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PG-EE-2018

SUBJECT : Mathematics Hons. (Five Year)

A

10881

Sr. No. ....

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

Roll No. (in figures)____________ (in words) ____________________

Name ____________________ Date of Birth ____________

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7. *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. Two finite sets have m and n elements. The total number of subsets of first set is 56 more than the total number of subsets of the second set, then the values of m and n are :

(1) 5, 2 (2) 7, 4 (3) 5, 1 (4) 6, 3

2. If A, B and C are any three sets, then $A - (B \cap C)$ is the same as :

(1) $(A \cap B) - (A \cap C)$
(2) $(A - B) \cap (A - C)$
(3) $(A - B) \cup (A - C)$
(4) $(A - B) \cup C$

3. For the set $A = \{1, 2, 3, 4, 5\}$ a relation R is defined by $R = \{(x, y) : x, y \in A \text{ and } x < y\}$. Then R is :

(1) transitive
(2) symmetric
(3) reflexive
(4) antisymmetric

4. $\dfrac{2\sin x}{\cos 3x} =$

(1) $\tan 3x - \tan 2x$
(2) $\tan 3x + \tan x$
(3) $\tan 3x + \tan 2x$
(4) $\tan 3x - \tan x$

5. If $\sin\alpha + \sin\beta = \sqrt{3/2}$ and $\cos\alpha + \cos\beta = \dfrac{1}{\sqrt{2}}$, then $\alpha =$

(1) $7\frac{1}{2}°$
(2) $15°$
(3) $30°$
(4) $45°$

6. If $\sin x + \sin^2 x = 1$, then $\cos^8 x + 2\cos^6 x + \cos^4 x =$

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

7. If $n \in N$, then $7^{2n} + 2^{3n-3} . 3^{n-1}$ is divisible by :

(1) 45
(2) 35
(3) 25
(4) 10

8. If α, β are two different complex numbers such that $|\alpha| = 1$, $|\beta| = 1$, then $\left|\dfrac{\beta - \alpha}{1 - \overline{\alpha}\beta}\right| =$

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

9. If $z=x+iy$ and $\left|\frac{1-iz}{z-i}\right|=1$, then $z=$

(1) i
(2) 1
(3) y
(4) x

10. If $z=1+i\sqrt{3}$, then $|\arg(z)| + |\arg(\bar{z})| =$

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

11. If the sum of the squares of the roots of the equation $x^2-(a-2)x-(a+1)=0$ assumes the least value, then $a=$

(1) 0
(2) –1
(3) 1
(4) 2

12. The condition that one root of the equation $ax^2+bx+c=0$ is double of the other, is :

(1) $2b^2=3ac$
(2) $2b^2=9ac$
(3) $b^2=9ac$
(4) $b^2=3ac$

13. In how many ways three different rings can be worn in four fingers with at most one in each finger ?

(1) 3
(2) 12
(3) 21
(4) 24

14. In how many ways a committee of 5 members can be selected from 6 men and 5 women consisting of 3 men and 2 women ?

(1) 200
(2) 181
(3) 160
(4) 120

15. In the expansion of $\left(3x^2-\frac{1}{2x^3}\right)^{10}$, the term independent of x is :

(1) $\frac{76545}{8}$
(2) $\frac{76545}{4}$
(3) $\frac{76545}{16}$
(4) $\frac{72375}{8}$

16. If the coefficients of rth and $(r + 1)$th terms in the expansion of $(7x+3)^{29}$ are equal, then $r =$

(1) 7 (2) 12
(3) 16 (4) 21

17. Sum of first three terms of a G. P. is 16 and the sum of next three terms is 128. The sum of n terms of this G. P. is :

(1) $\frac{8}{7}(2^n - 1)$ (2) $\frac{8}{9}(2^n - 1)$
(3) $\frac{16}{7}(2^n - 1)$ (4) $\frac{16}{9}(2^n - 1)$

18. If A_1, A_2 are two AM's and G_1, G_2 are two GM's between a and b, then $\frac{A_1 + A_2}{G_1 G_2} =$

(1) $\frac{a+b}{\sqrt{ab}}$ (2) $\frac{a+b}{ab}$
(3) $\frac{ab}{a+b}$ (4) $\frac{a+b}{2ab}$

19. The sum of n terms of an A. P. is $3n^2 + 5$. If its nth term is 159, then $n =$

(1) 15 (2) 18
(3) 24 (4) 27

20. If the sum of first n natural number is $\frac{1}{5}$ times the sum of their squares, then the value of n is :

(1) 5 (2) 7
(3) 8 (4) 9

21. The image of the point (3, 8) in the line $x + 3y = 7$ is :

(1) (1, 4) (2) (–4, –1)
(3) (–1, –4) (4) (4, 1)

22. The nearest point on the line $3x - 4y = 25$ from the origin is :

(1) (3, –4) (2) (4, –3)
(3) (3, 4) (4) (3, 5)

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23. The line which is parallel to x-axis and crosses the curve $y=\sqrt{x}$ at an angle 45°, is :

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

24. The distance between the parallel lines $4x + 3y = 11$ and $8x + 6y = 15$ is :

(1) $\frac{7}{10}$ units
(2) $\frac{10}{7}$ units
(3) $\frac{7}{5}$ units
(4) $\frac{5}{7}$ units

25. If the points (0, 0), (1, 0), (0, 1) and (k, k) are concyclic, then $k =$

(1) 2
(2) −1
(3) 1
(4) −2

26. The vertex of the parabola $y^2+6x-2y+13=0$ is :

(1) (1, 2)
(2) (2, 1)
(3) (2, −1)
(4) (−2, 1)

27. The eccentricity of an ellipse is $\frac{1}{2}$ and its foci are (±2, 0), its equation is :

(1) $\frac{x^2}{16}+\frac{y^2}{12}=1$
(2) $\frac{x^2}{12}+\frac{y^2}{16}=1$
(3) $\frac{x^2}{12}+\frac{y^2}{8}=1$
(4) $\frac{x^2}{8}+\frac{y^2}{12}=1$

28. If $5x^2+ky^2=20$ represents a rectangular hyperbola, then $k =$

(1) 5
(2) 4
(3) −4
(4) −5

29. The ratio in which the line joining the points (1, 2, 3) and (−3, 4, −5) is divided by the xy-plane, is :

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

30. A line passes through (2, 2) and is perpendicular to the line $3x + y = 3$. Its y-intercept is :

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

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

31. The point in the xy-plane which is equidistant from (2, 0, 3), (0, 3, 2) and (0, 0, 1) is :

(1) (2, 3, 0) (2) (3, –2, 0)

(3) (3, 2, 0) (4) (2, –3, 0)

32. $\lim_{x\to 0} \frac{e^{x^2} - \cos x}{x^2} =$

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

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

33. $\lim_{x\to 0} \frac{\sin 3x}{1-\sqrt{1-x}} =$

(1) 2 (2) 3

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

34. If $f(a) = 4,\ f'(a) = 2,$ then $\lim_{x\to a} \frac{xf(a) - af(x)}{x-a} =$

(1) $2a - 4$ (2) $4 - 2a$

(3) $4 - a$ (4) $2 - 2a$

35. The set of points of differentiability of the function $f(x) = |x-2| \sin x$ is :

(1) R (2) $R - \{1\}$

(3) $R - \{-2\}$ (4) $R - \{2\}$

36. The variance of first n natural number is :

(1) $\frac{n(n-1)}{12}$ (2) $\frac{n^2+1}{12}$

(3) $\frac{n^2-1}{12}$ (4) $\frac{(n+1)(2n+1)}{6}$

37. The sum of 10 items is 12 and the sum of their squares is 18, then the standa deviation is :

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

(3) $\frac{3}{5}$ (4) $\frac{3}{10}$

38. Three identical dice are rolled. The probability that the same number will appear each of them is :

(1) $\frac{1}{6}$ (2) $\frac{1}{12}$

(3) $\frac{1}{36}$ (4) $\frac{2}{9}$

39. A selection committee of five is constituted from a group of nine persons. T probability that a certain married couple will either be a part of the committee or r at all, is :

(1) $\frac{2}{9}$ (2) $\frac{7}{9}$

(3) $\frac{5}{9}$ (4) $\frac{4}{9}$

40. The probability that the roots of the equation $x^2+nx+\frac{1}{2}(n+1)=0$ are real whe $n \in N$ such that $n \leq 5$, is :

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

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

41. If $f: R \rightarrow R$ is given by $f(x) = 3x - 5$, then $f^{-1}(x) =$

(1) $\frac{1}{3x-5}$ (2) $\frac{x+5}{3}$

(3) $\frac{3}{x+5}$ (4) does not exist

42. The domain and range are same for :

(1) identity function (2) constant function

(3) injective function (4) surjective function

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43. The binary operation * defined by $a * b = 1 + ab$ is :

(1) both commutative and associative

(2) associative but not commutative

(3) commutative but not associative

(4) neither commutative nor associative

44. If $f(x)=x^2+2, g(x)=\frac{x}{x-1}$, then $(gof)\left(\frac{1}{2}\right)=$

(1) $\frac{7}{2}$ (2) $\frac{5}{2}$

(3) $\frac{4}{5}$ (4) $\frac{9}{5}$

45. If $\sin\left(\sin^{-1}\frac{1}{5}+\cos^{-1}x\right)=1$, then $x=$

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

(3) $\frac{4}{5}$ (4) 0

46. $\sin^{-1}\left(\frac{3}{5}\right)+\tan^{-1}\left(\frac{1}{7}\right)=$

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

(3) $\frac{\pi}{2}$ (4) π

47. Two angles of a triangle are $\cot^{-1}2$ and $\cot^{-1}3$, then the third angle is :

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

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

48. If A is a square matrix, then which of the following is ***not*** correct ?

(1) $A+A^T$ is symmetric (2) $A-A^T$ is skew-symmetric

(3) AA^T is symmetric (4) A^T-A is symmetric

49. If A and B are symmetric matrices of the same order, then $AB - BA$ is :

(1) symmetric matrix
(2) skew-symmetric matrix
(3) null matrix
(4) unit matrix

50. If A is a singular matrix, then $A \; adj \; A$ is :

(1) unit matrix
(2) scalar matrix
(3) identity matrix
(4) null matrix

51. If A is an invertible matrix and B is a matrix, then which of the following is ***true*** ?

(1) rank (AB) = rank(A)
(2) rank (AB) = rank(B)
(3) rank (AB) > rank(B)
(4) rank (AB) > rank(A)

52. The area of the triangle with vertices (5, 4), (–2, 4) and (2, –6) is :

(1) 25 sq. units
(2) 35 sq. units
(3) 42 sq. units
(4) 45 sq. units

53. Value of the determinant $\begin{vmatrix} \cos\alpha & -\sin\alpha & 1 \\ \sin\alpha & \cos\alpha & 1 \\ \cos(\alpha+\beta) & -\sin(\alpha+\beta) & 1 \end{vmatrix}$ is :

(1) independent of α and β
(2) independent of β
(3) independent of α
(4) 0

54. One root of $\begin{vmatrix} x & 3 & 7 \\ 2 & x & 2 \\ 7 & 6 & x \end{vmatrix} = 0$ is $x = -9$ the other two roots are :

(1) 7, 2
(2) 3, 8
(3) 5, 2
(4) 2, –1

55. If the system of equations $kx + y + z = 1$, $x + ky + z = k$ and $x + y + kz = k^2$ is inconsistent, then k =

(1) –1
(2) 1
(3) –2
(4) 2

56. The function $f(x) = \begin{cases} x^m \sin\left(\frac{1}{x}\right) & , \; x \neq 0 \\ 0 & , \; x = 0 \end{cases}$ is :

(1) continuous at $x = 0$
(2) discontinuous at $x = 0$
(3) continuous at $x = 0$, if $m < 0$
(4) continuous at $x = 0$, if $m > 0$

57. If $f(x)=\begin{cases}\frac{1}{x}[\log(1+ax)-\log(1-bx)] & , \quad x\neq 0\\ k & , \quad x=0\end{cases}$, and $f(x)$ is continuous at $x = 0$, then the value of k is :

(1) ab
(2) $a+b$
(3) $a-b$
(4) $\log ab$

58. The value of derivative of $|x-1|+|x-3|$ at $x=2$ is :

(1) 2
(2) −2
(3) 4
(4) 0

59. Let $f(x)$ be an even function, then $f'(x)$:

(1) is an odd function
(2) is an even function
(3) may be even or odd
(4) is a constant

60. If [ ] denotes the greatest integer function and $f(x)=[2x^3-3]$, then the number of points in (1, 2) where $f(x)$ is discontinuous, is :

(1) 15
(2) 13
(3) 10
(4) 7

61. Let $f(x) = \sin x$, $g(x)=x^2$ and $h(x) = \log x$. If $F(x) = (hogof)(x)$, then $F''(x)=$

(1) $-2\operatorname{cosec}^2 x$
(2) $-\operatorname{cosec}^2 x$
(3) $2\operatorname{cosec}^2 x$
(4) $-2\operatorname{cosec}^3 x$

62. If $x^y=e^{x-y}$, then $\frac{dy}{dx}=$

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

63. If $x=\sin^{-1}\left(\frac{2\theta}{1+\theta^2}\right), y=\tan^{-1}\left(\frac{2\theta}{1-\theta^2}\right)$, then $\frac{dy}{dx}=$

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

64. The equation of the tangent to the curve $y=(2x-1)e^{2(1-x)}$ at the point of its maxima is :

(1) $x-1=0$
(2) $y-1=0$
(3) $x+y-1=0$
(4) $x-y+1=0$

65. The equation of normal to the curve $x=a(1+\cos\theta)$, $y=a\sin\theta$ at θ is :

(1) $x\sin\theta-y\cos\theta=a$
(2) $x\cos\theta-y\sin\theta=a$
(3) $x\sin\theta-y\cos\theta=a\sin\theta$
(4) $x\cos\theta-y\sin\theta=a\sin\theta$

66. The function $f(x)=x+\cot^{-1}x$ is :

(1) decreases for all x
(2) decreases for $[1, \infty)$
(3) increasing for all x
(4) constant for all x

67. The function $f(x)=\sin^4 x+\cos^4 x$ increases if :

(1) $\frac{\pi}{4}<x<\frac{\pi}{2}$
(2) $\frac{3\pi}{8}<x<\frac{5\pi}{8}$
(3) $\frac{5\pi}{8}<x<\frac{3\pi}{4}$
(4) $0<x<\frac{\pi}{8}$

68. The curves $y=1-ax^2$ and $y=x^2$ intersect orthogonally, then the value of a is :

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

69. In the interval [0, 1] the function $f(x)=x^5(1-x)^{15}$ takes the maximum value at the point :

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

70. The maximum value of $\left(\frac{1}{x}\right)^x$ is :

(1) e^e

(2) $e^{1/e}$

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

(4) $e^{-1/e}$

71. $\int \frac{\cos x - \cos 2x}{1 - \cos x} dx =$

(1) $x + 2\sin x + c$

(2) $x - 2\sin x + c$

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

(4) $x + 2\cos x + c$

72. $\int \frac{\sqrt{x}}{x+1} dx =$

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

(2) $\sqrt{x} - \tan^{-1}\sqrt{x} + c$

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

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

73. $\int \frac{1 + x + x^2}{1 + x^2} e^{\tan^{-1} x} dx =$

(1) $e^{\tan^{-1} x} + c$

(2) $x^2 e^{\tan^{-1} x} + c$

(3) $\frac{1}{x} e^{\tan^{-1} x} + c$

(4) $x e^{\tan^{-1} x} + c$

74. $\int \frac{dx}{x\left(x^n + 1\right)} =$

(1) $\frac{1}{n}\log\left(\frac{x^n}{x^n + 1}\right) + c$

(2) $\log\left(\frac{x^n}{x^n + 1}\right) + c$

(3) $\frac{1}{n}\log\left(\frac{x^n + 1}{x^n}\right) + c$

(4) $\frac{1}{n}\log\left(x^n + 1\right) + c$

75. $\int_{0}^{1.5} [x^2]\, dx =$

(1) $\sqrt{2}$

(2) $2+\sqrt{2}$

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

(4) $3-\sqrt{2}$

76. $\int_{0}^{\pi/2} \frac{\sqrt{\sin x}}{\sqrt{\sin x}+\sqrt{\cos x}}\, dx =$

(1) 0

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

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

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

77. $\int_{\pi/4}^{3\pi/4} \frac{1}{1+\cos x}\, dx =$

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

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

(3) 1

(4) 2

78. The area enclosed between the curves $y = x^3$ and $y = \sqrt{x}$ is :

(1) $\frac{4}{5}$ sq. units

(2) $\frac{5}{4}$ sq. units

(3) $\frac{5}{8}$ sq. units

(4) $\frac{5}{12}$ sq. units

79. The area bounded by $y = xe^{|x|}$ and the lines $|x| = 1, y = 0$ is :

(1) 3 sq. units

(2) $\frac{3}{2}$ sq. units

(3) 2 sq. units

(4) $\frac{2}{3}$ sq. units

80. Solution of $\frac{dy}{dx} = \frac{e^{2x}+e^{4x}}{e^{x}+e^{-x}}$ is :

(1) $y = \frac{1}{3}e^{3x} + c$

(2) $y = \frac{2}{3}e^{3x} + c$

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

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

81. The degree and order of the differential equation of all parabolas whose axis is x-axis are :

(1) 2, 1 (2) 1, 2

(3) 2, 3 (4) 3, 2

82. Solution of $y\dfrac{dy}{dx}=x-1, y(1)=1$ is :

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

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

83. From a well shuffled pack of cards, two cards are drawn without replacement in two consecutive draws. The probability of drawing a diamond card in each draw is :

(1) $\dfrac{2}{7}$ (2) $\dfrac{1}{17}$

(3) $\dfrac{1}{13}$ (4) $\dfrac{4}{51}$

84. For two events A and B, it is given that $P(A)=P(A/B)=\dfrac{1}{4}$, $P(B/A)=\dfrac{1}{2}$, then which of the following is *true* ?

(1) $P(\overline{A}/B)=\dfrac{1}{4}$

(2) $P(\overline{A}/B)=\dfrac{1}{2}$

(3) $P(\overline{A}/B)=\dfrac{3}{4}$

(4) A and B are mutually exclusive events

85. The chances of A and B of winning a single game are equal. A needs 3 games and B needs 4 games to win a match. Then A's chance of winning the match is :

(1) $\dfrac{23}{32}$ (2) $\dfrac{21}{32}$

(3) $\dfrac{17}{32}$ (4) $\dfrac{11}{32}$

86. Six coins are tossed simultaneously. The probability of getting at least 4 heads is :

(1) $\frac{5}{32}$ (2) $\frac{9}{32}$

(3) $\frac{11}{32}$ (4) $\frac{13}{32}$

87. Two persons are selected out of 8 men and 5 women. The probability that at least one of the selected persons will be a woman, is :

(1) $\frac{4}{13}$ (2) $\frac{5}{13}$

(3) $\frac{22}{39}$ (4) $\frac{25}{39}$

88. If X follows a binomial distribution with parameters $n = 6$ and p. If $4.P(X = 4) = P(X = 2)$, then p =

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

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

89. The number of vectors of unit length perpendicular to the vectors $\vec{a} = \hat{i} + \hat{j}$ and $\vec{b} = \hat{j} + \hat{k}$, is :

(1) NIL (2) 1

(3) 2 (4) 3

90. The vector $\hat{i} + x\hat{j} + 3\hat{k}$ is rotated through an angle θ and doubled in magnitude, then it becomes $4\hat{i} + (4x - 2)\hat{j} + 2\hat{k}$. The value of x is :

(1) –2/3 (2) –3/2

(3) –2 (4) –3

91. If $\vec{a}$ and $\vec{b}$ are two unit vectors inclined at an angle θ such that $\vec{a} + \vec{b}$ is a unit vector, then θ =

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

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

92. Which of the following is *correct* ?

(1) Every LLP admits an optimal solution

(2) A LLP admits unique optimal solution

(3) The set of all feasible solutions of a LLP is not a convex set

(4) If a LLP admits two optimal solutions, it has an infinite number of optimal solutions

93. The vectors $2\hat{i}+\hat{j}+3\hat{k}$ and $4\hat{i}-\lambda\hat{j}+6\hat{k}$ are parallel if $\lambda =$

(1) -2 (2) -3

(3) 2 (4) 3

94. Projection of the vector $\hat{i}-2\hat{j}+\hat{k}$ on the vector $4\hat{i}-4\hat{j}+7\hat{k}$ is :

(1) $\frac{19}{9}$ (2) $\frac{9}{19}$

(3) $\frac{19}{6}$ (4) $\frac{17}{9}$

95. If $|\vec{a}|=7$, $|\vec{b}|=11$, $|\vec{a}+\vec{b}|=10\sqrt{3}$, then $|\vec{a}-\vec{b}| =$

(1) $\sqrt{10}$ (2) $3\sqrt{10}$

(3) $2\sqrt{10}$ (4) $10\sqrt{2}$

96. If α, β, γ are the angles made by a vector with the coordinate axes, then $\sin^2\alpha+\sin^2\beta+\sin^2\gamma =$

(1) 0 (2) 1

(3) 2 (4) 3

97. The image of the point $(3, -2, 1)$ in the plane $3x - y + 4z = 2$ is :

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

(3) $(1, 0, -3)$ (4) $(0, 1, -3)$

98. If a plane meets the coordinates axes at point A, B and C in such a way that the centroid of triangle ABC is (1, 2, 3), then the equation of the plane is :

(1) $6x + 3y + 2z - 2 = 0$ (2) $6x + 3y + 2z - 6 = 0$

(3) $6x + 3y + 2z - 18 = 0$ (4) $3x + 2y + z - 9 = 0$

99. The distance between the planes $\vec{r}.(\hat{i}+2\hat{j}-2\hat{k})+5=0$ and $\vec{r}.(\hat{i}+2\hat{j}-2\hat{k})-8=0$ is :

(1) $\frac{8}{3}$ units (2) $\frac{3}{13}$ units

(3) $\frac{10}{3}$ units (4) $\frac{13}{3}$ units

100. The equation of the passing through (–1, 2, –3) and perpendicular to the plane $2x+3y+z+5=0$ is :

(1) $\frac{x-1}{2}=\frac{y+2}{3}=\frac{z-3}{1}$ (2) $\frac{x+1}{2}=\frac{y-2}{3}=\frac{z+3}{1}$

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

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PG-EE-2018

SUBJECT : Mathematics Hons. (Five Year)

B

10882

Sr. No. ....

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

Roll No. (in figures)________________ (in words) ______________________

Name ______________________________ Date of Birth ________________

Father's Name ______________________ Mother's Name ______________________

Date of Exam ______________________

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SEAL

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1. If $f : R \to R$ is given by $f(x) = 3x - 5$, then $f^{-1}(x) =$

(1) $\frac{1}{3x-5}$ (2) $\frac{x+5}{3}$

(3) $\frac{3}{x+5}$ (4) does not exist

2. The domain and range are same for :

(1) identity function (2) constant function

(3) injective function (4) surjective function

3. The binary operation * defined by $a * b = 1 + ab$ is :

(1) both commutative and associative

(2) associative but not commutative

(3) commutative but not associative

(4) neither commutative nor associative

4. If $f(x) = x^2 + 2, g(x) = \frac{x}{x-1}$, then $(gof)\left(\frac{1}{2}\right) =$

(1) $\frac{7}{2}$ (2) $\frac{5}{2}$

(3) $\frac{4}{5}$ (4) $\frac{9}{5}$

5. If $\sin\left(\sin^{-1}\frac{1}{5} + \cos^{-1} x\right) = 1$, then $x =$

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

(3) $\frac{4}{5}$ (4) 0

6. $\sin^{-1}\left(\frac{3}{5}\right) + \tan^{-1}\left(\frac{1}{7}\right) =$

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

(3) $\frac{\pi}{2}$ (4) π

7. Two angles of a triangle are $\cot^{-1} 2$ and $\cot^{-1} 3$, then the third angle is :

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

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

8. If A is a square matrix, then which of the following is ***not*** correct ?

(1) $A + A^T$ is symmetric (2) $A - A^T$ is skew-symmetric

(3) AA^T is symmetric (4) $A^T - A$ is symmetric

9. If A and B are symmetric matrices of the same order, then $AB - BA$ is :

(1) symmetric matrix (2) skew-symmetric matrix

(3) null matrix (4) unit matrix

10. If A is a singular matrix, then $A \; adj \; A$ is :

(1) unit matrix (2) scalar matrix

(3) identity matrix (4) null matrix

11. Two finite sets have m and n elements. The total number of subsets of first set is 56 more than the total number of subsets of the second set, then the values of m and n are :

(1) 5, 2 (2) 7, 4 (3) 5, 1 (4) 6, 3

12. If A, B and C are any three sets, then $A - (B \cap C)$ is the same as :

(1) $(A \cap B) - (A \cap C)$ (2) $(A - B) \cap (A - C)$

(3) $(A - B) \cup (A - C)$ (4) $(A - B) \cup C$

13. For the set $A = \{1, 2, 3, 4, 5\}$ a relation R is defined by $R = \{(x, y) : x, y \in A \text{ and } x < y\}$. Then R is :

(1) transitive (2) symmetric

(3) reflexive (4) antisymmetric

14. $\frac{2\sin x}{\cos 3x} =$

(1) $\tan 3x - \tan 2x$ (2) $\tan 3x + \tan x$

(3) $\tan 3x + \tan 2x$ (4) $\tan 3x - \tan x$

15. If $\sin\alpha + \sin\beta = \sqrt{3/2}$ and $\cos\alpha + \cos\beta = \frac{1}{\sqrt{2}}$, then $\alpha =$

(1) $7\frac{1}{2}°$ (2) $15°$

(3) $30°$ (4) $45°$

16. If $\sin x + \sin^2 x = 1$, then $\cos^8 x + 2\cos^6 x + \cos^4 x =$

(1) 0 (2) 1

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

17. If $n \in N$, then $7^{2n} + 2^{3n-3} . 3^{n-1}$ is divisible by :

(1) 45 (2) 35

(3) 25 (4) 10

18. If α, β are two different complex numbers such that $|\alpha| = 1$, $|\beta| = 1$, then $\left|\frac{\beta - \alpha}{1 - \overline{\alpha}\beta}\right| =$

(1) 0 (2) 1

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

19. If $z = x + iy$ and $\left|\frac{1 - iz}{z - i}\right| = 1$, then $z =$

(1) i (2) 1

(3) y (4) x

20. If $z = 1 + i\sqrt{3}$, then $|\arg(z)| + |\arg(\overline{z})| =$

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

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

21. $\int \frac{\cos x - \cos 2x}{1 - \cos x} dx =$

(1) $x + 2\sin x + c$ (2) $x - 2\sin x + c$

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

22. $\int \frac{\sqrt{x}}{x+1} dx =$

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

(2) $\sqrt{x} - \tan^{-1}\sqrt{x} + c$

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

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

23. $\int \frac{1+x+x^2}{1+x^2} e^{\tan^{-1} x} dx =$

(1) $e^{\tan^{-1} x} + c$

(2) $x^2 e^{\tan^{-1} x} + c$

(3) $\frac{1}{x} e^{\tan^{-1} x} + c$

(4) $x e^{\tan^{-1} x} + c$

24. $\int \frac{dx}{x\left(x^n + 1\right)} =$

(1) $\frac{1}{n} \log\left(\frac{x^n}{x^n + 1}\right) + c$

(2) $\log\left(\frac{x^n}{x^n + 1}\right) + c$

(3) $\frac{1}{n} \log\left(\frac{x^n + 1}{x^n}\right) + c$

(4) $\frac{1}{n} \log\left(x^n + 1\right) + c$

25. $\int_0^{1.5} \left[x^2\right] dx =$

(1) $\sqrt{2}$

(2) $2 + \sqrt{2}$

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

(4) $3 - \sqrt{2}$

26. $\int_0^{\pi/2} \frac{\sqrt{\sin x}}{\sqrt{\sin x} + \sqrt{\cos x}} dx =$

(1) 0

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

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

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

27. $\int_{\pi/4}^{3\pi/4} \frac{1}{1+\cos x}\, dx =$

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

(3) 1 (4) 2

28. The area enclosed between the curves $y = x^3$ and $y = \sqrt{x}$ is :

(1) $\frac{4}{5}$ sq. units (2) $\frac{5}{4}$ sq. units

(3) $\frac{5}{8}$ sq. units (4) $\frac{5}{12}$ sq. units

29. The area bounded by $y = xe^{|x|}$ and the lines $|x| = 1, y = 0$ is :

(1) 3 sq. units (2) $\frac{3}{2}$ sq. units

(3) 2 sq. units (4) $\frac{2}{3}$ sq. units

30. Solution of $\frac{dy}{dx} = \frac{e^{2x} + e^{4x}}{e^{x} + e^{-x}}$ is :

(1) $y = \frac{1}{3}e^{3x} + c$ (2) $y = \frac{2}{3}e^{3x} + c$

(3) $y = e^{3x} + c$ (4) $y = \frac{1}{2}e^{2x} + c$

31. The degree and order of the differential equation of all parabolas whose axis is x-axis are :

(1) 2, 1 (2) 1, 2

(3) 2, 3 (4) 3, 2

32. Solution of $y\frac{dy}{dx} = x - 1, y(1) = 1$ is :

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

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

33. From a well shuffled pack of cards, two cards are drawn without replacement in two consecutive draws. The probability of drawing a diamond card in each draw is :

(1) $\frac{2}{7}$ (2) $\frac{1}{17}$

(3) $\frac{1}{13}$ (4) $\frac{4}{51}$

34. For two events A and B, it is given that $P(A)=P(A/B)=\frac{1}{4}$, $P(B/A)=\frac{1}{2}$, then which of the following is ***true*** ?

(1) $P(\overline{A}/B)=\frac{1}{4}$

(2) $P(\overline{A}/B)=\frac{1}{2}$

(3) $P(\overline{A}/B)=\frac{3}{4}$

(4) A and B are mutually exclusive events

35. The chances of A and B of winning a single game are equal. A needs 3 games and B needs 4 games to win a match. Then A's chance of winning the match is :

(1) $\frac{23}{32}$ (2) $\frac{21}{32}$

(3) $\frac{17}{32}$ (4) $\frac{11}{32}$

36. Six coins are tossed simultaneously. The probability of getting at least 4 heads is :

(1) $\frac{5}{32}$ (2) $\frac{9}{32}$

(3) $\frac{11}{32}$ (4) $\frac{13}{32}$

37. Two persons are selected out of 8 men and 5 women. The probability that at least one of the selected persons will be a woman, is :

(1) $\frac{4}{13}$ (2) $\frac{5}{13}$

(3) $\frac{22}{39}$ (4) $\frac{25}{39}$

38. If X follows a binomial distribution with parameters $n = 6$ and p. If 4.P(X = 4) = P(X = 2), then p =

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

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

39. The number of vectors of unit length perpendicular to the vectors $\vec{a} = \hat{i} + \hat{j}$ and $\vec{b} = \hat{j} + \hat{k}$, is :

(1) NIL (2) 1

(3) 2 (4) 3

40. The vector $\hat{i} + x\hat{j} + 3\hat{k}$ is rotated through an angle θ and doubled in magnitude, then it becomes $4\hat{i} + (4x-2)\hat{j} + 2\hat{k}$. The value of x is :

(1) –2/3 (2) –3/2

(3) –2 (4) –3

41. Let $f(x) = \sin x$, $g(x) = x^2$ and $h(x) = \log x$. If $F(x) = (hogof)(x)$, then $F''(x) =$

(1) $-2\operatorname{cosec}^2 x$ (2) $-\operatorname{cosec}^2 x$

(3) $2\operatorname{cosec}^2 x$ (4) $-2\operatorname{cosec}^3 x$

42. If $x^y = e^{x-y}$, then $\frac{dy}{dx} =$

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

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

43. If $x = \sin^{-1}\left(\frac{2\theta}{1+\theta^2}\right), y = \tan^{-1}\left(\frac{2\theta}{1-\theta^2}\right)$, then $\frac{dy}{dx} =$

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

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

44. The equation of the tangent to the curve $y=(2x-1)e^{2(1-x)}$ at the point of its maxima is :

(1) $x-1=0$ (2) $y-1=0$

(3) $x+y-1=0$ (4) $x-y+1=0$

45. The equation of normal to the curve $x = a(1 + \cos\theta)$, $y = a \sin\theta$ at θ is :

(1) $x \sin\theta - y \cos\theta = a$ (2) $x \cos\theta - y \sin\theta = a$

(3) $x \sin\theta - y \cos\theta = a \sin\theta$ (4) $x \cos\theta - y \sin\theta = a \sin\theta$

46. The function $f(x)=x+\cot^{-1}x$ is :

(1) decreases for all x (2) decreases for $[1, \infty)$

(3) increasing for all x (4) constant for all x

47. The function $f(x)=\sin^4 x+\cos^4 x$ increases if :

(1) $\frac{\pi}{4}<x<\frac{\pi}{2}$ (2) $\frac{3\pi}{8}<x<\frac{5\pi}{8}$

(3) $\frac{5\pi}{8}<x<\frac{3\pi}{4}$ (4) $0<x<\frac{\pi}{8}$

48. The curves $y=1-ax^2$ and $y=x^2$ intersect orthogonally, then the value of a is :

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

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

49. In the interval [0, 1] the function $f(x)=x^5(1-x)^{15}$ takes the maximum value at the point :

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

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

50. The maximum value of $\left(\frac{1}{x}\right)^x$ is :

(1) e^e (2) $e^{1/e}$

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

51. The image of the point (3, 8) in the line $x + 3y = 7$ is :

(1) (1, 4) (2) (–4, –1)

(3) (–1, –4) (4) (4, 1)

52. The nearest point on the line $3x - 4y = 25$ from the origin is :

(1) (3, –4) (2) (4, –3)

(3) (3, 4) (4) (3, 5)

53. The line which is parallel to x-axis and crosses the curve $y = \sqrt{x}$ at an angle 45°, is :

(1) $x = \frac{1}{2}$ (2) $y = \frac{1}{2}$

(3) $x = \frac{1}{4}$ (4) $y = \frac{1}{4}$

54. The distance between the parallel lines $4x + 3y = 11$ and $8x + 6y = 15$ is :

(1) $\frac{7}{10}$ units (2) $\frac{10}{7}$ units

(3) $\frac{7}{5}$ units (4) $\frac{5}{7}$ units

55. If the points (0, 0), (1, 0), (0, 1) and (k, k) are concyclic, then k =

(1) 2 (2) –1

(3) 1 (4) –2

56. The vertex of the parabola $y^2 + 6x - 2y + 13 = 0$ is :

(1) (1, 2) (2) (2, 1)

(3) (2, –1) (4) (–2, 1)

57. The eccentricity of an ellipse is $\frac{1}{2}$ and its foci are (±2, 0), its equation is :

(1) $\frac{x^2}{16}+\frac{y^2}{12}=1$ (2) $\frac{x^2}{12}+\frac{y^2}{16}=1$

(3) $\frac{x^2}{12}+\frac{y^2}{8}=1$ (4) $\frac{x^2}{8}+\frac{y^2}{12}=1$

58. If $5x^2+ky^2=20$ represents a rectangular hyperbola, then k =

(1) 5 (2) 4

(3) –4 (4) –5

59. The ratio in which the line joining the points (1, 2, 3) and (–3, 4, –5) is divided by the xy-plane, is :

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

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

60. A line passes through (2, 2) and is perpendicular to the line $3x + y = 3$. Its y-intercept is :

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

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

61. If $\vec{a}$ and $\vec{b}$ are two unit vectors inclined at an angle θ such that $\vec{a}+\vec{b}$ is a unit vector, then θ =

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

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

62. Which of the following is *correct* ?

(1) Every LLP admits an optimal solution

(2) A LLP admits unique optimal solution

(3) The set of all feasible solutions of a LLP is not a convex set

(4) If a LLP admits two optimal solutions, it has an infinite number of optimal solutions

63. The vectors $2\hat{i}+\hat{j}+3\hat{k}$ and $4\hat{i}-\lambda\hat{j}+6\hat{k}$ are parallel if $\lambda =$

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

64. Projection of the vector $\hat{i}-2\hat{j}+\hat{k}$ on the vector $4\hat{i}-4\hat{j}+7\hat{k}$ is :

(1) $\frac{19}{9}$
(2) $\frac{9}{19}$
(3) $\frac{19}{6}$
(4) $\frac{17}{9}$

65. If $|\vec{a}|=7$, $|\vec{b}|=11$, $|\vec{a}+\vec{b}|=10\sqrt{3}$, then $|\vec{a}-\vec{b}|=$

(1) $\sqrt{10}$
(2) $3\sqrt{10}$
(3) $2\sqrt{10}$
(4) $10\sqrt{2}$

66. If α, β, γ are the angles made by a vector with the coordinate axes, then $\sin^2\alpha+\sin^2\beta+\sin^2\gamma=$

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

67. The image of the point (3, –2, 1) in the plane $3x-y+4z=2$ is :

(1) (1, –1, –3)
(2) (0, –1, –3)
(3) (1, 0, –3)
(4) (0, 1, –3)

68. If a plane meets the coordinates axes at point A, B and C in such a way that the centroid of triangle ABC is (1, 2, 3), then the equation of the plane is :

(1) $6x+3y+2z-2=0$
(2) $6x+3y+2z-6=0$
(3) $6x+3y+2z-18=0$
(4) $3x+2y+z-9=0$

69. The distance between the planes $\vec{r}.(\hat{i}+2\hat{j}-2\hat{k})+5=0$ and $\vec{r}.(\hat{i}+2\hat{j}-2\hat{k})-8=0$ is :

(1) $\frac{8}{3}$ units
(2) $\frac{3}{13}$ units
(3) $\frac{10}{3}$ units
(4) $\frac{13}{3}$ units

8

70. The equation of the passing through (–1, 2, –3) and perpendicular to the plan $2x + 3y + z + 5 = 0$ is :

(1) $\frac{x-1}{2} = \frac{y+2}{3} = \frac{z-3}{1}$

(2) $\frac{x+1}{2} = \frac{y-2}{3} = \frac{z+3}{1}$

(3) $\frac{x+1}{-1} = \frac{y-2}{1} = \frac{z+3}{1}$

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

71. If A is an invertible matrix and B is a matrix, then which of the following is ***true*** ?

(1) rank (AB) = rank(A)

(2) rank (AB) = rank(B)

(3) rank (AB) > rank(B)

(4) rank (AB) > rank(A)

72. The area of the triangle with vertices (5, 4), (–2, 4) and (2, –6) is :

(1) 25 sq. units

(2) 35 sq. units

(3) 42 sq. units

(4) 45 sq. units

73. Value of the determinant $\begin{vmatrix} \cos\alpha & -\sin\alpha & 1 \\ \sin\alpha & \cos\alpha & 1 \\ \cos(\alpha+\beta) & -\sin(\alpha+\beta) & 1 \end{vmatrix}$ is :

(1) independent of α and β

(2) independent of β

(3) independent of α

(4) 0

74. One root of $\begin{vmatrix} x & 3 & 7 \\ 2 & x & 2 \\ 7 & 6 & x \end{vmatrix} = 0$ is $x = -9$ the other two roots are :

(1) 7, 2

(2) 3, 8

(3) 5, 2

(4) 2, –1

75. If the system of equations $kx + y + z = 1$, $x + ky + z = k$ and $x + y + kz = k^2$ is inconsistent, then k =

(1) –1

(2) 1

(3) –2

(4) 2

76. The function $f(x) = \begin{cases} x^m \sin\left(\frac{1}{x}\right) & , \ x \neq 0 \\ 0 & , \ x = 0 \end{cases}$ is :

(1) continuous at $x = 0$

(2) discontinuous at $x = 0$

(3) continuous at $x = 0$, if $m < 0$

(4) continuous at $x = 0$, if $m > 0$

B

77. If $f(x)=\begin{cases}\frac{1}{x}[\log(1+ax)-\log(1-bx)] & , x\neq 0 \\ k & , x=0\end{cases}$, and $f(x)$ is continuous at $x = 0$, then the value of k is :

(1) ab
(2) $a+b$
(3) $a-b$
(4) $\log ab$

78. The value of derivative of $|x-1|+|x-3|$ at $x=2$ is :

(1) 2
(2) –2
(3) 4
(4) 0

79. Let $f(x)$ be an even function, then $f'(x)$:

(1) is an odd function
(2) is an even function
(3) may be even or odd
(4) is a constant

80. If [ ] denotes the greatest integer function and $f(x)=[2x^3-3]$, then the number of points in (1, 2) where $f(x)$ is discontinuous, is :

(1) 15
(2) 13
(3) 10
(4) 7

81. The point in the xy-plane which is equidistant from (2, 0, 3), (0, 3, 2) and (0, 0, 1) is :

(1) (2, 3, 0)
(2) (3, –2, 0)
(3) (3, 2, 0)
(4) (2, –3, 0)

82. $\lim\limits_{x\to 0}\frac{e^{x^2}-\cos x}{x^2}=$

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

83. $\lim\limits_{x\to 0}\frac{\sin 3x}{1-\sqrt{1-x}}=$

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

84. If $f(a) = 4$, $f'(a) = 2$, then $\lim_{x \to a} \frac{xf(a) - af(x)}{x - a} =$

(1) $2a - 4$ (2) $4 - 2a$

(3) $4 - a$ (4) $2 - 2a$

85. The set of points of differentiability of the function $f(x) = |x - 2| \sin x$ is :

(1) R (2) $R - \{1\}$

(3) $R - \{-2\}$ (4) $R - \{2\}$

86. The variance of first n natural number is :

(1) $\frac{n(n-1)}{12}$ (2) $\frac{n^2+1}{12}$

(3) $\frac{n^2-1}{12}$ (4) $\frac{(n+1)(2n+1)}{6}$

87. The sum of 10 items is 12 and the sum of their squares is 18, then the standard deviation is :

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

(3) $\frac{3}{5}$ (4) $\frac{3}{10}$

88. Three identical dice are rolled. The probability that the same number will appear on each of them is :

(1) $\frac{1}{6}$ (2) $\frac{1}{12}$

(3) $\frac{1}{36}$ (4) $\frac{2}{9}$

89. A selection committee of five is constituted from a group of nine persons. The probability that a certain married couple will either be a part of the committee or not at all, is :

(1) $\frac{2}{9}$ (2) $\frac{7}{9}$

(3) $\frac{5}{9}$ (4) $\frac{4}{9}$

90. The probability that the roots of the equation $x^2 + nx + \frac{1}{2}(n+1) = 0$ are real where $n \in N$ such that $n \leq 5$, is :

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

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

91. If the sum of the squares of the roots of the equation $x^2 - (a-2)x - (a+1) = 0$ assumes the least value, then $a =$

(1) 0 (2) –1

(3) 1 (4) 2

92. The condition that one root of the equation $ax^2 + bx + c = 0$ is double of the other, is :

(1) $2b^2 = 3ac$ (2) $2b^2 = 9ac$

(3) $b^2 = 9ac$ (4) $b^2 = 3ac$

93. In how many ways three different rings can be worn in four fingers with at most one in each finger ?

(1) 3 (2) 12

(3) 21 (4) 24

94. In how many ways a committee of 5 members can be selected from 6 men and 5 women consisting of 3 men and 2 women ?

(1) 200 (2) 181

(3) 160 (4) 120

95. In the expansion of $\left(3x^2 - \frac{1}{2x^3}\right)^{10}$, the term independent of x is :

(1) $\frac{76545}{8}$ (2) $\frac{76545}{4}$

(3) $\frac{76545}{16}$ (4) $\frac{72375}{8}$

96. If the coefficients of rth and $(r + 1)$th terms in the expansion of $(7x+3)^{29}$ are equal, then $r =$

(1) 7 (2) 12

(3) 16 (4) 21

97. Sum of first three terms of a G. P. is 16 and the sum of next three terms is 128. The sum of n terms of this G. P. is :

(1) $\frac{8}{7}(2^n - 1)$

(2) $\frac{8}{9}(2^n - 1)$

(3) $\frac{16}{7}(2^n - 1)$

(4) $\frac{16}{9}(2^n - 1)$

98. If A_1, A_2 are two AM's and G_1, G_2 are two GM's between a and b, then $\frac{A_1 + A_2}{G_1 G_2} =$

(1) $\frac{a+b}{\sqrt{ab}}$

(2) $\frac{a+b}{ab}$

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

(4) $\frac{a+b}{2ab}$

99. The sum of n terms of an A. P. is $3n^2 + 5$. If its nth term is 159, then $n =$

(1) 15

(2) 18

(3) 24

(4) 27

100. If the sum of first n natural number is $\frac{1}{5}$ times the sum of their squares, then the value of n is :

(1) 5

(2) 7

(3) 8

(4) 9

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Sumeet 2/7/18 2/7/18

Total No. of Printed Pages : 17

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PG-EE-2018

SUBJECT : Mathematics Hons. (Five Year)

C

Sr. No. 10879

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

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

Name __________ Date of Birth __________

Father's Name __________ Mother's Name __________

Date of Exam __________

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

SEAL

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

1. ***All questions are compulsory and carry equal marks. The candidates are required to attempt all questions.***
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/misbehaviour 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. In case there is any discrepancy in any question(s) in the Question Booklet, the same may be brought to the notice of the Controller of Examinations in writing **within two hours** after the test is over. No such complaint(s) will be entertained thereafter.
4. 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.
5. ***Use only black or blue ball point pen of good quality in the OMR Answer-Sheet.***
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. *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 $\vec{a}$ and $\vec{b}$ are two unit vectors inclined at an angle θ such that $\vec{a}+\vec{b}$ is a unit vector, then $\theta =$

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

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

2. Which of the following is ***correct*** ?

(1) Every LLP admits an optimal solution

(2) A LLP admits unique optimal solution

(3) The set of all feasible solutions of a LLP is not a convex set

(4) If a LLP admits two optimal solutions, it has an infinite number of optimal solutions

3. The vectors $2\hat{i}+\hat{j}+3\hat{k}$ and $4\hat{i}-\lambda\hat{j}+6\hat{k}$ are parallel if $\lambda =$

(1) -2 (2) -3

(3) 2 (4) 3

4. Projection of the vector $\hat{i}-2\hat{j}+\hat{k}$ on the vector $4\hat{i}-4\hat{j}+7\hat{k}$ is :

(1) $\frac{19}{9}$ (2) $\frac{9}{19}$

(3) $\frac{19}{6}$ (4) $\frac{17}{9}$

5. If $|\vec{a}|=7$, $|\vec{b}|=11$, $|\vec{a}+\vec{b}|=10\sqrt{3}$, then $|\vec{a}-\vec{b}| =$

(1) $\sqrt{10}$ (2) $3\sqrt{10}$

(3) $2\sqrt{10}$ (4) $10\sqrt{2}$

6. If α, β, γ are the angles made by a vector with the coordinate axes, then $\sin^2\alpha+\sin^2\beta+\sin^2\gamma =$

(1) 0 (2) 1

(3) 2 (4) 3

7. The image of the point (3, –2, 1) in the plane $3x - y + 4z = 2$ is :

(1) (1, –1, –3) (2) (0, –1, –3)

(3) (1, 0, –3) (4) (0, 1, –3)

8. If a plane meets the coordinates axes at point A, B and C in such a way that the centroid of triangle ABC is (1, 2, 3), then the equation of the plane is :

(1) $6x + 3y + 2z - 2 = 0$ (2) $6x + 3y + 2z - 6 = 0$

(3) $6x + 3y + 2z - 18 = 0$ (4) $3x + 2y + z - 9 = 0$

9. The distance between the planes $\vec{r}.(\hat{i}+2\hat{j}-2\hat{k})+5=0$ and $\vec{r}.(\hat{i}+2\hat{j}-2\hat{k})-8=0$ is :

(1) $\frac{8}{3}$ units (2) $\frac{3}{13}$ units

(3) $\frac{10}{3}$ units (4) $\frac{13}{3}$ units

10. The equation of the passing through (–1, 2, –3) and perpendicular to the plane $2x + 3y + z + 5 = 0$ is :

(1) $\frac{x-1}{2}=\frac{y+2}{3}=\frac{z-3}{1}$ (2) $\frac{x+1}{2}=\frac{y-2}{3}=\frac{z+3}{1}$

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

11. The degree and order of the differential equation of all parabolas whose axis is x-axis are :

(1) 2, 1 (2) 1, 2

(3) 2, 3 (4) 3, 2

12. Solution of $y\frac{dy}{dx}=x-1, y(1)=1$ is :

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

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

13. From a well shuffled pack of cards, two cards are drawn without replacement in two consecutive draws. The probability of drawing a diamond card in each draw is :

(1) $\frac{2}{7}$ (2) $\frac{1}{17}$

(3) $\frac{1}{13}$ (4) $\frac{4}{51}$

14. For two events A and B, it is given that $P(A)=P(A/B)=\frac{1}{4}$, $P(B/A)=\frac{1}{2}$, then which of the following is ***true*** ?

(1) $P(\overline{A}/B)=\frac{1}{4}$

(2) $P(\overline{A}/B)=\frac{1}{2}$

(3) $P(\overline{A}/B)=\frac{3}{4}$

(4) A and B are mutually exclusive events

15. The chances of A and B of winning a single game are equal. A needs 3 games and B needs 4 games to win a match. Then A's chance of winning the match is :

(1) $\frac{23}{32}$ (2) $\frac{21}{32}$

(3) $\frac{17}{32}$ (4) $\frac{11}{32}$

16. Six coins are tossed simultaneously. The probability of getting at least 4 heads is :

(1) $\frac{5}{32}$ (2) $\frac{9}{32}$

(3) $\frac{11}{32}$ (4) $\frac{13}{32}$

17. Two persons are selected out of 8 men and 5 women. The probability that at least one of the selected persons will be a woman, is :

(1) $\frac{4}{13}$ (2) $\frac{5}{13}$

(3) $\frac{22}{39}$ (4) $\frac{25}{39}$

18. If X follows a binomial distribution with parameters $n = 6$ and p. If 4.P(X = 4) = P(X = 2), then p =

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

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

19. The number of vectors of unit length perpendicular to the vectors $\vec{a} = \hat{i} + \hat{j}$ and $\vec{b} = \hat{j} + \hat{k}$, is :

(1) NIL (2) 1

(3) 2 (4) 3

20. The vector $\hat{i} + x\hat{j} + 3\hat{k}$ is rotated through an angle θ and doubled in magnitude, then it becomes $4\hat{i} + (4x-2)\hat{j} + 2\hat{k}$. The value of x is :

(1) –2/3 (2) –3/2

(3) –2 (4) –3

21. The point in the xy-plane which is equidistant from (2, 0, 3), (0, 3, 2) and (0, 0, 1) is :

(1) (2, 3, 0) (2) (3, –2, 0)

(3) (3, 2, 0) (4) (2, –3, 0)

22. $\lim_{x \to 0} \dfrac{e^{x^2} - \cos x}{x^2} =$

(1) $\dfrac{3}{2}$ (2) $\dfrac{3}{4}$

(3) $\dfrac{2}{3}$ (4) $\dfrac{1}{2}$

23. $\lim_{x \to 0} \dfrac{\sin 3x}{1 - \sqrt{1-x}} =$

(1) 2 (2) 3

(3) 6 (4) $\dfrac{1}{3}$

24. If $f(a) = 4$, $f'(a) = 2$, then $\lim_{x \to a} \dfrac{xf(a) - af(x)}{x - a} =$

(1) $2a - 4$ (2) $4 - 2a$

(3) $4 - a$ (4) $2 - 2a$

25. The set of points of differentiability of the function $f(x) = |x - 2| \sin x$ is :

(1) R (2) $R - \{1\}$

(3) $R - \{-2\}$ (4) $R - \{2\}$

26. The variance of first n natural number is :

(1) $\frac{n(n-1)}{12}$ (2) $\frac{n^2+1}{12}$

(3) $\frac{n^2-1}{12}$ (4) $\frac{(n+1)(2n+1)}{6}$

27. The sum of 10 items is 12 and the sum of their squares is 18, then the standard deviation is :

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

(3) $\frac{3}{5}$ (4) $\frac{3}{10}$

28. Three identical dice are rolled. The probability that the same number will appear on each of them is :

(1) $\frac{1}{6}$ (2) $\frac{1}{12}$

(3) $\frac{1}{36}$ (4) $\frac{2}{9}$

29. A selection committee of five is constituted from a group of nine persons. The probability that a certain married couple will either be a part of the committee or not at all, is :

(1) $\frac{2}{9}$ (2) $\frac{7}{9}$

(3) $\frac{5}{9}$ (4) $\frac{4}{9}$

30. The probability that the roots of the equation $x^2+nx+\frac{1}{2}(n+1)=0$ are real where $n \in N$ such that $n \le 5$, is :

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

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

31. The image of the point (3, 8) in the line $x + 3y = 7$ is :

(1) (1, 4) (2) (–4, –1)

(3) (–1, –4) (4) (4, 1)

32. The nearest point on the line $3x - 4y = 25$ from the origin is :

(1) (3, –4) (2) (4, –3)

(3) (3, 4) (4) (3, 5)

33. The line which is parallel to x-axis and crosses the curve $y = \sqrt{x}$ at an angle 45°, is :

(1) $x = \frac{1}{2}$ (2) $y = \frac{1}{2}$

(3) $x = \frac{1}{4}$ (4) $y = \frac{1}{4}$

34. The distance between the parallel lines $4x + 3y = 11$ and $8x + 6y = 15$ is :

(1) $\frac{7}{10}$ units (2) $\frac{10}{7}$ units

(3) $\frac{7}{5}$ units (4) $\frac{5}{7}$ units

35. If the points (0, 0), (1, 0), (0, 1) and (k, k) are concyclic, then $k =$

(1) 2 (2) –1

(3) 1 (4) –2

36. The vertex of the parabola $y^2 + 6x - 2y + 13 = 0$ is :

(1) (1, 2) (2) (2, 1)

(3) (2, –1) (4) (–2, 1)

37. The eccentricity of an ellipse is $\frac{1}{2}$ and its foci are (±2, 0), its equation is :

(1) $\frac{x^2}{16} + \frac{y^2}{12} = 1$ (2) $\frac{x^2}{12} + \frac{y^2}{16} = 1$

(3) $\frac{x^2}{12} + \frac{y^2}{8} = 1$ (4) $\frac{x^2}{8} + \frac{y^2}{12} = 1$

38. If $5x^2 + ky^2 = 20$ represents a rectangular hyperbola, then $k =$

(1) 5 (2) 4

(3) –4 (4) –5

39. The ratio in which the line joining the points (1, 2, 3) and (–3, 4, –5) is divided by the xy-plane, is :

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

40. A line passes through (2, 2) and is perpendicular to the line $3x + y = 3$. Its y-intercept is :

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

41. $\int \frac{\cos x - \cos 2x}{1 - \cos x} dx =$

(1) $x + 2\sin x + c$ (2) $x - 2\sin x + c$
(3) $x - 2\cos x + c$ (4) $x + 2\cos x + c$

42. $\int \frac{\sqrt{x}}{x+1} dx =$

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

43. $\int \frac{1+x+x^2}{1+x^2} e^{\tan^{-1}x} dx =$

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

44. $\int \frac{dx}{x\left(x^n + 1\right)} =$

(1) $\frac{1}{n}\log\left(\frac{x^n}{x^n+1}\right) + c$ (2) $\log\left(\frac{x^n}{x^n+1}\right) + c$
(3) $\frac{1}{n}\log\left(\frac{x^n+1}{x^n}\right) + c$ (4) $\frac{1}{n}\log\left(x^n + 1\right) + c$

45. $\int_{0}^{1.5} [x^2] dx =$

(1) $\sqrt{2}$

(2) $2+\sqrt{2}$

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

(4) $3-\sqrt{2}$

46. $\int_{0}^{\pi/2} \frac{\sqrt{\sin x}}{\sqrt{\sin x}+\sqrt{\cos x}} dx =$

(1) 0

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

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

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

47. $\int_{\pi/4}^{3\pi/4} \frac{1}{1+\cos x} dx =$

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

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

(3) 1

(4) 2

48. The area enclosed between the curves $y = x^3$ and $y = \sqrt{x}$ is :

(1) $\frac{4}{5}$ sq. units

(2) $\frac{5}{4}$ sq. units

(3) $\frac{5}{8}$ sq. units

(4) $\frac{5}{12}$ sq. units

49. The area bounded by $y = xe^{|x|}$ and the lines $|x| = 1, y = 0$ is :

(1) 3 sq. units

(2) $\frac{3}{2}$ sq. units

(3) 2 sq. units

(4) $\frac{2}{3}$ sq. units

50. Solution of $\frac{dy}{dx} = \frac{e^{2x}+e^{4x}}{e^{x}+e^{-x}}$ is :

(1) $y = \frac{1}{3}e^{3x} + c$

(2) $y = \frac{2}{3}e^{3x} + c$

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

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

51. Two finite sets have m and n elements. The total number of subsets of first set is 56 more than the total number of subsets of the second set, then the values of m and n are :

(1) 5, 2 (2) 7, 4 (3) 5, 1 (4) 6, 3

52. If A, B and C are any three sets, then $A - (B \cap C)$ is the same as :

(1) $(A \cap B) - (A \cap C)$
(2) $(A - B) \cap (A - C)$
(3) $(A - B) \cup (A - C)$
(4) $(A - B) \cup C$

53. For the set $A = \{1, 2, 3, 4, 5\}$ a relation R is defined by $R = \{(x, y) : x, y \in A \text{ and } x < y\}$. Then R is :

(1) transitive
(2) symmetric
(3) reflexive
(4) antisymmetric

54. $\dfrac{2\sin x}{\cos 3x} =$

(1) $\tan 3x - \tan 2x$
(2) $\tan 3x + \tan x$
(3) $\tan 3x + \tan 2x$
(4) $\tan 3x - \tan x$

55. If $\sin\alpha + \sin\beta = \sqrt{3/2}$ and $\cos\alpha + \cos\beta = \dfrac{1}{\sqrt{2}}$, then $\alpha =$

(1) $7\frac{1}{2}°$
(2) 15°
(3) 30°
(4) 45°

56. If $\sin x + \sin^2 x = 1$, then $\cos^8 x + 2\cos^6 x + \cos^4 x =$

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

57. If $n \in N$, then $7^{2n} + 2^{3n-3} . 3^{n-1}$ is divisible by :

(1) 45
(2) 35
(3) 25
(4) 10

58. If α, β are two different complex numbers such that $|\alpha| = 1$, $|\beta| = 1$, then $\left|\dfrac{\beta - \alpha}{1 - \overline{\alpha}\beta}\right| =$

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

59. If $z = x + iy$ and $\left|\frac{1-iz}{z-i}\right| = 1$, then $z =$

(1) i (2) 1

(3) y (4) x

60. If $z = 1 + i\sqrt{3}$, then $|\arg(z)| + |\arg(\bar{z})| =$

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

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

61. If $f: R \to R$ is given by $f(x) = 3x - 5$, then $f^{-1}(x) =$

(1) $\frac{1}{3x-5}$ (2) $\frac{x+5}{3}$

(3) $\frac{3}{x+5}$ (4) does not exist

62. The domain and range are same for :

(1) identity function (2) constant function

(3) injective function (4) surjective function

63. The binary operation * defined by $a * b = 1 + ab$ is :

(1) both commutative and associative

(2) associative but not commutative

(3) commutative but not associative

(4) neither commutative nor associative

64. If $f(x) = x^2 + 2, g(x) = \frac{x}{x-1}$, then $(gof)\left(\frac{1}{2}\right) =$

(1) $\frac{7}{2}$ (2) $\frac{5}{2}$

(3) $\frac{4}{5}$ (4) $\frac{9}{5}$

65. If $\sin\left(\sin^{-1}\frac{1}{5}+\cos^{-1}x\right)=1$, then $x=$

(1) $\frac{2}{3}$
(2) $\frac{1}{5}$
(3) $\frac{4}{5}$
(4) 0

66. $\sin^{-1}\left(\frac{3}{5}\right)+\tan^{-1}\left(\frac{1}{7}\right)=$

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

67. Two angles of a triangle are $\cot^{-1}2$ and $\cot^{-1}3$, then the third angle is :

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

68. If A is a square matrix, then which of the following is ***not*** correct ?

(1) $A+A^T$ is symmetric
(2) $A-A^T$ is skew-symmetric
(3) AA^T is symmetric
(4) A^T-A is symmetric

69. If A and B are symmetric matrices of the same order, then $AB-BA$ is :

(1) symmetric matrix
(2) skew-symmetric matrix
(3) null matrix
(4) unit matrix

70. If A is a singular matrix, then A *adj* A is :

(1) unit matrix
(2) scalar matrix
(3) identity matrix
(4) null matrix

71. Let $f(x)=\sin x$, $g(x)=x^2$ and $h(x)=\log x$. If $F(x)=(hogof)(x)$, then $F''(x)=$

(1) $-2\operatorname{cosec}^2 x$
(2) $-\operatorname{cosec}^2 x$
(3) $2\operatorname{cosec}^2 x$
(4) $-2\operatorname{cosec}^3 x$

72. If $x^y = e^{x-y}$, then $\frac{dy}{dx} =$

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

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

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

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

73. If $x = \sin^{-1}\left(\frac{2\theta}{1+\theta^2}\right), y = \tan^{-1}\left(\frac{2\theta}{1-\theta^2}\right)$, then $\frac{dy}{dx} =$

(1) 1

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

(3) x

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

74. The equation of the tangent to the curve $y = (2x-1)e^{2(1-x)}$ at the point of its maxima is :

(1) $x - 1 = 0$

(2) $y - 1 = 0$

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

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

75. The equation of normal to the curve $x = a(1 + \cos\theta), y = a \sin\theta$ at θ is :

(1) $x \sin\theta - y \cos\theta = a$

(2) $x \cos\theta - y \sin\theta = a$

(3) $x \sin\theta - y \cos\theta = a \sin\theta$

(4) $x \cos\theta - y \sin\theta = a \sin\theta$

76. The function $f(x) = x + \cot^{-1} x$ is :

(1) decreases for all x

(2) decreases for $[1, \infty)$

(3) increasing for all x

(4) constant for all x

77. The function $f(x) = \sin^4 x + \cos^4 x$ increases if :

(1) $\frac{\pi}{4} < x < \frac{\pi}{2}$

(2) $\frac{3\pi}{8} < x < \frac{5\pi}{8}$

(3) $\frac{5\pi}{8} < x < \frac{3\pi}{4}$

(4) $0 < x < \frac{\pi}{8}$

78. The curves $y = 1 - ax^2$ and $y = x^2$ intersect orthogonally, then the value of a is :

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

79. In the interval [0, 1] the function $f(x) = x^5(1-x)^{15}$ takes the maximum value at the point :

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

80. The maximum value of $\left(\frac{1}{x}\right)^x$ is :

(1) e^e
(2) $e^{1/e}$
(3) $\frac{1}{e}$
(4) $e^{-1/e}$

81. If the sum of the squares of the roots of the equation $x^2 - (a-2)x - (a+1) = 0$ assumes the least value, then $a =$

(1) 0
(2) –1
(3) 1
(4) 2

82. The condition that one root of the equation $ax^2 + bx + c = 0$ is double of the other, is :

(1) $2b^2 = 3ac$
(2) $2b^2 = 9ac$
(3) $b^2 = 9ac$
(4) $b^2 = 3ac$

83. In how many ways three different rings can be worn in four fingers with at most one in each finger ?

(1) 3
(2) 12
(3) 21
(4) 24

84. In how many ways a committee of 5 members can be selected from 6 men and 5 women consisting of 3 men and 2 women ?

(1) 200
(2) 181
(3) 160
(4) 120

85. In the expansion of $\left(3x^2 - \frac{1}{2x^3}\right)^{10}$, the term independent of x is :

(1) $\frac{76545}{8}$
(2) $\frac{76545}{4}$
(3) $\frac{76545}{16}$
(4) $\frac{72375}{8}$

86. If the coefficients of rth and $(r + 1)$th terms in the expansion of $(7x+3)^{29}$ are equal, then $r =$

(1) 7
(2) 12
(3) 16
(4) 21

87. Sum of first three terms of a G. P. is 16 and the sum of next three terms is 128. Th sum of n terms of this G. P. is :

(1) $\frac{8}{7}(2^n - 1)$
(2) $\frac{8}{9}(2^n - 1)$
(3) $\frac{16}{7}(2^n - 1)$
(4) $\frac{16}{9}(2^n - 1)$

88. If A_1, A_2 are two AM's and G_1, G_2 are two GM's between a and b, then $\frac{A_1 + A_2}{G_1 G_2} =$

7

(1) $\frac{a+b}{\sqrt{ab}}$
(2) $\frac{a+b}{ab}$
(3) $\frac{ab}{a+b}$
(4) $\frac{a+b}{2ab}$

89. The sum of n terms of an A. P. is $3n^2 + 5$. If its nth term is 159, then $n =$

(1) 15
(2) 18
(3) 24
(4) 27

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90. If the sum of first n natural number is $\frac{1}{5}$ times the sum of their squares, then the value of n is :

(1) 5
(2) 7
(3) 8
(4) 9

91. If A is an invertible matrix and B is a matrix, then which of the following is ***true*** ?

(1) rank $(AB) = \text{rank}(A)$
(2) rank $(AB) = \text{rank}(B)$
(3) rank $(AB) > \text{rank}(B)$
(4) rank $(AB) > \text{rank}(A)$

92. The area of the triangle with vertices (5, 4), (–2, 4) and (2, –6) is :

(1) 25 sq. units
(2) 35 sq. units
(3) 42 sq. units
(4) 45 sq. units

93. Value of the determinant $\begin{vmatrix} \cos\alpha & -\sin\alpha & 1 \\ \sin\alpha & \cos\alpha & 1 \\ \cos(\alpha+\beta) & -\sin(\alpha+\beta) & 1 \end{vmatrix}$ is :

(1) independent of α and β
(2) independent of β
(3) independent of α
(4) 0

94. One root of $\begin{vmatrix} x & 3 & 7 \\ 2 & x & 2 \\ 7 & 6 & x \end{vmatrix} = 0$ is $x = -9$ the other two roots are :

(1) 7, 2
(2) 3, 8
(3) 5, 2
(4) 2, –1

95. If the system of equations $kx + y + z = 1$, $x + ky + z = k$ and $x + y + kz = k^2$ is inconsistent, then $k =$

(1) –1
(2) 1
(3) –2
(4) 2

96. The function $f(x) = \begin{cases} x^m \sin\left(\frac{1}{x}\right) & , \quad x \neq 0 \\ 0 & , \quad x = 0 \end{cases}$ is :

(1) continuous at $x = 0$
(2) discontinuous at $x = 0$
(3) continuous at $x = 0$, if $m < 0$
(4) continuous at $x = 0$, if $m > 0$

97. If $f(x)=\begin{cases}\frac{1}{x}[\log(1+ax)-\log(1-bx)] & , x\neq 0\\ k & , x=0\end{cases}$, and $f(x)$ is continuous at $x = 0$, then the value of k is :

(1) ab
(2) $a + b$
(3) $a - b$
(4) $\log ab$

98. The value of derivative of $|x-1|+|x-3|$ at $x = 2$ is :

(1) 2
(2) −2
(3) 4
(4) 0

99. Let $f(x)$ be an even function, then $f'(x)$:

(1) is an odd function
(2) is an even function
(3) may be even or odd
(4) is a constant

100. If [ ] denotes the greatest integer function and $f(x)=[2x^3-3]$, then the number of points in (1, 2) where $f(x)$ is discontinuous, is :

(1) 15
(2) 13
(3) 10
(4) 7

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PG-EE-2018

SUBJECT : Mathematics Hons. (Five Year)

D

10880

Sr. No. ....

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

Roll No. (in figures)_____________ (in words) ________________________

Name ____________________________ Date of Birth ____________

Father's Name __________________ Mother's Name __________________

Date of Exam __________________

________________________ ________________________

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

SEAL

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

1. ***All questions are compulsory and carry equal marks. The candidates are required to attempt all questions.***
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/misbehaviour 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. In case there is any discrepancy in any question(s) in the Question Booklet, the same may be brought to the notice of the Controller of Examinations in writing **within two hours** after the test is over. No such complaint(s) will be entertained thereafter.
4. 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.
5. ***Use only black or blue ball point pen of good quality in the OMR Answer-Sheet.***
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. *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 degree and order of the differential equation of all parabolas whose axis is x-axis are :

(1) 2, 1 (2) 1, 2

(3) 2, 3 (4) 3, 2

2. Solution of $y\frac{dy}{dx} = x - 1, y(1) = 1$ is :

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

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

3. From a well shuffled pack of cards, two cards are drawn without replacement in two consecutive draws. The probability of drawing a diamond card in each draw is :

(1) $\frac{2}{7}$ (2) $\frac{1}{17}$

(3) $\frac{1}{13}$ (4) $\frac{4}{51}$

4. For two events A and B, it is given that $P(A) = P(A/B) = \frac{1}{4}$, $P(B/A) = \frac{1}{2}$, then which of the following is ***true*** ?

(1) $P(\overline{A}/B) = \frac{1}{4}$

(2) $P(\overline{A}/B) = \frac{1}{2}$

(3) $P(\overline{A}/B) = \frac{3}{4}$

(4) A and B are mutually exclusive events

5. The chances of A and B of winning a single game are equal. A needs 3 games and B needs 4 games to win a match. Then A's chance of winning the match is :

(1) $\frac{23}{32}$ (2) $\frac{21}{32}$

(3) $\frac{17}{32}$ (4) $\frac{11}{32}$

6. Six coins are tossed simultaneously. The probability of getting at least 4 heads is :

(1) $\frac{5}{32}$
(2) $\frac{9}{32}$
(3) $\frac{11}{32}$
(4) $\frac{13}{32}$

7. Two persons are selected out of 8 men and 5 women. The probability that at least one of the selected persons will be a woman, is :

(1) $\frac{4}{13}$
(2) $\frac{5}{13}$
(3) $\frac{22}{39}$
(4) $\frac{25}{39}$

8. If X follows a binomial distribution with parameters $n = 6$ and p. If $4.P(X = 4) = P(X = 2)$, then p =

(1) $\frac{1}{3}$
(2) $\frac{1}{2}$
(3) $\frac{1}{4}$
(4) $\frac{1}{6}$

9. The number of vectors of unit length perpendicular to the vectors $\vec{a} = \hat{i} + \hat{j}$ and $\vec{b} = \hat{j} + \hat{k}$, is :

(1) NIL
(2) 1
(3) 2
(4) 3

10. The vector $\hat{i} + x\hat{j} + 3\hat{k}$ is rotated through an angle θ and doubled in magnitude, then it becomes $4\hat{i} + (4x - 2)\hat{j} + 2\hat{k}$. The value of x is :

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

11. If A is an invertible matrix and B is a matrix, then which of the following is ***true*** ?

(1) rank (AB) = rank(A)
(2) rank (AB) = rank(B)
(3) rank (AB) > rank(B)
(4) rank (AB) > rank(A)

12. The area of the triangle with vertices (5, 4), (–2, 4) and (2, –6) is :

(1) 25 sq. units
(2) 35 sq. units
(3) 42 sq. units
(4) 45 sq. units

13. Value of the determinant $\begin{vmatrix} \cos\alpha & -\sin\alpha & 1 \\ \sin\alpha & \cos\alpha & 1 \\ \cos(\alpha+\beta) & -\sin(\alpha+\beta) & 1 \end{vmatrix}$ is :

(1) independent of α and β
(2) independent of β
(3) independent of α
(4) 0

14. One root of $\begin{vmatrix} x & 3 & 7 \\ 2 & x & 2 \\ 7 & 6 & x \end{vmatrix} = 0$ is $x = -9$ the other two roots are :

(1) 7, 2
(2) 3, 8
(3) 5, 2
(4) 2, –1

15. If the system of equations $kx + y + z = 1$, $x + ky + z = k$ and $x + y + kz = k^2$ is inconsistent, then $k =$

(1) –1
(2) 1
(3) –2
(4) 2

16. The function $f(x) = \begin{cases} x^m \sin\left(\frac{1}{x}\right) & , \ x \neq 0 \\ 0 & , \ x = 0 \end{cases}$ is :

(1) continuous at $x = 0$
(2) discontinuous at $x = 0$
(3) continuous at $x = 0$, if $m < 0$
(4) continuous at $x = 0$, if $m > 0$

17. If $f(x) = \begin{cases} \frac{1}{x}[\log(1+ax) - \log(1-bx)] & , \ x \neq 0 \\ k & , \ x = 0 \end{cases}$, and $f(x)$ is continuous at $x = 0$, then the value of k is :

(1) ab
(2) $a + b$
(3) $a - b$
(4) $\log ab$

18. The value of derivative of $|x-1| + |x-3|$ at $x = 2$ is :

(1) 2
(2) –2
(3) 4
(4) 0

19. Let $f(x)$ be an even function, then $f'(x)$:

(1) is an odd function
(2) is an even function
(3) may be even or odd
(4) is a constant

20. If [ ] denotes the greatest integer function and $f(x)=\left[2x^3-3\right]$, then the number of points in (1, 2) where $f(x)$ is discontinuous, is :

(1) 15 (2) 13

(3) 10 (4) 7

21. If $f: R \to R$ is given by $f(x) = 3x - 5$, then $f^{-1}(x) =$

(1) $\frac{1}{3x-5}$ (2) $\frac{x+5}{3}$

(3) $\frac{3}{x+5}$ (4) does not exist

22. The domain and range are same for :

(1) identity function (2) constant function

(3) injective function (4) surjective function

23. The binary operation * defined by $a * b = 1 + ab$ is :

(1) both commutative and associative

(2) associative but not commutative

(3) commutative but not associative

(4) neither commutative nor associative

24. If $f(x)=x^2+2, g(x)=\frac{x}{x-1}$, then $(gof)\left(\frac{1}{2}\right)=$

(1) $\frac{7}{2}$ (2) $\frac{5}{2}$

(3) $\frac{4}{5}$ (4) $\frac{9}{5}$

25. If $\sin\left(\sin^{-1}\frac{1}{5}+\cos^{-1}x\right)=1$, then $x=$

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

(3) $\frac{4}{5}$ (4) 0

26. $\sin^{-1}\left(\frac{3}{5}\right)+\tan^{-1}\left(\frac{1}{7}\right)=$

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

(3) $\frac{\pi}{2}$ (4) π

27. Two angles of a triangle are $\cot^{-1}2$ and $\cot^{-1}3$, then the third angle is :

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

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

28. If A is a square matrix, then which of the following is ***not*** correct ?

(1) $A+A^T$ is symmetric (2) $A-A^T$ is skew-symmetric

(3) AA^T is symmetric (4) A^T-A is symmetric

29. If A and B are symmetric matrices of the same order, then $AB-BA$ is :

(1) symmetric matrix (2) skew-symmetric matrix

(3) null matrix (4) unit matrix

30. If A is a singular matrix, then $A\ adj\ A$ is :

(1) unit matrix (2) scalar matrix

(3) identity matrix (4) null matrix

31. $\int\frac{\cos x-\cos 2x}{1-\cos x}dx=$

(1) $x+2\sin x+c$ (2) $x-2\sin x+c$

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

32. $\int\frac{\sqrt{x}}{x+1}\,dx=$

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

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

33. $\int \frac{1+x+x^2}{1+x^2} e^{\tan^{-1}x} dx =$

(1) $e^{\tan^{-1}x} + c$

(2) $x^2 e^{\tan^{-1}x} + c$

(3) $\frac{1}{x} e^{\tan^{-1}x} + c$

(4) $x e^{\tan^{-1}x} + c$

34. $\int \frac{dx}{x(x^n+1)} =$

(1) $\frac{1}{n}\log\left(\frac{x^n}{x^n+1}\right) + c$

(2) $\log\left(\frac{x^n}{x^n+1}\right) + c$

(3) $\frac{1}{n}\log\left(\frac{x^n+1}{x^n}\right) + c$

(4) $\frac{1}{n}\log(x^n+1) + c$

35. $\int_0^{1.5} [x^2] dx =$

(1) $\sqrt{2}$

(2) $2+\sqrt{2}$

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

(4) $3-\sqrt{2}$

36. $\int_0^{\pi/2} \frac{\sqrt{\sin x}}{\sqrt{\sin x}+\sqrt{\cos x}} dx =$

(1) 0

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

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

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

37. $\int_{\pi/4}^{3\pi/4} \frac{1}{1+\cos x} dx =$

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

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

(3) 1

(4) 2

38. The area enclosed between the curves $y = x^3$ and $y = \sqrt{x}$ is :

(1) $\frac{4}{5}$ sq. units

(2) $\frac{5}{4}$ sq. units

(3) $\frac{5}{8}$ sq. units

(4) $\frac{5}{12}$ sq. units

39. The area bounded by $y = xe^{|x|}$ and the lines $|x| = 1, y = 0$ is :

(1) 3 sq. units

(2) $\frac{3}{2}$ sq. units

(3) 2 sq. units

(4) $\frac{2}{3}$ sq. units

40. Solution of $\frac{dy}{dx} = \frac{e^{2x} + e^{4x}}{e^x + e^{-x}}$ is :

(1) $y = \frac{1}{3}e^{3x} + c$

(2) $y = \frac{2}{3}e^{3x} + c$

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

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

41. The point in the xy-plane which is equidistant from (2, 0, 3), (0, 3, 2) and (0, 0, 1) is :

(1) (2, 3, 0)

(2) (3, –2, 0)

(3) (3, 2, 0)

(4) (2, –3, 0)

42. $\lim_{x \to 0} \frac{e^{x^2} - \cos x}{x^2} =$

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

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

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

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

43. $\lim_{x \to 0} \frac{\sin 3x}{1 - \sqrt{1-x}} =$

(1) 2

(2) 3

(3) 6

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

44. If $f(a) = 4,\ f'(a) = 2,$ then $\lim\limits_{x \to a} \dfrac{xf(a) - af(x)}{x - a} =$

(1) $2a - 4$
(2) $4 - 2a$
(3) $4 - a$
(4) $2 - 2a$

45. The set of points of differentiability of the function $f(x) = |x - 2| \sin x$ is :

(1) R
(2) $R - \{1\}$
(3) $R - \{-2\}$
(4) $R - \{2\}$

46. The variance of first n natural number is :

(1) $\dfrac{n(n-1)}{12}$
(2) $\dfrac{n^2+1}{12}$
(3) $\dfrac{n^2-1}{12}$
(4) $\dfrac{(n+1)(2n+1)}{6}$

47. The sum of 10 items is 12 and the sum of their squares is 18, then the standard deviation is :

(1) $\dfrac{2}{5}$
(2) $\dfrac{4}{5}$
(3) $\dfrac{3}{5}$
(4) $\dfrac{3}{10}$

48. Three identical dice are rolled. The probability that the same number will appear on each of them is :

(1) $\dfrac{1}{6}$
(2) $\dfrac{1}{12}$
(3) $\dfrac{1}{36}$
(4) $\dfrac{2}{9}$

49. A selection committee of five is constituted from a group of nine persons. The probability that a certain married couple will either be a part of the committee or not at all, is :

(1) $\dfrac{2}{9}$
(2) $\dfrac{7}{9}$
(3) $\dfrac{5}{9}$
(4) $\dfrac{4}{9}$

50. The probability that the roots of the equation $x^2+nx+\frac{1}{2}(n+1)=0$ are real where $n \in N$ such that $n \leq 5$, is :

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

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

51. If $\vec{a}$ and $\vec{b}$ are two unit vectors inclined at an angle θ such that $\vec{a}+\vec{b}$ is a unit vector, then θ =

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

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

52. Which of the following is ***correct*** ?

(1) Every LLP admits an optimal solution

(2) A LLP admits unique optimal solution

(3) The set of all feasible solutions of a LLP is not a convex set

(4) If a LLP admits two optimal solutions, it has an infinite number of optimal solutions

53. The vectors $2\hat{i}+\hat{j}+3\hat{k}$ and $4\hat{i}-\lambda\hat{j}+6\hat{k}$ are parallel if λ =

(1) –2 (2) –3

(3) 2 (4) 3

54. Projection of the vector $\hat{i}-2\hat{j}+\hat{k}$ on the vector $4\hat{i}-4\hat{j}+7\hat{k}$ is :

(1) $\frac{19}{9}$ (2) $\frac{9}{19}$

(3) $\frac{19}{6}$ (4) $\frac{17}{9}$

55. If $|\vec{a}|=7$, $|\vec{b}|=11$, $|\vec{a}+\vec{b}|=10\sqrt{3}$, then $|\vec{a}-\vec{b}|$ =

(1) $\sqrt{10}$ (2) $3\sqrt{10}$

(3) $2\sqrt{10}$ (4) $10\sqrt{2}$

56. If α, β, γ are the angles made by a vector with the coordinate axes, then $\sin^2\alpha + \sin^2\beta + \sin^2\gamma =$

(1) 0 (2) 1

(3) 2 (4) 3

57. The image of the point (3, –2, 1) in the plane $3x - y + 4z = 2$ is :

(1) (1, –1, –3) (2) (0, –1, –3)

(3) (1, 0, –3) (4) (0, 1, –3)

58. If a plane meets the coordinates axes at point A, B and C in such a way that the centroid of triangle ABC is (1, 2, 3), then the equation of the plane is :

(1) $6x + 3y + 2z - 2 = 0$ (2) $6x + 3y + 2z - 6 = 0$

(3) $6x + 3y + 2z - 18 = 0$ (4) $3x + 2y + z - 9 = 0$

59. The distance between the planes $\vec{r}\cdot(\hat{i} + 2\hat{j} - 2\hat{k}) + 5 = 0$ and $\vec{r}\cdot(\hat{i} + 2\hat{j} - 2\hat{k}) - 8 = 0$ is :

(1) $\frac{8}{3}$ units (2) $\frac{3}{13}$ units

(3) $\frac{10}{3}$ units (4) $\frac{13}{3}$ units

60. The equation of the passing through (–1, 2, –3) and perpendicular to the plane $2x + 3y + z + 5 = 0$ is :

(1) $\frac{x-1}{2} = \frac{y+2}{3} = \frac{z-3}{1}$ (2) $\frac{x+1}{2} = \frac{y-2}{3} = \frac{z+3}{1}$

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

61. If the sum of the squares of the roots of the equation $x^2 - (a-2)x - (a+1) = 0$ assumes the least value, then $a =$

(1) 0 (2) –1

(3) 1 (4) 2

62. The condition that one root of the equation $ax^2 + bx + c = 0$ is double of the other, is :

(1) $2b^2 = 3ac$ (2) $2b^2 = 9ac$

(3) $b^2 = 9ac$ (4) $b^2 = 3ac$

63. In how many ways three different rings can be worn in four fingers with at most one in each finger ?

(1) 3
(2) 12
(3) 21
(4) 24

64. In how many ways a committee of 5 members can be selected from 6 men and 5 women consisting of 3 men and 2 women ?

(1) 200
(2) 181
(3) 160
(4) 120

65. In the expansion of $\left(3x^2 - \frac{1}{2x^3}\right)^{10}$, the term independent of x is :

(1) $\frac{76545}{8}$
(2) $\frac{76545}{4}$
(3) $\frac{76545}{16}$
(4) $\frac{72375}{8}$

66. If the coefficients of rth and $(r + 1)$th terms in the expansion of $(7x+3)^{29}$ are equal, then $r =$

(1) 7
(2) 12
(3) 16
(4) 21

67. Sum of first three terms of a G. P. is 16 and the sum of next three terms is 128. The sum of n terms of this G. P. is :

(1) $\frac{8}{7}(2^n - 1)$
(2) $\frac{8}{9}(2^n - 1)$
(3) $\frac{16}{7}(2^n - 1)$
(4) $\frac{16}{9}(2^n - 1)$

68. If A_1, A_2 are two AM's and G_1, G_2 are two GM's between a and b, then $\frac{A_1 + A_2}{G_1 G_2} =$

(1) $\frac{a+b}{\sqrt{ab}}$
(2) $\frac{a+b}{ab}$
(3) $\frac{ab}{a+b}$
(4) $\frac{a+b}{2ab}$

69. The sum of n terms of an A. P. is $3n^2 + 5$. If its nth term is 159, then n =

(1) 15
(2) 18
(3) 24
(4) 27

70. If the sum of first n natural number is $\frac{1}{5}$ times the sum of their squares, then the value of n is :

(1) 5
(2) 7
(3) 8
(4) 9

71. The image of the point (3, 8) in the line $x + 3y = 7$ is :

(1) (1, 4)
(2) (–4, –1)
(3) (–1, –4)
(4) (4, 1)

72. The nearest point on the line $3x - 4y = 25$ from the origin is :

(1) (3, –4)
(2) (4, –3)
(3) (3, 4)
(4) (3, 5)

73. The line which is parallel to x-axis and crosses the curve $y = \sqrt{x}$ at an angle 45°, is :

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

74. The distance between the parallel lines $4x + 3y = 11$ and $8x + 6y = 15$ is :

(1) $\frac{7}{10}$ units
(2) $\frac{10}{7}$ units
(3) $\frac{7}{5}$ units
(4) $\frac{5}{7}$ units

75. If the points (0, 0), (1, 0), (0, 1) and (k, k) are concyclic, then k =

(1) 2
(2) –1
(3) 1
(4) – 2

76. The vertex of the parabola $y^2+6x-2y+13=0$ is :

(1) (1, 2)
(2) (2, 1)
(3) (2, –1)
(4) (–2, 1)

77. The eccentricity of an ellipse is $\frac{1}{2}$ and its foci are (±2, 0), its equation is :

(1) $\frac{x^2}{16}+\frac{y^2}{12}=1$
(2) $\frac{x^2}{12}+\frac{y^2}{16}=1$
(3) $\frac{x^2}{12}+\frac{y^2}{8}=1$
(4) $\frac{x^2}{8}+\frac{y^2}{12}=1$

78. If $5x^2+ky^2=20$ represents a rectangular hyperbola, then $k=$

(1) 5
(2) 4
(3) –4
(4) –5

79. The ratio in which the line joining the points (1, 2, 3) and (–3, 4, –5) is divided by the *xy*-plane, is :

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

80. A line passes through (2, 2) and is perpendicular to the line $3x+y=3$. Its y-intercept is :

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

81. Two finite sets have m and n elements. The total number of subsets of first set is 56 more than the total number of subsets of the second set, then the values of m and n are :

(1) 5, 2
(2) 7, 4
(3) 5, 1
(4) 6, 3

82. If A, B and C are any three sets, then $A-(B\cap C)$ is the same as :

(1) $(A\cap B)-(A\cap C)$
(2) $(A-B)\cap(A-C)$
(3) $(A-B)\cup(A-C)$
(4) $(A-B)\cup C$

83. For the set $A = \{1, 2, 3, 4, 5\}$ a relation R is defined by $R = \{(x, y) : x, y \in A \text{ and } x < y\}$. Then R is :

(1) transitive (2) symmetric

(3) reflexive (4) antisymmetric

84. $\frac{2\sin x}{\cos 3x} =$

(1) $\tan 3x - \tan 2x$ (2) $\tan 3x + \tan x$

(3) $\tan 3x + \tan 2x$ (4) $\tan 3x - \tan x$

85. If $\sin\alpha + \sin\beta = \sqrt{3/2}$ and $\cos\alpha + \cos\beta = \frac{1}{\sqrt{2}}$, then $\alpha =$

(1) $7\frac{1}{2}°$ (2) $15°$

(3) $30°$ (4) $45°$

86. If $\sin x + \sin^2 x = 1$, then $\cos^8 x + 2\cos^6 x + \cos^4 x =$

(1) 0 (2) 1

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

87. If $n \in N$, then $7^{2n} + 2^{3n-3} . 3^{n-1}$ is divisible by :

(1) 45 (2) 35

(3) 25 (4) 10

88. If α, β are two different complex numbers such that $|\alpha| = 1$, $|\beta| = 1$, then $\left|\frac{\beta - \alpha}{1 - \overline{\alpha}\beta}\right| =$

(1) 0 (2) 1

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

89. If $z = x + iy$ and $\left|\frac{1 - iz}{z - i}\right| = 1$, then z =

(1) i (2) 1

(3) y (4) x

90. If $z = 1 + i\sqrt{3}$, then $|\arg(z)| + |\arg(\overline{z})| =$

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

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

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

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(1) i (2) 1

(3) y (4) x

90. If $z = 1 + i\sqrt{3}$, then $|\arg(z)| + |\arg(\overline{z})| =$

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

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

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91. Let $f(x) = \sin x$, $g(x) = x^2$ and $h(x) = \log x$. If $F(x) = (hogof)(x)$, then $F''(x) =$

(1) $-2\operatorname{cosec}^2 x$ (2) $-\operatorname{cosec}^2 x$

(3) $2\operatorname{cosec}^2 x$ (4) $-2\operatorname{cosec}^3 x$

92. If $x^y = e^{x-y}$, then $\frac{dy}{dx} =$

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

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

93. If $x = \sin^{-1}\left(\frac{2\theta}{1+\theta^2}\right), y = \tan^{-1}\left(\frac{2\theta}{1-\theta^2}\right)$, then $\frac{dy}{dx} =$

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

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

94. The equation of the tangent to the curve $y = (2x-1)e^{2(1-x)}$ at the point of its maxima is :

(1) $x - 1 = 0$ (2) $y - 1 = 0$

(3) $x + y - 1 = 0$ (4) $x - y + 1 = 0$

95. The equation of normal to the curve $x = a(1 + \cos\theta)$, $y = a\sin\theta$ at θ is :

(1) $x\sin\theta - y\cos\theta = a$ (2) $x\cos\theta - y\sin\theta = a$

(3) $x\sin\theta - y\cos\theta = a\sin\theta$ (4) $x\cos\theta - y\sin\theta = a\sin\theta$

96. The function $f(x) = x + \cot^{-1} x$ is :

(1) decreases for all x (2) decreases for $[1, \infty)$

(3) increasing for all x (4) constant for all x

97. The function $f(x) = \sin^4 x + \cos^4 x$ increases if :

(1) $\frac{\pi}{4} < x < \frac{\pi}{2}$ (2) $\frac{3\pi}{8} < x < \frac{5\pi}{8}$

(3) $\frac{5\pi}{8} < x < \frac{3\pi}{4}$ (4) $0 < x < \frac{\pi}{8}$

98. The curves $y = 1 - ax^2$ and $y = x^2$ intersect orthogonally, then the value of a is :

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

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

99. In the interval [0, 1] the function $f(x) = x^5(1-x)^{15}$ takes the maximum value at the point :

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

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

100. The maximum value of $\left(\frac{1}{x}\right)^x$ is :

(1) e^e (2) $e^{1/e}$

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

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ANSWER KEY OF M.SC. MATH 5 YEAR -2018				
Q.NO.	A	B	C	D
1	4	2	2	2
2	3	1	4	3
3	1	3	1	2
4	4	4	1	3
5	2	2	3	2
6	2	1	3	3
7	3	1	2	4
8	2	4	3	1
9	4	2	4	3
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41	2	1	1	3
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43	3	1	4	3
44	4	2	1	2
45	2	3	3	4
46	1	3	4	3
47	1	1	4	3
48	4	4	4	3

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Head
Department of Mathematics
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Rohtak-124001 (Haryana)

ANSWER KEY OF M.SC. MATH 5 YEAR -2018				
Q.NO.	A	B	C	D
49	2	4	3	4
50	4	2	1	1
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95	3	1	3	3
96	3	4	4	3
97	2	3	2	1
98	3	2	4	4
99	4	4	1	4
100	2	2	2	2

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