frac{2}{3}, \frac{2}{3}\right)$ are :

(1) Non-coplanar

(2) Co-planar

(3) The vertices of a parallelogram

(4) None of these

89. The ratio in which the line joining (2, 4, 5), (3, 5, –4) is divided by the yz-plane is :

(1) 2 : 3

(2) 3 : 2

(3) 4 : –3

(4) –2 : 3

90. The direction ratio of a normal to the plane through (1, 0, 0), (0, 1, 0), which makes an angle of $\pi/4$ with the plane $x + y = 3$ are :

(1) $<\sqrt{2}, 1, 1>$

(2) $<1, \sqrt{2}, 1>$

(3) $(1, 1, \sqrt{2})$

(4) $<1, 1, 2>$

91. The centre of sphere passing through four points (0, 0, 0), (0, 2, 0), (1, 0, 0) and (0, 0, 4) is :

(1) $\left(\frac{1}{2}, 1, 2\right)$ (2) $\left(-\frac{1}{2}, 1, 2\right)$

(3) $\left(\frac{1}{2}, 1, -2\right)$ (4) $\left(1, \frac{1}{2}, 2\right)$

92. The point equidistant from the points (0, 0, 0), (1, 0, 0), (0, 2, 0) and (0, 0, 3) is :

(1) (1, 2, 3) (2) $\left(\frac{1}{2}, 1, \frac{3}{2}\right)$

(3) $\left(-\frac{1}{2}, -1, -\frac{3}{2}\right)$ (4) None of these

93. If $\int f(x)\,dx = g(x)$, then $\int f(x)\,g(x)\,dx$ is equal to :

(1) $\log g(x)$ (2) $\frac{1}{2}(g(x))^2$

(3) $\frac{1}{2}(f(x))^2$ (4) None of these

94. $\int_{-2}^{2}[x]\,dx$ is equal to :

(1) 2

(2) 0

(3) –2

(4) None of these

95. $\lim_{x\to 0}\frac{\sin x - x}{x^3}$ is equal to :

(1) $\frac{1}{6}$ (2) 0

(3) $-\frac{1}{3}$ (4) $-\frac{1}{6}$

96. Every continuous function is :

(1) Increasing

(2) Decreasing

(3) Differentiable

(4) Not differentiable

97. In order that the function $f(x) = (x+1)^{\cot x}$ is continuous at $x = 0$, $f(0)$ must be defined as :

(1) $f(0) = 0$ (2) $f(0) = 1/e$

(3) $f(0) = e$ (4) None of these

98. Area of the quadrilateral whose vertices are (2, 3), (3, 4), (4, 5), (5, 6) is :

(1) 0 (2) 4

(3) 6 (4) None of these

99. If A and B are symmetric matrices of order $n (A \neq B)$, then :

(1) $A + B$ is a zero matrix

(2) $(A + B)$ is a diagonal matrix

(3) $A + B$ is a skew-symmetric

(4) $A + B$ is symmetric

100. If $A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ a & b & -1 \end{bmatrix}$, then A^2 is equal to :

(1) $-A$

(2) A

(3) Null matrix

(4) Unit matrix

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B

SET-Z

UG-EE-June, 2024

SUBJECT : Mathematics (4 Year)

10006

Sr. No. .....

Time : **1¼ Hours** Max. Marks : **100** Total Questions : **100**

Roll No. (in figures)_____ (in words) _____

Name _____ Date of Birth_____

Father's Name _____ Mother's Name _____

Date of Examination _____

_____ _____

(Signature of the Candidate) (Signature of the Invigilator)

CANDIDATES MUST READ THE FOLLOWING INFORMATION/INSTRUCTIONS BEFORE STARTING THE QUESTION PAPER.

1. ***All questions are compulsory.***
2. The candidates ***must return*** the question booklet as well as OMR Answer-Sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfair-means / mis-behaviour will be registered against him / her, in addition to lodging of an FIR with the police. Further the answer-sheet of such a candidate will not be evaluated.
3. Keeping in view the transparency of the examination system, carbonless OMR Sheet is provided to the candidate so that a copy of OMR Sheet may be kept by the candidate.
4. Question Booklet along with answer key of all the A, B, C & D code shall be got uploaded on the University Website immediately after the conduct of Entrance Examination. Candidates may raise valid objection/complaint if any, with regard to discrepancy in the question booklet/answer key within 24 hours of uploading the same on the University Website. The complaint be sent by the students to the Controller of Examinations by hand or through email. Thereafter, no complaint in any case, will be considered.
5. The candidate ***must not*** do any rough work or writing in the OMR Answer-Sheet. Rough work, if any, may be done in the question booklet itself. Answers ***must not*** be ticked in the question booklet.
6. ***There will be no negative marking. Each correct answer will be awarded one full mark. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.***
7. Use only **Black** or **Blue Ball Point Pen** of good quality in the OMR Answer-Sheet.
8. *Before answering the questions, the candidates should ensure that they have been supplied correct and complete booklet. Complaints, if any, regarding misprinting etc. will not be entertained* **30** *minutes after starting of the examination.*

1. The volume of the parallelopiped whose edges are represented by the vectors $\hat{i}+\hat{j}$, $\hat{j}+\hat{k}$ and $\hat{i}+\hat{k}$ is :

   (1) 2 (2) 0

   (3) $\sqrt{2}$ (4) None of these

2. The value of $[\vec{a}-\vec{b}, \vec{b}-\vec{c}, \vec{c}-\vec{a}]$ where $|\vec{a}|=1$, $|\vec{b}|=2$ and $|\vec{c}|=3$ is :

   (1) 6 (2) 3

   (3) 1 (4) 0

3. The minimum value of $P = 6x + 16y$ subject to constraints $x \leq 40$, $y \geq 20$ and $x, y \geq 0$:

   (1) 240

   (2) 320

   (3) 560

   (4) None of these

4. Let $z = px + qy$, where $p, q > 0$ be the objective function. Find the condition on p and q so that the maximum value of z occurs at $B(10, 14)$ and $C(12, 12)$:

   (1) $p > q$

   (2) $p = q$

   (3) $p < q$

   (4) None of these

5. Which of the terms is not used in a linear programming problem ?

   (1) Slack variables

   (2) Objective function

   (3) Concave region

   (4) Feasible region

6. The maximum value of $P = 8x + 3y$ subject to the constraints $x + y \leq 3$, $4x + y \leq 6$, $x \geq 0, y \geq 0$ is :

(1) 6 (2) 12

(3) 14 (4) None of these

7. The co-ordinates of foot of perpendicular drawn from point (1, 3, 9) on x-axis are :

(1) (1, 0, 0) (2) (0, 3, 0)

(3) (0, 3, 9) (4) (0, 0, 9)

8. The points (1, 1, 0), (0, 1, 1), (1, 0, 1) and $\left(\frac{2}{3}, \frac{2}{3}, \frac{2}{3}\right)$ are :

(1) Non-coplanar

(2) Co-planar

(3) The vertices of a parallelogram

(4) None of these

9. The ratio in which the line joining (2, 4, 5), (3, 5, –4) is divided by the yz-plane is :

(1) 2 : 3

(2) 3 : 2

(3) 4 : –3

(4) –2 : 3

10. The direction ratio of a normal to the plane through (1, 0, 0), (0, 1, 0), which makes an angle of $\pi/4$ with the plane $x + y = 3$ are :

(1) $<\sqrt{2}, 1, 1>$

(2) $<1, \sqrt{2}, 1>$

(3) $(1, 1, \sqrt{2})$

(4) <1, 1, 2>

11. The slope at any point of a curve $y = f(x)$ is given by $\frac{dy}{dx} = 3x^2$ and it passes through $(-1, 1)$. The equation of the curve is :

(1) $x^3 + 2$ (2) $-x^3 - 2$

(3) $3x^3 + 4$ (4) None of these

12. The order of differential equation whose solution is $y = A\cos x + B\sin x + Ce^{-x}$ is :

(1) 1 (2) 2

(3) 3 (4) None of these

13. The probability of having at least one tail in 4 throws with a coin is :

(1) $\frac{1}{16}$ (2) $\frac{15}{16}$

(3) 1 (4) None of these

14. If for any two events A and B, $P(A) = \frac{4}{5}$ and $P(A \cap B) = \frac{7}{10}$, then $P(B/A)$ is equal to :

(1) $\frac{1}{10}$ (2) $\frac{1}{8}$

(3) $\frac{7}{8}$ (4) None of these

15. If three dice are thrown simultaneously, then the probability of getting a score of 5 is :

(1) $1/6$

(2) $1/72$

(3) $5/216$

(4) $1/36$

16. Three vertices out of six of a hexagon are chosen at random. The probability that the triangle is equilateral triangle is :

(1) $1/10$ (2) $2/5$

(3) $3/2$ (4) $4/5$

17. The probability that a man will live 10 more years is $1/4$ and the probability that his wife will live 10 more years is $1/3$. Then the probability that neither will be alive in 10 years is :

(1) $5/12$ (2) $1/2$

(3) $7/12$ (4) $11/12$

18. If $|\vec{a}\times\vec{b}| = |\vec{a}.\vec{b}|$, then the angle between $\vec{a}$ and $\vec{b}$ is :

(1) $\pi/2$ (2) $\pi/4$

(3) $2\pi/3$ (4) None of these

19. Let $\vec{a}$ and $\vec{b}$ be the two unit vectors such that angle between them is 60°, then $|\vec{a}-\vec{b}|$ is equal to :

(1) $\sqrt{5}$ (2) $\sqrt{3}$

(3) 0 (4) 1

20. Which of the following is a true statement ?

(1) $(\vec{a}\times\vec{b})\times\vec{c}$ is coplanar with $\vec{c}$

(2) $(\vec{a}\times\vec{b})\times\vec{c}$ is perpendicular to $\vec{a}$

(3) $(\vec{a}\times\vec{b})\times\vec{c}$ is perpendicular to $\vec{b}$

(4) $(\vec{a}\times\vec{b})\times\vec{c}$ is perpendicular to $\vec{c}$

21. The centre of sphere passing through four points (0, 0, 0), (0, 2, 0), (1, 0, 0) and (0, 0, 4) is :

(1) $\left(\frac{1}{2}, 1, 2\right)$ (2) $\left(-\frac{1}{2}, 1, 2\right)$

(3) $\left(\frac{1}{2}, 1, -2\right)$ (4) $\left(1, \frac{1}{2}, 2\right)$

22. The point equidistant from the points (0, 0, 0), (1, 0, 0), (0, 2, 0) and (0, 0, 3) is :

(1) (1, 2, 3) (2) $\left(\frac{1}{2}, 1, \frac{3}{2}\right)$

(3) $\left(-\frac{1}{2}, -1, -\frac{3}{2}\right)$ (4) None of these

23. If $\int f(x)dx = g(x)$, then $\int f(x)\,g(x)dx$ is equal to :

(1) $\log g(x)$ (2) $\frac{1}{2}(g(x))^2$

(3) $\frac{1}{2}(f(x))^2$ (4) None of these

24. $\int_{-2}^{2}[x]dx$ is equal to :

(1) 2

(2) 0

(3) –2

(4) None of these

25. $\lim_{x\to 0}\frac{\sin x - x}{x^3}$ is equal to :

(1) $\frac{1}{6}$ (2) 0

(3) $-\frac{1}{3}$ (4) $-\frac{1}{6}$

26. Every continuous function is :

(1) Increasing

(2) Decreasing

(3) Differentiable

(4) Not differentiable

27. In order that the function $f(x) = (x+1)^{\cot x}$ is continuous at $x = 0$, $f(0)$ must be defined as :

(1) $f(0) = 0$

(2) $f(0) = 1/e$

(3) $f(0) = e$

(4) None of these

28. Area of the quadrilateral whose vertices are (2, 3), (3, 4), (4, 5), (5, 6) is :

(1) 0

(2) 4

(3) 6

(4) None of these

29. If A and B are symmetric matrices of order $n (A \neq B)$, then :

(1) $A + B$ is a zero matrix

(2) $(A + B)$ is a diagonal matrix

(3) $A + B$ is a skew-symmetric

(4) $A + B$ is symmetric

30. If $A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ a & b & -1 \end{bmatrix}$, then A^2 is equal to :

(1) $-A$

(2) A

(3) Null matrix

(4) Unit matrix

31. Which of the following sets is an empty set ?

(1) The set having zero as its only element

(2) $\{x : x + 3 = 3\}$

(3) $\{y : y^3 = 27, y = 2\}$

(4) None of these

32. If A and B are two disjoint sets, then $n(A \cup B)$ is equal to :

(1) $n(A) + n(B)$

(2) $n(A) + n(B) - n(A \cap B)$

(3) $n(A) + n(B) + n(A \cap B)$

(4) $n(A) \cdot n(B)$

33. If n elements are common to A and B, then number of elements common in $A \times B$ and $B \times A$ is :

(1) n (2) $2n$

(3) n^3 (4) n^2

34. The function $f : R \to R$ is defined by $f(x) = \cos^2 x + \sin^4 x$ then $f(R)$ equals :

(1) $\left[\frac{3}{4}, 1\right)$ (2) $\left(\frac{3}{4}, 1\right]$

(3) $\left[\frac{3}{4}, 1\right]$ (4) $\left(\frac{3}{4}, 1\right)$

35. If $\tan x = \frac{a}{b}$, then $b \cos 2x + a \sin 2x$ is equal to :

(1) a (2) b

(3) $\frac{a}{b}$ (4) $\frac{b}{a}$

36. If x is an acute angle and $\tan x = 1/\sqrt{7}$, then the value of $\frac{\operatorname{cosec}^2 x - \sec^2 x}{\operatorname{cosec}^2 x + \sec^2 x}$ is :

(1) $3/4$ (2) $1/2$

(3) 2 (4) $5/4$

37. The trigonometric function $\cos x$ is increasing in quadrant :

(1) I and II

(2) II and III

(3) III and IV

(4) I and IV

38. The complex number, which when multiplied by $2 + 5i$ gives $3 - 7i$, is :

(1) $-1 + i$ (2) $-1 - i$

(3) $1 - i$ (4) $1 + i$

39. The value of $\sin 30° + \cos 30°$ in polar form :

(1) $\cos \pi/6 + i \sin \pi/6$

(2) $\cos \pi/6 - i \sin \pi/6$

(3) $\cos \pi/3 - i \sin \pi/3$

(4) None of these

40. Solution of the quadratic equation $x^2 - 7ix - 12 = 0$ are :

(1) $3i, 4i$ (2) $-3i, 4i$

(3) $-3i, -4i$ (4) None of these

41. If $\begin{vmatrix} 2 & 3 & 2 \\ x & x & x \\ 4 & 9 & 1 \end{vmatrix} + 3 = 0$, then the value of x is :

(1) 9

(2) 4

(3) 1

(4) -1

42. If $f(x) = x^2 - 3x + 1$ and $f(2\alpha) = 2f(\alpha)$, then α is equal to :

(1) $\frac{1}{\sqrt{2}}$ (2) $\frac{1}{\sqrt{3}}$

(3) $\frac{1}{\sqrt{5}}$ (4) None of these

43. The range of the function $\sin(\sin^{-1} x + \cos^{-1} x)$, $|x| \leq 1$ is :

(1) $[-1, 1]$

(2) $(-1, 1)$

(3) $\{0\}$

(4) $\{1\}$

44. The domain of the function $f(x) = \cos^{-1}[x]$ is :

(1) $(-1, 2)$ (2) $(-2, 1)$

(3) $[-1, 2)$ (4) $[1, 2]$

45. If $y = \sin^{-1} x$ and $z = \cos^{-1}\sqrt{1-x^2}$, then $\frac{dy}{dz}$ is equal to :

(1) $\frac{1}{\sqrt{1-x^2}}$ (2) $\cos^{-1} x$

(3) 1 (4) None of these

46. Derivative of x^{2x} w.r.t. x is :

(1) x^{2x-1} (2) $2x^{2x}\log x$

(3) $2x^{2x}(1-\log x)$ (4) $2x^{2x}(1+\log x)$

47. $f(x) = 3x^3 - x^2$, then $f(x)$ is increasing in the interval :

(1) $\left(\frac{1}{3}, \infty\right)$ (2) $\left(-\infty, \frac{1}{3}\right)$

(3) $\left(0, \frac{1}{3}\right)$ (4) None of these

48. If $x + y = 8$, then the maximum value of xy is :

(1) 12

(2) 16

(3) 20

(4) None of these

49. The minimum value of $x + \cos x$ in $[0, \pi)$ is :

(1) π

(2) 1

(3) $\pi/2$

(4) None of these

50. $\int_0^{\pi/2} \cos^6 x\, dx$ is equal to :

(1) $3\pi/32$ (2) $4\pi/32$

(3) $5\pi/32$ (4) None of these

51. $\int_0^1 \frac{\tan^{-1} x}{1+x^2} dx$ is equal to :

(1) $\pi^2/4$ (2) $\pi^2/32$

(3) 1 (4) None of these

52. $\int_0^{\pi} \cos^{101} x \, dx$ is equal to :

(1) $\pi/4$ (2) $1/102$

(3) $(\pi/3)^{101}$ (4) 0

53. $\int_0^{1/2} |\sin \pi x| dx$ is equal to :

(1) 0 (2) π

(3) $-\pi$ (4) $1/\pi$

54. The value of $\int e^x (f(x) + f'(x)) dx$ is :

(1) $e^x f(x) + c$ (2) $e^x + f(x) + c$

(3) $2e^x f(x) + c$ (4) None of these

55. The area of region bounded by curve $x + 2y + 3$, lines $y = 1$, $y = -1$ and y-axis is :

(1) 4 square units

(2) $3/2$ square units

(3) 6 square units

(4) None of these

56. If $\int_0^a \frac{dx}{1+4x^2} = \pi/8$, then value of a is :

(1) $1/2$

(2) $1/4$

(3) $1/8$

(4) None of these

57. The value of $\int_{-\pi}^{\pi} \sin^3 x \cos^2 x \, dx$ is :

(1) $\pi/4$

(2) $\pi/2$

(3) 0

(4) None of these

58. The integrating factor of the differential equation $\frac{dy}{dx} + y = \frac{1+y}{x}$ is :

(1) x/e^x

(2) e^x/x

(3) xe^x

(4) None of these

59. The sum of the order and degree of the differential equation $1+\left(\frac{dy}{dx}\right)^4 = 7\left(\frac{d^2y}{dx^2}\right)^3$ is :

(1) 7

(2) 5

(3) 3

(4) None of these

60. The general solution of the differential equation $\frac{dy}{dx} = e^{x+y}$ is :

(1) $e^{x+y} + c = 0$

(2) $e^x + e^y = c$

(3) $e^x + e^{-y} = c$

(4) None of these

61. The minimum value of the expression $3^x + 3^{1-x}$, $x \in R$ is given by :

(1) $\geq 2\sqrt{3}$ (2) $\leq 2\sqrt{3}$

(3) $4\sqrt{3}$ (4) None of these

62. If the vertices of a triangle are $(-4, 6)$, $(2, -2)$ and $(2, 5)$, then its centroid is :

(1) $(3, 0)$ (2) $(-3, 0)$

(3) $(0, -3)$ (4) $(0, 3)$

63. The distance between the lines $5x + 3y - 7 = 0$ and $15x + 9y + 14 = 0$ is :

(1) $\frac{35}{\sqrt{34}}$ (2) $\frac{1}{3\sqrt{34}}$

(3) $\frac{35}{3\sqrt{34}}$ (4) None of these

64. If the lines $ax + 2y + 1 = 0$, $bx + 3y + 1 = 0$ and $cx + 4y + 1 = 0$ are concurrent, then relation between a, b, c is given by :

(1) $a + b = c$

(2) $a + c = 2b$

(3) $a + c = b$

(4) None of these

65. The line which cuts off equal intercept from the axes and pass through the point $(1, -2)$ is :

(1) $x + y + 1 = 0$

(2) $x - y + 5 = 0$

(3) $x + 3y = 0$

(4) None of these

66. The equation of circle which touches the y-axis at origin and whose radius is 3 units.

(1) $x^2 + y^2 = 9$

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

(3) $x^2 + y^2 \pm 6x = 0$

(4) None of these

67. If the focus of a parabola is $(-2, 1)$ and the directrix has the equation $x + y = 3$, then its vertex :

(1) $(0, 3)$

(2) $\left(-1, \frac{1}{2}\right)$

(3) $(2, -1)$

(4) $(-1, 2)$

68. Equation of the hyperbola whose vertices are $(\pm 3, 0)$ and foci at $(\pm 5, 0)$ is :

(1) $9x^2 - 16y^2 = 144$

(2) $16x^2 - 9y^2 = 144$

(3) $25x^2 - 9y^2 = 225$

(4) None of these

69. The length of the perpendicular drawn from the point $P(a, b, c)$ on z-axis is :

(1) $\sqrt{a^2 + b^2}$

(2) $\sqrt{b + c^2}$

(3) $\sqrt{a^2 + c^2}$

(4) $\sqrt{a^2 + b^2 + c^2}$

70. A is the foot of the perpendicular drawn from a point $P(3, 4, 5)$ on the xz-plane. The co-ordinates of point A are :

(1) $(3, 0, 0)$

(2) $(0, 4, 5)$

(3) $(3, 0, 5)$

(4) None of these

71. If x and b are real number, $b > 0$ and $|x| > b$, then :

(1) $x \in (-b, \infty)$

(2) $x \in (-\infty, b)$

(3) $x \in (-b, b)$

(4) $x \in (-\infty, -b) \cup (b, \infty)$

72. Which of the points lies in the half-plane $\frac{x}{2} + \frac{y}{3} - 1 \geq 0$?

(1) (0, 1) (2) (1, 5)

(3) (–3, –4) (4) None of these

73. The number of words which can be formed out of the letters of the word ARTICLE, so that vowels occupy the even place is :

(1) 1440 (2) 144

(3) 7! (4) None of these

74. If ${}^{n}P_{r} = 840$, ${}^{n}C_{r} = 35$, find the value of r :

(1) 8 (2) 6

(3) 4 (4) None of these

75. In how many ways can 5 boys and 5 girls be seated at a round table, so that no two girls are seated together ?

(1) 2880 (2) 2680

(3) 1860 (4) None of these

76. Find the middle term in the expansion of $\left(\frac{2x^2}{3}+\frac{3}{2x^2}\right)^{10}$:

(1) 252

(2) $250\,x^2$

(3) $248\,x^{-2}$

(4) None of these

77. Find the co-efficient of x^4 in the expansion of $(1+x+x^2+x^3)^{11}$:

(1) 890

(2) 990

(3) 690

(4) None of these

78. The first and last term of an A.P. are 1 and 11. If the sum of its terms is 36, then the number of terms will be :

(1) 8

(2) 7

(3) 6

(4) None of these

79. Which term of the sequence $8-6i$, $7-4i$, $6-2i$, ... is purely imaginary ?

(1) 4

(2) 7

(3) 9

(4) None of these

80. The third term of G.P. is 4. The product of its first five term is :

(1) 4^2

(2) 4^3

(3) 4^4

(4) 4^5

81. Set A has 3 elements and set B has 4 elements. The number of injections that can be defined from A to B is :

(1) 144 (2) 12

(3) 24 (4) None of these

82. Let S be a finite set containing n elements, then the total number of binary operation of S is :

(1) n^n (2) 2^n

(3) n^2 (4) None of these

83. The least values of $(\sin^{-1} x)^2 + \cos^{-1} x^2$ is :

(1) $\pi^2/16$ (2) $\pi^2/8$

(3) $\pi^2/4$ (4) None of these

84. If $\tan^{-1} x - \cot^{-1} x = \tan^{-1}\left(\frac{1}{\sqrt{3}}\right)$, the value of x is :

(1) $\frac{1}{\sqrt{3}}$ (2) $\sqrt{3}$

(3) $2\sqrt{3}$ (4) None of these

85. For any 2×2 matrix A, if $A(adj\ A) = \begin{bmatrix} 10 & 0 \\ 0 & 10 \end{bmatrix}$, then $|A|$ is equal to :

(1) 0

(2) 10

(3) 20

(4) None of these

86. The diagonal elements of a skew-hermitian matrix are :

(1) Equal to one

(2) Real

(3) Purely imaginary or zero

(4) None of these

87. Every real symmetric metric is :

(1) Hermitian

(2) Skew-hermitian

(3) Skew-symmetric

(4) None of these

88. A and B be two square matrices and if their inverse exists than $(AB)^{-1}$ is equal to :

(1) $A^{-1}B^{-1}$

(2) AB^{-1}

(3) $A^{-1}B$

(4) $B^{-1}A^{-1}$

89. If the system of equation $x + ay = 0$, $az + y = 0$, $ax + z = 0$ has infinite solutions, than the value of a is :

(1) -1

(2) 1

(3) 0

(4) None of these

90. A and B are square matrices of order 3 each, $|A| = 2$ and $|B| = 3$, the value of $|3AB|$ is :

(1) 18

(2) 54

(3) 108

(4) None of these

91. $\lim_{x \to 1}[x-1]$, where [.] is a greatest integer function, is equal to :

(1) 1

(2) 2

(3) 0

(4) Does not exist

92. The value of $\lim_{x \to 5} \frac{e^x - e^5}{x-5}$ is equal to :

(1) 5

(2) e

(3) e^5

(4) None of these

93. If $f(x) = 1 - x + x^2 - x^3 + \ldots\ldots\ldots - x^{99} + x^{100}$, then the value of $f'(1)$ is :

(1) 50

(2) 25

(3) 0

(4) None of these

94. The mean deviation of the data 3, 10, 10, 4, 7, 10, 5 from the mean is :

(1) 2

(2) 2.57

(3) 3

(4) None of these

95. The standard deviation for first 10 natural numbers is :

(1) 2.87

(2) 2.97

(3) 3.87

(4) None of these

96. The mean of first n terms of an A.P. whose first term is a and common difference is d

(1) $a + (n-1)d$

(2) $a + nd$

(3) $a + (n-1)\frac{d}{2}$

(4) None of these

97. In a leap year the probability of having 53 Sunday or 53 Monday is :

(1) $2/7$

(2) $3/7$

(3) $4/7$

(4) None of these

98. Seven persons are to be seated in a row. The probability that two particular persons s next to each other is :

(1) $\frac{1}{3}$

(2) $\frac{1}{6}$

(3) $\frac{2}{7}$

(4) None of these

99. A card is drawn at random from a well shuffled pack of 52 cards. The probability o getting a two of heart or a two of diamond is :

(1) $1/52$

(2) $3/52$

(3) $4/52$

(4) $1/26$

100. If R is a relation from a set A to a set B and S is a relation from B to a set C, then the relation SoR :

(1) is from A to C

(2) is from C to A

(3) does not exist

(4) None of these

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C

SET-Z

UG-EE-June, 2024

SUBJECT : Mathematics (4 Year)

10091

Sr. No. .....

Time : 1¼ Hours | Max. Marks : 100 | Total Questions : 100

Roll No. (in figures) _____ (in words) _____

Name _____ Date of Birth _____

Father's Name _____ Mother's Name _____

Date of Examination _____

_____ _____

(Signature of the Candidate) (Signature of the Invigilator)

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4. Question Booklet along with answer key of all the A, B, C & D code shall be got uploaded on the University Website immediately after the conduct of Entrance Examination. Candidates may raise valid objection/complaint if any, with regard to discrepancy in the question booklet/answer key within 24 hours of uploading the same on the University Website. The complaint be sent by the students to the Controller of Examinations by hand or through email. Thereafter, no complaint in any case, will be considered.
5. The candidate ***must not*** do any rough work or writing in the OMR Answer-Sheet. Rough work, if any, may be done in the question booklet itself. Answers ***must not*** be ticked in the question booklet.
6. ***There will be no negative marking. Each correct answer will be awarded one full mark. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.***
7. Use only **Black** or **Blue Ball Point Pen** of good quality in the OMR Answer-Sheet.
8. *Before answering the questions, the candidates should ensure that they have been supplied correct and complete booklet. Complaints, if any, regarding misprinting etc. will not be entertained* 30 *minutes after starting of the examination.*

1. The minimum value of the expression $3^x + 3^{1-x}$, $x \in R$ is given by :

(1) $\geq 2\sqrt{3}$

(2) $\leq 2\sqrt{3}$

(3) $4\sqrt{3}$

(4) None of these

2. If the vertices of a triangle are $(-4, 6)$, $(2, -2)$ and $(2, 5)$, then its centroid is :

(1) $(3, 0)$

(2) $(-3, 0)$

(3) $(0, -3)$

(4) $(0, 3)$

3. The distance between the lines $5x + 3y - 7 = 0$ and $15x + 9y + 14 = 0$ is :

(1) $\frac{35}{\sqrt{34}}$

(2) $\frac{1}{3\sqrt{34}}$

(3) $\frac{35}{3\sqrt{34}}$

(4) None of these

4. If the lines $ax + 2y + 1 = 0$, $bx + 3y + 1 = 0$ and $cx + 4y + 1 = 0$ are concurrent, then relation between a, b, c is given by :

(1) $a + b = c$

(2) $a + c = 2b$

(3) $a + c = b$

(4) None of these

5. The line which cuts off equal intercept from the axes and pass through the point $(1, -2)$ is :

(1) $x + y + 1 = 0$

(2) $x - y + 5 = 0$

(3) $x + 3y = 0$

(4) None of these

6. The equation of circle which touches the y-axis at origin and whose radius is 3 units.

(1) $x^2 + y^2 = 9$

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

(3) $x^2 + y^2 \pm 6x = 0$

(4) None of these

7. If the focus of a parabola is (–2, 1) and the directrix has the equation $x + y = 3$, then its vertex :

(1) (0, 3)

(2) $\left(-1, \frac{1}{2}\right)$

(3) (2, –1)

(4) (–1, 2)

8. Equation of the hyperbola whose vertices are (±3, 0) and foci at (±5, 0) is :

(1) $9x^2 - 16y^2 = 144$

(2) $16x^2 - 9y^2 = 144$

(3) $25x^2 - 9y^2 = 225$

(4) None of these

9. The length of the perpendicular drawn from the point $P(a, b, c)$ on z-axis is :

(1) $\sqrt{a^2 + b^2}$

(2) $\sqrt{b + c^2}$

(3) $\sqrt{a^2 + c^2}$

(4) $\sqrt{a^2 + b^2 + c^2}$

10. A is the foot of the perpendicular drawn from a point $P(3, 4, 5)$ on the xz-plane. The co-ordinates of point A are :

(1) (3, 0, 0)

(2) (0, 4, 5)

(3) (3, 0, 5)

(4) None of these

11. If $\begin{vmatrix} 2 & 3 & 2 \\ x & x & x \\ 4 & 9 & 1 \end{vmatrix} + 3 = 0$, then the value of x is :

(1) 9

(2) 4

(3) 1

(4) -1

12. If $f(x) = x^2 - 3x + 1$ and $f(2\alpha) = 2f(\alpha)$, then α is equal to :

(1) $\frac{1}{\sqrt{2}}$

(2) $\frac{1}{\sqrt{3}}$

(3) $\frac{1}{\sqrt{5}}$

(4) None of these

13. The range of the function $\sin(\sin^{-1} x + \cos^{-1} x)$, $|x| \leq 1$ is :

(1) $[-1, 1]$

(2) $(-1, 1)$

(3) $\{0\}$

(4) $\{1\}$

14. The domain of the function $f(x) = \cos^{-1}[x]$ is :

(1) $(-1, 2)$

(2) $(-2, 1)$

(3) $[-1, 2)$

(4) $[1, 2]$

15. If $y = \sin^{-1} x$ and $z = \cos^{-1}\sqrt{1-x^2}$, then $\frac{dy}{dz}$ is equal to :

(1) $\frac{1}{\sqrt{1-x^2}}$

(2) $\cos^{-1} x$

(3) 1

(4) None of these

16. Derivative of x^{2x} w.r.t. x is :

(1) x^{2x-1}

(2) $2x^{2x}\log x$

(3) $2x^{2x}(1-\log x)$

(4) $2x^{2x}(1+\log x)$

17. $f(x) = 3x^3 - x^2$, then $f(x)$ is increasing in the interval :

(1) $\left(\frac{1}{3}, \infty\right)$

(2) $\left(-\infty, \frac{1}{3}\right)$

(3) $\left(0, \frac{1}{3}\right)$

(4) None of these

18. If $x + y = 8$, then the maximum value of xy is :

(1) 12

(2) 16

(3) 20

(4) None of these

19. The minimum value of $x + \cos x$ in $[0, \pi)$ is :

(1) π

(2) 1

(3) $\pi/2$

(4) None of these

20. $\int_0^{\pi/2} \cos^6 x\, dx$ is equal to :

(1) $3\pi/32$

(2) $4\pi/32$

(3) $5\pi/32$

(4) None of these

21. The volume of the parallelopiped whose edges are represented by the vectors $\hat{i}+\hat{j}$, $\hat{j}+\hat{k}$ and $\hat{i}+\hat{k}$ is :

(1) 2
(2) 0
(3) $\sqrt{2}$
(4) None of these

22. The value of $[\vec{a}-\vec{b}, \vec{b}-\vec{c}, \vec{c}-\vec{a}]$ where $|\vec{a}|=1$, $|\vec{b}|=2$ and $|\vec{c}|=3$ is :

(1) 6
(2) 3
(3) 1
(4) 0

23. The minimum value of $P = 6x + 16y$ subject to constraints $x \leq 40$, $y \geq 20$ and $x, y \geq 0$:

(1) 240
(2) 320
(3) 560
(4) None of these

24. Let $z = px + qy$, where $p, q > 0$ be the objective function. Find the condition on p and q so that the maximum value of z occurs at $B(10, 14)$ and $C(12, 12)$:

(1) $p > q$
(2) $p = q$
(3) $p < q$
(4) None of these

25. Which of the terms is not used in a linear programming problem ?

(1) Slack variables
(2) Objective function
(3) Concave region
(4) Feasible region

26. The maximum value of $P = 8x + 3y$ subject to the constraints $x + y \leq 3$, $4x + y \leq 6$, $x \geq 0, y \geq 0$ is :

(1) 6 (2) 12

(3) 14 (4) None of these

27. The co-ordinates of foot of perpendicular drawn from point (1, 3, 9) on x-axis are :

(1) (1, 0, 0) (2) (0, 3, 0)

(3) (0, 3, 9) (4) (0, 0, 9)

28. The points (1, 1, 0), (0, 1, 1), (1, 0, 1) and $\left(\frac{2}{3}, \frac{2}{3}, \frac{2}{3}\right)$ are :

(1) Non-coplanar

(2) Co-planar

(3) The vertices of a parallelogram

(4) None of these

29. The ratio in which the line joining (2, 4, 5), (3, 5, –4) is divided by the yz-plane is :

(1) 2 : 3

(2) 3 : 2

(3) 4 : –3

(4) –2 : 3

30. The direction ratio of a normal to the plane through (1, 0, 0), (0, 1, 0), which makes an angle of $\pi/4$ with the plane $x + y = 3$ are :

(1) $<\sqrt{2}, 1, 1>$

(2) $<1, \sqrt{2}, 1>$

(3) $(1, 1, \sqrt{2})$

(4) $<1, 1, 2>$

31. The slope at any point of a curve $y = f(x)$ is given by $\frac{dy}{dx} = 3x^2$ and it passes through $(-1, 1)$. The equation of the curve is :

(1) $x^3 + 2$

(2) $-x^3 - 2$

(3) $3x^3 + 4$

(4) None of these

32. The order of differential equation whose solution is $y = A\cos x + B\sin x + Ce^{-x}$ is :

(1) 1

(2) 2

(3) 3

(4) None of these

33. The probability of having at least one tail in 4 throws with a coin is :

(1) $\frac{1}{16}$

(2) $\frac{15}{16}$

(3) 1

(4) None of these

34. If for any two events A and B, $P(A) = \frac{4}{5}$ and $P(A \cap B) = \frac{7}{10}$, then $P(B/A)$ is equal to :

(1) $\frac{1}{10}$

(2) $\frac{1}{8}$

(3) $\frac{7}{8}$

(4) None of these

35. If three dice are thrown simultaneously, then the probability of getting a score of 5 is :

(1) $1/6$

(2) $1/72$

(3) $5/216$

(4) $1/36$

36. Three vertices out of six of a hexagon are chosen at random. The probability that the triangle is equilateral triangle is :

(1) $1/10$ (2) $2/5$

(3) $3/2$ (4) $4/5$

37. The probability that a man will live 10 more years is $1/4$ and the probability that his wife will live 10 more years is $1/3$. Then the probability that neither will be alive in 10 years is :

(1) $5/12$ (2) $1/2$

(3) $7/12$ (4) $11/12$

38. If $|\vec{a}\times\vec{b}| = |\vec{a}.\vec{b}|$, then the angle between $\vec{a}$ and $\vec{b}$ is :

(1) $\pi/2$ (2) $\pi/4$

(3) $2\pi/3$ (4) None of these

39. Let $\vec{a}$ and $\vec{b}$ be the two unit vectors such that angle between them is 60°, then $|\vec{a}-\vec{b}|$ is equal to :

(1) $\sqrt{5}$ (2) $\sqrt{3}$

(3) 0 (4) 1

40. Which of the following is a true statement ?

(1) $(\vec{a}\times\vec{b})\times\vec{c}$ is coplanar with $\vec{c}$

(2) $(\vec{a}\times\vec{b})\times\vec{c}$ is perpendicular to $\vec{a}$

(3) $(\vec{a}\times\vec{b})\times\vec{c}$ is perpendicular to $\vec{b}$

(4) $(\vec{a}\times\vec{b})\times\vec{c}$ is perpendicular to $\vec{c}$

41. If x and b are real number, $b > 0$ and $|x| > b$, then :

(1) $x \in (-b, \infty)$

(2) $x \in (-\infty, b)$

(3) $x \in (-b, b)$

(4) $x \in (-\infty, -b) \cup (b, \infty)$

42. Which of the points lies in the half-plane $\frac{x}{2}+\frac{y}{3}-1 \geq 0$?

(1) (0, 1)

(2) (1, 5)

(3) (–3, –4)

(4) None of these

43. The number of words which can be formed out of the letters of the word ARTICLE, so that vowels occupy the even place is :

(1) 1440

(2) 144

(3) 7!

(4) None of these

44. If ${}^{n}P_{r} = 840$, ${}^{n}C_{r} = 35$, find the value of r :

(1) 8

(2) 6

(3) 4

(4) None of these

45. In how many ways can 5 boys and 5 girls be seated at a round table, so that no two girls are seated together ?

(1) 2880

(2) 2680

(3) 1860

(4) None of these

46. Find the middle term in the expansion of $\left(\frac{2x^2}{3}+\frac{3}{2x^2}\right)^{10}$:

(1) 252

(2) $250\,x^2$

(3) $248\,x^{-2}$

(4) None of these

47. Find the co-efficient of x^4 in the expansion of $(1+x+x^2+x^3)^{11}$:

(1) 890

(2) 990

(3) 690

(4) None of these

48. The first and last term of an A.P. are 1 and 11. If the sum of its terms is 36, then the number of terms will be :

(1) 8

(2) 7

(3) 6

(4) None of these

49. Which term of the sequence $8-6i, 7-4i, 6-2i, \ldots\ldots$ is purely imaginary ?

(1) 4

(2) 7

(3) 9

(4) None of these

50. The third term of G.P. is 4. The product of its first five term is :

(1) 4^2

(2) 4^3

(3) 4^4

(4) 4^5

51. $\lim_{x \to 1}[x-1]$, where [.] is a greatest integer function, is equal to :

(1) 1

(2) 2

(3) 0

(4) Does not exist

52. The value of $\lim_{x \to 5} \frac{e^x - e^5}{x-5}$ is equal to :

(1) 5

(2) e

(3) e^5

(4) None of these

53. If $f(x) = 1 - x + x^2 - x^3 + \ldots\ldots\ldots - x^{99} + x^{100}$, then the value of $f'(1)$ is :

(1) 50

(2) 25

(3) 0

(4) None of these

54. The mean deviation of the data 3, 10, 10, 4, 7, 10, 5 from the mean is :

(1) 2

(2) 2.57

(3) 3

(4) None of these

55. The standard deviation for first 10 natural numbers is :

(1) 2.87

(2) 2.97

(3) 3.87

(4) None of these

56. The mean of first n terms of an A.P. whose first term is a and common difference is d.

(1) $a + (n-1)d$

(2) $a + nd$

(3) $a + (n-1)\frac{d}{2}$

(4) None of these

57. In a leap year the probability of having 53 Sunday or 53 Monday is :

(1) $2/7$ (2) $3/7$

(3) $4/7$ (4) None of these

58. Seven persons are to be seated in a row. The probability that two particular persons sit next to each other is :

(1) $\frac{1}{3}$ (2) $\frac{1}{6}$

(3) $\frac{2}{7}$ (4) None of these

59. A card is drawn at random from a well shuffled pack of 52 cards. The probability of getting a two of heart or a two of diamond is :

(1) $1/52$ (2) $3/52$

(3) $4/52$ (4) $1/26$

60. If R is a relation from a set A to a set B and S is a relation from B to a set C, then the relation SoR :

(1) is from A to C (2) is from C to A

(3) does not exist (4) None of these

61. Which of the following sets is an empty set ?

(1) The set having zero as its only element

(2) $\{x : x + 3 = 3\}$

(3) $\{y : y^3 = 27, y = 2\}$

(4) None of these

62. If A and B are two disjoint sets, then $n(A \cup B)$ is equal to :

(1) $n(A) + n(B)$

(2) $n(A) + n(B) - n(A \cap B)$

(3) $n(A) + n(B) + n(A \cap B)$

(4) $n(A) \cdot n(B)$

63. If n elements are common to A and B, then number of elements common in $A \times B$ and $B \times A$ is :

(1) n

(2) $2n$

(3) n^3

(4) n^2

64. The function $f : R \to R$ is defined by $f(x) = \cos^2 x + \sin^4 x$ then $f(R)$ equals :

(1) $\left[\frac{3}{4}, 1\right)$

(2) $\left(\frac{3}{4}, 1\right]$

(3) $\left[\frac{3}{4}, 1\right]$

(4) $\left(\frac{3}{4}, 1\right)$

65. If $\tan x = \frac{a}{b}$, then $b \cos 2x + a \sin 2x$ is equal to :

(1) a

(2) b

(3) $\frac{a}{b}$

(4) $\frac{b}{a}$

66. If x is an acute angle and $\tan x = 1/\sqrt{7}$, then the value of $\frac{\operatorname{cosec}^2 x - \sec^2 x}{\operatorname{cosec}^2 x + \sec^2 x}$ is :

(1) $3/4$ (2) $1/2$

(3) 2 (4) $5/4$

67. The trigonometric function $\cos x$ is increasing in quadrant :

(1) I and II

(2) II and III

(3) III and IV

(4) I and IV

68. The complex number, which when multiplied by $2 + 5i$ gives $3 - 7i$, is :

(1) $-1 + i$ (2) $-1 - i$

(3) $1 - i$ (4) $1 + i$

69. The value of $\sin 30° + \cos 30°$ in polar form :

(1) $\cos \pi/6 + i \sin \pi/6$

(2) $\cos \pi/6 - i \sin \pi/6$

(3) $\cos \pi/3 - i \sin \pi/3$

(4) None of these

70. Solution of the quadratic equation $x^2 - 7ix - 12 = 0$ are :

(1) $3i, 4i$ (2) $-3i, 4i$

(3) $-3i, -4i$ (4) None of these

71. Set A has 3 elements and set B has 4 elements. The number of injections that can be defined from A to B is :

(1) 144
(2) 12
(3) 24
(4) None of these

72. Let S be a finite set containing n elements, then the total number of binary operation of S is :

(1) n^n
(2) 2^n
(3) n^2
(4) None of these

73. The least values of $(\sin^{-1} x)^2 + \cos^{-1} x^2$ is :

(1) $\pi^2/16$
(2) $\pi^2/8$
(3) $\pi^2/4$
(4) None of these

74. If $\tan^{-1} x - \cot^{-1} x = \tan^{-1}\left(\frac{1}{\sqrt{3}}\right)$, the value of x is :

(1) $\frac{1}{\sqrt{3}}$
(2) $\sqrt{3}$
(3) $2\sqrt{3}$
(4) None of these

75. For any 2×2 matrix A, if $A(adj\ A) = \begin{bmatrix} 10 & 0 \\ 0 & 10 \end{bmatrix}$, then $|A|$ is equal to :

(1) 0
(2) 10
(3) 20
(4) None of these

76. The diagonal elements of a skew-hermitian matrix are :

(1) Equal to one

(2) Real

(3) Purely imaginary or zero

(4) None of these

77. Every real symmetric metric is :

(1) Hermitian

(2) Skew-hermitian

(3) Skew-symmetric

(4) None of these

78. A and B be two square matrices and if their inverse exists than $(AB)^{-1}$ is equal to :

(1) $A^{-1}B^{-1}$ (2) AB^{-1}

(3) $A^{-1}B$ (4) $B^{-1}A^{-1}$

79. If the system of equation $x + ay = 0$, $az + y = 0$, $ax + z = 0$ has infinite solutions, than the value of a is :

(1) -1 (2) 1

(3) 0 (4) None of these

80. A and B are square matrices of order 3 each, $|A| = 2$ and $|B| = 3$, the value of $|3AB|$ is :

(1) 18 (2) 54

(3) 108 (4) None of these

81. The centre of sphere passing through four points (0, 0, 0), (0, 2, 0), (1, 0, 0) and (0, 0, 4) is :

(1) $\left(\frac{1}{2}, 1, 2\right)$ (2) $\left(-\frac{1}{2}, 1, 2\right)$

(3) $\left(\frac{1}{2}, 1, -2\right)$ (4) $\left(1, \frac{1}{2}, 2\right)$

82. The point equidistant from the points (0, 0, 0), (1, 0, 0), (0, 2, 0) and (0, 0, 3) is :

(1) (1, 2, 3) (2) $\left(\frac{1}{2}, 1, 3/2\right)$

(3) $\left(-\frac{1}{2}, -1, -3/2\right)$ (4) None of these

83. If $\int f(x)\,dx = g(x)$, then $\int f(x)\,g(x)\,dx$ is equal to :

(1) $\log g(x)$ (2) $\frac{1}{2}(g(x))^2$

(3) $\frac{1}{2}(f(x))^2$ (4) None of these

84. $\int_{-2}^{2}[x]\,dx$ is equal to :

(1) 2

(2) 0

(3) –2

(4) None of these

85. $\lim_{x\to 0}\frac{\sin x - x}{x^3}$ is equal to :

(1) $\frac{1}{6}$ (2) 0

(3) $-\frac{1}{3}$ (4) $-1/6$

86. Every continuous function is :

(1) Increasing

(2) Decreasing

(3) Differentiable

(4) Not differentiable

87. In order that the function $f(x) = (x+1)^{\cot x}$ is continuous at $x = 0, f(0)$ must be defined as :

(1) $f(0) = 0$

(2) $f(0) = 1/e$

(3) $f(0) = e$

(4) None of these

88. Area of the quadrilateral whose vertices are (2, 3), (3, 4), (4, 5), (5, 6) is :

(1) 0

(2) 4

(3) 6

(4) None of these

89. If A and B are symmetric matrices of order $n (A \neq B)$, then :

(1) $A + B$ is a zero matrix

(2) $(A + B)$ is a diagonal matrix

(3) $A + B$ is a skew-symmetric

(4) $A + B$ is symmetric

90. If $A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ a & b & -1 \end{bmatrix}$, then A^2 is equal to :

(1) $-A$

(2) A

(3) Null matrix

(4) Unit matrix

91. $\int_0^1 \frac{\tan^{-1} x}{1+x^2} dx$ is equal to :

(1) $\pi^2/4$

(2) $\pi^2/32$

(3) 1

(4) None of these

92. $\int_0^{\pi} \cos^{101} x \, dx$ is equal to :

(1) $\pi/4$

(2) $1/102$

(3) $(\pi/3)^{101}$

(4) 0

93. $\int_0^{1/2} |\sin \pi x| dx$ is equal to :

(1) 0

(2) π

(3) $-\pi$

(4) $1/\pi$

94. The value of $\int e^x (f(x) + f'(x)) dx$ is :

(1) $e^x f(x) + c$

(2) $e^x + f(x) + c$

(3) $2e^x f(x) + c$

(4) None of these

95. The area of region bounded by curve $x + 2y + 3$, lines $y = 1$, $y = -1$ and y-axis is :

(1) 4 square units

(2) $3/2$ square units

(3) 6 square units

(4) None of these

96. If $\int_0^a \frac{dx}{1+4x^2} = \pi/8$, then value of a is :

(1) $1/2$

(2) $1/4$

(3) $1/8$

(4) None of these

97. The value of $\int_{-\pi}^{\pi} \sin^3 x \cos^2 x \, dx$ is :

(1) $\pi/4$

(2) $\pi/2$

(3) 0

(4) None of these

98. The integrating factor of the differential equation $\frac{dy}{dx} + y = \frac{1+y}{x}$ is :

(1) x/e^x

(2) e^x/x

(3) xe^x

(4) None of these

99. The sum of the order and degree of the differential equation $1+\left(\frac{dy}{dx}\right)^4 = 7\left(\frac{d^2y}{dx^2}\right)^3$ is :

(1) 7

(2) 5

(3) 3

(4) None of these

100. The general solution of the differential equation $\frac{dy}{dx} = e^{x+y}$ is :

(1) $e^{x+y} + c = 0$

(2) $e^x + e^y = c$

(3) $e^x + e^{-y} = c$

(4) None of these

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SET-Z

UG-EE-June, 2024

SUBJECT : Mathematics (4 Year)

10016

Sr. No. .....

Time : **1¼ Hours** Max. Marks : **100** Total Questions : **100**

Roll No. (in figures)_____ (in words) _____

Name _____ Date of Birth_____

Father's Name _____ Mother's Name_____

Date of Examination _____

_____ _____

(Signature of the Candidate) (Signature of the Invigilator)

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2. The candidates ***must return*** the question booklet as well as OMR Answer-Sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfair-means / mis-behaviour will be registered against him / her, in addition to lodging of an FIR with the police. Further the answer-sheet of such a candidate will not be evaluated.
3. Keeping in view the transparency of the examination system, carbonless OMR Sheet is provided to the candidate so that a copy of OMR Sheet may be kept by the candidate.
4. Question Booklet along with answer key of all the A, B, C & D code shall be got uploaded on the University Website immediately after the conduct of Entrance Examination. Candidates may raise valid objection/complaint if any, with regard to discrepancy in the question booklet/answer key within 24 hours of uploading the same on the University Website. The complaint be sent by the students to the Controller of Examinations by hand or through email. Thereafter, no complaint in any case, will be considered.
5. The candidate ***must not*** do any rough work or writing in the OMR Answer-Sheet. Rough work, if any, may be done in the question booklet itself. Answers ***must not*** be ticked in the question booklet.
6. ***There will be no negative marking. Each correct answer will be awarded one full mark. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.***
7. Use only **Black** or **Blue Ball Point Pen** of good quality in the OMR Answer-Sheet.
8. *Before answering the questions, the candidates should ensure that they have been supplied correct and complete booklet. Complaints, if any, regarding misprinting etc. will not be entertained* **30** *minutes after starting of the examination.*

SEAL

1. The centre of sphere passing through four points (0, 0, 0), (0, 2, 0), (1, 0, 0) and (0, 0, 4) is :

(1) $\left(\frac{1}{2}, 1, 2\right)$ (2) $\left(-\frac{1}{2}, 1, 2\right)$

(3) $\left(\frac{1}{2}, 1, -2\right)$ (4) $\left(1, \frac{1}{2}, 2\right)$

2. The point equidistant from the points (0, 0, 0), (1, 0, 0), (0, 2, 0) and (0, 0, 3) is :

(1) (1, 2, 3) (2) $\left(\frac{1}{2}, 1, 3/2\right)$

(3) $\left(-\frac{1}{2}, -1, -3/2\right)$ (4) None of these

3. If $\int f(x)dx = g(x)$, then $\int f(x)g(x)dx$ is equal to :

(1) $\log g(x)$ (2) $\frac{1}{2}(g(x))^2$

(3) $\frac{1}{2}(f(x))^2$ (4) None of these

4. $\int_{-2}^{2}[x]dx$ is equal to :

(1) 2

(2) 0

(3) –2

(4) None of these

5. $\lim_{x\to 0}\frac{\sin x - x}{x^3}$ is equal to :

(1) $\frac{1}{6}$ (2) 0

(3) $-\frac{1}{3}$ (4) $-1/6$

6. Every continuous function is :

(1) Increasing

(2) Decreasing

(3) Differentiable

(4) Not differentiable

7. In order that the function $f(x) = (x+1)^{\cot x}$ is continuous at $x = 0$, $f(0)$ must be defined as :

(1) $f(0) = 0$

(2) $f(0) = 1/e$

(3) $f(0) = e$

(4) None of these

8. Area of the quadrilateral whose vertices are (2, 3), (3, 4), (4, 5), (5, 6) is :

(1) 0

(2) 4

(3) 6

(4) None of these

9. If A and B are symmetric matrices of order n $(A \neq B)$, then :

(1) $A + B$ is a zero matrix

(2) $(A + B)$ is a diagonal matrix

(3) $A + B$ is a skew-symmetric

(4) $A + B$ is symmetric

10. If $A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ a & b & -1 \end{bmatrix}$, then A^2 is equal to :

(1) $-A$

(2) A

(3) Null matrix

(4) Unit matrix

11. $\lim_{x \to 1}[x-1]$, where [.] is a greatest integer function, is equal to :

(1) 1

(2) 2

(3) 0

(4) Does not exist

12. The value of $\lim_{x \to 5} \frac{e^x - e^5}{x-5}$ is equal to :

(1) 5

(2) e

(3) e^5

(4) None of these

13. If $f(x) = 1 - x + x^2 - x^3 + \ldots\ldots\ldots - x^{99} + x^{100}$, then the value of $f'(1)$ is :

(1) 50

(2) 25

(3) 0

(4) None of these

14. The mean deviation of the data 3, 10, 10, 4, 7, 10, 5 from the mean is :

(1) 2

(2) 2.57

(3) 3

(4) None of these

15. The standard deviation for first 10 natural numbers is :

(1) 2.87

(2) 2.97

(3) 3.87

(4) None of these

16. The mean of first n terms of an A.P. whose first term is a and common difference is d.

(1) $a + (n - 1)d$

(2) $a + nd$

(3) $a + (n-1)\frac{d}{2}$

(4) None of these

17. In a leap year the probability of having 53 Sunday or 53 Monday is :

(1) $\frac{2}{7}$

(2) $\frac{3}{7}$

(3) $\frac{4}{7}$

(4) None of these

18. Seven persons are to be seated in a row. The probability that two particular persons sit next to each other is :

(1) $\frac{1}{3}$

(2) $\frac{1}{6}$

(3) $\frac{2}{7}$

(4) None of these

19. A card is drawn at random from a well shuffled pack of 52 cards. The probability of getting a two of heart or a two of diamond is :

(1) $\frac{1}{52}$

(2) $\frac{3}{52}$

(3) $\frac{4}{52}$

(4) $\frac{1}{26}$

20. If R is a relation from a set A to a set B and S is a relation from B to a set C, then the relation SoR :

(1) is from A to C

(2) is from C to A

(3) does not exist

(4) None of these

21. The slope at any point of a curve $y = f(x)$ is given by $\frac{dy}{dx} = 3x^2$ and it passes through $(-1, 1)$. The equation of the curve is :

(1) $x^3 + 2$

(2) $-x^3 - 2$

(3) $3x^3 + 4$

(4) None of these

22. The order of differential equation whose solution is $y = A\cos x + B\sin x + Ce^{-x}$ is :

(1) 1

(2) 2

(3) 3

(4) None of these

23. The probability of having at least one tail in 4 throws with a coin is :

(1) $\frac{1}{16}$

(2) $\frac{15}{16}$

(3) 1

(4) None of these

24. If for any two events A and B, $P(A) = \frac{4}{5}$ and $P(A \cap B) = \frac{7}{10}$, then $P(B/A)$ is equal to :

(1) $\frac{1}{10}$

(2) $\frac{1}{8}$

(3) $\frac{7}{8}$

(4) None of these

25. If three dice are thrown simultaneously, then the probability of getting a score of 5 is :

(1) $1/6$

(2) $1/72$

(3) $5/216$

(4) $1/36$

26. Three vertices out of six of a hexagon are chosen at random. The probability that the triangle is equilateral triangle is :

(1) $1/10$ (2) $2/5$

(3) $3/2$ (4) $4/5$

27. The probability that a man will live 10 more years is $1/4$ and the probability that his wife will live 10 more years is $1/3$. Then the probability that neither will be alive in 10 years is :

(1) $5/12$ (2) $1/2$

(3) $7/12$ (4) $11/12$

28. If $|\vec{a}\times\vec{b}| = |\vec{a}.\vec{b}|$, then the angle between $\vec{a}$ and $\vec{b}$ is :

(1) $\pi/2$ (2) $\pi/4$

(3) $2\pi/3$ (4) None of these

29. Let $\vec{a}$ and $\vec{b}$ be the two unit vectors such that angle between them is 60°, then $|\vec{a}-\vec{b}|$ is equal to :

(1) $\sqrt{5}$ (2) $\sqrt{3}$

(3) 0 (4) 1

30. Which of the following is a true statement ?

(1) $(\vec{a}\times\vec{b})\times\vec{c}$ is coplanar with $\vec{c}$

(2) $(\vec{a}\times\vec{b})\times\vec{c}$ is perpendicular to $\vec{a}$

(3) $(\vec{a}\times\vec{b})\times\vec{c}$ is perpendicular to $\vec{b}$

(4) $(\vec{a}\times\vec{b})\times\vec{c}$ is perpendicular to $\vec{c}$

31. The minimum value of the expression $3^x + 3^{1-x}$, $x \in R$ is given by :

(1) $\geq 2\sqrt{3}$ (2) $\leq 2\sqrt{3}$

(3) $4\sqrt{3}$ (4) None of these

32. If the vertices of a triangle are $(-4, 6)$, $(2, -2)$ and $(2, 5)$, then its centroid is :

(1) $(3, 0)$ (2) $(-3, 0)$

(3) $(0, -3)$ (4) $(0, 3)$

33. The distance between the lines $5x + 3y - 7 = 0$ and $15x + 9y + 14 = 0$ is :

(1) $\frac{35}{\sqrt{34}}$ (2) $\frac{1}{3\sqrt{34}}$

(3) $\frac{35}{3\sqrt{34}}$ (4) None of these

34. If the lines $ax + 2y + 1 = 0$, $bx + 3y + 1 = 0$ and $cx + 4y + 1 = 0$ are concurrent, then relation between a, b, c is given by :

(1) $a + b = c$

(2) $a + c = 2b$

(3) $a + c = b$

(4) None of these

35. The line which cuts off equal intercept from the axes and pass through the point $(1, -2)$ is :

(1) $x + y + 1 = 0$

(2) $x - y + 5 = 0$

(3) $x + 3y = 0$

(4) None of these

36. The equation of circle which touches the y-axis at origin and whose radius is 3 units.

(1) $x^2 + y^2 = 9$

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

(3) $x^2 + y^2 \pm 6x = 0$

(4) None of these

37. If the focus of a parabola is (–2, 1) and the directrix has the equation $x + y = 3$, then its vertex :

(1) (0, 3)

(2) $\left(-1, \frac{1}{2}\right)$

(3) (2, –1)

(4) (–1, 2)

38. Equation of the hyperbola whose vertices are (±3, 0) and foci at (±5, 0) is :

(1) $9x^2 - 16y^2 = 144$

(2) $16x^2 - 9y^2 = 144$

(3) $25x^2 - 9y^2 = 225$

(4) None of these

39. The length of the perpendicular drawn from the point $P(a, b, c)$ on z-axis is :

(1) $\sqrt{a^2 + b^2}$

(2) $\sqrt{b + c^2}$

(3) $\sqrt{a^2 + c^2}$

(4) $\sqrt{a^2 + b^2 + c^2}$

40. A is the foot of the perpendicular drawn from a point $P(3, 4, 5)$ on the xz-plane. The co-ordinates of point A are :

(1) (3, 0, 0)

(2) (0, 4, 5)

(3) (3, 0, 5)

(4) None of these

41. $\int_0^1 \frac{\tan^{-1} x}{1+x^2} dx$ is equal to :

(1) $\pi^2/4$ (2) $\pi^2/32$

(3) 1 (4) None of these

42. $\int_0^{\pi} \cos^{101} x \, dx$ is equal to :

(1) $\pi/4$ (2) $1/102$

(3) $(\pi/3)^{101}$ (4) 0

43. $\int_0^{1/2} |\sin \pi x| dx$ is equal to :

(1) 0 (2) π

(3) $-\pi$ (4) $1/\pi$

44. The value of $\int e^x (f(x) + f'(x)) dx$ is :

(1) $e^x f(x) + c$ (2) $e^x + f(x) + c$

(3) $2e^x f(x) + c$ (4) None of these

45. The area of region bounded by curve $x + 2y + 3$, lines $y = 1$, $y = -1$ and y-axis is :

(1) 4 square units

(2) $3/2$ square units

(3) 6 square units

(4) None of these

46. If $\int_0^a \frac{dx}{1+4x^2} = \pi/8$, then value of a is :

(1) $1/2$ (2) $1/4$

(3) $1/8$ (4) None of these

47. The value of $\int_{-\pi}^{\pi} \sin^3 x \cos^2 x \, dx$ is :

(1) $\pi/4$

(2) $\pi/2$

(3) 0

(4) None of these

48. The integrating factor of the differential equation $\frac{dy}{dx} + y = \frac{1+y}{x}$ is :

(1) x/e^x (2) e^x/x

(3) xe^x (4) None of these

49. The sum of the order and degree of the differential equation $1+\left(\frac{dy}{dx}\right)^4 = 7\left(\frac{d^2y}{dx^2}\right)^3$ is :

(1) 7 (2) 5

(3) 3 (4) None of these

50. The general solution of the differential equation $\frac{dy}{dx} = e^{x+y}$ is :

(1) $e^{x+y} + c = 0$

(2) $e^x + e^y = c$

(3) $e^x + e^{-y} = c$

(4) None of these

51. The volume of the parallelopiped whose edges are represented by the vectors $\hat{i}+\hat{j}$, $\hat{j}+\hat{k}$ and $\hat{i}+\hat{k}$ is :

(1) 2 (2) 0

(3) $\sqrt{2}$ (4) None of these

52. The value of $[\vec{a}-\vec{b}, \vec{b}-\vec{c}, \vec{c}-\vec{a}]$ where $|\vec{a}|=1$, $|\vec{b}|=2$ and $|\vec{c}|=3$ is :

(1) 6 (2) 3

(3) 1 (4) 0

53. The minimum value of $P = 6x + 16y$ subject to constraints $x \leq 40$, $y \geq 20$ and $x, y \geq 0$:

(1) 240

(2) 320

(3) 560

(4) None of these

54. Let $z = px + qy$, where $p, q > 0$ be the objective function. Find the condition on p and q so that the maximum value of z occurs at $B(10, 14)$ and $C(12, 12)$:

(1) $p > q$

(2) $p = q$

(3) $p < q$

(4) None of these

55. Which of the terms is not used in a linear programming problem ?

(1) Slack variables

(2) Objective function

(3) Concave region

(4) Feasible region

56. The maximum value of $P = 8x + 3y$ subject to the constraints $x + y \leq 3$, $4x + y \leq 6$, $x \geq 0, y \geq 0$ is :

(1) 6

(2) 12

(3) 14

(4) None of these

57. The co-ordinates of foot of perpendicular drawn from point (1, 3, 9) on x-axis are :

(1) (1, 0, 0)

(2) (0, 3, 0)

(3) (0, 3, 9)

(4) (0, 0, 9)

58. The points (1, 1, 0), (0, 1, 1), (1, 0, 1) and $\left(\frac{2}{3}, \frac{2}{3}, \frac{2}{3}\right)$ are :

(1) Non-coplanar

(2) Co-planar

(3) The vertices of a parallelogram

(4) None of these

59. The ratio in which the line joining (2, 4, 5), (3, 5, –4) is divided by the yz-plane is :

(1) 2 : 3

(2) 3 : 2

(3) 4 : –3

(4) –2 : 3

60. The direction ratio of a normal to the plane through (1, 0, 0), (0, 1, 0), which makes an angle of $\pi/4$ with the plane $x + y = 3$ are :

(1) $<\sqrt{2}, 1, 1>$

(2) $<1, \sqrt{2}, 1>$

(3) $(1, 1, \sqrt{2})$

(4) $<1, 1, 2>$

61. Set A has 3 elements and set B has 4 elements. The number of injections that can be defined from A to B is :

(1) 144 (2) 12

(3) 24 (4) None of these

62. Let S be a finite set containing n elements, then the total number of binary operation of S is :

(1) n^n (2) 2^n

(3) n^2 (4) None of these

63. The least values of $(\sin^{-1} x)^2 + \cos^{-1} x^2$ is :

(1) $\pi^2/16$ (2) $\pi^2/8$

(3) $\pi^2/4$ (4) None of these

64. If $\tan^{-1} x - \cot^{-1} x = \tan^{-1}\left(\frac{1}{\sqrt{3}}\right)$, the value of x is :

(1) $\frac{1}{\sqrt{3}}$ (2) $\sqrt{3}$

(3) $2\sqrt{3}$ (4) None of these

65. For any 2×2 matrix A, if $A(adj\ A) = \begin{bmatrix} 10 & 0 \\ 0 & 10 \end{bmatrix}$, then $|A|$ is equal to :

(1) 0

(2) 10

(3) 20

(4) None of these

66. The diagonal elements of a skew-hermitian matrix are :

(1) Equal to one

(2) Real

(3) Purely imaginary or zero

(4) None of these

67. Every real symmetric metric is :

(1) Hermitian

(2) Skew-hermitian

(3) Skew-symmetric

(4) None of these

68. A and B be two square matrices and if their inverse exists than $(AB)^{-1}$ is equal to :

(1) $A^{-1}B^{-1}$ (2) AB^{-1}

(3) $A^{-1}B$ (4) $B^{-1}A^{-1}$

69. If the system of equation $x + ay = 0$, $az + y = 0$, $ax + z = 0$ has infinite solutions, than the value of a is :

(1) -1 (2) 1

(3) 0 (4) None of these

70. A and B are square matrices of order 3 each, $|A| = 2$ and $|B| = 3$, the value of $|3AB|$ is :

(1) 18 (2) 54

(3) 108 (4) None of these

71. If $\begin{vmatrix} 2 & 3 & 2 \\ x & x & x \\ 4 & 9 & 1 \end{vmatrix} + 3 = 0$, then the value of x is :

(1) 9

(2) 4

(3) 1

(4) -1

72. If $f(x) = x^2 - 3x + 1$ and $f(2\alpha) = 2f(\alpha)$, then α is equal to :

(1) $\frac{1}{\sqrt{2}}$ (2) $\frac{1}{\sqrt{3}}$

(3) $\frac{1}{\sqrt{5}}$ (4) None of these

73. The range of the function $\sin(\sin^{-1} x + \cos^{-1} x)$, $|x| \leq 1$ is :

(1) $[-1, 1]$

(2) $(-1, 1)$

(3) $\{0\}$

(4) $\{1\}$

74. The domain of the function $f(x) = \cos^{-1}[x]$ is :

(1) $(-1, 2)$ (2) $(-2, 1)$

(3) $[-1, 2)$ (4) $[1, 2]$

75. If $y = \sin^{-1} x$ and $z = \cos^{-1}\sqrt{1-x^2}$, then $\frac{dy}{dz}$ is equal to :

(1) $\frac{1}{\sqrt{1-x^2}}$ (2) $\cos^{-1} x$

(3) 1 (4) None of these

76. Derivative of x^{2x} w.r.t. x is :

(1) x^{2x-1}

(2) $2x^{2x}\log x$

(3) $2x^{2x}(1-\log x)$

(4) $2x^{2x}(1+\log x)$

77. $f(x) = 3x^3 - x^2$, then $f(x)$ is increasing in the interval :

(1) $\left(\frac{1}{3}, \infty\right)$

(2) $\left(-\infty, \frac{1}{3}\right)$

(3) $\left(0, \frac{1}{3}\right)$

(4) None of these

78. If $x + y = 8$, then the maximum value of xy is :

(1) 12

(2) 16

(3) 20

(4) None of these

79. The minimum value of $x + \cos x$ in $[0, \pi)$ is :

(1) π

(2) 1

(3) $\pi/2$

(4) None of these

80. $\int_0^{\pi/2} \cos^6 x\, dx$ is equal to :

(1) $3\pi/32$

(2) $4\pi/32$

(3) $5\pi/32$

(4) None of these

81. Which of the following sets is an empty set ?

(1) The set having zero as its only element

(2) $\{x : x + 3 = 3\}$

(3) $\{y : y^3 = 27, y = 2\}$

(4) None of these

82. If A and B are two disjoint sets, then $n(A \cup B)$ is equal to :

(1) $n(A) + n(B)$

(2) $n(A) + n(B) - n(A \cap B)$

(3) $n(A) + n(B) + n(A \cap B)$

(4) $n(A) \cdot n(B)$

83. If n elements are common to A and B, then number of elements common in $A \times B$ and $B \times A$ is :

(1) n (2) $2n$

(3) n^3 (4) n^2

84. The function $f : R \to R$ is defined by $f(x) = \cos^2 x + \sin^4 x$ then $f(R)$ equals :

(1) $\left[\frac{3}{4}, 1\right)$ (2) $\left(\frac{3}{4}, 1\right]$

(3) $\left[\frac{3}{4}, 1\right]$ (4) $\left(\frac{3}{4}, 1\right)$

85. If $\tan x = \frac{a}{b}$, then $b \cos 2x + a \sin 2x$ is equal to :

(1) a (2) b

(3) $\frac{a}{b}$ (4) $\frac{b}{a}$

86. If x is an acute angle and $\tan x = 1/\sqrt{7}$, then the value of $\frac{\text{cosec}^2 x - \sec^2 x}{\text{cosec}^2 x + \sec^2 x}$ is :

(1) $3/4$ (2) $1/2$

(3) 2 (4) $5/4$

87. The trigonometric function $\cos x$ is increasing in quadrant :

(1) I and II

(2) II and III

(3) III and IV

(4) I and IV

88. The complex number, which when multiplied by $2 + 5i$ gives $3 - 7i$, is :

(1) $-1 + i$ (2) $-1 - i$

(3) $1 - i$ (4) $1 + i$

89. The value of $\sin 30° + \cos 30°$ in polar form :

(1) $\cos \pi/6 + i \sin \pi/6$

(2) $\cos \pi/6 - i \sin \pi/6$

(3) $\cos \pi/3 - i \sin \pi/3$

(4) None of these

90. Solution of the quadratic equation $x^2 - 7ix - 12 = 0$ are :

(1) $3i, 4i$ (2) $-3i, 4i$

(3) $-3i, -4i$ (4) None of these

91. If x and b are real number, $b > 0$ and $|x| > b$, then :

(1) $x \in (-b, \infty)$

(2) $x \in (-\infty, b)$

(3) $x \in (-b, b)$

(4) $x \in (-\infty, -b) \cup (b, \infty)$

92. Which of the points lies in the half-plane $\frac{x}{2}+\frac{y}{3}-1 \geq 0$?

(1) (0, 1)

(2) (1, 5)

(3) (–3, –4)

(4) None of these

93. The number of words which can be formed out of the letters of the word ARTICLE, so that vowels occupy the even place is :

(1) 1440

(2) 144

(3) 7!

(4) None of these

94. If ${}^{n}P_{r} = 840$, ${}^{n}C_{r} = 35$, find the value of r :

(1) 8

(2) 6

(3) 4

(4) None of these

95. In how many ways can 5 boys and 5 girls be seated at a round table, so that no two girls are seated together ?

(1) 2880

(2) 2680

(3) 1860

(4) None of these

96. Find the middle term in the expansion of $\left(\frac{2x^2}{3} + \frac{3}{2x^2}\right)^{10}$:

(1) 252

(2) $250\,x^2$

(3) $248\,x^{-2}$

(4) None of these

97. Find the co-efficient of x^4 in the expansion of $(1 + x + x^2 + x^3)^{11}$:

(1) 890

(2) 990

(3) 690

(4) None of these

98. The first and last term of an A.P. are 1 and 11. If the sum of its terms is 36, then the number of terms will be :

(1) 8 (2) 7

(3) 6 (4) None of these

99. Which term of the sequence $8 - 6i$, $7 - 4i$, $6 - 2i$, ... is purely imaginary ?

(1) 4 (2) 7

(3) 9 (4) None of these

100. The third term of G.P. is 4. The product of its first five term is :

(1) 4^2 (2) 4^3

(3) 4^4 (4) 4^5

Answer keys of B.Sc. (MATHS) 4-Years entrance exam dated 21.06.2024				
Q. NO.	A	B	C	D
1	3	1	1	1
2	1	4	4	2
3	4	2	3	2
4	3	2	2	3
5	2	3	1	4
6	1	3	3	4
7	3	1	4	3
8	2	2	2	1
9	4	4	1	4
10	1	3	3	4
11	4	1	4	4
12	2	3	1	3
13	2	2	4	1
14	3	3	3	2
15	1	4	3	1
16	1	1	4	3
17	2	2	1	2
18	3	2	2	3
19	3	4	2	4
20	4	4	3	1
21	1	1	1	1
22	4	2	4	3
23	3	2	2	2
24	2	3	2	3
25	1	4	3	4
26	3	4	3	1
27	4	3	1	2
28	2	1	2	2
29	1	4	4	4
30	3	4	3	4
31	4	3	1	1
32	3	1	3	4
33	1	4	2	3
34	2	3	3	2
35	1	2	4	1
36	3	1	1	3
37	2	3	2	4
38	3	2	2	2
39	4	4	4	1
40	1	1	4	3
41	3	4	4	2
42	1	1	2	4
43	2	4	2	4
44	2	3	3	1
45	2	3	1	3
46	3	4	1	1
47	1	1	2	3
48	4	2	3	2
49	1	2	3	2
50	4	3	4	3

Answer keys of B.Sc. (MATHS) 4-Years entrance exam dated 21.06.2024				
Q. NO.	A	B	C	D
51	4	2	4	1
52	1	4	3	4
53	4	4	1	2
54	3	1	2	2
55	3	3	1	3
56	4	1	3	3
57	1	3	2	1
58	2	2	3	2
59	2	2	4	4
60	3	3	1	3
61	2	1	3	3
62	4	4	1	1
63	4	3	4	2
64	1	2	3	2
65	3	1	2	2
66	1	3	1	3
67	3	4	3	1
68	2	2	2	4
69	2	1	4	1
70	3	3	1	4
71	1	4	3	4
72	3	2	1	1
73	2	2	2	4
74	3	3	2	3
75	4	1	2	3
76	1	1	3	4
77	2	2	1	1
78	2	3	4	2
79	4	3	1	2
80	4	4	4	3
81	1	3	1	3
82	4	1	2	1
83	2	2	2	4
84	2	2	3	3
85	3	2	4	2
86	3	3	4	1
87	1	1	3	3
88	2	4	1	2
89	4	1	4	4
90	3	4	4	1
91	1	4	2	4
92	2	3	4	2
93	2	1	4	2
94	3	2	1	3
95	4	1	3	1
96	4	3	1	1
97	3	2	3	2
98	1	3	2	3
99	4	4	2	3
100	4	1	3	4