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STD: XII - A

Mathematics

BOOK BACK ONEWORDS VOLUME - 1

CHOOSE THE CORRECT ANSWER:

1. If $\left|z - \frac{3}{z}\right| = 2$, then the least value of $|z|$ is

a. 1 b. 2 c. 3 d. 5

2. A polynomial equation in x of degree n always has

a. n distinct roots b. n real roots
c. n imaginary roots d. at most one root

3. If (1 + i)(1 + 2i)(1 + 3i)…..(1 + ni) = x + iy, then 2.5.10…..$(1 + n^2)$ is

a. 1 b. i c. $x^2 + y^2$ d. $1 + n^2$

4. $\sin^{-1}[\tan \frac{\pi}{4}] - \sin^{-1}[\frac{\sqrt{3}}{x}] = \frac{\pi}{6}$. Then x is a root of the equation

a. $x^2 - x - 6 = 0$ b. $x^2 - x - 12 = 0$
c. $x^2 + x - 12 = 0$ d. $x^2 + x - 6 = 0$

5. The ellipse E_1: $\frac{x^2}{9} + \frac{y^2}{4} = 1$ is inscribed in a rectangle R whose sides are parallel to the coordinate axes. Another ellipse E_2 passing through the point (0, 4) circumscribes the rectangle R. The eccentricity of the ellipse is

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

6. If $\vec{a}, \vec{b}, \vec{c}$ are non-coplanar, non-zero vectors such that $[\vec{a}, \vec{b}, \vec{c}] = 3$, then $\{[\vec{a} \times \vec{b}, \vec{b} \times \vec{c}, \vec{c} \times \vec{a}]\}^2$ is equal to

a) 81 b) 9 c) 27 d) 18

7. $\sin^{-1}\frac{3}{5} - \cos^{-1}\frac{12}{13} + \sec^{-1}\frac{5}{3} - \mathrm{cosec}^{-1}\frac{13}{12}$ is

a. 2π b. π c. 0 d. $\tan^{-1}\frac{12}{65}$

8. The circle $x^2 + y^2 = 4x + 8y + 5$ intersects the line 3x – 4y = m at two distinct points if

a) $15 < m < 65$ b) $35 < m < 85$ c) $-85 < m < -35$ d) $-35 < m < 15$

9. If A, B and C are invertible matrices of some order, then which one of the following is not true?

a. adj A = $|A|\, A^{-1}$ b. adj (AB) = (adj A)(adj B)
c. det $A^{-1} = (\det A)^{-1}$ d. $(ABC)^{-1} = C^{-1}B^{-1}A^{-1}$

10. The value of $\sin^{-1}(\cos x)$, $0 \le x \le \pi$ is

a. $\pi - x$ b. $x - \frac{\pi}{2}$ c. $\frac{\pi}{2} - x$ d. $x - \pi$

11. The eccentricity of the hyperbola whose latus rectum is 8 and conjugate axis is equal to half the distance between the foci is

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

12. If $\vec{a} = 2\hat{\imath} + 3\hat{\jmath} - \hat{k}, \vec{b} = \hat{\imath} + 2\hat{\jmath} - 5\hat{k}, \vec{c} = 3\hat{\imath} + 5\hat{\jmath} - \hat{k}$, then a vector perpendicular to $\vec{a}$ *lies in the plane containing* $\hat{b}$ *and* $\hat{c}$ is

a) $-17\hat{\imath} + 21\hat{\jmath} - 97\hat{k}$ b) $17\hat{\imath} + 21\hat{\jmath} - 123\hat{k}$

c) $-17\hat{\imath} - 21\hat{\jmath} + 97\hat{k}$ d) $-17\hat{\imath} - 21\hat{\jmath} - 97\hat{k}$

13. The area of the triangle formed by the complex numbers z, iz and z + iz in the Argand's diagram is

a. $\frac{1}{2}|z|^2$ b. $|z|^2$ c. $\frac{3}{2}|z|^2$ d. $2|z|^2$

14. The polynomial $x^3 - kx^2 + 9x$ has three real zeros if and only if, k satisfies

a. $|k| \leq 6$ b. k = 0 c. $|k| > 0$ d. $k \geq 6$

15. If $\omega \neq 1$ is a cubic root of unit and $\begin{vmatrix} 1 & 1 & 1 \\ 1 & -\omega^2 - 1 & \omega^2 \\ 1 & \omega^2 & \omega^7 \end{vmatrix} = 3k$, then k is equal to

a. 1 b. -1 c. $\sqrt{3}i$ d. $-\sqrt{3}i$

16. The vector equation $\vec{r} = (\hat{\imath} - 2\hat{\jmath} - \hat{k}) + t(2\hat{\imath} - \hat{k})$ represents a straight line passing through the points

a) (0, 6, - 1) and (1, - 2, - 1) b) (0, 6, - 1) and (- 1, - 4, - 2)

c) (1, - 2, - 1) and (1, 4, - 2) d) (1, - 2,- 1) and (0, - 6,1)

17. The area of quadrilateral formed with foci of the hyperbolas $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ and $\frac{x^2}{a^2} - \frac{y^2}{b^2} = -1$ is

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

18. The rank of the matrix $\begin{bmatrix} 1 & 2 & 3 & 4 \\ 2 & 4 & 6 & 8 \\ -1 & -2 & -3 & -4 \end{bmatrix}$ is ____________.

a. 1 b. 2 c. 4 d. 3

19. An ellipse has OB as semi minor axes, F and F' its foci and the angle FBF' is a right angle. Then the eccentricity of the ellipse is

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

20. If z = x + iy is a complex number such that $|z + 2| = |z - 2|$, then the locus of z is

a. real axis b. imaginary axis c. ellipse d. circle

21. The value of $\left(\frac{1+i\sqrt{3}}{1-i\sqrt{3}}\right)^{10}$ is

a. cis $\frac{2\pi}{3}$ b. cis $\frac{4\pi}{3}$ c. –cis $\frac{2\pi}{3}$ d. –cis $\frac{4\pi}{3}$

22. The equation $\tan^{-1}x - \cot^{-1}x = \tan^{-1}\left(\frac{1}{\sqrt{3}}\right)$ has

a. no solution b. unique solution

c. two solutions d. infinite number of solutions

23. The locus of a point whose distance from (- 2, 0) is 2/3 times its distance from the line $x = -\frac{9}{2}$ is

a) a parabola b) a hyperbola c) an ellipse d) a circle

24. If x = $\frac{1}{5}$, the value of cos(cos^{-1}x + 2sin^{-1}x) is

a. $-\sqrt{\frac{24}{25}}$ b. $\sqrt{\frac{24}{25}}$ c. $\frac{1}{5}$ d. $-\frac{1}{5}$

25. If the planes $\vec{r}\,.(2\hat{\imath} - \lambda\hat{\jmath} + \hat{k}) = 3$ and $\vec{r}\,.(4\hat{\imath} + \hat{\jmath} - \mu\hat{k})$ are parallel, then the value of λ and μ are

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

26. The eccentricity of the ellipse $(x - 3)^2 + (y - 4)^2 = \frac{y^2}{9}$ is

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

27. If f and g are polynomials of degree m and n respectively, and if h(x) = (f ∘ g)(x), then the degree of h is

a. mn b. m + n c. m^n d. n^m

28. If A = $\begin{bmatrix} \frac{3}{5} & \frac{2}{5} \\ x & \frac{3}{5} \end{bmatrix}$ and $A^T = A^{-1}$, then the value of x is ____________.

a. $\frac{-4}{5}$ b. $\frac{-3}{5}$ c. $\frac{3}{5}$ d. $\frac{4}{5}$

29. If $\frac{z-1}{z+1}$ is purely imaginary, then $|z|$ is

a. ½ b. 1 c. 2 d. 3

30. sin(tan^{-1}x), $|x| < 1$ is equal to

a. $\frac{x}{\sqrt{1-x^2}}$ b. $\frac{1}{\sqrt{1-x^2}}$ c. $\frac{1}{\sqrt{1+x^2}}$ d. $\frac{x}{\sqrt{1+x^2}}$

31. If z is a non zero complex number, such that $2i\, z^2 = \bar{z}$ then $|z|$ is

a. ½ b. 1 c. 2 d. 3

32. The length of the diameter of the circle which touches the x -axis at the point (1, 0) and passes through the point (2, 3)

a) $\frac{6}{5}$ b) $\frac{5}{3}$ c) $\frac{10}{3}$ d) $\frac{3}{5}$

33. If $|adj(adj\ A)| = |A|^9$, then the order of the square matrix A is

a. 3 b. 4 c. 2 d. 5

34. Tangents are drawn to the hyperbola $\frac{x^2}{9} - \frac{y^2}{4} = 1$ parallel to the straight line 2x – y = 1. One of the points of contact of tangents on the hyperbola is

a) $(\frac{9}{2\sqrt{2}}, \frac{-1}{\sqrt{2}})$ b) $(\frac{-9}{2\sqrt{2}}, \frac{1}{\sqrt{2}})$ c) $(\frac{9}{2\sqrt{2}}, \frac{1}{\sqrt{2}})$ d) $(3\sqrt{3}, -2\sqrt{2})$

35. If $\vec{a}, \vec{b}, \vec{c}$ are three unit vectors such that $\vec{a}$ is perpendicular to $\vec{b}$ and is parallel to $\vec{c}$ then $\vec{a} \times (\vec{b} \times \vec{c})$ is equal to

a) $\vec{a}$ b) $\vec{b}$ c) $\vec{c}$ d) $\vec{0}$

36. If sin^{-1}($\frac{x}{5}$) + cot^{-1}($\frac{5}{4}$) = $\frac{\pi}{2}$, then the value of x is

a. 4 b. 5 c. 2 d. 3

37. If z is a complex number such that $z \in \mathbb{C}\backslash\mathbb{R}$ and $z + \frac{1}{z} \in \mathbb{R}$, then $|z|$ is

a. 0 b. 1 c. 2 d. 3

38. If the normals of the parabola $y^2 = 4ax$ drawn at the end points of its latus rectum are tangents to the circle $(x - 3)^2 + (y + 2)^2 = r^2$, then the value of r^2 is

a) 2 b) 3 c) 1 d) 4

39. If $[\vec{a}, \vec{b}, \vec{c}] = 1$, then the value of $\frac{\vec{a}\,.\,(\vec{b}\times\vec{c})}{(\vec{c}\times\vec{b}).\,\vec{b}} + \frac{\vec{b}\,.\,(\vec{c}\times\vec{a})}{(\vec{a}\times\vec{b}).\,\vec{c}} + \frac{\vec{a}\,.\,(\vec{a}\times\vec{b})}{(\vec{c}\times\vec{b}).\,\vec{a}}$ is

a) 1 b) – 1 c) 2 d) 3

40. Which of the following is/are correct?

(i) Adjoint of a symmetric matrix is also a symmetric matrix

(ii) Adjoint of a diagonal matrix is also a diagonal matrix

(iii)If A is a square matrix of order n and λ is a scalar, then $adj(\lambda A) = \lambda^n adj(A)$

(iv) A(adj A) = (adj A)A = $|A|$I

a. only (i) b. (ii) and (iii) c. (iii) and (iv) d. (i), (ii) and (iv)

41. The principal argument of $\frac{3}{-1+i}$ is

a. $-\frac{5\pi}{6}$ b. $-\frac{2\pi}{3}$ c. $-\frac{3\pi}{4}$ d. $-\frac{\pi}{2}$

42. If $\cot^{-1}x = \frac{2\pi}{5}$ for some $x \in R$, the value of $\tan^{-1}x$ is

a. $-\frac{\pi}{10}$ b. $\frac{\pi}{5}$ c. $\frac{\pi}{10}$ d. $-\frac{\pi}{5}$

43. If A = $\begin{bmatrix} 3 & 5 \\ 1 & 2 \end{bmatrix}$, B = adj A and C = 3A, then $\frac{|adj\ B|}{|C|}$ = ________.

a. 1/3 b. 1/9 c. ¼ d. 1

44. If $\omega \neq 1$ is a cubic root of unit and $(1 + \omega)^7 = A + B = A + B\omega$, then (A, B) equals

a. (1, 0) b. (-1, 1) c. (0, 1) d. (1, 1)

45. The values of m for which the line $y = mx + 2\sqrt{5}$ touches the hyperbola $16x^2 - 9y^2 = 144$ are the roots of $x^2 - (a + b)x - 4 = 0$, then the value of $(a + b)$ is

a) 2 b) 4 c) 0 d) -2

46. If $\vec{a} \times (\vec{b} \times \vec{c}) = \overrightarrow{(a} \times \vec{b}) \times \vec{c}$ where $\vec{a}, \vec{b}, \vec{c}$ are any three vectors such that $\vec{b}\,.\,\vec{c} \neq 0$ and $\vec{a}\,.\,\vec{b} \neq 0$, then $\vec{a}$ *and* $\vec{c}$ are

a) perpendicular b) parallel

c) inclined at an angle $\frac{\pi}{3}$ d) inclined at an angle $\frac{\pi}{6}$

47. The product of all four values of $(\cos\frac{\pi}{3} + i\sin\frac{\pi}{3})^{\frac{3}{4}}$ is

a. -2 b. -1 c. 1 d. 2

48. If A = $\begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix}$ and A(adj A) = $\begin{bmatrix} k & 0 \\ 0 & k \end{bmatrix}$, then k = ______.

a. 0 b. $\sin\theta$ c. $\cos\theta$ d. 1

49. If $\rho(A) = \rho([A|B])$, then the system AX = B of linear equation is

a. Consistent and has a unique solution b. consistent

c. Consistent and has infinitely many solution d. inconsistent

50. If the function f(x) = $\sin^{-1}x(x^2 - 3)$ then x belongs to

a. [-1, 1] b. [$\sqrt{2}$, 2] c. [-2, -$\sqrt{2}$] ∪ [$\sqrt{2}$, 2] d. [-2, -$\sqrt{2}$]

51. If the volume of the parallelepiped with, $\vec{a} \times \vec{b}, \vec{b} \times \vec{c}, \vec{c} \times \vec{a}$ as coterminous edges is 8 cubic units, then the volume of the parallelepiped with $\overrightarrow{(a \times \vec{b})} \times (\vec{b} \times \vec{c})$, $(\vec{b} \times \vec{c}) \times (\vec{c} \times \vec{a})$ as coterminous edges is,

a) 8 cubic units b) 512 cubic units c)64 cubic units d) 24 cubic units

52. The equation of the normal to the circle $x^2 + y^2 - 2x - 2y + 1 = 0$ = which is parallel to the line $2x + 4y = 3$ 3 is

a) x + 2y = 3 b) x + 2y + 3 = 0 c) 2x + 4y + 3 = 0 d) x − 2y + 3 = 0

53. If A is 3 X 3 non-singular matrix $AA^T = A^T$ and $B = A^{-1}A^T$, then BB^T = _____.

a. A b. B c. I_3 d. B^T

54. If α, β *and* γ are the zeros of $x^3 + px^2 + qx + r$, then $\sum \frac{1}{\alpha}$ is

a. $-\frac{q}{r}$ b. $-\frac{p}{r}$ c. $\frac{q}{r}$ d. $-\frac{q}{p}$

55. The principal argument of $(\sin 40° + i \cos 40°)^5$ is

a. -110° b. -70° c. 70° d. 110°

56. If A = $\begin{bmatrix} 1 & \tan\frac{\theta}{2} \\ -\tan\frac{\theta}{2} & 1 \end{bmatrix}$ and AB = I_2, then B = ___________.

a. ($\cos^2\frac{\theta}{2}$)A b. ($\cos^2\frac{\theta}{2}$)A^T c. ($\cos^2\theta$)A d. ($\sin^2\frac{\theta}{2}$)A

57. The number of real numbers in [0, 2π] satisfying $\sin^4x - 2\sin^2x + 1$ is

a. 2 b. 4 c. 1 d. ∞

58. The equation of the circle passing through the foci of the ellipse $\frac{x^2}{16} + \frac{y^2}{9} = 1$ having centre at (0, 3) is

a) $x^2 + y^2 - 6y - 7 = 0$ b) $x^2 + y^2 - 6y + 7 = 0$

c) $x^2 + y^2 - 6y - 5 = 0$ d) $x^2 + y^2 - 6y + 5 = 0$

59. The radius of the circle $3x^2 + by^2 + 4bx - 6by + b^2 = 0$ is

a) 1 b) 3 c) $\sqrt{10}$ d) $\sqrt{11}$

60. The number of positive zeros of the polynomial $\sum_{j=0}^{n} nc_r (-1)^r x^r$ is

a. 0 b. n c. < n d. r

61. If $(AB)^{-1} = \begin{bmatrix} 12 & -17 \\ -19 & 27 \end{bmatrix}$ and $A^{-1} = \begin{bmatrix} 1 & -1 \\ -2 & 3 \end{bmatrix}$, then B^{-1} = ____________.

a. $\begin{bmatrix} 2 & -5 \\ -3 & 8 \end{bmatrix}$ b. $\begin{bmatrix} 8 & 5 \\ 3 & 2 \end{bmatrix}$ c. $\begin{bmatrix} 3 & 1 \\ 2 & 1 \end{bmatrix}$ d. $\begin{bmatrix} 8 & -5 \\ -3 & 2 \end{bmatrix}$

62. If $\sin^{-1}x + \sin^{-1}y = \frac{2\pi}{3}$; then $\cos^{-1}x + \cos^{-1}y$ is equal to

a. $\frac{2\pi}{3}$ b. $\frac{\pi}{3}$ c. $\frac{\pi}{6}$ d. π

63. If P = $\begin{bmatrix} 1 & x & 0 \\ 1 & 3 & 0 \\ 2 & 4 & -2 \end{bmatrix}$ is the adjoint of 3 X 3 matrix A and $|A| = 4$, then x is _______.

a. 15 b. 12 c. 14 d. 11

64. If $\sin^{-1}x = 2\sin^{-1}\alpha$ has a solution, then

a. $|\alpha| \leq \frac{1}{\sqrt{2}}$ b. $|\alpha| \geq \frac{1}{\sqrt{2}}$ c. $|\alpha| < \frac{1}{\sqrt{2}}$ d. $|\alpha| > \frac{1}{\sqrt{2}}$

65. The volume of the parallelepiped with its edges represented by the vectors $\hat{\imath} + \hat{\jmath}, \hat{\imath} + 2\hat{\jmath}$, $\hat{\imath} + \hat{\jmath} + \pi\hat{k}$ is

a. $\frac{\pi}{2}$ b) $\frac{\pi}{3}$ c) π d) $\frac{\pi}{4}$

66. If $\sin^{-1}x + \sin^{-1}y + \sin^{-1}z = \frac{3\pi}{2}$; the value of $x^{2017} + y^{2018} + z^{2019} - \frac{9}{x^{101} + y^{101} + z^{101}}$ is

a. 0 b. 1 c. 2 d. 3

67. According to the rational root theorem, which number is not possible rational zero of $4x^7 + 2x^4 - 10x^3 - 5$?

a. -1 b. $\frac{5}{4}$ c. $\frac{4}{5}$ d. 5

68. The circle passing through (1, - 2) and touching the axis of x at (3, 0) passing through the point

a) (-5, 2) b) (2, - 5) c) (5, - 2) d) (- 2, 5)

69. Let A = $\begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$ and 4B = $\begin{bmatrix} 3 & 1 & -1 \\ 1 & 3 & x \\ -1 & 1 & 3 \end{bmatrix}$. If B is the inverse of A, then the value of x is ___________.

a. 2 b. 4 c. 3 d. 1

70. $\tan^{-1}(\frac{1}{4}) + \tan^{-1}(\frac{2}{9})$ is equal to

a. $\frac{1}{2}\cos^{-1}(\frac{3}{5})$ b. $\frac{1}{2}\sin^{-1}(\frac{3}{5})$ c. $\frac{1}{2}\tan^{-1}(\frac{3}{5})$ d. $\tan^{-1}(\frac{1}{2})$

71. Distance from the origin to the plane $3x - 6y + 2z + 7 = 0$ is

a) 0 b) 1 c) 2 d) 3

72. Consider an ellipse whose centre is of the origin and its major axis is along x-axis. If its eccentrcity is $\frac{3}{5}$ and the distance between its foci is 6, then the area of the quadrilateral inscribed in the ellipse with diagonals as major and minor axis of the ellipse is

a) 8 b) 32 c) 80 d) 40

73. If A $\begin{bmatrix} 1 & -2 \\ 1 & 4 \end{bmatrix} = \begin{bmatrix} 6 & 0 \\ 0 & 6 \end{bmatrix}$, then A = ___________.

a. $\begin{bmatrix} 1 & -2 \\ 1 & 4 \end{bmatrix}$ b. $\begin{bmatrix} 1 & 2 \\ -1 & 4 \end{bmatrix}$ c. $\begin{bmatrix} 4 & 2 \\ -1 & 1 \end{bmatrix}$ d. $\begin{bmatrix} 4 & -1 \\ 2 & 1 \end{bmatrix}$

74. $\sin^{-1}(2\cos^2x - 1) + \cos^{-1}(1 - 2\sin^2x) =$

a. $\frac{\pi}{2}$ b. $\frac{\pi}{3}$ c. $\frac{\pi}{4}$ d. $\frac{\pi}{6}$

75. If $\cot^{-1}(\sqrt{\sin\alpha}) + \tan^{-1}(\sqrt{\sin\alpha}) = u$, then cos 2u is equal to

a. $\tan^2\alpha$ b. 0 c. -1 d. $\tan 2\alpha$

76. If $|x| \leq 1$, then $2\tan^{-1}x - \sin^{-1}\frac{2x}{1-x^2}$ is equal to

a. $\tan^{-1}x$ b. $\sin^{-1}x$ c. 0 d. π

77. If $0 \leq \theta \leq \pi$ and the system of equations $x + (\sin\theta)y - (\cos\theta)z = 0$,

(cos θ)x – y + z = 0, (sin θ)x + y – z = 0 has a non-trivial solution then θ is _________.

a. $\frac{2\pi}{3}$ b. $\frac{3\pi}{4}$ c. $\frac{5\pi}{6}$ d. $\frac{\pi}{4}$

78. If $\sin^{-1}x + \cot^{-1}\left(\frac{1}{2}\right) = \frac{\pi}{2}$, then x is equal to

a. $\frac{1}{2}$ b. $\frac{1}{\sqrt{5}}$ c. $\frac{2}{\sqrt{5}}$ d. $\frac{\sqrt{3}}{2}$

79. If $|z_1| = 1$, $|z_2| = 2$, $|z_3| = 9$ and $|9\, z_1 z_2 + 4\, z_1 z_3 + z_3 z_2| = 12$, then the value of $|z_1 + z_2 + z_3|$ is

a. 1 b. 2 c. 3 d. 4

80. If $z = \frac{(\sqrt{3}+i)^3\,(3i+4)^2}{(8+6i)^2}$, then $|z|$ is equal to

a. 0 b. 1 c. 2 d. 3

81. The equation of the circle passing through (1, 5) and (4, 1) and touching y-axis is $x^2 + y^2 - 5x - 6y + 9 + \lambda(4x + 3y - 19) = 0$ where λ is equal to

a) 0, $-\frac{40}{9}$ b) 0 c) $\frac{40}{9}$ d) $-\frac{40}{9}$

82. If A^TA^{-1} is symmetric, then A^2 = ____________.

a. A^{-1} b. $(A^T)^2$ c. A^T d. $(A^{-1})^2$

83. If $A = \begin{bmatrix} 3 & 1 & -1 \\ 2 & -2 & 0 \\ 1 & 2 & -1 \end{bmatrix}$ and $A^{-1} = \begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix}$ then the value of a_{23} is _________.

a. 0 b. -2 c. -3 d. -1

84. If $|z - 2 + i| \leq 2$, then the greatest value of $|z|$ is

a. $\sqrt{3} - 2$ b. $\sqrt{3} + 2$ c. $\sqrt{5} - 2$ d. $\sqrt{5} + 2$

85. The polynomial $x^3 + 2x + 3$ has

a. one negative and two imaginary roots

b. one positive and two imaginary roots

c. three real roots d. no zeros

86. The centre of the circle inscribed in a square formed by the lines $x^2 - 8x - 12 = 0$ and $y^2 - 14y + 15 = 0$ is

a) (4, 7) b) (7, 4) c) (9, 4) d) (4, 9)

87. The angle between the line $\vec{r} = (\hat{\imath} + 2\hat{\jmath} - 3\hat{k}) + t(2\hat{\imath} + \hat{\jmath} - 2\hat{k})$ and the plane $\vec{r}\,.(\hat{\imath} + \hat{\jmath} - \hat{k}) = 3$ are

a) 0° b) 30° c) 45° d) 90°

88. $\sin^{-1}(\cos x) = \frac{\pi}{2} - x$ is valid for

a. $-\pi \leq x \leq 0$ b. $0 \leq x \leq \pi$ c. $-\frac{\pi}{2} \leq x \leq \frac{\pi}{2}$ d. $-\frac{\pi}{4} \leq x \leq \frac{3\pi}{4}$

89. The radius of the circle passing through the point (6, 2)two of whose diameter are $x + y = 6$ and $x + 2y = 4$ is

a) 10 b) $2\sqrt{5}$ c) 6 d) 4

90. If adj $A = \begin{bmatrix} 2 & 3 \\ 4 & -1 \end{bmatrix}$ and adj $B = \begin{bmatrix} 1 & -2 \\ -3 & 1 \end{bmatrix}$ then adj(AB) is ________.

a. $\begin{bmatrix} -7 & -1 \\ 7 & -9 \end{bmatrix}$ b. $\begin{bmatrix} -6 & 5 \\ -2 & -10 \end{bmatrix}$ c. $\begin{bmatrix} -7 & 7 \\ -1 & -9 \end{bmatrix}$ d. $\begin{bmatrix} -6 & -2 \\ 5 & -10 \end{bmatrix}$

91. If z_1, z_2 and z_3 are complex numbers such that $z_1 + z_2 + z_3$ and $|z_1| = |z_2| = |z_3| = 1$ then $z_1{}^2 + z_2{}^2 + z_3{}^2$ is

a. 3 b. 2 c. 1 d. 0

92. If x + y = k is a normal to the parabola $y^2 = 12x$, then the value of k is

a) 3 b) -1 c) 1 d) 9

93. If a vector $\vec{\alpha}$ lies in the plane of $\vec{\beta}$ and $\vec{\gamma}$, then

a) $\overline{[\vec{\alpha}, \vec{\beta}, \vec{\gamma}]} = 1$ b) $\overline{[\vec{\alpha}, \vec{\beta}, \vec{\gamma}]} = -1$ c) $\overline{[\vec{\alpha}, \vec{\beta}, \vec{\gamma}]} = 0$ d) $\overline{[\vec{\alpha}, \vec{\beta}, \vec{\gamma}]} = 2$

94. If $|z| = 1$, then the value of $\frac{1+z}{1+\bar{z}}$.

a. z b. $\bar{z}$ c. $\frac{1}{z}$ d. 1

95. If $\vec{a}$ and $\vec{b}$ are unit vectors such that $[\vec{a}, \vec{b}, \vec{a} \times \vec{b}] = \frac{\pi}{4}$, then the angle between $\vec{a}$ and $\vec{b}$ is

a) $\frac{\pi}{6}$ b) $\frac{\pi}{4}$ c) $\frac{\pi}{3}$ d) $\frac{\pi}{2}$

96. The distance between the planes x + 2y + 3z + 7 = 0 and 2x + 4y + 6z + 7 = 0 is

a) $\frac{\sqrt{7}}{2\sqrt{2}}$ b) $\frac{7}{2}$ c) $\frac{\sqrt{7}}{2}$ d) $\frac{7}{2\sqrt{2}}$

97. If $\cot^{-1}2$ and $\cot^{-1}3$ are two angles of a triangle, then the third angle is

a. $\frac{\pi}{4}$ b. $\frac{3\pi}{4}$ c. $\frac{\pi}{6}$ d. $\frac{\pi}{3}$

98. Area of the greatest rectangle inscribed in the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ is

a) 2ab b) ab c) $\sqrt{ab}$ d) $\frac{a}{b}$

99. If $x^a y^b = e^m$, $x^c y^d = e^n$, $\Delta_1 = \begin{vmatrix} m & b \\ n & d \end{vmatrix}$, $\Delta_2 = \begin{vmatrix} a & m \\ c & n \end{vmatrix}$, $\Delta_3 = \begin{vmatrix} a & b \\ c & d \end{vmatrix}$, then the values of x and y are respectively.

a. $e^{(\Delta_2/\Delta_1)}, e^{(\Delta_3/\Delta_1)}$ b. $\log(\Delta_1/\Delta_3), \log(\Delta_2/\Delta_3)$

c. $\log(\Delta_2/\Delta_1), \log(\Delta_3/\Delta_1)$ d. $e^{(\Delta_1/\Delta_3)}, e^{(\Delta_2/\Delta_3)}$

100. $i^n + i^{n+1} + i^{n+2} + i^{n+3}$

a. 0 b. 1 c. -1 d. i

101. If two tangents drawn from a point P to the parabola yx 2 4= are at right angles then the locus of P is

a) $2x + 1 = 0$ b) $x = -1$ c) $2x - 1 = 0$ d) $x = 1$

102. The domain of the function defined by $f(x) = \sin^{-1}\sqrt{x-1}$ is

a. [1, 2] b. [-1, 1] c. [0, 1] d. [-1, 0]

103. The augmented matrix of a system of linear equations is $\begin{bmatrix} 1 & 2 & 7 & 3 \\ 0 & 1 & 4 & 6 \\ 0 & 0 & \lambda-7 & \mu+5 \end{bmatrix}$. The system has infinitely many solution if ______________.

a. $\lambda = 7, \mu \neq -5$ b. $\lambda = -7, \mu = 5$ c. $\lambda \neq 7, \mu \neq -5$ d. $\lambda = 7, \mu = -5$

104. The principal argument of the complex number $\frac{(1+i\sqrt{3})^2}{4i(1-i\sqrt{3})}$ is

a. $\frac{2\pi}{3}$ b. $\frac{\pi}{6}$ c. $\frac{5\pi}{6}$ d. $\frac{\pi}{2}$

105. If the coordinates at one end of a diameter of the circle $x^2 + y^2 - 8x - 4y + c = 0$ are (11, 2), the coordinates of the other end are

a)(- 5,2) b) (2, - 5) c) (5, - 2) d) (- 2, 5)

106. If $\vec{a}$ and $\vec{b}$ are parallel vectors, then $[\vec{a}, \vec{c}, \vec{b}]$ is equal to

a) 2 b) – 1 c) 1 d) 0

107. If A = $\begin{bmatrix} 7 & 3 \\ 4 & 2 \end{bmatrix}$, then $9I_2 - A$ = ________________.

a. A^{-1} b. $\frac{A^{-1}}{2}$ c. $3A^{-1}$ d. $2A^{-1}$

108. If $\vec{a}.\vec{b} = \vec{b}.\vec{c} = \vec{c}.\vec{a} = 0$, then the value of $[\vec{a}, \vec{b}, \vec{c}]$ is

a) $|\vec{a}||\vec{b}||\vec{c}|$ b) $\frac{1}{3}|\vec{a}||\vec{b}||\vec{c}|$ c) 1 d) – 1

109. The solution of the equation $|z| - z = 1 + 2i$ is

a. $\frac{3}{2} - 2i$ b. $-\frac{3}{2} + 2i$ c. $2 - \frac{3}{2}i$ d. $2 + \frac{3}{2}i$

110. If P(x, y) be any point on $16x^2 + 25y^2 = 400$ = with foci $F_1(3, 0)$ and $F_2(-3, 0)$ then $PF_1 + PF_2$ is

a) 8 b) 6 c) 10 d) 12

111. If $x^3 + 12x^2 + 10ax + 1999$ definitely has a positive zero, if and only if

a. $a \geq 0$ b. $a > 0$ c. $a < 0$ d. $a \leq 0$

112. If $\vec{a} = \hat{\imath} + \hat{\jmath} + \hat{k}, \vec{b} = \hat{\imath} + \hat{\jmath}, \hat{c} = \hat{\imath}$ and $(\overrightarrow{a} \times \vec{b}) \times \vec{c} = \lambda\vec{a} + \mu\vec{b}$, then the value of $\lambda + \mu$ is

a) 0 b) 1 c) 6 d) 3

113. If A = $\begin{bmatrix} 2 & 0 \\ 1 & 5 \end{bmatrix}$ and B = $\begin{bmatrix} 1 & 4 \\ 2 & 0 \end{bmatrix}$ then $|adj\ (AB)|$ = _____________.

a. -40 b. -80 c. -60 d. -20

114. If $\vec{a}, \vec{b}, \vec{c}$ are three non-coplanar vectors such that $\vec{a} \times (\vec{b} \times \vec{c}) = \frac{\vec{b} + \vec{c}}{\sqrt{2}}$, then the angle between $\vec{a}$ and $\vec{b}$ is

a) $\frac{\pi}{2}$ b) $\frac{3\pi}{4}$ c) π d) $\frac{\pi}{4}$

115. The conjugate of a complex number is $\frac{1}{i-2}$. Then the complex number is

a. $\frac{1}{i+2}$ b. $\frac{-1}{i+2}$ c. $\frac{-1}{i-2}$ d. $\frac{1}{i-2}$

116. A zero of $x^3 + 64$ is

a. 0 b. 4 c. 4i d. -4

117. Consider the vectors $\vec{a}, \vec{b}, \vec{c}, \vec{d}$ such that $(\overrightarrow{a} \times \vec{b}) \times (\vec{c} \times \vec{d}) = \vec{0}$. Let P_1 and P_2 be the planes determined by the pairs of vectors , $\vec{a}, \vec{b}$ and $\vec{c}, \vec{d}$ *d* respectively. Then the angle betwee P_1 and P_2 is

a) 0° b) 45° c) 60° d) 90°

118. If α and β are the roots of $x^2 + x + 1 = 0$, then $\alpha^{2020} + \beta^{2020}$ is

a. -2 b. -1 c. 1 d. 2

119. If A is non-singular matrix such that A^{-1} = $\begin{bmatrix} 5 & 3 \\ -2 & -1 \end{bmatrix}$, then $(A^T)^{-1}$ = ______.

a. $\begin{bmatrix} -5 & 3 \\ 2 & 1 \end{bmatrix}$ b. $\begin{bmatrix} 5 & 3 \\ -2 & -1 \end{bmatrix}$ c. $\begin{bmatrix} -1 & -3 \\ 2 & 5 \end{bmatrix}$ d. $\begin{bmatrix} 5 & -2 \\ 3 & -1 \end{bmatrix}$

120. The angle between the lines $\frac{x-2}{3} = \frac{y+1}{-2}, z = 2$ and $\frac{x-1}{1} = \frac{2y+3}{3} = \frac{z+5}{2}$ is

a) $\frac{\pi}{6}$ b) $\frac{\pi}{4}$ c) $\frac{\pi}{3}$ d) $\frac{\pi}{2}$

121. If the line $\frac{x-2}{3} = \frac{y-1}{-5} = \frac{z+2}{2}$ lies in the plane x + 3y – αz + β = 0, then (α, β) is

a) (- 5, 5) b) (- 6, 7) c) (5, - 5) d) (6, - 7)

122. The value of $\sum_{i=1}^{13} i^n + i^{n-1}$

a. 1+ i b. i c. 1 d. 0

123. The coordinates of the point where the line $\vec{r} = (6\hat{\imath} - \hat{\jmath} - 3\hat{k}) + t(-\hat{\imath} + 4\hat{k})$ meets the plane $\vec{r}\,.(\hat{\imath} + \hat{\jmath} - \hat{k})$ = 3 are

a) (2,1,0) b) (7, - 1,- 7) c) (1,2, - 6) d) (5,- 1,1)

124. If ω = cis $\frac{2\pi}{3}$, then the number of distinct roots of

$$\begin{vmatrix} z+1 & \omega & \omega^2 \\ \omega & z+\omega^2 & 1 \\ \omega^2 & 1 & z+\omega \end{vmatrix} = 0 \text{ is}$$

a. 1 b. 2 c. 3 d. 4

125. Let C be the circle with centre at (1, 1) and radius = 1. If T is the circle centered at (0, y) passing through the origin and touching the circle C externally, then the radius of T is equal to

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

126. If the direction cosines of a line are $\frac{1}{c}, \frac{1}{c}, \frac{1}{c}$ then

a) c = ± 3 b) c = ± $\sqrt{3}$ c) c > 0 d) 0 < c < 1

127. If A = $\begin{bmatrix} 2 & 3 \\ 5 & -2 \end{bmatrix}$ be such that λA^{-1} = A, then λ is ___________.

a. 17 b. 14 c. 19 d. 21

128. If the distance of the point (1,1,1) from the origin is half of its distance from the plane x + y + z + k = 0, then the values of *k* are

a) ± 3 b) ± 6 c) - 3, 9 d) 3, - 9

129. If the length of the perpendicular from the origin to the plane 2x + 3y + λz = 1, λ > 0 is $\frac{1}{5}$, then the value of λ is

a) $2\sqrt{3}$ b) $3\sqrt{2}$ c) 0 d) 1

130. If A = $\begin{bmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{bmatrix}$, then adj(adj A) is ___________.

a. $\begin{bmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{bmatrix}$ b. $\begin{bmatrix} 6 & -6 & 8 \\ 4 & -6 & 8 \\ 0 & -2 & 2 \end{bmatrix}$ c. $\begin{bmatrix} -3 & 3 & -4 \\ -2 & 3 & -4 \\ 0 & 1 & -1 \end{bmatrix}$ d. $\begin{bmatrix} 3 & -3 & 4 \\ 0 & -1 & 1 \\ 2 & -3 & 4 \end{bmatrix}$

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STD: XII - A **Mathematics**

BOOK BACK ONEWORDS VOLUME - 2

CHOOSE THE CORRECT ANSWER:

1. The differential equation representing the family of curves $y = A\cos(x + B)$, where A and B are parameters, is

a) $\frac{d^2y}{dx^2} - y = 0$ b) $\frac{d^2y}{dx^2} + y = 0$ c) $\frac{d^2y}{dx^2} = 0$ d) $\frac{d^2x}{dy^2} = 0$

2. The value of $\int_0^1 x(1-x)^{99}dx$ is

a) $\frac{1}{11000}$ b) $\frac{1}{10100}$ c) $\frac{1}{10010}$ d) $\frac{1}{10001}$

3. The number of arbitrary constants in the particular solution of a differential equation of third order is

a) 3 b) 2 c) 1 d) 0

4. Which one of the following is not true?

(1) Negation of a negation of a statement is the statement itself.
(2) If the last column of the truth table contains only T then it is a tautology.
(3) If the last column of its truth table contains only F then it is a contradiction
(4) If p and q are any two statements then $p \leftrightarrow q$ is a tautology.

5. A computer salesperson knows from his past experience that he sells computers to one in every twenty customers who enter the showroom. What is the probability that he will sell a computer to exactly two of the next three customers?

a) $\frac{57}{20^3}$ b) $\frac{57}{20^2}$ c) $\frac{19^3}{20^3}$ d) $\frac{57}{20}$

6. If $\int_0^x f(t)dt = x + \int_x^1 t\,f(t)dt$, then the value of f(1) is

a) ½ b) 2 c) 1 d) ¾

7. Which one of the following is incorrect? For any two propositions p and q , we have

a) $\neg(p \vee q) \equiv \neg p \wedge \neg q$ b) $\neg(p \wedge q) \equiv \neg p \vee \neg q$
c) $\neg(p \vee q) \equiv \neg p \vee \neg q$ d) $\neg(\neg p) \equiv p$

8. Four buses carrying 160 students from the same school arrive at a football stadium. The buses carry, respectively, 42, 36, 34, and 48 students. One of the students is randomly selected. Let X denote the number of students that were on the bus carrying the randomly selected student. One of the 4 bus drivers is also randomly selected. Let Y denote the number of students on that bus. Then $E(X)$ and $E(Y)$ respectively are

a) 50, 40 b) 40,50 c) 40.75, 40 d) 41,41

9. binomial variable which follows the relation $9P(X=4) = P(X=2)$, then the probability of success is

a)0.125 b) 0.25 c) 0.375 d) 0.75

10. If a compound statement involves 3 simple statements, then the number of rows in the truth table is

a) 9 b) 8 c) 6 d) 3

11. If $u(x, y) = x^2 + 3xy + y - 2019$, then $\frac{\partial u}{\partial x}\Big|_{(4,\,-5)}$ is equal to

a) – 4 b) – 3 c) – 7 d) 13

12. Determine the truth value of each of the following statements:
(a) 4+2=5 and 6+3=9 (b) 3+2=5 and 6+1=7
(c) 4+5=9 and1+2= 4 (d) 3+2=5 and 4+7=11
(a) (b) (c) (d)
(1) *F T F T*
(2) *T F T F*
(3) *T T F F*
(4) *F F T T*

13. The value of $\int_0^{\frac{2}{3}} \frac{dx}{\sqrt{4-9x^2}}$ is

a) $\frac{\pi}{6}$ b) $\frac{\pi}{2}$ c) $\frac{\pi}{4}$ d) π

14. The differential equation of the family of curves $y = Ae^x + Be^{-x}$, where A and B are arbitrary constants is

a) $\frac{d^2y}{dx^2} + y = 0$ b) $\frac{d^2y}{dx^2} - y = 0$ c) $\frac{dy}{dx} + y = 0$ d) $\frac{dy}{dx} - y = 0$

15. For any value of n ∈ ℤ, $\int_0^{\pi} e^{cos^2x} cos^3[(2n+1)x]\, dx$ is

a) $\frac{\pi}{2}$ b) π c) 0 d) 2

16. Consider a game where the player tosses a six-sided fair die. If the face that comes up is 6, the player wins Rs. 36, otherwise he loses Rs.k^2 , where k is the face that comes up $k = \{1, 2, 3, 4, 5\}$. The expected amount to win at this game in ` is

a) $\frac{19}{6}$ b) $-\frac{19}{6}$ c) $\frac{3}{2}$ d) $-\frac{3}{2}$

17. The integrating factor of the differential equation $\frac{dy}{dx} + P(x)y = Q(x)$ is x, then P(x)

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

18. The solution of the differential equation $\frac{dy}{dx} = \frac{y}{x} + \frac{\emptyset\left(\frac{y}{x}\right)}{\emptyset'\left(\frac{y}{x}\right)}$ is

a) $x\,\emptyset\left(\frac{y}{x}\right) = k$ b) $\emptyset\left(\frac{y}{x}\right) = kx$ c) $y\,\emptyset\left(\frac{y}{x}\right) = k$ d) $\emptyset\left(\frac{y}{x}\right) = ky$

19. If f(x) = $\int_0^x t\cos t\, dt$, then $\frac{df}{dx}$ =

a) cos x – x sin x b) sin x + x cos x c) x cos x d) x sin x

20. The probability mass function of a random variable is defined as:

x	-2	-1	0	1	2
$f(x)$	k	$2k$	$3k$	$4k$	$5k$

Then $E(X)$ is equal to:

a) $\frac{1}{15}$ b) $\frac{1}{10}$ c) $\frac{1}{3}$ d) $\frac{2}{3}$

21. The order and degree of the differential equation $\frac{d^2y}{dx^2} + (\frac{dy}{dx})^{1/3} + x^{1/4} = 0$ are respectively

a) 2, 3 b) 3, 3 c) 2, 6 d) 2, 4

22. Let *X* represent the difference between the number of heads and the number of tails obtained when a coin is tossed *n* times. Then the possible values of X are

a) $i + 2n, i = 0,1,2...n$ b) $2i - n, i = 0,1,2...n$

c) $n - i, i = 0,1,2...n$ d) $2i + 2n, i = 0,1,2...n$

23. On a multiple-choice exam with 3 possible destructives for each of the 5 questions, the probability that a student will get 4 or more correct answers just by guessing is

a) $\frac{11}{243}$ b) $\frac{3}{8}$ c) $\frac{1}{243}$ d) $\frac{5}{243}$

24. In the set $\mathbb{R}$ of real numbers '* ' is defined as follows. Which one of the following is not a binary operation on $\mathbb{R}$?

a) $a * b$=min $(a . b)$ b) $a * b$ = max (a,b)
c) $a* b= a$ d) $a * b= a^b$

25. The slope of the line normal to the curve $f(x) = 2\cos 4x$ at $x = \frac{\pi}{12}$ is

a) $-4\sqrt{3}$ b) -4 c) $\frac{\sqrt{3}}{12}$ d) $4\sqrt{3}$

26. The maximum value of the product of two positive numbers, when their sum of the squares is 200, is

a) 100 b) $25\sqrt{7}$ c) 28 d) $24\sqrt{14}$

27. Let X be random variable with probability density function $(x) = \begin{cases} \frac{2}{x^3} & x \geq 1 \\ 0 & x < 1 \end{cases}$.

Which of the following statement is correct?

a) both mean and variance exist b) mean exists but variance does not exist
c) both mean and variance do not exist d) variance exists but Mean does not exist

28. The volume of solid of revolution of the region bounded by $y^2 = x(a - x)$ about x-axis is

a) πa^3 b) $\frac{\pi a^3}{4}$ c) $\frac{\pi a^3}{5}$ d) $\frac{\pi a^3}{6}$

29. The order of the differential equation of all circles with centre at (h, k) and radius 'a' is

a) 2 b) 3 c) 4 d) 1

30. The value of $\int_0^\infty e^{-3x}x^2\, dx$ is

a) $\frac{7}{27}$ b) $\frac{5}{27}$ c) $\frac{4}{27}$ d) $\frac{2}{27}$

31. Angle between $y^2 = x$ and $x^2 = y$ at the origin is

a) $\tan^{-1}\frac{3}{4}$ b) $\tan^{-1}\frac{4}{3}$ c) $\frac{\pi}{2}$ d) $\frac{\pi}{4}$

32. The solution of $\frac{dy}{dx} + p(x)y = 0$ is

a) $y = ce^{\int pdx}$ b) $y = ce^{-\int pdx}$ c) $x = ce^{-\int pdy}$ d) $x = ce^{\int pdy}$

33. The random variable X has the probability density function $f(x) = \begin{cases} ax + b & 0 < x < 1 \\ 0 & otherwise \end{cases}$

and $E(X) = \frac{7}{12}$, then a and b are respectively

a) 1 and ½ b) ½ and 1 c) 2 and 1 d) 1 and 2

34. Which of the following is a discrete random variable?

I. The number of cars crossing a particular signal in a day.
II. The number of customers in a queue to buy train tickets at a moment.
III. The time taken to complete a telephone call.

a) I and II b) II only c) III only d) II and III

35. The value of $\int_0^a (\sqrt{a^2 - x^2})^3 dx$ is

a) $\frac{\pi a^3}{16}$ b) $\frac{3\pi a^4}{16}$ c) $\frac{3\pi a^2}{8}$ d) $\frac{3\pi a^4}{8}$

36. Which one of the following statements has truth value *F* ?
a) Chennai is in India or $\sqrt{2}$ is an integer
b) Chennai is in India or $\sqrt{2}$ is an irrational number
c) Chennai is in China or $\sqrt{2}$ is an integer
d) Chennai is in China or $\sqrt{2}$ is an irrational number

37. *P* is the amount of certain substance left in after time *t*. If the rate of evaporation of the substance is proportional to the amount remaining, then
a) $P = Ce^{kt}$ b) $P = Ce^{-kt}$ c) $P = Ckt$ d) $Pt = C$

38. A pair of dice numbered 1, 2, 3, 4, 5, 6 of a six-sided die and 1, 2, 3, 4 of a four-sided die is rolled and the sum is determined. Let the random variable *X* denote this sum. Then the number of elements in the inverse image of 7 is
a) 1 b) 2 c) 3 d) 4

39. The value of $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} sin^2x \cos x \, dx$ is
a) $\frac{3}{2}$ b) $\frac{1}{2}$ c) 0 d) $\frac{2}{3}$

40. The abscissa of the point on the curve $f(x) = 8 - 2x$ at which the slope of the tangent is -0.25?
a) −8 b) −4 c) −2 d) 0

41. The degree of the differential equation $y(x) = 1 + \frac{dy}{dx} + \frac{1}{1\,.\,2}\left(\frac{dy}{dx}\right)^2 + \frac{1}{1.2.3}\left(\frac{dy}{dx}\right)^3 + \cdots$ is
a) 2 b) 3 c) 1 d) 4

42. The slope at any point of a curve $y = f(x)$ is given by $\frac{dy}{dx} = 3x^2$ and it passes through (-1,1). Then the equation of the curve is
a) $y = x^3 + 2$ b) $y = 3x^2 + 4$ c) $y = 3x^3 + 4$ d) $y = x^3 + 5$

43. The area between $y^2 = 4x$ and its latus rectum is
a) $\frac{2}{3}$ b) $\frac{4}{3}$ c) $\frac{8}{3}$ d) $\frac{5}{3}$

44. A balloon rises straight up at 10 m/s. An observer is 40 m away from the spot where the balloon left the ground. The rate of change of the balloon's angle of elevation in radian per second when the balloon is 30 metres above the ground.
a) $\frac{3}{25}$ radians/sec b) $\frac{4}{25}$ radians/sec c) $\frac{1}{5}$ radians/sec d) $\frac{1}{3}$ radians/sec

45. The value of $\int_0^{\pi} \frac{dx}{1 + 5^{\cos x}}$ is
a) $\frac{\pi}{2}$ b) $\frac{3\pi}{2}$ c) π d) 2π

46. Let *X* have a Bernoulli distribution with mean 0.4, then the variance of $(2X–3)$ is
a) 0.24 b) 0.48 c) 0.6 d) 0.96

47. If the solution of the differential equation $\frac{dy}{dx} = \frac{ax + 3}{2y + f}$ represents a circle, then the value of *a* is
a) 2 b) −2 c) 1 d) −1

48. The value of $\int_0^{\pi} cos^4x \, dx$ is
a) $\frac{3\pi}{10}$ b) $\frac{3\pi}{8}$ c) $\frac{3\pi}{4}$ d) $\frac{3\pi}{2}$

49. A binary operation on a set *S* is a function from
a) $S \to S$ b) $(S\times S) \to S$ c) $S \to (S\times S)$ d) $(S\times S) \to (S\times S)$

50. The number of arbitrary constants in the general solutions of order n and n +1are respectively

a) $n-1, n$ b) $n, n+1$ c) $n+1, n+2$ d) $n+1, n$

51. The change in the surface area $S = 6x^2$ of a cube when the edge length varies from x_0 to $X_0 + dx$ is

a) $12x_0 + dx$ b) $12\, x_0\, dx$ c) $6\, x_0\, dx$ d) $6\, x_0 + dx$

52. If f(x) = $\int_1^u \frac{e^{\sin u}}{u} du$, x > 1 and $\int_1^3 \frac{e^{\sin x^2}}{x} dx = \frac{1}{2}[f(a) - f(1)]$,then one of the possible value of a is

a) 3 b) 6 c) 9 d) 5

53. If $a * b = \sqrt{a^2 + b^2}$ on the real numbers then * is

a) commutative but not associative b) associative but not commutative

c) both commutative and associative d) neither commutative nor associative

54. If f(x, y, z) = xy + yz + zx, then $f_x - f_y$ is equal to

a) z – x b) y – z c) x – z d) y – x

55. The value of $\int_{-4}^{4}\left[tan^{-1}\left(\frac{x^2}{x^4+1}\right) + tan^{-1}\left(\frac{x^4+1}{x^2}\right)\right] dx$ is

a) π b) $2\,\pi$ c) $3\,\pi$ d) $4\,\pi$

56. A circular template has a radius of 10 cm. The measurement of radius has an approximate
error of 0.02 cm. Then the percentage error in calculating area of this template is

a) 0.2% b) 0.4% c) 0.04% d) 0.08%

57. The solution of $\frac{dy}{dx} = 2^{y-x}$ is

a) $2^x + 2^y = C$ b) $2^x - 2^y = C$ c) $\frac{1}{2^x} - \frac{1}{2^y} = C$ d) x + y = C

58. The order and degree of the differential equation $\sqrt{\sin x}\,(dx + dy) = \sqrt{\cos x}\,(dx - dy)$ is

a) 1, 2 b) 2, 2 c) 1, 1 d) 2, 1

59. The approximate change in the volume V of a cube of side x metres caused by increasing the side by 1% is

a) $0.\,3x\, dx\, m^3$ b) $0.03x\, m^3$ c) $0.03x^2\, m^3$ d) $0.03x^3\, m^3$;

60. The minimum value of the function $|\, 3- x\,| + 9$ is

a) 0 b) 3 c) 6 d) 9

61. If v(x, y) = log($e^x + e^y$), then $\frac{\partial v}{\partial x} + \frac{\partial v}{\partial x}$ is equal to

a) $e^x + e^y$ b) $\frac{1}{e^x + e^y}$ c) 2 d) 1

62. The solution of the differential equation $2x\frac{dy}{dx} - y = 3$ represents

a) straight lines b) circles c) parabola d) ellipse

63. The function $\sin^4 x + \cos^4 x$ is increasing in the interval

a) $[\frac{5\pi}{8}, \frac{3\pi}{4}]$ b) $[\frac{\pi}{2}, \frac{5\pi}{8}]$ c) $[\frac{\pi}{4}, \frac{\pi}{2}]$ d) $[0, \frac{\pi}{4}]$

64. The integrating factor of the differential equation $\frac{dy}{dx} + y = \frac{1+y}{\lambda}$ is

a) $\frac{x}{e^\lambda}$ b) $\frac{e^\lambda}{x}$ c) λe^x d) e^x

65. The value of $\int_0^{\frac{\pi}{6}} cos^3 3x\, dx$ is

a) $\frac{2}{3}$ b) $\frac{2}{9}$ c) $\frac{1}{9}$ d) $\frac{1}{3}$

66. The point of inflection of the curve $y = (x-1)^3$ is
a) (0,0) b) (0,1) c) (1,0) d) (1,1)
67. If p and q are the order and degree of the differential equation
$y\frac{dy}{dx} + x^3\left(\frac{d^2y}{dx^2}\right) + xy = \cos x$, when
a) p < q b) p = q c) p > q d) p exists and q does not exist
68. In the last column of the truth table for $\neg(p \vee \neg q)$ the number of final outcomes of the truth value '*F*' are
a) 1 b) 2 c) 3 d) 4
69. If $\frac{\Gamma(n+2)}{\Gamma(n)} = 90$ then n is
a) 10 b) 5 c) 8 d) 9
70. The solution of the differential equation $\frac{dy}{dx} + \frac{1}{\sqrt{1-x^2}} = 0$ is
a) $y + \sin^{-1}x = c$ b) $x + \sin^{-1}y = c$ c) $y^2 + 2\sin^{-1}x = C$ d) $x^2 + 2\sin^{-1}y = c$
71. The volume of a sphere is increasing in volume at the rate of $3\pi cm^3$ / sec .
The rate of change of its radius when radius is ½ cm
a) 3 cm/s b) 2 cm/s c) 1 cm/s d) ½ cm/s
72. If $f(x, y) = e^{xy}$, then $\frac{\partial^2 f}{\partial x \partial y}$ is equal to
a) xye^{xy} b) $(1 + xy)e^{xy}$ c) $(1 + y)e^{xy}$ d) $(1 + x)e^{xy}$
73. If *X* is a binomial random variable with expected value 6 and variance 2.4, then *P*(*X* = 5) is
a) $\binom{10}{5}\left(\frac{3}{5}\right)^6\left(\frac{2}{5}\right)^4$ b) $\binom{10}{5}\left(\frac{3}{5}\right)^{10}$ c) $\binom{10}{5}\left(\frac{3}{5}\right)^4\left(\frac{2}{5}\right)^6$ d) $\binom{10}{5}\left(\frac{3}{5}\right)^5\left(\frac{2}{5}\right)^5$
74. If $w(x, y, z) = x^2(y - z) + y^2(z - x) + z^2(x - y)$, then $\frac{\partial w}{\partial x} + \frac{\partial w}{\partial y} + \frac{\partial w}{\partial z}$ is
a) xy + yz + zx b) x(y + z) c) y(z + x) d) 0
75. The value of $\int_{-\frac{\pi}{4}}^{\frac{\pi}{4}}\left(\frac{2x^7-3x^5+7x^3-x+1}{\cos^2 x}\right)dx$ is
a) 4 b) 3 c) 2 d) 0
76. Integrating factor of the differential equation $\frac{dy}{dx} = \frac{x+y+1}{x+1}$ is
a) $\frac{1}{x+1}$ b) $x+1$ c) $\frac{1}{\sqrt{x+1}}$ d) $\sqrt{x+1}$
77. If $u(x, y) = e^{x^2+y^2}$, then $\frac{\partial u}{\partial x}$ is equal to
a) $e^{x^2+y^2}$ b) 2xu c) x^2u d) y^2u
78. In the set ℚ define $a \odot b = a + b + ab$. For what value of y, $3\odot(y\odot 5)=7$?
a) $y = \frac{2}{3}$ b) $y = \frac{-2}{3}$ c) $y = -\frac{3}{2}$ d) $y = 4$
79. One of the closest points on the curve $x^2 - y^2 = 4$ to the point (6,0) is
a) (2,0) b) $(\sqrt{5},1)$ c) $(3,\sqrt{5})$ d) $(\sqrt{13},-\sqrt{3})$
80. Subtraction is not a binary operation in
a) ℝ b) ℤ c) ℕ d) ℚ
81. If we measure the side of a cube to be 4 cm with an error of 0.1 cm, then the error in our calculation of the volume is
a) 0.4 cu.cm b) 0.45 cu.cm c) 2 cu.cm d) 4.8 cu.cm
82. Which one is the contrapositive of the statem tvent $(p \vee q) \rightarrow r$?
a) $\neg r \rightarrow (\neg p \wedge \neg q)$ b) $\neg r \rightarrow (p \vee q)$ c) $r \rightarrow (p \wedge q)$ d) $p \rightarrow (q \vee r)$

83. The truth table for ($p \wedge q) \rightarrow \neg q$ is given below

p	q	$(p \wedge q) \vee (\neg q)$
T	T	(a)
T	F	(b)
F	T	(c)
F	F	(d)

Which one of the following is true?

(a) (b) (c) (d)
(1) T T T T
(2) T F T T
(3) T T F T
(4) T F F F

84. The maximum slope of the tangent to the curve $y = e^x \sin x$, x_[0,2π] is at

a) $x = \frac{\pi}{4}$ b) $x = \frac{\pi}{2}$ c) $x = \pi$ d) $x = \frac{3\pi}{2}$

85. A random variable X has binomial distribution with $n = 25$ and $p = 0.8$ then standard deviation of X is

a) 6 b) 4 c) 3 d) 2

86. The value of $\int_0^1 (\sin^{-1} x)^2 \, dx$ is

a) $\frac{\pi^2}{4} - 1$ b) $\frac{\pi^2}{4} + 2$ c) $\frac{\pi^2}{4} + 1$ d) $\frac{\pi^2}{4} - 2$

87. If the function $f(x) = \frac{1}{12}$ $a < x < b$ for, represents a probability density function of a continuous random variable X, then which of the following cannot be the value of a and b?

a) 0 and 12 b) 5 and 17 c) 7 and 19 d) 16 and 24

88. The tangent to the curve $y^2 - xy + 9 = 0$ is vertical when

a) $y = 0$ b) $y = \pm\sqrt{3}$ c) $y = \frac{1}{2}$ d) $y = \pm 3$

89. The position of a particle moving along a horizontal line of any time t is given by $s(t) = 3t^2 - 2t - 8$. The time at which the particle is at rest is

a) $t = 0$ b) $t = \frac{1}{3}$ c) $t = 1$ d) $t = 3$

90. If $P(X = 0) = 1 - P(X = 1)$. If $E(X) = 3\text{Var}(X)$, then $P(X = 0)$ is

a) $\frac{2}{3}$ b) $\frac{2}{5}$ c) $\frac{1}{5}$ d) $\frac{1}{3}$

91. The general solution of the differential equation $\log(\frac{dy}{dx}) = x + y$ is

a) $e^x + e^y = C$ b) $e^x + e^{-y} = C$ c) $e^{-x} + e^y = C$ d) $e^{-x} + e^{-y} = C$

92. The proposition $p \wedge (\neg p \vee q)$ is

a) a tautology b) a contradiction
c) logically equivalent to $p \wedge q$ d) logically equivalent to $p \vee q$

93. Linear approximation for g(x) = cos x at $x = \frac{\pi}{2}$ is

a) $x + \frac{\pi}{2}$ b) $-x + \frac{\pi}{2}$ c) $x - \frac{\pi}{2}$ d) $-x - \frac{\pi}{2}$

94. Suppose that X takes on one of the values 0, 1, and 2. If for some constant k, $P(X = i) = k\,P(X = i - 1)$ for $i = 1, 2$ and $P(X = 0) = 1/7$, then the value of k is

a) 1 b) 2 c) 3 d) 4

95. If $\int_0^a \frac{1}{4 + x^2} dx = \frac{\pi}{8}$ then a is

a) 4 b) 1 c) 3 d) 2

96. The dual of $\neg(p \vee q) \vee [p \vee (p \wedge \neg r)]$ is

a) $\neg(p \wedge q) \wedge [p \vee (p \wedge \neg r)]$ b) $(p \wedge q) \wedge [p \wedge (p \vee \neg r)]$
c) $\neg(p \wedge q) \wedge [p \wedge (p \wedge r)]$ d) $\neg(p \wedge q) \wedge [p \wedge (p \vee \neg r)]$

97. Two coins are to be flipped. The first coin will land on heads with probability 0.6, the second with Probability 0.5. Assume that the results of the flips are independent, and let X equal the total number of heads that result. The value of $E(X)$ is

a) 0.11 b) 1.1 c)11 d)1

98. The population P in any year t is such that the rate of increase in the population is proportional to the population. Then

a) $P = Ce^{kt}$ b) $P = Ce^{-kt}$ c) $P = Ckt$ d) $P = C$

99. If $f(x) = \frac{x}{x+1}$, then its differential is given by

a) $\frac{-1}{(x+1)^2}\,dx$ b) $\frac{1}{(x+1)^2}\,dx$ c) $\frac{1}{x+1}\,dx$ d) $\frac{-1}{x+1}\,dx$

100. The point on the curve $6y = x^3 + 2$ at which y-coordinate changes 8 times as fast as x-coordinate is

a) (4,11) b) (4,−11) c) (−4,11) d) (−4,−11)

101. If $g(x, y) = 3x^2 - 5y + 2y^2$, $x(t) = e^t$ and $y(t) = \cos t$, then $\frac{dg}{dt}$ is equal to

a) $6e^{2t} + 5\sin t - 4\cos t \sin t$ b) $6e^{2t} - 5\sin t + 4\cos t \sin t$
c) $3e^{2t} + 5\sin t + 4\cos t \sin t$ d) $3e^{2t} - 5\sin t + 4\cos t \sin t$

102. The curve $y = ax^4 + bx^2$ with $ab > 0$

a) has no horizontal tangent b) is concave up
c) is concave down d) has no points of inflection

103. Which one of the following is a binary operation on $\mathbb{N}$?

a) Subtraction b) Multiplication c) Division d) All the above

104. The general solution of the differential equation $\frac{dy}{dx} = \frac{y}{x}$ is

a) $xy = k$ b) $y = k \log x$ c) $y = kx$ d) $\log y = kx$

105. The operation * defined by $a * b = \frac{ab}{7}$ is not a binary operation on

a) $\mathbb{Q}^+$ b) $\mathbb{Z}$ c) $\mathbb{R}$ d) $\mathbb{C}$

106. The value of $\int_{-1}^{2} |x|\, dx$ is

a) $\frac{1}{2}$ b) $\frac{3}{2}$ c) $\frac{5}{2}$ d) $\frac{7}{2}$

107. The maximum value of the function $x^2 e^{-2x}$, $x > 0$ is

a) 1/e b) 1/2e c) $\frac{1}{e^2}$ d) $\frac{4}{e^4}$

108. Which one of the following statements has the truth value T ?

a) $\sin x$ is an even function.
b) Every square matrix is non-singular
c) The product of complex number and its conjugate is purely imaginary
d) $\sqrt{5}$ is an irrational number

109. The number given by the Mean value theorem for the function $\frac{1}{x}$, $x \in [1, 9]$ is

a) 2 b) 2.5 c) 3 d) 3.5

110. The value of the limit $\lim_{x \to 0}\left(\cot x - \frac{1}{x}\right)$ is

a) 0 b) 1 c) 2 d) ∞

111. Which one is the inverse of the statement $(p \vee q) \rightarrow (p \wedge q)$?

a) $(p \wedge q) \rightarrow (p \vee q)$ b) $\neg(p \vee q) \rightarrow (p \wedge q)$
c) $(\neg p \vee \neg q) \rightarrow (\neg p \wedge \neg q)$ d) $(\neg p \wedge \neg q) \rightarrow (\neg p \vee \neg q)$

112. A rod of length $2l$ is broken into two pieces at random. The probability density function of the shorter of the two pieces is $f(x) = \begin{cases} \frac{1}{l} & 0 < x < 1 \\ 0 & l \leq x < 2l \end{cases}$. The mean and variance of the shorter of the two pieces are respectively

a) $\frac{l}{2}, \frac{l^2}{3}$ b) $\frac{l}{2}, \frac{l^2}{6}$ c) $l, \frac{l^2}{12}$ d) $\frac{l}{2}, \frac{l^2}{12}$

113. The solution of the differential equation $\frac{dy}{dx} = 2xy$ is

a) $y = Ce^{x^2}$ b) $y = 2x^2 + C$ c) $y = Ce^{-x^2} + C$ d) $y = x^2 + C$

114. The percentage error of fifth root of 31 is approximately how many times the percentage error in 31?

a) $\frac{1}{31}$ b) $\frac{1}{5}$ c) 5 d) 31

115. If $w(x, y) = x^y$, $x > 0$, then $\frac{\partial w}{\partial x}$ is equal to

a) $x^y \log x$ b) $y \log x$ c) $y x^{y-1}$ d) $x \log y$

116.

p	q	$(p \wedge q) \rightarrow \neg p$
T	T	(a)
T	F	(b)
F	T	(c)
F	F	(d)

Which one of the following is correct for the truth value of $(p \wedge q) \rightarrow \neg p$?

(a) (b) (c) (d)
(1) T T T T
(2) F T T T
(3) F F T T
(4) T T T F

117. If $f(x) = \begin{cases} 2x & 0 \leq x \leq a \\ 0 & otherwise \end{cases}$ is a probability density function of a random variable, then the value of a is

a) 1 b) 2 c) 3 d) 4

118. If $\sin x$ is the integrating factor of the linear differential equation $\frac{dy}{dx} + Py = Q$, then P is

a) $\log \sin x$ b) $\cos x$ c) $\tan x$ d) $\cot x$

119. The number given by the Rolle's theorem for the function $x^3 - 3x^2$, $x \in [0,3]$ is

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

120. A stone is thrown up vertically. The height it reaches at time t seconds is given by $x = 80t - 16t^2$. The stone reaches the maximum height in time t seconds is given by

a) 2 b) 2.5 c) 3 d) 3.5

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