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Test Booklet Series | B

ROLL No. | | | | | |

QN. BOOKLET No. 21617

TEST FOR FIRST DEGREE PROGRAMMES IN ENGINEERING AND TECHNOLOGY

MATHEMATICS

Time: 1 Hour and 30 Minutes

Maximum Marks: 375

INSTRUCTIONS TO CANDIDATES

1. You are provided with a Question Booklet and an Optical Mark Reader (OMR) Answer Sheet to mark your responses. Do not soil your OMR Sheet. Read carefully all the instructions given on the OMR Sheet.
2. Write your Roll Number in the space provided on the top of **this page**.
3. Also write your Roll Number, Test Centre Code, Test Centre Name, Test Subject and the date and time of the examination in the columns provided for the same on the **Answer Sheet**. Darken the appropriate bubbles with HB pencil.
4. Darken the appropriate bubble corresponding to the Test Booklet Series, as given on the top of this page, in the OMR Answer Sheet. **If the corresponding bubble is not darkened, such answer sheets will not be valued and will be summarily rejected.**
5. The paper consists of 125 objective type questions. All questions carry equal marks.
6. Each Question has four alternative responses marked **A, B, C** and **D** and you have to **darken** the bubble fully by **HB pencil** corresponding to the correct response as indicated in the example shown on the Answer Sheet. Also, write the alphabet of your response with ball pen in the starred column against attempted questions and put an '×' mark by ball pen in the starred column against unattempted questions as given in the example in the OMR Sheet.
7. Each correct answer carries **3** marks and each wrong answer carries **1** minus mark.
8. Please do your rough work only on the space provided for it at the end of this question booklet.
9. You should return the Answer Sheet to the Invigilator before you leave the examination hall. However Question Booklet may be retained with the Candidate.
10. Every precaution has been taken to avoid errors in the Question Booklet. In the event of such unforeseen happenings, suitable remedial measures will be taken at the time of evaluation.
11. Please feel comfortable and relaxed. You can do better in this test in a tension-free disposition.

WISH YOU A SUCCESSFUL PERFORMANCE

MATHEMATICS

1. If $100 \equiv x \pmod 7$, then the least positive value of x is

   (A) 1 (B) 3
   (C) 4 (D) 2

2. With respect to multiplication, the set $\{0,1,-1\}$ does not form a group, since it fails to satisfy

   (A) associativity (B) closure
   (C) existence of identity (D) existence of inverse

3. Given a in a group G and $a^3 = a^6 = a^9 = a^{12}$, the order of a is

   (A) 3 (B) 6
   (C) 9 (D) 12

4. If $(G,*)$ is an abelian group, then for $a,b \in G$

   (A) $a^2 * b^2 = (a*b)^2$ (B) $a^2 * b^2 = a^2 + b^2$
   (C) $a^2 * b^2 = (a^2 * b^2)^2$ (D) $a^2 * b^2 = a^2 / b^2$

5. The set of all n^{th} roots of unity with multiplication is

   (A) a monoid (B) a non-abelian group
   (C) a semi group (D) an abelian group

6. Which of the following is not a sub group of $(C,+)$?

   (A) $(R,+)$ (B) $(Q,+)$
   (C) $(Z,+)$ (D) $(N,+)$

7. If 'a' is a generator of a cyclic group, then

   (A) e is also a generator (B) 'a' is the only generator
   (C) a^{-1} is also a generator (D) a^{-1} is not a generator

8. $(H,*)$ is a proper sub group of the group $(G,*)$. If the order of G is 8, then the order H can be

(A) 4
(B) 3
(C) 6
(D) 5

9. For the operation $*$ defined by $a*b=\frac{ab}{2}$, the identity element is

(A) 0
(B) 1
(C) 2
(D) 4

10. If G is a group of even order which has the identity element e, then G has another element a such that

(A) $a^2=e$
(B) $a^3=e$
(C) $a^{0(G)}=a$
(D) no power of $a=e$

11. $\{[1],[3],[5],[7]\}$ under multiplication modulo 8 forms

(A) a cyclic group
(B) a monoid
(C) an abelian group
(D) the Klein four group

12. If $\phi=\begin{pmatrix}1 & 2 & 3 & 4\\ 4 & 1 & 2 & 3\end{pmatrix}$, then ϕ^{-1} is equal to

(A) $\begin{pmatrix}1 & 2 & 3 & 4\\ 1 & 4 & 3 & 2\end{pmatrix}$
(B) $\begin{pmatrix}1 & 2 & 3 & 4\\ 2 & 3 & 4 & 1\end{pmatrix}$
(C) $\begin{pmatrix}1 & 2 & 3 & 4\\ 3 & 4 & 1 & 2\end{pmatrix}$
(D) $\begin{pmatrix}1 & 2 & 3 & 4\\ 4 & 1 & 2 & 3\end{pmatrix}$

13. $y=ae^x+be^{-x}$ is a solution of the differential equation

(A) $y''+y=0$
(B) $y''+y'+y=0$
(C) $y''-y=0$
(D) $y''-aby=0$

14. If $f(x,y)=0$ is the solution of the differential equation $xdx+ydy=0$ such that $y=1$, when $x=1$, then the curve $f(x,y)=0$

(A) passes through the point $(1,-1)$
(B) passes through the origin
(C) touches the line $y=x$
(D) touches the coordinate axes

15. Solution of $\left(x^2-ay\right)dx=\left(ax-y^2\right)dy$ is

(A) $x^3-2axy+\frac{y^3}{3}=c$ (B) $x^3+y^3=axy+c$
(C) $x^3+y^3=3axy+c$ (D) $x^3-y^3=3axy+c$

16. The integrating factor of $\frac{dy}{dx}-\frac{y}{(x\log x)}=\frac{\sin 2x}{\log x}$ is

(A) $\log x$ (B) x
(C) $\frac{1}{x}$ (D) $\frac{1}{x\log x}$

17. The curve $9y^2a=x(x-3a)^2$ is symmetrical about

(A) $x-$axis only (B) $y-$axis only
(C) both x and $y-$axes (D) neither $x-$axis nor $y-$axis

18. The equation of the plane passing through the point $(1,-2,3),(3,1,2)$ and $(2,3,-1)$ is

(A) $-19x-y+3z+28=0$ (B) $x-y-z=0$
(C) $x+y-z=0$ (D) $19x-y-3z+28=0$

19. Geometrically, $3x+2y=4$ and $x+5y=2$ taken together represent

(A) finite number of points (B) only one point
(C) two lines (D) infinite number of points

20. Which of the following is not true?

(A) $\log\left(x+\sqrt{x^2+1}\right)$ is an odd function

(B) $\log\left(x+\sqrt{x^2-1}\right)=-\log\left(x-\sqrt{x^2-1}\right)$

(C) $\log\left(x+\sqrt{x^2+1}\right)=\log\left(-x+\sqrt{x^2+1}\right)$

(D) $\dfrac{a^x+a^{-x}}{a^x-a^{-x}}$ is an odd function

21. Let $f(x)=\sqrt[5]{3-x^5}, x>0$. Then

(A) $f^{-1}(x)=f(x)$
(B) $f^{-1}(x)=\dfrac{1}{f(x)}$
(C) $f(x)=(f\circ f)(x)$
(D) $f^{-1}(x)=f(-x)$

22. If α and β are roots of the equation $x^2+x+1=0$, then the equation whose roots are α^{143}, β^{29} is

(A) $x^2+x-1=0$
(B) $x^2+x+1=0$
(C) $x^2-x-1=0$
(D) $x^2-x+1=0$

23. The curve represented by $|z|=\text{Im}(z)+4$ (here $\text{Im}(z)$ denotes the imaginary part of the complex number z) is

(A) a parabola
(B) an ellipse
(C) a circle
(D) a straight line

24. The number of positive integral solutions (x,y) of the equation $x^2-y^2=1998$ is

(A) one
(B) two
(C) infinitely many
(D) zero

25. A plot of land is in the shape of a trapezium *ABCD*. Let *E* be a point on *CD* such that *BE* is perpendicular to *CD*. If *AB*=10 *cm*, *AD*=13 *cm*, *BE*=12 *cm* and *CD*=24 *cm* then the perimeter of the trapezium *ABCD* is

(A) 42 *cm* (B) 52 *cm*
(C) 62 *cm* (D) 72 *cm*

26. If a wall of height b meters casts a shadow of length f meters, then at the same time of the day a tree of height 20 meters casts a shadow of length

(A) $\frac{20f}{b}$ meters (B) $\frac{f}{20b}$ meters
(C) $\frac{20b}{f}$ meters (D) $\frac{b}{20f}$ meters

27. If x, y and z are consecutive negative integers and if $x > y > z$, then which of the following must be a positive odd integer?

(A) xyz (B) $x - yz$
(C) $x + y + z$ (D) $(x - y)(y - z)$

28. Let $ABCD$ be a square with $A = (-3,0)$ and $B = (0,6)$. The length of the diagonal AC is

(A) $3\sqrt{5}$ (B) $3\sqrt{10}$
(C) $6\sqrt{5}$ (D) $6\sqrt{10}$

29. If the sides of a triangle are 9, 12 and 15, then the length of the largest altitude is

(A) 9 (B) 12
(C) 15 (D) $6\sqrt{5}$

30. A die is thrown. Let A be the event that the number obtained is greater than 2 and B be the event that the number obtained is less than 5. Then the conditional probability of A given B is

(A) $\frac{1}{2}$ (B) $\frac{1}{3}$
(C) $\frac{2}{3}$ (D) 1

31. The equation of a chord of the circle $x^2+y^2=16$ whose mid point is $(-3,4)$ is

(A) $3x-4y-25=0$ (B) $3x+4y+25=0$
(C) $3x+4y-25=0$ (D) $3x-4y+25=0$

32. If the line $y=3x+2$ meets the circle $x^2+y^2=4$ at A and B, then the centre of the circle having AB as its diameter is

(A) $\left(-\frac{3}{2},\frac{1}{2}\right)$ (B) $\left(\frac{3}{2},\frac{1}{2}\right)$
(C) $\left(-\frac{3}{5},\frac{1}{5}\right)$ (D) $\left(\frac{3}{5},\frac{1}{5}\right)$

33. If the sum of second and eighth term of an A.P is 12, then the sum of first nine terms of this A.P is

(A) 48 (B) 52
(C) 54 (D) 56

34. If p and q are roots of the equation $x^2+bx+c=0$, then the equation whose roots are $p+q-pq$ and $pq+p+q$ is

(A) $x^2+2bx+b^2-c^2=0$ (B) $x^2+2cx-b^2+c^2=0$
(C) $x^2-2bx+b^2-c^2=0$ (D) $x^2-2cx-b^2+c^2=0$

35. The equation $|x-1|+|x+5|=4$ has

(A) no solution (B) one solution
(C) two solutions (D) many solutions

36. In the sequence 1,2,3,…,9750, the number of square numbers is

(A) 99 (B) 100
(C) 97 (D) 98

37. If two circles of radii 13 *cm* and 15 *cm* intersect each other and the length of the common chord is 24 *cm*, then the distance between their centres is

(A) $13cm$ (B) $13\sqrt{2}cm$
(C) $14\sqrt{2}cm$ (D) $14cm$

38. Let X and Y be two random variables with standard deviations 5, 7 respectively. If the correlation co-efficient between X and Y is 11, then the correlation coefficient between X and $X+Y$ is

(A) $\frac{4}{3\sqrt{5}}$ (B) $\frac{8}{5\sqrt{6}}$
(C) $\frac{9}{5\sqrt{6}}$ (D) $\frac{9}{6\sqrt{5}}$

39. If $\lim_{x\to 0}(1+3x)^{b/x}=e^6$, where b is a positive integer, then the value of b is

(A) 3 (B) 2
(C) 6 (D) 4

40. If a and b are two positive integers such that $a^2-b^2=7$, then the value of ab is

(A) 49 (B) 21
(C) 12 (D) 14

41. If $y=1+\frac{1+3}{2!}x+\frac{1+3+5}{3!}x^2+\ldots$, then

(A) $y=(x+2)e^x$ (B) $\int_0^1 4y\,dx=e^2$
(C) $\frac{dy}{dx}=(x+4)e^x$ (D) $y=(x+1)e^x$

42. If $f:\mathbb{R}\to\mathbb{R}$ is defined by $f(x)=x^2+2$, then the sets $f^{-1}(27)$ and $f^{-1}(3)$ are

(A) $\{5,-5\};\{1,-1\}$
(B) $\{\sqrt{5},-\sqrt{5}\};\{1,-1\}$
(C) $\{2,-2\};\{i,-i\}$
(D) $\{\sqrt{2},-\sqrt{2}\};\{i,-i\}$

43. Let $f,g:\mathbb{R}\to\mathbb{R}$ be defined by $f(x)=\frac{1}{\sqrt{|x|-x}}$, and $g(x)=\frac{1}{\sqrt{x-|x|}}$ then

(A) $dom\ f = dom\ g$
(B) $dom\ f=\phi,\ dom\ g\neq\phi$
(C) $dom\ f\neq\phi,\ dom\ g\neq\phi$
(D) $dom\ f\neq\phi,\ dom\ g=\phi$

44. The function $f(x)=\log\left[\frac{1+x}{1-x}\right]$ satisfies the equation

(A) $f(x+2)-2f(x+1)+f(x)=0$
(B) $f(x)+f(x+1)=f(x(x+1))$
(C) $f(x_1)f(x_2)=f(x_1+x_2)$
(D) $f(x_1)+f(x_2)=f\left(\frac{x_1+x_2}{1+x_1x_2}\right)$

45. The function $\cos x$ defined from $[0,\pi]$ into $(-\infty,\infty)$

(A) one to one and onto
(B) one to one but not onto
(C) onto but not one to one
(D) neither one to one nor onto

46. If the infinite sum of the G.P. given by $p,1,\frac{1}{p},\frac{1}{p^2},\ldots$ is 4, then the value of p is

(A) 1
(B) −1
(C) 2
(D) −2

47. The sum of the series $\log_4 2-\log_8 2+\log_{16} 2-\ldots$ is

(A) $1+\log 2$
(B) $\log 2-1$
(C) $1-\log 2$
(D) $e^{\log 2}$

48. If $0 \le x \le 1$ and $f(x) = \begin{vmatrix} x & 1 & 1 \\ -1 & x & 0 \\ 0 & -1 & x \end{vmatrix}$, then the least and the greatest value of $f(x)$ are

(A) 0, 1
(B) 1, 2
(C) 1, 3
(D) 1, 4

49. If $A = \begin{pmatrix} 1 & 10^3 \\ 0 & 1 \end{pmatrix}$, then A^{10} is

(A) $\begin{pmatrix} 1 & (10^3)^{10} \\ 0 & 1 \end{pmatrix}$
(B) $\begin{pmatrix} 1 & 3(10^{10}) \\ 0 & 1 \end{pmatrix}$
(C) $\begin{pmatrix} 1 & 10^4 \\ 0 & 1 \end{pmatrix}$
(D) $\begin{pmatrix} 1 & 10^{10} \\ 0 & 1 \end{pmatrix}$

50. If $f(x)$ satisfies the relation $f(x+y) = f(x) + f(y) \forall x, y \in \mathbb{R}$ and $f(1) = 10$, then the value of $\sum_{i=1}^{n} f(i)$ is

(A) $5n(n+1)$
(B) $7n(n+1)$
(C) $11n(n+1)$
(D) $13n(n+1)$

51. The angle between the minute hand of a clock and hour hand when the time is 7.20 A.M. is

(A) 180°
(B) 100°
(C) 80°
(D) 110°

52. In a triangle ABC, if $a \cos A = b \cos B$, then the triangle ABC is

(A) equilateral
(B) right angled but not isosceles
(C) obtuse angle triangle but not isosceles
(D) isosceles

53. $1+i^2+i^4+i^6+...+i^{20}$ is equal to

(A) -1
(B) 0
(C) 1
(D) i

54. The 9^{th} term in the expansion of $\left(\frac{x}{a}-\frac{3a}{x^2}\right)^{12}$ is

(A) $\binom{12}{9}x^{-12}a^4 3^8$
(B) $\binom{12}{4}x^{-12}a^4 3^8$
(C) $\binom{12}{9}x^{-12}a^9 3^8$
(D) $\binom{12}{4}x^{-4}a^{-12} 3^8$

55. Slope of the line determined by the points $P(4,6)$ and $Q(2,12)$ is

(A) -2
(B) 2
(C) 3
(D) -3

56. $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ is the equation of

(A) hyperbola
(B) circle
(C) straight line
(D) None of these

57. Equation of the circle when the co-ordinate of the end points of a diameter are $(3,4)$ and $(-3,-4)$ is

(A) $2x^2+y^2=25$
(B) $x^2-y^2=25$
(C) $x^2+y^2=25$
(D) $x^2+2y^2=25$

58. Solutions x and y of the equations $x^2+y^2=34$, $x^4-y^4=544$ are respectively

(A) $\pm4, \pm3$
(B) $\pm5, \pm3$
(C) $\pm3, \pm5$
(D) $\pm3, \pm4$

59. A city has a population of 3,00,000 out of which 1,80,000 are males. 50 per cent of the population is illiterate. If 70 percent of the males are literate, the number of literate females is

(A) 24,000 (B) 30,000
(C) 54,000 (D) 60,000

60. If $x+2y=2x+y$, then $\frac{x^2}{y^2}$ is equal to

(A) 0 (B) 1
(C) 2 (D) 4

61. The smallest number which when added to 37825 will make it divisible by 13 is

(A) 2 (B) 3
(C) 4 (D) 5

62. If the roots of the equation $x^2-kx+k=0$ are a and b, then the real value of k for which a^2+b^2 is minimum is

(A) 1 (B) 2
(C) 0 (D) 3

63. The number of real solutions of $\cos x = x$ is

(A) 0 (B) 1
(C) 2 (D) ∞

64. The value of $\int_{-a}^{a}\sqrt{1-\frac{x^2}{a^2}}\,dx$ is

(A) $\frac{\pi a}{2}$ (B) πa
(C) $2\pi a$ (D) πa^2

65. The average age of a class is 13 years. If the average age of the taller one-third of the class is 14, then the average age of the rest of the class is

(A) cannot be found from the available data
(B) 13½ years
(C) 12½ years
(D) 12⅓ years

66. $\left(1-\frac{1}{4}\right)\left(1-\frac{1}{5}\right)\left(1-\frac{1}{6}\right)\ldots\left(1-\frac{1}{n+3}\right)$ is equal to

(A) $\frac{n+1}{n+3}$
(B) $\frac{3}{n+3}$
(C) $\frac{n-1}{n+3}$
(D) None of these

67. If $\sin^{-1}x-\cos^{-1}x=\frac{\pi}{6}$, then x is equal to

(A) $\frac{1}{2}$
(B) $\frac{\sqrt{3}}{2}$
(C) $-\frac{1}{2}$
(D) None of these

68. If $f(x)=|\log_{10}x|$, then at $x=1$

(A) $f(x)$ is continuous and $f'(1^+)=\log_{10}e$
(B) $f(x)$ is continuous and $f'(1^+)=-\log_{10}e$
(C) $f(x)$ is continuous and $f'(1^-)=\log_{10}e$
(D) $f(x)$ is continuous and $f'(1^-)=-\log_{10}e$

69. If $y=\log\left(\frac{1-x^2}{1+x^2}\right)$, then $\frac{dy}{dx}$ is equal to

(A) $\frac{4x^3}{1-x^4}$
(B) $-\frac{4x}{1-x^4}$
(C) $\frac{1}{4-x^4}$
(D) $-\frac{4x^3}{1-x^4}$

70. The distance moved by the particle in time t is given by $x = t^3 - 12t^2 + 6t + 8$. At the instant, when its acceleration is zero, the velocity is

(A) 42 (B) −42
(C) 48 (D) −48

71. In a sphere, the rate of change of volume is

(A) π times the rate of change of radius
(B) surface area times the rate of change of diameter
(C) surface area times the rate of change of radius
(D) None of these

72. If n^{th} term of the sequence 72, 70, 68, 66, ... is 40, then n is

(A) 15 (B) 16
(C) 17 (D) 18

73. If $\frac{2}{3}, k, \frac{5}{8}$ are in A.P., then the value of k will be

(A) $\frac{48}{31}$ (B) $\frac{31}{48}$
(C) $\frac{31}{24}$ (D) $\frac{24}{31}$

74. The locus of the mid point of the portion intercepted between the axes by the line $x\cos\alpha + y\sin\alpha = p$, where p is constant is

(A) $x^2 + y^2 = 4p^2$ (B) $\frac{1}{x^2} + \frac{1}{y^2} = \frac{4}{p^2}$
(C) $x^2 + y^2 = \frac{4}{p^2}$ (D) $\frac{1}{x^2} + \frac{1}{y^2} = \frac{2}{p^2}$

75. The points (1, 1), (−1, −1) and $\left(-\sqrt{3}, \sqrt{3}\right)$ are the vertices of a triangle, then the triangle is

(A) right angled (B) isosceles
(C) equilateral (D) None of these

76. If $\mathbf{a} = (1,0,-1)$ and $\mathbf{c} = (0,1,0)$ are given vectors, then a vector $\mathbf{b}$ that satisfies $\mathbf{a} \times \mathbf{b} + \mathbf{c} = (1,1,1)$ and $\mathbf{a} \cdot \mathbf{b} = 4$ is

(A) (2,2,−1) (B) (2,1,2)
(C) (−1,2,1) (D) (2,1,−2)

77. Let the function $f(x) = \lim_{n\to\infty} n\left(x^{\frac{1}{n}} - 1\right),\ x > 0$. Suppose f satisfies $f\left(\frac{1}{x}\right) = kf(x)$, then k is

(A) 1 (B) −1
(C) 2 (D) −2

78. If $y = \tan^{-1}\frac{\sqrt{1+x^2}-1}{x}$, then $y'(0)$ is $\left(\text{where } \frac{dy}{dx} = y'\right)$

(A) 1 (B) 2
(C) $\frac{1}{2}$ (D) 12

79. The degree and the order of the differential equation of all parabolas, whose axes are x − axis, are respectively.

(A) 1,2 (B) 2,1
(C) 1,1 (D) 2,2

80. The differential equation, for which $xy = ae^{x} + be^{-x} + x^2$ is a solution, is

(A) $xy'' + 2y' - xy + x^2 = 2$ (B) $xy'' + 2y' - xy + x^2 = -2$
(C) $xy'' + 2y' + xy + x^2 = 2$ (D) $xy'' + 2y' + xy + x^2 = -2$

81. The orthogonal trajectories of the family of curves $y = cx^2$ are given by

(A) $2y^2 + x^2 = \text{constant}$ (B) $2y^2 - x^2 = \text{constant}$
(C) $y^2 + x^2 = \text{constant}$ (D) $y^2 - x^2 = \text{constant}$

82. $\int_0^{\frac{\pi}{2}} \frac{\sin x}{x} dx$ is less than

(A) $\frac{\pi}{2}$ (B) $\frac{\pi}{4}$

(C) $\frac{\pi}{6}$ (D) $\frac{\pi}{8}$

83. If $x_r = \cos\left(\frac{\pi}{2^r}\right) + i\sin\left(\frac{\pi}{2^r}\right)$, then $x_1 x_2 x_3 \ldots$ upto ∞ is

(A) -3 (B) -2

(C) -1 (D) 1

84. The value of the expression $1 - \frac{\sin^2 y}{1+\cos y} + \frac{1+\cos y}{\sin y} - \frac{\sin y}{1-\cos y}$ is

(A) 0 (B) 1

(C) $\sin y$ (D) $\cos y$

85. The remainder when 2^{2003} is divided by 17 is

(A) 4 (B) -8

(C) 8 (D) 16

86. $6\sin\theta + 7\cos\theta = 9$ if

(A) $\tan\theta = \frac{3}{4}$ (B) $\tan\theta = \frac{8}{15}$

(C) $\tan\theta = \frac{7}{8}$ (D) $\tan\theta = \frac{13}{4}$

87. If x, y, z are distinct and $\begin{vmatrix} x^k & x^{k+2} & x^{k+3} \\ y^k & y^{k+2} & y^{k+3} \\ z^k & z^{k+2} & z^{k+3} \end{vmatrix} = (x-y)(y-z)(z-x)\left(\frac{1}{x}+\frac{1}{y}+\frac{1}{z}\right)$, then

(A) $k=-3$ (B) $k=-1$

(C) $k=1$ (D) $k=3$

88. Let $ABCD$ be a square in which A lies on the positive $y-$axis and B lies on the positive $x-$axis. If D is the point (12, 17), then the co-ordinates of C are

(A) (17, 12) (B) (17, 5)
(C) (14, 16) (D) (15, 3)

89. The function $f(x) = x|x| (x - \text{real})$ is such that

(A) $f'(0) = 0$ (B) $f'(0) = 1$
(C) $f'(0) = -1$ (D) $f'(0)$ does not exist

90. The graph of the function $y = |x|$ in the (x, y) plane is

(A) V shaped (B) U shaped
(C) a line (D) a circle

91. The three complex numbers 0, 1, i form the vertices of a

(A) right angled isosceles triangle
(B) equilateral triangle
(C) a triangle with angles 30°, 60°, 90°
(D) a triangle which is neither equilateral nor right angled

92. If $i^2 = -1$, then the series $\sum_{n=0}^{\infty} i^n$

(A) converges to 0 (B) converges to 1
(C) converges to i (D) does not converge

93. The function $y = |x|^2$ defined on the whole of real axis is differentiable

(A) except at 0 (B) except at ± 1
(C) at all points (D) at no point

94. If f and g are two functions defined on the real axis with $f'(x) = g'(x)$ for all x, then

(A) $f(x) = g(x)$ (B) $f(x) = g(x) + c$ (c, a constant)
(C) $f(x) = g^2(x)$ (D) $f^2(x) = g(x)$

95. A line and a circle meet

(A) atmost at two points
(B) exactly at two points
(C) exactly at one point
(D) at no point

96. The inverse of the function $f(x) = \log_5\left(-x + \sqrt{x^2+1}\right)$ is

(A) $\frac{5^{-x} - 5^x}{2}$
(B) $\frac{5^x - 5^{-x}}{2}$
(C) $\frac{5^{-x} + 5^x}{2}$
(D) 5^x

97. $\int_0^4 f(x)\,dx$ is equal to

(A) $4\int_0^4 f(x-4)\,dx$
(B) $\int_0^4 f(4-x)\,dx$
(C) $\int_0^4 f(x-4)\,dx$
(D) $4\int_0^4 f(4-x)\,dx$

98. The set of all points where $f(x) = \sqrt{1 - e^{-x^2}}$ is differentiable is

(A) $(0, \infty)$
(B) $(-\infty, \infty)$
(C) $(-\infty, \infty)\setminus\{0\}$
(D) $(-1, \infty)$

99. Let z be a root of $x^5 - 1 = 0$ with $z \neq 1$. The value of $z^{15} + z^{16} + \ldots + z^{50}$ is

(A) 0
(B) 1
(C) −1
(D) 2

100. Which of the following is true?

(A) $(17)^{20} > (63)^{12}$
(B) $(17)^{20} < (63)^{12}$
(C) $(17)^{20} = (63)^{12}$
(D) $(17)^{20} = 2(63)^{12}$

101. The points $(-a,-b),(0,0),(a,b)$ and (a^2,ab) are

(A) collinear
(B) vertices of a rectangle
(C) vertices of a parallelogram
(D) None of these

102. The eccentricity of the ellipse $16x^2+7y^2=112$ is

(A) $\frac{4}{3}$
(B) $\frac{7}{16}$
(C) $\frac{3}{\sqrt{7}}$
(D) $\frac{3}{4}$

103. $\lim_{x\to 0}\frac{1-\cos 2x}{x^2}$ is equal to

(A) 0
(B) 1
(C) 2
(D) 3

104. If $\lim_{x\to 0}\frac{x^9-a^9}{x-a}=9$, then value of a will be

(A) 1
(B) -1
(C) 0
(D) ±1

105. The vector $\cos\alpha\,\cos\beta\hat{i}+\cos\alpha\,\sin\beta\hat{j}+\sin\alpha\hat{k}$ is a

(A) null vector
(B) unit vector
(C) constant vector
(D) None of these

106. The smallest set A such that $A\cup[1,2]=[1,2,3,5,9]$ is

(A) $[1]$
(B) $[1,2,3]$
(C) $[3,5,9]$
(D) $[5,9]$

107. The displacement of a particle travelling in a straight line is given by $s=5\sin 2t$. The displacement, when the velocity becomes zero, is

(A) 0
(B) $\frac{5}{2}$
(C) 5
(D) 10

108. The curve $y = \tan x$ intersects the $x-$axis at the origin at an angle of

(A) 0
(B) $\frac{\pi}{6}$
(C) $\frac{\pi}{4}$
(D) $\frac{\pi}{3}$

109. The equation of the tangent to the curve $x = \frac{t-1}{t+1}$, $y = \frac{t+1}{t-1}$ at $t = 2$ is

(A) $9x - y = -6$
(B) $9y - x = 6$
(C) $9x + y = -6$
(D) $9y + x = 6$

110. The curves $y^2 = x$ and $x^2 = 4y$ intersect each other at

(A) only one point
(B) two points
(C) three points
(D) four points

111. $\lim_{x \to 0} (\cos x)^{\cot^2 x}$

(A) $\frac{1}{\sqrt{2}}$
(B) $\frac{1}{\sqrt{e}}$
(C) 1
(D) $-\frac{1}{2}$

112. Given $f(x, y) = \frac{x(x^3 - y^3)}{x^3 + y^3}$, $xf_x + yf_y$ is

(A) 0
(B) f
(C) $2f$
(D) $3f$

113. It ω is a complex cube root of unity, then the value of $(2 + 2\omega + 5\omega^2)^3$ is

(A) -1
(B) 3
(C) 5
(D) 27

114. $Arg(1+i)^2$ is

(A) $\frac{\pi}{4}$ (B) $\frac{\pi}{2}$

(C) $\left(\frac{\pi}{4}\right)^2$ (D) $\left(\frac{\pi}{2}\right)^2$

115. If a complex number is multiplied by (−1), its argument

(A) gets decreased by 90° (B) gets divided by 90°

(C) gets increased by 90° (D) gets multiplied by 90°

116. Three consecutive vertices of a parallelogram are representing the complex numbers −1, 3+*i*, 2+2*i*. The fourth vertex is representing the number

(A) 2+*i* (B) −2+*i*

(C) 1−2*i* (D) 1+2*i*

117. Distance between the two complex numbers $(2+2i)$ and $(3+i)$ is

(A) $\sqrt{2}$ (B) 2

(C) 1 (D) $4\sqrt{2}$

118. If z is a complex number such that $\text{Re}\frac{(\bar{z})-3}{z-i}=1$, then the locus of z is

(A) $x^2-y^2-3x+y=0$ (B) $2y^2+3x-3y+1=0$

(C) $3x-3y+1=0$ (D) $2y^2-3x-y+1=0$

119. The least value of n, for which $\left[(1+i)/(1-i)\right]^n=1$, is

(A) 1 (B) 2

(C) 4 (D) 6

120. If $1-i,\ 2+i,\ -1+\lambda i$ are collinear, then λ is equal to

(A) −5 (B) −1

(C) 1 (D) 2

121. Given $\vec{A}, \vec{B}, \vec{C}$ are three non-zero, non coplanar vectors and m, n, p are three scalars such that $m\vec{A} + n\vec{B} + p\vec{C} = 0$, then

(A) $m = n = p = 0$ (B) $m + n + p = 0$

(C) $\frac{m}{n} = \frac{n}{p}$ (D) $m + p = 2n$

122. The vectors $\vec{a} + \vec{b} + \vec{c}$, $\vec{a} - 2\vec{b} - \vec{c}$ and $-2\vec{a} + \vec{b} + x\vec{c}$ are the sides of a triangle. The value of x is

(A) -1 (B) 0

(C) 1 (D) 2

123. If $\vec{i} + 2\vec{j} + 3\vec{k}$, $2\vec{i} + 3\vec{j} + \vec{k}$, $3\vec{i} + \vec{j} + 2\vec{k}$ are the position vectors of the vertices of a triangle, then its centroid is

(A) $\vec{i} + \vec{j} + \vec{k}$ (B) $2(\vec{i} + \vec{j} + \vec{k})$

(C) $3(\vec{i} + \vec{j} + \vec{k})$ (D) $6(\vec{i} + \vec{j} + \vec{k})$

124. The angle between the vectors $8\vec{i} + 7\vec{j} - \vec{k}$ and $3\vec{i} - 3\vec{j} + 3\vec{k}$ is

(A) 0° (B) 30°

(C) 60° (D) 90°

125. If a semi group has the following properties, then it can be called a group

(A) having identity
(B) having inverse for every element
(C) having identity and inverse for each element
(D) commutative

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