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Test Booklet Series C

ROLL No. 1 5 6 1 2

QN. BOOKLET No. 07494

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 bubbles are 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. Write the alphabet of your response with Ball Pen in the starred column and for unattempted question put a 'X' mark by ball pen in the starred column as given in the example in the OMR.

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 tension-free disposition.

SEAL

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MATHEMATICS

1. Locus of p which moves in such a way that its distance from fixed points A and B adds upto the length AB is

   (A) a parabola
   (B) a hyperbola
   (C) a circle
   (D) the line segment between A and B

2. The diagonal of a square is increasing at the rate of $2cm/sec$. The rate of increase of the area when the diagonal is $8cm$ is

   (A) $8cm^2/sec$
   (B) $32cm^2/sec$
   (C) $16cm^2/sec$
   (D) $30cm^2/sec$

3. In a group G if $a^2 * b^2 = (a*b)^2$ for all $a,b \in G$ then which of the following is true?

   (A) G is abelian
   (B) G is cyclic
   (C) G is infinite
   (D) every element of G is its own inverse

4. $\lim_{x\to 0} x\sin(1/x) =$

   (A) ∞
   (B) 0
   (C) indeterminate
   (D) 1

5. The orthogonal trajectories of the family of all curves $xy = k^2$ is the set of

   (A) rectangular hyperbolas
   (B) ellipses
   (C) parabolas
   (D) circles with centre on x-axis

6. If one base angle of a triangle is three times the angle at vertex and 3/2 times the angle at the other base then the sides of the triangle are in the ratio

   (A) $1:2:\sqrt{3}$
   (B) $1:\sqrt{2}:3$
   (C) $1:\sqrt{2}:\sqrt{3}$
   (D) $2:\sqrt{3}:4$

7. The particular solution of $\log\left(\frac{dy}{dx}\right) = 5x - 3y$ with $y(0) = 0$ is

   (A) $5e^{5y} + 3e^{5x} = 20$
   (B) $5e^{3y} + 3e^{5x} = 4$
   (C) $5e^{3y} - 3e^{5x} = 2$
   (D) $3e^{3y} - 5e^{5x} = 21$

8. If $y = e^{-2x} + 3e^{x}$ satisfies the relation $y'' + Ay' + By = 0$ then A and B are respectively

(A) $-3, -1$ (B) $-2, 5$
(C) $1, -6$ (D) $1, -2$

9. The degree and the order of the differential equation satisfied by the curve $\sqrt{1+x} + a\sqrt{1+y} = 5$ are

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

10. Suppose $f'(x)$ exists for each real x and $h(x) = f(x) - (f(x))^2 + (f(x))^3$ for every real x. Then

(A) h always increasing independent of f
(B) h is increasing whenever f is decreasing
(C) h is decreasing whenever f is increasing
(D) h is increasing whenever f is increasing

11. The area of the triangle formed by the positive x-axis and the normal and tangent to the circle $x^2 + y^2 = 4$ at $(1, \sqrt{3})$ is

(A) $\frac{5\sqrt{3}}{2}$ (B) $2\sqrt{3}$
(C) $\frac{3\sqrt{3}}{2}$ (D) $\frac{\sqrt{3}}{2}$

12. If a.b=b.c=c.a=0, then $[a, b, c]$ is equal to

(A) 0 (B) 1
(C) -1 (D) $|a||b||c|$

13. Given $a = 2i + j - 4k$, $b = -2i + 2j + 4k$ and $c = 2j - 4k$. The vector perpendicular to both a+b and b+c is

(A) i (B) j
(C) k (D) $i + j + k$

14. The value of $|a \times i|^2 + |a \times j|^2 + |a \times k|^2$ if $|a| = 4$ is

(A) 42 (B) 32
(C) 22 (D) 12

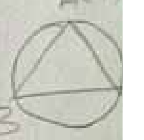
15. Let $x.a = x.b = x.c = 0$ for some non zero vector x. If $|a| = |b| = |c| = 1$. Then the volume of the parallelopiped formed by a, b, c is

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

16. The portion of a straight line intercepted between the axes is bisected at the points (–3, 2). Then the equation of the straight line is

(A) $x - y + 12 = 0$
(B) $x + y - 12 = 0$
(C) $2x + 3y - 12 = 0$
(D) $2x - 3y + 12 = 0$

17. Let A, B, C form an inscribed equilateral triangle in the circle $x^2 + y^2 = 1$ with A=(1,0). The equation of BC is



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

18 The circles $x^2 + y^2 - 2x + 6y + 6 = 0$ and $x^2 + y^2 - 5x + 6y + 15 = 0$

$g_1 = 1, f_1 = -3$
$g_2 = 5/2, f_2 = 3$

(A) touch each other internally
(B) touch each other externally
(C) are intersecting circles at two points
(D) concentric circles

19. A circle is given by $x^2 + y^2 + 4x - 7y + 2 = 0$. Then the points (0,0) and (−2,1) are such that

$4 + 1 - 8 - 7 + 2$
-8

(A) both lie inside the circle
(B) both lie outside the circle
(C) one lies inside and other outside
(D) one lies on the circle and the other inside

20. The maxima and minima of $\sin^4 x + \cos^4 x \left(0 \le x \le \frac{\pi}{2}\right)$ occur at

$\sin^4 x + \cos^4 x$.

(A) $x = 0; x = 0$
(B) $x = 0; x = \pi$
(C) $x = 0; x = \frac{\pi}{2}$
(D) $x = 0; x = \frac{\pi}{4}$

$y = \frac{1}{\sqrt{2\pi}} e^{-x^2/2}$.

21. The point of inflection of the curve $y = \frac{1}{\sqrt{2\pi}} e^{\frac{-x^2}{2}}$ is at $x =$

(A) ± 1
(B) 2
(C) 3
(D) 0

22. If $u=\sin^{-1}\left(\frac{y}{x}\right), |y|\le|x|, x\neq 0$ then

$u = \frac{y}{x}$.

(A) $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=x$ (B) $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=y$

(C) $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=1$ (D) $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=0$

23. Let $f(x)=x|x|$. The set of all points where $f(x)$ is differentiable is

(A) $(-\infty,0)$ (B) $(0,\infty)$

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

24. If the anti-derivative of $\frac{1}{\sqrt{x+x^{\frac{3}{2}}}}$ is $A\sqrt{1+\sqrt{x}}+C$ then A is

$\frac{1}{\sqrt{x+x^{3/2}}}$

(A) 4 (B) 3

(C) 2 (D) 1

25. If $A(t)=\int_{-\infty}^{t} e^{-|x|}dx$ then $\lim_{t\to\infty} A(t)$ is

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

(C) e (D) $2-e$

26. The function $f:\mathbb{R}\to\mathbb{R}$ given by $f(x)=3-2\sin x$ is

(A) injective but not surjective (B) surjective but not injective

(C) neither injective nor surjective (D) bijective

27. Given $g(x)=\frac{1}{\sqrt{|x|-x}}$ and $f(x)=\frac{1}{\sqrt{x-|x|}}$ then domains of f and g are respectively

(A) $\phi, \mathbb{R}^*$ (B) $\phi, \mathbb{R}^+$

(C) $\mathbb{R}^-, \phi$ (D) $\mathbb{R}^+, \phi$

28. If f is one to one then

(A) $f(A\cap B)=f(A)\cap f(B)$ (B) $f(A\setminus B)=f(A)\setminus f(B)$

(C) $f(A\cap B)=f(A)\cup f(B)$ (D) $f(A\setminus B)=f(A)\cup f(B^C)$

29. Let $f(x)=x^2$ and $g(x)=2^x$ then the solution set of $(f \circ g)(x)=(g \circ f)(x)$ is

$fog = f(2^x)$

(A) $\mathbb{R}$ (B) $\{0,2\}$

(C) $\{0\}$ (D) $\{2\}$

$gof = 2^{x^2}$

30. The function defined by $f(x)=\begin{cases} 1 & \text{if } x \text{ is a rational number} \\ 0 & \text{if } x \text{ is an irrational number} \end{cases}$

(A) is not a periodic function
(B) cannot be represented by a graph
(C) not an even function
(D) not a well-defined function

31. The sum of $i^2+i^4+i^6+....$ upto $(2n+1)$ terms is equal to

(A) i (B) $-i$

(C) -1 (D) 1

$i^2(i+i^2+i^3+$

32. Let z and w be two complex numbers such that $|z|=|w|=1$ and $Arg\, z+Arg\, w=\pi$. Then $z=$

(A) w (B) $-w$

(C) $\overline{w}$ (D) $-\overline{w}$

33. If $|z|=4$, then the area of the triangle whose sides are having magnitudes equal to the moduli of the complex numbers $z, \omega z$ and $z+\omega z$ where $\omega \neq 1$ is the cube root of unity, is

(A) $4\sqrt{3}$ (B) $3\sqrt{3}$

(C) $2\sqrt{3}$ (D) $\sqrt{3}$

34. The system of equations $|z+1-i|=\sqrt{2}$ and $|z|=3$, where z is a complex number has

(A) only one solution (B) finite number of solutions

(C) infinite number of solutions (D) no solution

$|x+iy+1-i|=\sqrt{2}$

35. Let z_1, z_2, z_3, z_4 be the vertices of a square in that order, then

$|(x+1)+i(y-1)|$

(A) $\dfrac{z_1-z_3}{z_2-z_4}$ is purely real (B) $|z_1-z_3| \neq |z_2-z_4|$

$\sqrt{(x+1)^2+(y-1)^2}=2$

(C) $\dfrac{z_1-z_3}{z_2-z_4}$ is purely imaginary (D) $|z_1+z_3| \neq |z_2+z_4|$

$(x+1)^2+(y-1)^2=4$

$x^2+2x+1+y^2-2y+1=4$.

36. If a, b, c are three complex numbers such that $\frac{a}{b-c}+\frac{b}{c-a}+\frac{c}{a-b}=0$, then the value of $\frac{a^2}{(b-c)^2}+\frac{b^2}{(c-a)^2}+\frac{c^2}{(a-b)^2}$ is

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

$i(z^3+1)+z(z-1)$

37. If $iz^3+z^2-z+i=0$, then $|z|=$

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

38. If 3 complex numbers each of modulus 1 form an equilateral triangle, the modulus of their sum is

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

39. The value of m for which the equation given below has roots equal in magnitude but opposite in sign $\frac{a}{x+a+m}+\frac{b}{x+b+m}=1$ with $ab>0$ is

(A) -1 (B) 0
(C) $\frac{a-b}{a+b}$ (D) $\frac{a+b}{a-b}$

40. If $a+b+c=0$, then the roots of the equation $(b+c-a)x^2+(c+a-b)x+(a+b-c)=0$ should be

(A) only zero (B) imaginary and unequal
(C) imaginary and equal (D) real

41. If the equations $y^2+ay+b=0$ and $y^2+by+a=0\,(a\neq b)$ have a common root, then the numerical value of $a+b$ is

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

42. Let a_n be the n^{th} term of an A.P. If $\sum_{r=1}^{50} a_{2r} = \alpha$ and $\sum_{r=1}^{50} a_{2r-1} = \beta$, then the common difference of the A.P. is

(A) $\frac{\alpha-\beta}{50}$ (B) $\frac{\alpha-\beta}{100}$

(C) $\frac{\alpha+\beta}{50}$ (D) $\frac{\alpha+\beta}{100}$

43. If the arithmetic mean of two positive numbers a and b ($a>b$) is two times their geometric mean, then $a:b$ is

(A) $2:7\pm4\sqrt{3}$ (B) $2:4\pm7\sqrt{3}$

(C) $7\pm4\sqrt{3}:1$ (D) $4\pm7\sqrt{3}:1$

44. Suppose $a_1, a_2, a_3....$ are in $G.P.$ with common ratio $r \neq 1$ and $a_i > 0 \forall i$. Let $f(x) = x^{a_1-1} + x^{a_2-1} + ... + x^{a_n-1}$ then $\int_0^1 f(x)dx$ is

(A) $\frac{a_1 - a_{n+1}}{a_n(a_2 - a_1)}$ (B) $\frac{a_{n+1} - a_1}{a_n(a_2 - a_1)}$

(C) $\frac{a_{n+1} - a_n}{a_n(a_{n+1} - a_1)}$ (D) 0

45. The number of ways in which a pack of 52 cards of four different suits can be distributed equally among four players so that each player gets the Ace, King, Queen and Knave of the same suit is

(A) $\frac{52!4!}{(9!)^4}$ (B) $\frac{52!}{(9!)^4 4!}$

(C) $\frac{36!}{(9!)^4 4!}$ (D) $\frac{36!4!}{(9!)^4}$

46. The number of numbers between 1 and 10^{10} which contain the digit 1 is

(A) $10^{10}-1$ (B) $10^{10}-(9^{10}-1)$

(C) $10^{10}-(9^{10}-8^{10}-1)$ (D) 10^{10}

47. If $k \in \mathbb{R}$ and the middle term of $\left(\frac{k}{2}+2\right)^8$ is 5670, then the value of k is

(A) ± 3
(B) ± 5
(C) ± 7
(D) ± 11

$t_4 = 5670.$

48. If $n > 0$ is an integer, then $20^{2n+1}+1$ is multiple of

(A) 10
(B) 5
(C) 20
(D) 21

49. The sum of the series $\log_e 5 + \frac{1}{2!}(\log_e 5)^2 + \frac{1}{3!}(\log_e 5)^3 + \ldots$

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

50. If $\frac{1}{e^{7x}}\left(e^{5x}+e^{9x}\right) = a_0 + a_1x + a_2x^2 + a_3x^3 + \ldots$ then the value of $2a_1 + 2^3a_3 + 2^5a_5 + \ldots$ is

(A) 0
(B) e^0
(C) e^2
(D) $e+e^2$

51. Let $f(x) = \begin{vmatrix} \sin x & \sin^2 x & 0 \\ 1 & 4\sin x & \sin^2 x \\ 0 & 1 & \sin x \end{vmatrix}$ then $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} f(x)\,dx$ is

(A) $\sin^3 x$
(B) $cos^3 x$
(C) 1
(D) 0

20^5+1

$8000+1$

52. If a, b, c are real numbers, then $\Delta = \begin{vmatrix} a & 1+7i & 7-2i \\ 1-7i & b & -7-4i \\ 7+2i & -7+4i & c \end{vmatrix}$ is

(A) purely imaginary
(B) purely real
(C) 0
(D) i

53. If A and B are symmetric matrices, then ABA is

(A) scalar matrix
(B) skew matrix
(C) diagonal matrix
(D) symmetric matrix

54. If $A=\begin{pmatrix}1 & 0\\ \frac{1}{2} & 1\end{pmatrix}$ then A^{100} is

(A) $\begin{pmatrix}1 & 0\\ 25 & 1\end{pmatrix}$
(B) $\begin{pmatrix}1 & 0\\ 50 & 1\end{pmatrix}$
(C) $\begin{pmatrix}1 & 0\\ 75 & 1\end{pmatrix}$
(D) $\begin{pmatrix}1 & 0\\ 100 & 1\end{pmatrix}$

55. If $\lim_{x\to -a}\dfrac{x^7+a^7}{x+a}=7^7$ then the value of a is

(A) 3
(B) 5
(C) 7
(D) 11

56. If $A=\{(x,y)/x^2+y^2=25\}$ and $B=\{(x,y)/x^2+9y^2=144\}$ then $A\cap B$ contains

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

57. Let $f:(-1,1)\to B$ be a function defined by $f(x)=\tan^{-1}\dfrac{2x}{1-x^2}$ then f is both one-to-one and onto when B is the interval:

(A) $\left(\dfrac{-\pi}{2},\dfrac{\pi}{2}\right)$
(B) $\left[\dfrac{-\pi}{2},\dfrac{\pi}{2}\right]$
(C) $\left[0,\dfrac{\pi}{2}\right)$
(D) $\left(0,\dfrac{\pi}{2}\right)$

58. If $f:\mathbb{R}\to\mathbb{R}$ satisfies $f(x+y)=f(x)+f(y)$ for all $x,y\in\mathbb{R}$ and $f(1)=7$ then $\sum_{r=1}^{n} f(r)$ is

(A) $\dfrac{7n}{2}$
(B) $\dfrac{7(n+1)}{2}$
(C) $7(n+1)$
(D) $\dfrac{7n(n+1)}{2}$

59. If three complex numbers are in A.P then they lie on:

(A) a circle in the complex plane
(B) a straight line in the complex plane
(C) a parabola in the complex plane
(D) an ellipse in the complex plane

60. If the points z_1, z_2, z_3 are the vertices and z_0 the circum centre of an equilateral triangle in the complex plane then the value of $z_1^2 + z_2^2 + z_3^2$ is equal to

(A) $3z_0^2$ (B) $\frac{3}{z_0^2}$
(C) $\frac{3}{2z_0^2}$ (D) z_0^2

61. If z and w are two non-zero complex numbers such that $|zw| = 1$ and $\arg(z) - \arg(w) = \frac{\pi}{2}$ then $\bar{z}w$ is equal to

(A) 1 (B) −1
(C) i (D) $-i$

62. If $w = \frac{z}{z - \frac{i}{3}}$ and $|w| = 1$ then z lies on:

$w = \frac{x+iy}{x+iy-\frac{i}{3}}$

(A) a circle (B) a semi-circle
(C) a straight line (D) a parabola

63. Locus of z satisfying $\arg\left(\frac{z-1}{z+1}\right) = \frac{\pi}{2}$ is

$\frac{3(x+iy)}{3(x+iy)-i}$

(A) a circle (B) a semi-circle
(C) a straight line (D) a parabola

64. Multiplying a complex number by i rotates the vector representing the complex number through an angle of

(A) 180° clockwise (B) 90° anti-clockwise
(C) 60° clockwise (D) 90° clockwise

65. The area of the triangle whose vertices are represented by the complex numbers $0, z, ze^{i\alpha}$ $(0 < \alpha < \pi)$ equals

(A) $\frac{1}{2}|z|^2\cos\alpha$

(B) $\frac{1}{2}|z|^2\sin\alpha\cos\alpha$

(C) $\frac{1}{2}|z|^2\sin\alpha$

(D) $\frac{1}{2}|z|^2$

66. The value of $\sum_{k=1}^{10}\left[\sin\left(\frac{2k\pi}{11}\right)+i\cos\left(\frac{2k\pi}{11}\right)\right]$ is

Sin 2π

(A) 1

(B) −1

(C) i

(D) $-i$

67. The general value of x for which $\cos 2x, \frac{1}{2}, \sin 2x$ are in A.P are given by

(A) $n\pi, n\pi+\frac{\pi}{2}$

(B) $n\pi, n\pi+\frac{\pi}{4}$

(C) $n\pi+\frac{\pi}{4}, \frac{3n\pi}{4}$

(D) $n\pi, \frac{\pi}{4}+\frac{3n\pi}{4}$

68. The number of solutions of the equations $|\cos x| = 2[x]$ where $[x]$ denotes the greatest integer less than or equal to x is

(A) one

(B) two

(C) infinite

(D) nil

69. The expression $(1+\tan x+\tan^2 x)(1-\cot x+\cot^2 x)$ has positive values if

$(1+1+1)(1-1+1)$

(A) $0 \le x \le \frac{\pi}{2}$

(B) $0 \le x \le \pi$

(C) $x \in \mathbb{R}$

(D) $x \ge 0$

70. If $\Delta = \begin{vmatrix} 1 & 2 & 3 \\ 2 & 5 & 7 \\ 3 & 9 & 13 \end{vmatrix}$ and $\Delta' = \begin{vmatrix} 7 & 20 & 29 \\ 2 & 5 & 7 \\ 3 & 9 & 13 \end{vmatrix}$

$\Delta' =$

(A) $\Delta' = 3\Delta$

(B) $\Delta' = \frac{3}{\Delta}$

(C) $\Delta' = \Delta$

(D) $\Delta' = 2\Delta$

71. If a, b, c are positive integers then the determinant $\Delta = \begin{vmatrix} a^2+x & ab & ac \\ ab & b^2+x & bc \\ ac & bc & c^2+x \end{vmatrix}$ is divisible by

x+ab+ac
y+ab+bc

(A) x^3
(B) x^2
(C) $\left(a^2+b^2+c^2\right)$
(D) $\left(a^2+b^2\right)$

72. The sum of n terms of the following series $1+(1+x)+\left(1+x+x^2\right)+....$ will be

(A) $\frac{1-x^n}{1-x}$
(B) $\frac{x\left(1-x^n\right)}{1-x}$
(C) $\frac{n(1-x)-x\left(1-x^n\right)}{(1-x)^2}$
(D) $\frac{x^2\left(1-x^n\right)}{1-x}$

73. If $f'(x)=g(x)$ and $g'(x)=-f(x)$ for all x and $f(2)=4=f'(2)$ then $f^2(19)+g^2(19)$ is

(A) 16
(B) 32
(C) 64
(D) 46

74. The value of the $\lim_{x\to 0}(1+x)^{\log x}$ is

(A) 1
(B) 0
(C) 5
(D) -1

75. The function $y=\left(x^2+1\right)^{50}$ should be differentiated 70 times to result in a polynomial of the degree

(A) 30
(B) 40
(C) 50
(D) 55

76. If $x^2-hx-21=0$ and $x^2-3hx+35=0\,(h>0)$ have a common root, then h is equal to

(A) 4
(B) 5
(C) 0
(D) 1

77. $\lim_{n\to\infty}\sum_{r=1}^{n}\tan^{-1}\left(\frac{1}{2r^2}\right)$ is

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

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

(C) $\frac{\pi}{3}$

(D) π

78. If $\frac{d}{dx}f\left(x^2\right)=x^2$ then $f'(16)$ is

(A) 2

(B) 4

(C) 6

(D) 8

79. For A, B non-empty sets which one of the following is correct?

(A) $A\cap B=A^C\cup B^C$

(B) $A\cup B=(A\setminus B)\cup(A^C\setminus B)$

(C) $A\setminus B=B^C\cap A$

(D) $B\setminus A=(A\setminus B)^C$

80. $A=\{x/1<x<11\}$ can also be represented as

(A) $\{x/x>1\}\cap\{x/-x>11\}$

(B) $\{y/|y-6|<5\}$

(C) $\{x/x>1\}\cup\{x/x<11\}$

(D) $\{y/y>1\}\cap\{y/y>11\}$

81. If ${}^{10}p_r=2.\,{}^{9}p_r$ then r is

$r=10$

(A) 10

(B) 5

(C) 15

(D) 20

82. A unit vector in the direction from $(-1,2)$ towards $(1,5)$ is

(A) $\frac{-2}{\sqrt{13}}\vec{i}-\frac{3}{\sqrt{13}}\vec{j}$

(B) $\frac{2}{\sqrt{15}}\vec{i}+\frac{3}{\sqrt{15}}\vec{j}$

(C) $\frac{2}{\sqrt{5}}\vec{i}+\frac{3}{\sqrt{5}}\vec{j}$

(D) $\frac{2}{\sqrt{13}}\vec{i}+\frac{3}{\sqrt{13}}\vec{j}$

83. The geometric mean of $a,ar,ar^2,....,ar^n$ is

(A) $\sqrt{ar^n}$

(B) $ar^{\frac{n}{2}}$

(C) a^2r^n

(D) $(ar^n)^2$

84. The domain of the function $f:\mathbb{R}\to\mathbb{R}$ defined by $f(x)=\frac{x^2-1}{x^2-9}$ is

(A) $\{x\in\mathbb{R}/x\neq\pm1,\pm3\}$
(B) $\{x\in\mathbb{R}/x\neq\pm1\}$
(C) $\{x\in\mathbb{R}/x\neq\pm3\}$
(D) $\{x\in\mathbb{R}/x>9\}$

85. If $f(x)=\frac{x+3}{x+1}, x>0$ then the function $g(x)$ such that $g(f(x))=x$, is given by

(A) $g(x)=\frac{x+1}{x+3}, x>3$
(B) $g(x)=\frac{x-3}{x-1}, x>1$
(C) $g(x)=\frac{1-x}{3-x}, x>3$
(D) $g(x)=\frac{3-x}{x-1}, x>1$

86. $\lim\limits_{x\to-1}\frac{x^2-1}{x+1}$ is

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

87. If $f(x)=\begin{cases}\sin x & \text{if } x\in\left[0,\frac{3\pi}{2}\right)\\ 1-\cos x & \text{if } x\in\left(\frac{-\pi}{2},0\right]\end{cases}$, then

(A) f is not well defined
(B) f is not continuous
(C) f is not one to one
(D) None of the above

88. If $f(x)=\begin{cases}x-1 & \text{if } x<2\\ \frac{x}{2} & \text{if } x\geq 2\end{cases}$ then $\lim\limits_{x\to2}f(x)$ is

(A) 0
(B) 1
(C) $\frac{1}{2}$
(D) 2

89. If $f(x)=\begin{cases}2 & \text{if } x<-1\\ |x|+1 & \text{if } -1\leq x\leq 1\\ 2 & \text{if } x>1\end{cases}$ then

(A) $\lim\limits_{x\to0}f(x)=1$
(B) $\lim\limits_{x\to0}f(x)=2$
(C) $\lim\limits_{x\to-1}f(x)=-2$
(D) $\lim\limits_{x\to1}f(x)=0$

90. $f(x)=\begin{cases}2x & if\ x<2\\ x^2 & if\ x\geq 2\end{cases}$. Which one of the following is true?

(A) f has discontinuity at $x=2$
(B) f is continuous only for $x\geq 2$
(C) f is continuous on $\mathbb{R}$
(D) f has discontinuity at $x=\pm 2$

91. If $f(x)=\begin{cases}1 & \text{for } x\in(1,2)\\ 2 & \text{for } x\in(5,7)\end{cases}$, then

(A) f is not continuous
(B) f is continuous
(C) f is continuous in $[2,5]$
(D) None of the above

92. If $Z=4+3i$ real part of $\frac{Z}{\overline{Z}}$ is

$\frac{4+3i}{4-3i}\times\frac{4+3i}{4+3i}$

$\frac{16+24i-9}{25}$

(A) $\frac{7}{25}$
(B) 1
(C) $\frac{24}{25}$
(D) $\frac{4}{25}$

93. Which of the following is true for complex numbers?

(A) $\left(\frac{z_1\cdot z_2}{z_3}\right)=\frac{\overline{z}_1\cdot\overline{z}_2}{z_3}$
(B) $Im\,z=\frac{1}{2}(z-\overline{z})$
(C) $|z|=\sqrt{z\overline{z}}$
(D) $|z_1z_2|\geq|z_1||z_2|$

94. $\sqrt[3]{i}$ are

(A) $-i, 1+i, \sqrt{3}-i$
(B) $-i, \frac{1}{2}(1-i), \frac{1}{2}\sqrt{3}+i$
(C) $-i, \frac{1}{2}\left(\sqrt{3}+i\right), \frac{1}{2}\left(-\sqrt{3}+i\right)$
(D) None of the above

95. How many diagonals a polygon of n sides has?

(A) n
(B) nc_2
(C) $\frac{n(n-1)}{2}$
(D) $\frac{n(n-3)}{2}$

96. For any two positive integers $n, r\,(r\leq n)$ $nc_0+nc_1+nc_2+....+nc_r$ is

(A) 2^r
(B) 2^n
(C) $2^n-\left(nc_{r+1}+....+nc_n\right)$
(D) $2^r-\left(nc_{r+1}+....+nc_n\right)$

97. In how many ways can 8 persons be seated at a round table?

(A) $8!$
(B) 1
(C) $\frac{8!}{2}$
(D) $7!$

98. In how many ways can 52 cards be divided among four players so that each may have 13?

(A) $52C_3$
(B) $\frac{52!}{(13!)^4}$
(C) $\frac{52!}{4!(13!)^4}$
(D) $13!$

99. A coin is tossed three times. The probability that at least one head turns up is

(A) $\frac{7}{8}$
(B) $\frac{1}{8}$
(C) 1
(D) $\frac{3}{8}$

100. By adding a positive number to each observation of a group of observations the variance

(A) decreases
(B) unchanged
(C) increases
(D) becomes 1

101. If $4\cot x = 3\cot y$ and $4\sin x = \sec y$ then $x - y$ is

(A) $\sin^{-1}(7/16)$
(B) $\sin^{-1}(5/16)$
(C) $\sin^{-1}(3/16)$
(D) $\sin^{-1}(1/16)$

102. The value of $\tan 1^\circ \tan 2^\circ .... \tan 89^\circ$ is

(A) 1
(B) 0
(C) ∞
(D) greater than 1

103. For real $x, k = \frac{x^2+1}{x^2+2x+1}$ then

(A) $2k \geq 1$
(B) $3k \leq 2$
(C) $1 \leq 2k \leq 4$
(D) $2k \leq 1$

104. The equation $3^{x-1}+5^{x-1}=34$ has

(A) no solution
(B) one solution
(C) two solutions
(D) more than two solutions

105. The number of real roots of the equation $Sin\left(e^{x}\right)=3^{x}+3^{-x}$ is

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

106. If $\log 2, \log\left(2^{x}-1\right)$ and $\log\left(2^{x}+3\right)$ are in A.P. then 2^{x} is equal to

(A) 5/2
(B) 2
(C) 5
(D) 2/5

107. If $1-\frac{1}{2}+\frac{1}{3}-\frac{1}{4}+....=\log 2$ then $\frac{1}{1.3}+\frac{1}{2.5}+\frac{1}{3.7}+....\infty=$

(A) $1-\log 2$
(B) $1-2\log 2$
(C) $2-2\log 2$
(D) $3-2\log 2$

108. Let a,b,c be in A.P. and $|a|,|b|,|c|<1$. If $x=\sum_{n=0}^{\infty}a^{n}$, $y=\sum_{n=0}^{\infty}b^{n}$ and $z=\sum_{n=0}^{\infty}c^{n}$ then x,y,z

(A) are in A.P.
(B) are in H.P.
(C) are in G.P.
(D) satisfy $xy=z^{2}y$

109. For all positive integers n, which of the following is true?

(A) $2^{3^n}+1$ is divisible by 3^{n+1}
(B) $2^{3^n}+1$ is divisible by 3^{n+2}
(C) $2^{3^n}+1$ is divisible by $3^{n}+1$
(D) $2^{3^n}+1$ is divisible by $3^{n+1}-3^{n}$

110. The number of non-negative integer solutions of the equation $2x+y=40$ such that $x\leq y$ is

(A) 10
(B) 6
(C) 7
(D) 0

111. If A and B are two sets with 5 and 10 elements respectively then the number of one-to-one functions from A into B is

(A) $\frac{10!}{6!}$ (B) 10^5
(C) 2^{20} (D) $\frac{10!}{5!}$

112. The greatest integer less than or equal to $\left(\sqrt{2}+1\right)^4$ is

(A) 32 (B) 33
(C) 34 (D) 35

113. The sum of the co-efficients of the polynomial $(x+y)^{2n+1}$ is 8192 then the greatest co-efficient in the expansion is

(A) ${}^{13}C_5$ (B) ${}^{13}C_6$
(C) ${}^{13}C_8$ (D) ${}^{13}C_9$

114. Let $A=\begin{pmatrix}1 & 2 & 3\\ 2 & 1 & 4\\ 0 & 1 & 2\end{pmatrix}$. Then the product of the adjoint of the inverse of A and the determinant of A is

(A) zero matrix (B) identity matrix
(C) A itself (D) inverse of A

115. A bullet is fired into a target with velocity 5m/s. It comes to rest after penetrating 20 cm inside the target. Then the retardation for the bullet is

(A) $62.5m/s^2$ (B) $625m/s^2$
(C) $6.25m/s^2$ (D) $0.625m/s^2$

116. In a direct impact of perfectly elastic spheres, after collision their velocities

(A) are unchanged (B) change their direction
(C) are interchanged (D) become zero

117. Two lines $y=3x+4,\ z=4x+1$ and $y=kx+3,\ z=lx+1$ will be perpendicular if and only if

(A) $3k+4l+1=0$ (B) $3k+2l=1$
(C) $3k+4l-1=0$ (D) $3k-4l-1=0$

118. The image of the point $(1,-2,-1)$ in the plane $2x-2y=0$ is

(A) $(-2,1,1)$
(B) $(-2,1,-1)$
(C) $(-4,2,-2)$
(D) $(-6,3,-1)$

119. The volume of a parallelopiped whose adjacent edges are $\vec{i}+a\vec{j}+\vec{k}, \vec{j}+\vec{k}, \vec{i}+\vec{k}$ is 2 units then the value of a is

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

120. Let two forces $\vec{i}+\vec{j}+2\vec{k}$ and $-\vec{j}+\vec{k}$ acting on a particle at A move it to B. If the position vectors of A and B are $-\vec{i}+\vec{k}$, $\vec{i}+2\vec{j}+\vec{k}$ then the work done is

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

121. x^x is minimum at

(A) $x=e$
(B) $x=\frac{1}{e}$
(C) $x=1$
(D) $x=0$

122. The set of vectors reciprocal to $\vec{i}, \vec{i}+\vec{j}$ and $\vec{i}+\vec{k}$ are

(A) $\vec{i}, \vec{j}, \vec{k}$
(B) $\vec{i}+\vec{j}, \vec{i}+\vec{k}, \vec{j}+\vec{k}$
(C) $\vec{i}-\vec{j}-\vec{k}, -\vec{j}, -\vec{k}$
(D) $\vec{i}-\vec{j}-\vec{k}, \vec{j}, \vec{k}$

123. The differential equation representing the family of all concentric circles centered at (2, 3) is given by

(A) $(y-2)dy=-(x-3)dx$
(B) $(y-2)dx=(x-3)dy$
(C) $(x-2)dy=(y-3)dx$
(D) $(y-3)dy=-(x-2)dx$

124. The graph of the function $y = x|x|$ is

(A) pair of straight lines
(B) parts of parabolas
(C) ellipse
(D) circle

125. The line $\vec{r} = \vec{a} + t\vec{b}$ is perpendicular to the plane whose standard equation is $\vec{r}.\vec{n} = b$ if

(A) $\vec{b}.\vec{n} = 0$
(B) $\vec{a} = k\vec{n}$ where k is a scalar
(C) $\vec{a}.\vec{n} = 0$
(D) $\vec{b} = k\vec{n}$ where k is a scalar

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