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A

SET-X

PG(Hons)-EE-June, 2023

Mathematics (Hons.) Five Year Integrated

10213

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 _____

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1. If $A = \{x, y\}$, then which of the following statement is ***true*** ?

   (1) $\phi \in A$ (2) $y \subseteq A$

   (3) $\{y\} \in A$ (4) $\{x\} \subseteq A$

2. If A is any set, then :

   (1) $A \cup A = A$ (2) $A \cup A = \phi$

   (3) $A \cup A = \{A, \phi\}$ (4) $A \cup A = \{0\}$

3. In a class of 60 boys, there are 45 boys who play cards and 30 boys who play carrom. How many boys play cards only ?

   (1) 15 (2) 30

   (3) 20 (4) 10

4. Which of the following functions is neither even nor odd ?

   (1) $x^2 + 7$ (2) $x^7 + 2x^5$

   (3) $|x| + 4$ (4) $x + 2$

5. If A = {1, 3, 5, 7} and B = {2, 5}, then the number of relations from A to B is :

   (1) 64 (2) 128

   (3) 256 (4) 512

6. If $\frac{\cos x}{a} = \frac{\cos(x+\theta)}{b} = \frac{\cos(x+2\theta)}{c} = \frac{\cos(x+3\theta)}{d}$, then $\frac{a+c}{b+d}$ is equal to :

   (1) $\frac{a}{d}$ (2) $\frac{b}{c}$

   (3) $\frac{c}{d}$ (4) $\frac{d}{a}$

7. If in a triangle ABC, $\tan A + \tan B + \tan C > 0$, then the triangle is :

(1) Always acute angled triangle

(2) Always obtuse angled triangle

(3) Always equilateral triangle

(4) Nothing can be said about the type of triangle

8. The number of solutions of $\sum_{r=1}^{5} \cos rx = 5$ in the interval $[0, 2\pi]$ is :

(1) 10 (2) 5

(3) 1 (4) 0

9. If $1 + \sin\theta + \sin^2\theta + \ldots\ldots\ldots \infty = 4 + 2\sqrt{3}$, $0 < \theta < \pi$, $\theta \neq \frac{\pi}{2}$, then :

(1) $\theta = \frac{\pi}{3}$ (2) $\theta = \frac{\pi}{6}$

(3) $\frac{\pi}{3}$ or $\frac{\pi}{6}$ (4) $\theta = \frac{\pi}{3}$ or $\frac{2\pi}{3}$

10. If the multiplicative inverse of a complex number is $\frac{(\sqrt{3} + 4i)}{19}$, then the complex number itself is :

(1) $4 - i\sqrt{3}$ (2) $\sqrt{3} + 4i$ (3) $4 + i\sqrt{3}$ (4) $\sqrt{3} - 4i$

11. If 1, ω ω^2 are the three cube roots of unity, then the roots of the equation $(x-1)^3 = 8$ are :

(1) $3, 1 + 2\omega, 1 + 2\omega^2$ (2) $-1, -1, -2\omega$

(3) $3, 2\omega, 2\omega^2$ (4) None of these

12. If one root of the equation $x^2 - \lambda x + 12 = 0$ is even prime, and $x^2 + \lambda x + \mu = 0$ has equal roots, then μ is :

(1) 8 (2) 16 (3) 24 (4) 32

13. If α, β are roots of the equation $8x^2 - 3x + 27 = 0$, then the value of $\left[\left(\frac{\alpha^2}{\beta}\right)^{1/3} + \left(\frac{\beta^2}{\alpha}\right)^{1/3}\right]$ is :

(1) $\frac{1}{6}$ (2) $\frac{1}{5}$

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

14. The number of arrangements of the letters of the word BANANA in which the two N's do not appear adjacently is :

(1) 100 (2) 80

(3) 60 (4) 40

15. The maximum number of points of intersection of 8 straight lines, is :

(1) 28 (2) 56

(3) 8 (4) 16

16. Total number of words formed by using 2 vowels and 3 consonants taken from 4 vowels and 5 consonants is equal to :

(1) 60 (2) 120

(3) 720 (4) None of these

17. If the co-efficient of x^3 in the expansion of $(1 + ax)^4$ is 32, then a equals :

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

18. If the sum of the binomial coefficients in the expansion of $\left(x + \frac{1}{x}\right)^n$ is 64, then the term independent of x is equal to :

(1) 40 (2) 20 (3) 60 (4) 30

19. A series whose nth term is $\frac{n}{x}+y$, the sum of r terms will be :

(1) $\frac{r(r+1)}{2x}+ry$ (2) $\frac{r(r-1)}{2x}$

(3) $\frac{r}{2x}+ry$ (4) $\frac{r(r-1)}{2x}+ry$

20. If a, b, c are in G.P., then $\frac{b-a}{b-c}+\frac{b+a}{b+c}$ is equal to :

(1) b^2-c^2 (2) ab

(3) ac (4) zero

21. If a, b, c are three unequal numbers such that a, b, c are in A.P. and $b-a, c-b, a$ are in G.P., then $a : b : c$ is equal to :

(1) 1 : 2 : 3 (2) 1 : 2 : 4

(3) 3 : 2 : 1 (4) 2 : 3 : 5

22. If $\Sigma n, \frac{\sqrt{10}}{3}\Sigma n^2, \Sigma n^3$ are in G.P., then the value of n is :

(1) 3 (2) 1

(3) 0 (4) 4

23. The equation of straight line passing through the point (1, 2) and perpendicular to the line $x+y+1=0$ is :

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

(3) $x+y=1$ (4) $x-y=1$

24. The straight lines $x+y=0$, $3x+y-4=0$, and $x+3y-4=0$ form a triangle which is :

(1) Right angled (2) Equilateral

(3) Isosceles (4) None of these

25. The locus of the mid-point of the distance between the axes of the variable line $x \cos \alpha + y \sin \alpha = p$, where p is constant, is :

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

(3) $\frac{1}{x^2}-\frac{1}{y^2}=\frac{4}{p^2}$ (4) $x^2 - y^2 = \frac{4}{p^2}$

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

(1) Vertices of a rectangle

(2) Vertices of a square

(3) Vertices of a parallelogram

(4) Collinear

27. Radius of the largest circle which passes through the focus of the parabola $y^2 = 4x$ and contained in it, is :

(1) 4 (2) 8

(3) 2 (4) 5

28. The length of the latus rectum of an ellipse is one third of the major axis, its eccentricity would be :

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

(3) $\frac{1}{\sqrt{2}}$ (4) $\frac{2}{3}$

29. If $(a-2)x^2 + ay^2 = 4$ represents rectangular hyperbola, then a equals :

(1) 0 (2) 2

(3) 1 (4) 3

30. The line joining the points (1, 1, 2) and (3, –2, 1) meets the plane $3x + 2y + z = 6$ at the point :

(1) (1, 1, 2)

(2) (2, 3, –1)

(3) (3, 2, 1)

(4) (3, –2, 1)

31. The length of the perpendicular from (1, 0, 2) on the line $\frac{x+1}{3} = \frac{y-2}{-2} = \frac{z+1}{-1}$ is :

(1) $2\sqrt{3}$

(2) $3\sqrt{2}$

(3) $\frac{6\sqrt{3}}{5}$

(4) $\frac{3\sqrt{6}}{2}$

32. A plane meets the coordinate axes in A, B, C such that the centroid of the triangle ABC is the point (a, a, a). If the equation of the plane is $x + y + z = p$, then p is :

(1) a

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

(3) $3a$

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

33. $\lim\limits_{x \to 0} \frac{\sin(\pi \cos^2 x)}{x^2}$ is :

(1) $-\pi$

(2) π

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

(4) 1

34. Let $f(x) = 3x^{10} - 7x^8 + 5x^6 - 21x^3 + 3x^2 - 7$. Then $\lim\limits_{h \to 0} \frac{f(1-h) - f(1)}{h^3 + 3h}$ is equal to :

(1) $\frac{53}{3}$

(2) $\frac{25}{3}$

(3) $\frac{50}{3}$

(4) $\frac{22}{3}$

35. If $y=\sqrt{x+\sqrt{x+\sqrt{x+.....\infty}}}$, then $\frac{dy}{dx}$ is equal to :

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

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

36. If $\sin(x+y)=\log_e(x+y)$, then $\frac{dy}{dx}$ is equal to :

(1) 2 (2) 1

(3) –1 (4) –2

37. Two small square on a chess board are chosen at random. Probability that they have a common side is :

(1) $\frac{1}{3}$ (2) $\frac{1}{9}$

(3) $\frac{5}{18}$ (4) $\frac{1}{18}$

38. For n independent events A_i, $P(A_i)=\frac{1}{(1+i)}$, $i = 1, 2, 3, ..., n$. The probability that at least one of the events occurs is :

(1) $\frac{1}{n}$ (2) $\frac{1}{(n+1)}$

(3) $\frac{n}{(n+1)}$ (4) None of these

39. Two dice are thrown, the probability that the sum of the points on two dice will be 7 is :

(1) $\frac{5}{36}$ (2) $\frac{6}{36}$

(3) $\frac{7}{36}$ (4) $\frac{8}{36}$

40. A single letter is selected at random from the word "PROBABILITY". The probability that it is a vowel, is :

(1) $\frac{3}{11}$ (2) $\frac{4}{11}$

(3) $\frac{2}{11}$ (4) zero

41. If $4\sin^{-1}x+\cos^{-1}x=\pi$, then x is equal to :

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

(3) $\frac{\sqrt{3}}{2}$ (4) $\frac{1}{\sqrt{2}}$

42. $\tan^{-1}\left(\tan\frac{3\pi}{4}\right)$ is equal to :

(1) $-\frac{\pi}{4}$ (2) $\frac{\pi}{4}$

(3) $\frac{3\pi}{4}$ (4) $-\frac{3\pi}{4}$

43. The principal value of $\sin^{-1}\left(-\frac{\sqrt{3}}{2}\right)$ is equal to :

(1) $-\frac{2\pi}{3}$ (2) $\frac{4\pi}{3}$

(3) $-\frac{\pi}{3}$ (4) $\frac{5\pi}{3}$

44. If $A=\begin{bmatrix}1 & 0\\ -1 & 7\end{bmatrix}$ and $A^2=8A+KI_2$, then K is equal to :

(1) –1 (2) 1

(3) 7 (4) –7

45. If $A=\begin{bmatrix} 2 & 3 & 4 \\ 5 & -3 & 8 \\ 9 & 2 & 16 \end{bmatrix}$, then trace of A is :

(1) 15 (2) 17

(3) 8 (4) 25

46. If A is a square matrix of order $n \times n$, then $adj\ (adj\ A)$ is equal to :

(1) $|A|^n A$ (2) $|A|^{n-2} A$

(3) $|A|^{n-1} A$ (4) $|A|^{n-3} A$

47. If α, β are non-real numbers satisfying $x^3 - 1 = 0$, then the value of $\begin{vmatrix} \lambda+1 & \alpha & \beta \\ \alpha & \lambda+\beta & 1 \\ \beta & 1 & \lambda+\alpha \end{vmatrix}$ is equal to :

(1) λ^3 (2) $\lambda^3 + 1$

(3) $\lambda^3 - 1$ (4) 0

48. The value of x for which the matrix $A=\begin{bmatrix} 6 & x-2 \\ 3 & x \end{bmatrix}$ has no inverse is :

(1) 0 (2) 2

(3) –2 (4) 3

49. If $A=\begin{pmatrix} 1 & x+3 \\ 2x+1 & x-1 \end{pmatrix}$ is symmetric, then x is equal to :

(1) 5 (2) 7

(3) 3 (4) 2

50. If $2^x + 2^y = 2^{x+y}$, then the value of $\frac{dy}{dx}$ at $x = y = 1$ is :

(1) 0 (2) –1 (3) 1 (4) 2

51. If $y^2 = ax^2 + bx + c$, then $y^3 \frac{d^2y}{dx^2}$ is :

(1) a constant

(2) a function of x only

(3) a function of y only

(4) a function of x and y

52. Let f be a function satisfying $f(x+y) = f(x) + f(y)$ and $f(x) = x^2 g(x)$ for all x and y, where $g(x)$ is a continuous function, then $f'(x)$ is equal to :

(1) $g'(x)$ (2) $g(0)$

(3) $g(0) + g'(x)$ (4) 0

53. Which of the following is ***not*** continuous for all x ?

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

(2) $\frac{\cos x}{|\cos x|}$

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

(4) $\sin|x| + |\sin x|$

54. The line $\frac{x}{a} + \frac{y}{b} = 1$ touches the curve $y = be^{-x/a}$ at the point :

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

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

55. If $a < 0$, the function $f(x) = e^{ax} + e^{-ax}$ is a monotonically decreasing function for values of x given by :

(1) $x < 1$ (2) $x > 1$ (3) $x < 0$ (4) $x > 0$

56. Let $f(x)$ be differential function for all x. If $f(1) = -2$ and $f'(x) \geq 2$ for all x in $[1, 6]$, then minimum value of $f(6)$ is equal to :

(1) 8 (2) 6

(3) 4 (4) 2

57. $\int \frac{10x^9 + 10^x \log_e 10}{10^x + x^{10}} dx$ is equal to :

(1) $\log (10^x + x^{10}) + c$

(2) $\frac{1}{10^x + x^{10}} + c$

(3) $\log (x^9 + 10^x + x^{10}) + c$

(4) None of these

58. $\int \sec^3 x \, dx$ is equal to :

(1) $\frac{1}{3}[\sec x . \tan x + \log(\sec x + \tan x)]$

(2) $\frac{1}{2}[\sec x . \tan x + \log(\sec x + \tan x)]$

(3) $\frac{1}{4}[\sec x . \tan x + \log(\sec x + \tan x)]$

(4) $\tan x . \sec^2 x$

59. $\int \frac{x-1}{(x-3)(x-2)} dx$ is equal to :

(1) $\log (x-3)^2 + \log (x-2) + c$

(2) $\log (x-3) + \log (x-2) + c$

(3) $\log (x-3)^2 - \log (x-2) + c$

(4) $\log (x-3) - \log (x-2) + c$

60. $\int \frac{dx}{x^2+x+1}$ is equal to :

(1) $\frac{\sqrt{3}}{2}\tan^{-1}\left(\frac{2x+1}{\sqrt{3}}\right)+c$

(2) $\tan^{-1}\left(\frac{2x+1}{\sqrt{3}}\right)+c$

(3) $\frac{1}{\sqrt{3}}\tan^{-1}\left(\frac{2x+1}{\sqrt{3}}\right)+c$

(4) $\frac{2}{\sqrt{3}}\tan^{-1}\left(\frac{2x+1}{\sqrt{3}}\right)+c$

61. If $f(a-x)=f(x)$, then $\int_0^a x\,f(x)\,dx$ is equal to :

(1) $\frac{a}{2}\int_0^a f(x)\,dx$

(2) $a\int_0^a f(x)\,dx$

(3) $\frac{a^2}{2}\int_0^a f(x)\,dx$

(4) $\frac{2}{a}\int_0^a f(x)\,dx$

62. $\int_{-1}^{1} \sin^3 x.\cos^2 x\,dx$ is equal to :

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

(2) 1

(3) 2

(4) 0

63. The area of the region bounded by the curve $x^2=4y$, line $x=2$ and x-axis is :

(1) 1

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

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

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

64. The area enclosed between the curves $y = ax^2$, $x = ay^2$ $(a > 0)$ is 1 sq. unit. Then the value of a is :

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

(3) $\frac{1}{\sqrt{3}}$ (4) 1

65. If p and q are order and degree of differential equation $y^2\left(\frac{d^2y}{dx^2}\right)^2 + 3x\left(\frac{dy}{dx}\right) + x^2y^2 = \sin x$, then :

(1) $p > q$ (2) $\frac{p}{q} = \frac{1}{2}$

(3) $p = q$ (4) $p < q$

66. The integrating factor of differential equation $\frac{dy}{dx} + \frac{1}{x}y = 3x$ is :

(1) x (2) 0

(3) e^x (4) $\frac{1}{x}$

67. The solution of differential equation $(\cos x)\cos y\,dx + (\sin x)\sin y\,dy = 0$ is :

(1) $\tan x = c$

(2) $\cos x = c \sin y$

(3) $\sec x - \sec y = c$

(4) $\sin x = c \cos y$

68. The elimination of A and B from the equation $y^2 = Ax + B$ gives the differential equation of order :

(1) First (2) Second

(3) Third (4) Zero

69. If $\alpha = 2\hat{i} + 3\hat{j} - \hat{k}$, $\beta = -\hat{i} + 2\hat{j} - 4\hat{k}$, $\gamma = \hat{i} + \hat{j} + \hat{k}$, then $(\alpha \times \beta).(\alpha \times \gamma)$ is equal to :

(1) 64 (2) 74

(3) –74 (4) –64

70. If $\vec{a}$ and $\vec{b}$ are two vectors such that $\vec{a}.\vec{b} = 0$ and $\vec{a} \times \vec{b} = \vec{0}$, then :

(1) either $\vec{a}$ or $\vec{b}$ is a null vector

(2) $\vec{a}$ is parallel to $\vec{b}$

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

(4) None of these

71. The two vectors $\vec{a} = 2\hat{i} + \hat{j} + 3\hat{k}$, $\vec{b} = 4\hat{i} - \lambda\hat{j} + 6\hat{k}$ are parallel if λ is equal to :

(1) 2 (2) –3

(3) 3 (4) –2

72. If a straight line in space is equally inclined to the co-ordinate axes, the cosine of its angle of inclination to any one of the axes is :

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

(3) $\frac{1}{2}$ (4) $\frac{1}{\sqrt{2}}$

73. If the lines $\frac{x-1}{2}, \frac{y+1}{3} = \frac{z-1}{4}$ and $\frac{x-3}{1} = \frac{y-k}{2} = \frac{z}{1}$ intersect, then the value of k is :

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

(3) $\frac{9}{2}$ (4) $-\frac{3}{2}$

74. Distance of the point (2, 3, 4) from the plane $3x-6y+2z+11=0$ is :

(1) 2 (2) 1

(3) 0 (4) 3

75. If the straight line $\frac{x-3}{-4}=\frac{y-4}{-7}=\frac{z+3}{13}$ lies in the plane $5x-y+z=a$, then a is equal to :

(1) 8 (2) 9

(3) 2 (4) –3

76. A fair coin is tossed repeatedly. If tail appears on first four tosses, then the probability of head appearing on fifth toss is :

(1) $\frac{1}{5}$ (2) $\frac{31}{32}$

(3) $\frac{1}{32}$ (4) $\frac{1}{2}$

77. Seven white balls and three black balls are placed in a row. The probability that no two black balls are placed adjacently equals :

(1) $\frac{1}{3}$ (2) $\frac{2}{15}$

(3) $\frac{7}{15}$ (4) $\frac{4}{15}$

78. A man is known to speak truth in 75% cases. If he throws an unbiased die and tells his friends that it is a six, then the probability that it is actually a six, is :

(1) $\frac{1}{6}$ (2) $\frac{1}{8}$

(3) $\frac{3}{8}$ (4) $\frac{3}{4}$

79. Let $f: R \to R$ be defined by $f(x) = 3x - 4$, then $f^{-1}(x)$ is equal to :

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

(3) $3x + 4$ (4) Not defined

80. The function $f: R \to R$ defined by $f(x) = (x - 1)(x - 2)(x - 3)$ is :

(1) one-one but not onto

(2) onto but not one-one

(3) both one-one and onto

(4) neither one-one nor onto

81. A linear function $Z = ax + by$, where a, b are constants, which has to be maximized or minimized is called a linear :

(1) Subjective function

(2) Collective function

(3) Objective function

(4) None of these

82. Any point in the feasible region that gives the maximum or minimum value of the objective function is called an :

(1) Optical solution

(2) Optimal solution

(3) Practical solution

(4) None of these

83. Ten eggs are drawn successively with replacement from a lot containing 10% defective eggs. Find the probability that there is at least one defective egg :

(1) $1-\frac{9^{10}}{10^{10}}$

(2) $1-\frac{9^{10}-1}{10^{10}}$

(3) $1-\frac{9^{9}}{10^{9}}$

(4) $1-\frac{9^{10}}{10^{9}}$

84. Let X be a random variable whose possible values $x_1, x_2, x_3, \ldots\ldots, x_n$ occur with probabilities $p_1, p_2, p_3, \ldots\ldots, p_n$. The mean of random variable X is given by :

(1) $E(X)=\sum_{i=1}^{n}\frac{p_i}{x_i}$

(2) $E(X)=\sum_{i=1}^{n}\frac{x_i}{p_i}$

(3) $E(X)=\sum_{i=1}^{n}(p_i+x_i)$

(4) $E(X)=\sum_{i=1}^{n}p_i x_i$

85. A region is said to be convex, if the line segment joining any two arbitrary points of the region lies :

(1) Entirely within the region

(2) Entirely outside the region

(3) Anywhere within or outside the region

(4) None of these

86. If $P(n)$ is the statement, "$\frac{1}{1\times2}+\frac{1}{2\times3}+\frac{1}{3\times4}+\ldots\ldots\ldots+\frac{1}{n(n+1)}=\frac{n}{n+1}$", where $n\in N$, then $P(2)$ is the statement :

(1) $\frac{1}{2}+\frac{1}{6}=\frac{2}{3}$ (2) $\frac{1}{1\times2}=\frac{1}{1+1}$

(3) $\frac{1}{1\times2}+\frac{1}{3\times4}=\frac{7}{12}$ (4) None of these

87. The solution of linear inequation $2x + 10 \geq 0$ is :

(1) $x \in (-5, \infty)$ (2) $x \in (-\infty, \infty)$

(3) $x \in [-5, \infty)$ (4) $x \leq -5$

88. Which of the following is ***not*** correct ?

(1) $x \geq 4 \Rightarrow x - 3 \geq 1$

(2) $x \leq y \Rightarrow -3x \geq -3y$

(3) $2x - 6y \geq 0 \Rightarrow x \geq 3y$

(4) $4x \geq 8 \Rightarrow x \leq 2$

89. A company manufactures toys and its cost equation for a week is $C = 300 + 1.5x$ and its revenue equation is $R = 2x$, where x is the number of toys sold in a week. How many toys must be sold for the company to realize a profit ?

(1) Between 500 and 600

(2) More than 600

(3) At most 550

(4) None of these

90. A sentence is a statement if it is :

(1) Always true (2) Always false

(3) Either true or false but not both (4) Sometimes true, sometimes false

91. Let p and q stand for, the statements :

'Sohan is intelligent' and 'Sohan is hardworking'. Then the statement 'Sohan is not intelligent and Sohan is hardworking' is denoted by :

(1) $p \wedge q$ (2) $\sim p \wedge \sim q$

(3) $\sim p \wedge q$ (4) None of these

92. The disjunction $p \vee q$ is false only when :

(1) p is false

(2) p and q are both false

(3) p or q are both false

(4) p is false and q may be true

93. The mean of the first n natural numbers is given by :

(1) $\frac{n}{2}$ (2) $\frac{n(n+1)}{2}$

(3) $\frac{n+1}{2n}$ (4) $\frac{n+1}{2}$

94. Which of the following is ***not*** a merit of standard deviation ?

(1) It is based on all the items

(2) It is simple to understand

(3) It is unduly affected by the extreme items

(4) It has sampling stability

95. A measure of scatteredness of items about some average is called a measure of :

(1) Dispersion (2) Conclusion

(3) Logic (4) None of these

96. The coefficient of Standard Deviation (S.D.) is given by :

(1) $\left(\frac{\text{S.D.}}{100}\right)$ (2) $\left(\frac{\text{S.D.}}{\bar{x}}\right)100$

(3) $\left(\frac{\text{S.D.}}{\bar{x}}\right)$ (4) $\left(\frac{\bar{x}}{\text{S.D.}}\right)$

97. How many numbers are there between 100 and 1000 such that every digit is either 2 or 9 ?

(1) 8 (2) 6

(3) 4 (4) 48

98. In the expansion of $\left(x+\frac{1}{x}\right)^6$, the third term from the end is :

(1) $\frac{1}{x^2}$ (2) $\frac{15}{x^2}$ (3) $\frac{15}{x^4}$ (4) ${}^6C_4$

99. If $(x^2-5x+7)^2-(x-2)(x-3)=1$ and let $y=x^2-5x$. Then the values of y are :

(1) –7, –6 (2) 3, 2

(3) –7, 6 (4) $\frac{5\pm i\sqrt{3}}{2}$

100. For the standard ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$, which of the following is ***true*** ?

(1) $a^2=b^2(1+e^2)$

(2) $b^2=a^2(e^2-1)$

(3) $a^2=\frac{b^2}{2}(1-e^2)$

(4) $b^2=a^2(1-e^2)$

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B

SET-X

PG(Hons)-EE-June, 2023

Mathematics (Hons.) Five Year Integrated

10222

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 two vectors $\vec{a} = 2\hat{i} + \hat{j} + 3\hat{k}$, $\vec{b} = 4\hat{i} - \lambda\hat{j} + 6\hat{k}$ are parallel if λ is equal to :

(1) 2 (2) 3

(3) 3 (4) 2

2. If a straight line in space is equally inclined to the co-ordinate axes, the cosine of its angle of inclination to any one of the axes is :

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

(3) $\frac{1}{2}$ (4) $\frac{1}{\sqrt{2}}$

3. If the lines $\frac{x-1}{2}, \frac{y+1}{3} = \frac{z-1}{4}$ and $\frac{x-3}{1} = \frac{y-k}{2} = \frac{z}{1}$ intersect, then the value of k is :

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

(3) $\frac{9}{2}$ (4) $-\frac{3}{2}$

4. Distance of the point (2, 3, 4) from the plane $3x - 6y + 2z + 11 = 0$ is :

(1) 2 (2) 1

(3) 0 (4) 3

5. If the straight line $\frac{x-3}{-4} = \frac{y-4}{-7} = \frac{z+3}{13}$ lies in the plane $5x - y + z = a$, then a is equal to :

(1) 8 (2) 9 (3) 2 (4) 3

6. A fair coin is tossed repeatedly. If tail appears on first four tosses, then the probability of head appearing on fifth toss is :

(1) $\frac{1}{5}$ (2) $\frac{31}{32}$ (3) $\frac{1}{32}$ (4) $\frac{1}{2}$

7. Seven white balls and three black balls are placed in a row. The probability that no two black balls are placed adjacently equals :

(1) $\frac{1}{3}$ (2) $\frac{2}{15}$

(3) $\frac{7}{15}$ (4) $\frac{4}{15}$

8. A man is known to speak truth in 75% cases. If he throws an unbiased die and tells his friends that it is a six, then the probability that it is actually a six, is :

(1) $\frac{1}{6}$ (2) $\frac{1}{8}$

(3) $\frac{3}{8}$ (4) $\frac{3}{4}$

9. Let $f: R \to R$ be defined by $f(x) = 3x - 4$, then $f^{-1}(x)$ is equal to :

(1) $\frac{1}{3}(x+4)$

(2) $\frac{x}{3} - 4$

(3) $3x + 4$

(4) Not defined

10. The function $f: R \to R$ defined by $f(x) = (x-1)(x-2)(x-3)$ is :

(1) one-one but not onto

(2) onto but not one-one

(3) both one-one and onto

(4) neither one-one nor onto

11. If $y^2 = ax^2 + bx + c$, then $y^3 \frac{d^2y}{dx^2}$ is :

(1) a constant

(2) a function of x only

(3) a function of y only

(4) a function of x and y

12. Let f be a function satisfying $f(x+y) = f(x) + f(y)$ and $f(x) = x^2 g(x)$ for all x and y, where $g(x)$ is a continuous function, then $f'(x)$ is equal to :

(1) $g'(x)$ (2) $g(0)$

(3) $g(0) + g'(x)$ (4) 0

13. Which of the following is ***not*** continuous for all x ?

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

(2) $\frac{\cos x}{|\cos x|}$

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

(4) $\sin|x| + |\sin x|$

14. The line $\frac{x}{a} + \frac{y}{b} = 1$ touches the curve $y = be^{-x/a}$ at the point :

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

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

15. If $a < 0$, the function $f(x) = e^{ax} + e^{-ax}$ is a monotonically decreasing function for values of x given by :

(1) $x < 1$ (2) $x > 1$ (3) $x < 0$ (4) $x > 0$

16. Let $f(x)$ be differential function for all x. If $f(1) = -2$ and $f'(x) \geq 2$ for all x in $[1, 6]$, then minimum value of $f(6)$ is equal to :

(1) 8

(2) 6

(3) 4

(4) 2

17. $\int \frac{10x^9 + 10^x \log_e 10}{10^x + x^{10}} dx$ is equal to :

(1) $\log (10^x + x^{10}) + c$

(2) $\frac{1}{10^x + x^{10}} + c$

(3) $\log (x^9 + 10^x + x^{10}) + c$

(4) None of these

18. $\int \sec^3 x \, dx$ is equal to :

(1) $\frac{1}{3}[\sec x . \tan x + \log(\sec x + \tan x)]$

(2) $\frac{1}{2}[\sec x . \tan x + \log(\sec x + \tan x)]$

(3) $\frac{1}{4}[\sec x . \tan x + \log(\sec x + \tan x)]$

(4) $\tan x . \sec^2 x$

19. $\int \frac{x-1}{(x-3)(x-2)} dx$ is equal to :

(1) $\log (x-3)^2 + \log (x-2) + c$

(2) $\log (x-3) + \log (x-2) + c$

(3) $\log (x-3)^2 - \log (x-2) + c$

(4) $\log (x-3) - \log (x-2) + c$

20. $\int \frac{dx}{x^2+x+1}$ is equal to :

(1) $\frac{\sqrt{3}}{2}\tan^{-1}\left(\frac{2x+1}{\sqrt{3}}\right)+c$

(2) $\tan^{-1}\left(\frac{2x+1}{\sqrt{3}}\right)+c$

(3) $\frac{1}{\sqrt{3}}\tan^{-1}\left(\frac{2x+1}{\sqrt{3}}\right)+c$

(4) $\frac{2}{\sqrt{3}}\tan^{-1}\left(\frac{2x+1}{\sqrt{3}}\right)+c$

21. The length of the perpendicular from (1, 0, 2) on the line $\frac{x+1}{3}=\frac{y-2}{-2}=\frac{z+1}{-1}$ is :

(1) $2\sqrt{3}$

(2) $3\sqrt{2}$

(3) $\frac{6\sqrt{3}}{5}$

(4) $\frac{3\sqrt{6}}{2}$

22. A plane meets the coordinate axes in A, B, C such that the centroid of the triangle ABC is the point (a, a, a). If the equation of the plane is $x+y+z=p$, then p is :

(1) a

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

(3) $3a$

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

23. $\lim_{x\to 0}\frac{\sin(\pi\cos^2 x)}{x^2}$ is :

(1) $-\pi$

(2) π

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

(4) 1

6

24. Let $f(x) = 3x^{10} - 7x^8 + 5x^6 - 21x^3 + 3x^2 - 7$. Then $\lim\limits_{h \to 0} \dfrac{f(1-h) - f(1)}{h^3 + 3h}$ is equal to :

(1) $\dfrac{53}{3}$

(2) $\dfrac{25}{3}$

(3) $\dfrac{50}{3}$

(4) $\dfrac{22}{3}$

25. If $y = \sqrt{x + \sqrt{x + \sqrt{x + \ldots\ldots\infty}}}$, then $\dfrac{dy}{dx}$ is equal to :

(1) $2\sqrt{x}$

(2) $\dfrac{1}{2y-1}$

(3) $\sqrt{x}$

(4) None of these

26. If $\sin(x+y) = \log_e(x+y)$, then $\dfrac{dy}{dx}$ is equal to :

(1) 2

(2) 1

(3) -1

(4) -2

27. Two small square on a chess board are chosen at random. Probability that they have a common side is :

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

(2) $\dfrac{1}{9}$

(3) $\dfrac{5}{18}$

(4) $\dfrac{1}{18}$

28. For n independent events A_i, $P(A_i) = \dfrac{1}{(1+i)}$, $i = 1, 2, 3, \ldots\ldots, n$. The probability that at least one of the events occurs is :

(1) $\dfrac{1}{n}$

(2) $\dfrac{1}{(n+1)}$

(3) $\dfrac{n}{(n+1)}$

(4) None of these

29. Two dice are thrown, the probability that the sum of the points on two dice will be 7 is :

(1) $\frac{5}{36}$ (2) $\frac{6}{36}$

(3) $\frac{7}{36}$ (4) $\frac{8}{36}$

30. A single letter is selected at random from the word "PROBABILITY". The probability that it is a vowel, is :

(1) $\frac{3}{11}$ (2) $\frac{4}{11}$

(3) $\frac{2}{11}$ (4) zero

31. If 1, ω ω^2 are the three cube roots of unity, then the roots of the equation $(x-1)^3 = 8$ are :

(1) $3, 1+2\omega, 1+2\omega^2$ (2) $-1, -1, -2\omega$

(3) $3, 2\omega, 2\omega^2$ (4) None of these

32. If one root of the equation $x^2 - \lambda x + 12 = 0$ is even prime, and $x^2 + \lambda x + \mu = 0$ has equal roots, then μ is :

(1) 8 (2) 16 (3) 24 (4) 32

33. If α, β are roots of the equation $8x^2 - 3x + 27 = 0$, then the value of $\left[\left(\frac{\alpha^2}{\beta}\right)^{1/3} + \left(\frac{\beta^2}{\alpha}\right)^{1/3}\right]$ is :

(1) $\frac{1}{6}$ (2) $\frac{1}{5}$

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

34. The number of arrangements of the letters of the word BANANA in which the two N's do not appear adjacently is :

(1) 100 (2) 80

(3) 60 (4) 40

35. The maximum number of points of intersection of 8 straight lines, is :

(1) 28 (2) 56

(3) 8 (4) 16

36. Total number of words formed by using 2 vowels and 3 consonants taken from 4 vowels and 5 consonants is equal to :

(1) 60 (2) 120

(3) 720 (4) None of these

37. If the co-efficient of x^3 in the expansion of $(1 + ax)^4$ is 32, then a equals :

(1) 4 (2) 3

(3) 2 (4) 6

38. If the sum of the binomial coefficients in the expansion of $\left(x+\frac{1}{x}\right)^n$ is 64, then the term independent of x is equal to :

(1) 40 (2) 20

(3) 60 (4) 30

39. A series whose nth term is $\frac{n}{x}+y$, the sum of r terms will be :

(1) $\frac{r(r+1)}{2x}+ry$ (2) $\frac{r(r-1)}{2x}$

(3) $\frac{r}{2x}+ry$ (4) $\frac{r(r-1)}{2x}+ry$

40. If a, b, c are in G.P., then $\frac{b-a}{b-c}+\frac{b+a}{b+c}$ is equal to :

(1) b^2-c^2 (2) ab

(3) ac (4) zero

41. Let p and q stand for, the statements :

'Sohan is intelligent' and 'Sohan is hardworking'. Then the statement 'Sohan is not intelligent and Sohan is hardworking' is denoted by :

(1) $p \wedge q$ (2) $\sim p \wedge \sim q$

(3) $\sim p \wedge q$ (4) None of these

42. The disjunction $p \vee q$ is false only when :

(1) p is false

(2) p and q are both false

(3) p or q are both false

(4) p is false and q may be true

43. The mean of the first n natural numbers is given by :

(1) $\frac{n}{2}$ (2) $\frac{n(n+1)}{2}$

(3) $\frac{n+1}{2n}$ (4) $\frac{n+1}{2}$

44. Which of the following is ***not*** a merit of standard deviation ?

(1) It is based on all the items

(2) It is simple to understand

(3) It is unduly affected by the extreme items

(4) It has sampling stability

45. A measure of scatteredness of items about some average is called a measure of :

(1) Dispersion (2) Conclusion

(3) Logic (4) None of these

46. The coefficient of Standard Deviation (S.D.) is given by :

(1) $\left(\frac{\text{S.D.}}{100}\right)$

(2) $\left(\frac{\text{S.D.}}{\bar{x}}\right)100$

(3) $\left(\frac{\text{S.D.}}{\bar{x}}\right)$

(4) $\left(\frac{\bar{x}}{\text{S.D.}}\right)$

47. How many numbers are there between 100 and 1000 such that every digit is either 2 or 9 ?

(1) 8 (2) 6

(3) 4 (4) 48

48. In the expansion of $\left(x+\frac{1}{x}\right)^6$, the third term from the end is :

(1) $\frac{1}{x^2}$ (2) $\frac{15}{x^2}$

(3) $\frac{15}{x^4}$ (4) ${}^6C_4$

49. If $(x^2-5x+7)^2-(x-2)(x-3)=1$ and let $y=x^2-5x$. Then the values of y are :

(1) –7, –6 (2) 3, 2

(3) –7, 6 (4) $\frac{5\pm i\sqrt{3}}{2}$

50. For the standard ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$, which of the following is *true* ?

(1) $a^2 = b^2(1 - e^2)$ (2) $b^2 = a^2(e^2 - 1)$

(3) $a^2 = \frac{b^2}{2}(1 - e^2)$ (4) $b^2 = a^2(1 - e^2)$

51. If $f(a - x) = f(x)$, then $\int_0^a x f(x)\,dx$ is equal to :

(1) $\frac{a}{2}\int_0^a f(x)\,dx$ (2) $a\int_0^a f(x)\,dx$

(3) $\frac{a^2}{2}\int_0^a f(x)\,dx$ (4) $\frac{2}{a}\int_0^a f(x)\,dx$

52. $\int_{-1}^{1} \sin^3 x . \cos^2 x\,dx$ is equal to :

(1) $\frac{1}{2}$ (2) 1 (3) 2 (4) 0

53. The area of the region bounded by the curve $x^2 = 4y$, line $x = 2$ and x-axis is :

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

(3) $\frac{4}{3}$ (4) $\frac{8}{3}$

54. The area enclosed between the curves $y = ax^2$, $x = ay^2$ $(a > 0)$ is 1 sq. unit. Then the value of a is :

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

(3) $\frac{1}{\sqrt{3}}$ (4) 1

55. If p and q are order and degree of differential equation $y^2\left(\frac{d^2y}{dx^2}\right)^2 + 3x\left(\frac{dy}{dx}\right) + x^2y^2 = \sin x$, then :

(1) $p > q$

(2) $\frac{p}{q} = \frac{1}{2}$

(3) $p = q$

(4) $p < q$

56. The integrating factor of differential equation $\frac{dy}{dx} + \frac{1}{x}y = 3x$ is :

(1) x

(2) 0

(3) e^x

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

57. The solution of differential equation $(\cos x)\cos y\,dx + (\sin x)\sin y\,dy = 0$ is :

(1) $\tan x = c$

(2) $\cos x = c \sin y$

(3) $\sec x - \sec y = c$

(4) $\sin x = c \cos y$

58. The elimination of A and B from the equation $y^2 = Ax + B$ gives the differential equation of order :

(1) First

(2) Second

(3) Third

(4) Zero

59. If $\alpha = 2\hat{i} + 3\hat{j} - \hat{k}$, $\beta = -\hat{i} + 2\hat{j} - 4\hat{k}$, $\gamma = \hat{i} + \hat{j} + \hat{k}$, then $(\alpha \times \beta).(\alpha \times \gamma)$ is equal to :

(1) 64

(2) 74

(3) –74

(4) –64

60. If $\vec{a}$ and $\vec{b}$ are two vectors such that $\vec{a}.\vec{b} = 0$ and $\vec{a} \times \vec{b} = \vec{0}$, then :

(1) either $\vec{a}$ or $\vec{b}$ is a null vector

(2) $\vec{a}$ is parallel to $\vec{b}$

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

(4) None of these

61. A linear function $Z = ax + by$, where a, b are constants, which has to be maximized or minimized is called a linear :

(1) Subjective function

(2) Collective function

(3) Objective function

(4) None of these

62. Any point in the feasible region that gives the maximum or minimum value of the objective function is called an :

(1) Optical solution

(2) Optimal solution

(3) Practical solution

(4) None of these

63. Ten eggs are drawn successively with replacement from a lot containing 10% defective eggs. Find the probability that there is at least one defective egg :

(1) $1 - \frac{9^{10}}{10^{10}}$

(2) $1 - \frac{9^{10} - 1}{10^{10}}$

(3) $1 - \frac{9^{9}}{10^{9}}$

(4) $1 - \frac{9^{10}}{10^{9}}$

64. Let X be a random variable whose possible values $x_1, x_2, x_3, \ldots\ldots, x_n$ occur with probabilities $p_1, p_2, p_3, \ldots\ldots, p_n$. The mean of random variable X is given by :

(1) $E(X) = \sum_{i=1}^{n} \frac{p_i}{x_i}$

(2) $E(X) = \sum_{i=1}^{n} \frac{x_i}{p_i}$

(3) $E(X) = \sum_{i=1}^{n} (p_i + x_i)$

(4) $E(X) = \sum_{i=1}^{n} p_i x_i$

65. A region is said to be convex, if the line segment joining any two arbitrary points of the region lies :

(1) Entirely within the region

(2) Entirely outside the region

(3) Anywhere within or outside the region

(4) None of these

66. If $P(n)$ is the statement, "$\frac{1}{1\times 2} + \frac{1}{2\times 3} + \frac{1}{3\times 4} + \ldots\ldots\ldots + \frac{1}{n(n+1)} = \frac{n}{n+1}$", where $n \in N$, then $P(2)$ is the statement :

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

(2) $\frac{1}{1\times 2} = \frac{1}{1+1}$

(3) $\frac{1}{1\times 2} + \frac{1}{3\times 4} = \frac{7}{12}$

(4) None of these

67. The solution of linear inequation $2x + 10 \geq 0$ is :

(1) $x \in (-5, \infty)$

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

(3) $x \in [-5, \infty)$

(4) $x \leq -5$

68. Which of the following is ***not*** correct ?

(1) $x \geq 4 \Rightarrow x - 3 \geq 1$

(2) $x \leq y \Rightarrow -3x \geq -3y$

(3) $2x - 6y \geq 0 \Rightarrow x \geq 3y$

(4) $4x \geq 8 \Rightarrow x \leq 2$

69. A company manufactures toys and its cost equation for a week is $C = 300 + 1.5x$ and its revenue equation is $R = 2x$, where x is the number of toys sold in a week. How many toys must be sold for the company to realize a profit ?

(1) Between 500 and 600

(2) More than 600

(3) At most 550

(4) None of these

70. A sentence is a statement if it is :

(1) Always true

(2) Always false

(3) Either true or false but not both

(4) Sometimes true, sometimes false

71. If $4\sin^{-1} x + \cos^{-1} x = \pi$, then x is equal to :

(1) 0

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

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

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

72. $\tan^{-1}\left(\tan\frac{3\pi}{4}\right)$ is equal to :

(1) $-\frac{\pi}{4}$

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

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

(4) $-\frac{3\pi}{4}$

73. The principal value of $\sin^{-1}\left(-\frac{\sqrt{3}}{2}\right)$ is equal to :

(1) $-\frac{2\pi}{3}$ (2) $\frac{4\pi}{3}$

(3) $-\frac{\pi}{3}$ (4) $\frac{5\pi}{3}$

74. If $A=\begin{bmatrix} 1 & 0 \\ -1 & 7 \end{bmatrix}$ and $A^2 = 8A + KI_2$, then K is equal to :

(1) -1 (2) 1

(3) 7 (4) -7

75. If $A=\begin{bmatrix} 2 & 3 & 4 \\ 5 & -3 & 8 \\ 9 & 2 & 16 \end{bmatrix}$, then trace of A is :

(1) 15 (2) 17

(3) 8 (4) 25

76. If A is a square matrix of order $n \times n$, then $adj\ (adj\ A)$ is equal to :

(1) $|A|^n A$

(2) $|A|^{n-2} A$

(3) $|A|^{n-1} A$

(4) $|A|^{n-3} A$

77. If α, β are non-real numbers satisfying $x^3 - 1 = 0$, then the value of $\begin{vmatrix} \lambda+1 & \alpha & \beta \\ \alpha & \lambda+\beta & 1 \\ \beta & 1 & \lambda+\alpha \end{vmatrix}$ is equal to :

(1) λ^3 (2) $\lambda^3 + 1$

(3) $\lambda^3 - 1$ (4) 0

78. The value of x for which the matrix $A = \begin{bmatrix} 6 & x-2 \\ 3 & x \end{bmatrix}$ has no inverse is :

(1) 0 (2) 2 (3) -2 (4) 3

79. If $A = \begin{pmatrix} 1 & x+3 \\ 2x-1 & x-1 \end{pmatrix}$ is symmetric, then x is equal to :

(1) 5 (2) 7 (3) 3 (4) 2

80. If $2^x - 2^y = 2^{x-y}$, then the value of $\frac{dy}{dx}$ at $x = y = 1$ is :

(1) 0 (2) -1 (3) 1 (4) 2

81. If a, b, c are three unequal numbers such that a, b, c are in A.P. and $b - a$, $c - b$, a are in G.P., then $a : b : c$ is equal to :

(1) 1 : 2 : 3 (2) 1 : 2 : 4

(3) 3 : 2 : 1 (4) 2 : 3 : 5

82. If Σn, $\frac{\sqrt{10}}{3}\Sigma n^2$, Σn^3 are in G.P., then the value of n is :

(1) 3 (2) 1

(3) 0 (4) 4

83. The equation of straight line passing through the point (1, 2) and perpendicular to the line $x + y + 1 = 0$ is :

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

(3) $x + y = 1$ (4) $x - y = 1$

84. The straight lines $x + y = 0$, $3x + y - 4 = 0$, and $x + 3y - 4 = 0$ form a triangle which is :

(1) Right angled (2) Equilateral

(3) Isosceles (4) None of these

85. The locus of the mid-point of the distance between the axes of the variable line $x \cos \alpha + y \sin \alpha = p$, where p is constant, is :

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

(2) $x^2 + y^2 = \frac{4}{p^2}$

(3) $\frac{1}{x^2} - \frac{1}{y^2} = \frac{4}{p^2}$

(4) $x^2 - y^2 = \frac{4}{p^2}$

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

(1) Vertices of a rectangle

(2) Vertices of a square

(3) Vertices of a parallelogram

(4) Collinear

87. Radius of the largest circle which passes through the focus of the parabola $y^2 = 4x$ and contained in it, is :

(1) 4

(2) 8

(3) 2

(4) 5

88. The length of the latus rectum of an ellipse is one third of the major axis, its eccentricity would be :

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

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

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

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

89. If $(a - 2)x^2 + ay^2 = 4$ represents rectangular hyperbola, then a equals :

(1) 0

(2) 2

(3) 1

(4) 3

90. The line joining the points (1, 1, 2) and (3, –2, 1) meets the plane $3x + 2y + z = 6$ at the point :

(1) (1, 1, 2) (2) (2, 3, –1)

(3) (3, 2, 1) (4) (3, –2, 1)

91. If $A = \{x, y\}$, then which of the following statement is ***true*** ?

(1) $\phi \in A$ (2) $y \subseteq A$

(3) $\{y\} \in A$ (4) $\{x\} \subseteq A$

92. If A is any set, then :

(1) $A \cup A = A$ (2) $A \cup A = \phi$

(3) $A \cup A = \{A, \phi\}$ (4) $A \cup A = \{0\}$

93. In a class of 60 boys, there are 45 boys who play cards and 30 boys who play carrom. How many boys play cards only ?

(1) 15 (2) 30

(3) 20 (4) 10

94. Which of the following functions is neither even nor odd ?

(1) $x^2 + 7$ (2) $x^7 + 2x^5$

(3) $|x| + 4$ (4) $x + 2$

95. If A = {1, 3, 5, 7} and B = {2, 5}, then the number of relations from A to B is :

(1) 64 (2) 128

(3) 256 (4) 512

96. If $\frac{\cos x}{a} = \frac{\cos(x+\theta)}{b} = \frac{\cos(x+2\theta)}{c} = \frac{\cos(x+3\theta)}{d}$, then $\frac{a+c}{b+d}$ is equal to :

(1) $\frac{a}{d}$ (2) $\frac{b}{c}$

(3) $\frac{c}{d}$ (4) $\frac{d}{a}$

97. If in a triangle ABC, $\tan A + \tan B + \tan C > 0$, then the triangle is :

(1) Always acute angled triangle

(2) Always obtuse angled triangle

(3) Always equilateral triangle

(4) Nothing can be said about the type of triangle

98. The number of solutions of $\sum_{r=1}^{5} \cos rx = 5$ in the interval $[0, 2\pi]$ is :

(1) 10 (2) 5

(3) 1 (4) 0

99. If $1 + \sin\theta + \sin^2\theta + \ldots\ldots = x = 4 + 2\sqrt{3}$, $0 < \theta < \pi$, $\theta \neq \frac{\pi}{2}$, then :

(1) $\theta = \frac{\pi}{3}$ (2) $\theta = \frac{\pi}{6}$

(3) $\frac{\pi}{3}$ or $\frac{\pi}{6}$ (4) $\theta = \frac{\pi}{3}$ or $\frac{2\pi}{3}$

100. If the multiplicative inverse of a complex number is $\frac{(\sqrt{3}+4i)}{19}$, then the complex number itself is :

(1) $4 - i\sqrt{3}$ (2) $\sqrt{3} + 4i$

(3) $4 + i\sqrt{3}$ (4) $\sqrt{3} - 4i$

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SET-X

PG(Hons)-EE-June, 2023
Mathematics (Hons.) Five Year Integrated

10315

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. If $4\sin^{-1}x+\cos^{-1}x=\pi$, then x is equal to :

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

(3) $\frac{\sqrt{3}}{2}$ (4) $\frac{1}{\sqrt{2}}$

2. $\tan^{-1}\left(\tan\frac{3\pi}{4}\right)$ is equal to :

(1) $-\frac{\pi}{4}$ (2) $\frac{\pi}{4}$

(3) $\frac{3\pi}{4}$ (4) $-\frac{3\pi}{4}$

3. The principal value of $\sin^{-1}\left(-\frac{\sqrt{3}}{2}\right)$ is equal to :

(1) $-\frac{2\pi}{3}$ (2) $\frac{4\pi}{3}$

(3) $-\frac{\pi}{3}$ (4) $\frac{5\pi}{3}$

4. If $A=\begin{bmatrix}1 & 0\\ -1 & 7\end{bmatrix}$ and $A^2=8A+KI_2$, then K is equal to :

(1) -1 (2) 1

(3) 7 (4) -7

5. If $A=\begin{bmatrix}2 & 3 & 4\\ 5 & -3 & 8\\ 9 & 2 & 16\end{bmatrix}$, then trace of A is :

(1) 15 (2) 17

(3) 8 (4) 25

6. If A is a square matrix of order $n \times n$, then $adj\ (adj\ A)$ is equal to :

(1) $|A|^n A$ (2) $|A|^{n-2} A$

(3) $|A|^{n-1} A$ (4) $|A|^{n-3} A$

7. If α, β are non-real numbers satisfying $x^3 - 1 = 0$, then the value of $\begin{vmatrix} \lambda+1 & \alpha & \beta \\ \alpha & \lambda+\beta & 1 \\ \beta & 1 & \lambda+\alpha \end{vmatrix}$ is equal to :

(1) λ^3 (2) $\lambda^3 + 1$

(3) $\lambda^3 - 1$ (4) 0

8. The value of x for which the matrix $A = \begin{bmatrix} 6 & x-2 \\ 3 & x \end{bmatrix}$ has no inverse is :

(1) 0 (2) 2

(3) –2 (4) 3

9. If $A = \begin{pmatrix} 1 & x+3 \\ 2x+1 & x-1 \end{pmatrix}$ is symmetric, then x is equal to :

(1) 5 (2) 7

(3) 3 (4) 2

10. If $2^x + 2^y = 2^{x+y}$, then the value of $\frac{dy}{dx}$ at $x = y = 1$ is :

(1) 0 (2) –1

(3) 1 (4) 2

11. If a, b, c are three unequal numbers such that a, b, c are in A.P. and $b - a$, $c - b$, a are in G.P., then $a : b : c$ is equal to :

(1) 1 : 2 : 3 (2) 1 : 2 : 4

(3) 3 : 2 : 1 (4) 2 : 3 : 5

12. If $\Sigma n, \frac{\sqrt{10}}{3}\Sigma n^2, \Sigma n^3$ are in G.P., then the value of n is :

(1) 3 (2) 1

(3) 0 (4) 4

13. The equation of straight line passing through the point (1, 2) and perpendicular to the line $x + y + 1 = 0$ is :

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

(3) $x + y = 1$ (4) $x - y = 1$

14. The straight lines $x + y = 0$, $3x + y - 4 = 0$, and $x + 3y - 4 = 0$ form a triangle which is :

(1) Right angled (2) Equilateral

(3) Isosceles (4) None of these

15. The locus of the mid-point of the distance between the axes of the variable line $x \cos \alpha + y \sin \alpha = p$, where p is constant, is :

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

(3) $\frac{1}{x^2} - \frac{1}{y^2} = \frac{4}{p^2}$ (4) $x^2 - y^2 = \frac{4}{p^2}$

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

(1) Vertices of a rectangle (2) Vertices of a square

(3) Vertices of a parallelogram (4) Collinear

17. Radius of the largest circle which passes through the focus of the parabola $y^2 = 4x$ and contained in it, is :

(1) 4 (2) 8

(3) 2 (4) 5

18. The length of the latus rectum of an ellipse is one third of the major axis, its eccentricity would be :

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

(3) $\frac{1}{\sqrt{2}}$ (4) $\frac{2}{3}$

19. If $(a-2)x^2 + ay^2 = 4$ represents rectangular hyperbola, then a equals :

(1) 0 (2) 2

(3) 1 (4) 3

20. The line joining the points (1, 1, 2) and (3, –2, 1) meets the plane $3x + 2y + z = 6$ at the point :

(1) (1, 1, 2) (2) (2, 3, –1)

(3) (3, 2, 1) (4) (3, –2, 1)

21. If $A = \{x, y\}$, then which of the following statement is ***true*** ?

(1) $\phi \in A$ (2) $y \subseteq A$

(3) $\{y\} \in A$ (4) $\{x\} \subseteq A$

22. If A is any set, then :

(1) $A \cup A = A$ (2) $A \cup A = \phi$

(3) $A \cup A = \{A, \phi\}$ (4) $A \cup A = \{0\}$

23. In a class of 60 boys, there are 45 boys who play cards and 30 boys who play carrom. How many boys play cards only ?

(1) 15 (2) 30 (3) 20 (4) 10

24. Which of the following functions is neither even nor odd ?

(1) $x^2 + 7$ (2) $x^7 + 2x^5$

(3) $|x| + 4$ (4) $x + 2$

25. If A = {1, 3, 5, 7} and B = {2, 5}, then the number of relations from A to B is :

(1) 64 (2) 128

(3) 256 (4) 512

26. If $\frac{\cos x}{a} = \frac{\cos(x+\theta)}{b} = \frac{\cos(x+2\theta)}{c} = \frac{\cos(x+3\theta)}{d}$, then $\frac{a+c}{b+d}$ is equal to :

(1) $\frac{a}{d}$ (2) $\frac{b}{c}$ (3) $\frac{c}{d}$ (4) $\frac{d}{a}$

27. If in a triangle ABC, $\tan A + \tan B + \tan C > 0$, then the triangle is :

(1) Always acute angled triangle

(2) Always obtuse angled triangle

(3) Always equilateral triangle

(4) Nothing can be said about the type of triangle

28. The number of solutions of $\sum_{r=1}^{5} \cos rx = 5$ in the interval $[0, 2\pi]$ is :

(1) 10 (2) 5

(3) 1 (4) 0

29. If $1 + \sin\theta + \sin^2\theta + \ldots\ldots \infty = 4 + 2\sqrt{3}$, $0 < \theta < \pi$, $\theta \neq \frac{\pi}{2}$, then :

(1) $\theta = \frac{\pi}{3}$ (2) $\theta = \frac{\pi}{6}$

(3) $\frac{\pi}{3}$ or $\frac{\pi}{6}$ (4) $\theta = \frac{\pi}{3}$ or $\frac{2\pi}{3}$

30. If the multiplicative inverse of a complex number is $\frac{(\sqrt{3}+4i)}{19}$, then the complex number itself is :

(1) $4-i\sqrt{3}$ (2) $\sqrt{3}+4i$ (3) $4+i\sqrt{3}$ (4) $\sqrt{3}-4i$

31. Let p and q stand for, the statements :

'Sohan is intelligent' and 'Sohan is hardworking'. Then the statement 'Sohan is not intelligent and Sohan is hardworking' is denoted by :

(1) $p \wedge q$ (2) $\sim p \wedge \sim q$

(3) $\sim p \wedge q$ (4) None of these

32. The disjunction $p \vee q$ is false only when :

(1) p is false

(2) p and q are both false

(3) p or q are both false

(4) p is false and q may be true

33. The mean of the first n natural numbers is given by :

(1) $\frac{n}{2}$ (2) $\frac{n(n+1)}{2}$

(3) $\frac{n+1}{2n}$ (4) $\frac{n+1}{2}$

34. Which of the following is ***not*** a merit of standard deviation ?

(1) It is based on all the items

(2) It is simple to understand

(3) It is unduly affected by the extreme items

(4) It has sampling stability

35. A measure of scatteredness of items about some average is called a measure of :

(1) Dispersion (2) Conclusion

(3) Logic (4) None of these

36. The coefficient of Standard Deviation (S.D.) is given by :

(1) $\left(\frac{\text{S.D.}}{100}\right)$

(2) $\left(\frac{\text{S.D.}}{\bar{x}}\right)100$

(3) $\left(\frac{\text{S.D.}}{\bar{x}}\right)$

(4) $\left(\frac{\bar{x}}{\text{S.D.}}\right)$

37. How many numbers are there between 100 and 1000 such that every digit is either 2 or 9 ?

(1) 8 (2) 6

(3) 4 (4) 48

38. In the expansion of $\left(x+\frac{1}{x}\right)^6$, the third term from the end is :

(1) $\frac{1}{x^2}$ (2) $\frac{15}{x^2}$

(3) $\frac{15}{x^4}$ (4) ${}^6C_4$

39. If $(x^2-5x+7)^2-(x-2)(x-3)=1$ and let $y=x^2-5x$. Then the values of y are :

(1) $-7, -6$ (2) 3, 2

(3) $-7, 6$ (4) $\frac{5\pm i\sqrt{3}}{2}$

40. For the standard ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$, which of the following is ***true*** ?

(1) $a^2=b^2(1+e^2)$ (2) $b^2=a^2(e^2-1)$

(3) $a^2=\frac{b^2}{2}(1-e^2)$ (4) $b^2=a^2(1-e^2)$

41. If $f(a-x)=f(x)$, then $\int_0^a x\,f(x)\,dx$ is equal to :

(1) $\frac{a}{2}\int_0^a f(x)\,dx$ (2) $a\int_0^a f(x)\,dx$

(3) $\frac{a^2}{2}\int_0^a f(x)\,dx$ (4) $\frac{2}{a}\int_0^a f(x)\,dx$

42. $\int_{-1}^{1}\sin^3 x.\cos^2 x\,dx$ is equal to :

(1) $\frac{1}{2}$ (2) 1 (3) 2 (4) 0

43. The area of the region bounded by the curve $x^2=4y$, line $x=2$ and x-axis is :

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

(3) $\frac{4}{3}$ (4) $\frac{8}{3}$

44. The area enclosed between the curves $y=ax^2$, $x=ay^2$ $(a>0)$ is 1 sq. unit. Then the value of a is :

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

(3) $\frac{1}{\sqrt{3}}$ (4) 1

45. If p and q are order and degree of differential equation $y^2\left(\frac{d^2y}{dx^2}\right)^2 + 3x\left(\frac{dy}{dx}\right) + x^2y^2 = \sin x$, then :

(1) $p > q$ (2) $\frac{p}{q} = \frac{1}{2}$

(3) $p = q$ (4) $p < q$

46. The integrating factor of differential equation $\frac{dy}{dx} + \frac{1}{x}y = 3x$ is :

(1) x (2) 0

(3) e^x (4) $\frac{1}{x}$

47. The solution of differential equation $(\cos x)\cos y\,dx + (\sin x)\sin y\,dy = 0$ is :

(1) $\tan x = c$ (2) $\cos x = c \sin y$

(3) $\sec x - \sec y = c$ (4) $\sin x = c \cos y$

48. The elimination of A and B from the equation $y^2 = Ax + B$ gives the differential equation of order :

(1) First (2) Second (3) Third (4) Zero

49. If $\alpha = 2\hat{i} + 3\hat{j} - \hat{k}$, $\beta = -\hat{i} + 2\hat{j} - 4\hat{k}$, $\gamma = \hat{i} + \hat{j} + \hat{k}$, then $(\alpha \times \beta).(\alpha \times \gamma)$ is equal to :

(1) 64 (2) 74 (3) –74 (4) –64

50. If $\vec{a}$ and $\vec{b}$ are two vectors such that $\vec{a}.\vec{b} = 0$ and $\vec{a} \times \vec{b} = \vec{0}$, then :

(1) either $\vec{a}$ or $\vec{b}$ is a null vector

(2) $\vec{a}$ is parallel to $\vec{b}$

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

(4) None of these

51. The length of the perpendicular from (1, 0, 2) on the line $\frac{x+1}{3} = \frac{y-2}{-2} = \frac{z+1}{-1}$ is :

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

(3) $\frac{6\sqrt{3}}{5}$ (4) $\frac{3\sqrt{6}}{2}$

52. A plane meets the coordinate axes in A, B, C such that the centroid of the triangle ABC is the point (a, a, a). If the equation of the plane is $x + y + z = p$, then p is :

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

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

53. $\lim_{x \to 0} \frac{\sin(\pi \cos^2 x)}{x^2}$ is :

(1) $-\pi$ (2) π

(3) $\frac{\pi}{2}$ (4) 1

54. Let $f(x) = 3x^{10} - 7x^8 + 5x^6 - 21x^3 + 3x^2 - 7$. Then $\lim_{h \to 0} \frac{f(1-h) - f(1)}{h^3 + 3h}$ is equal to :

(1) $\frac{53}{3}$ (2) $\frac{25}{3}$

(3) $\frac{50}{3}$ (4) $\frac{22}{3}$

55. If $y = \sqrt{x + \sqrt{x + \sqrt{x + \ldots\ldots\infty}}}$, then $\frac{dy}{dx}$ is equal to :

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

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

56. If $\sin(x+y) = \log_e(x+y)$, then $\frac{dy}{dx}$ is equal to :

(1) 2 (2) 1

(3) –1 (4) –2

57. Two small square on a chess board are chosen at random. Probability that they have a common side is :

(1) $\frac{1}{3}$ (2) $\frac{1}{9}$

(3) $\frac{5}{18}$ (4) $\frac{1}{18}$

58. For n independent events A_i, $P(A_i) = \frac{1}{(1+i)}$, $i = 1, 2, 3, \ldots\ldots, n$. The probability that at least one of the events occurs is :

(1) $\frac{1}{n}$ (2) $\frac{1}{(n+1)}$

(3) $\frac{n}{(n+1)}$ (4) None of these

59. Two dice are thrown, the probability that the sum of the points on two dice will be 7 is :

(1) $\frac{5}{36}$ (2) $\frac{6}{36}$

(3) $\frac{7}{36}$ (4) $\frac{8}{36}$

60. A single letter is selected at random from the word "PROBABILITY". The probability that it is a vowel, is :

(1) $\frac{3}{11}$ (2) $\frac{4}{11}$

(3) $\frac{2}{11}$ (4) zero

61. The two vectors $\vec{a} = 2\hat{i} + \hat{j} + 3\hat{k}$, $\vec{b} = 4\hat{i} - \lambda\hat{j} + 6\hat{k}$ are parallel if λ is equal to :

(1) 2 (2) –3

(3) 3 (4) –2

62. If a straight line in space is equally inclined to the co-ordinate axes, the cosine of its angle of inclination to any one of the axes is :

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

(3) $\frac{1}{2}$ (4) $\frac{1}{\sqrt{2}}$

63. If the lines $\frac{x-1}{2}, \frac{y+1}{3} = \frac{z-1}{4}$ and $\frac{x-3}{1} = \frac{y-k}{2} = \frac{z}{1}$ intersect, then the value of k is :

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

(3) $\frac{9}{2}$ (4) $-\frac{3}{2}$

64. Distance of the point (2, 3, 4) from the plane $3x - 6y + 2z + 11 = 0$ is :

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

65. If the straight line $\frac{x-3}{-4} = \frac{y-4}{-7} = \frac{z+3}{13}$ lies in the plane $5x - y + z = a$, then a is equal to :

(1) 8 (2) 9

(3) 2 (4) –3

66. A fair coin is tossed repeatedly. If tail appears on first four tosses, then the probability of head appearing on fifth toss is :

(1) $\frac{1}{5}$ (2) $\frac{31}{32}$ (3) $\frac{1}{32}$ (4) $\frac{1}{2}$

67. Seven white balls and three black balls are placed in a row. The probability that no two black balls are placed adjacently equals :

(1) $\frac{1}{3}$ (2) $\frac{2}{15}$

(3) $\frac{7}{15}$ (4) $\frac{4}{15}$

68. A man is known to speak truth in 75% cases. If he throws an unbiased die and tells his friends that it is a six, then the probability that it is actually a six, is :

(1) $\frac{1}{6}$ (2) $\frac{1}{8}$

(3) $\frac{3}{8}$ (4) $\frac{3}{4}$

69. Let $f: R \to R$ be defined by $f(x) = 3x - 4$, then $f^{-1}(x)$ is equal to :

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

(3) $3x + 4$ (4) Not defined

70. The function $f: R \to R$ defined by $f(x) = (x-1)(x-2)(x-3)$ is :

(1) one-one but not onto (2) onto but not one-one

(3) both one-one and onto (4) neither one-one nor onto

71. A linear function $Z = ax + by$, where a, b are constants, which has to be maximized or minimized is called a linear :

(1) Subjective function (2) Collective function

(3) Objective function (4) None of these

72. Any point in the feasible region that gives the maximum or minimum value of the objective function is called an :

(1) Optical solution

(2) Optimal solution

(3) Practical solution

(4) None of these

73. Ten eggs are drawn successively with replacement from a lot containing 10% defective eggs. Find the probability that there is at least one defective egg :

(1) $1-\frac{9^{10}}{10^{10}}$

(2) $1-\frac{9^{10}-1}{10^{10}}$

(3) $1-\frac{9^{9}}{10^{9}}$

(4) $1-\frac{9^{10}}{10^{9}}$

74. Let X be a random variable whose possible values $x_1, x_2, x_3, \ldots\ldots, x_n$ occur with probabilities $p_1, p_2, p_3, \ldots\ldots, p_n$. The mean of random variable X is given by :

(1) $E(X)=\sum_{i=1}^{n}\frac{p_i}{x_i}$

(2) $E(X)=\sum_{i=1}^{n}\frac{x_i}{p_i}$

(3) $E(X)=\sum_{i=1}^{n}(p_i+x_i)$

(4) $E(X)=\sum_{i=1}^{n}p_i\,x_i$

75. A region is said to be convex, if the line segment joining any two arbitrary points of the region lies :

(1) Entirely within the region

(2) Entirely outside the region

(3) Anywhere within or outside the region

(4) None of these

76. If $P(n)$ is the statement, "$\frac{1}{1\times 2}+\frac{1}{2\times 3}+\frac{1}{3\times 4}+\ldots\ldots\ldots+\frac{1}{n(n+1)}=\frac{n}{n+1}$", where $n\in N$, then $P(2)$ is the statement :

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

(2) $\frac{1}{1\times 2}=\frac{1}{1+1}$

(3) $\frac{1}{1\times 2}+\frac{1}{3\times 4}=\frac{7}{12}$

(4) None of these

77. The solution of linear inequation $2x + 10 \geq 0$ is :

(1) $x \in (-5, \infty)$ (2) $x \in (-\infty, \infty)$

(3) $x \in [-5, \infty)$ (4) $x \leq -5$

78. Which of the following is ***not*** correct ?

(1) $x \geq 4 \Rightarrow x - 3 \geq 1$

(2) $x \leq y \Rightarrow -3x \geq -3y$

(3) $2x - 6y \geq 0 \Rightarrow x \geq 3y$

(4) $4x \geq 8 \Rightarrow x \leq 2$

79. A company manufactures toys and its cost equation for a week is $C = 300 + 1.5x$ and its revenue equation is $R = 2x$, where x is the number of toys sold in a week. How many toys must be sold for the company to realize a profit ?

(1) Between 500 and 600

(2) More than 600

(3) At most 550

(4) None of these

80. A sentence is a statement if it is :

(1) Always true

(2) Always false

(3) Either true or false but not both

(4) Sometimes true, sometimes false

81. If $1, \omega, \omega^2$ are the three cube roots of unity, then the roots of the equation $(x-1)^3 = 8$ are :

(1) $3, 1+2\omega, 1+2\omega^2$

(2) $-1, -1, -2\omega$

(3) $3, 2\omega, 2\omega^2$

(4) None of these

82. If one root of the equation $x^2 - \lambda x + 12 = 0$ is even prime, and $x^2 + \lambda x + \mu = 0$ has equal roots, then μ is :

(1) 8

(2) 16

(3) 24

(4) 32

83. If α, β are roots of the equation $8x^2 - 3x + 27 = 0$, then the value of $\left[\left(\frac{\alpha^2}{\beta}\right)^{1/3} + \left(\frac{\beta^2}{\alpha}\right)^{1/3}\right]$ is :

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

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

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

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

84. The number of arrangements of the letters of the word BANANA in which the two N's do not appear adjacently is :

(1) 100 (2) 80

(3) 60 (4) 40

85. The maximum number of points of intersection of 8 straight lines, is :

(1) 28 (2) 56

(3) 8 (4) 16

86. Total number of words formed by using 2 vowels and 3 consonants taken from 4 vowels and 5 consonants is equal to :

(1) 60 (2) 120

(3) 720 (4) None of these

87. If the co-efficient of x^3 in the expansion of $(1 + ax)^4$ is 32, then a equals :

(1) 4 (2) 3

(3) 2 (4) 6

88. If the sum of the binomial coefficients in the expansion of $\left(x+\frac{1}{x}\right)^n$ is 64, then the term independent of x is equal to :

(1) 40 (2) 20

(3) 60 (4) 30

89. A series whose nth term is $\frac{n}{x}+y$, the sum of r terms will be :

(1) $\frac{r(r+1)}{2x}+ry$ (2) $\frac{r(r-1)}{2x}$

(3) $\frac{r}{2x}+ry$ (4) $\frac{r(r-1)}{2x}+ry$

90. If a, b, c are in G.P., then $\frac{b-a}{b-c}+\frac{b+a}{b+c}$ is equal to :

(1) b^2-c^2

(2) ab

(3) ac

(4) zero

91. If $y^2=ax^2+bx+c$, then $y^3\frac{d^2y}{dx^2}$ is :

(1) a constant

(2) a function of x only

(3) a function of y only

(4) a function of x and y

92. Let f be a function satisfying $f(x+y)=f(x)+f(y)$ and $f(x)=x^2g(x)$ for all x and y, where $g(x)$ is a continuous function, then $f'(x)$ is equal to :

(1) $g'(x)$

(2) $g(0)$

(3) $g(0)+g'(x)$

(4) 0

93. Which of the following is ***not*** continuous for all x ?

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

(2) $\frac{\cos x}{|\cos x|}$

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

(4) $\sin|x|+|\sin x|$

94. The line $\frac{x}{a}+\frac{y}{b}=1$ touches the curve $y=be^{-x/a}$ at the point :

(1) $\left(a, \frac{b}{a}\right)$

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

(3) $\left(a, -\frac{b}{a}\right)$

(4) None of these

95. If $a < 0$, the function $f(x)=e^{ax}+e^{-ax}$ is a monotonically decreasing function for values of x given by :

(1) $x<1$

(2) $x>1$

(3) $x<0$

(4) $x>0$

96. Let $f(x)$ be differential function for all x. If $f(1) = -2$ and $f'(x) \geq 2$ for all x in $[1, 6]$, then minimum value of $f(6)$ is equal to :

(1) 8

(2) 6

(3) 4

(4) 2

97. $\int\frac{10x^9+10^x \log_e 10}{10^x+x^{10}}dx$ is equal to :

(1) $\log(10^x+x^{10})+c$

(2) $\frac{1}{10^x+x^{10}}+c$

(3) $\log(x^9+10^x+x^{10})+c$

(4) None of these

98. $\int \sec^3 x\,dx$ is equal to :

(1) $\frac{1}{3}[\sec x.\tan x + \log(\sec x + \tan x)]$

(2) $\frac{1}{2}[\sec x.\tan x + \log(\sec x + \tan x)]$

(3) $\frac{1}{4}[\sec x.\tan x + \log(\sec x + \tan x)]$

(4) $\tan x.\ \sec^2 x$

99. $\int \frac{x-1}{(x-3)(x-2)}dx$ is equal to :

(1) $\log (x-3)^2 + \log (x-2) + c$

(2) $\log (x-3) + \log (x-2) + c$

(3) $\log (x-3)^2 - \log (x-2) + c$

(4) $\log (x-3) - \log (x-2) + c$

100. $\int \frac{dx}{x^2+x+1}$ is equal to :

(1) $\frac{\sqrt{3}}{2}\tan^{-1}\left(\frac{2x+1}{\sqrt{3}}\right)+c$

(2) $\tan^{-1}\left(\frac{2x+1}{\sqrt{3}}\right)+c$

(3) $\frac{1}{\sqrt{3}}\tan^{-1}\left(\frac{2x+1}{\sqrt{3}}\right)+c$

(4) $\frac{2}{\sqrt{3}}\tan^{-1}\left(\frac{2x+1}{\sqrt{3}}\right)+c$

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SET-X

PG(Hons)-EE-June, 2023
Mathematics (Hons.) Five Year Integrated

10244

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. If 1, ω ω^2 are the three cube roots of unity, then the roots of the equation $(x-1)^3 = 8$ are :

   (1) $3, 1+2\omega, 1+2\omega^2$

   (2) $-1, -1, -2\omega$

   (3) $3, 2\omega, 2\omega^2$

   (4) None of these

2. If one root of the equation $x^2 - \lambda x + 12 = 0$ is even prime, and $x^2 + \lambda x + \mu = 0$ has equal roots, then μ is :

   (1) 8 (2) 16

   (3) 24 (4) 32

3. If α, β are roots of the equation $8x^2 - 3x + 27 = 0$, then the value of $\left[\left(\frac{\alpha^2}{\beta}\right)^{1/3} + \left(\frac{\beta^2}{\alpha}\right)^{1/3}\right]$ is :

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6. Total number of words formed by using 2 vowels and 3 consonants taken from 4 vowels and 5 consonants is equal to :

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

8. If the sum of the binomial coefficients in the expansion of $\left(x + \frac{1}{x}\right)^n$ is 64, then the term independent of x is equal to :

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9. A series whose nth term is $\frac{n}{x} + y$, the sum of r terms will be :

(1) $\frac{r(r+1)}{2x} + ry$ (2) $\frac{r(r-1)}{2x}$

(3) $\frac{r}{2x} + ry$ (4) $\frac{r(r-1)}{2x} + ry$

10. If a, b, c are in G.P., then $\frac{b-a}{b-c} + \frac{b+a}{b+c}$ is equal to :

(1) $b^2 - c^2$ (2) ab

(3) ac (4) zero

11. Let p and q stand for, the statements :

'Sohan is intelligent' and 'Sohan is hardworking'. Then the statement 'Sohan is not intelligent and Sohan is hardworking' is denoted by :

(1) $p \wedge q$ (2) $\sim p \wedge \sim q$

(3) $\sim p \wedge q$ (4) None of these

12. The disjunction $p \vee q$ is false only when :

(1) p is false

(2) p and q are both false

(3) p or q are both false

(4) p is false and q may be true

13. The mean of the first n natural numbers is given by :

(1) $\frac{n}{2}$ (2) $\frac{n(n+1)}{2}$

(3) $\frac{n+1}{2n}$ (4) $\frac{n+1}{2}$

14. Which of the following is ***not*** a merit of standard deviation ?

(1) It is based on all the items

(2) It is simple to understand

(3) It is unduly affected by the extreme items

(4) It has sampling stability

15. A measure of scatteredness of items about some average is called a measure of :

(1) Dispersion (2) Conclusion

(3) Logic (4) None of these

16. The coefficient of Standard Deviation (S.D.) is given by :

(1) $\left(\frac{\text{S.D.}}{100}\right)$ (2) $\left(\frac{\text{S.D.}}{\bar{x}}\right)100$

(3) $\left(\frac{\text{S.D.}}{\bar{x}}\right)$ (4) $\left(\frac{\bar{x}}{\text{S.D.}}\right)$

17. How many numbers are there between 100 and 1000 such that every digit is either 2 or 9 ?

(1) 8 (2) 6

(3) 4 (4) 48

18. In the expansion of $\left(x+\frac{1}{x}\right)^6$, the third term from the end is :

(1) $\frac{1}{x^2}$ (2) $\frac{15}{x^2}$ (3) $\frac{15}{x^4}$ (4) ${}^6C_4$

19. If $(x^2-5x+7)^2-(x-2)(x-3)=1$ and let $y=x^2-5x$. Then the values of y are :

(1) $-7, -6$ (2) $3, 2$

(3) $-7, 6$ (4) $\frac{5\pm i\sqrt{3}}{2}$

20. For the standard ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$, which of the following is ***true*** ?

(1) $a^2=b^2(1+e^2)$ (2) $b^2=a^2(e^2-1)$

(3) $a^2=\frac{b^2}{2}(1-e^2)$ (4) $b^2=a^2(1-e^2)$

21. The two vectors $\vec{a}=2\hat{i}+\hat{j}+3\hat{k}$, $\vec{b}=4\hat{i}-\lambda\hat{j}+6\hat{k}$ are parallel if λ is equal to :

(1) 2 (2) -3 (3) 3 (4) -2

22. If a straight line in space is equally inclined to the co-ordinate axes, the cosine of its angle of inclination to any one of the axes is :

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

(3) $\frac{1}{2}$ (4) $\frac{1}{\sqrt{2}}$

23. If the lines $\frac{x-1}{2}, \frac{y+1}{3}=\frac{z-1}{4}$ and $\frac{x-3}{1}=\frac{y-k}{2}=\frac{z}{1}$ intersect, then the value of k is :

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

(3) $\frac{9}{2}$ (4) $-\frac{3}{2}$

24. Distance of the point (2, 3, 4) from the plane $3x-6y+2z+11=0$ is :

(1) 2 (2) 1

(3) 0 (4) 3

25. If the straight line $\frac{x-3}{-4}=\frac{y-4}{-7}=\frac{z+3}{13}$ lies in the plane $5x-y+z=a$, then a is equal to :

(1) 8 (2) 9

(3) 2 (4) –3

26. A fair coin is tossed repeatedly. If tail appears on first four tosses, then the probability of head appearing on fifth toss is :

(1) $\frac{1}{5}$ (2) $\frac{31}{32}$

(3) $\frac{1}{32}$ (4) $\frac{1}{2}$

27. Seven white balls and three black balls are placed in a row. The probability that no two black balls are placed adjacently equals :

(1) $\frac{1}{3}$ (2) $\frac{2}{15}$

(3) $\frac{7}{15}$ (4) $\frac{4}{15}$

28. A man is known to speak truth in 75% cases. If he throws an unbiased dic and tells his friends that it is a six, then the probability that it is actually a six, is :

(1) $\frac{1}{6}$ (2) $\frac{1}{8}$

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

(3) $3x + 4$ (4) Not defined

30. The function $f: R \to R$ defined by $f(x) = (x-1)(x-2)(x-3)$ is :

(1) one-one but not onto

(2) onto but not one-one

(3) both one-one and onto

(4) neither one-one nor onto

31. If $y^2 = ax^2 + bx + c$, then $y^3 \frac{d^2y}{dx^2}$ is :

(1) a constant (2) a function of x only

(3) a function of y only (4) a function of x and y

32. Let f be a function satisfying $f(x+y) = f(x) + f(y)$ and $f(x) = x^2 g(x)$ for all x and y, where $g(x)$ is a continuous function, then $f'(x)$ is equal to :

(1) $g'(x)$ (2) $g(0)$

(3) $g(0) + g'(x)$ (4) 0

33. Which of the following is ***not*** continuous for all x ?

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

(2) $\frac{\cos x}{|\cos x|}$

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

(4) $\sin|x| + |\sin x|$

34. The line $\frac{x}{a} + \frac{y}{b} = 1$ touches the curve $y = be^{-x/a}$ at the point :

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

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

35. If $a < 0$, the function $f(x) = e^{ax} + e^{-ax}$ is a monotonically decreasing function for values of x given by :

(1) $x < 1$ (2) $x > 1$ (3) $x < 0$ (4) $x > 0$

36. Let $f(x)$ be differential function for all x. If $f(1) = -2$ and $f'(x) \geq 2$ for all x in $[1, 6]$, then minimum value of $f(6)$ is equal to :

(1) 8 (2) 6 (3) 4 (4) 2

37. $\int \frac{10x^9 + 10^x \log_e 10}{10^x + x^{10}} dx$ is equal to :

(1) $\log(10^x + x^{10}) + c$

(2) $\frac{1}{10^x + x^{10}} + c$

(3) $\log(x^9 + 10^x + x^{10}) + c$

(4) None of these

38. $\int \sec^3 x\,dx$ is equal to :

(1) $\frac{1}{3}[\sec x.\tan x + \log(\sec x + \tan x)]$

(2) $\frac{1}{2}[\sec x.\tan x + \log(\sec x + \tan x)]$

(3) $\frac{1}{4}[\sec x.\tan x + \log(\sec x + \tan x)]$

(4) $\tan x.\ \sec^2 x$

39. $\int \frac{x-1}{(x-3)(x-2)}dx$ is equal to :

(1) $\log (x-3)^2 + \log (x-2) + c$

(2) $\log (x-3) + \log (x-2) + c$

(3) $\log (x-3)^2 - \log (x-2) + c$

(4) $\log (x-3) - \log (x-2) + c$

40. $\int \frac{dx}{x^2+x+1}$ is equal to :

(1) $\frac{\sqrt{3}}{2}\tan^{-1}\left(\frac{2x+1}{\sqrt{3}}\right)+c$

(2) $\tan^{-1}\left(\frac{2x+1}{\sqrt{3}}\right)+c$

(3) $\frac{1}{\sqrt{3}}\tan^{-1}\left(\frac{2x+1}{\sqrt{3}}\right)+c$

(4) $\frac{2}{\sqrt{3}}\tan^{-1}\left(\frac{2x+1}{\sqrt{3}}\right)+c$

41. The length of the perpendicular from (1, 0, 2) on the line $\frac{x+1}{3} = \frac{y-2}{-2} = \frac{z+1}{-1}$ is :

(1) $2\sqrt{3}$

(2) $3\sqrt{2}$

(3) $\frac{6\sqrt{3}}{5}$

(4) $\frac{3\sqrt{6}}{2}$

42. A plane meets the coordinate axes in A, B, C such that the centroid of the triangle ABC is the point (a, a, a). If the equation of the plane is $x + y + z = p$, then p is :

(1) a

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

(3) $3a$

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

43. $\lim_{x \to 0} \frac{\sin(\pi \cos^2 x)}{x^2}$ is :

(1) $-\pi$

(2) π

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

(4) 1

44. Let $f(x) = 3x^{10} - 7x^8 + 5x^6 - 21x^3 + 3x^2 - 7$. Then $\lim_{h \to 0} \frac{f(1-h) - f(1)}{h^3 + 3h}$ is equal to :

(1) $\frac{53}{3}$

(2) $\frac{25}{3}$

(3) $\frac{50}{3}$

(4) $\frac{22}{3}$

45. If $y = \sqrt{x + \sqrt{x + \sqrt{x + ...\infty}}}$, then $\frac{dy}{dx}$ is equal to :

(1) $2\sqrt{x}$

(2) $\frac{1}{2y-1}$

(3) $\sqrt{x}$

(4) None of these

46. If $\sin(x+y) = \log_e(x+y)$, then $\frac{dy}{dx}$ is equal to :

(1) 2 (2) 1 (3) -1 (4) -2

47. Two small square on a chess board are chosen at random. Probability that they have a common side is :

(1) $\frac{1}{3}$ (2) $\frac{1}{9}$

(3) $\frac{5}{18}$ (4) $\frac{1}{18}$

48. For n independent events A_i, $P(A_i) = \frac{1}{(1+i)}$, $i = 1, 2, 3, \ldots\ldots, n$. The probability that at least one of the events occurs is :

(1) $\frac{1}{n}$ (2) $\frac{1}{(n+1)}$

(3) $\frac{n}{(n+1)}$ (4) None of these

49. Two dice are thrown, the probability that the sum of the points on two dice will be 7 is :

(1) $\frac{5}{36}$ (2) $\frac{6}{36}$

(3) $\frac{7}{36}$ (4) $\frac{8}{36}$

50. A single letter is selected at random from the word "PROBABILITY". The probability that it is a vowel, is :

(1) $\frac{3}{11}$ (2) $\frac{4}{11}$

(3) $\frac{2}{11}$ (4) zero

51. If a, b, c are three unequal numbers such that a, b, c are in A.P. and $b-a, c-b, a$ are in G.P., then $a : b : c$ is equal to :

(1) 1 : 2 : 3

(2) 1 : 2 : 4

(3) 3 : 2 : 1

(4) 2 : 3 : 5

52. If $\Sigma n, \frac{\sqrt{10}}{3}\Sigma n^2, \Sigma n^3$ are in G.P., then the value of n is :

(1) 3

(2) 1

(3) 0

(4) 4

53. The equation of straight line passing through the point (1, 2) and perpendicular to the line $x+y+1=0$ is :

(1) $x-y=5$

(2) $x+y=5$

(3) $x+y=1$

(4) $x-y=1$

54. The straight lines $x+y=0$, $3x+y-4=0$, and $x+3y-4=0$ form a triangle which is :

(1) Right angled

(2) Equilateral

(3) Isosceles

(4) None of these

55. The locus of the mid-point of the distance between the axes of the variable line $x\cos\alpha + y\sin\alpha = p$, where p is constant, is :

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

(2) $x^2+y^2=\frac{4}{p^2}$

(3) $\frac{1}{x^2}-\frac{1}{y^2}=\frac{4}{p^2}$

(4) $x^2-y^2=\frac{4}{p^2}$

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

(1) Vertices of a rectangle

(2) Vertices of a square

(3) Vertices of a parallelogram

(4) Collinear

57. Radius of the largest circle which passes through the focus of the parabola $y^2 = 4x$ and contained in it, is :

(1) 4

(2) 8

(3) 2

(4) 5

58. The length of the latus rectum of an ellipse is one third of the major axis, its eccentricity would be :

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

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

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

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

59. If $(a-2)x^2 + ay^2 = 4$ represents rectangular hyperbola, then a equals :

(1) 0

(2) 2

(3) 1

(4) 3

60. The line joining the points (1, 1, 2) and (3, –2, 1) meets the plane $3x + 2y + z = 6$ at the point :

(1) (1, 1, 2)

(2) (2, 3, –1)

(3) (3, 2, 1)

(4) (3, –2, 1)

61. If $4\sin^{-1}x + \cos^{-1}x = \pi$, then x is equal to :

(1) 0 (2) $\frac{1}{2}$ (3) $\frac{\sqrt{3}}{2}$ (4) $\frac{1}{\sqrt{2}}$

62. $\tan^{-1}\left(\tan\frac{3\pi}{4}\right)$ is equal to :

(1) $-\frac{\pi}{4}$ (2) $\frac{\pi}{4}$

(3) $\frac{3\pi}{4}$ (4) $-\frac{3\pi}{4}$

63. The principal value of $\sin^{-1}\left(-\frac{\sqrt{3}}{2}\right)$ is equal to :

(1) $-\frac{2\pi}{3}$ (2) $\frac{4\pi}{3}$

(3) $-\frac{\pi}{3}$ (4) $\frac{5\pi}{3}$

64. If $A=\begin{bmatrix}1 & 0\\ -1 & 7\end{bmatrix}$ and $A^2 = 8A + KI_2$, then K is equal to :

(1) -1 (2) 1

(3) 7 (4) -7

65. If $A=\begin{bmatrix}2 & 3 & 4\\ 5 & -3 & 8\\ 9 & 2 & 16\end{bmatrix}$, then trace of A is :

(1) 15 (2) 17

(3) 8 (4) 25

66. If A is a square matrix of order $n \times n$, then $adj\ (adj\ A)$ is equal to :

(1) $|A|^n A$ (2) $|A|^{n-2} A$

(3) $|A|^{n-1} A$ (4) $|A|^{n-3} A$

67. If α, β are non-real numbers satisfying $x^3 - 1 = 0$, then the value of $\begin{vmatrix} \lambda+1 & \alpha & \beta \\ \alpha & \lambda+\beta & 1 \\ \beta & 1 & \lambda+\alpha \end{vmatrix}$ is equal to :

(1) λ^3

(2) $\lambda^3 + 1$

(3) $\lambda^3 - 1$

(4) 0

68. The value of x for which the matrix $A = \begin{bmatrix} 6 & x-2 \\ 3 & x \end{bmatrix}$ has no inverse is :

(1) 0

(2) 2

(3) –2

(4) 3

69. If $A = \begin{pmatrix} 1 & x+3 \\ 2x+1 & x-1 \end{pmatrix}$ is symmetric, then x is equal to :

(1) 5

(2) 7

(3) 3

(4) 2

70. If $2^x + 2^y = 2^{x+y}$, then the value of $\frac{dy}{dx}$ at $x = y = 1$ is :

(1) 0

(2) –1

(3) 1

(4) 2

71. If $f(a-x) = f(x)$, then $\int_0^a x f(x)\,dx$ is equal to :

(1) $\frac{a}{2}\int_0^a f(x)\,dx$

(2) $a\int_0^a f(x)\,dx$

(3) $\frac{a^2}{2}\int_0^a f(x)\,dx$

(4) $\frac{2}{a}\int_0^a f(x)\,dx$

72. $\int_{-1}^{1} \sin^3 x.\cos^2 x\,dx$ is equal to :

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

(3) 2 (4) 0

73. The area of the region bounded by the curve $x^2 = 4y$, line $x = 2$ and x-axis is :

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

(3) $\frac{4}{3}$ (4) $\frac{8}{3}$

74. The area enclosed between the curves $y = ax^2$, $x = ay^2$ $(a > 0)$ is 1 sq. unit. Then the value of a is :

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

(3) $\frac{1}{\sqrt{3}}$ (4) 1

75. If p and q are order and degree of differential equation $y^2\left(\frac{d^2y}{dx^2}\right)^2 + 3x\left(\frac{dy}{dx}\right) + x^2y^2 = \sin x$, then :

(1) $p > q$ (2) $\frac{p}{q} = \frac{1}{2}$

(3) $p = q$ (4) $p < q$

76. The integrating factor of differential equation $\frac{dy}{dx} + \frac{1}{x}y = 3x$ is :

(1) x (2) 0

(3) e^x (4) $\frac{1}{x}$

77. The solution of differential equation $(\cos x)\cos y\,dx + (\sin x)\sin y\,dy = 0$ is :

(1) $\tan x = c$

(2) $\cos x = c \sin y$

(3) $\sec x - \sec y = c$

(4) $\sin x = c \cos y$

78. The elimination of A and B from the equation $y^2 = Ax + B$ gives the differential equation of order :

(1) First

(2) Second

(3) Third

(4) Zero

79. If $\alpha = 2\hat{i} + 3\hat{j} - \hat{k}$, $\beta = -\hat{i} + 2\hat{j} - 4\hat{k}$, $\gamma = \hat{i} + \hat{j} + \hat{k}$, then $(\alpha \times \beta).(\alpha \times \gamma)$ is equal to :

(1) 64

(2) 74

(3) –74

(4) –64

80. If $\vec{a}$ and $\vec{b}$ are two vectors such that $\vec{a}.\vec{b} = 0$ and $\vec{a} \times \vec{b} = \vec{0}$, then :

(1) either $\vec{a}$ or $\vec{b}$ is a null vector

(2) $\vec{a}$ is parallel to $\vec{b}$

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

(4) None of these

81. If $A = \{x, y\}$, then which of the following statement is ***true*** ?

(1) $\phi \in A$

(2) $y \subseteq A$

(3) $\{y\} \in A$

(4) $\{x\} \subseteq A$

82. If A is any set, then :

(1) $A \cup A = A$ (2) $A \cup A = \phi$

(3) $A \cup A = \{A, \phi\}$ (4) $A \cup A = \{0\}$

83. In a class of 60 boys, there are 45 boys who play cards and 30 boys who play carrom. How many boys play cards only ?

(1) 15 (2) 30 (3) 20 (4) 10

84. Which of the following functions is neither even nor odd ?

(1) $x^2 + 7$ (2) $x^7 + 2x^5$

(3) $|x| + 4$ (4) $x + 2$

85. If A = {1, 3, 5, 7} and B = {2, 5}, then the number of relations from A to B is :

(1) 64 (2) 128

(3) 256 (4) 512

86. If $\frac{\cos x}{a} = \frac{\cos(x+\theta)}{b} = \frac{\cos(x+2\theta)}{c} = \frac{\cos(x+3\theta)}{d}$, then $\frac{a+c}{b+d}$ is equal to :

(1) $\frac{a}{d}$ (2) $\frac{b}{c}$

(3) $\frac{c}{d}$ (4) $\frac{d}{a}$

87. If in a triangle ABC, $\tan A + \tan B + \tan C > 0$, then the triangle is :

(1) Always acute angled triangle

(2) Always obtuse angled triangle

(3) Always equilateral triangle

(4) Nothing can be said about the type of triangle

88. The number of solutions of $\sum_{r=1}^{5} \cos rx = 5$ in the interval $[0, 2\pi]$ is :

(1) 10 (2) 5

(3) 1 (4) 0

89. If $1 + \sin\theta + \sin^2\theta + \ldots\ldots \infty = 4 + 2\sqrt{3}$, $0 < \theta < \pi$, $\theta \neq \frac{\pi}{2}$, then :

(1) $\theta = \frac{\pi}{3}$ (2) $\theta = \frac{\pi}{6}$

(3) $\frac{\pi}{3}$ or $\frac{\pi}{6}$ (4) $\theta = \frac{\pi}{3}$ or $\frac{2\pi}{3}$

90. If the multiplicative inverse of a complex number is $\frac{(\sqrt{3} + 4i)}{19}$, then the complex number itself is :

(1) $4 - i\sqrt{3}$ (2) $\sqrt{3} + 4i$ (3) $4 + i\sqrt{3}$ (4) $\sqrt{3} - 4i$

91. A linear function $Z = ax + by$, where a, b are constants, which has to be maximized or minimized is called a linear :

(1) Subjective function

(2) Collective function

(3) Objective function

(4) None of these

92. Any point in the feasible region that gives the maximum or minimum value of the objective function is called an :

(1) Optical solution

(2) Optimal solution

(3) Practical solution

(4) None of these

93. Ten eggs are drawn successively with replacement from a lot containing 10% defective eggs. Find the probability that there is at least one defective egg :

(1) $1-\frac{9^{10}}{10^{10}}$

(2) $1-\frac{9^{10}-1}{10^{10}}$

(3) $1-\frac{9^{9}}{10^{9}}$

(4) $1-\frac{9^{10}}{10^{9}}$

94. Let X be a random variable whose possible values $x_1, x_2, x_3, \ldots\ldots, x_n$ occur with probabilities $p_1, p_2, p_3, \ldots\ldots, p_n$. The mean of random variable X is given by :

(1) $E(X)=\sum_{i=1}^{n}\frac{p_i}{x_i}$

(2) $E(X)=\sum_{i=1}^{n}\frac{x_i}{p_i}$

(3) $E(X)=\sum_{i=1}^{n}(p_i+x_i)$

(4) $E(X)=\sum_{i=1}^{n}p_i\,x_i$

95. A region is said to be convex, if the line segment joining any two arbitrary points of the region lies :

(1) Entirely within the region

(2) Entirely outside the region

(3) Anywhere within or outside the region

(4) None of these

96. If $P(n)$ is the statement, "$\frac{1}{1\times2}+\frac{1}{2\times3}+\frac{1}{3\times4}+\ldots\ldots\ldots+\frac{1}{n(n+1)}=\frac{n}{n+1}$", where $n\in N$, then $P(2)$ is the statement :

(1) $\frac{1}{2}+\frac{1}{6}=\frac{2}{3}$ (2) $\frac{1}{1\times2}=\frac{1}{1+1}$

(3) $\frac{1}{1\times2}+\frac{1}{3\times4}=\frac{7}{12}$ (4) None of these

97. The solution of linear inequation $2x + 10 \geq 0$ is :

(1) $x \in (-5, \infty)$ (2) $x \in (-\infty, \infty)$

(3) $x \in [-5, \infty)$ (4) $x \leq -5$

98. Which of the following is ***not*** correct ?

(1) $x \geq 4 \Rightarrow x - 3 \geq 1$

(2) $x \leq y \Rightarrow -3x \geq -3y$

(3) $2x - 6y \geq 0 \Rightarrow x \geq 3y$

(4) $4x \geq 8 \Rightarrow x \leq 2$

99. A company manufactures toys and its cost equation for a week is $C = 300 + 1.5x$ and its revenue equation is $R = 2x$, where x is the number of toys sold in a week. How many toys must be sold for the company to realize a profit ?

(1) Between 500 and 600

(2) More than 600

(3) At most 550

(4) None of these

100. A sentence is a statement if it is :

(1) Always true (2) Always false

(3) Either true or false but not both (4) Sometimes true, sometimes false

ANSWER KEYS OF MATHEMATICS (HONS.) 5 YEARS INTEGRATED COURSE FOR SESSION 2023-24				
Q. NO.	A	B	C	D
1	4	4	2	1
2	1	1	1	2
3	2	3	3	3
4	4	2	4	4
5	3	1	1	1
6	2	4	2	4
7	1	3	1	3
8	3	3	3	2
9	4	1	4	1
10	4	2	2	4
11	1	1	1	3
12	2	4	4	2
13	3	2	2	4
14	4	4	3	3
15	1	3	1	1
16	4	1	4	3
17	3	1	1	1
18	2	2	2	2
19	1	3	3	1
20	4	4	4	4
21	1	4	4	4
22	4	3	1	1
23	2	2	2	3
24	3	1	4	2
25	1	2	3	1
26	4	3	2	4
27	1	4	1	3
28	2	3	3	3
29	3	2	4	1
30	4	1	4	2
31	4	1	3	1
32	3	2	2	4
33	2	3	4	2
34	1	4	3	4
35	2	1	1	3
36	3	4	3	1
37	4	3	1	1
38	3	2	2	2
39	2	1	1	3
40	1	4	4	4
41	2	3	1	4
42	1	2	4	3
43	3	4	2	2
44	4	3	3	1
45	1	1	3	2
46	2	3	1	3
47	1	1	4	4
48	3	2	2	3
49	4	1	3	2
50	2	4	1	1

ANSWER KEYS OF MATHEMATICS (HONS.) 5 YEARS INTEGRATED COURSE FOR SESSION 2023-24				
Q. NO.	A	B	C	D
51	1	1	4	1
52	4	4	3	4
53	2	2	2	2
54	4	3	1	3
55	3	3	2	1
56	1	1	3	4
57	1	4	4	1
58	2	2	3	2
59	3	3	2	3
60	4	1	1	4
61	1	3	4	2
62	4	2	1	1
63	2	1	3	3
64	3	4	2	4
65	3	1	1	1
66	1	1	4	2
67	4	3	3	1
68	2	4	3	3
69	3	2	1	4
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72	1	1	2	4
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82	2	4	2	1
83	1	2	3	2
84	4	3	4	4
85	1	1	1	3
86	1	4	4	2
87	3	1	3	1
88	4	2	2	3
89	2	3	1	4
90	3	4	4	4
91	3	4	1	3
92	2	1	4	2
93	4	2	2	1
94	3	4	4	4
95	1	3	3	1
96	3	2	1	1
97	1	1	1	3
98	2	3	2	4
99	1	4	3	2
100	4	4	4	3

22/6/23

22/6/2023

22/06/2023