61211

ROLL No. | | | | | |

QN. BOOKLET No. **015**

TEST FOR POST GRADUATE PROGRAMMES

MATHEMATICS

Time: 2 Hours

Maximum Marks: 450

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 Code, 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. The paper consists of 150 objective type questions. All questions carry equal marks.
5. 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.
6. Each correct answer carries **3** marks and each wrong answer carries **1** minus mark.
7. Please do your rough work only on the space provided for it at the end of this question booklet.
8. You should return the Answer Sheet to the Invigilator before you leave the examination hall. However Question Booklet may be retained with the Candidate.
9. 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.
10. Please feel comfortable and relaxed. You can do better in this test in a tension-free disposition.

WISH YOU A SUCCESSFUL PERFORMANCE

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MATHEMATICS

1. $x = \frac{a}{a-1};\ y = \frac{1}{a-1}$

(A) $x > y$
(B) $y < x$ if $a < 1$
(C) $x = y$
(D) $x = y$ if $a < 1$

2. 8⅓% of ?=105

(A) 1260
(B) 1800
(C) 1350
(D) 1400

3. $4^{61} + 4^{62} + 4^{63} + 4^{64}$ is divisible by

(A) 3
(B) 10
(C) 11
(D) 13

4. A number is doubled and 9 is added. If the resultant is trebled, it becomes 75. The number is

(A) 3.5
(B) 6
(C) 8
(D) 10

5. If $\left(\frac{1}{5}\right)^{3y} = 0.008$, the value of $(0.25)^y$ is

(A) 0.25
(B) 0.35
(C) 0.3
(D) 0.2

6. The largest number among $\sqrt[4]{6}, \sqrt{2}$ and $\sqrt[3]{4}$ is

(A) $\sqrt[4]{6}$
(B) $\sqrt{2}$
(C) $\sqrt[3]{4}$
(D) All are equal

7. If 50% of $(x-y) = 30\%$ of $(x+y)$, then what percent of x is y?

(A) 15%
(B) 20%
(C) 25%
(D) 30%

8. x varies inversely as square of y. Given that $y = 2$ for $x = 1$. The value of x for $y = 6$ is

(A) 3 (B) 9

(C) $\frac{1}{3}$ (D) $\frac{1}{9}$

9. If x is a whole number, then $x^2(x^2 - 1)$ is always divisible by

(A) 12 (B) 24

(C) $24 - x$ (D) multiples of 12

10. The least number exactly divisible by 12, 15, 20 and 27 is

(A) 440 (B) 480

(C) 520 (D) 540

11. If $2p + 3q = 18$ and $2p - q = 2$, then $2p + q =$

(A) 6 (B) 7

(C) 10 (D) 20

12. $\left(\sqrt{2} + \frac{1}{\sqrt{2}}\right)^2$ is equal to

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

(C) $4\frac{1}{2}$ (D) $5\frac{1}{2}$

13. If a sum of money at simple interest doubles in 6 years, it will become 4 times in

(A) 12 years (B) 4 years

(C) 16 years (D) 18 years

14. A square and a rectangle have equal areas. If their perimeters are p_1 and p_2 respectively, then

(A) $p_1 < p_2$ (B) $p_1 > p_2$

(C) $p_1 = p_2$ (D) None of these

15. If each edge of a cube is increased by 25%, then the percentage increase in its surface area is

(A) 25% (B) 48.75%
(C) 50% (D) 56.25%

16. How many cubes of 3 cm edge can be cut out of a cube of 18 cm edge?

(A) 36 (B) 216
(C) 218 (D) 432

17. The radii of two cones are in the ratio 2:1, their volumes are equal. The ratio of their heights is

(A) 1 : 8 (B) 1 : 4
(C) 2 : 1 (D) 4 : 1

18. The value of $\left(\frac{5}{7} \text{ of } 1\frac{6}{13}\right) \div \left(2\frac{5}{7} \div 3\frac{1}{4}\right)$ is

(A) $\frac{20}{169}$ (B) 1

(C) $\frac{5}{4}$ (D) $1\frac{119}{180}$

19. If $\sqrt{2} = 1.4142$, then the value of $\frac{\sqrt{2}}{2+\sqrt{2}}$ is

(A) 0.4042 (B) 0.3142
(C) 1.4042 (D) 0.4142

20. The modulus of the complex number $\frac{(-1+i)(1-i)}{1+i\sqrt{3}}$ is

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

(C) 1 (D) $\frac{1}{2}$

21. If p represents a complex number z satisfying $|z-2-3i|=4$, then the locus of p is

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

22. If $\omega^3=1$ and n is a multiple of 3, then

(A) $\omega^{2n}=-1$
(B) $\omega^n=1$
(C) $\omega^{3n}=-1$
(D) $\omega^{3n}=\omega$

23. If the rate of increase of x^3-5x^2+5x+8 is twice the rate of increase of x, then the values of x are

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

24. The equation of the normal at $(2,-12)$ to the curve $y=4x-3x^2-x^3$ is

(A) $x-20y=0$
(B) $x+20y-242=0$
(C) $x-20y-242=0$
(D) $x+20y=0$

25. If the slope of the normal to the curve $y=x^4-kx^2$ at $(1,-2)$ is $\frac{1}{2}$, then the value of k is

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

26. The value of $\int_0^{\pi}\int_x^{\pi}\int_0^{y}\frac{\sin y}{y}\,dz\,dy\,dx$ is

(A) -2
(B) 2
(C) $-\pi$
(D) π

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27. The set of linearly solutions of the differential equation $\frac{d^4y}{dx^4}-\frac{d^2y}{dx^2}=0$ is

(A) $\{1,x,e^x,e^{-x}\}$ (B) $\{1,x,e^x,xe^{-x}\}$
(C) $\{1,x,e^x,xe^x\}$ (D) $\{1,x,xe^{-x},e^{-x}\}$

28. The initial value problem corresponding to the integral equation $y(x)=1+\int_0^x y(t)\,dt$ is

(A) $y'-y=0,\ y(0)=1$ (B) $y'+y=0,\ y(0)=0$
(C) $y'-y=0,\ y(0)=0$ (D) $y'+y=0,\ y(0)=1$

29. Consider the polynomial $P(x)=\sum_{j=0}^{n}c_jx^j$, where n is non negative odd integer and $c_0,c_n\neq 0$. If $c_0c_n>0$ then on the negative half of the real line, P has

(A) at least one zero (B) exactly one zero
(C) no zeros (D) insufficient data

30. Suppose f and g are maps from R^2 to R^2 defined by $f(x,y)=(x-y,x)$ and $g(x,y)=(|x-y|,y)$. Then

(A) both f and g are linear (B) f is linear, but not g
(C) g is linear, but not f (D) neither f nor g is linear

31. The value of $\lim_{n\to\infty}\sum_{r=1}^{n-1}\frac{1}{\sqrt{n^2-r^2}}$ is

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

32. The equation $\sum_{i=0}^{n}a_ix^{n-i}=0$ has at least one root between 0 and 1 if

(A) $\sum_{i=0}^{n-1}\frac{a_i}{n-i}=0$ (B) $\sum_{i=0}^{n}\frac{a_i}{n+1-i}=0$
(C) $\sum_{i=0}^{n}\frac{a_i}{n}=0$ (D) $\sum_{i=0}^{n-1}\frac{a_i}{n+1+i}=0$

33. If $\frac{e^x}{1-x} = \sum_{i=0}^{\infty} B_i x^i$ then $B_n - B_{n-1}$ is given by

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

34. If $(x+iy)^{\frac{1}{3}} = a - ib$ then $\frac{x}{a} - \frac{y}{b}$ is given by

(A) $2(a^2+b^2)$
(B) $2(a^2-b^2)$
(C) $4(a^2-b^2)$
(D) $4(a^2+b^2)$

35. The value of the $\int_{|z|=1} \frac{|dz|}{|z-a|^2}$, where a is a complex number such that $|a|<1$

(A) $\frac{2\pi}{1-|a|^2}$
(B) $\frac{2\pi}{1+|a|^2}$
(C) 0
(D) 1

36. Let $A \in R^{m \times n}$. The system of equations $Ax = b$ has solutions if

(A) $\text{rank } A = \text{rank}[A:b]$
(B) $\text{rank } A = \text{rank}[A:b] = n$
(C) $\text{rank } A = \text{rank}[A:b] = m$
(D) $\text{rank } A \neq \text{rank}[A:b]$

37. Eigen values of real symmetric matrix is

(A) real
(B) imaginary
(C) purely imaginary
(D) can be both real and imaginary

38. The equation $x^2 + y^2 + 2gx + 2fy + 1 = 0$ represents a pair of lines if

(A) $f^2 + g^2 = 1$
(B) $f^2 - g^2 = 1$
(C) $f = g$
(D) $f + g = 1$

39. Two circles $(x-1)^2+(y-3)^2=r^2$ and $x^2+y^2-8x+2y+8=0$ intersect in two distinct points if

(A) $r<2$
(B) $r>8$
(C) $2<r<8$
(D) $1<r<2$

40. $a+ib>c+id$ is defined only when

(A) $a=0$ and $c=0$
(B) $c=0$ and $d=0$
(C) $a=0$ and $d=0$
(D) $b=0$ and $d=0$

41. The point of intersection of the lines given by $x^2-5xy+4y^2+x+2y-2=0$ is

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

42. The area enclosed by the curves $y=4x^3$ and $y=16x$ is

(A) 32
(B) 16
(C) 64
(D) 2π

43. Two perpendicular tangents to $y^2=4ax$ always intersects on the line

(A) $x-a=0$
(B) $x+a=0$
(C) $x+2a=0$
(D) $x+4a=0$

44. The point which is equidistant from the points $(0,0,0),(2,0,0),(0,2,0)$ and $(2,2,2)$ is

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

45. The volume of the parallelepiped whose edges are represented by the vectors $i+j,\ j+k,\ k+i$ is

(A) 2
(B) 0
(C) 1
(D) 6

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46. If $\vec{a}, \vec{b}$ and $\vec{c}$ are three mutually perpendicular unit vectors then $\left|\vec{a}+\vec{b}+\vec{c}\right|$ is

(A) $\sqrt{3}$
(B) 3
(C) 2
(D) 0

47. The maximum magnitude of the directional derivative for the surface $x^2+xy+yz=9$ at the point $(1,2,3)$ is along the direction

(A) $\vec{i}+\vec{j}+\vec{k}$
(B) $\vec{i}+2\vec{j}+4\vec{k}$
(C) $2\vec{i}+2\vec{j}+\vec{k}$
(D) $\vec{i}+2\vec{j}+2\vec{k}$

48. Let V be the vector space of real polynomials of degree at most 2. Define a linear operator $T:V\rightarrow V$ by $T\left(x^i\right)=\sum_{i=0}^{i} x^i$, $i=0,1,2$. Then matrix T^{-1} with respect to the basis $\left\{1,x,x^2\right\}$ is

(A) $\begin{bmatrix}1 & 1 & 1\\ 1 & 1 & 0\\ 1 & 0 & 0\end{bmatrix}$
(B) $\begin{bmatrix}1 & -1 & 0\\ 0 & 1 & -1\\ 0 & 0 & 1\end{bmatrix}$
(C) $\begin{bmatrix}1 & 1 & 1\\ 0 & 1 & 1\\ 0 & 0 & 1\end{bmatrix}$
(D) $\begin{bmatrix}1 & 0 & 1\\ 1 & 1 & 0\\ 0 & 1 & 1\end{bmatrix}$

49. The number of linearly independent eigen vectors of the matrix $\begin{bmatrix}2 & 2 & 0 & 0\\ 2 & 1 & 0 & 0\\ 0 & 0 & 3 & 0\\ 0 & 0 & 1 & 4\end{bmatrix}$ is

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

50. The solution of $xu_x+yu_y=0$ is of the form

(A) $f\left(\frac{y}{x}\right)$
(B) $f(xy)$
(C) $f(x+y)$
(D) $f(x-y)$

51. Let $1+x$ and e^x be two solutions of $y''(x)+P(x)y'(x)+Q(x)y(x)=0$ then $P(x)$ is

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

52. Consider the function $f(z)=\frac{e^{iz}}{z(z^2+1)}$. The residue at the isolated singular point in the upper half plane $\{z=x+iy \in C : y>0\}$ is

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

53. The residue at of $f(z)=\frac{z^3}{(z-1)^4(z-2)(z-3)}$ at $z=1$ is

(A) $\frac{101}{16}$
(B) 1
(C) 0
(D) $\frac{111}{6}$

54. $w=\frac{iz+2}{4z+i}$ will transform the real axis into

(A) real axis
(B) imaginary axis
(C) straight line
(D) a circle

55. If for the equation $x^3-3x^2-kx+3=0$ one root is the negative of the other, then the value of k is

(A) 3
(B) −3
(C) 1
(D) −1

56. The inverse of the permutation $\begin{pmatrix} 1 & 2 & 3 \\ 2 & 3 & 1 \end{pmatrix}$ is

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

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

57. If $f(x) = e^x$ and $g(x) = \ln(x)$ then $\frac{d}{dx}((g \circ f)(x))$ is

(A) 1 (B) x

(C) 0 (D) $\frac{1}{x}$

58. If $f(x) = ax + b,\ x \in [-1,1]$ then point $c \in [-1,1]$, where $f'(c) = \frac{f(1) - f(-1)}{2}$

(A) does not exist (B) can be only 1

(C) can be only -1 (D) $c \in (-1,1)$

59. The value of $\int_{-a}^{a} |x| dx$ is

(A) a (B) a^2

(C) $-a$ (D) 0

60. If p and q are positive real numbers, then the series $\sum_{1}^{\infty} \frac{(n+1)^p}{n^q}$ is convergent for

(A) $p < q - 1$ (B) $p < q + 1$

(C) $p \geq q + 1$ (D) $p \geq q - 1$

61. If the equation of the base of the equilateral triangle is $x+y=2$ and the vertex is $(2,-1)$, then the length of the side is

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

62. The function $f(x)=|x|$ is

(A) differentiable at origin
(B) continuous at origin
(C) nowhere differentiable
(D) nowhere continuous

63. $\lim\limits_{x\to\infty}\dfrac{\sin\frac{1}{x}}{\frac{1}{x}}$ is

(A) 1
(B) 0
(C) −1
(D) does not exist

64. If $f(x)=\int_0^x t\sin t\,dt$ then $f'(x)$ is

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

65. The value of the natural number a for which $\sum_{k=1}^{n} f(a+k)=16(2^n-1)$, where the function satisfies $f(x+y)=f(x)f(y)$ and $f(1)=2$, is

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

66. If $y=\frac{x}{1!}+\frac{x^2}{2!}+\frac{x^3}{3!}+....$ then x is

(A) $\frac{y}{1}-\frac{y^2}{2}+\frac{y^3}{3}-....$
(B) $\frac{y}{1}+\frac{y^2}{2}+\frac{y^3}{3}+....$
(C) $1+\frac{y}{1}-\frac{y^2}{2}+\frac{y^3}{3}-....$
(D) $-\frac{y}{1}-\frac{y^2}{2}-\frac{y^3}{3}-....$

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67. The maximum value of the function $f(x) = x^{1/x}$ is

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

(C) e^{-e} (D) $e^{e^{-1}}$

68. If $\left(x_i, \frac{1}{x_i}\right)$, for $i = 1, 2, 3, 4$ are four points on the circle then $x_1x_2x_3x_4$ is

(A) 0 (B) -1

(C) 1 (D) π

69. The distance between the parallel lines given by the equation $x^2 + 2xy + y^2 - 6x - 6y + 8 = 0$ is

(A) 0 (B) 1

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

70. The function $\frac{1-2x-x^2}{1+x-2x^2}$ always

(A) decreases as x increases (B) decreases as x decreases

(C) increases as x increases (D) increases for all values of x

71. The greatest area of the rectangle that can be inscribed in a circle of radius a is

(A) a^2 (B) $2a^2$

(C) $\frac{a^2}{2}$ (D) $4a^2$

72. The maximum value of $5\sin x + 2$ is

(A) -1 (B) 2

(C) 10 (D) 7

73. If $f(2)=g(2)=0$ and $f'(2)=3, g'(2)=6$, then the value of $\lim_{x\to 2}\frac{f(x)}{g(x)}$ is

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

74. $\underset{x\to 0}{lt}\ x^{\sin x}$ is equal to

(A) $\frac{1}{2}$
(B) ∞
(C) 0
(D) 1

75. The length of the latus rectum of the ellipse $\frac{x^2}{100}+\frac{y^2}{25}=1$ is

(A) 40
(B) $\frac{5}{2}$
(C) 10
(D) 5

76. The focus of the parabola $x^2-2x-4y-11=0$ is

(A) $(1,2)$
(B) $(-1,-2)$
(C) $(-11,0)$
(D) $(1,-2)$

77. The area enclosed between the lines $x=2,\ x=4$ and $y=2x$ is

(A) 6 sq. units
(B) 12 sq. units
(C) 16 sq. units
(D) 32 sq. units

78. If $A=\begin{vmatrix} 6 & 9 & 12 \\ 1 & 1 & 0 \\ 4 & 6 & 2 \end{vmatrix}$, then the cofactor of 12 is equal to

(A) 2
(B) 4
(C) 8
(D) 6

79. The projection of x- axis on y-axis is

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

80. $\left[\hat{i}+\hat{j},\ \hat{j}+\hat{k},\ \hat{k}+\hat{i}\right]$ is equal to

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

81. The local minima of the function $\frac{x}{2}+\frac{2}{x}$, $x>0$, is

(A) −2
(B) 2
(C) 4
(D) 0

82. The quadratic equation whose one of the roots is $i\sqrt{18}$ is

(A) $x^2+18=0$
(B) $x^2-18=0$
(C) $x^2+\sqrt{18}=0$
(D) $x+\sqrt{18}=0$

83. If a is the length of the semi-transverse axis of a rectangular hyperbola $xy=c^2$, then the value of c^2 is

(A) $\frac{a^2}{2}$
(B) $\frac{a^2}{4}$
(C) $2a^2$
(D) $4a^2$

84. $\left(\sqrt{2}+1\right)^5-\left(\sqrt{2}-1\right)^5$ is equal to

(A) 80
(B) 82
(C) 86
(D) 88

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85. $\frac{d}{dx}\sin(\log x)$ is equal to

(A) $\frac{\sin(\log x)}{x}$ (B) $\frac{\log(\sin x)}{x}$

(C) $\sin(\log x)$ (D) $\frac{\cos(\log x)}{x}$

86. $\frac{d}{dx}(\log x)^2$ is equal to

(A) $2\log x$ (B) $\frac{\log x}{x^2}$

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

87. If the coordinates $\left(2,\frac{3}{2}\right),\left(-3,\frac{-7}{2}\right)$ and $\left(k,\frac{9}{2}\right)$ are collinear, then the value of k is

(A) 1 (B) 3
(C) 4 (D) 5

88. The coordinates $(2a,4a),(2a,6a),\left(2a+\sqrt{3}a,5a\right)$ are the vertices of

(A) an isosceles triangle (B) an equilateral triangle
(C) a right angled triangle (D) None of the above

89. The equation of a straight line through $(2,-1)$ and making an angle 45^0 with the $x-$axis is

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

90. If the straight line $\frac{x}{a}+\frac{y}{b}=1$ passes through $(1,1)$, then

(A) $ab=a-1$ (B) $ab=a+b$
(C) $ab=b-1$ (D) $ab=a-b-1$

91. The ratio in which the straight line joining the coordinates $(-3,4,8)$ and $(5,-6,4)$ is divided by the xy-plane is

(A) $2:3$ (B) $1:3$
(C) $1:2$ (D) $2:1$

92. If the slope of one of the lines $ax^2+2hxy+by^2=0$ is $\frac{3}{2}$ times the other, then

(A) $12h^2=5ab$ (B) $12h^2=7ab$
(C) $24h^2=7ab$ (D) $24h^2=25ab$

93. The equation of the circle on the line joining the points $(-3,7)$ and $(2,-5)$ as a diameter is

(A) $x^2+y^2+x-2y-41=0$ (B) $x^2+y^2-x+2y-41=0$
(C) $x^2+y^2+x+2y+41=0$ (D) $x^2+y^2-x-2y+41=0$

94. The equation of the chord of contact of the tangents from $(-5,2)$ to the circle $x^2+y^2-4x+2y-6=0$ is

(A) $3x-7y-6=0$ (B) $3x-7y+6=0$
(C) $7x-3y+6=0$ (D) $7x-3y-6=0$

95. The locus of the middle points of parallel chords of the parabola $y^2=4ax$ is

(A) $y=2am$ (B) $y=\frac{2a}{m}$
(C) $y=\frac{m}{2a}$ (D) $y=\frac{2m}{a}$

96. If a and b are two relatively prime numbers then $\phi(ab)$ is

(A) $\phi(a)\phi(b)$ (B) 1
(C) ab (D) $\phi(a/b)$

97. If A, B. C are the angles made by a straight line with co-ordinate axes then the value $\sin^2 A + \sin^2 B + \sin^2 C$ is

(A) 1
(B) 0
(C) −1
(D) 2

98. $\int_0^1 (1-x)^{m-1} x^{n-1} dx$ is

(A) divergent
(B) convergent for all the values for m and n
(C) converges for $m > 0$ and $n > 0$
(D) converges for $m < 0$ and $n < 0$

99. $\frac{1}{2}\int_c (x\,dy - y\,dx)$ gives

(A) the volume enclosed by the curve
(B) area enclosed by the curve
(C) length of the curve
(D) surface area of the curve

100. The Laplace transform of the function $\frac{e^{-1}\sin t}{t}$ is

(A) $\tan^{-1} s$
(B) $\cot^{-1} s$
(C) $\tan^{-1}(s+1)$
(D) $\cot^{-1}(s+1)$

101. The value of $\begin{vmatrix} 1 & \omega & \omega^2 \\ \omega & \omega^2 & 1 \\ \omega^2 & 1 & \omega \end{vmatrix}$, where ω is the cube root of unity, is

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

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102. Which of the following is not true?

(A) Centre of the group is abelian
(B) Kernel of the homomorphism is always normal
(C) Every subgroup of abelian group is abelian
(D) If $a \in G$ then $|a|$ need not divide $|G|$

103. Let a be an element of a group and let $|a| = 15$. Then the order of an element a^3 is

(A) 15
(B) 5
(C) 3
(D) 10

104. Let G be a group such that $a^2 = e$ for each $a \in G$, where e is the identity element of G. Then

(A) G is cyclic
(B) G is finite
(C) G is abelian
(D) G has a subgroup which is not normal

105. Let G be a group of order 49. Then

(A) G is abelian
(B) G is cyclic
(C) G is non-abelian
(D) centre of G has order 7

106. In the group $(Z, +)$, the sub group generated by 2 and 7 is

(A) Z
(B) $5Z$
(C) $9Z$
(D) $14Z$

107. Which of the following is true?

(A) For every positive integer n, Z_n is a field
(B) Every finite integral domain is a field
(C) Every ring has a zero divisor
(D) The ring of integers Z is isomorphic to the ring of integers 2Z

108. Which of the following statement is incorrect?

(A) Every basis has a same number of vectors
(B) (1, 0, 0), (0, 1, 0) is linearly independent in V_3
(C) Every linearly independent set is a basis of some vector space
(D) (1, 0, 0), (0, 1, 0), (1, 1, 0) is linearly independent in V_3

109. The map $T: V_2 \to V_2$ defined by $T(a, b) = (0,0)$ is

(A) linear, one to one
(B) linear but neither one to one nor onto
(C) linear, onto
(D) None of the above

110. Let S and T be linear maps from the vector space $V_2 \to V_2$ defined by $S(a,b) = (2a-b, a+3b)$ and $T(a,b) = (a+b, 2b-a)$, then

(A) $[S \circ T](a,b) = (3a, 7b-2a)$

(B) $[S \circ T](a,b) = (3b, 7a-2b)$

(C) $[S \circ T](a,b) = (7b-2a, 3a)$

(D) $[S \circ T](a,b) = (7a-2b, 3b)$

111. The characteristic polynomial of the matrix $A = \begin{bmatrix} 3 & 6 & 6 \\ 0 & 2 & 0 \\ -3 & -12 & -6 \end{bmatrix}$ is

(A) $(2-\lambda)(\lambda^2 - 3\lambda)$ (B) $(3-\lambda)(\lambda^2 - 3\lambda)$
(C) $(\lambda-2)(\lambda^2 + 3\lambda)$ (D) $(2-\lambda)(\lambda^2 - 4\lambda)$

112. The number of integers relatively prime to and less than 8 is

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

113. The area bounded by the curve $y = x^3$ and the lines $x = 1$, $x = 3$ and x - axis is

(A) 25 (B) 10
(C) 20 (D) 15

114. If the distance s traveled by a particle in time t is given by $s = 3t^2 - 12t + 8$, then the particle comes to rest when t is

(A) 8 (B) 4
(C) 3 (D) 2

115. The graph of $y = \sin x$ in the interval $(0, \pi)$ is

(A) concave (B) convex
(C) neither concave nor convex (D) parallel to $x -$ axis

116. If $E(X)$ is the mathematical expectation of the random variable X, then $E(3X+2)$ is equal to

(A) $3X+2$ (B) $2E(X)+3$
(C) $3E(X)$ (D) $3E(X)+2$

117. On Z define $a * b = a + b + 1$. The identity element in the group $(Z, *)$ is

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

118. Which of the following constitutes a group?

(A) $(Z, \cdot)$ (B) $(N, +)$
(C) $(Z, -)$ (D) $(Z, +)$

119. Let A_1, B_1, C_1 be the cofactors of the elements a_1, b_1, c_1 respectively in the determinant $\Delta = \begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}$. Then $a_2A_1 + b_2B_1 + c_2C_1$ is equal to

(A) Δ (B) 1
(C) $-\Delta$ (D) 0

120. Binomial distribution applies to

(A) rare events
(B) repeated two alternatives
(C) three events
(D) impossible events

121. If $2-i$ is a solution of the equation $x^2-4x+k=0$ then the value of k is

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

122. If $2\hat{i}-2\hat{j}+\hat{k}$ and $\hat{i}-m\hat{k}$ are perpendicular, then m is equal to

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

123. The volume of the solid generated by the area of $y=4x^2$, $x=0$, $y=16$ about $y-$axis is

(A) 16π
(B) 32π
(C) 64π
(D) 48π

124. The differential equation of $y=\frac{k}{x}$ is

(A) $\frac{dy}{dx}=\frac{y}{x}$
(B) $\frac{dy}{dx}=-\frac{y}{x}$
(C) $\frac{dy}{dx}=\frac{x}{y}$
(D) $\frac{dy}{dx}=-\frac{x}{y}$

125. If $E(X)=2$, $E(X^2)=8$, then $Var(X)$ is

(A) 0
(B) 4
(C) 8
(D) 6

126. The curve $y=2-x^2$ is

(A) concave upward
(B) convex downward
(C) straight line
(D) concave downward

127. If $f(x,y)=2x+ye^{-x}$, then $f_y(1,0)$ is equal to

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

128. Suppose that $f(-1)=3$ and that $f'(x)=0$ for all x. Then

(A) $f(x)=3$ for all x (B) $f(x)=x^3$
(C) $f(x)=3x^2+x$ for all x (D) None of the above

129. The graph of $\frac{x}{a}+\frac{y}{b}+\frac{z}{c}=1$ is a plane. Which planes have an equation of this form? All the planes except those through

(A) origin
(B) parallel to co-ordinate axis
(C) origin or parallel to co-ordinate axis
(D) None of the above

130. $a_n = \begin{cases} \frac{n}{2^n} & \text{n is odd} \\ \frac{1}{2^n} & \text{n is even} \end{cases}$

(A) diverges (B) converges
(C) converges to –1 (D) None of the above

131. $\sum_{n=1}^{\infty}\frac{(x-2)^{n-1}}{2^{n-1}(-1)^n}$

(A) converges $0<x<4$ (B) converges $0<x<5$
(C) diverges (D) can't say

132. The probability of getting a head and a tail when two unbiased coins are tossed simultaneously is

(A) $\frac{1}{4}$ (B) $\frac{1}{3}$

(C) $\frac{1}{5}$ (D) $\frac{1}{2}$

133. If $\frac{a}{3}=\frac{b}{4}=\frac{c}{7}$, then $\frac{a+b+c}{c}=$

(A) 1 (B) 3

(C) 5 (D) 2

134. The sum of n terms of an A.P. is $3n^2+5n$ and the k^{th} term of the A.P. is 152. The value of k is

(A) 21 (B) 23

(C) 25 (D) 19

135. The sum of all the numbers between 200 and 400 which are divisible by 7 is

(A) 8529 (B) 8629

(C) 8729 (D) 8829

136. If the roots of the equation $(m-n)x^2+(n-l)x+l=m$ are equal, then l, m, n are in

(A) A.P. (B) G.P.

(C) H.P. (D) None of the above

137. $\int \frac{dx}{x\log x}$ is

(A) $\frac{x}{\log x}+c$ (B) $\frac{\log x}{x}+c$

(C) $\log(\log x)+c$ (D) $\frac{1}{\log(\log x)}+c$

138. The inverse of the matrix $\begin{bmatrix} 2 & -1 \\ 0 & 1 \end{bmatrix}$ is

(A) $\frac{1}{2}\begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix}$
(B) $\frac{1}{2}\begin{bmatrix} 1 & 1 \\ 0 & 2 \end{bmatrix}$
(C) $\frac{1}{2}\begin{bmatrix} 1 & -1 \\ 0 & 2 \end{bmatrix}$
(D) $\frac{1}{2}\begin{bmatrix} 1 & 1 \\ 0 & -2 \end{bmatrix}$

139. If A, B, C are three sets such that $A \cup B = A \cup C$, $A \cap B = A \cap C$, then

(A) $A = C$
(B) $A = B$
(C) $A = A \cup B$
(D) $B = C$

140. Let $f: R \to R$ defined by $f(x) = \begin{cases} 1 \text{ if } x \text{ is rational} \\ -1 \text{ if } x \text{ is irrational} \end{cases}$

The value of $f(0.2333...)$ is

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

141. For the function $f(x) = \tan x$, $\frac{-\pi}{2} < x < \frac{\pi}{2}$, the range is

(A) $\left(\frac{-\pi}{2}, 0\right)$
(B) $\left(0, \frac{\pi}{2}\right)$
(C) $(0, \infty)$
(D) $(-\infty, \infty)$

142. $\underset{n\to\infty}{Lt}\left(1+\frac{1}{1!}+\frac{1}{2!}+\frac{1}{3!}+...+\frac{1}{n!}\right)$ is equal to

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

143. If p is a given integer, then $\frac{x^n}{n^p} \to \infty$ as $n \to \infty$, if

(A) $x < 1$
(B) $-1 < x < 1$
(C) $x > 1$
(D) None of these

144. The coefficient of x^7 in $(1-x)^4(1+x)^9$ is

(A) −45
(B) −47
(C) −48
(D) −49

145. $\underset{x\to 0}{Lt}\dfrac{e^x-1}{x}$ is equal to

(A) 0
(B) ∞
(C) 1
(D) −1

146. The order of the element 5 in $(Z,+)$ is

(A) ∞
(B) 5
(C) 0
(D) 1

147. If $\begin{vmatrix} x & 2 \\ 8 & y \end{vmatrix} = 0$, then the values of x and y are

(A) 2, −8
(B) 4, −4
(C) 1, −1
(D) 4, 4

148. If $|\vec{a}\times\vec{b}| = \sqrt{15}, |\vec{a}| = 2, |\vec{b}| = \sqrt{5}$, then the angle between $\vec{a}$ and $\vec{b}$ is

(A) $\frac{\pi}{6}$
(B) $\frac{\pi}{4}$
(C) $\frac{\pi}{3}$
(D) $\frac{\pi}{2}$

149. The angle between the curves $y=e^x$ and $y=e^{-x}$ is

(A) 0°
(B) 45°
(C) 90°
(D) 30°

150. $\hat{j}\times(\hat{k}\times\hat{j})$ is equal to

(A) 0
(B) $\hat{j}$
(C) $\hat{k}$
(D) $-\hat{k}$

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